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CURRENT ARCHAEOLOGICAL RESEARCH IN KENTUCKY: VOLUME THREE

edited
by
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Photograph on cover illustrates experimental Kramer and Robbins projectile points hafted on hardwood foreshafts (from Wall et al. this volume).

PREFACE

Since its creation in 1966, the Kentucky Heritage Council has taken the lead in preserving and protecting Kentucky's cultural resources. To accomplish its legislative charge, the Heritage Council maintains three program areas: Site Development, Site Identification, and Site Protection and Archaeology. Site Development administers the state and federal Main Street programs, providing technical assistance in downtown revitalization to communities throughout the state. It also runs the Certified Local Government, Investment Tax Credit, and Restoration Grants-in-Aid programs.

The Site Identification staff maintains the inventory of historic buildings and is responsible for working with a Review Board, composed of professional historians, historic architects, archaeologists, and others interested in historic preservation, to nominate sites to the National Register of Historic Places. This program also is actively working to promote rural preservation and to protect Civil War sites.

The Site Protection and Archaeology Program Area staff works with a variety of federal and state agencies, local governments, and individuals to ensure their compliance with Section 106 of the National Historic Preservation Act of 1966 and to ensure that potential impacts to significant cultural resources are adequately addressed prior to the implementation of federally funded or licensed projects. They also are responsible for administering the Heritage Council's archaeological programs, which include the agency's state and federal archaeological grants; this conference and the publication of selected papers; the dissemination of educational materials, such as the Kentucky Before Boone poster/booklet and the recently published Kentuckians Before Boone; and the Kentucky Archaeological Registry, which is designed to provide information on site management and protection to the owners of Kentucky's most important archaeological sites. The Site Protection and Archaeology Program Area staff also undertakes field and research projects, such as the investigation of the Slack Farm Site in Union County.

The Eleventh Annual Kentucky Heritage Council Archaeological Conference was held in Highland Heights, Kentucky on February 26-27, 1994. The conference was co-sponsored by Northern Kentucky University and the Boone County Historic Preservation Review Board, and was well-attended by archaeologists from throughout the Ohio Valley region. Dr. Barbara Thiel, Susan Cabot, and Don Clare were excellent hosts and we look forward to holding future conferences in northern Kentucky.

More than 30 papers were presented at the conference. Of these, nine are included in this volume, three are from the Ninth Annual Heritage Council Conference (papers from this conference have been incorporated within the edited volumes for the tenth and eleventh conferences), and one is a contributed paper. As in years past, these papers provide a cross-section of on-going archaeological research in Kentucky. The papers are arranged chronologically from the Paleo-Indian to the Historic period. Some of the papers are the products of on-going research, such as those by Lane et al., Kreisa and McDowell, and Lawrence and Mainfort. The papers by Gremillion, Kreisa, Matternes, Jefferies, Mocas, and Young were supported in part by grants from the Kentucky Heritage Council. Most of the other papers were produced as part of Section 106 related compliance projects. These include the papers by Ross-Stallings, Duerksen et al., Wall et al., and Miller and Duerksen.

One of the highlights of the conference was the reception and tour at the Behringer-Crawford Museum; special thanks to Laurie Risch, Director of the museum and the Boone County Historic Preservation Review Board for hosting this event.

Thomas N. Sanders, Charles D. Hockensmith, and Valerie Haskins, all Kentucky Heritage Council staff members, contributed to the success of the conference. Phyllis Bergman, Robyn Connell,

Rob McLelland, Don Miller, and Veronica Riegel provided crucial logistical support during the physical assembling of this volume; these individuals deserve many thanks. The Kentucky Heritage Council is grateful to 3D/Environmental and Dr. Virgil Brack, Jr. for providing John Doershuk and Christopher Bergman with adequate release time and funding for basic editorial expenses to help see this volume through to completion. Finally, I would like to thank John and Chris for agreeing to coedit this volume with David Pollack of the Heritage Council and for pulling this volume together in a timely manner. They were both a pleasure to work with.

David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer

The editors would like to take this opportunity to thank David L. Morgan for his continued support of Kentucky archaeology and in particular, the statewide archaeological conference and the publication of this volume.

★ SITES DISCUSSED IN THIS VOLUME:

1) OTTO SHARP
2) WICKLIFFE
3) CRAWFORD LAKE
4) ROWLANDTOWN
5) TOLU
6) SARA, RAILWAY MUSEUM, LOCUST GROVE
7) BIG BONE LICK
8) WEST RUNWAY
9) NEWT KASH HOLLOW, HOOTEN HOLLOW
10) CROLEY-EVANS
11) WOLFE SHELTER

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EARLY PALEOINDIANS AND EASTERN U.S. ROCKSHELTERS: FINDINGS AND IMPLICATIONS OF TEST EXCAVATIONS AT WOLFE SHELTER (15CU21)

By
Leon Lane, Dennis Stanford, Tom Dillehay, C. Vance Haynes,
Carl Shields, and Michael French[1]

ABSTRACT

In 1992, excavations were conducted at the Wolfe Shelter Site, Cumberland County, Kentucky. Analysis of the diagnostic lithic artifacts collected during the excavations and by the landowners indicates that the site was utilized from the Paleoindian period to the Terminal Woodland/Early Mississippian period (8000 B.C. - A.D. 1200). Excavation of the site showed that most of the exposed stratigraphy was disturbed. Disturbance was also indicated by the classification of tool types by collection level, which indicated that the vertical integrity of the stratigraphic layers is questionable. The initial work suggests that both natural and cultural agencies have impacted the archaeological record at portions of this site. However, the identification of pockets of intact stratigraphy, and preliminary lithic analyses suggest the potential for future research addressing Paleoindian occupations.

INTRODUCTION

Little is known of the age and type of Paleoindian cultural deposits contained in the caves and rockshelters of the eastern United States. Until recently, most archaeologists have assumed that these settings were unutilized or underutilized by Paleoindian groups. Preliminary archaeological work at a few caves and rockshelters, including Wolfe Shelter (15Cu21), Cumberland County, Kentucky, are beginning to yield data to question current thinking on early Paleoindian land use patterns in parts of the eastern United States (early Paleoindian refers to Clovis occupations, any co-eval Clovis occupations, or possible pre-Clovis occupations).

The Wolfe Shelter has been known to local artifact collectors for several years. The site was brought to the attention of Stanford by the owner's grandson, Dale Cross, who sent artifacts collected from the Wolfe Shelter and surrounding vicinity to the Smithsonian Institution for study. These artifacts included Eastern Woodland Clovis, Cumberland, and Dalton projectile points. In 1990, Stanford was initially attracted to the rockshelter itself by Cross' recovery of Clovis points from a "red sediment" underlying a stratum containing Cumberland materials. The basal deposits below the alleged Clovis layer yielded bi-pointed bifaces similar to Lerma projectile points. Cross also found perforated needle bone pins, but from an unprovenienced context. Additionally, Cross had found Clovis points in several nearby rockshelters and ridgetops. These materials are currently housed at the Smithsonian Institute.

[1] L. Lane, T. Dillehay, C. Shields, and M. French, University of Kentucky, Lexington, Kentucky, D. Stanford, Smithsonian, Washington, D.C., and C. V. Haynes, University of Arizona, Tuscon.

In 1992, Stanford, Dillehay, Haynes, and two graduate students from the University of Kentucky (Bryant Evans and Ken Duerksen) carried out limited excavations in the shelter. The primary goals of this research were to investigate: 1) the site stratigraphy, 2) the integrity of the alleged Clovis deposits, and 3) the cultural affiliation of other material from the site. This paper presents the results of the 1992 field season and the subsequent preliminary analyses of a portion of the cultural materials recovered from the site. Also discussed are the types of cherts exploited by residents of the site, and the stratigraphic and artifactual evidence for disturbed deposits. Not included in the analysis are the artifacts collected by the Cross family which are currently stored at the Smithsonian Institution and the non-lithic materials (i.e., ceramics, faunal, and botanical remains) excavated in 1992.

A secondary goal is to call attention to the need for more careful and rigorous interdisciplinary research of the rapidly disappearing cultural deposits in the rockshelters and caves of eastern Kentucky. Cave deposits have long been an important object of archaeological inquiry in other parts of the world. For instance, Francois Bordes' (1972) work at the French sites of Pech de l'Aze and Combe-Grenal in the mid-portion of the 20th century initiated intensive and interdisciplinary research in rockshelters. One of Bordes' primary research goals was an understanding of both the natural and cultural processes forming and transforming the archaeological deposits in these sites. Subsequent investigators, such as Henri Laville (1976; Laville et al. 1980) in France, Karl Butzer (1982) in Spain, C. V. Haynes and George A. Agogino (1986) at Sandia Cave, New Mexico, and others have refined our understanding of the sedimentological processes involved in the deposition of materials in cave deposits throughout the world. The systematic research fostered by these and other investigators (e.g., Colcutt 1979; Collins 1991; Farrand 1975, 1979, 1985) has led to more serious work at and a better understanding of rockshelter and cave sites in many areas.

In contrast, the rockshelters of eastern Kentucky in general, and more specifically the Upper Cumberland, have been subjected to little systematic archaeological investigation. Notable exceptions within eastern Kentucky are Sparks Rockshelter (Adovasio et al. 1982:14-19, 59-63; Fitzgibbons et al. 1977), Dameron Rockshelter (Adovasio et al. 1982:14-19; Vento et al. 1980), Enoch Fork Shelter (Bush 1988; Ison 1989), Deep Shelter (Dorwin et al. 1970), Cold Oak Shelter (Ison 1988; O'Steen et al. 1991), Haystack (Cowan 1979), and Cloudsplitter Rockshelter (Cowan et al. 1981). Prior to these studies, Webb and Funkhouser conducted limited investigations at several caves and rockshelters in the 1920s and 1930s, though much of their work remains unpublished. They also worked more extensively at the Newt Kash and Hooten Hollow shelters (Webb and Funkhouser 1936).

Despite our present limited knowledge of rockshelter and cave sites in the study area, and the eastern United States in general, it has often been assumed that there was little or no occupation in them during the early Paleoindian period. Kelly and Todd (1988), in particular, have proposed that rockshelters in the Eastern Woodlands were not utilized during this period due to the probable rapid mobility of the first Paleoindians across the landscape. According to Kelly and Todd, such mobility did not allow early migrants to familiarize themselves with local resources and landscapes long enough to locate rockshelters suitable for human habitation. However, the work of Meltzer (1984, 1985, 1988, 1989; Meltzer and Smith 1986) has shown that late Paleoindians in the eastern United States were adapted to a wide variety of regionally available resources, possibly suggesting a more detailed acquaintance with local landscape features than admitted by Kelly and Todd. Other variables, such as geological conditions of caves and rockshelters and the locations of these sites next to primary resources, in addition to unfamiliarity should be sought to explain the perceived lack of early Paleoindian use of caves and rockshelters.

This absence also may simply reflect the type or lack of research conducted at rockshelters. Collins (1991), for example, has noted the occupation of rockshelters by Paleoindian groups as far back as 8,500 B.C. in Texas and surrounding regions. Although little, if any, reliable evidence of Paleoindian occupation exists for the rockshelters and caves of eastern Kentucky, little systematic research has been carried out in them, especially in the basal deposits. Most archaeologists terminate their excavations of these sites after finding Cumberland, Dalton, and Quad points, assuming that older cultural materials do not exist. This may not be the case, however. Clear evidence of middle and late Paleoindian occupations in the rockshelters of Kentucky exists (Bush 1988; Carstens 1980; Gatus 1983; Sanders and Maynard 1979; Rolingson 1964; Schenian 1988; Tankersley 1990).

Limited archaeological evidence is also available, including that garnered from artifact collectors, suggesting the probability of early Paleoindian remains in some rockshelters of Kentucky (Bush 1988; Ison 1989). Such evidence may also exist in Wolfe Shelter, located in the karst topography of south-central Kentucky.

ARCHAEOLOGICAL INVESTIGATIONS AT WOLFE SHELTER

Investigations at the Wolfe Shelter consisted of four days of excavation by the project team. During this period, five 1 m^2 units (Units 1-5) were opened adjacent to each other inside of the drip line of the shelter (Figure 1). The units were placed in areas where Dale Cross reported the recovery of Clovis and Clovis-like points. Once the test units had been laid out and mapped using a transit, the surface topography of the cave was recorded and photographed. The excavations were concentrated along the northwestern wall of the cave, in an area where minor looting was evident, but where roof fall was believed to have created a bench of potentially intact deeper cultural deposits.

Due to the observed post-depositional disturbance of most surface deposits, the decision was made to excavate initially in arbitrary 15 cm levels to define the stratigraphy. Once defined, the underlying naturally deposited sediments were excavated stratigraphically, with arbitrary 10 cm levels within the strata when appropriate. These sediments were designated as Fill 1, 2, and 3 by Haynes. Excavations of these three fills resulted in the determination that most exposed areas were fluvially reworked deposits (see below). It is estimated that at most, approximately 20 percent of the excavated deposits were intact. Each of the three fills varied in thickness, but was characterized by a distinct set of traits, including color, friability, texture, material content, and the presence or absence of bedding.

The excavations recovered an assortment of chipped stone tools, ceramics, botanical and faunal remains, and lithic debitage. The artifacts were washed and cataloged. Analysis of the lithic materials were conducted in the fall of 1993. The materials collected and documents from the excavation were curated at the University of Kentucky. At the time of this report, only a

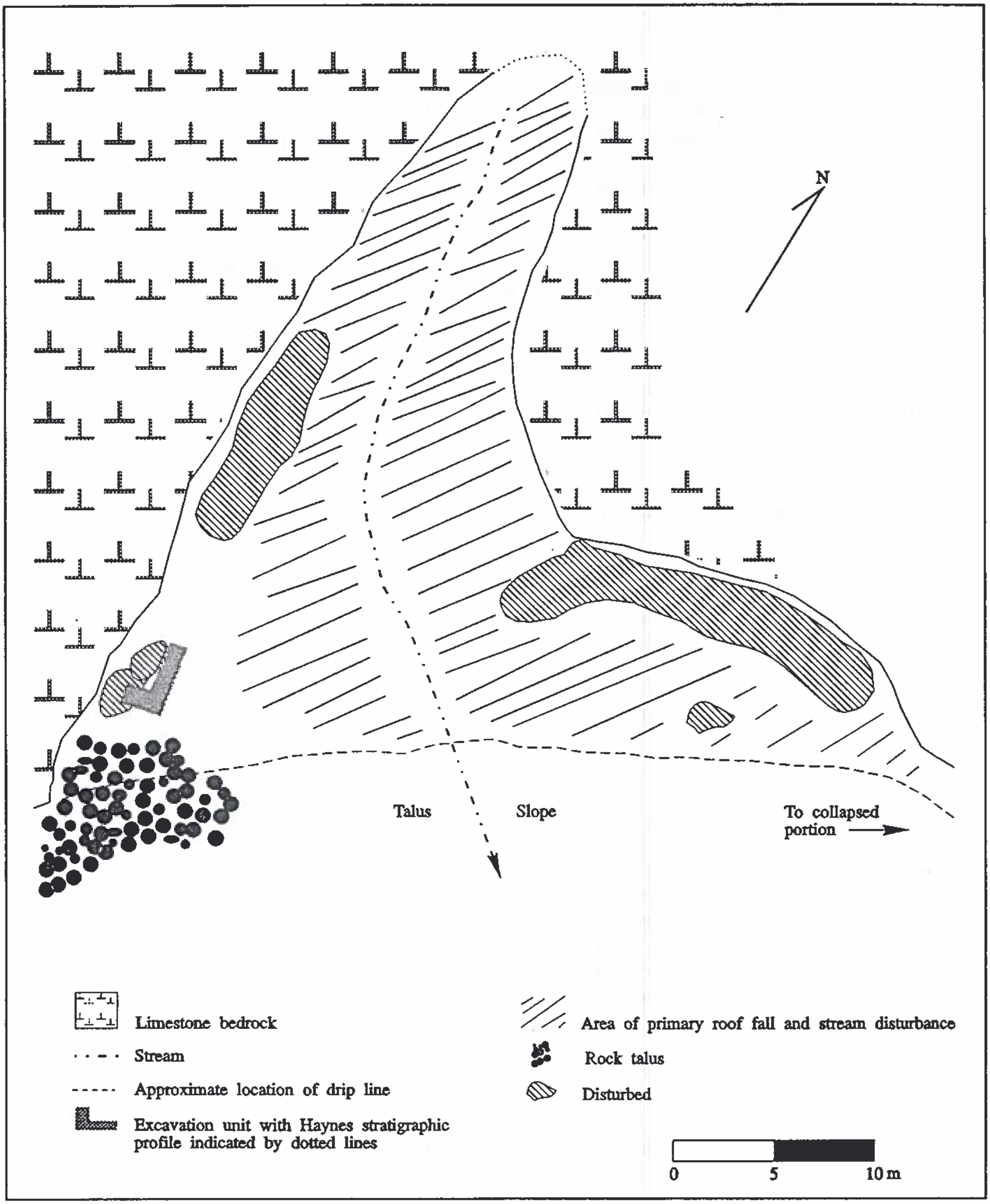


Figure 1. Schematic Map of the Wolfe Shelter.

portion of the artifact analysis has been completed and is reported here. Table 1 provides a summary of preliminary chert source analysis. Table 2 summaries metric and chert source information on all of the recovered diagnostic chipped stone tools.

GEOGRAPHIC AND DEPOSITIONAL SETTING

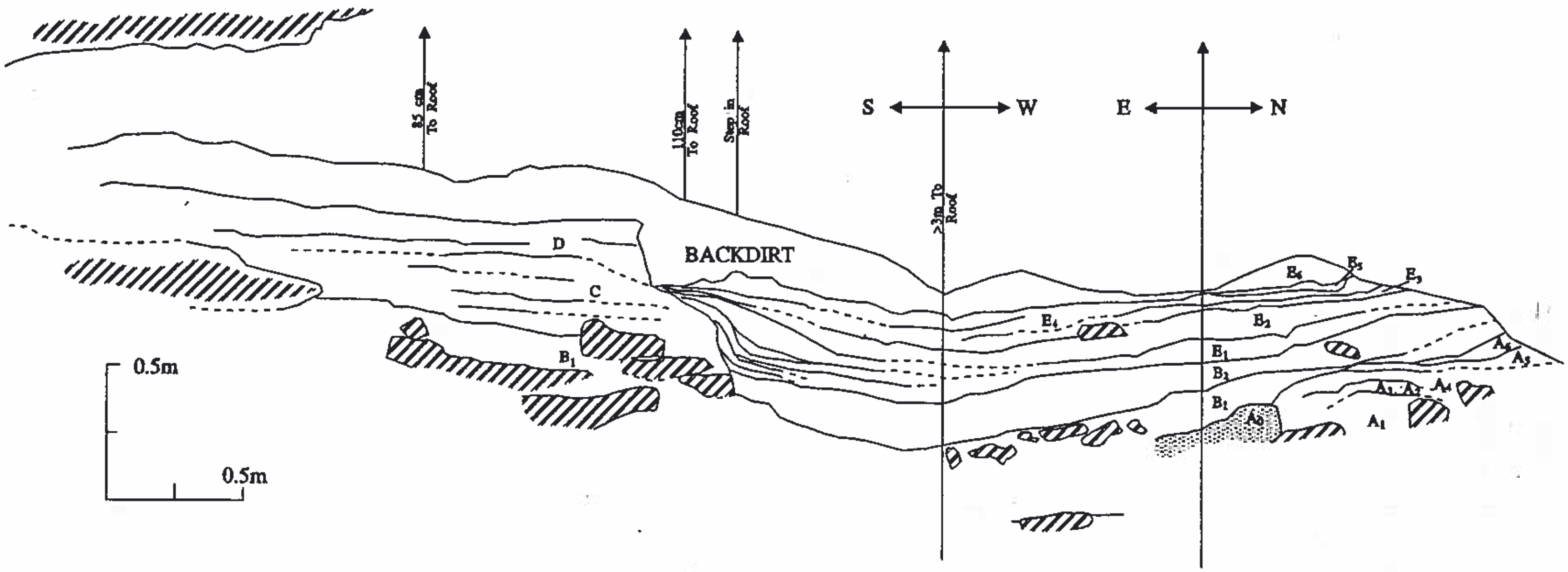
The Wolfe Shelter is located in Cumberland County, Kentucky, at the head of a narrow, steep sided valley formed by a small stream draining into the Oil Fork, a tributary of the Cumberland River. The site is situated 1.05 km southeast of Modoc, Kentucky, and 0.5 km south-southwest of Brannan, Kentucky. The site is located in the Lake Cumberland portion of the Upper Cumberland archaeological management area of Kentucky (Pollack 1990). Geologically, the Wolfe Shelter is in the eastern margin of Fenneman's (1938) Interior Low Plateaus Physiographic Region. The area is deeply dissected topographically with limestone ridges separating valleys (Bladen and Bailey 1977; Fenneman 1938; Jillson 1951; McFarlan 1943). This area has a strongly developed karst topography that exhibits numerous sinkholes, springs, and caves (Jilson 1951; McGrain 1983). Specifically, in the vicinity of the Wolfe Shelter, there are four Mississippian formations. The Fort Payne Formation is overlain by the Salem and Warsaw Formations which is capped by St. Louis Limestone (Lewis 1967).

The Wolfe Shelter Site itself was created by weathering and erosion of the underlying limestone by a spring situated at the base of the cliff and an underground stream that descends through the back of the shelter to the hollow below. Additionally, a ridge top chute channels runoff into the rockshelter, temporarily increasing stream volume, sedimentation, and erosion. These processes have formed a shelter that is currently 40 m wide with approximately an additional 35 m of collapsed roof fall to the east (Figures 2 and 3).

Sediments at the site were created primarily by the processes of intermittent fluvial stream deposition, colluvial runoff from the lateral chutes, roof exfoliation, and intrusion of cultural materials. Roof exfoliation has caused the collapse of the eastern portion of the shelter and has caused the stream to alter its course through time, impacting both the sedimentation and erosional processes and the cultural deposits. This has resulted in the formation of a talus slope and bench in front of the collapsed portion of the shelter.

Haynes' analysis of the stratigraphy documented in the excavation units (Figure 1) revealed three main sequences of sedimentary fill (Figure 2). The earliest (Fill 1) consists of a basal gravel, A_0, and six overlying layers of brown sands and clays, A_1 - A_6. An erosional disconformity separates these sediments from overlying layers of Fill 2, which consists of sand and clay layers; B_1, B_2, C, and D. These are separated from an overlying sequence of alternating brown sands and clays, layers E_1 - E_6, by a pronounced disconformity that truncates Fill 2 with a steep cut that is most likely artificial, and was probably made by earlier uncontrolled excavations.

The disconformity separating Fill 1 from Fill 2 also appears to be artificial. This suggests that all of the fills identified during our investigations were produced by the recent reworking of the original cave fill by local people, followed by slope wash reworked by water



Fill 1: A_0 - 15 cm, Brown to dark brown clayey pebble gravel and slabs of roof rock; A_1 - 5 cm, Dark brown silty clay (possible MnO_2 staining); A_2 - 7 cm, Banded yellowish-brown and greenish gray clayey fine sand; A_3 - 6 cm, Reddish-brown clayey fine to medium sand with brownish black pisolites; A_4 - 15 cm, Pale olive gray clay; A_5 - 6 cm, Light brownish-yellow clayey fine sand with current bedding; A_6 - 6 cm, Olive gray clay.

Fill 2: B_1 - 15+ cm, Light brownish-yellow clayey fine sand, gradational southward to grayish brown rubbly clay; B_2 - 20 cm, Banded light and dark yellowish brown clayey fine sand; C - 30 cm, Light brown and yellowish-brown banded clay and clayey fine sand; D - 15 cm (not described but probably clayey fine sand).

Fill 3: E_1 - 13 cm, Light brown (tan) banded clay; E_2 - 11 cm, Banded light and dark yellowish-brown clayey fine sand (like B_2); E_3 - 7 cm, Light brown (tan) banded clay (like E_1); E_4 - 8 cm, Like B_2 and E_2 but less banded and more massive sand; E_5 - 4 cm, Like E_1 and E_3; E_6 - 10 cm, Like B_2 and E_2.

Figure 2. The entrance to Wolfe Shelter facing east. Note the stream originating in the extant shelter and the collapsed portion to the right.

Figure 3. The entrance to Wolfe Shelter facing east. Note the stream originating in the extant shelter and the collapsed portion to the right.

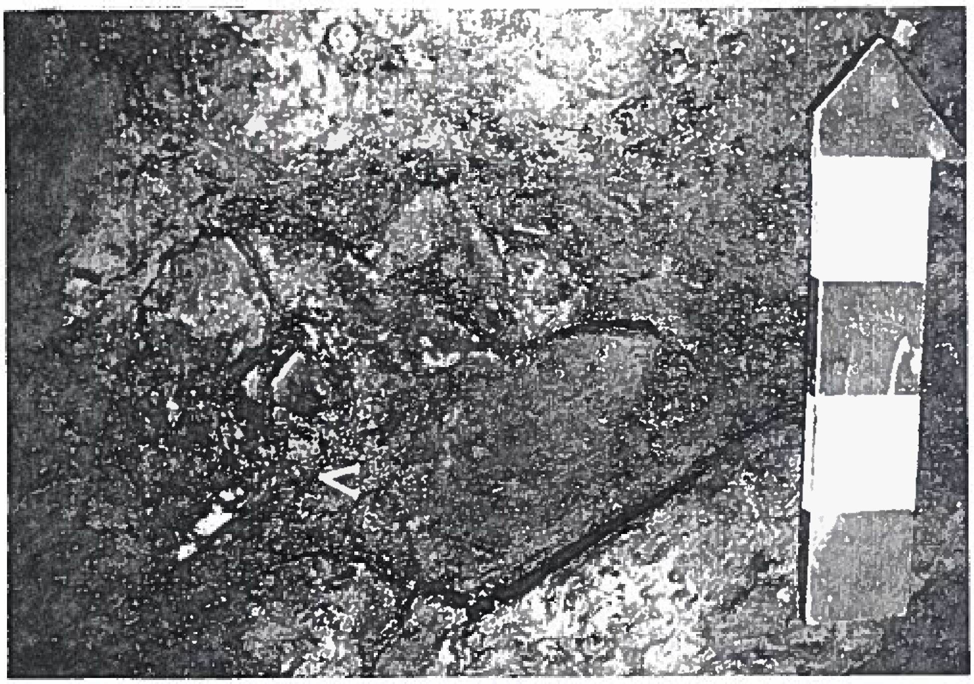


Figure 4. A probable fluvially deposited flake. The bulb of percussion is oriented upstream to stream flow indicated by the "V".

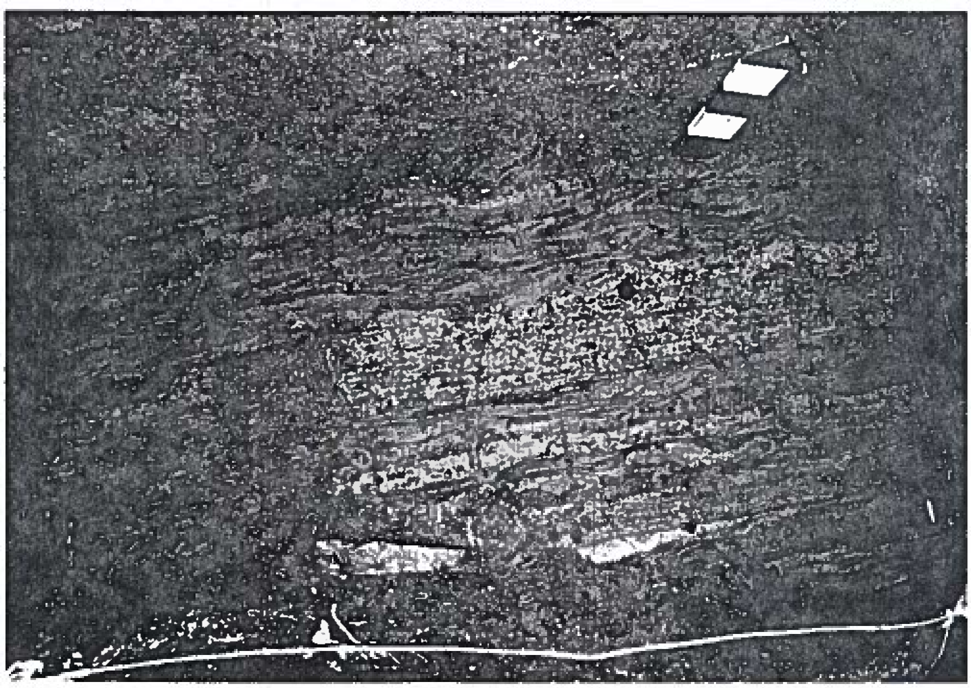


Figure 5. Disturbed stratigraphy. The interbedding of rippled and crossbedded strata (fluvial deposits) with planar laminated strata (non-fluvial deposits) in the left half of the profile indicates repeated fluvial disturbances. The lack of bedforms in the upper right portion of the profile is an indication of culturally disturbed deposits.

Table 1. Chert Types and Categories: Descriptions, Weights and Counts*.

Chert Type	Color	Luster	Grain Texture	Fl. Ct.	Fl. wt. (g)
Ste. Geneveve Subcategory A	Dark gray with little or no mottling	Dull shiny to shiny	Smooth	3	25.7 g
Ste. Geneveve Subcategory B	Dark gray to black with light gray to white amorphous mottling. All flakes show evidence of heating	Shiny	Smooth	10	23.6 g
Ste. Geneveve Subcategory C	Dark gray with linear light gray to white striations	Shiny	Smooth	1	51.6 g
Ste. Geneveve Subcategory D	Light gray to gray with light gray to white amorphous mottling	Dull shiny	Smooth	23	84.3 g
Ste. Geneveve Subcategory E	Light gray in color with little or no mottling	Moderate shiny	Smooth	7	5.2 g
Fort Payne Subcategory A	Milky white blending to yellowish tan	Dull	Inter-mediate to smooth	5	36.5 g
Fort Payne Subcategory B	Milky white blending to light gray	Dull	Inter-mediate to smooth	1	8.8 g
St. Louis Subcategory A	Light to dark gray with some tan	Dull	Inter-mediate to rough	18	9.6 g
St. Louis Subcategory B	Gray to red with tan (with cortex)	Dull	Inter-mediate to rough	8	21.4 g
Unidentified A	Gray with minute black inclusions	Shiny	Smooth	2	1.8 g
Unidentified B	Light milky gray color with minute black inclusions	Shiny	Smooth	1	1.6 g
Unidentified C	Gray with light gray and black "salt and pepper" inclusions	Shiny	Smooth	1	1.2 g

*All criteria are subjective and based on macroscopic observation.

Table 2. Lithic Measurements and Raw Material Source Analyses.

Hamilton Incurvate (Figure 6a) Test Unit 1, Fill 2, B2, Level 1.

LENGTH:	+28 mm
WIDTH:	21 mm
THICKNESS:	4 mm
CHERT TYPE:	Ste. Geneveve, Subcategory D.

Hamilton Incurvate (Figure 6b) Test Unit 1, Fill 2, B2, Level 1.

LENGTH:	+22 mm
WIDTH:	18 mm
THICKNESS:	3 mm
CHERT TYPE:	Unidentified B.

Ledbetter/Saratoga (Figure 6c) Test Unit 1, Fill 2, B2, Level 1.

LENGTH:	+112 mm
BLADE LENGTH:	97 mm
SHOULDER WIDTH:	37 mm
THICKNESS:	9 mm
STEM WIDTH:	21 mm
STEM LENGTH:	+15 mm
CHERT TYPE:	Fort Payne, Subcategory A.

Jack's Reef/Bakers Creek/Lowe Flared Base (Figure 7a) Test Unit 4, Fill 2, B1, Level 1.

LENGTH:	37 mm
SHOULDER WIDTH:	22 mm
THICKNESS:	7 mm
STEM LENGHT:	9 mm
STEM WIDTH:	16 mm
BASAL WIDTH:	+19 mm
CHERT TYPE:	Ste. Geneveve, Subcategory A.

Copena (Figure 7b) Test Unit 4, Fill 2, B1, Level 2.

LENGTH:	59 mm
WIDTH:	30 mm
THICKNESS:	8 mm
CHERT TYPE:	Ste Geneveve, Subcategory B.

Motley (Figure 7c) Test Unit 4, Fill 2, B1, Level 3.

LENGTH:	39 mm
BASAL WIDTH:	16 mm
NECK WIDTH:	10 mm
SHOULDER WIDTH:	28 mm
THICKNESS:	6 mm
CHERT TYPE:	Ste Geneveve, Subcategory B.

Madison/Levanna (Figure 7d) Test Unit 4, Fill 2, B1, Level 3.

LENGTH:	+19 mm
WIDTH:	21 mm
THICKNESS:	2 mm
CHERT TYPE:	Ste. Geneveve, Subcategory B.

Paleoindian point (Figures 7e,f) Test Unit 4, Fill 2, B1, Level 4.

LENGTH:	+33 mm
WIDTH:	26 mm
THICKNESS:	6 mm
CHERT TYPE:	Ste. Geneveve, Subcategory C.

flowing into the shelter from the south side of the mouth. This sequence was repeated at least three times to produce the three fill episodes. Although this interpretation could be further tested by analyzing some of the radiocarbon samples collected, the inversion of the artifact sequence documented during the course of this study is adequate evidence of significant disturbance of most of the sedimentary record of Wolfe Shelter. The expense of intensive radiocarbon dating does not appear to be justified at this time. However, it might be worthwhile to analyze a single sample from each fill zone as a final test of the depositional chronology.

Nonetheless, it appears that the stream has reworked most of the strata at the site, eroding, scouring, depositing, and redepositing sediments and archaeological materials. Along the western and back walls of the shelter, roof debris has diverted the stream away from some sediments, forming benches with potentially intact archaeological materials. These areas are defined by isolated pockets or columns of stratified sediments and small concentrations of charcoal and artifacts. Further excavation and interpretation of the specific archaeological contexts of these areas is required to understand the formation processes that produced and preserved them.

Although the sample size was small and not studied systematically, the dip and strike of several excavated lithics (primarily flakes) is preliminary evidence suggesting fluvial disturbance and/or digging by collectors. The bulbs of percussion of several long flakes were oriented upstream, suggesting deposition by fluvial action (Figure 4). The interbedded nature of the coarse sands and small clasts containing these flakes suggests the same. The long axis of other lithics were oriented perpendicular to the stream, suggesting they were potentially deposited by other means, perhaps through cultural agencies. This also corroborates the few small pockets of intact cultural debris observed in the test units.

In addition to natural processes of transformation, the site has been subjected to numerous post-depositional episodes of human disturbance. Human burials dating from the Middle Woodland to the Late Prehistoric periods (200 B.C. to A.D. 1700) intrude into earlier stratigraphic layers. Additionally, artifact collectors have disturbed significant sections of the site (Figure 5), including portions of the excavated area. Taken together, these two processes have considerably altered most of the observed archaeological record at the site.

The research team was aware of the potential for human and natural disturbances at the site and documented these processes during the excavations. (It is for these reasons that most of the excavations were carried out in arbitrary levels, although when possible, natural layers were followed.) Although some excavated units revealed small pockets of intact stratigraphy with discrete breaks between layers, they often lacked archaeological integrity. This was apparent to the excavators, who noted that early and late diagnostic archaeological materials were recovered from the same layers. Reversed stratigraphy was also evidenced by the location of later diagnostic archaeological materials in layers found below layers containing earlier diagnostic archaeological materials (see below). Preliminary analyses of the diagnostic lithics were conducted to test independently for stratigraphic disturbance resulting in the support of the field observations.

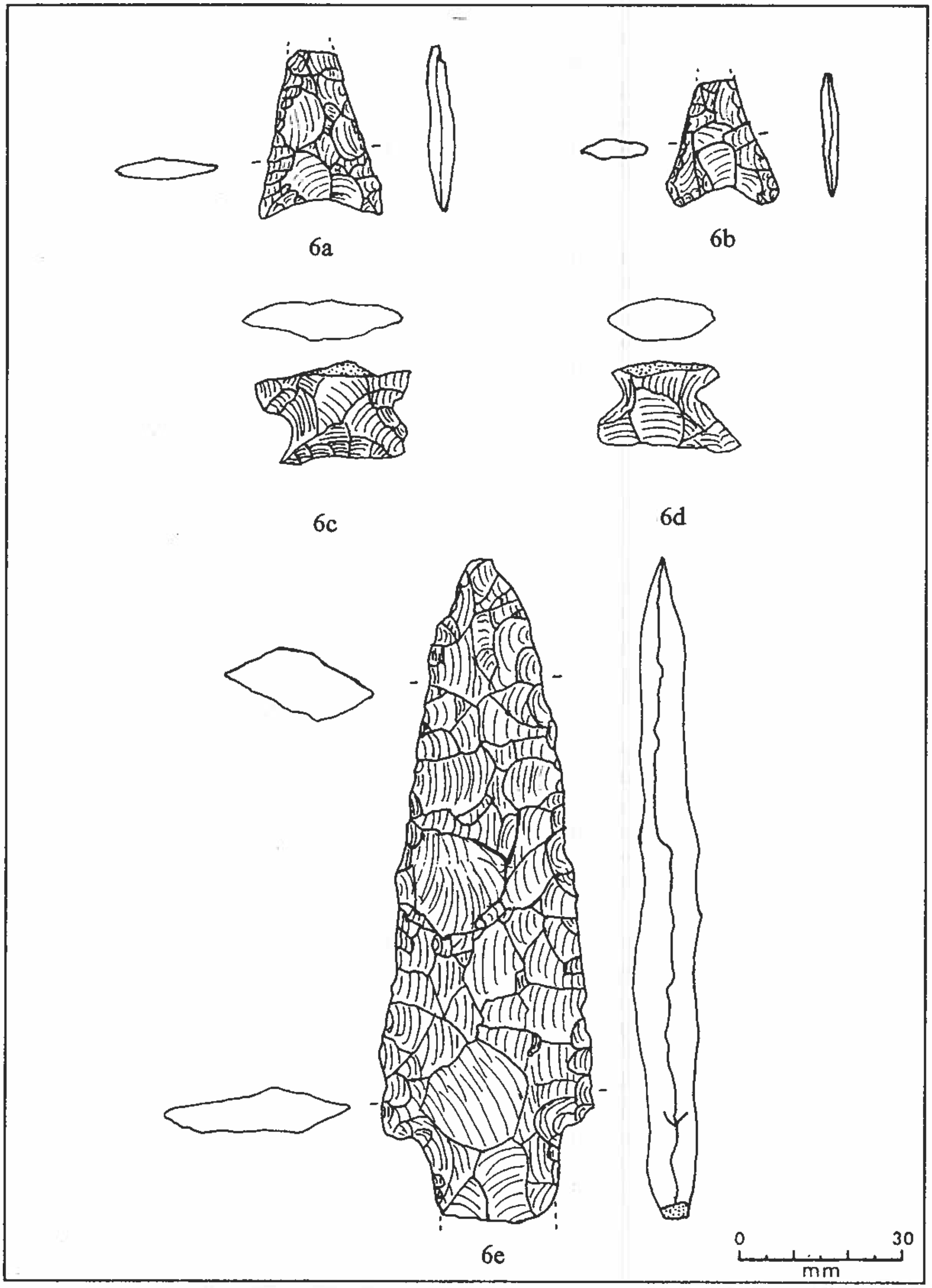


Figure 6. Lithics from Test Unit 1, Fill 2, B_2, Level 1: a-b, Hamilton incurvates; c, Ledbetter/Saratoga.

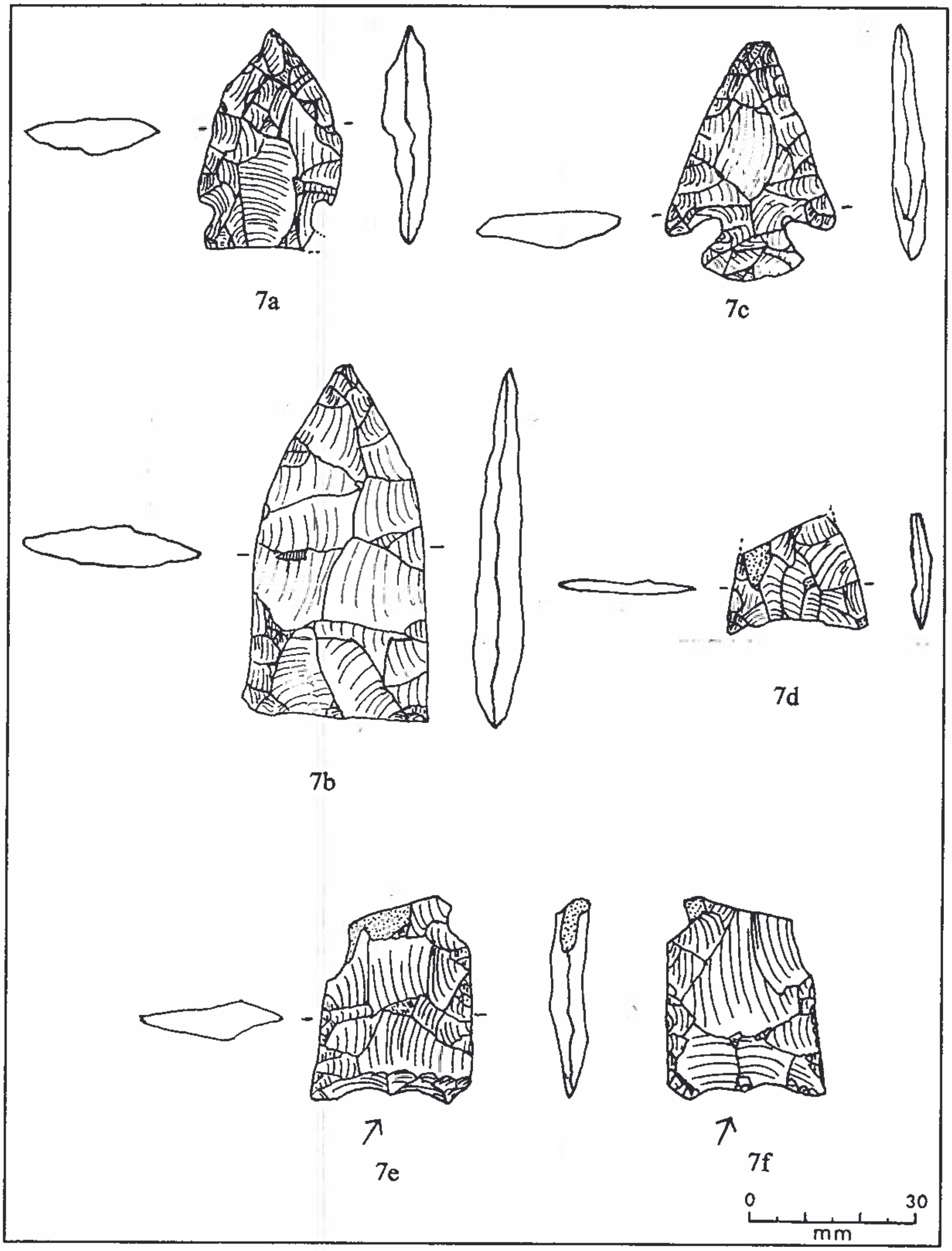


Figure 7. Diagnostic lithics. Test Unit 4, Fill 2, B_1, Levels 1 and 2: a, Bakers Creek/Lowe Flared Base/Jack's Reef Corner Notched; b, Copena. Test Unit 4, Fill 2, B_1, Level 3: c, Motley; d, Madison/Levanna. Test Unit 4, Fill 2, B_1, Level 4: e,f Paleoindian projectile point base, both sides illustrated (note the nipple [arrow] in base).

CHIPPED STONE ARTIFACT SOURCE ANALYSIS

Analysis of chipped stone artifacts first addressed the chert utilized by the inhabitants of Wolfe Shelter. The goal of this analysis was to provide preliminary results of the potential range of exploitation of chert exploitation for the eight diagnostic chipped stone artifacts utilized by the prehistoric occupants. Additionally, a large subsample of 80 flakes (ca. 60 percent of the total sample) and amorphous pieces of chert (293.3 g) were examined and grouped into categories to determine if cherts not represented by diagnostic chipped stone artifacts had been utilized. Given the disturbed nature of the deposits and the stratigraphic association of early and late diagnostic artifacts (see below), only a sample of the total flakes was selected for preliminary analysis. This sample included all flakes and amorphous pieces of chert (n=80) from Test Unit 4, Fill 2, which contained the largest sample and widest range of chert types. Although the sample size is small and derived largely from disturbed deposits, which severely limits a discussion of temporal variability in chert exploitation, it does provide preliminary results that suggests future lines of research.

The diagnostic chipped stone artifacts and flakes were compared with a chert type collection stored in the Museum of Anthropology at the University of Kentucky. For the purpose of this study, a chert "type" is defined as a siliceous sedimentary rock that can be identified macroscopically as derived from a particular geologic formation. Initial sorting of chipped stone artifacts by chert type was based on the macroscopic examinations of four observable criteria: 1) color; 2) degree and nature of mottling; 3) surface texture (rough, intermediate, and smooth); and 4) luster, or surface sheen.

Three distinct local chert types were identified at the site: Ste. Geneveve, Fort Payne, and Saint Louis (Lewis 1967; McDowell 1986:23; Niquette and Donham 1985:428) (Table 1). One diagnostic chipped stone artifact (Hamilton Incurvate) and four flakes (4.6 g) could not be identified with the sample collection. These artifacts were determined to represent three distinct unidentified chert types (Table 1), suggesting they are nonlocal cherts.

In summary, the bulk of the chert types identified were similar to samples from locally available chert sources. Although these materials were probably procured from local chert outcrops, it is possible that some cherts were derived from distant outcrops of the same type.

CHIPPED STONE TOOL ANALYSIS

Typological and metric analysis (in sensu Justice 1987:240-246) of the diagnostic lithic tools was conducted to determine the temporal and cultural occupations and the extent of disturbance at the Wolfe Shelter. Results of this analysis provided temporal associations for each of the stratigraphic fills of the excavated units. The results confirmed the observations made in the field --- most of the archaeological stratigraphy is mixed. All of the diagnostic artifacts came from disturbed deposits. A summary of the metric observations and raw material source is provided in Table 2.

Of the eight diagnostic projectile points recovered from the excavated units, all but one had been manufactured from local cherts (Table 2). All diagnostic artifacts were recovered from Fill 2 of Test Units 1 and 4.

Within Test Unit 1, Fill 2, B_2, Level 1, a total of three partial projectile points were excavated. Two of these points are isosceles triangles in form, with incurvate basal and blade edges. Both points have broken tips and display some degree of retouch. The shoulders of one tool are barbed (Figure 6a), whereas the other is more rounded (Figure 6b). Morphologically, these points conform to the Hamilton Incurvate type (Justice 1987:229-230), and are associated with the Late Woodland Hamilton culture (Justice 1987:229-230), which dates from approximately A.D. 500 to 1000 (Railey 1990:256-257).

A large stemmed Archaic projectile point was also found in Level 1. The blade edges of this point are long and narrow, becoming slightly excurvate near the tip. One shoulder is partially missing (it appears to taper), while the other is rounded. The stem is broken near the base but appears to have parallel sides. However, there is a possibility that the stem could have tapered or expanded (Figure 6c). Morphologically, this point conforms to both the Ledbetter or Saratoga cluster types. The Ledbetter type is associated with the Late Archaic period Ledbetter phase, which dates from 3000 to 1000 B.C. The Saratoga cluster is associated with the Late Archaic and Early Woodland periods, and temporally dates from 3000 to approximately 200 B.C. (Jefferies 1990:153-159; Justice 1987:149-159; Railey 1990:249-250). Additionally, two cordmarked, grit tempered Woodland sherds were found in this fill level. Given the temporal associations of these lithic tools and ceramic sherds (Late Archaic to Late Woodland), the stratigraphy within this unit is culturally to this depth.

Within Test Unit 4, Fill 2, B_1, Level 1, a stemmed projectile point and a triangular projectile point were excavated. The base of the stemmed projectile point (Figure 7a) exhibits slight grinding and the shoulders of the blade are squared and formed by notching of the basal edge. The blade form is slightly triangular, with an incurvate blade edge. Retouch is evident. The base is slightly incurvate, possibly the result of basal thinning. Part of the basal area is broken, however, making identification difficult. The present form suggests expanding stem or corner notching. The projectile point base exhibits possible features of the Lowe Flared Base, Bakers Creek, or Jack's Reef Corner Notched point types. The Lowe Flared Base has a flaring, straight-edged base, while the Bakers Creek and Jack's Reef have corner notching. The absence of beveling on the edges of the blade and base of the stem correlate more strongly with the Bakers Creek type rather than the Lowe Flared Base type. Profile identification, a diagnostic trait for all three point types, is difficult to determine because of the amount of retouch and the presence of step fractures. A triangular blade form is suggestive of all three point types. Jack's Reef Corner Notched projectile points are diagnostic of the late Middle Woodland to Late Woodland periods (Justice 217-219), dating from 200 B.C. to approximately A.D. 1000 (Railey 1990:251-257). Bakers Creek projectile points are diagnostic of the middle to terminal Middle Woodland periods and date approximately from 200 B.C. to A.D. 500. Lowe Flared Base projectile points are found in the terminal Middle Woodland phase and date approximately from A.D. 200 to 500 (Justice 1987:211-214; Railey 1990:251-256).

A medium-sized triangular point with excurvate sides was also found in this level. This bifacial tool has an acute tip, slightly flared base, recurvate blade edges, and a straight, thinned base (Figure 7b). Morphologically, this projectile point conforms to the Middle Woodland period Copena type (Justice 1987:204-208). Temporally, it dates between approximately 200 B.C and A.D. 500 (Railey 1990:251-256).

One projectile point and one projectile point base were found within Test Unit 4, Fill 2, B_1, Level 3. The projectile point has a triangulate blade with straight edges (Figure 7c). The base is formed by deep, wide, rounded corner notches producing a narrow neck and wide, downward projecting barbed shoulders. The basal edge is straight to convex. There is no evidence of basal grinding. This point belongs to the Motley cluster, which appears in the Late Archaic and continues into the Early Woodland period (Justice 1987:198-201), which temporally spans a period from 3000 to 200 B.C. (Jefferies 1990:153-159; Railey 1990:249-250).

The projectile point base is concave and has a slight excurvate blade edge that would have formed a triangular-blade with pointed basal margins (Figure 7d). The tip has broken off. In cross section, this tool is very thin and flat. The artifact base morphologically conforms to a number of points in the Late Woodland Triangular Cluster. Based on the excurvate form of the existing blade edges, this tool most strongly correlates with either the Madison and Levanna types (Justice 1987:224-230). This type is associated with the early Late Woodland phase, and temporally ranges from approximately A.D. 700 to 1200 (Railey 1990:256-257).

The presence of the Motley and Madison/Levanna projectile points in the same collection level of Test Unit 4 is another clear indicator that the stratigraphy of this unit is disturbed at least to this depth.

Within Test Unit 4, Fill 2, B_1, Level 4, a single unfinished and fractured projectile point was found in association with two nonshell tempered Woodland sherds. The blade edges are parallel and the complete projectile probably had a lancelot shape. One edge of the blade exhibits slight grinding near the base. The base is concave with a slight nipple in the center of the base (Figure 7e-f). The base and nipple were evidently created as a platform to produce an interlined flute or longitudinal thinning flake that is present on one side. This point is of late or transitional Paleoindian age (Justice 1987:17-30). The specimen was possibly broken and discarded during the manufacturing process. Based on the incongruence of temporal associations of artifact types, the archaeological context of this unit is also considered to be culturally mixed to the depth of Level 4.

SUMMARY AND CONCLUSION

This limited excavation and analysis of the Wolfe Shelter Site suggest that most of its cultural deposits are heavily disturbed, although small pockets of intact deposits still exist. Exhaustive interdisciplinary work needs to be carried out to identify and understand the palimpsests of natural and cultural site formation processes that took place at this site (and others like it). Although not detailed here, the "signatures" of each of these processes are often subtle and difficult to determine, especially in areas where fluvial, colluvial, and cultural agencies acted in unison to form and subsequently disturb stratigraphic layers. This dictates the caution and knowledge that must be applied to an investigation of this type of rockshelter, and indeed, of most archaeological settings.

The reported Clovis points and the excavated broken point with an interlined flute or longitudinal thinning flake hint at an early Paleoindian occupation at the Wolfe Shelter Site. If these deposits occur, they are probably located in the collapsed section of the shelter or under the large rocks fallen from the roof and resting along the southwest dripline. Although not discussed previously, it also is possible that some early Paleoindian material was deposited by the stream that flows through the shelter. Further research on the origin of this stream and the depositional environments it drains must be intensified to determine this possibility.

The cultural chronology and stratigraphic deposits at Wolfe Shelter may be typical of other rockshelters in eastern Kentucky. However, due to the geochronology and nonsystematic artifact collecting that has occurred at these kinds of sites as well as difficulties related to collapsed sections, future investigators must decide whether to dedicate the time and energy required to study them. We recommend that the collapsed portions of rockshelters be given more serious consideration, because the deposits underlying these sections are likely intact.

Although not discussed above, Dale Cross has reported the presence of Clovis points in several other rockshelters and on several nearby ridgetops, including the one above the Wolfe Shelter Site, and of Cumberland points around large area sinkholes. The distribution of these materials in different, but related depositional environments, suggest rockshelters should not be seen as self-contained units, but rather as parts of a suite of landscape locations used by early hunter-gatherers in eastern North America. Total landscape or human habitat oriented research needs to be the basis of archaeological investigations at each of these closely juxtaposed depositional environments.

With these cautions and recommendations in mind, the authors of this report urge a far more extensive professional study of Kentucky's rockshelters and surrounding landscapes. Although the rockshelters of Kentucky have received little systematic attention by archaeologists, they have not escaped the attention of artifact collectors. Rockshelters are the "favored target of relic collectors who in their search for artifacts can destroy a site in a single day" (Ison 1989:205). However, as this report and others have concluded, substantial amounts of important data may remain intact within disturbed shelters.

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ANALYSIS OF THE HUMAN SKELETAL REMAINS FROM THE RAILWAY MUSEUM SITE (15JF630)

By
Nancy A. Ross-Stallings[1]

ABSTRACT

The in situ analysis of a total of eleven burial features was conducted in the fall of 1993 to salvage data from a small portion of the Railway Museum Site (15Jf630). The site is a Late Archaic settlement located on a terrace of the Ohio River, approximately three river miles upstream from the Falls of the Ohio River. Through previous agreement, the interments were left in situ and were buried under fill before construction proceeded. A total of 17 individuals, of all ages and both sexes, were identified during analysis. No advanced statistical studies were conducted on the burials because of small sample size. No outstanding pathologies were present, however moderate iron deficiency anemia affected a large proportion of the sample population. Tooth attrition, as with most Archiac Period skeletal material, was rapid. Episodes of violence were not present in the skeletal remains. Burial mode included single and multiple interments, some placed in pits dug for that purpose, while others were interred in partially filled trash pits. The bodies were most often placed in a flexed or semi-flexed position, although two were placed extended, face down. Flexed interments were placed on their backs, sides or on their stomachs.

INTRODUCTION

The Railway Museum Site is a Late Archiac village site located on an alluvial terrace remnant on the south bank of the Ohio River near River Mile 601.5, in the northeast part of Louisville. The Falls of the Ohio are located about 4.8 km downstream of the site, and the floodplain on the Kentucky side of the Ohio is about 0.6-1.0 km in width at the site location. Although the exact boundaries of the site could not be delineated, it is estimated that as little as 10 percent of the site may have been salvaged by Cultural Resource Analysts, Inc., in September and October 1993. The excavated site area was once occupied by the State Railway Museum. The site was discovered in August 1993 when work began to relocate railroad tracks to another location. The purpose of the track relocation was a component of the Louisville Waterfront Project, a planned development fronting a 3 km long portion of the Ohio River in Louisville. The impacted site area was approximately 20 m east to west and 40 m north to south (Anslinger et al. 1994).

A total of 71 projectile points were recovered from the excavations. Of those, 32 were placed in the Broad-barbed stemmed category, and only six of the points were complete. Only 13 of the points were assigned to established typologies and these included Saratoga parallel stem (n=1), Saratoga-like (n=9), Delhi (n=1), and Delhi-like (n=2). Seven points were placed in the Broad blade notched category, and of those, six were typed as Table Rock (n=3), Brewerton (n=1), Salt River Side Notched (n=1), and Big Sandy II (n=1). Eight of the points were typed as Lance Stemmed. Within that category, Table Rock (n=2), Matanzas (n=1), McWhinney Heavy Stemmed (n=1), and McWhinney Heavy Stemmed-like (n=1) were

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recognized. The final category of recovered points was Small Notched Stemmed (n=3); of those two were typed as Merom-Trimble or Merom-Trimble-like and the third was typed as Table Rock. The remaining 21 points and fragments could not be typed with confidence (Anslinger et al. 1994:70-74).

Additional recovered artifacts of interest were seven bell-shaped pestles, three anvil stones, 21 hammerstones, a chipped slate item which may have been a gorget preform, 10 bone awls, seven points made of deer antler, one fish hook, and one bone pin. The bone pin was found in association with Burial 2. Three sherds and four sherdlets were also recovered. The sherdlets were excluded from further analysis, since they were less than 1 cm^2 size. The remaining three sherds had grit as a primary temper type. One sherd also contained crushed quartzite, and a crushed, unidentified igneous rock was found in the other two sherds. The prehistoric ceramic typology for this area has not been well-defined, but the sherds resembled an Early Woodland type called Mid-Valley Cordmarked. One of the sherds with igneous tempering displayed fingernail impressions applied over the cordmarking (Anslinger et al. 1994:85-92).

A total of 45,424 animal bone fragments were recovered from 46 features and six test units. Fish were the most abundant, followed by mammals (including domestic dogs), reptiles, and birds. In addition, a total of 14,575 shell fragments were recovered from 29 pit features; of those, 4,063 could be identified to the genus or species level. The largest number of shells came from 40 species of freshwater mussels, followed by five taxa of aquatic snails. The mussels' habitat indicates that wadeable shoals were located in close proximity to the site. The lack of crushing of the shell points to the probability that they were steamed and/or boiled. The distribution of the fauna indicates that mussels formed a secondary but important role in subsistence. Nutshells were the most common form of flora, and of those, hickory and walnut accounted for 99.7 percent of the nutshells. Four cucurbita fragments were recovered, and by their morphology were thought to represent a nondomesticated gourd-like species found from Middle Archiac times in eastern North America. The site also produced a low evidence of wood charcoal (n=148). Of the identifiable types, honey locust accounted for 40.8 percent of the total. Other types included ash, oak, red oak, hickory, maple, hackberry, Kentucky coffeetree, and mulberry (Anslinger et al. 1994:91-97).

Two radiocarbon dates that were obtained from nut charcoal place the heaviest occupation of the site in the Late Archiac. Artifacts recovered corroborate this date of occupation. The first date came from a feature that was interpreted as an earth oven, and an uncorrected date of 2830±80 B.C. (Beta-70350) was derived. This earth oven had huge densities of mussel shell, limestone, and charcoal. The second uncorrected date was also from an earth oven with three distinct fill zones. Two distinct shell lenses were present. A date of 2770±70 B.C. (Beta-70351) was obtained from this earth oven (Anslinger et al. 1994:132). The superimposed pit features and burial mixing in the excavated area of the site indicate that the site was occupied periodically (Figure 1). The site probably functioned as a relatively permanent or stable residential base, which may have been occupied seasonally. Faunal and floral remains suggest that the site was probably most heavily occupied in the summer and fall. Artifacts indicated that extractive and processing tools were both well represented, but there was a large and functionally diverse artifact assemblage recovered at the site (Anslinger 1994:138-139).

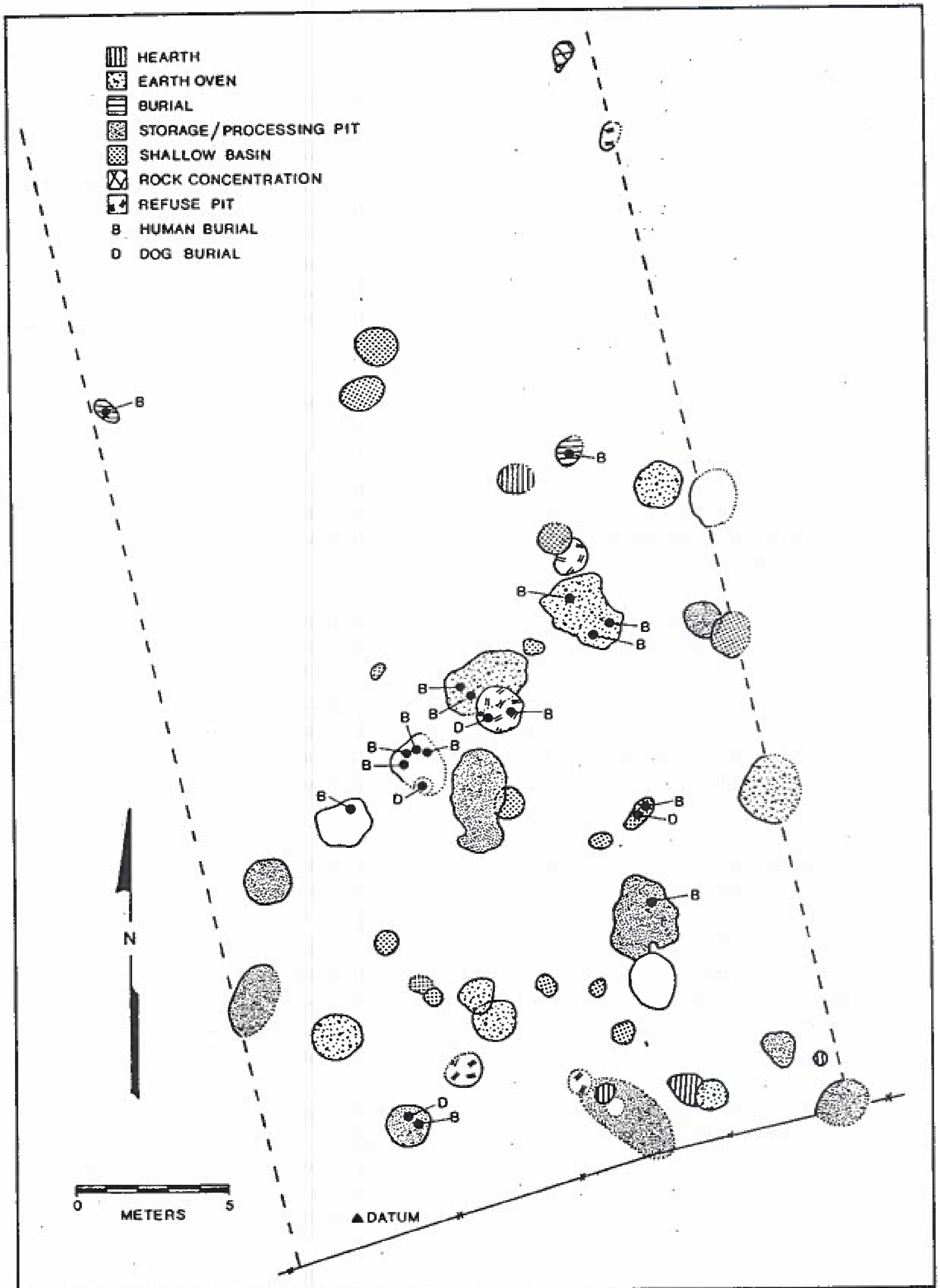


Figure 1. Distribution of features at the Railway Museum Site by function (from Anslinger et al. 1994:54).

METHODS OF ANALYSIS

The analysis of the skeletal material from the Railway Museum Site was conducted in the field. The scope of work developed for the site required that burials be analyzed *in situ.* Nine of the individuals were interred on their sides, stomach, or back in tightly flexed positions. The head was positioned to one side in most cases, or more rarely, face down or face up. This presented some problems from the perspective of data collection, because nearly all the bones from one side of the body were not visible for measurement, or for examination of the material for pathologies and anomalies. Some traditional areas of bioarchaeological inquiry, such as studies of bilateral asymmetry, or occupationally derived osteoarthritis, were difficult or impossible to accomplish. Every effort was made to recover as much information as possible from each interment.

The burials were left *in situ* after they had been cleaned, and maps and photographs were made. As the skeletal material was excavated and cleaned, heavy black plastic was placed over the bones and carefully secured at the edges to prevent deterioration of the remains. *In situ* analysis was then conducted, with the plastic still covering portions of the skeleton that were not currently being examined. Each bone or component of the skeleton was carefully assessed for evidence of pathology, anomalies, genetic traits, determination of sex and age, and overall nutritional and health status.

Standard anthropometric measurements were taken of those bones that could be seen. Bass (1987) was utilized as the source for stature determinations and other measurements. Further cleaning and delineation of at least portions of the bones resulted in obtaining additional measurements. This was particularly the case for femoral circumferences and those measurements associated with the ends of long bones and the size of teeth. In the case of the measurements of long bones, stature and sex determination were very dependent on these data. However, as with any skeletal material that is field analyzed, it was impossible to recover all available data.

The preservation of the skeletal material ranged from very poor to very good. In some cases, there was a great deal of variability in bone preservation within a single individual. Factors affecting preservation included looting (unauthorized individuals had dug into burial features, destroying at least a portion of some burials, and in at least one case repositioned some broken cranial material so that the orientation of the burial was lost); recent construction-related earth moving activity at the site before the discovery and reporting of the skeletal material; nineteenth and early twentieth century use of the site for a dwelling and railroad museum; soil ph; and the activities of the site's prehistoric inhabitants.

Repeated or prolonged use of the site after some of the people were interred resulted in the site's inhabitants truncating or partially destroying some of the burials during the course of interring additional bodies or in the process of day-to-day activities, such as the excavation of a storage pit. It is unknown if this activity was inadvertent, or if the site's inhabitants possessed a different value system regarding disturbance of burials that had been interred quite some time before. It is entirely possible that if the site was repeatedly occupied, perhaps seasonally or at least periodically, subsequent visitors to the site would not have realized that certain spots within the site contained human interments. However, it must be stated that at least some of the site's inhabitants were very open to the concept of apportioning the use of a part of larger pit features for interments. In some cases, it appears that pits were being used for refuse, and as they became filled, one of the final uses was to inter the deceased.

BURIAL DESCRIPTIONS

Table 1 documents the demographic profile of the interments at the site and their estimated statures, when possible. Table 2 summarizes the mode of burial, orientation, and grave goods. Table 3 is an abbreviated description of anomalies and pathologies. The mortuary behavior and paleopathological analysis will be discussed in later sections of this paper. For detailed descriptions of the individual interments and the skeletal material, see Anslinger et al. (1994).

A few of the interments merit special mention, however. Burial 12, a female aged 20-25 years, exhibited anterior/posterior bowing at midshaft on her tibiae, as noted in Table 3. It must be noted that this bowing was not consistent with treponemal syndrome, since none of the other bones and none of the visible teeth in this skeleton showed bony involvement consistent with treponemal syndrome (Bogden and Weaver 1992; Hackett 1976; Ortner and Putshar 1985:180-218; Powell 1991 and 1992; Ross-Stallings 1989). This is notable, since there was good preservation of those bones that would show treponemal involvement if it were present. The cause of the bowing is not rickets or osteomalacia (Ortner and Putshar 1985:273-287). The tibiae and the bones on the remainder of the skeleton show no pathology consistent with these conditions.

Burial 13, a 5 to 7 year old child, was interred with Burial 12. The child was aged by dentition (based on the complete eruption of permanent mandibular and maxillary first molars) and long bone diaphyseal lengths. The diaphyseal lengths of the two complete long bones, 17.7 cm (right humerus) and 22.3 cm (left femur), corroborated the estimated age from the dentition. Researchers consider dental development more reliable indicators of childhood age than skeletal development (Sundick 1977:141-142, 1972:18). The length of the individual's femur correlates well with Sundick's examination of subadults at Indian Knoll (degree of dental development and femur length [Sundick 1972:146]) and the humeral length versus dental development (Sundick 1972:133). The humeral length and femoral length of this individual also correlated reasonably with Johnston's (1959, 1961, and 1962:251) estimated ages for bone lengths for Indian Knoll infants and young children. Although the oldest child Johnston was working with for the purposes of the latter article was 4.5-5.5 years, the rate of growth for the humerus and femur (about 20 mm per year) between the fourth and fifth years would mean that Burial 13's bone lengths could reasonably be expected to belong to a child of approximately six years of age.

By way of comparison, the dental eruption schedule of Burial 13 corresponds with the age at eruption for twentieth century U.S. middle class children (Hoffman 1979:464), but not for the length of the femoral diaphysis. In Hoffman's twentieth century sample, the mean femoral diaphysis length was about 27.0 cm long, making these children considerably taller than the Archaic period children from Indian Knoll and the Burial 13 child. The sample of the twentieth century children at age 5-6 years had slightly longer mean humeral diaphyseal lengths, but was more comparable to Burial 13 (mean length at age 5 years was 17.0 cm and mean length at age 6 years was 18.0. By age 7 years however, these children had mean lengths of about 19.0 cm (Hofman 1979:465). A nineteenth century white Canadian cemetery sample shows more agreement with Hoffman's twentieth century data than it does with the Archaic data (Saunders and Hoppa 1993:144) for the femur. Saunders and Hoppa did not publish tables for the diaphysis of the humerus.

Table 1. Demographic Profile of Human Skeletal Remains.

Burial Number	Feature Number	Sex	Age	Estimated Stature (cm)
1	Unit 2, Fea. 4	U*	25-30	NA**
2	11	M	25-30	163.59+/-2.99
3	26	U	25+	NA
4	17A	M	25-30	162.13+/-2.99
5	17	F	30+	162.47+/-4.45
6	18	U	Adult***	NA
7	18	F	18-23	164.02+/-3.72
8	18	M	35-40	167.88+/-4.24
9	40	U	Adult	NA
10	41	F	30+	159.82+/-3.72
11	Dog Burial			
12	41	F	20-25	168.28+/-4.45
13	41	U	5-7	NA
14	39	F	45+	159.44+/-4.45
15	41	M	20-25	168.96+/-2.99
16	Unit 6, Fea. 9	U	1.5-2.5	NA
17	23	U	17-19	NA

Mean Female Stature (n=5) - 62.646 cm
Mean Male Stature (n=4) - 165.64 cm

* Skeletal remains were too fragmentary to assess sex.
** Long bones were too fragmentary to derive estimated stature.
*** Skeletal remains were too fragmentary to assess age more accurately.

Table 2. Summary of Mode of Burial, Orientation and Grave Goods.

Burial Number	Demographic Summary	Mode of Burial, Orientation, Grave Goods
1	Adult, Unknown Sex	Flexed on back: Top of head to northwest, Buttocks to southeast: No grave goods.
2	Male, 25-30	Face down on stomach, legs bent at knee and feet tucked against buttocks: Top of head to northeast, face to south, knees to southwest: Worked bone hairpin.
3	Adult, Unknown Sex	Flexed(?), severely disturbed: Top of head to southeast, buttocks to northwest: McWhinney Stemmed point found near, but not in, burial.
4	Male, 25-30	Flexed on stomach: Top of head to west, face to the south, buttocks to east: Worked bone awl.
5	Female, 30+	Flexed on left side: Top of head to northwest, buttocks to southeast: No grave goods.
6	Adult, Unknown Sex	Flexed on left side: Orientation of head unknown (burial was looted and skull missing), buttocks to southeast: No apparent grave goods.
7	Female, 18-23	Flexed on right side: Top of head to west, buttocks to east: No grave goods.
8	Male, 35-40	Semiflexed on back/left side: Top of head to west, buttocks to northeast: Partial deer mandible placed between flexed legs.
9	Adult, Unknown Sex	Damaged - top of pelvis to skull missing: May have been tightly flexed: Orientation of head unknown, buttocks to southwest: No grave goods.
10	Female, 30+	Flexed on stomach - face down: Top of head to southwest, buttocks to northeast: No grave goods.
12/13	Female, 20-25	Multiple interment - Female: Flexed on back with left arm under child (Burial 13): Facing west with top of head to north, buttocks to south: No grave goods.
	Child, 5-7	Child: Extended on stomach, face down, placed on top of left arm of female (Burial 12): Top of head to north, feet to south: No grave goods.
14	Female, 45+	Flexed on left side: Top of head to southeast, buttocks to northwest: Interred on top of dog.
15	Male, 20-25	Disturbed by Burials 12, 13, and 10 - torso missing from pelvis up: Body probably extended on back: Skull displaced to feet, feet to south, left humerus and scapula displaced to southeast edge of burial pit: Hammerstone, hafted scraper, and antler billet probably associated.
16	Toddler, 1.5-2.5	Disturbed (looted) and poor preservation: Orientation unknown: No apparent grave goods.
17	Sex Unknown, 18+	Disturbed: Orientation unknown: No apparent grave goods.

Table 3. Summary of Skeletal Pathologies and Anomalies.

Burial Number	Sex	Age	Pathology/Anomaly
1	U*	25-30	None noted: Burial poorly preserved.
2	M	25-30	Peg molar - right maxillary M3.
3	U	25+	None noted: Burial poorly preserved.
4	M	25-30	Mild porotic hyperostosis: Enamel hypoplasia on upper crown visible on the upper crown of left maxillary M2: Abscess around the left maxillary PM2 root.
5	F	30+	Interdental carie on the right maxillary M2: Periodontal disease present: Moderate porotic hyperostosis present on cranium: Cervical vertebrae 3-7 visible and exhibited arthritic lipping and anterior wedging: Mild arthritic lipping on distal end of left ulna and proximal end of right ulna: Right patella exhibits severe arthritic lipping on disto/medial side: Left hand had moderate arthritic lipping on preserved metacarpals and phalanges.
6	U	Adult	Moderate porotic hyperostosis on cranium: Postcranial skeleton poorly preserved.
7	F	18-23	Moderate porotic hyperostosis on cranium: Enamel hypoplasia present on upper crown of left mandibular canine: Right dental arcade not visible.
8	M	35-40	Moderate porotic hyperostosis on cranium.
9	U	Adult	None noted: Burial poorly preserved.
10	F	30+	Moderate porotic hyperostosis on cranium: Pierced olecranon fossa on left humerus - diameter 4.5 mm: Right humerus not visible: Enamel extension present on left mandibular M1.
12	F	20-25	Severe periodontal disease present: Moderate porotic hyperostosis on cranium: Very slight arthritic lipping present on body of cervical vertebrae 5 and 6: Both tibiae exhibit anterior/posterior bowing at mid-shaft.
13	U	5-7	Enamel hypoplasia from midpoint of the crown to the root of left maxillary M1, tooth also exhibits an enamel extension.
14	F	45+	Senile mandibular/maxillary area: Only tooth in visible dental arcade was a mandibular canine: Extreme mandibular and maxillary resorption: Slight arthritic lipping on distal portion of right humerus, proximal portion of right ulna, and proximal portion of right radius: Slight periostitis present on anterior and posterior of distal 1/3 of shaft of right femur: On right tibia, incipient periostitis on proximal and medial side, and moderate periostitis present on midshaft of right fibula, distal to nutrient foramen: In distal end of tibia, cortical bone is thinned with an expanded medullary area indicative of senile osteoporosis: Skeleton is too badly preserved to note presence of condition in other uninflamed areas.
15	M	20-25	Enamel hypoplasia visible on right mandibular canine near base of crown.
16	U	1.5-2.5	None noted: Burial poorly preserved.
17	U	18+	Skeletal material very fragmentary: Carie present on occlusal area of left maxillary M3, tooth also has enamel hypoplasia on upper crown.

* Skeletal remains were too fragmentary to assess sex.

The notable size difference is discussed here with reference to the fact that children from prehistoric populations were, in at least some cases, notably smaller than nineteenth or twentieth century children. It is necessary to look at overall developmental attributes, in addition to consulting age/growth charts for diaphyseal lengths, in order to estimate age at death.

Burial 7, an 18 to 23 year old female (Figure 2), was the best preserved interment at the site. The skeleton could be tightly aged, due to its clear stages of development via teeth, unfused clavicles, recently fused long bones, and the appearance of the pelvis. The teeth were already heavily worn. This tightly aged interment and its worn dentition served as an index of dental wear for other interments at the site and contributed to reasonable aging of the older adult skeletons.

OTHER HUMAN BONE AT THE SITE

As previously noted, a number of the excavated interments had been disturbed, both by the prehistoric inhabitants and by more recent activities associated with construction. A number of pit features that were not intended for funerary use contained small amounts of human bone that were redeposited there, primarily because the site had been intensively occupied over a long period of time. This is not an unusual occurrence at such sites (Ross-Stallings 1991). Although an exhaustive compendium of bone slivers and fragments by feature would be inappropriate here, the two skeletal fragments noted below are of interest. A very limited number of fragments were found on the surface of the site, usually from trenches dug by heavy equipment. It would be nearly impossible to tie them with any degree of confidence to the formal interments.

The fragments of interest were found in Feature 7 and consisted of a neural arch fragment from a newborn infant and a molar tooth cap from a forming crown. This, of course, indicates that there was at least one infant interred at the site. Unfortunately, no long bones or an ilium were found with these infant remains, so calculating length or determining the sex of this infant was not possible. This same pit feature also contained a few fragments of adult bone. It is impossible to determine where this material originated. It is highly possible that the infant was not initially interred in this pit, and that the infant bone fragments and the adult bone fragments may have come from different portions of the site.

BONE PATHOLOGIES AND ANOMALIES: A DISCUSSION OF THEIR BIOCULTURAL SIGNIFICANCE

It must be noted that the list of anomalies and pathologies found on the skeletal material from the Railway Museum Site is a comparatively short one. No evidence of violence or violent deaths (such as from warfare) was found. Only one example of what was believed to be traumatic arthritis was noted (Burial 5), and that sort of damage to the knee could have been the result of an unfortunate fall, or a series of such falls. The discussion below is not exhaustive, in that not all pathologies and anomalies found in Table 3 are covered in detail. However, the more frequent and the unique conditions are reviewed and comparative data are presented.

In general, Archaic populations tend to be healthier, on the average, than later Woodland and Mississippian populations. There are a number of factors, including diet, food preparation practices, population pressure (which increases conflict, the spread of infectious disease and the drain on plant and animal resources for food, clothing, and shelter), sedentary life in large villages (disease, sanitation problems, increased chances of injury from physical exertion after long periods of sedentism), and development of status differences (which result in differential access to resources). Although this list is by no means exhaustive, a number of Southeastern and Ohio Valley studies have been conducted examining health issues unique to one time period, or contrasting Archaic hunter-gatherers with the later agriculturalists. Usually, the studies deal with Archaic and Mississippian groups, but sometimes Woodland peoples are also considered. Examples of such studies include Blakely (1971), Bogden and Weaver (1992), Bridges (1985, 1991a, 1991b), Cassidy (1972, 1984), Charles et al. (1988), Cook (1984), Frankenberg et al. (1988), Goodman (1991), Hancock (1986), Kelley (1980), Kennedy (1989), Palkovich (1987), Parham and Scott (1980), Perzigian et al. (1984), Rothschild (1975, 1979), and Smith (1986).

The most frequent pathological condition at the Railway Museum Site was porotic hyperostosis (see Table 3), with a total of seven individuals exhibiting it. None of the cases was severe, and of those afflicted individuals, four were females, two were males, and one was an adult of unknown sex. Two of the burials had no preserved cranial fragments, so the observed frequency of the condition was 50 percent (see Table 3).

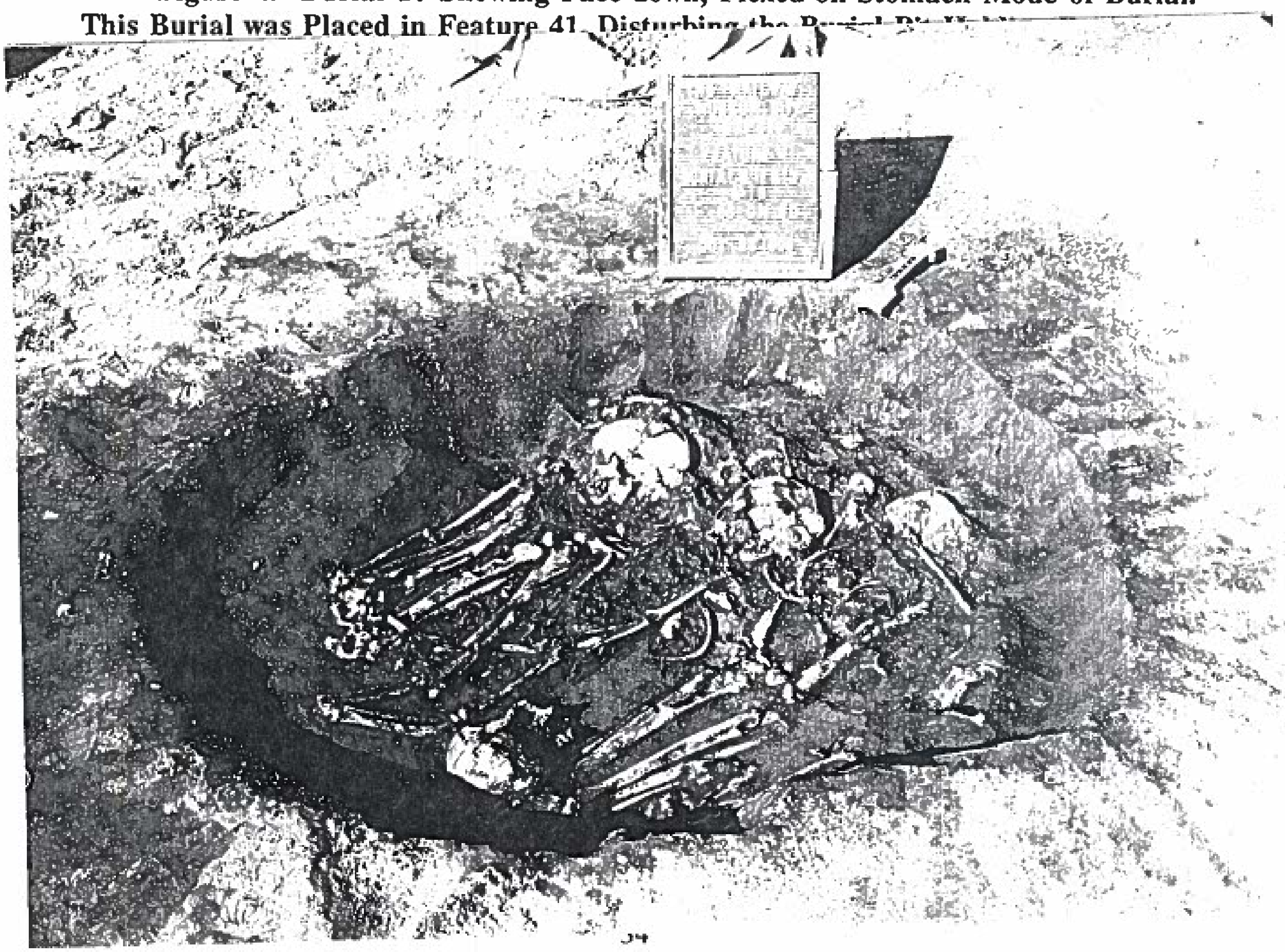
Previous discussions about porotic hyperostosis by biological anthropologists encompass literature reviews and historical perspectives regarding the study of the condition; examples include Hancock (1986), Hill and Armelagos (1990), Klepinger (1992:122-124), Ortner and Putschar (1985), Palkovich (1987), and Stuart-Macadam (1987, 1991). The most common, non-genetic causes of this condition are severe anemia as a result of malnutrition, a serious infestation of intestinal parasites, or from a medical condition that is preventing normal intestinal absorption of nutrients (or a combination of these). Eating corn with most meals and slow cooking foods in stews to the point that all the nutrients are cooked out of the food by the time it is consumed are examples of ways in which populations with adequate diets can find themselves with iron deficiency anemia. Corn is low in iron and it has phytates that bind vegetally derived iron in the intestine, thus preventing the absorption of the iron in the corn and from other vegetal foods consumed with it (Hancock 1986:88).

As iron deficiency anemia progresses, the frontal, occipital, and parietal bones in the skull and the ribs attempt to expand their surface areas of trabecular tissue in order to produce more red blood cells. The affected bone begins to develop a pitted and channelled appearance and begins to thicken. In populations with marginal nutrition, those most susceptible are infants, children, adolescents, and women of childbearing age. Pregnant and lactating women are particularly susceptible. If whatever is causing the anemia is corrected, the body can, to a certain extent, resorb some of the bone.

Populations vary markedly in the frequency of porotic hyperostosis. In the Southeast, it seems to occur in greatest frequency among agricultural populations. At the Bonds Site (22Tu530), a transitional Late Woodland/Emergent Mississippian village in northwest Mississippi, 100 percent of the individuals exhibited porotic hyperostosis (Ross-Stallings 1989:10). The Fort Ancient Anderson Village Site in Ohio exhibited a frequency of 65.9 percent (Perzigian et al. 1984:359). But at Hardin Village, a Fort Ancient site in Kentucky, only 8 percent of the skeletons exhibited this condition (Cassidy 1984, 1972). Interestingly,

Figure 2. Burial 7 Showing Flexed-on-Side Mode of Burial.

Figure 4. Burial 10 Showing Face-down, Flexed-on-Stomach Mode of Burial.
This Burial was Placed in Feature 41, Disturbing the [illegible]



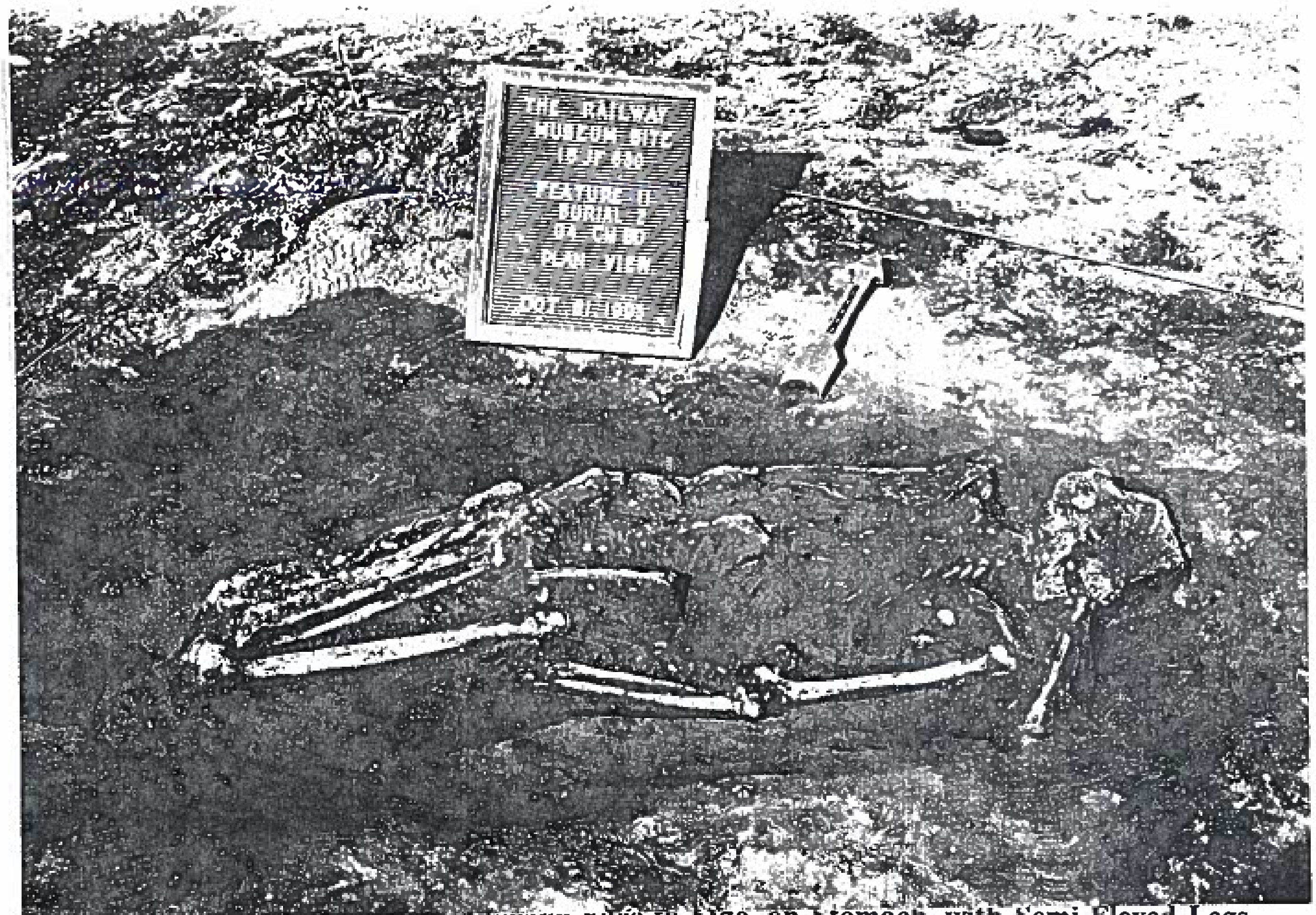
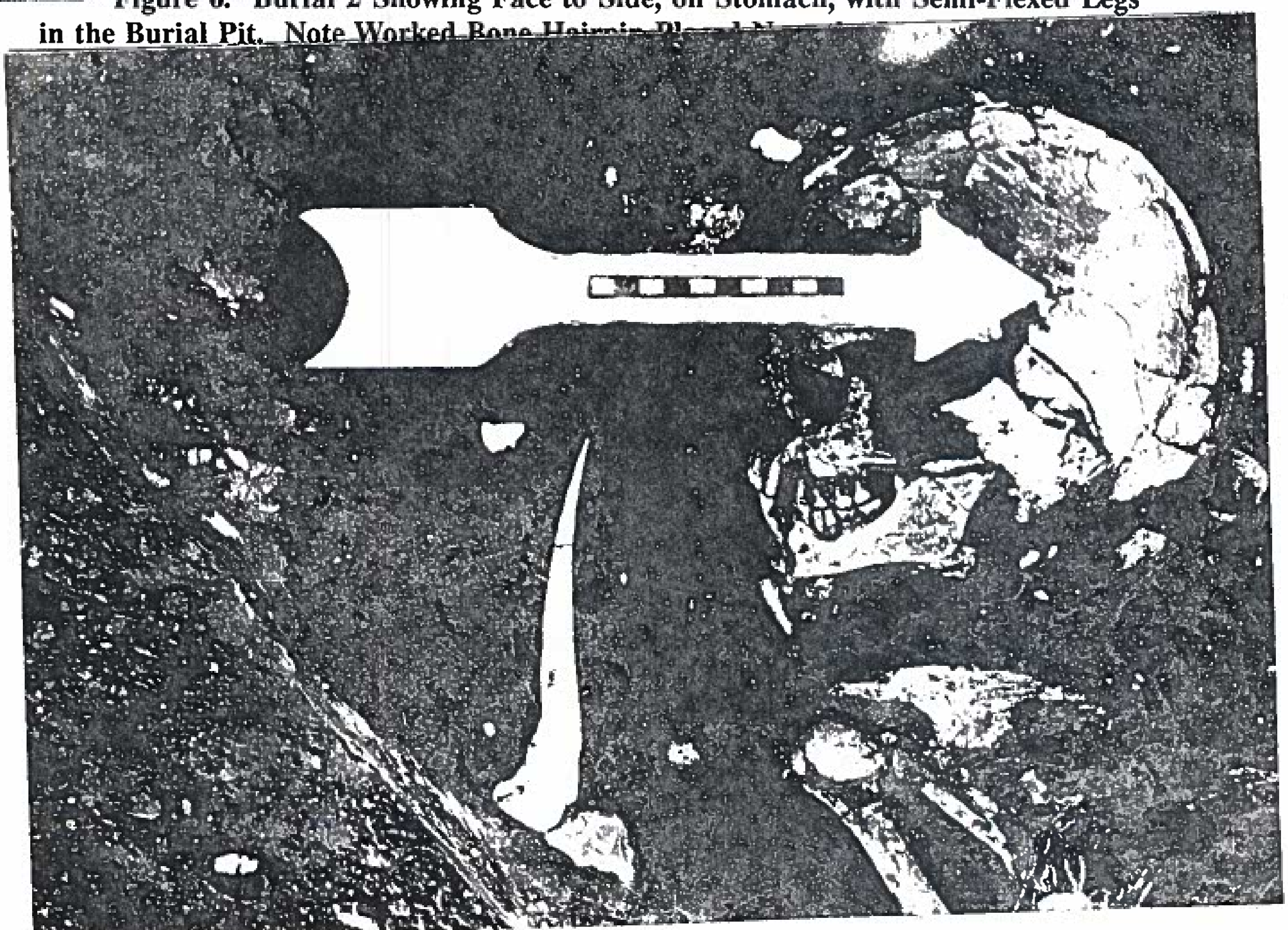


Figure 6. Burial 2 Showing Face to Side, on Stomach, with Semi-Flexed Legs in the Burial Pit. Note Worked Bone Hairpin Pl



Cassidy (1972:73) also examined a sample of Indian Knoll material and found a frequency of 31.7 percent. Cassidy (1972:72) qualified her assessment with the statement that the changes on the Indian Knoll material were so slight that they may not represent a pathologic process. Kelley (1980:121) also examined a sample of Indian Knoll material for porotic hyperostosis and found a frequency of 0.9 percent. Of the 62 burials excavated by Morse (1967) at the Robinson Site, an Archaic site in Tennessee, not one interment was cited as showing evidence of porotic hyperostosis. However, Morse's analysis of the skeletal material appeared to lack detail. At the Elizabeth Site in the Lower Illinois Valley, Frankenberg et al. (1988) compared pathologies among adult and sub-adult groups. No anemias for adults were indentified; however, for subadults, the anemia frequency for the Archaic population was 14 percent, compared to 39 percent for the combined Early and Late Woodland populations (Frankenberg et al. 1988:108). Interestingly, the Railway Museum Site inhabitants with anemia were all adults, although there were only two child interments. These examples indicate that the frequency of porotic hyperostosis varies widely spatially and temporally, but not always in predictive ways. This condition seems more site-specific than following broad regional trends.

Enamel hypoplasia was observed in 5 out of the 13 Railway Museum interments that had at least some teeth, an occurrence rate of 38.5 percent (see Table 3). This condition occurs when the crowns of the teeth are forming in babyhood and childhood. Enamel formation on the teeth is a continuous process, unless it is interrupted by severe illness or malnutrition. Unlike porotic hyperostosis, the pattern of enamel deposition is irreversible, so the horizontal lines remain on the teeth until attrition wears the teeth away. Predictably, many skeletons with porotic hyperostosis will exhibit enamel hypoplasia. However, other forms of malnutrition and any form of serious illness can cause the lines to form. Since teeth form at fairly comparable rates in people, the location of the hypoplasia on the tooth crown, and which tooth crown exhibits it, can be used to determine approximately when the body was stressed during childhood (for an excellent discussion of stress and enamel hypoplasias, see Goodman and Rose 1990).

Modern populations in marginal environments still exhibit frequent enamel hypoplasias, and in 1985, an examination of 300 children from villages located north of Mexico City revealed that 44.4 percent exhibited enamel hypoplasia on their permanent maxillary central incisors (Goodman 1988:263). At the Railway Museum Site, the age at stress varied with the individual. Burial 4, a 25 to 30 year old of unknown sex, had episodes of stress from ages 5 to 7 years. Burial 7, an 18 to 23 year old female, showed stress episodes at 4 to 5 years. Burial 13, a 5 to 7 year old child, showed stress episodes at 1-2 years. Burial 15, a 20 to 25 year old male, showed stress episodes at age 4-5 years. Burial 17 showed stress episodes at 11-14 years.

Perzigian et al. (1984:354) report that their southwestern Ohio Fort Ancient sample showed a rate of dental hypoplasia of 60 percent for each tooth examined, whereas their Middle Woodland sites and Archaic sites showed a per tooth incidence of 20 percent and 21 percent frequency, respectively. At the Archaic Period Habich Site (15Jf550), nearly 2 km upstream from the Railway Museum Site on the same terrace of the Ohio River, no significant skeletal pathologies were noted on the skeletal material by Wilson (1993:18) on the 26 burials recovered from the site. However, dental examinations were undertaken by Ensor (1993), and marked attrition was noted. However, the incidence of caries was very low (Ensor 1993:22), making the dental profile at this site very comparable with the Railway Museum Site (for an excellent review of caries and periodontal disease in prehistoric populations see Moore and Corbett, 1983). Ensor (1993:26) provided data regarding the mean age at development of the enamel hypoplasia for each of six permanent teeth of the burials excavated at this site. These data indicate that, in general, the hypoplasia developed between the age of 1.3 and 3.8 years among the site inhabitants. This age range in prehistoric populations, based on ethnographic studies of hunting and gathering populations, marks the transition from infant diets (primarily mother's milk) to an adult diet. Given seasonal availability of food, and the chances of food shortages, toddlers and small children would have been subject to the same dietary shortcomings as the rest of the inhabitants. Interestingly, this earlier age range of stress contrasts markedly with the people at the Railway Museum Site. Thus, despite the close proximity of the two sites, the distribution of enamel hypoplasia differed markedly.

Cassidy (1984:322), in her examination of the Indian Knoll site inhabitants, reported the incidence of this condition on permanent canines and third molars. At Indian Knoll, 86.5 percent of males, 86.0 percent of females, and 93.8 percent of adolescents had the condition on their canines. For the third molar, 11.5 percent of males and 7.0 percent of females had the condition. It is suggested that the higher levels of enamel hypoplasia found on the adolescent canines may be a feature of more stressed individuals dying at younger ages.

Although moderate arthritic lipping occurred in three of the more completely preserved Railway Museum interments, it is suggested that this condition would have had a higher frequency had the articular surfaces of more bones and more vertebrae been preserved for examination. As noted on Table 3, all of the observed cases occurred in females. Two of the females (Burials 5 and 12) exhibited arthritic lipping on cervical vertebrae. Arthritis can be cautiously utilized as an indicator of occupational stress (for example, see Bridges 1991b and Kennedy 1989). Kennedy (1989:150) notes that, in cases of cervical arthritis, the condition can develop by repeatedly carrying heavy loads on the top of the head. His ethnographic analogies are black South African laborers; males carry grain sacks on their heads and females carry wood and water on their heads. Although no cause for the arthritis could be positively identified, these ethnographic examples are at least thought-provoking. The predisposition for developing arthritis does have a genetic component, and in a series of 4000 modern U.S. autopsies, some degree of spinal osteophytosis was present in 60 percent of females and 80 percent of males by the end of the fifth decade of life (Ortner and Putschar 1985:421).

Although cervical arthritis is not frequently mentioned in paleopathological reports, the Elizabeth Mound Group in Illinois had a frequency of 3 percent for cervical arthritis in the combined Early and Late Woodland group and 4 percent in the Archiac group (Frankenberg et al. 1988:108). Although Cassidy (1984:321) reported only on vertebral arthritis and did not delineate by type of vertebra, she found a frequency of 58 percent for a combined sample of males and females at Indian Knoll. Kelley, in an examination of a very large sample (n=813) from Indian Knoll, found that 39 percent of adults displayed spinal arthritis. Again, no breakdown by type of vertebra was available for his data (Kelley 1980:105).

SITE DEMOGRAPHICS, STATURE, AND SEXUAL DIMORPHISM

A total of 17 individuals were recovered from the Railway Museum site; this count includes the fragmentary newborn infant found in a refuse pit. Of the 17 individuals, five adults were of unknown sex, and three were less than 7 years old. The remaining nine consisted of five females and four males. For the purposes of determining mortality, age ranges shown in Tables 1-3 have been rounded to the midpoint for each individual; ages specified as 25+, for example, have been rounded down to the minimum age, although it is recognized that this may skew the sample to younger ages than were probably extant. Individuals who could only be assessed as "Adult" because of preservation were not considered in the demographics calculations.

Mean age at death for all individuals was 22.77 years, and the median age was 27.5 years. If an individual survived childhood, and lived to age 18 years, mean adult age increased to 27.8 years, not much of an increase. Exactly one half (n=6) of the adults, for which age could be determined, died between the ages of 25 and 35 years. Two adults died over the age of 35 years: Burial 18, (male, 37.5 years) and Burial 14 (female, 45+ years). The second largest number of adults died between the ages of 18 and 25 years (Burials 7, 12, 15, and 17). The sex of the individuals does not appear to have much influence on age at death. Of course, part of the less than complete demographic data is reflected in the fact that five (35.7 percent) of the 14 adults at the site could not be sexed, due to preservation.

Ages at death are found to be highly variable in larger demographic Archiac Period samples from sites in the Southeast and Midwest. At the Carlston Annis Site in west central Kentucky (Butler County), a sample of 354 individuals yielded a mean age at death of 21.9 years, remarkably similar to the Railway Museum Site (Mensforth 1986:30, 1990:96). If an individual from Carlston Annis achieved adulthood, which was defined by Mensforth as reaching 15 years, mean adult age increased to 34.7 years. This is considerably higher than the mean adult age at the Railway Museum Site.

For Indian Knoll, in Ohio County, Mensforth (1990:89) found that Snow's preliminary analysis in 1948 indicated that mean adult age (for individuals achieving age 20 years) was 26.1 years, using cranial suture closure as the aging technique. Later, in 1961, Snow and Johnston reexamined 873 of the 1234 individuals and utilized McKern and Stewart's method of aging via the os pubis and population-specific rates of dental wear. The mean adult age (after age 20 years was achieved) was then determined to be 30.7 years, which was an increase of 4.6 years over the 1948 study (Mensforth 1990:89). Rothschild (1975) utilized the Indian Knoll data in a survey of age, status and role in cemetery populations across eastern North America. Seven sites were compared for age distribution at death. Rothschild did not report mean age at death for the sites, but did indicate that the highest number of people in the Indian Knoll cemetery (in a percentage composition by age class) was 25-30 years old at death (Rothschild 1975:76).

For the Elizabeth Mound Group in Illinois, Frankenberg et al. (1988:118) report that life expectancy at birth was 30.8 years for the Archaic population, using Weiss's model life tables. Frankenberg et al. also calculated life expectancy using Boquet-Appel and Massett's regression equations for the Archaic population, yielding a life expectancy at birth of 24.9 years (1988:118). Fairly comparable life expectancy was derived from the skeletal material at the Middle Archiac Anderson Site (40Wm9) in Williamson County, Tennessee. The life expectancy at birth for this site was 23 years (Joerschke 1983:iv).

For the Eva Site, Benton County, Tennessee, Lewis and Lewis (1961:109) presented data on 69 adults, out of the 180 interments at the site. These data were presented in a table showing age groups at death. Although a mean age at death or an adult life expectancy was not calculated, the largest group (23.1 percent) died between the age of 18-25 years. The next highest age groups, both at 18.8 percent, were the 30 to 35 year old and the over 60 year old people. Interestingly, the 18-25 year old age group in the cemetery was heavily skewed for females, because 37.8 percent of all adult females died at that age. In contrast, only 15.5 percent of the males died in that age cohort.

Although many other Archaic sites in Kentucky and adjacent states have been excavated, detailed demographic studies have not been published on the skeletal material. For example, the Barrett Site (McL4) and the Butterfield Site (McL7) were both excavated in 1938-1939. Webb and Haag (1947:33) divided the ages of the individuals into four classes at the Butterfield Site: adult, children, infants, and indeterminate. At the Barrett Site (1947:16), the ages were grouped into more detailed categories, but these were also not in traditional age cohorts useful to demographic study.

The mean stature at the Railway Museum Site for males was 165.64 cm with a range of 162.13 to 168.96 cm, based on a sample size of four individuals. The mean stature for females was 162.65 cm., with a range of 159.44 to 168.28 cm, based on a sample size of five individuals. Table 1 has a complete listing of estimated statures for the site inhabitants. Stature is one of the measures of sexual dimorphism, and it is also of some value in comparing populations, both spatially and temporally.

At the nearby Habich Site, Wilson (1993:12) reported an estimated stature of 167.3 ± 3.4 cm from the left femur and 164.55 ± 3.4 cm from the right femur of the same male. This is the only set of statures from the site, and they are comparable to the range of statures for males at the Railway Museum Site.

Stature has been reported by Morse (1967) for the Robinson Site (40Sm4) in Smith County, Tennessee. This locality is a shallow Late Archaic shell mound that contained only 20 skeletons that were sufficiently complete for stature comparisons. Thirteen were female and seven were male. The total range for male stature was 161.8 to 182.2 cm with a mean stature of 167.3 cm. Total range for female stature was 147.5 to 160.7 cm, with a mean stature of 154.7 cm. As Morse (1967:135) noted, there was no male/female overlap, but he thought that this was due to the small sample size. It would appear that the population was highly sexually dimorphic. Although the mean male stature is somewhat taller at the Robinson Site than at the Railway Museum Site, it is not outside of an expected range of variation. However, the Railway Museum Site females appear to be markedly taller than the Robinson Site females.

At the Late Archaic DuPont Site in Southwestern Hamilton County, Ohio, Perzigian et al. (1984:351) report the mean stature for males was 169.5 cm and for females 159.9 cm. These data were based on a sample of femora from five males and five females.

Stature and other sexually dimorphic characteristics are often hypothesized as changing significantly when the shift from hunting and gathering to horticulture occurred. There are two schools of thought regarding stature. One is that stature decreased with a shift to maize agriculture (Joerschke 1983:iv), and the other school of thought is that hoe agriculturalists would have a much more physically demanding lifestyle than hunter-gatherers, and that therefore long bones should be longer and more robust in the former population (Bridges 1991a:89). In fact, the data are conflicting and sometimes frustratingly site-specific, since other factors such as existing gene pools, genetic drift, in and out migration, and nutrition must also be considered. For example, at the Middle Archaic Anderson Site in Tennessee, Joerschke (1983:iv) found that males had very similar femur lengths when compared both spatially and temporally to other males, even when subsistence patterns were different. In contrast, the females at the site had a much smaller mean femur length than Late Mississippian females in Tennessee.

This pattern is corroborated by Bridges (1985,1991a) in her analysis of Mississippian and Archaic period inhabitants of the Pickwick Basin in Northwestern Alabama. The Mississippian females were found to have increased bone size and strength for all long bones in both arms and legs compared to Archaic females. Mississippian males were found to have larger long bones in the legs only (Bridges 1991:98-99). From ethnographic inference, Bridges notes that the Mississippian females may have had a wide range of tasks, including most of the agricultural field work; processing of the products of the harvest, including corn pounding; gathering wild food; chopping and hauling firewood; carrying water, and curing animal skins. These would have caused a strong selection for overall skeletal strength. The males built houses, went on long distance raiding and hunting trips, and played in competitive ball games, activities that she contended would build up lower limb bones (Bridges 1991a:99-100).

Although no comparable measurements for sexual dimorphism could be located for the Indian Knoll series, Allaway (1980) conducted discriminant function analysis on a series of 64 adults, taking measurements on the cranium, mandible, innominate, and femur (1980:20). However, Allaway did not present the raw data in her thesis, so detailed comparisons could not be made between this site and others noted here, including the Railway Museum Site. In general, Allaway (1980:93) found that the Indian Knoll series was highly dimorphic, with the males being much more robust than the females. Perzigian et al. (1984:351) took 12 measurements to help determine the degree of sexual dimorphism in Ohio Valley Archiac populations. The total percent of sexual dimorphism was 8.33 percent.

For the Railway Museum Site, Tables 4 to 7 include various metric skeletal data that are frequently used for determinations of skeletal robustness and sexual dimorphism. Table 4 compares the midshaft femoral circumference for males and females. The means for males and females show a 10.4 mm size difference, with the males being more robust than the females. When the female mean is compared as a fraction of the male mean, the difference is 11.58 percent. Table 5 compares the maximum humeral head diameter of males and females. The mean measurements show a 4.14 mm size difference, with the male mean larger than the female mean: a difference of 9.36 percent. Table 6 compares maximum femoral head diameters, and the males again are more robust than the females, showing a 6.85 mm size difference: a difference of 14.65 percent. Finally, Table 7 is a measurement of the epicondylar width of the humeri, and the male mean is 7.15 mm larger than the female mean. This is a difference of 12.42 percent.

Data from the Railway Museum Site thus indicate that the population was quite sexually dimorphic, but there was also some overlap in measurements between males and females. With consideration given to the small sample size, it indicates that although sexual dimorphism was quite pronounced, it does not appear to have been nearly as marked when compared to some populations such as Morse's (1967) Archaic Robinson Mound sample in Tennessee.

Table 4. Mid-Shaft Femoral Circumferences* of Sexed Adults.

Burial Number	Male	Female	Mid-Shaft Femoral Circumference (mm)
2	X		93.0
4	X		83.0
5		X	78.5
7		X	79.5
8	X		88.0
10		X	82.0
12		X	82.0
14		X	76.0
15	X		96.1

Female Mean (n=5) - 79.6 mm
Male Mean (n=4) - 90.025 mm
* Measurements are from the left femur when possible.

Table 5. Maximum Humeral Head Diameters* of Sexed Adults.

Burial Number	Male	Female	Maximum Humeral Head Diameter (mm)
2	X		44.3
4	X		41.0
5		X	35.1
7		X	38.5
8	X		48.5
10		X	42.1
12		X	45.0
15	X		43.5

Female Mean (n=4) - 40.175 mm
Male Mean (n=4) - 44.325 mm
* Measurements are from the left humerus when possible.

Table 6. Maximum Femoral Head Diameters* of Sexed Adults.

Burial Number	Male	Female	Maximum Femoral Head Diameter (mm)
5		X	42.6
7		X	37.5
8	X		48.0
10		X	40.0
12		X	39.5
15	X		45.5

Female Mean (n=4) - 39.9 mm
Male Mean (n=2) - 46.75 mm
* Measurements taken from the left femur when possible.

Table 7. Epicondylar Width* of the Humerus of Sexed Adults.

Burial Number	Male	Female	Width (mm)
2	X		54.0
5		X	50.8
7		X	48.5
10		X	46.0
12		X	53.2
14		X	53.5
15	X		61.1

Female Mean (n=5) - 50.4 mm
Male Mean (n=2) - 57.55 mm
* Measurements were taken from the left humerus when possible.

Note: Only two bicondylar widths of femora were taken. Burial 4, a male, had a width of 72.0 mm. Burial 10, a female, had a width of 70.4 mm.

MORTUARY BEHAVIOR

As noted by Buikstra (1981:125), a bioarchaeological study includes the burial position, facility, and location, and an examination of the grave goods. Thus, the discipline is concerned not only with the analysis of the skeletal material, but also with its context. Buikstra (1981:126) further notes that ethnographic reports repeatedly emphasize the frequency with which humans conduct their burial practices according to sex, age, or reasons for death. In the central Mississippian drainage, just to the north and south of St. Louis, Charles and Buikstra (1983:133-134) noted that there was very little structure to be found in Archiac cemeteries. The pattern in this area appeared to be cemeteries with many individuals, but having no spatial segregation. Artifacts did not appear at these sites to be associated with a specific adult. At the Bullseye Site (11Ge127) in Greene County, Illinois, the Archiac cemetery was very large and appeared to have been used throughout the Early and Middle Archaic. In at least some corroboration with Charles and Buikstra's data, this cemetery was found to contain a very large number of grave offerings. However, questions have been raised regarding the possibility that these artifacts were not associated with specific individuals, but with groups of people (Hassen and Farnsworth 1987:11-12).

In Tennessee, at the Ledbetter, Eva, and Cherry sites, grave goods were found more frequently with adults, and more males had grave goods than females. Most of the grave goods at these Archaic sites were of a utilitarian nature. The burial patterns were essentially the same for all of the sites, with individual interments by far making up the largest category. There were only a few multiple interments (Higgins 1982:57-58). Magennis (1977:iii), in an earlier study of the Late Archaic Eva and Cherry sites, determined that there was little elaboration of mortuary ritual and that all individuals were given similar treatment at death, with consideration to sex and age. It was interpreted that this area of Tennessee had an egalitarian social system during this time period.

At the Robinson Site in Tennessee, Morse (1967:122) notes that the usual mode of interment was a tightly flexed body, placed on its right or left side in a roughly circular pit; only about 17 to 20 percent of the interments were found to be associated with preserved grave goods. Lewis and Lewis (1961:105) noted the flexed burial position was customary for adults, children, and infants at the Eva Site in Tennessee. Hofman (1986:2) noted that in the Archiac period, flexed burials appeared to be the norm. However, at the Archaic Ervin Site, located on the Duck River in Tennessee, he found that secondary bundle burials and cremations were also used as burial treatments. In his comparative study, Hofman found that no fewer than 15 other Archaic sites in the Middle South and Midwest also contained cremations, and 13 sites contained secondary bundle burials. Although flexed interments were the favored mode in 26 of the 30 Archiac sites from which Hofman (1986:149-150) obtained data, there were four sites with no flexed interments at all.

At the Indian Knoll site, 758 of the 792 interments identified by Hofman (1986:149-150) as Archaic and having mortuary data were flexed, 11 were extended, and 25 appeared to be dismembered. At Carlston Annis, Hofman (1986:149-150) noted that 329 were flexed, one was extended, three were bundled and seven were dismembered. Finally, at Robinson, there were 54 flexed interments, one extended, and one in a bundle (Hofman 1986:149-150). Rothschild (1975:72) examined the Indian Knoll population for burial treatment and status and found that there was no evidence of a stratified society, and only a weak tendency for the sex of the deceased to have an effect on mortuary behavior.

Given all of these comparative data, how does the Railway Museum Site compare? The location of the burial features shows a weak patterning, with most of the interments running in a rough east-west line, just to the north of the heaviest cluster of features (see Figure 1). Despite the fact that all but one interment appears to have contained a single individual, certain of these features were used at least twice to inter single individuals. Burial 14, a 45+ year old female, was buried with a dog and was located in the far southwest corner of the site. Burial 1 was located at the greatest distance from the existing feature concentration and was far to the north in an isolated feature, with no grave goods. Many of the interments, however, were placed in what appears to have been old refuse pits, so excavation of a formal place for interment seems to have been quite a rare occurrence.

Burial mode is more varied than is the norm at the Archaic sites that were examined for comparative purposes (see Table 2). Only six of the interments were flexed and placed on either the right or left side (see Figure 2). The left side was favored 50 percent of the time (n=3), but two of the other flexed burials were so disturbed, and in such poor condition, it was difficult to determine on which side the deceased was placed. Of the six that were flexed and on their side, three were females, and three were of undetermined sex. Burials 16 and 17 were so damaged, it was impossible to determine orientation.

The remainder of the interments deviated from the "Archaic norm." These included three people who were buried on their backs in a flexed or semi-flexed position. One was an adult male, the second was an adult female, and the third was an adult of unknown sex (Figure 3). Hofman (1986:89) encountered the flexed on back position in the course of his Archaic mortuary patterning study, and he noted that the nature of settling after decomposition may cause a skeleton to appear more tightly flexed than it was at the time of interment. Another mode that was encountered was flexed, "on stomach." An adult male and an adult female were buried in this position (Figure 4). At the Butterfield Site, Webb and Haag (1947:13,33) noted that one adult was found in this same position. One interment, Burial 15 was believed to have originally been interred extended, on his back, but subsequent interments had greatly disturbed the interment, and his torso from the pelvis up was missing.

The final three burials were interred in the rare, but not unheard of, extended, face down; and face down with legs semiflexed position. Burial 13, a 5-7 year old child, was found face down in an extended position. The child was interred with Burial 12, a female who was placed in a flexed position on her back (Figure 5). Only one interment was placed face down with legs semiflexed. This interment was Burial 2, an adult male (Figure 6). At the Austin Site (22Tu549), a Late Woodland-Early Mississippian palisaded village site in Tunica County, Mississippi, a total of three interments were found in an extended, face down position. None had grave goods, and both males and females were represented (Ross-Stallings 1989:8). Hall (1976:362) addressed the question of face down interments, when looking the ethnographic record. He noted that some ethnographic accounts tell of disposing of the dead in a face down position to confound their ghosts. He cited data from a report detailing mortuary customs among the Shawnee and other eastern tribes (1976:362). Of course, it is impossible to determine what prompted the inhabitants of the Railway Museum Site to inter these individuals in this manner.

Orientation of the individuals within the grave was also examined, and, again, no real pattern emerged. The individuals seemed almost random in their placement (Table 2). Grave goods in the site show a marked bias toward male interments, although caution is suggested since this is such a small burial sample (Table 2). None of the known females had preserved grave goods, except for Burial 14, and the "grave good" consisted of the inclusion of an elderly dog (based on extreme tooth wear). None of the interments of unknown sex had a grave good with the exception of Burial 3, an adult. A Late Archiac Table Rock Point was found in the pit, but its association with the burial is in question.

The types of recovered grave goods included a worked bone hairpin found at the head of Burial 2, a 25 to 30 year old male who was found buried in a face down position with the legs semi-flexed (Figure 6). Burial 4, a 25 to 30 year old male, had a worked bone awl that was also placed at the head, and he was buried flexed, on his stomach (Figure 7). Burial 8, a 35 to 40 year old male, was interred with a partial deer mandible placed between his lower legs. Burial 15, a 20 to 25 year old male, was interred with the elements of a flintknapping kit, plus a hafted scraper. The kit elements included a hammerstone, and a small antler billet.

The Robinson Site Burial 62, a 13 year old male, had an antler tine with a missing tip included as a grave good (Morse 1967:133). Webb and Haag (1947:34) also found antler tine grave goods at the Butterfield Site. Burial 35, a 31 year old male, had two antler tines among his grave goods, and Burial 49, a 33 year old male, had one antler tine among his grave goods. Feature 4 at the Elizabeth Mound 1 Site area had the remains of four young adult males. Included in this feature were the additional remains of at least 12 partial or disarticulated individuals placed above or beside the four primary interments. Included with the grave goods were three worked antler artifacts. Two had transverse holes drilled through their shafts (Charles and Buikstra 1983:134, 138).

The pattern of burial at the Railway Museum Site, in terms of its demographics, follows what Hofman (1986:175) refers to as the aggregate group burial pattern. These Archaic shell mound sites, such as Indian Knoll and Robinson, have a large number of individuals that are infants, as well as a large number of individuals who could be considered in their prime of life, with the peak of this distribution in the 14 to 45 year old age group (Hofman 1986:175). By contrast, Archaic rockshelter sites such as the Stanfield-Worley Bluffshelter, Modoc, and Russell Cave, show interments that are weighted toward the predominance of the very young and the very old. Only a limited number of individuals fall into the 20 to 39 year old group (Hofman 1986:181). The general pattern argues for families occupying rockshelters, possibly during the winter months, whereas the shell midden areas appear to have been exploited by larger groups of people, presumably during times of aggregation (Hofman 1986:181,217).

CONCLUSIONS

The interments at the Railway Museum Site, consisting of the remains of 17 individuals, were analyzed *in situ*, in accordance with the excavation plan of the site. Because of the flexed-on-side and flexed-on-stomach or -back positions of the interments, analysis and measurements of the material were limited to partial skeletal elements for nearly all of the individuals. No advanced statistical studies were conducted on the skeletal material because of the very small sample size. Skeletal preservation ranged from very poor to very good. No outstanding pathologies were noted; however, moderate iron deficiency anemia appeared to have affected a large proportion of the population. Tooth attrition, as with most Archaic period skeletons, was rapid. No episodes of violence were noted in the skeletal remains.

The interments were placed in the graves in a variety of positions and with no special orientation. However, the majority of the interments were placed in one region of the site. With one exception, only adult males had non-perishable grave goods. In accordance with the excavation plan for the site, the grave goods were left interred with the skeletons at the close of the excavations. The demographic profile of the interments points to an aggregate group plan burial pattern for the site.

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BOTANICAL CONTENTS OF PALEOFECES FROM TWO EASTERN KENTUCKY ROCKSHELTERS

By
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ABSTRACT

Desiccated paleofeces of probable human origin from the Newt Kash Hollow and Hooton Hollow rockshelters in eastern Kentucky were reconstituted and their contents analyzed. All were found to contain, in various combinations and quantities, the remains of native crop plants including sunflower, sumpweed, and chenopod. Uncalibrated accelerator dates on three of the feces cluster around 1000 B.C. Consumption of epidermal tissue (possibly bark), which is abundant in many of the samples, may be partly attributable to nondietary uses of plants. The occurrence of cultigen remains in feces possibly not of human origin suggests commensalism between humans and other animal species occupying rockshelters.

INTRODUCTION

Fecal remains have long been recognized as important sources of evidence for the dietary habits of animals (Seton 1925). Studies of this kind have been conducted with increasing frequency on human paleofeces (sometimes called coprolites), especially since the development of effective methods of rehydrating dried plant and animal tissue (Benninghoff 1947; Van Cleave and Ross 1947). Pioneers and chief contributors to this field of study include Callen (1963, 1965, 1967), Reinhard (1988), and Bryant (1974), among others. Although single-authored studies usually focus on only one or two types of paleofecal constituents, potential avenues of scientific investigation offered by paleofecal studies are numerous (Reinhard and Bryant 1992). They reflect the frequently varied contents of paleofecal samples, which may include such components as seeds, fibers, pollen, and other plant tissues; bones, meat, and scales; parasite cysts or eggs; and minerals. Thus, these archaeological resources, though rare in most environments, have been invaluable sources of evidence for prehistoric diet and health.

The potential of this type of investigation for documenting the development of food production is illustrated by the key role played by paleofecal studies in establishing the dietary importance of native crop plants in eastern North America (Yarnell 1969, 1974). To date, however, that potential has been only lightly tapped in the uplands of eastern Kentucky despite the area's impressive record of early farming and the relative abundance in the region of suitable depositional environments for preservation of paleofeces. Jones (1936) examined paleofeces from the Newt Kash shelter, whose major occupations date to the Late Archaic and Early Woodland periods. However, he did not quantify his results, instead making qualitative assessments of the relative abundance of various plant taxa. A more thorough study of paleofecal remains from eastern Kentucky was conducted by Cowan (1978), who studied pollen and macrobotanical remains from paleofeces collected at the Late Woodland Haystack

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Rockshelter. He proposed that the unusually high proportion of inner bark found in these specimens might be attributable to dietary stress during the spring "lean season."

Similar analyses, however, have not so far been conducted for the critical Terminal Archaic-Early Woodland time period (ca. 2000-500 B.C.). In eastern Kentucky, this period marks at its inception the initiation of plant husbandry, which has been amply documented by well-dated macrobotanical remains from several sites (Cowan 1985; Cowan et al. 1981; Gremillion 1993d; Smith and Cowan 1987). At its close, there is evidence that domesticated plants were playing an increasingly important dietary role as storable resources. Although some shift in the subsistence importance of domesticated plants is clearly indicated both by the increasing abundance of crop seeds in archaeological deposits and the proliferation of storage features in rockshelters, direct evidence for diet during the Archaic-Woodland transition has so far been limited to the inadequately dated and unquantified Newt Kash data.

The present study focuses on the botanical constituents of a series of paleofeces from two dry rockshelters in eastern Kentucky, Hooton Hollow and Newt Kash, that date to this important transitional period. In the absence of adequate contextual information, the obvious problem of chronological placement was addressed through obtaining a series of accelerator mass spectrometry (AMS) radiocarbon dates directly on the fecal contents. Currently accepted techniques for processing and analyzing the specimens were employed to maximize the dietary information obtained. In this way, data from old collections that have long been discounted as of little value have been used to address important questions about the development of food production in eastern North America.

RESEARCH HISTORY AND ARCHAEOLOGICAL CONTEXT

UKMA COLLECTIONS FROM HOOTON HOLLOW AND NEWT KASH

Paleofecal samples were discovered in the University of Kentucky Museum of Anthropology (UKMA) collections as part of a systematic inventory of paleoethnobotanical materials from dry rockshelters in eastern Kentucky. Hooton Hollow is reported as 15Mf10 by Wyss and Wyss (1977), and catalog cards for Hooton Hollow at UKMA also bear that number -- Haag (1974) reported nearly 40 years after excavation that the site was in Powell County. The site was excavated in the 1930s with the intent of clarifying cultural sequences in rockshelters and their relationship to Adena. However, the results of these excavations were never made available because all the records associated with excavation of the site were borrowed during World War II and never returned (Haag 1974). Thus, only basic horizontal and vertical provenience information was available to help place the paleofecal remains into some sort of archaeological context. The ceramic and lithic artifacts from Hooton Hollow had been sorted into morphological categories. In addition, it appeared at first that various plant remains (including those of domesticates) had been sorted from the paleofeces and placed in separate containers. However, some of these remains are probably actually from Newt Kash and were placed in the Hooton Hollow boxes in error (see below).

The Newt Kash paleofeces removed for analysis were part of a small collection of artifacts, plant remains, and feces from the site still curated at UKMA (most ethnobotanical remains from Newt Kash remained at the University of Michigan, where they were sent for analysis). No provenience information is available for the Newt Kash material, although it was excavated systematically, if somewhat crudely, by modern professional standards (Funkhouser and Webb 1936).

CONTEXT AND CHRONOLOGY OF THE SPECIMENS

Overview of cultural materials

In conjunction with studies of ethnobotanical materials, collections of artifacts from Hooton Hollow and Newt Kash curated at UKMA were examined. Although it was not possible to establish specific associations between plant remains or paleofecal specimens and artifacts from particular contexts, a brief overview of artifact assemblages provides some cultural context for plant materials.

The Hooton Hollow catalog cards reviewed at the UKMA contained basic horizontal and vertical provenience data, though this information was limited to unit designations and depths in half-foot increments. However, none of the ceramics examined seemed to be spatially associated with any of the lots of paleofeces. The collection of pottery from Hooton Hollow had been sorted into categories according to temper and surface treatment by a person or persons unknown. Based on this documentation as well as observation by the author, at least Early Woodland and Late Woodland and/or Late Prehistoric components seem to be represented. The majority of sherds are limestone-tempered plain, with a sizeable minority of limestone-tempered check-stamped and cordmarked. A wide variety of other types of tempering agents was noted, including some of shell mixed with mineral inclusions. Lithic artifacts from Hooton Hollow include a sandstone bedrock mortar with grooves and "nutting depressions." Projectile points (which also had been sorted) include a variety of morphological types, including small triangular, side-notched, corner-notched, and stemmed forms. Although artifact variability indicates that more than one cultural component is represented at Hooton Hollow, Haag (1974) observed that much of the cultural midden on the site was associated with Early Woodland activity.

Plant remains from Hooton Hollow include wood charcoal, cane and grass stems, bark, and fibers, as well as cordage and other textiles. A large lot of whole hickory nuts (several hundred) from Feature 8 mixed with grass stems and fibers offers strong evidence for storage. Cucurbit rind (*Cucurbita pepo*, squash/gourd) from Hooton Hollow was previously studied by Cowan (1993), who found that chemical treatment had changed rind morphology enough to make measurements unreliable. He also measured sunflower and sumpweed achenes from the site (Cowan 1985; Yarnell 1978).

Artifacts from Newt Kash were also examined; many were illustrated in the original report of excavations (Funkhouser and Webb 1936:125). Limestone-tempered plain and cordmarked pottery was noted as well as a variety of biface types, including stemmed, side-notched, and weak-shouldered forms. Adena points are among those represented. The artifact assemblage and radiocarbon determinations of ca. 1500 B.C. (Smith and Cowan 1987) and 700 B.C. (Crane 1956) obtained previously are consistent with Terminal Archaic to Early Woodland site use, as is the accelerator date obtained on one of the fecal samples (see below). Plant remains from both feces and refuse deposits at Newt Kash were studied by Jones (1936). In addition, over the years the site has supplied analysts with remains of domesticates for morphometric study (Cowan 1985; Gremillion 1993c; Heiser 1978; Yarnell 1978).

Provenience and chronological placement of paleofeces

Paleofeces were selected for analysis from three lots of material associated with Hooton Hollow (Mf10). One, assigned the catalog number V3, consisted of a cardboard box of paleofeces wrapped in cotton batting. No provenience information was associated with this sample. One specimen from this lot (V3/1) produced an AMS radiocarbon determination of 3090 ± 55 B.P.:1140 B.C. (Beta 62662; ETH-10489) (Table 1). It is likely that all the fragments from V3 were collected at the same time during excavation and were spatially associated on the site, although without proper documentation and consideration of stratigraphy this assumption cannot be tested.

Table 1. AMS Radiocarbon Dates Obtained on Paleofecal Specimens.

Specimen	RCYBP	Cal Age Ranges[a]
Mf10/V3/1	3090 ± 55	cal B.C. 1444(1390,1340,1320)1169
Mf10/V5/1	3100 ± 60	cal B.C. 1507(1390,1330)1169
Mf1/V13/3	3025 ± 55	cal B.C. 1408(1260)1074

[a]Two-sigma minimum (calibrated age) two-sigma maximum (Stuiver and Reimer 1993).

Specimen Mf10/V4 consisted of a mixture of nutshells, feces, bone, and cucurbit rind from Unit 30L5 at a depth of between .5 and 1 ft. Also in the same box were several vials containing sumpweed and sunflower achenes and one small unidentified seed. No AMS dates were obtained from this lot of material. However, judging by the limited provenience information available, these specimens were recovered at the same or somewhat greater depth than specimen V5 (see below).

Specimen V5 consisted of a box containing paleofeces and an assortment of smaller boxes and vials containing a sunflower (*Helianthus annuus*) disk fragment, maygrass (*Phalaris caroliniana*) grains, sunflower achene fragments, and sumpweed (*Iva annua*) achenes. The paleofeces were associated with what appeared to be one of the original field bags, which are labeled as being from 3.4 ft west of 30L5 and 3.4 ft south of 30L5 in the .5 ft level. However, suspicions that the smaller vials were actually from Newt Kash were raised by the discovery of a label reading "Frag. sunflower head - *Helianthus annuus* Det. R. M. Goslin 10-19-54." Goslin reported these materials as having been recovered from Newt Kash (Goslin 1957), but does not mention Hooton Hollow in the same publication. Thus, it seems likely that the smaller vials containing materials he analyzed were placed alongside remains from Hooton Hollow in error. One paleofecal fragment from V5 (V5/1) produced an AMS radiocarbon age of 3100 ± 60 B.P.:1150 B.C. (Beta-62663; ETH-10490) (Table 1).

Only one lot of paleofecal material from Newt Kash was located (catalog number Mf1/V13). Its box was labeled "Miscl. Material - feces Newt Kash Hollow Rockshelter." In the box, along with an assortment of fecal fragments of various sizes and shapes, were two labels: "Human feces" and "Animal feces." One specimen of probable human origin was observed to contain numerous sunflower achene fragments. A sample of material from this specimen (V13/3) returned an AMS date of 3025 ± 55 B.P.:1075 B.C. (Table 1).

In general, AMS dates from the paleofeces are consistent with artifact assemblages and with dates previously obtained from Newt Kash (Crane 1956; Smith and Cowan 1987). Dated specimens appear to be associated with earlier, Archaic period, occupations of the two sites, based on calibrated dates (see Table 1). Short of direct dating of each individual fecal fragment, there is no way to demonstrate conclusively that all the analyzed samples fall into this same time frame. However, it is reasonable to assume a ca. 1100 - 1500 B.C. placement for the Hooton Hollow specimens V5 and V3 on the basis of probable association. The case for a Terminal Archaic date for specimen Mf10/V4 is somewhat weaker; however, V4 does not seem to have been recovered from deposits stratigraphically above the location of V5. For Newt Kash, no association between individual specimens can be assumed. However, a second millennium to early first millennium B.C. placement for all human paleofeces from the site is so far supported by both radiometric age determinations and artifact assemblages.

Source of the specimens

The validity of interpretations about human diet on the basis of paleofecal contents depends at the most basic level on correct assessment of the human origin of the feces. Assessment of fecal origin can be made at several stages during the research process (Bryant 1974; Fry 1985; Reinhard and Bryant 1992). Context of the feces (e.g., the presence of latrine areas on a site) is often relevant and should be carefully observed and recorded during fieldwork. In the laboratory, size and morphology can be used to separate human from non-human feces. However, human feces are known to be highly variable in their morphology, depending on the age and diet of the defecator. During the process of reconstitution (see Analytic Methods, below), the color of the solution containing the sample and its odor are reflective of diet and, to some extent, species of origin. Human feces typically tint the solution an opaque dark brown or black and emit a foul, fecal odor, in contrast to those of carnivores and herbivores. However, the experiences of analysts and experiments conducted to test these assumptions have shown that neither color nor odor of feces are fool-proof criteria for species assignment (Reinhard and Bryant 1992). Finally, the characteristically omnivorous diet of humans is often reflected in fecal contents and can be assessed during the analysis phase of investigation.

Based on these criteria, it is likely that all or most of the fecal samples analyzed from Hooton Hollow and Newt Kash are of human origin. Little contextual information is available for the material, except for a mention of feces occurring in grass "bedding" and mixed with other types of cultural debris (Jones 1936:147). In the present study, most of the specimens were judged on morphological grounds to be potentially of human origin, with the exception of a few pellet-shaped or pad-like masses from Newt Kash, which were excluded from further study. Specimens were selected for dating on the basis of their morphological resemblance to human feces and the presence of, or probable association with, remains of domesticates. One of the analyzed specimens, Mf1/V13/6, although consistent in size and shape with human origin, had a hard, almost cement-like outer surface. Hard coatings are characteristic of the dung of carnivores, whose intestines secrete a protective lubricant (Bryant 1974). All but one of the specimens stained the reconstitution solution an opaque dark brown to black color and had a musty odor that was only slightly, if at all, fecal. The exception was again specimen Mf1/V13/6, which tinted the reconstitution solution a cloudy yellow. Contents of paleofecal fragments varied in type and number, but none appear inconsistent with human dietary practices. Again, the possible exception is provided by Mf1/V13/6, which contained unusually large rocks and bones in addition to a variety of seeds and other food remains. Whether human or not, the defecator consumed foodstuffs that were stored or discarded by the human occupants of the shelter. Likely candidates for such a role are dogs, opossums, or raccoons. Alternatively, a human toddler might be expected to ingest items not likely to enter the adult human diet; however, whether or not the yellowish color produced is to be expected in such a case is not known.

MATERIALS AND METHODS

Analysis of each specimen followed standard procedures for reconstitution and concentration of residues contained in desiccated feces (Bryant 1974; Fry 1985; Reinhard and Bryant 1992). Each specimen was photographed, measured, and weighed. Most were then bisected before analysis, although some fragments were too small to permit subsampling and were processed in their entirety. Each specimen was placed in a glass jar containing a dilute aqueous solution of trisodium phosphate (either .1 percent or .5 percent; see below) and left to soak for between 72 and 168 hours. The resulting mixture was disaggregated using a magnetic stirrer and washed gently with distilled water through a series of nested sieves with mesh sizes of 1 mm, .5 mm, and .25 mm. The solids passing through the smallest sieve were concentrated by centrifugation, preserved with 10 percent neutral formalin solution, and retained for future study of pollen and parasite content.

Solids remaining in the sieves were dried on filter paper and then examined using a binocular dissecting microscope at 10X-40X power. Materials greater than 1 mm in diameter were placed into taxonomic categories if possible, and otherwise were sorted according to more general material or tissue categories. Residue smaller than 1 mm in size was scanned to check for the presence of any other items not observed in the larger size category; if found, these were recorded as present but not quantified.

During initial processing, it was noted that some types of plant remains (especially the seed coat or testa of chenopod [*Chenopodium*]) were severely distorted or fragmented during reconstitution and screening. Whole sumpweed achenes in specimen Mf10/V4/4 were observed to dissolve into fragments while being washed (because its contents had deteriorated to such an extent, this specimen was not further analyzed). Because concentrations of trisodium phosphate in excess of .5 percent can damage plant tissues (Bryant 1974), an experiment was conducted to determine whether a .1 percent solution (used by Cowan [1978]) might be substituted and still allow effective separation of fecal constituents. One specimen, Mf10/V4/6, was divided into four unequal portions. Two were not reconstituted; instead, one was picked apart using a dissection needle, and the other was washed through the sieves with plain distilled water and the contents air-dried. The remaining two subsamples were reconstituted following standard procedures, using .1 percent and .5 percent solutions of trisodium phosphate for 72 hours. Samples were then analyzed. As expected, no chenopod seed coat fragments survived the .5 percent solution; however, other plant tissues appeared undamaged, and there was little difference in percentage composition by weight between the subsamples. In addition, SEM examination at approximately

500X magnification revealed no apparent structural differences in the bark, chenopod testa, sumpweed achene, and hickory shell between subsamples subjected to different processing techniques. However, plant remains recovered using the .5 percent solution were much cleaner than any of the others.

In general, it was concluded that the advantages of more complete disaggregation of fecal contents outweighs the potential loss of certain plant tissues, although experimental assessment of such loss should probably be conducted before any analysis. Because many of the plant tissues contained in paleofeces from Newt Kash and Hooton Hollow proved to be fragile, a .1 percent solution was used on all samples except the first three that were processed and the experimental sample. In the tables below, the experimental sample is represented by combined results from the two of its subsamples that were reconstituted using trisodium phosphate solution.

RESULTS

OVERVIEW OF FECAL CONTENTS

Paleofeces from both sites contained a wide variety of materials of plant, animal, and inorganic origin (Tables 2 and 3). The outer coverings of seeds and fruits of domesticated plants are well represented; such remains include the outer seed coat or testa of *Chenopodium* and the outer layer (pericarp) of the dry fruits or achenes of sunflower and sumpweed. Achene coat fragments of giant ragweed (*Ambrosia trifida*), generally considered a probable weed crop rather than a domesticate, were rather abundant in one sample from Hooton Hollow. Most of the seed and fruit remains are fragmentary, although some near-intact specimens were noted. Other probable food remains recovered include hickory (*Carya* sp.) and acorn (*Quercus* sp.) shells. Very few non-cultigen seeds or fruits were observed, and these were restricted almost exclusively to specimens from Newt Kash. The remaining botanical components represent a variety of plant tissues from stems (such as wood charcoal, fibers, epidermis, and "bark" or periderm) as well as both monocot and dicot leaf fragments. Materials from animal sources include insect exoskeleton, small feathers, hair, bone, and an apparently organic substance tentatively identified as meat. Small rocks were found in most of the specimens.

CROP REMAINS

Chenopodium berlandieri

Testa fragments of chenopod (*Chenopodium berlandieri*) occurred in 60 percent of the 12 specimens analyzed, and in 56 percent of samples from Hooton Hollow alone. Few intact seeds were observed; however, based on the morphology of these specimens, both domesticated and wild or weedy forms of chenopod were consumed (Gremillion 1993a). Most of the seed coat fragments measured under high magnification using the SEM (from Hooton Hollow Specimens V4/6 and V3/1) were between 20 and 22 microns thick (n = 3). These values are consistent with expectations for domesticated varieties of *C. berlandieri* (Smith 1985), although most cultigen populations have mean testa thickness values below 20 microns (Gremillion 1993b). A larger

Table 2. Components of Paleofeces (Weights in Grams).

Component	Hooton Hollow (Mf10)									Newt Kash (Mf1)		
	V3/1	V3/2	V3/3	V3/4	V4/5	V4/6	V5/1	V5/2	V5/3	V13/3	V13/5	V13/6
Hickory shell					0.02	0.04				0.67	0.01	0.21
Acorn shell												0.03
Chenopod seed	X		X		X	X		X			0.02	0.03
Sunflower achene			0.10							0.14	0.01	0.01
Sumpweed achene		X			0.15	0.09				X	0.21	0.09
Giant ragweed achene			0.16					0.02				
Other seed/fruit									0.02[a]		X[b]	X[c]
Plant epidermis	0.08		0.02				X		X	X		
Periderm ("bark")?	0.05	0.37	0.33	0.06	0.12	0.25	0.07	0.33	0.08	0.06	X	0.08
Dicot leaf											0.02	0.04
Monocot leaf	X		X	X					X			
Stem				X	0.01	X		0.02		0.01	X	0.07
Fibers	X	X	0.03			X	X			0.01		0.02
Charcoal	X	X	0.01	X	X	X	X	0.01	X	X	X	0.03
Miscellaneous plant	0.14	X	0.01		X			0.01		0.12	0.01	0.02
Insect exoskeleton	X	X	X	X				X		X	X	
Feathers						X				X		
Hair							X			X	X	X
Meat?											X	0.14
Bone			0.01				0.02			0.34	0.01	0.73
Rocks		0.01	0.05	0.02			0.11	0.26		X	0.03	1.22

[a] Unidentified seed coat

[b] Honeylocust (*Gleditsia triacanthos*) pod; strawberry (*Fragaria virginiana*) seed; bulrush (*Scirpus*) seed.

[c] Grass seed.

Note: x = less than 0.005 g.

Table 3. Percentage of Plant Remains in Paleofeces.

Specimen	Percentage of Plant Remains by Weight							
	Hickory	Acorn	Chenopod	Sun-flower	Sumpweed	Giant Ragweed	Epidermis/ "Bark"	Other
Mf10/V3/1			tr				48.1	51.9
Mf10/V3/2					tr		100.0	tr
Mf10/V3/3			tr	15.2		24.2	53.0	7.3
Mf10/V3/4							100.0	tr
Mf10/V4/5	6.7		tr		50.0		40.0	3.3
Mf10/V4/6	10.5		tr		23.7		65.8	tr
Mf10/V5/1							100.0	tr
Mf10/V5/2			tr			5.1	84.6	10.3
Mf10/V5/3							80.0	20.0
Hooton Hollow Total	2.3		tr	3.8	9.2	6.9	67.7	10.0
Mf1/V13/3	66.3			13.9	tr		5.9	13.9
Mf1/V13/5	3.6		7.1	3.6	75.0		tr	10.7
Mf1/V13/6	33.3	4.8	4.8	1.6	14.3		12.7	28.6
Newt Kash Total	46.4	1.6	2.6	8.3	15.6		7.3	18.2

Note: tr = trace (< 0.05 %).

sample would be needed for comparison with previously studied collections. However, if the measurements so far obtained from Hooton Hollow are indeed average for the seeds consumed, they may indicate either a population in early stages of domestication or the product of hybridization between wild and domesticated forms. The presence of wild or weed populations (or at least the morphology characteristic of free-living chenopods) is clearly indicated by one specimen (from V3/1) with a seed coat approximately 43 microns thick, rounded cross-sectional shape, and prominently patterned seed coat surface (Smith 1985). Similar testa thickness values have been observed in other archaeological collections, and because they are intermediate between modern wild and domesticated forms, they are thought to reflect hybridization between the two (Gremillion 1993a). Similar characteristics that suggest a transitional or genetically mixed population have also been noted in previously examined samples from Newt Kash that may date to Terminal Archaic occupation of the site (Gremillion 1993d).

The age of most of the *Chenopodium* material from Hooton Hollow and Newt Kash can be confidently estimated through direct association with dated feces (e.g., the weedy and domesticate types from Mf10/V3/3). Other measured specimens from Mf10/V4 are very likely to date to a similar, or earlier, time period based on provenience information, although this inference is not as secure. These results are similar to previously obtained age assessments of *Chenopodium* from Newt Kash feces at ca. 1450 B.C. (Smith and Cowan 1987) and provide additional support for the second millennium B.C. domestication of this taxon. In addition, the morphology of seeds from both sites is consistent with expectations for evolving and/or hybridizing populations rather than carefully managed, genetically isolated crops.

Helianthus annuus

Fragments of sunflower achene coats were present in one sample from Hooton Hollow and from all three specimens from Newt Kash. One nearly intact achene from Newt Kash (V13/3) was found to be 6.5 mm in length, and some of the broken specimens from the same sample exceeded that length. These dimensions are near the limits of the range of achene lengths recorded for modern free-living sunflowers (Yarnell 1978) and meet or exceed the 7-mm "baseline" suggested by Heiser (1985) as a criterion for domesticate status of individual achenes. These achene fragments are comparable morphologically to material from the Hayes site in central Tennessee that produced an uncorrected AMS date of ca. 2200 B.C. (Crites 1993) and likewise constitute important evidence for the initial domestication of sunflower during the Late Archaic.

Iva annua

Sumpweed is represented in 33 percent of the specimens from Hooton Hollow and in all three of the Newt Kash samples (including the AMS dated specimen from the latter site). All individual measurable achenes are outside the range found in wild populations (Asch and Asch 1978). Achenes from Hooton Hollow (V4/5) had an average length of 5.3 mm (s.d. = .4, n = 12), and the average length of one collection from Newt Kash (V13/5) was 5.4 mm (s.d. = .8, n = 8). These values are similar to those obtained from midden and feature deposits at the Cold Oak shelter dated to ca. 1000 B.C. (Gremillion 1993d) and also to previously collected data from Newt Kash and Hooton Hollow (Yarnell 1978).

Ambrosia trifida

Although once thought to have been domesticated prehistorically on the basis of its large achenes (Gilmore 1931), giant ragweed is now generally assigned the status of a weed crop or quasi-domesticate whose achenes vary in size along a geographical cline (Payne and Jones 196; Yarnell 1986). Evidence for its status as a crop comes primarily from its abundance and association with known domesticates in archaeological contexts (Asch and Asch 1985; Cowan 1985; Gilmore 1931). For example, giant ragweed was found together with chenopod and sunflower at the Napoleon Hollow site in a Titterington phase feature dating to the third millennium B.C. (Asch and Asch 1985:161). However, ragweed was not identified in paleofeces from Salts Cave, and was poorly represented in flotation samples from the cave's vestibule (Yarnell 1969, 1974). Its presence in the Hooton Hollow specimens thus constitutes important direct evidence for dietary use of this plant by prehistoric populations of the eastern United States.

DIETARY INTERPRETATIONS

Plant remains from these paleofecal specimens and associated radiocarbon dates add significantly to the growing evidence for Late Archaic plant domestication in the Eastern Woodlands. However, the dietary role of crop plants is more difficult to infer based on the data at hand. First, the sample is small and cannot be considered representative of the diet of either an entire population or of an individual throughout the annual seasonal cycle of resource availability. Second, as is frequently observed with regard to macrobotanical remains recovered from site sediments, what is recovered represents waste and not what is consumed. In the case of paleofeces, what passes through the digestive system are parts that do not contribute to growth and maintenance of body tissues. However, these data are important in that they do represent a partial picture of what kinds of tissues were ingested and from which species. They also provide a rough indication of the relative proportions of different tissues and taxa in individual meals or series of meals, particularly if entire intact stools are studied.

In some cases, domesticates are major constituents of fecal fragments, and in others they are present in only trace amounts, as comparisons of estimated percentages based on volume demonstrate (Figures 1 and 2). Thus it appears that the importance of domesticates in Terminal Archaic diets in eastern Kentucky was highly variable between individuals and probably also between seasons. At least some individuals on some occasions consumed meals that contained significant quantities of crop seeds, but in general the proportional representation of domesticates at these sites is less than that observed in samples from Salts Cave dating to ca. 600 - 300 B.C. (Yarnell 1969, 1974). In fact, many of the specimens from Newt Kash and Hooton Hollow contain only small quantities of crop remains. A variable and often limited dietary role for domesticates is compatible with the small quantities of crop seeds that are usually associated with Terminal Archaic habitation refuse in eastern Kentucky (Gremillion 1993d) and likely reflects a relatively casual involvement in food production.

The dietary use of giant ragweed, previously inferred on other grounds, is confirmed by its presence in two specimens and its status as a major constituent of one (see Table 3). Although less prominent in the archaeological record than the closely related sumpweed and sunflower, giant ragweed clearly was part of the Terminal Archaic food production system. Whether its status was that of a crop or tolerated or encouraged weed is less certain in the absence of morphological evidence for selection under domestication. Perhaps, as Cowan (1985)

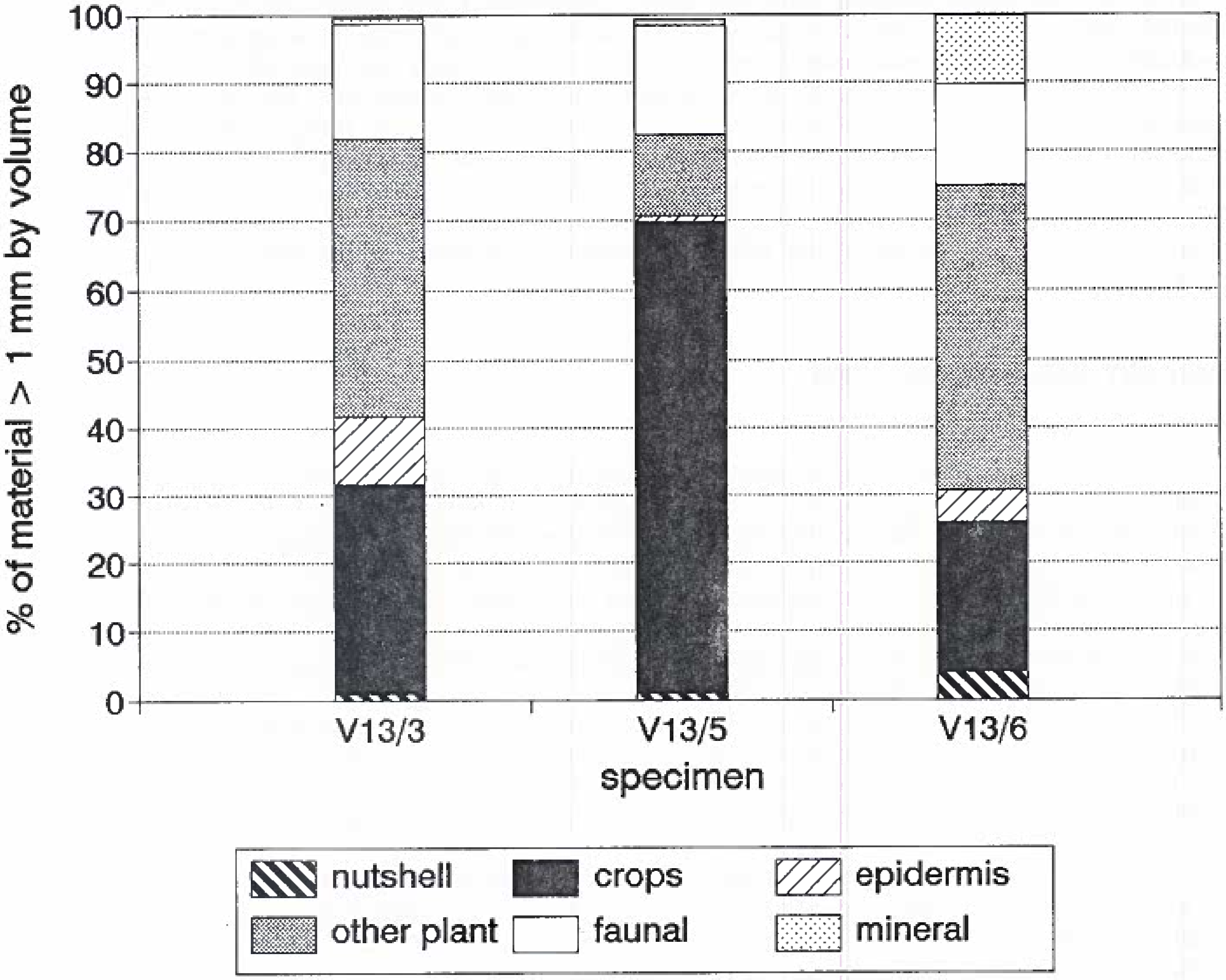

Figure 1. Contents of paleofeces, Newt Kash shelter (15Mf1). Crops include chenopod, sunflower, sumpweed, and giant ragweed; epidermis includes possible bark.

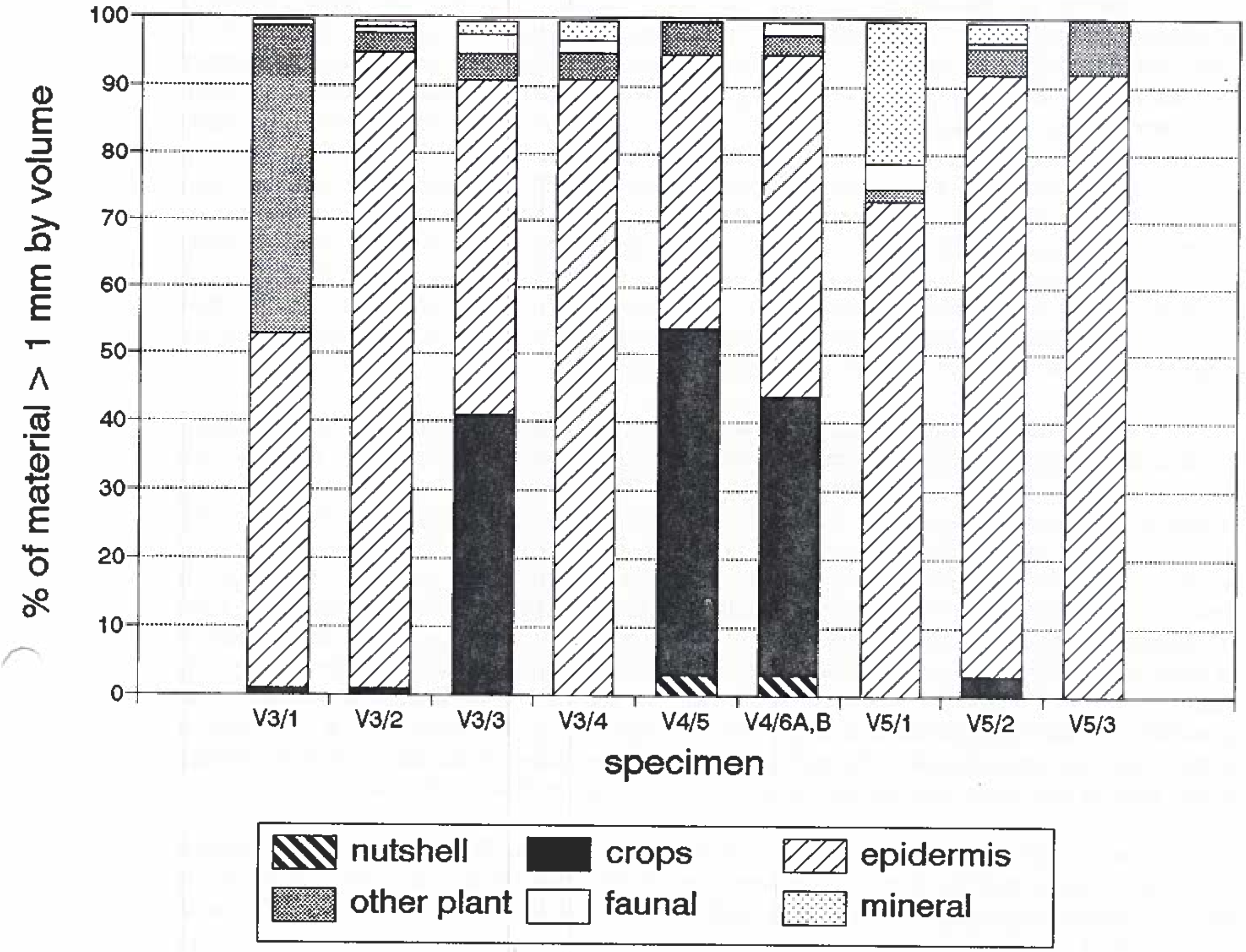

Figure 2. Contents of paleofeces, Hooton Hollow shelter (15Mf10). Crops include chenopod, sunflower, sumpweed, and giant ragweed; epidermis includes possible bark.

suggests, giant ragweed colonized crop gardens and was harvested incidentally to activities involving the more carefully managed plants.

Contents of paleofeces indicate that crop storage, evidence for which becomes increasingly common after about 1000 B.C. in eastern Kentucky (Cowan 1985; O'Steen et al. 1991), was practiced as early as the Late Archaic period. At Newt Kash, a single strawberry seed was associated with a specimen containing chenopod, sunflower, and sumpweed (V13/5). Strawberry ripens between April and June, whereas the crops would have been available probably only as early as July and most likely not until later in the summer (Radford et al. 1968). Because strawberry fruits are poor candidates for storage (Yarnell 1969), it is most likely that the crops were consumed out of season and represent stored resources. Thus, at least some of the storage pits reported during the initial excavation of Newt Kash (Funkhouser and Webb 1936) probably are contemporaneous with the occupations producing the fecal material and many of the crop remains. There are no seasonal indicators of storage for Hooton Hollow, but the fact that storage was indeed practiced at some time during the site's occupation is amply attested by the large prepared pit containing hundreds of whole hickory nuts.

Further investigation of seasonal variation in resource use is warranted by the abundance of material resembling plant epidermis in many of the Hooton Hollow feces. Some of this material is similar in structure to the inner layers of "bark" or periderm (the functional analog of epidermis in plant tissues, such as many woody stems, that results from secondary growth). In many cases, tissue of this kind makes up nearly the entire volume of paleofecal contents by weight and similarly dominates volumetrically (see Table 3 and see Figure 2). Cowan (1978) reports that inner bark was abundant in all analyzed paleofecal specimens from the Late Woodland Haystack shelter and was dominant in one of them. He suggests that the abundance of inner bark in feces may reflect consumption of low-ranked resources during the early spring, when stores were depleted and inner bark easy to remove and relatively nutritious. The plausibility of this interpretation is supported for Haystack by the prevalence in the feces of pollen types that are released in the spring. A similar broadening of the diet to include "famine foods" such as tree bark may explain the patterns observed at Hooton Hollow.

The frequent association of bark or epidermis with plant fibers in the Hooton Hollow feces raises the possibility that the consumption of this material may not have been strictly dietary. Several large fragments of bark or epidermis were observed adhering to vascular tissue that appeared to include fibers. Many of the Hooton Hollow specimens also contained loose fibers. In light of the ample evidence of textile manufacture from the site in the form of finished artifacts and prepared bark and fibers, it seems likely that bark and fibers may have been consumed as a by-product of textile manufacturing activities. Menomini women are reported to have removed basswood bark with the teeth in order to separate the fibers (Erichsen-Brown 1979:56). Both woody and nonwoody taxa were used for textile manufacture at Hooton Hollow and Newt Kash, including basswood (*Tilia*), pawpaw (*Asimina triloba*), Indian hemp (*Apocynum*), and milkweeds (*Asclepias* spp.). At present the hypothesis of nondietary consumption of bark cannot be adequately tested. However, support for it will be forthcoming if the fibers associated with the inner bark can be identified as one of the economic fibers used in textile manufacture locally. Such an identification would not rule out dual use of some plants for both food and fiber.

SUMMARY

Although crop remains associated with the Late Archaic-to-Early Woodland period of initial food production in eastern Kentucky have been central to the establishment of eastern North America as an independent center of plant domestication, the research value of such collections has been limited by inadequate chronological information. However, their scientific potential is clearly illustrated by the results obtained from direct dating and quantitative analysis of paleofeces from Newt Kash and Hooton Hollow. These indicate a highly variable role for domesticates during the initial stages of food production rather than a rapidly established central role, as might be expected under circumstances of persistent dietary stress to which food production offered a solution. Thus, paleofecal data suggest that an opportunistic rather than a stress-based model of agricultural origins may prove to be most appropriate for the uplands of eastern Kentucky.

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FAYETTE THICK CERAMIC CHRONOLOGY AT THE WEST RUNWAY SITE (15BE391), BOONE COUNTY, KENTUCKY

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ABSTRACT

The West Runway Site (15Be391) offered a rare opportunity to study an Early Woodland domestic habitation in the Northern Bluegrass region of Kentucky. Investigations at this upland locality yielded intact features, approximately 5,000 pieces of lithic debitage, 200 ceramic sherds, and more than 30 diagnostic lithic tools. The excavation and analysis of the site's cultural features revealed contextual associations between diagnostic artifact types, as well as a suite of radiocarbon dates firmly placing the occupation within the Early Woodland period. This paper discusses feature characteristics and site chronology, as well as the relationships between the recovered Fayette Thick ceramics, Kramer projectile points, and absolute dates.

INTRODUCTION

The West Runway Site (15Be391) was located, until recent new runway construction, at the western end of Runway 9/27 at the Cincinnati/Northern Kentucky International Airport, Boone County, Kentucky. The site was situated in an upland setting over the headwaters of Gunpowder Creek, approximately 2.4 km southeast of the town of Hebron (Bergman et al. 1992; Duerksen et al. 1994; Haywood 1992). The West Runway Site was found on a level ridgetop at an elevation of 268 m above mean sea level (Figure 1). The property at the time of the site's discovery and excavation was open pasture, but it had been subjected to plowing and cultivation in the recent past.

Archaeological investigations, directed by John F. Doershuk, consisted of the following: plowing and repeated surface collection, the hand excavation of large areal blocks, and mechanical removal of plowzone to locate features. A total of 166 (1 x 1 m) units were ultimately hand excavated at the site, while 600 m^2 of the surface area were mechanically stripped. Development activities related to airport expansion have since completely destroyed the site and significantly reshaped the local landscape.

Research at the West Runway Site has provided important data concerning Early Woodland lithic and ceramic assemblages, settlement patterns, and chronological developments in Northern Kentucky, and the Middle Ohio Valley as a whole. In particular, this investigation has contributed to our understanding of the structure of Early Woodland land use, early ceramic technology in the Middle Ohio Valley, the chronological relationship between Adena Plain and Fayette Thick ceramic types, and the co-occurrence of Kramer straight-stemmed projectile points and early ceramics (see Wall et al. [this volume] for a detailed discussion of West Runway Site lithic technology and functional studies).

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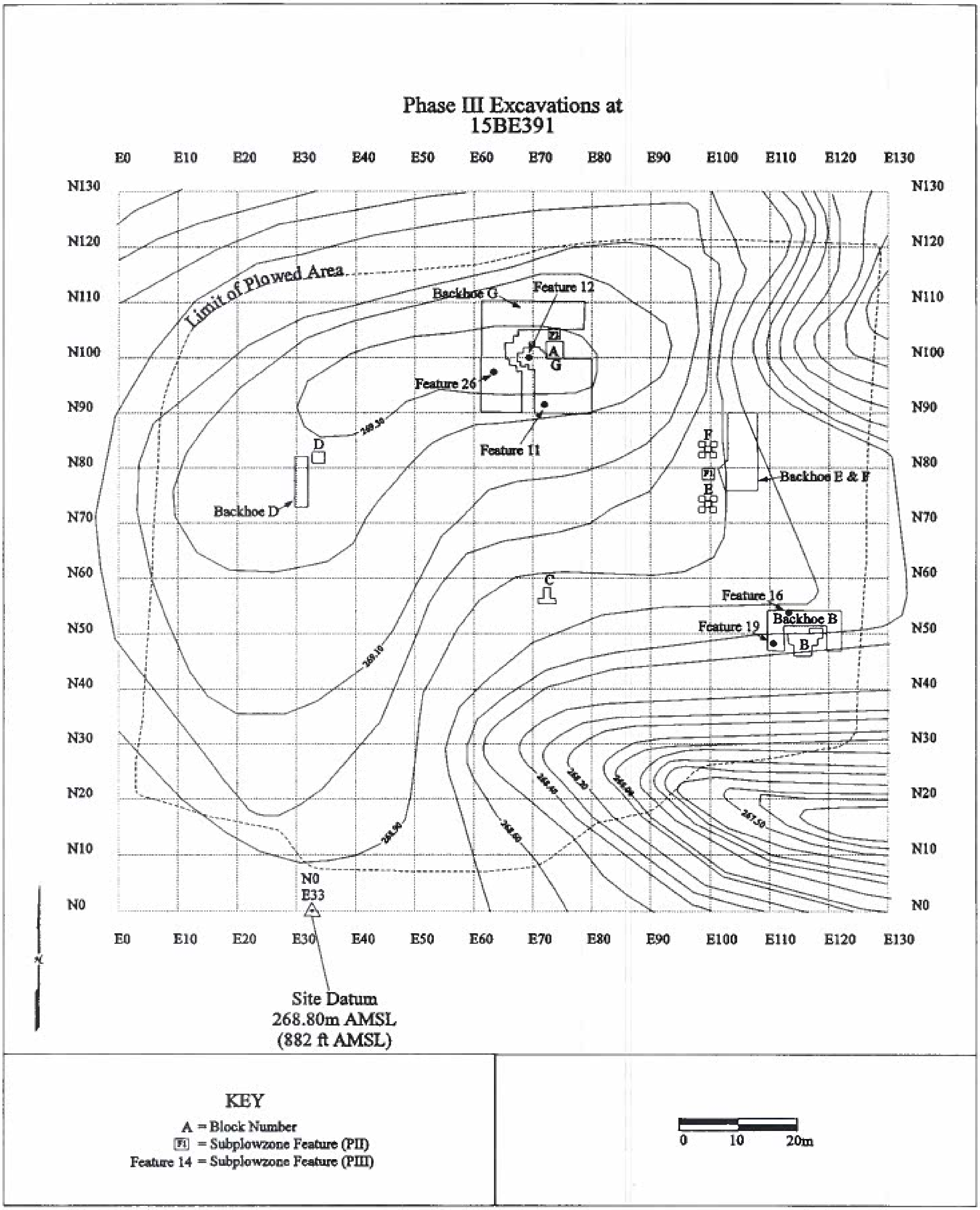

Figure 1. Site plan showing topography and Phase III blocks.

Several scholars (Brown 1992:81; Clay 1986:586; Seeman 1986:566) have expressed concerns about the classificatory taxons traditionally applied to regional cultural entities which appeared in the Woodland period. For example, in Kentucky, the Adena is regarded as Middle Woodland in date, contemporaneous with a portion of what is considered Hopewell north of the Ohio River. Similarly, the Adena manifestations of Ohio appear and subsequently terminate earlier than in areas farther south and are considered to belong entirely within the Early Woodland (Muller 1986:83; Railey 1990:252). For the purposes of this paper, the Early Woodland is regarded as spanning the time period between 1000 and 200 B.C., as suggested by Railey (1990). Using this chronology, the authors place the major component of the West Runway Site wholly within this portion of the Woodland, thus predating the Adena in Kentucky.

GENERAL RESULTS AND FINDINGS

The results of the excavations confirmed a plowzone origin for most of the archaeological materials. In spite of this fact, the recovered artifacts tended to be concentrated in horizontally discrete clusters. More than 5000 lithic artifacts, including 22 Kramer projectile points and point fragments, were collected and analyzed. The Kramer points (Figure 2), along with an assemblage of Fayette Thick ceramic sherds, provided the initial rationale for assigning this site to the Early Woodland period.

Numerous potential features were exposed beneath the plowzone in both hand-excavated areas and in the areas of mechanical stripping. Artifacts were found in, and adjacent to, some of these features, although only seven of the total of 27 identified soil stains were unequivocally identified as cultural features. The rest of the stains proved to be either root-molds, in-filled animal burrows, or of a highly equivocal nature. A total of six radiocarbon assays have been completed to date at the West Runway Site, five of which bracket the Early Woodland occupation at the site between 770 and 450 B.C. The sixth date of A.D. 980±70 was derived from carbon recovered from Feature 4, a deep, amorphous stain containing four chert flakes. This date has been removed from consideration for the Early Woodland component due to its temporal separation from the other dates, and the possibility that Feature 4 was a tree root-mold. The Early Woodland dates are provided below in the descriptions of each of the site's significant cultural features.

Feature 1 (N81 E94) was a large pit with horizontal dimensions at the base of the plowzone of approximately 1 x 2 m, with the long axis oriented east-west. Red oxidized earth was found beneath the feature, and the fill was rich in carbon. Adequate samples were collected for standard radiocarbon dating. A date of 770±90 B.C. (Figure 6) was derived from this material. No artifacts were found in direct association with this feature, but the analysis of flotation samples indicated the presence of oak and hickory charcoal, carbonized hickory nut endocarps, and carbonized maygrass seeds.

Feature 2 (N108 E64) was located through shovel testing during the Phase I survey, and it was completely investigated as part of the Phase II scope of work. This feature was an irregular pit containing a single chert flake, three large unmodified stones (totaling 7.8 kg), 10 pieces of fire-cracked rock (totaling 1.3 kg), and a single pitted stone. The irregular plan view of Feature 2 measures about 50 cm east-west and 40 cm north-south. The intact portion of the feature extended to approximately 15 cm below the point of its truncation by plowing. No carbon was found in this feature, and its exact function has not been determined.

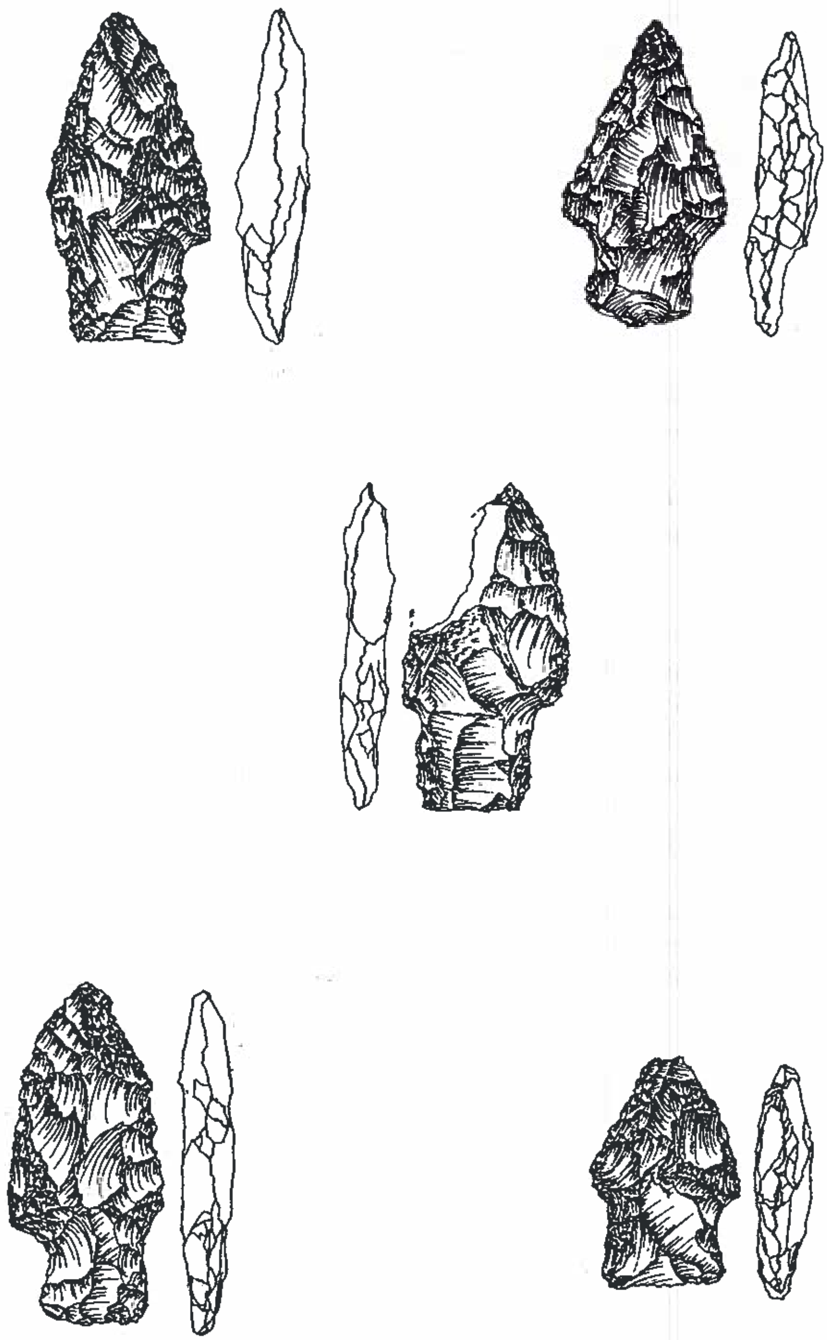

Figure 2. Kramer points from 15BE391.

15BE391
Feature #11

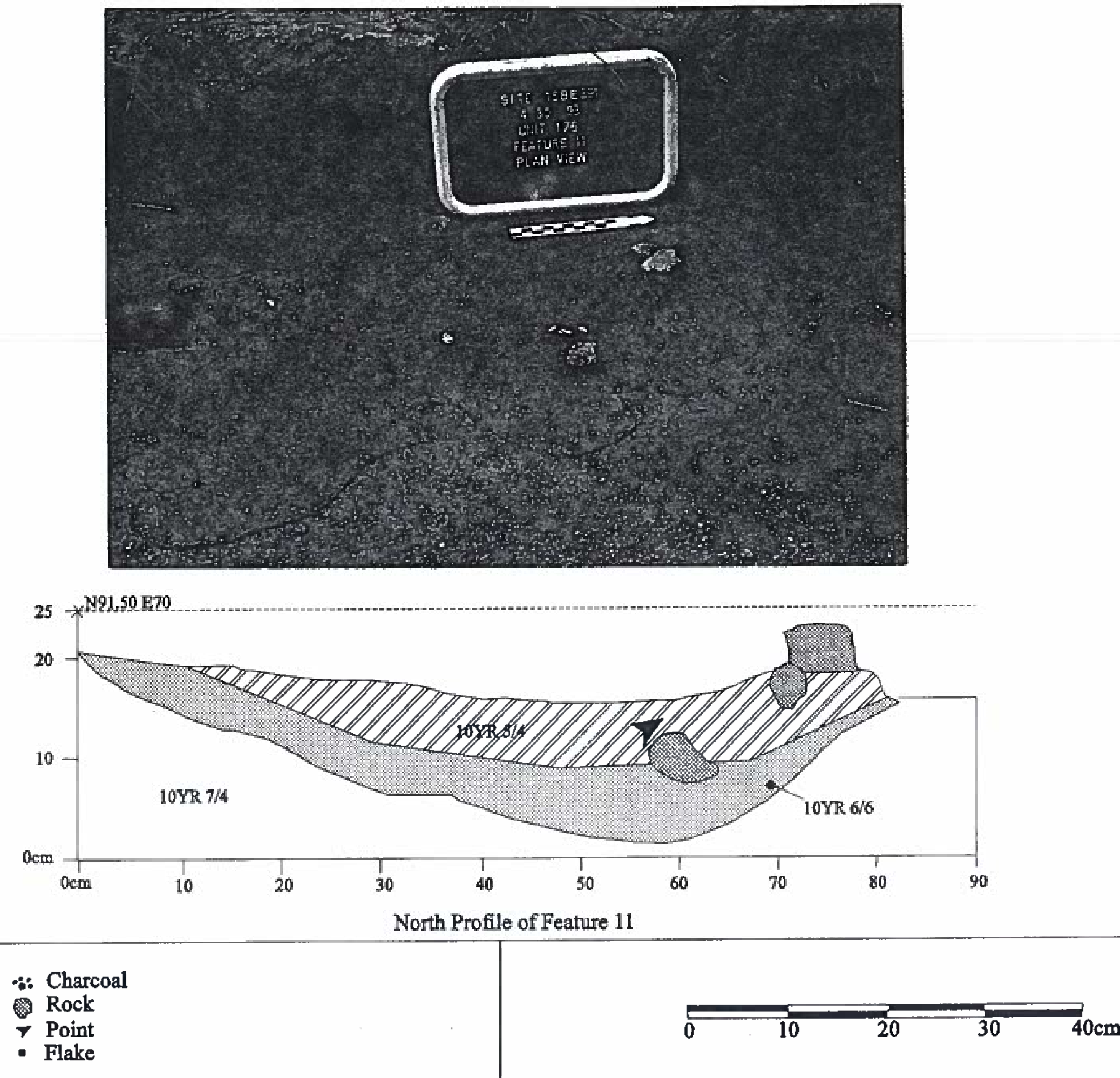

Figure 3. Plan photograph and profile of Feature 11.

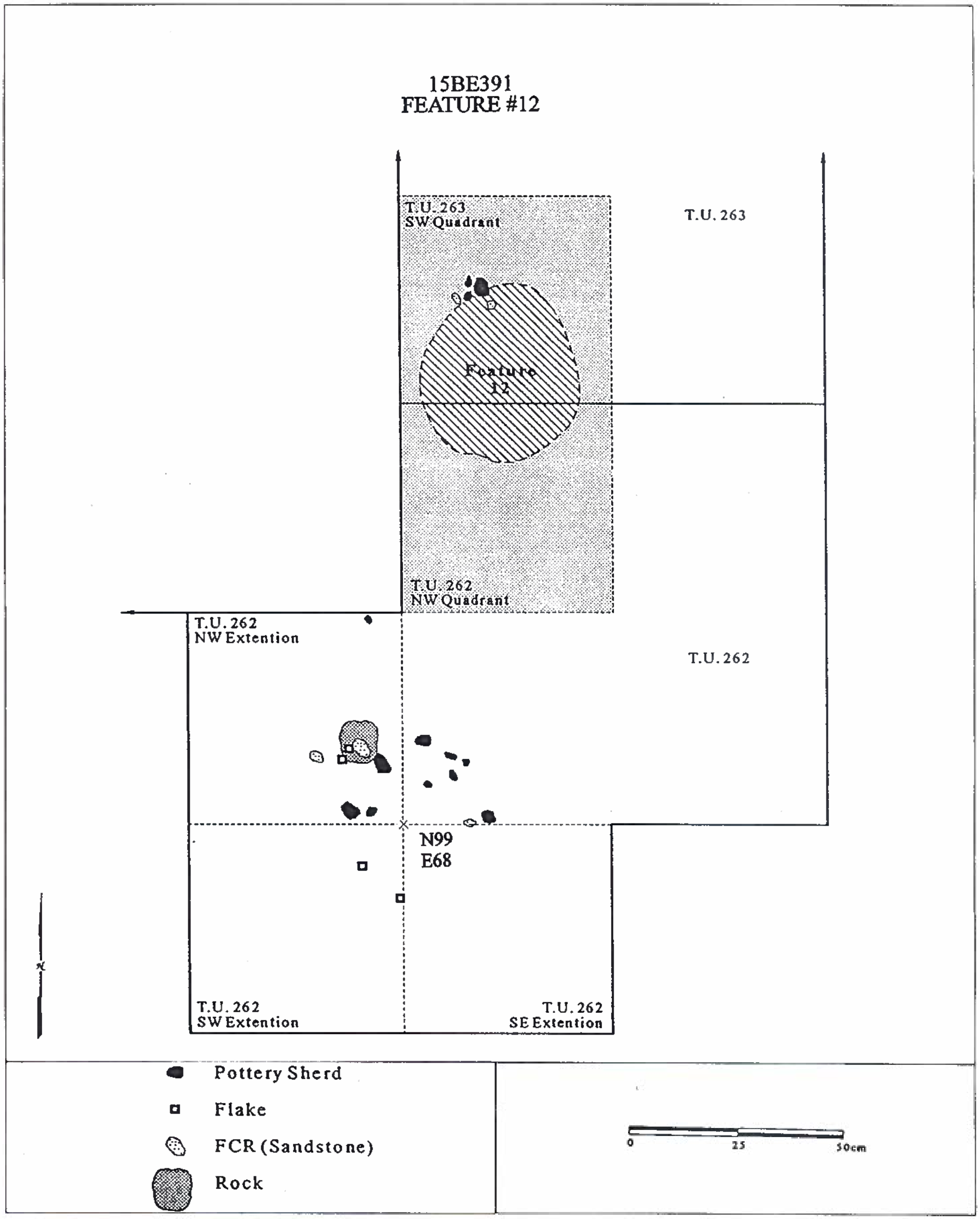

Figure 4. Planview of Feature 12.

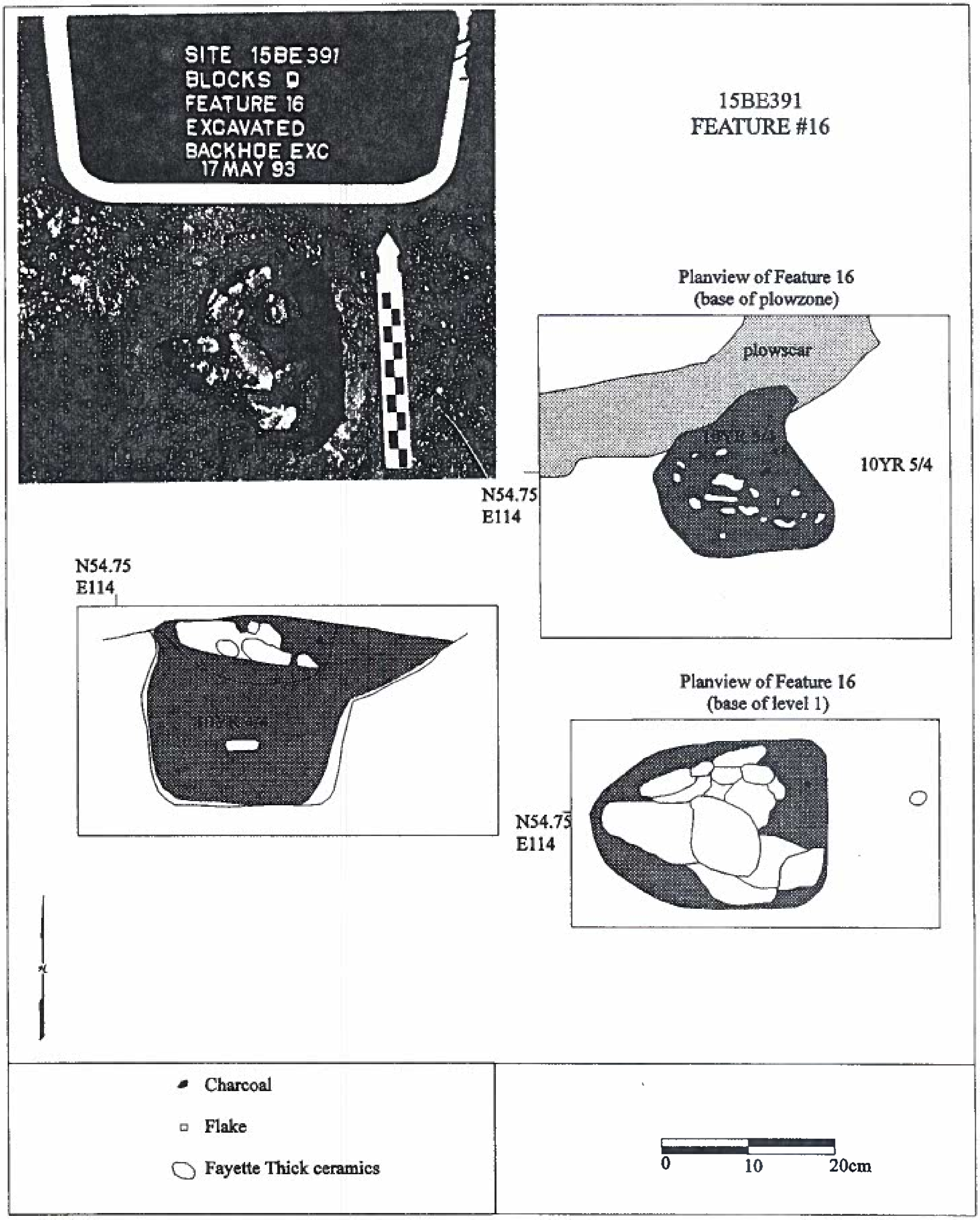

Figure 5. Planviews and Profile of Feature 16 (Note: in-situ Fayette Thick Ceramics in Photograph).

Feature 11 (N91.5 E70.5) first appeared as an amorphous stain approximately 1 m in diameter at the base of the plowzone in Test Unit 176, in the southwestern portion of hand-excavated Block G (Figure 3). This feature was a shallow basin containing fire-cracked rock (94 pieces weighing 3.0 kg), dozens of chert flakes representing all but the earliest stages of reduction, one biface, and, most significantly, three sherdlets of Fayette Thick ceramics and an impact damaged Kramer projectile point. The artifacts and fire-cracked rock were found clustered in a small depression with horizontal dimensions of approximately 50 cm north-south by 40 cm east-west that extended to a depth of 19 cm below the base of the plowzone. The low density of charcoal present in the feature fill necessitated the use of the AMS dating technique, which placed the age of the deposit at 490±60 B.C. (Figure 6).

Feature 12 (N100.2 E68.4) was identified through hand excavation of Test Unit 262 and 263 in the northwest corner of Block G, a portion of the site where a small area of intact cultural deposits escaped agricultural disturbance (Figure 4). Feature 12 was determined to be a small conical pit that contained abundant wood charcoal and a horizon of chert flakes. These materials defined an otherwise indistinct internal stratigraphy across the lower portions of the feature. The feature was roughly circular in plan, with a diameter of approximately 35 cm, and it extended to about 20 cm below the base of the plowzone. Analysis of flotation samples identified only two fragments of carbonized hickory nut shell as possible food remains. Although no ceramics were recovered from within the feature fill itself, several sherds of the Fayette Thick variety were found at the base of the plowzone in direct contact with the truncated top of the feature. Additionally, an in-situ cluster of Fayette Thick sherds along with several chert flakes was mapped resting just below the base of the plowzone, less than 1 m south of Feature 12. A date of 450±60 B.C. (Figure 6) was generated from carbon recovered from this feature.

Feature 16 (N54.75 E114) was defined following mechanical stripping in the southeastern portion of the site. This small pit yielded fire-cracked rock and numerous large body sherds of Fayette Thick ceramics that constitute a portion of a single vessel (Figure 5). This roughly circular feature was conical in profile, measuring 30 cm north-south and 40 cm east-west; it had a depth of about 25 cm below the base of the plowzone. Clear internal stratigraphy was demarcated by the concentration of ceramic sherds, several of which were found in a conjoined position *in situ* Ethnobotanical analysis of a sample of the feature fill identified no plant food remains. A small sample of charcoal was collected from this feature, requiring the application of the AMS technique to generate a date of 640±60 B.C. (Figure 6). Since the feature was located through mechanical stripping, no data are available concerning the quantity or condition of additional ceramic material that may have been present in the surrounding plowzone.

Features 19 (N50 E111.5) and **26** (N98 E60) have both been characterized as shallow basins containing small quantities of lithic debitage and fire-cracked rock; however, only Feature 19 produced quantities of charcoal adequate for radiocarbon dating. Carbon samples from the feature generated a date of 610±160 B.C. (Figure 6). Both features were found during the mechanical stripping of large areas around Phase III hand excavation blocks. Feature 19 was an irregular oval in planview, measuring 40 cm east-west to 25 cm north-south, and had an amorphous profile with a depth of about 20 cm below the base of the plowzone. Feature 26 had a roughly circular planview and a diameter of approximately 50 cm. The essentially level base of this feature intruded about 15 cm into the subsoil.

The spatial patterning of the various artifact classes recovered indicates that although the vertical dimension at the West Runway Site appears for the most part undifferentiated due to its plowzone character, the horizontal dimension related to the artifacts and features clearly signals differential deposition. Success in dissecting these aspects of West Runway Site structure was in large part due to the application of specialized studies such as refitting, technological replication and experimentation, and microwear analysis (Duerksen et al. 1994; Wall et al. this volume). The spatial structure of a number of discrete depositional loci associated with a particular chronological period and sets of specific activities can be established for the West Runway Site. The data suggest a wide range of activities, including flintknapping, wood or bone working, butchery and animal product processing, feature use and maintenance, and ceramic vessel use, occurred similarly, with some variation, at each of these depositional loci within the site. These loci appear to reflect discrete occupational events involving a subset of behaviors within the range typically conducted by the Early Woodland occupants of the site.

CHRONOLOGY

The five uncorrected radiocarbon dates from the West Runway Site range between 770 to 450 B.C. The dates are all derived from the contents of intact portions of features that were associated, directly or indirectly, with Early Woodland artifacts. The uncorrected dates suggest a 300 to 400 year period of successive occupations during the Early Woodland. The calibrated ages for these assays maintain essentially the same curve represented by the uncorrected dates, but generally shifts the entire temporal range back by around 100 to 150 years (Figure 6).

Feature 1 yielded the oldest date from the site (770±90 B.C.). This large pit or hearth is a unique occurrence within the site. It contained oak and hickory wood charcoal, carbonized hickory nut endocarps, and carbonized maygrass seeds, but no lithic or ceramic artifacts. Additionally, this feature was situated in a portion of the site where surface and plowzone artifact densities were very low. In contrast, the other dated features contained, or were located within, dense concentrations of materials diagnostic of the Early Woodland period, including both Kramer points and Fayette Thick ceramics. Whether or not this situation reflects a temporal or purely spatial division, it is clear that activities fundamentally distinct from the rest of the site were associated with Feature 1. If the date from Feature 1 is excluded, the determinations from the other dated features suggest a more restricted range of occupation of 250 years between 640 B.C. and about 450 B.C. This interval is maximally restricted to just 70 years if the reported single standard deviation is considered. Significantly, this temporal span coincides closely with Early Woodland occupations containing Marion Thick ceramics and Kramer points in the Mississippi and Illinois Valleys (Harn 1986; Stafford 1992).

Perhaps the most chronologically significant data from the West Runway Site derive from the firm association between the radiocarbon dates and the assemblage of Fayette Thick ceramics. Two dated features at the site (Features 16 and 11) contained Fayette Thick sherds, while a third (Feature 12) was located within a plowzone and subplowzone scatter of these ceramics. The Fayette Thick sherds excavated from Feature 16 were associated with an AMS date of 640±60 B.C. Additionally, the co-association in Feature 11 of Fayette Thick ceramics with a Kramer point, as well as the date of 490±60 B.C., supports the long-held, yet never-demonstrated, belief that these two artifact types were components of a single cultural complex in the Middle Ohio Valley.

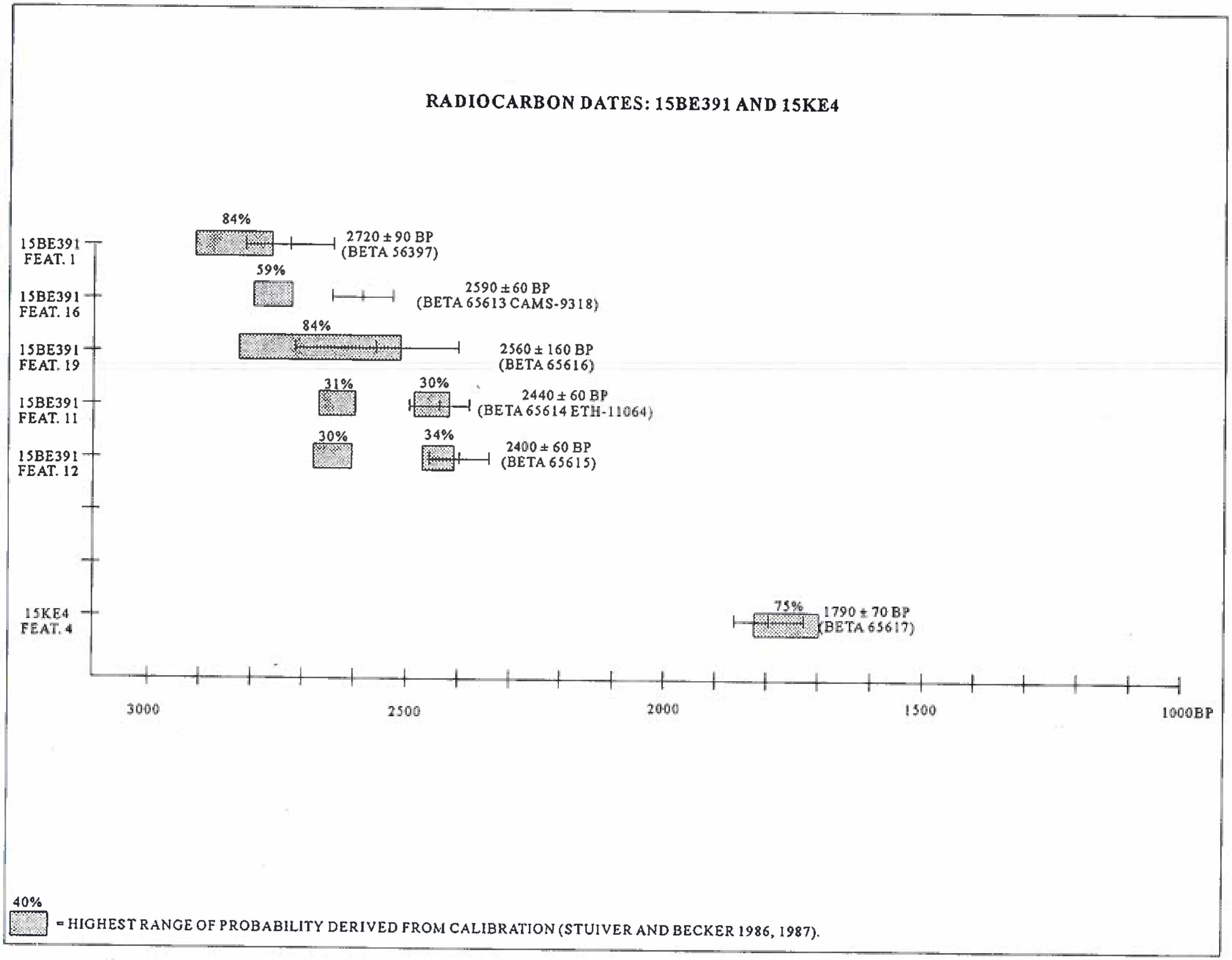

Figure 6. Uncorrected and Calibrated Radiocarbon Dates from the West Runway Site (15Be391) and Gibson Greeting Card Site (15Ke4).

THE WEST RUNWAY SITE FAYETTE THICK CERAMIC ASSEMBLAGE

Mitigation investigations at the West Runway Site recovered ceramic sherds from plowzone, subplowzone, and feature contexts. The ceramic sample was extremely fragile and only 38 specimens were large enough to analyze. Of these, six sherds are rims, one is a basal sherd, and 31 are body sherds. The authors believe that these sherds (Figure 7) are typical of the Fayette Thick type as characterized by James B. Griffin (1945), and later refined by Berle Clay (1980; 1985), Nancy O'Malley, Malinda Blustain, and Teresa Tune (O'Malley et al. 1983; Tune 1985), from surface collections and excavations at the type site, Peter Village (15Fa166). It is possible that some scholars will disagree with the placement of the West Runway Site ceramics within the Fayette thick type definition. Such disputes, while of interest for the understanding of variability within this artifact type, are wholly tangential to the significance of the presence of these thick, coarse-tempered wares in Northern Kentucky.

Griffin states that thickness and the size of the tempering particles are the most noticeable and constant features of this ceramic type. Further, he mentions that "tempering material, surface finish, color, and probably basal shape have some variability, but the size of the vessel wall remains the unifying character of this type" (Griffin 1943). Clay (1988) identifies fingernail pinching as an important surface treatment of the Fayette Thick assemblage from Peter Village, but suggests that the low portability of the type influenced a wide range of variability between different sites or population centers. No fingernail-pinched decoration is present on any of the pottery from the West Runway Site. However, the absence of sherds decorated in this fashion simply may be due to small sample size; only three to six vessels are represented in the assemblage. In comparison, only a small percentage of sherds (6%) display pinching in a much larger sample analyzed by Tune from Peter Village. Alternatively, early Fayette Thick assemblages may lack fingernail-pinching.

One of the few sites in Kentucky yielding an accepted Fayette Thick assemblage is the Hartman Mound (15Be32) (Clay 1988; Railey 1990; Webb and Snow 1943). This small mound, only 16 km from the West Runway Site, produced Fayette Thick ceramics and a date of approximately 450±150 B.C. (Turnbow 1981) from the fill of its central burial pit. Pinching is absent from the 17 sherds recovered from Hartman, yet this material is invariably discussed as Fayette Thick, based on the more salient characteristics of thickness and temper particle size.

The West Runway Site Fayette Thick ceramics are tempered with fragments of igneous/metamorphic rock, including angular or blocky particles of feldspar, hornblende, and quartz. Numerous ironstone concretions are present in the paste (which probably occur naturally in the soils). Likewise, the grit tempering materials are probably local to the site area, occurring naturally in glacial till and outwash. Temper density is moderate, with temper size ranging from very fine particles to particles up to 10 mm in length, giving a very coarse appearance to the paste. Clay particles that make up the body of the paste also are relatively large. This factor, coupled with a low firing temperature and a moderately dense temper, results in a paste that is

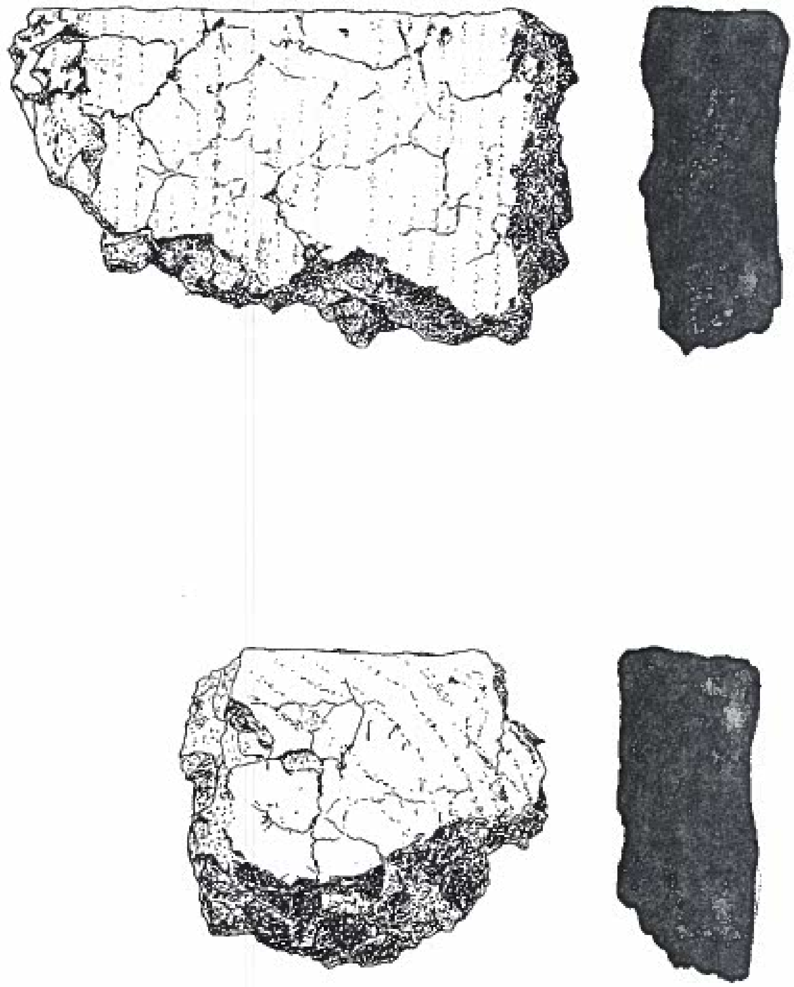

Figure 7. Fayette Thick ceramics.

poorly consolidated. Surface color is typically orange buff, although a few sherds are a light buff or reddish orange. Several sherds show evidence of breakage along bond fractures, suggesting that vessel walls were usually constructed by coiling.

Sherd exterior and interior surfaces are grainy, coarse-textured, and poorly smoothed. Most specimens exhibit impressions of woven fabric or vertically oriented cordage markings that are indistinct or partially obliterated probably due to unintentional smoothing. The cordage impressions are less distinct on the exterior surface of body sherds, whereas the rims and interior sherd surfaces have cord/fabric impressions that are visually more discernable. It is likely that most, if not all, of the cordage impressions result from various types of woven fabric being impressed into wet clay. Because of the friable nature of the pottery, only one rim sherd with distinctive cord impressions was sturdy enough to impress with modeling clay to produce a negative cast. Cordage impressions from this specimen were two-ply and S-twist. Analyzed collections of Fayette Thick pottery from the Peter and Grimes Village sites, however, suggest that S- and Z-twist cordage impressions are usually present in about equal proportions (Tune 1985).

Vessel characteristics were derived primarily from the examination of six rim sherds and one basal fragment. The single rim sherd of sufficient size to estimate vessel circumference was recovered from Feature 16, and it has an estimated orifice of 32 cm. All of the rims are direct or slightly everted, while the lip profiles are either flat, rounded, or interiorly beveled. Pottery from the site is generally thick-walled, ranging from 10.5 to 23.0 mm. Lip thickness is variable, ranging from 8.5 to 16.0 mm. Variability in body sherd thickness is illustrated within a concentration of ten sherds from a single vessel found in the vicinity of Feature 12. These sherds varied in thickness from 10.5 to 20.0 mm, with an average thickness of 14.5 mm. It is presumed that the thicker sherds came from the lower portions of this vessel, while the thinner ones came from higher up the vessel wall.

Despite the presence of several pottery concentrations, few sherds could be refitted to form vessel sections large enough to estimate vessel height or volume, although jars and basin-shaped vessel forms are suggested. One sherd from near Feature 12 varied in thickness from 16.5 to 20.0 mm and may be a basal sherd, indicating the vessel had a rounded bottom. Sherds from the fragmentary vessel recovered from Feature 16 range in thickness from 16.5 to 19.5 mm, with a mean thickness of 18.5 mm. Three sherds in this group had thicknesses of 19.0 to 19.5 mm, and in the absence of flat basal sherds, it is assumed that this vessel also had a rounded bottom. These data concur with recent investigations at Peter Village, during which several vessels with rounded bases were documented (Tune 1985).

FAYETTE THICK CHRONOLOGY

The Fayette Thick wares share many traits with other thick Early Woodland ceramics known from various Midwestern local and regional traditions, but is perhaps most similar to the Marion Thick type of the Illinois and central Mississippi Valleys. The latter is firmly associated with an early portion of the Early Woodland, dated to around 600 to 500 B.C., and further characterized by the occurrence of Kramer projectile points (Emerson 1986; Stafford and Stafford 1992). In Kentucky, prior to the West Runway Site investigations, the exact cultural and temporal placement of Fayette Thick ceramics has remained somewhat ambiguous.

This was due in part to the type's occasional occurrence on non-mortuary sites with consecutive (and stratigraphically mixed) pre-Adena and Adena occupations, where Adena Plain and Fayette Thick ceramics occur together, and as incidental inclusions within mound fill (Clay 1985; Fenwick and Wienland 1978). In his 1985 study of Peter Village (15Fa166), Clay outlined several hypotheses that might explain the nature of the relationship between the two types. These include the possibilities that:

1) Fayette Thick and Adena Plain were produced and used concurrently, and the two types reflect stylistic variability,

2) The two types occurred sequentially but were utilized similarly, reflecting stylistic change over time;

3) Fayette Thick and Adena Plain were produced concurrently, but with specific functions for each type; or finally

4) The types changed over time, concurrently with changes in function.

Clay's (1985) excavations at Peter Village identified a ditch associated with the site's massive earthworks that had been gradually filled in through colluvial action throughout and following the period of the site's occupation. Within the ditch, Clay observed three distinct strata interpreted as representing incremental deposition, the oldest of which he attributed to the initial period of occupation during the Early Woodland period, and the most recent probably occurring in historic times. Small quantities of both Fayette Thick and Adena Plain ceramics were recovered from the ditch, with the latter being stratigraphically superimposed above the former. Clay interpreted these data, as well as other information from Peter Village, to suggest that Adena Plain ceramics replaced Fayette Thick during the site's occupation sometime between 300 and 200 B.C. (Clay 1985).

Radiocarbon dates from Clay's excavations include a date of 190±110 B.C., derived from charcoal stratigraphically associated with the Adena Plain specimens, and a date of 310±60 B.C., derived from the charred contents of a postmold. The postmold was associated with the remains of a stockade that apparently ran concentrically 3 m within the margin defined by the ditch. A quantity of charred wood, which Clay associated with the stockade's destruction, was found covered with sediments apparently associated with the initial excavation of the ditch. Fayette Thick sherds were recovered in direct contact with the base of the ditch, and thus they were assumed to have been deposited a relatively short time after ditch excavation. Although the law of stratigraphic superposition indicates that deposition of the Fayette Thick material occurred before that of the Adena Plain sherds, not one of the radiocarbon dates from the site is directly associated with the Fayette Thick wares.

An opportunity for direct dating of Adena Plain materials from another northern Kentucky locale resulted from Jack Schock's 1984 excavations at the Gibson Greeting Card site (15Ke4). This site has been described as an early Middle Woodland settlement by Railey (1990), suggesting a chronologically later position relative to the West Runway Site. The Gibson Greeting Card site yielded a series of Adena Plain wares from feature contexts, Snyders and Lowe Flared base points, and datable carbon. As a component of West Runway Site research, a curated sample of carbon from Feature 4 at the Gibson Greeting Card site was submitted by the authors for a radiocarbon determination, yielding a date of A.D. 160±70 (Figure 6). This date falls considerably later than the dates associated with the West Runway Fayette Thick wares, supporting Clay's conclusion that Fayette Thick wares predate the Adena Plain.

DISCUSSION

One of the most formidable problems currently facing Early Woodland research is the difficulty archaeologists experience in trying to locate habitation sites as opposed to mortuary or ritual facilities. The low archaeological visibility of habitation sites dating to this period, when compared with Late Archaic occupations, relates to several factors including the relatively short length of the cultural period, the smaller scale of social organization and group size, the method and type of resource targeting and procurement, and restricted territorial boundaries (Lewis 1986; Railey 1991).

Functional and spatial analyses of material from the West Runway Site reflect short-term, and probably repeated, utilization of the locality by small groups of hunter/gatherers. The site's location on a large lobe of a major upland ridge system would have offered immediate access to extensive patches of seasonally occurring nuts and other plant foods, as well as to the animal populations that relied on these same resources. Although preservation conditions at the site were such that no faunal remains, and very little in the way of ethnobotanical data, were recovered, the material culture of the site's prehistoric inhabitants provides a sound basis for commentary on the position of this locality in the subsistence and settlement system of northern Kentucky during the Early Woodland period.

Previous discussions on the role of early ceramic material in Early Woodland settlement systems stress the concept of portability, and the various effects such a technology might have on settlement dynamics. Muller (1986) suggests that the occurrence of thick early ceramics reflects and, in turn necessitates, a high degree of sedentism. Conversely, Seeman (1986) notes:

> Despite (these vessels') apparent awkwardness.....they were apparently taken everywhere; Early Woodland pottery has been found on river floodplains, in rockshelters, and on upland knolls. Such vessels were obviously worth the trouble to move about.

Data from the West Runway Site does not fully concur with either of these statements. The reconstructed lithic reduction sequence of the West Runway Site (Duerksen et al. 1994; Wall et al., this volume), in combination with the site's radiocarbon dates, reflects a series of short-term, periodic occupations over a restricted temporal span. The use of thick, early ceramics at this site thus appears to have occured in the context of a relatively mobile settlement strategy. The size and friable consistency of these cumbersome vessels, as well as available evidence concerning their manufacture, do little to promote the concept of their portability. Current data on the raw materials utilized by Fayette Thick potters show that the clays and tempers reflect resources immediately available to the areas in which the ceramics were recovered (see Clay 1988:109; Nancy O'Malley, personal communication 1993). In fact, the type description itself allows for regionally variable tempers such as crushed chert, crushed limestone, and the crushed igneous and metamorphic materials found in the West Runway assemblage. There is no reason to assume that these ceramic materials were not produced, used, and discarded at, or very near, the localities from which they were recovered.

CONCLUSIONS

At first glance, the research prospects for the West Runway Site seemed unpromising. Before mitigation, this site was known to be a shallowly stratified, upland plowzone site that had been subjected to agricultural impacts during the Historic and Modern periods. The authors believe that the data presented here should dispel any such initial impressions.

First and foremost, the West Runway Site has demonstrated that perhaps our predictive modelling for site location in the Early Woodland period needs reconsideration. Specifically, the identification of an Early Woodland domestic locality in an upland setting, removed from surface water, indicates that archaeologists may have been looking in the wrong places for these site types. The relatively impoverished database on habitation sites, as opposed to ceremonial or mortuary centers, may therefore simply be an artificial effect created by a misunderstanding of Early Woodland site location parameters. Clearly, the present research should provide an impetus for renewed inquiries into site location and settlement systems for this temporal phase.

A suite of radiocarbon dates, spanning the time period between 640 B.C. and about 450 B.C., firmly establishes the chronological setting of the West Runway Site in the Early Woodland period. Perhaps the most significant date from the site comes from Feature 16, where Fayette Thick ware was associated with carbon dated to approximately 640 B.C. This is the earliest secure date yet recorded in the Ohio Valley for ceramic material. The investigation of the material remains recovered from the site has also documented the co-association of Kramer projectile points and Fayette Thick ceramics in the Ohio Valley. The fact that these typological designations have been applied to the West Runway Site artifacts is not pivotal. Rather, the demonstrated relationship between thick, coarse tempered ceramics and straight stemmed points in an Early Woodland context is the significant issue.

One of the major chronological issues for the Early Woodland of the region has been resolved by the investigations at the West Runway Site. The ceramic assemblage from the West Runway Site marks the first time that Fayette Thick pottery has been recovered from an Early Woodland non-ceremonial context. Also, this investigation, which includes the re-examination and dating of Adena Plain wares from the Gibson Greeting Card site, provides strong evidence that Fayette Thick pottery is the earliest ceramic type in the Bluegrass region, predating both the Adena Plain and Montgomery Incised types. The date of 640 B.C. obtained from Feature 16 extends the date range of this type backward by 200 to 300 years. It also suggests that the Fayette Thick type is contemporary with other Early Woodland, thick, grit tempered ceramic types, such as Marion Thick, that occur elsewhere in the Midwest.

The careful excavation and laboratory methods applied to the West Runway Site supported detailed reconstruction of site function during the Early Woodland occupation. Microwear analysis (Duerksen et al. 1994; Wall et al. this volume) indicates relatively few activities are represented by the lithic artifacts. These include hunting, butchery, and activities related to hide, stone, wood, and bone/antler working. The spatial analysis suggests that, although these artifacts have been subjected to horizontal dilation by plowing, there is definite clustering observable between the features, the lithics, and the Fayette Thick wares. Careful mapping of site activity areas in this manner allows for statements about site function. The usefulness of these data, however, will not be fully realized until more sites in the region are recognized, excavated, and analyzed in a comparable fashion to the West Runway Site.

In conclusion, the authors suggest that the excavation of the West Runway Site demonstrates the importance to prehistoric archaeology of carefully studying upland plowzone sites. The gathering of archaeological data is a synthetic process that relies on information from many sources. Plowzone sites have a "tradition" of not providing data suitable for making precise statements about prehistoric activities. Although this may have been the case in the past, it does not hold true for the present. Modern methodologies for excavating and interpreting prehistoric sites do provide a framework for effectively dealing with these spatially complex, and often partially disorganized, localities. We suggest that the research described above amply validates this statement.

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KRAMER PROJECTILE POINTS AND EARLY WOODLAND ACTIVITY AT THE WEST RUNWAY SITE (15BE391), BOONE COUNTY, KENTUCKY

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ABSTRACT

This paper describes an investigation of the manufacture and use of Kramer points from the West Runway Site using experimental reconstructions and microwear analysis. The West Runway Site is an Early Woodland residential encampment dating between ca. 770 and 450 B.C. The artifact assemblage is characterized by Kramer points and Fayette Thick ceramics. The projectile points appear to have been utilized intensively, but subjected to rather limited tasks related to hunting and the processing of animal products. Data from the site are compared with recently developed models describing subsistence and settlement patterns during the earliest stages of the Woodland period.

INTRODUCTION

The West Runway Site (15Be391) was situated in an upland setting near the headwaters of Gunpowder Creek, approximately 2.4 km southeast of the town of Hebron in Boone County, Kentucky. The site was located on a level ridgetop overlooking an intermittent creek at an elevation of 268 m above mean sea level. Since a general description of the West Runway Site appears elsewhere (see Duerksen et al. 1994), the following provides only a short overview of the site. The Phase III data recovery investigations involved the hand excavation of 166 m^2 of the site area followed by mechanical stripping of approximately 600 m^2. More than 5,000 lithic artifacts, including a sample of 22 Kramer projectile points and point fragments, were collected and analyzed. These points, along with Fayette Thick ceramics (Tune 1994) and numerous radiocarbon determinations, date the site to the Early Woodland period. Specifically, radiocarbon dates bracket the Early Woodland occupation at the West Runway Site between 770 and 450 B.C. In one instance, Fayette Thick sherdlets occurred in a shallow pit (Feature 11) that also yielded an impact-damaged Kramer point. An AMS date of 490$\pm$60 B.C. (Beta 65614 ETH-11064) was obtained from a carbon sample taken from the interior fill.

This paper reports on an investigation of the manufacture and use of Kramer points from the West Runway Site as a means to reconstruct Early Woodland activity and, perhaps, verify current hypotheses concerning settlement and subsistence patterns. A concept introduced by French archaeologists, *chaine operatoire*, may be used to describe the totalizing process of technological organization at any prehistoric site. In behavioral terms, this totalization envelops an original project as a response to a need, as well as the means and by-products of the activities

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employed to achieve the desired goal. Thus, prehistoric lithic artifacts must not be viewed as static objects, but rather as residual "events" reflecting a dynamic, interrelated system comprising needs, projects, and organized activities involving modification of materials to achieve goals (*praxis*). In examining technological organization as expressed through a flaked stone tool assemblage, consideration is usually given to raw material selection, as well as tool manufacturing, use, breakage, sharpening, and discard trajectories. In as much as each component of this sequence refers to a specific project or projects, they signify task-oriented prehistoric behavior.

The function of flaked stone tools is determined in order to understand the activities that took place during the Early Woodland occupation at the West Runway Site. The manner in which functional studies of lithic materials are conducted usually relies on data from experimental analogy. Thus, the prehistoric artifacts must first be replicated, using locally available raw materials, and then subjected to a variety of tasks. The experimental approach, when conducted in isolation, often provides only a series of potential functional trajectories for a particular artifact type. For example, Kramer points can be hafted and used as both knives and projectile points; in addition, the same tool can be used for several tasks, alternatively serving as a knife to butcher animals, a projectile point, a woodworking tool, or a scraper. In order to determine specific tool functions, the analytical process must incorporate microwear studies.

Microwear analysis is based on an examination, preferably using high-power microscopy (cf. Keeley 1980), of the edges of prehistoric stone tools. This examination defines the characteristics of microscopic polishes and linear striations with the aim of precisely determining tool function. The main assumption underlying this method of analysis is that any material contacted by a tool's edge will leave discrete wear traces. Thus, the pattern of wear traces produced by contact with meat and bone are expected to be qualitatively, and perhaps quantitatively, different from those resulting from woodworking.

Sites like the West Runway locality, confined largely to plowzone settings, often provide little in the way of site structure data or features to aid in the interpretation of site function. Due to this fact, many archaeologists discount "plowzone sites," especially those that contain stratigraphically jumbled artifact assemblages and few intact features, as being capable of providing meaningful data on prehistoric lifeways. The analytical approach described below, using experimental and microwear analyses of stone artifacts, provides a means for interpreting site function at these localities. In the case of the West Runway Site, this methodology was used to identify, describe, and interpret Early Woodland activities, despite the relative paucity of other forms of material evidence.

THE LITHIC ASSEMBLAGE FROM THE WEST RUNWAY SITE

The analysis of the lithic assemblage involved an initial sorting of lithic artifacts into tools and debitage. The unretouched flakes were separated into two major groups: 1) those artifacts that could not be assigned to a specific reduction sequence, and 2) those flakes that could clearly be identified as deriving from biface reduction. Table 1 presents the numbers and percentages of flakes in the debitage sample from the West Runway Site.

Table 1. Debitage Types.

Type	N	Percent
Initial reduction flake	262	5.87%
Flake, unspecifiable reduction sequence	964	21.61%
Biface initial reduction flake	382	8.56%
Biface thinning/shaping flake	1319	29.57%
Biface finishing/edge preparation flake	626	14.03%
Chip (complete, <1 cm)	261	5.85%
Shatter	445	9.97%
Microdebitage (<5 mm)	175	3.92%
Janus flake	25	.56%
Total	**4460**	**99.94%**

Due to the plowzone nature of the site (see Duerksen et al. this volume), it is not easy to assign the debitage to a discrete temporal component. In spite of this limitation, useful data can still be obtained by consideration of the flake assemblage as a whole. Initial reduction flakes are relatively rare, making up only 5.87 percent (n=262) of the total of 4460 pieces of debitage. There were 1319 biface thinning/shaping flakes and 626 biface finishing flakes, which outnumber the biface initial reduction products by a ratio of more than 5 to 1. These data suggest the following two possibilities: 1) that bifacial preforms, initially flaked outside the site area, were finished at the West Runway site; and 2) that sharpening and repair of worn and broken tools was a frequent focus of lithic reduction on the site.

There were 10 simple flake cores in the collection, and all of these were made from secondary source cobble cherts. These cobbles were probably collected from streams dissecting the pre-Illinoian drift deposits that occur in the area (Gibbons 1972). The closest drift deposits to the West Runway Site are presently located approximately 2 km to the northeast. Five cores had single plain or natural surface striking platforms, and the remainder consisted of two discoidal cores and three core fragments. It is most likely that the cores from the West Runway Site were flaked by direct percussion with a hammerstone. The heaviest example weighs only 65 g, but it must be remembered that all of these pieces had been flaked before abandonment. Thus, it is difficult to estimate the original size and weight of the cobbles before reduction. However, there are two cores from the site that provide evidence that the cobbles were roughly fist-sized or smaller before being flaked.

The retouched tools are primarily composed of projectile points, particularly those examples belonging to the Early Woodland stemmed cluster of Justice (1987:184-189). The Early and Middle Woodland components at the West Runway Site are composed of 22 Kramer points, as well as a Robbins point, a hafted scraper made from a Cresap point, and an Adena stemmed point base (Figure 1). The following discussion relates to the Kramer points as representative of the Early Woodland component at the site.

The Kramer points from the West Runway Site have mean dimensions of 40 x 23 x 7 mm with standard deviations of 5, 3, and 1, respectively. The metric data from these artifacts provide interesting comparative material for known morphological parameters described from other Midwestern collections. The measurement of 23 Kramer points from the American Bottoms, Illinois, by Munson (1971:7, Table 3) yielded average dimensions of 55 x 24 x 7 mm. Kramer points from the West Runway Site display an average length that is 15 mm shorter than those described by Munson. The maximum recorded length of the points in the Illinois sample was 71 mm, whereas the longest complete Kramer point at the West Runway Site measures only 45 mm. The average measurements of width and thickness from both collections are virtually identical. It is worth noting that width is less sensitive than length to factors such as breakage and subsequent repair. A possible explanation for the diminutive size of the West Runway Site Kramer points is that they may have been curated more intensively, undergoing numerous functional and sharpening episodes, than those pieces discussed by Munson. This assertion would seem to be supported by the multifunctional role assumed by these tools at the West Runway Site (see below), as well as the general scarcity of raw material occurring in large blocks in the vicinity of the site.

The stems on nine of the West Runway Site Kramer points expand slightly and exhibit straight basal edges; five specimens have both straight stems and basal edges. Twelve points show grinding along the stem and basal edge, whereas the remaining 10 specimens are ground only along the stem margins. The assemblage displays roughly equal distributions of biconvex (n=9) and planoconvex cross-sections (n=10). Planoconvex cross-sections are often indicative of a biface having been produced from a flake blank. Although small remnants of cortex and natural surface occur on several of these points, no portions of the ventral or dorsal surfaces of an original flake blank could be identified on any piece.

Intentional heat-treatment does not appear to have been a factor in the production of Kramer points. Five points in the assemblage show signs of alteration caused by heat, such as a perceptible reddening or, in more extreme instances, surficial cracking and crazing. This does not, however, appear to be the result of an effort by prehistoric knappers to enhance the vitreous qualities of the chert, which, if correctly approached, typically bestows a waxy luster to flake scars following the heating event. Rather, heating of these pieces is most likely due to accidental loss or intentional discard within or near a hearth, or their post-depositional contact with subsequently kindled fires.

The techniques used by prehistoric knappers to manufacture Kramer points at the site were delimited through an examination of flake scars and flake scar patterns. Typically, scars left by the percussive removal of biface thinning flakes are usually wide and expanding, whereas flakes removed by pressure are narrower and parallel-sided. These data suggest that percussion was the primary method used to produce the Kramer points from the West Runway Site. Pressure flaking appears limited only to the final shaping of a tool's edges or to maintenance-related retouch for repair of dull or broken tools.

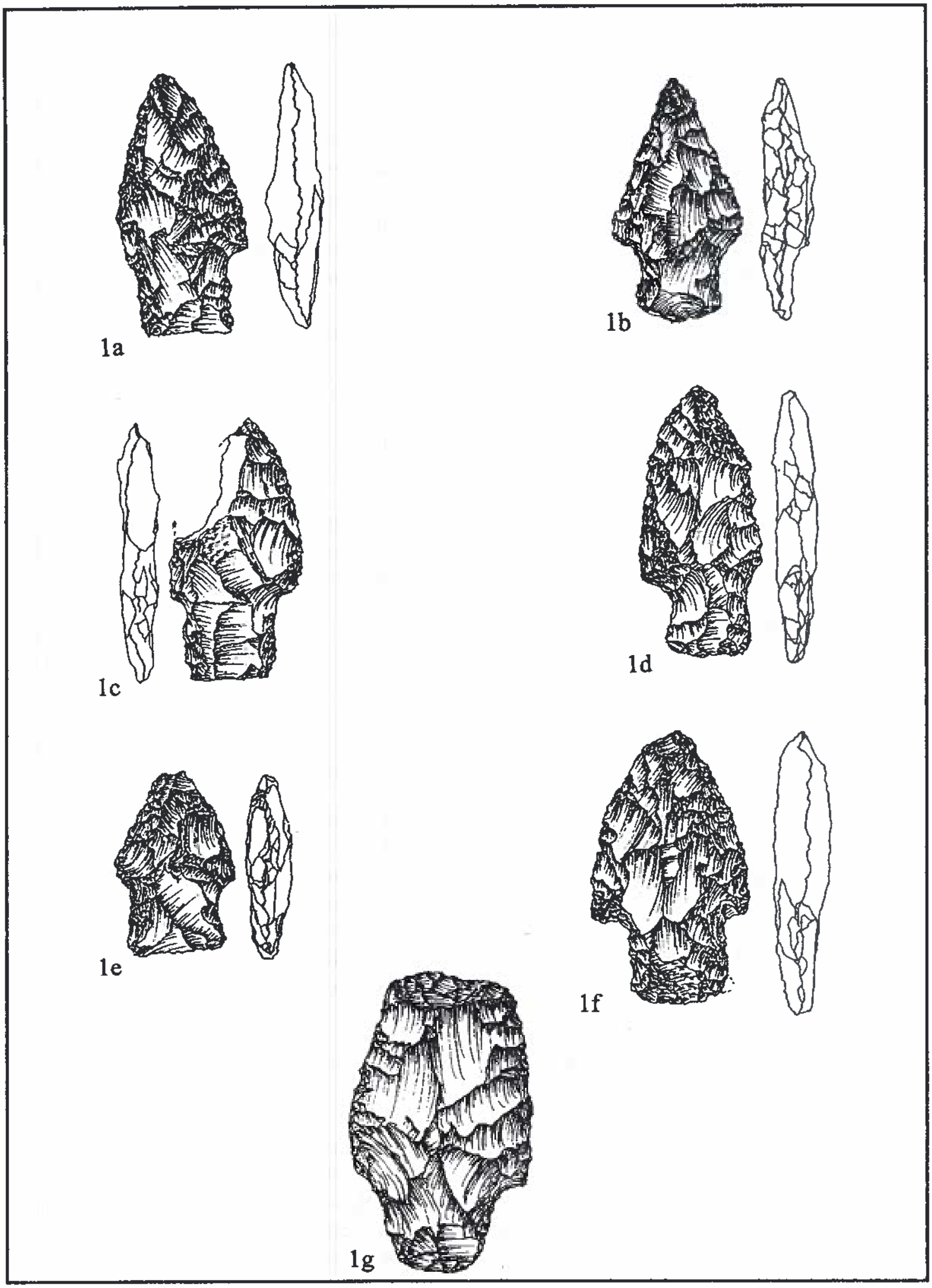


Figure 1. Projectile Points: a-e, Kramer; f, Robbins; g, Cresap Point Modified into a Hafted Scraper (scale 1:1).

REDUCTION SEQUENCES AND REPLICATION OF THE LITHIC MATERIALS

Any replicative study of lithic manufacturing/functional trajectories must have as its starting point the acquisition of appropriate raw materials. This is especially the case when microwear analysis is involved, due to that fact that the physical properties of different cherts will affect wear polish formation and development. It is believed that numerous types of chert are represented in the West Runway Site assemblage including Wyandotte (Harrison County, Indiana) and Vanport/Flint Ridge (Licking County, Ohio), as well as secondary source cobble cherts, undoubtedly derived from local drift deposits. In the case of the cobble cherts, several surveys of the area surrounding the site located drift deposits containing similar materials to those utilized prehistorically. Although chert pebbles and cobbles exist in abundance within pre-Illinoian drift deposits on the USGS Burlington and Addyston Quadrangles Geological Map (Gibbons 1972), only a few cobbles large enough to be knapped into Kramer points were collected. In all cases, the raw materials used in the experiments were selected to match, as closely as possible, the characteristics of the cherts used for the Kramer points, particularly in texture and grain size.

Flintknapping, as a process, is similar to the activity undertaken by an artist while creating a stone sculpture. It may be stated that while an artist imposes his/her character on a block of stone by hammer blows, so the stone imposes its nature on the artist. This interactive state certainly exists when flaking chert: the quality and character of the raw material directly influences the methods and approaches taken to lithic reduction. Four separate manufacturing or repair-oriented activities have been identified, each involving different flaking objectives: 1) on-site flake core reduction using secondary source cobbles; 2) off-site and on-site biface reduction using secondary source cobbles; 3) biface reduction using relatively large flakes, probably involving raw material transport; and 4) sharpening of existing projectile points and knives, some of which may have been carried onto the West Runway Site (Figure 2).

Production of the bifacial tools found at the West Runway Site is thought to have occurred along two separate trajectories. First, locally available cobbles were reduced directly into bifaces by percussion and, second, relatively large flakes were detached from cores to provide bifacial tool blanks. The use of secondary source raw materials initially involves the selection of cobbles with a desirable shape and thickness. Spherical cobbles, for example, are not an optimal choice due to the obvious problems associated with successfully thinning them. Careful selection of raw material, however, does not always ensure success; unsealed fractures, not visible on the cobble's surface, may lead to knapping failures. In order to avoid the problem of transporting poor quality materials, prehistoric peoples often tested, and partially prepared, tool blanks at the source. Based on the flake class frequencies discussed above, this statement would appear to hold true for the West Runway Site.

Although the by-products from primary reduction of secondary source cobbles are generally absent from the site, it is possible to reconstruct the flaking methods through experimental analogy. Initial reduction was most likely achieved by direct, hard hammer percussion. A hard hammer is best for this purpose due to the fact that the smooth, rounded surfaces of a cobble generally do not provide adequate striking platforms for a soft hammer like an antler billet. Initial reduction has two primary goals: 1) to create adequate platforms around the edge of the cobble; and 2) to create ridges that act to guide flake removal over the interior surfaces of the cobble. Completion of this stage allows for the more careful platform preparation required during primary thinning and shaping.

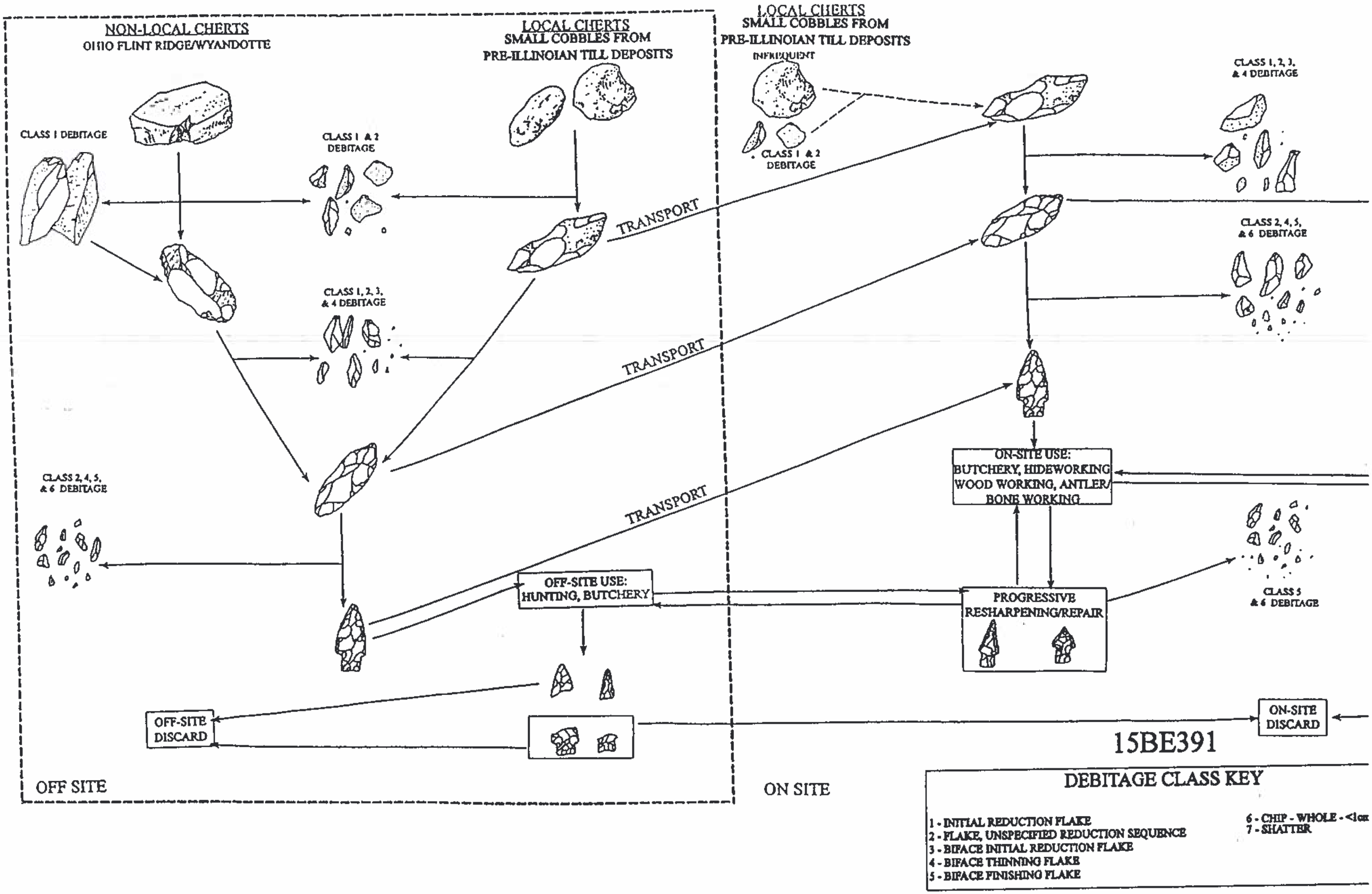


Figure 2. Schematic illustration of reduction sequences from the West Runway Site.

Having removed a series of flakes from the surface of the block of raw material, and thus created suitable striking surfaces, the knapper begins the initial thinning and shaping stage. The majority of the flaking is done with a soft hammer, and the pieces detached tend to be invasive extending into the midsection of the biface. Careful striking platform preparation is evidenced during this stage by the increased number of flakes with faceted butts. By the end of the first thinning/shaping stage, the biface has achieved a biconvex cross-section. A later stage of thinning may follow, which consists of further platform preparation and detachment of invasive flakes with progressively straighter profiles in order to obtain a flatter cross-section. In the case of some of the West Runway Site Kramer points, this stage may not have been implemented; several examples, even before sharpening, appear to have been relatively narrow with biconvex cross-sections. Finally, the tool's edge is prepared by a combination of fine percussion work and/or pressure flaking if required.

A second biface manufacturing trajectory identified at the site, utilizing a flake, begins with core reduction and the manufacture of a suitable flake blank. At the West Runway Site, this initial manufacturing stage almost certainly occurred off-site with flake blanks, or partially reduced preforms, being transported on-site. Bifacial reduction of a flake involves the preparation of the lateral edges of the piece in order to create platforms for the thinning and shaping stages that follow. The initial series of flakes detached often have no cortex, but they display portions of the original dorsal or ventral surfaces of the flake from which they were struck. It should be noted that primary reduction flakes from this manufacturing sequence can be wholly non-cortical. Thus, the use of the presence of cortex alone to define initial reduction is of limited value. In most other respects, the reduction methods and by-products are similar to those described above. Finally, it is worth noting that the use of a flake blank will frequently result in a projectile point with a planoconvex cross-section. This feature was identified on 10 of the West Runway Site Kramer points.

Replication of the experimental tools consisted of collecting locally available chert cobbles from pre-Illinoian drift deposits, as well as two non-local cherts found at the site, Wyandotte and Vanport/Flint Ridge. Flaking of these materials was achieved through the use of quartzite hard hammers, antler billets, and antler tine pressure flakers. Manufacturing times ranged from approximately 35 minutes for relatively small-sized Kramer points to 55 minutes for the larger examples.

EXPERIMENTAL RECONSTRUCTIONS OF ARTIFACT FUNCTIONS

The experimental research, using replicas of the West Runway Site lithic materials, had two main goals: 1) to examine the operational dynamics of the tools concerned; and 2) to provide a comparative dataset for the microwear analysis. Each experiment was designed to simulate realistic tasks thought to have been undertaken prehistorically. Thus, in an experiment related to butchering an animal, an entire white-tailed deer was slaughtered beginning with gutting and skinning and ending with disarticulation and preparation of meat cuts. It is the authors' belief that this approach provides the only suitable database for microwear analysis. Using experimental tools to cut through "store-bought" meat and bone in an offhand manner does not, in our opinion, provide a valid analog to prehistoric butchering activities. Such an approach may cause significant differences in the development and distribution of microwear traces on the experimental pieces.

EXPERIMENT 1: BUTCHERING A WHITE-TAILED DEER

Before beginning the experiment, two projectile points, a Robbins and a Kramer point, were hafted on hardwood handles by insertion into a slot that was then bound with deer leg sinew. This area was covered with a pine pitch to protect the sinew, which is hygroscopic, from moisture. A 70 kg white-tailed buck (Odocoileus virginianus) was obtained through the courtesy of Mr. John Phillips and the 5th District Conservation Officers of the Kentucky Fish and Wildlife Resources.

The initial gutting of the animal involved an incision from the sternum to roughly the area of the bladder. This was achieved through the use of two large biface thinning flakes produced during the manufacture of a Robbins point. The deer was picked up by its forelegs and bounced, allowing the entrails to spill out of the body cavity. Skinning was conducted on the ground through a combination of hand stripping and use of the hafted knives. Bifacial tool edges, like those on projectile points, are especially suited for making detachment cuts as they are less prone to damaging the skin than the sharper, unmodified lateral edges of flakes. Once the skin was removed, the hafted knives were again utilized to disarticulate the body into smaller portions for preparation of various meat cuts. The cranium was removed between the second and third cervical vertebrae, while the ilium was detached from the terminal lumbar vertebra. The two femurs were detached at the ball joint contact with the ilium, thus removing the rear limbs. The forelegs were detached by cutting through the muscles attaching the scapula to the upper torso (Figure 3). Once this procedure had been completed, selected meat cuts were obtained, for example, by slicing along the thoracic vertebrae to peel back the muscles along the ribs.

The process outlined above took approximately 2.5 hours from the initial skinning to the preparation of the meat for consumption. The two biface thinning flakes displayed edge damage in the form of discontinuous, occasionally scalar, retouch along the lateral edges. The knives also had edge damage in the form of tiny, noninvasive, flakes along their edges. This short retouch occurred on opposite sides of the knives due to the fact that the tool handles were repeatedly (although not consciously) flipped over during use. The knives required no sharpening during the entire process, a significant observation when considering problems of tool curation and longevity. Assuming that no breakage occurs, it is extrapolated that a single Kramer or Robbins knife could potentially be sharpened and used for numerous butchering episodes.

EXPERIMENT 2: ATLATL EXPERIMENTS

Experiment 2 tested the effectiveness of replica Kramer and Robbins projectile points as tips for darts. A further goal of this experiment was to examine the types of macroscopic and microscopic damage resulting from penetration and impact with hard materials such as bone. The three atlatls used in the experiment varied in design and ranged from a composite example with wood and antler parts, like those from Indian Knoll, to a facsimile of a Basketmaker spear thrower. Each example was manufactured from appropriate materials, which included white oak (Quercus alba), pignut hickory (Carya glabra), white-tailed deer (Odocoileus virginianus) antler, and hide glue and sinew for the necessary adhesive and binding. Two atlatls utilized weights, one was a banded slate birdstone weighing 40 g and the other was a catlinite boatstone of the same weight.

The seasoned dart mainshaft was made of cane (Arundinaria gigantea) that had been heat straightened. Filson (1969:318) states that "dense stands of cane [were] mentioned by the early explorers of eastern Kentucky," suggesting this resource was also available prehistorically. It should be noted that as long as the cane shaft is laterally straight it will fly with considerable accuracy. Small bends in the shaft caused by the cane's nodes have no appreciable effect on the flight; complete removal of the nodes should be avoided as it weakens the integrity of the mainshaft. The mainshaft was fletched tangentially with two wild turkey (Meleagris gallopavo) feathers bound in place with sinew. The basal cup (cf. Hamilton 1982:Figure 6) of the mainshaft, which inserts onto the spur or hook of the atlatl, was also bound with sinew to reinforce this potentially weak point. Cane as a projectile material requires the use of a foreshaft and, consequently, all 10 experimental points were first hafted on pignut hickory (Carya glabra) foreshafts (Figure 4). The points were inserted in narrow slots and bound into place with sinew; in order to protect the sinew from moisture, this area was covered with pitch. The weight of the fletched mainshaft was 86.0 g, whereas the foreshafts with mounted points ranged from 19.7 to 31.7 g.

The target was a 55 kg white-tailed buck (Odocoileus virginianus) suspended by rope from two trees in a standing position (Figure 5); the deer was gutted and allowed to bleed before the experiment. The distance between the person throwing the dart and the target ranged between 5 m and 7 m. Although the authors are aware of the problems associated with experimentation on nonliving targets, it was not possible, or indeed legal, to hunt live deer using our equipment. In spite of this admission, it is still thought that the basic data obtained would be of value to the microwear research. Table 2 illustrates the results of the 10 atlatl experiments.

There can be no doubt that dart shafts tipped with Kramer and Robbins points served as effective projectiles. As stated in other research, a dart has a relatively slow velocity when compared with an arrow (Bergman et al. 1988; Raymond 1988), but it imparts more energy on impact. Thus, it was noted that relatively little effort was required to propel the dart for delivering a fatal wound. Three of the throws would have resulted in a relatively quick fatality from hemorrhage and anoxia, whereas two others would have debilitated an animal, perhaps leading later to death (cf. Frison 1986:119). Stone projectile points were certainly regarded as expendable (cf. Guthrie 1983), but it is worth noting how many experimental points survived missed shots. Only those examples that contacted a hard material, such as stone or bone, suffered damage, and just a few of these would have been impossible to sharpen and reshape. It is suggested here that bifacial stone projectile points may have potentially long curation values, an observation that has bearing on any microwear interpretation. Along with this fact is the consideration that a point that is attached to a foreshaft also has the potential for serving as a hafted knife. The issue of multifunctional roles for single tools was examined in Experiment 3 below.

EXPERIMENT 3: BUTCHERING A WHITE-TAILED DEER

The white-tailed buck used for the atlatl experiments was skinned and butchered in a manner similar to that described in Experiment 1. The only departure from the method outlined above was that the animal was suspended from its hind legs to facilitate skinning. Thus, the skin was removed by hand stripping downward toward the neck. Once again, the cut separating the head from the neck occurred between the second and third cervical vertebrae; the skin and head were removed together.

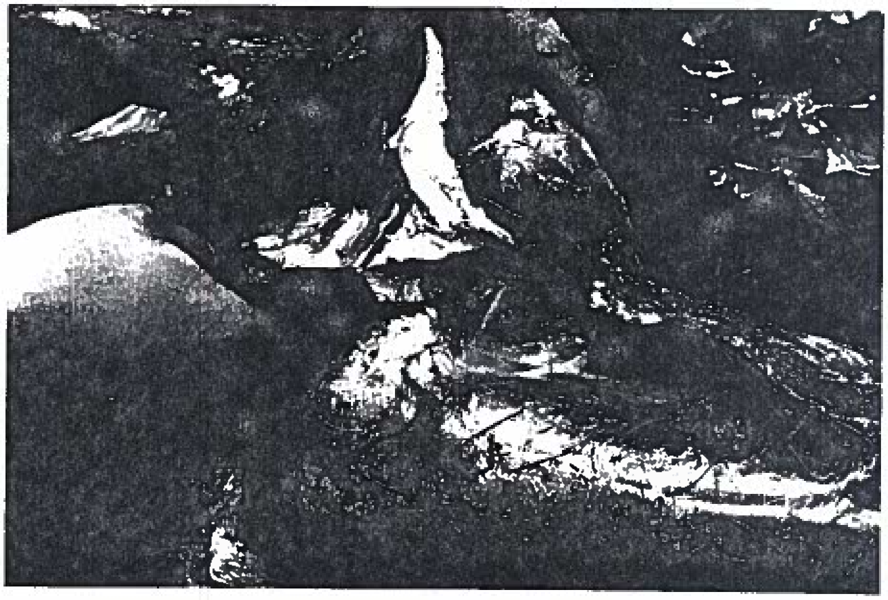


Figure 3. Experimental Butchery Utilizing a Hafted Robbins Point.

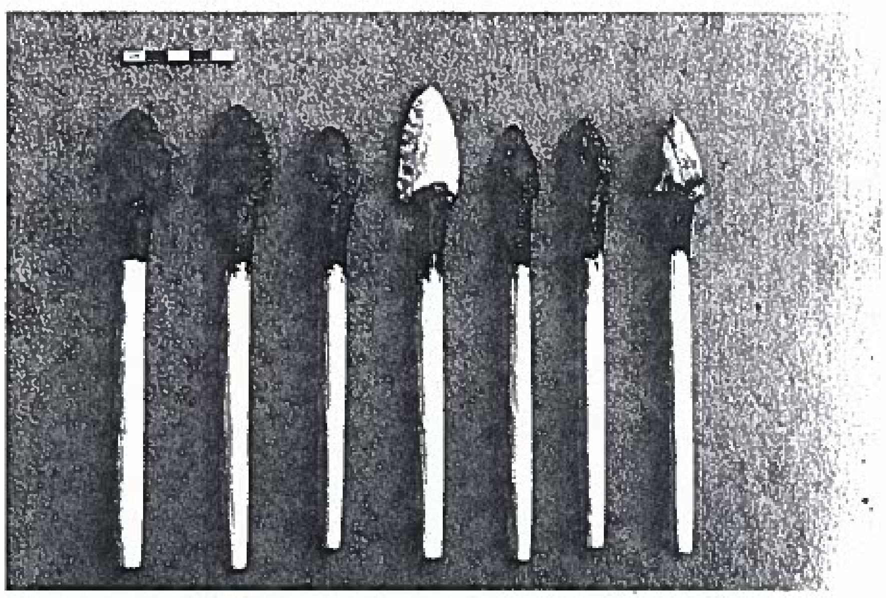


Figure 4. Replica Kramer and Robbins Points Hafted on Hardwood Foreshafts.

Figure 5. White-tailed Deer Target with Dart Shaft Embedded in Chest.

Figure 6. Replica Hafted Scraper, Made from a Modified Cresap Point, Defleshing a Hide.

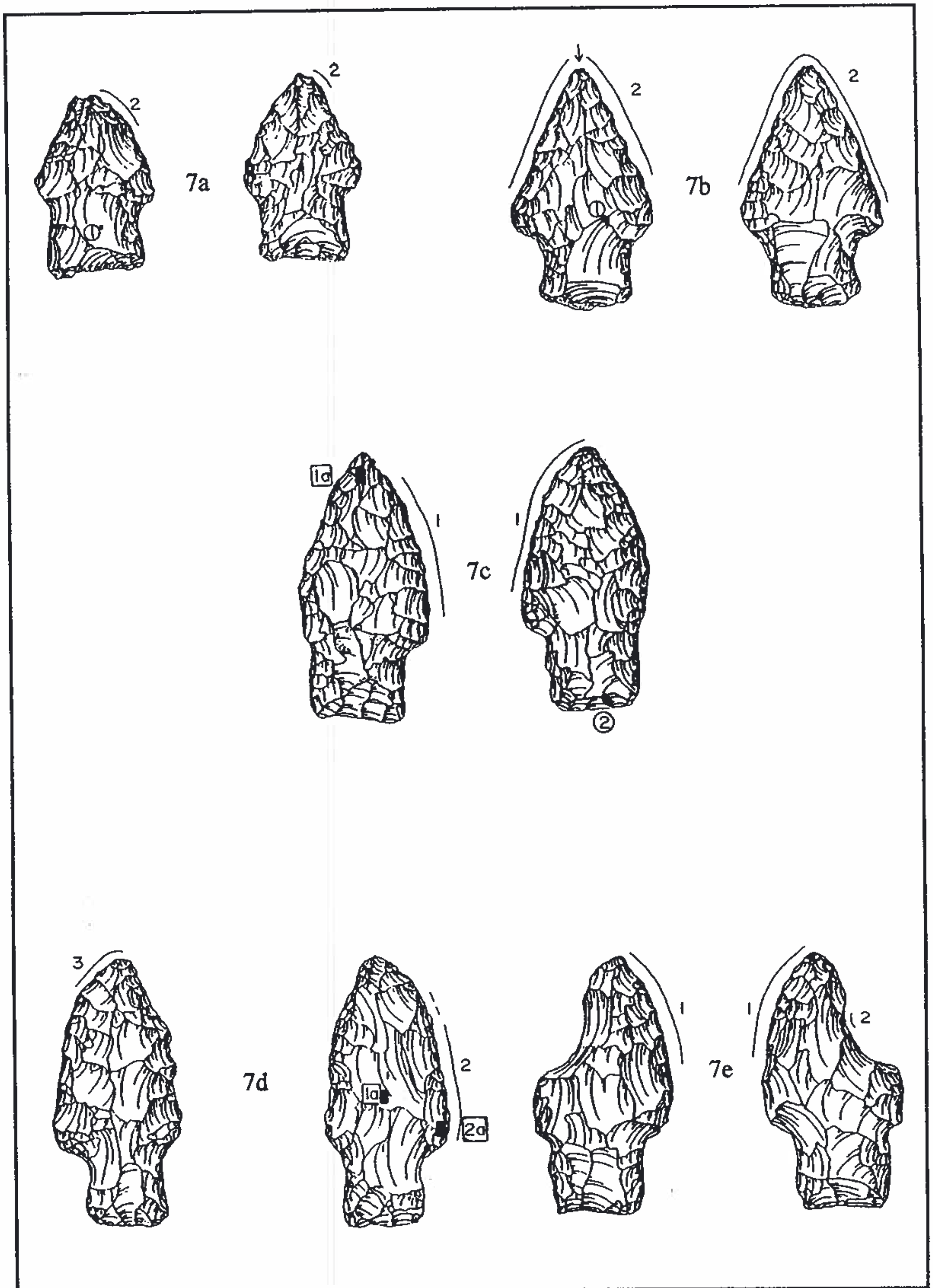
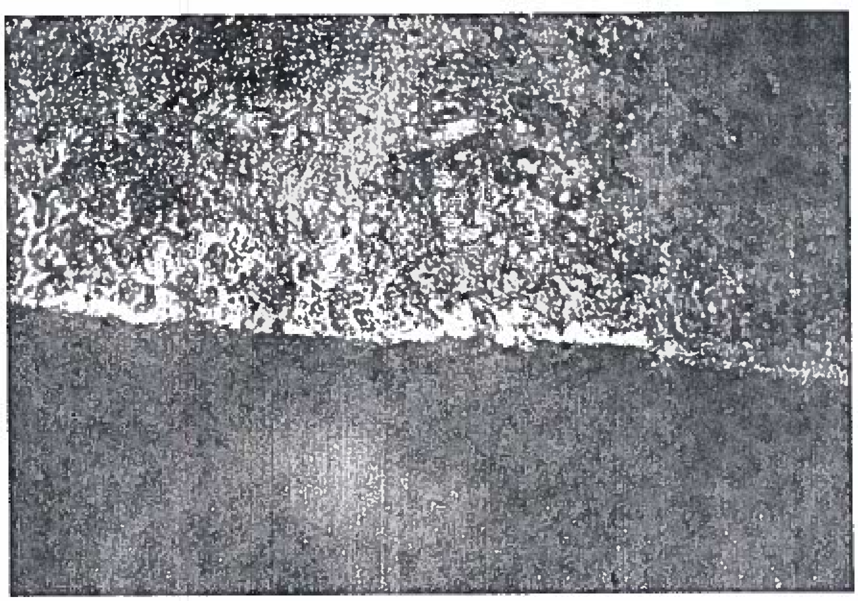


Figure 7. A Sample of Kramer Points from the West Runway Site Analyzed for Microwear Traces. (The observed microtraces are indicated by lines; arrows are used to denote micro-impact fractures; and darkened spots with an adjacent encircled number indicate hafting traces. A solid rectangle with an adjacent alphanumeric code inside a rectangle illustrates the location of a microphotograph.)

a, (50x)



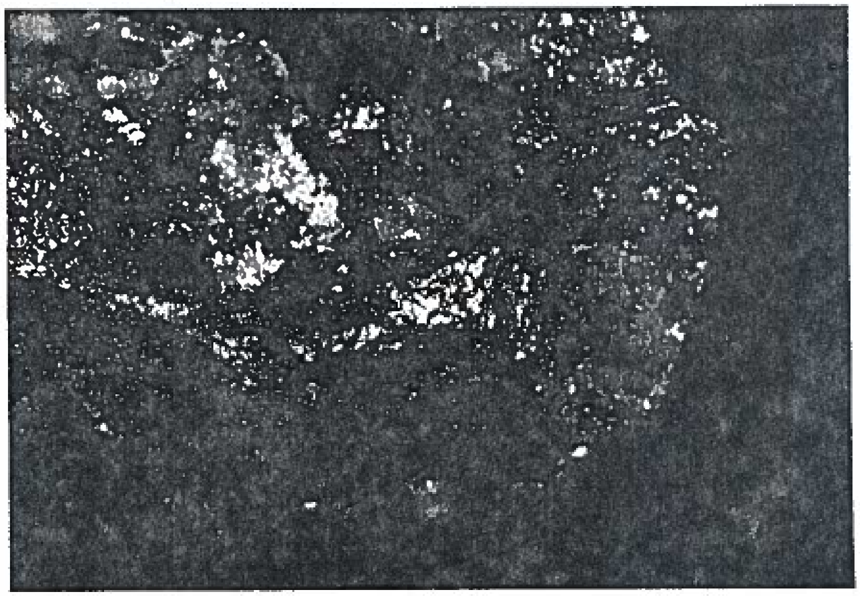
b, (200x)

Figure 8. Fresh Hide Polish at UT1a on Point Illustrated in Figure 7c: a, (50x); b, (200x).

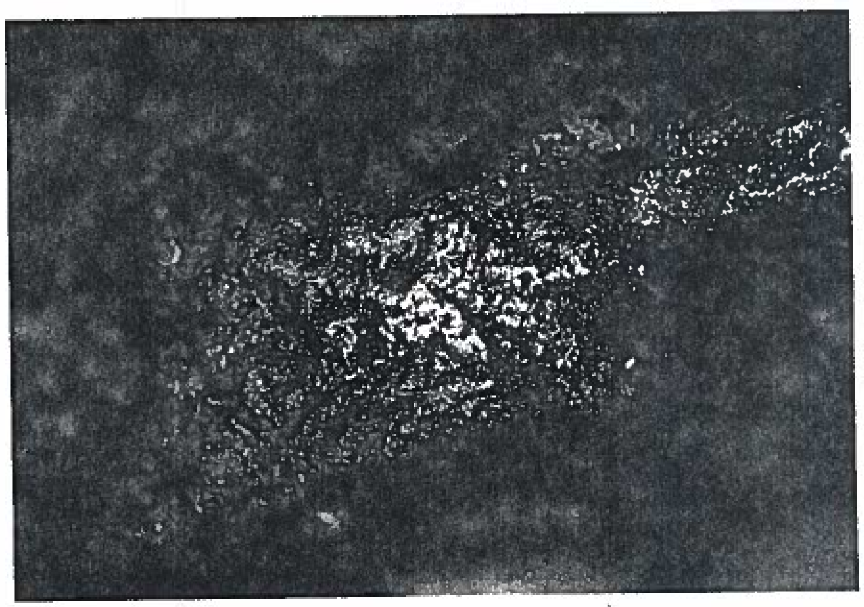
a, (50x)

b, (200x)

Figure 9. Linear Trace from Projectile Use at UT1a on Point Illustrated in Figure 4d: a, (50x); b, (200x).



a, (50x)



b, (200x)

Figure 10. Fresh Hide Polish at UT2a on Point Illustrated in Figure 4d: a, (50x); b, (200x).

Table 2. Atlatl Experiment Results.

Number	Point Type	Dart Weight (g)	Throws	Portion of Target Impacted
1	Kramer	115.7	3	two missed shots; 3rd shot penetrated the chest cavity between 8th and 9th rib - fatal shot
2	Kramer	105.6	11	10 missed shots; 11th shot penetrated the chest cavity between the 4th and 5th rib - fatal shot
3	Robbins	118.9	2	2 missed shots; 2nd shot resulted in point breaking at base with stem still bound onto the foreshaft
4	Robbins	114.2	10	all 10 shots missed target; last throw resulted in a crushed point tip
5	Kramer	109.9	2	one missed shot; 2nd shot embedded in the ulna, causing a spiral fracture the length of the bone; impact damage due to flexion at the base of the point, tip snapped off in the bone
6	Kramer	106.7	2	first shot missed; 2nd shot also missed and hit a rock, resulting in a flute-like break to point tip
7	Robbins	115.6	2	first shot missed; 2nd shot hit target adjacent to the scapula and embedded in thoracic vertebra - fatal shot
8	Kramer	117.7	1	missed shot that resulted in the foreshaft breaking at the slot holding point
9	Kramer	108.0	1	shot missed; point separated from foreshaft due to hafting failure
10	Kramer	108.5	3	three missed shots; experiment ended due to fracturing of the mainshaft

The two hafted knives described in the first experiment also were used here; before butchering, the edges of both tools were sharpened, resulting in a roughly 3 mm reduction to the width of each piece. In addition, a projectile point hafted on a foreshaft also was successfully employed for dismembering the carcass. The entire process took approximately 2 hours and required no sharpening of the knives or point to complete the task.

EXPERIMENT 4: HIDE PREPARATION

The skin removed from the smaller of the two white-tailed bucks was later defleshed and prepared for tanning. Two hafted scrapers, one an ordinary endscraper, the other a modified Cresap point, were used for this task. The endscraper was placed in a slot cut into a white-tailed deer antler handle; heat-activated, loaded, pine pitch was used as an adhesive. The Cresap point was placed in a slotted wooden handle with pine pitch. This haft was constructed so that the tool was mounted perpendicularly; thus, the scraper projected down at a right angle to the long axis of the handle (Figure 6). Such a design allows for a good "purchase" on the tool's handle, making it possible to put a great deal of pressure on the scraping edge.

The aim of the defleshing process, which took 1.5 hours to complete, was to remove remaining bits of fat and muscle adhering to the skin. The skin was laid out, unstaked, on the ground, and small portions of the surface were worked individually. In order to function effectively, the scraping edges of the tools should not have abrupt retouch, that is, possess a 90° edge angle. Semi-abrupt scraper edges, forming roughly a 45° angle, function best, allowing for an effective removal of tissue from the inside surface of the hide. Aside from this consideration, to avoid tearing the skin, the scraper edge should have no sharp projections.

THE MICROWEAR ANALYSIS

A microwear analysis of 20 Kramer projectile points from the West Runway Site was undertaken to ascertain prehistoric tool function. These functional determinations have been made in the context of experiments conducted by Larry Kimball, as well as the research described above. In all cases, the experimental work was designed to evaluate microtraces, from both use and hafting, on experimental points comparable to those recovered from the site (see also Kimball 1992, 1994).

An Olympus BH metallurgical binocular microscope with incident-light and 50x, 100x, 200x, and 500x power magnifications was used in the analysis. A 10x hand lens was also employed to inspect each specimen before cleaning to check for surviving residues. Each specimen was drawn to scale and then cleaned before microscopic examination. The cleaning process involved soaking each specimen in baths of an ammonia-based detergent, a 10 percent solution of HCl, and water.

Some of the archaeological specimens analyzed from the West Runway Site are illustrated in Figure 7. The locations of observable microtraces are indicated by lines (dashed lines indicate some doubt about the continuation of the polish), arrows (micro-impact fractures), darkened spots with an adjacent encircled number (indicating a hafting trace), or a solid rectangle with an adjacent alphanumeric code inside a rectangle (indicating the location of a microphotograph).

In the case of the micrographs, taken at 50x and 200x (Figures 8-10), the placement of the solid rectangle in Figure 7 indicates the proper photographic orientation.

The results of the microwear analysis of the 20 Kramer points are summarized in Table 3. This analysis resulted in the identification of eight patterns of projectile point use (Figure 7):

(1) projectile and light butchery (Figure 7c; Figures 8a-b);
(2) projectile and heavy butchery (Figure 7a-b);
(3) projectile and butchery, followed by the modification of the tip to create a more drill-like bit, which was then used to bore hide (Figure 7d; Figures 9a-b and 10a-b);
(4) projectile and heavy butchery, followed by the modification of the distal end to create a drill-like boring tool, which is used to bore bone or antler (Figure 7e);
(5) projectile followed by hide-working (scraping and cleaning);
(6) projectile followed by burination then bone/antler grooving;
(7) projectile (assumed) followed by bipolarization resulting from wedging bone/antler; and
(8) use of a perpendicular break edge created by a flexion or bending fracture at the stem to plane wood.

The above results suggest that the Kramer points from the West Runway Site served multifunctional roles. The primary use of these pieces would appear to be as tips for projectiles, presumably delivered by an atlatl. Secondary functions include activities involving the working of wood, bone or antler, and hide. These are especially interesting observations because evidence for working these materials is otherwise absent from the data collected at the site. These tool functions suggest possible on-site activities such as the manufacture or repair of clothing or shelters and the manufacture of wood and bone or antler tools and ornaments.

The microwear analysis of the Kramer points also highlights the diverse utility of these bifacial tools. When coupled with the observation that many of the West Runway Site Kramer points were heavily sharpened, these data suggest that these tools were curated intensively and reused. Simply put, many of these hafted points underwent use and sharpening episodes until they were broken or exhausted, removed from their handles, and abandoned. In contrast to the connotations inherent in the term "hafted biface," which implies all bifacial tools functioned as prehistoric "Swiss Army knives," the functional parameters of this sample suggest restricted sets of activities confined to hunting and the processing of animal products. Given the modest number of points and their limited function, it is tempting to speculate that these materials represent the debris discarded by a small group over a relatively short period of time.

CONCLUDING REMARKS

The Early Woodland component of the West Runway Site predates the well-known Adena culture of the Middle Ohio Valley. Because of an emphasis on the study of Adena ritual and mortuary sites, little data exist on the Early Woodland in the northern Bluegrass Management Area and the Middle Ohio Valley in general. Most of what is known about the early portion of the Woodland period has been derived from Works Progress Administration (WPA) excavations of Adena mounds and enclosures. This work, which took place in the 1930s and 1940s, was for the most part conducted by William S. Webb and his colleagues. Unquestionably, these early excavations provided a wealth of archaeological information on Early and Middle Woodland mortuary and ceremonial activities. However, it must also be admitted that they led to the

Table 3. Microwear Traces on Kramer Points

Artifact Type	Provenience	Hafting trace	Function
Kramer point	N90 E90	type 2:flat, abraded	butchery
Kramer point	N105 E90	type 4:antler-like	projectile;heavy butchery
Kramer point	N75 E41	type 5:bone/antler-like	butchery
Kramer point	TU 167	type 4:antler-like	butchery;fresh hide cleaning/ scraping
Kramer point	N100 E90	not determined	projectile;butchery;hide boring
Kramer point	N70 E50	not determined	projectile;butchery;bone/ antler boring
Kramer point	N50 E70-surf.	not determined	butchery
Kramer point	TU 206, level 1	type 6:antler-like	projectile;fresh hide scraping; butchery
Kramer point	TU 167, level 1	type 4:antler-like	butchery;fresh hide cleaning/ scraping
Kramer point	N20 E80-surf.	type 4:antler-like	projectile;bone/antler grooving
Kramer point	TU 3	type 3:bone/antler-like	butchery;bone/antler grooving?
Kramer point	N20 E90-surf.	type 3:bone/antler-like	butchery;bone/antler grooving
Kramer point	Feature 11	not determined	projectile;bone/antler wedging
Kramer base	TU 223, level 1	type 6:bone/antler-like	wood planing
Kramer base	TU 256, level 2	not determined	not determined
Kramer base	surface	not determined	not determined
Kramer base	TU 103, level 1	type 3:bone/antler-like	not determined
Kramer base	N80 E30-surf.	type 3:bone/antler-like	not determined
Kramer point	N102 E97-surf.	type 3:bone/antler-like	not determined
Kramer point	TU 139, level 1	not determined	projectile

creation of an unbalanced database. In particular, they focused interest on the most highly visible aspect of the prehistoric Woodland landscape, the Adena mortuary and ritual facilities, to the near exclusion of habitation sites. Due to the paucity of data on Pre-Adena Early Woodland habitation sites in the Middle Ohio Valley, reference to research on the chronologically later Adena phase becomes essential to elucidate settlement and subsistence strategies.

Clay (1986:594) and Railey (1991) suggest that the ritual architecture of the Adena, specifically the mounds and submound enclosures, served as places of intensive social interaction, as well as territorial markers on an otherwise low contrast landscape. Seeman (1986:576) hypothesizes that the Adena mound sites were locations that small communities periodically visited in order to honor their dead and interact with other related social groups. Although the mortuary context of Adena mound sites has been clarified in recent years, the seemingly more scarce habitation site type remains poorly understood in Kentucky (Clay 1986).

Recently, Lewis (1986:596), working in the Lower Illinois Valley, raised the question, "Why are Early Woodland base camps so rare?" Lewis answered his own question, in part, by pointing out that the low archaeological visibility of Early Woodland base camps, when compared with Late Archaic occupations, relates to several factors. For the Early Woodland period, the following conditions are thought to have contributed to the general obscurity of habitation sites: 1) the relatively short length of the cultural period; 2) the smaller scale of social organization and group size; 3) the method and type of resource targeting and procurement; and 4) restricted territorial boundaries. Railey's (1991) research suggests that these considerations are also of relevance to the Middle Ohio Valley. He has proposed a dispersed settlement pattern for Adena groups in northern Kentucky primarily related to efficient resource exploitation. Relatively small social units, with subsistence systems geared toward short-term (seasonal) extraction of locally available resources, have also been described by Fortier et al. (1984:55) for the Ohio Valley. In addition, Clay (1986:594) and Seeman (1986:576) have argued that data on Adena settlement patterning, and presumably Early Woodland groups as well, suggest small bands operating in restricted, internally less diverse territories than those of the Late Archaic.

The focus on small extractive territories by Early Woodland peoples presents a marked contrast to the later stages of the Archaic period. The trend among Ohio Valley Middle and Late Archaic hunter-gatherers was the development of increasingly sedentary settlement patterns based on scheduled procurement of resources. Specialized "collector groups" made forays from large multiseasonal base camps into targeted resource catchments. During the Early Woodland period, these large base camps were apparently abandoned for more dispersed habitations that were utilized for shorter periods of time and, possibly, frequented from season to season. This kind of settlement pattern would play a beneficial role in an economic system in which seasonal congregation of large groups for subsistence purposes had become obsolete or counterproductive.

The authors believe that the data presented on Kramer point function and Early Woodland activity at the West Runway Site, albeit limited, are consistent with the type of settlement and subsistence patterns initially posited by Clay. Analysis of the West Runway lithic assemblage indicates a locally focused cycle of tool manufacture, transport, curation, and use. The microwear data suggest that the Kramer projectile points were used primarily for resource procurement activities, specifically hunting, along with a few other tasks related to more domestic settings. The presence of ceramics at the site seems to argue against use of the location as simply a short-term stopover camp used only for foraging expeditions. It is unlikely that large pots, especially the cumbersome Fayette Thick wares, would have been casually transported across the landscape. However, the limited quantity of features and ceramic materials, when considered with the moderate numbers and restricted functions of the Kramer points, might suggest a residential occupation composed of a small number of individuals. Such an interpretation would be wholly in keeping with the current understanding of social structuring for the Early Woodland. Data from the West Runway Site further indicate that a dispersed settlement system predates the appearance of Adena mortuary and ritual facilities. This, in turn, supports suggestions that these facilities later served to integrate "household units" scattered across the northern Kentucky landscape. What prompted the development of these facilities and the need for greater social integration remains a significant problem for Early Woodland studies.

ACKNOWLEDGEMENTS

Frank McAvinchey provided the drawings of the projectile points from the West Runway Site. Officer Clark Kyle of Northern Kentucky University helped in obtaining one of the white-tailed bucks, which, most conveniently, chose to expire within close proximity of the Northern Kentucky University Department of Anthropology. 3D/Environmental provided word processing and graphics support during preparation of this manuscript.

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THE SARA SITE (15JF187): AN EARLY LATE WOODLAND SITE IN THE FALLS OF THE OHIO RIVER REGION

By
Stephen T. Mocas[1]

ABSTRACT

The SARA Site is the first well-documented early Late Woodland site in the Falls of the Ohio region. The occupants of the site exploited nuts, wild plants, cultigens, and domesticates and performed a multiplicity of cutting, scraping, and piercing tasks. Lowe Cluster projectile points and limestone tempered and siltstone tempered, cord-wrapped paddle impressed ceramics co-occur, and a radiocarbon determination of A.D. 550 provides an absolute date for the occurrence of these materials. The site and its contents indicate local continuity, but share attributes with late Middle Woodland and early Late Woodland sites in the central Ohio River Valley.

INTRODUCTION

The SARA Site was an open habitation site located directly east of a small slough on the floodplain of the Ohio River in Louisville, Kentucky (Figure 1). It was exposed in May 1974, after an estimated 75-90 cm of alluvium had been removed by earthmoving activities related to the construction of the Southwestern Jefferson County Floodwall. The site was uncovered slightly before cessation of earth borrowing on a Saturday and destroyed the following Monday morning. During the time the site was exposed, a group of volunteers, under the supervision of the author, spent the available daylight hours troweling out the contents of the most distinct features.

Cultural materials were found on three parallel sand ridges, approximately 30 m apart. The east and west ridges had lesser amounts of cultural debris and no diagnostic materials, therefore excavation activities focused on the central ridge, which contained many cultural features. The central ridge was oriented parallel to the Ohio River at a distance of approximately 200 m (Figure 2). Excavations were restricted primarily to a series of prehistoric pits concentrated within an 18 x 90 m area along the crest of the central ridge. This excavation plan was used because time did not permit study of all exposed pits, and this approach offered the opportunity to ascertain interrelationships among the features and gain an overview of the variety of activities within a portion of the site. Nine of the 10 features (Table 1) excavated within the demarcated portion of the central ridge are believed to be of Woodland cultural affiliation. Only Feature 10, a Late Archaic refuse pit, is excluded from this report.

The SARA Site was the first site in the Falls of the Ohio area to yield intact subsurface deposits that could be assigned to the late Middle Woodland/early Late Woodland with any degree of confidence. During the last 20 years, several small samples of cultural materials similar to those from the SARA Site have been recovered from the surface of other sites, but none has been excavated.

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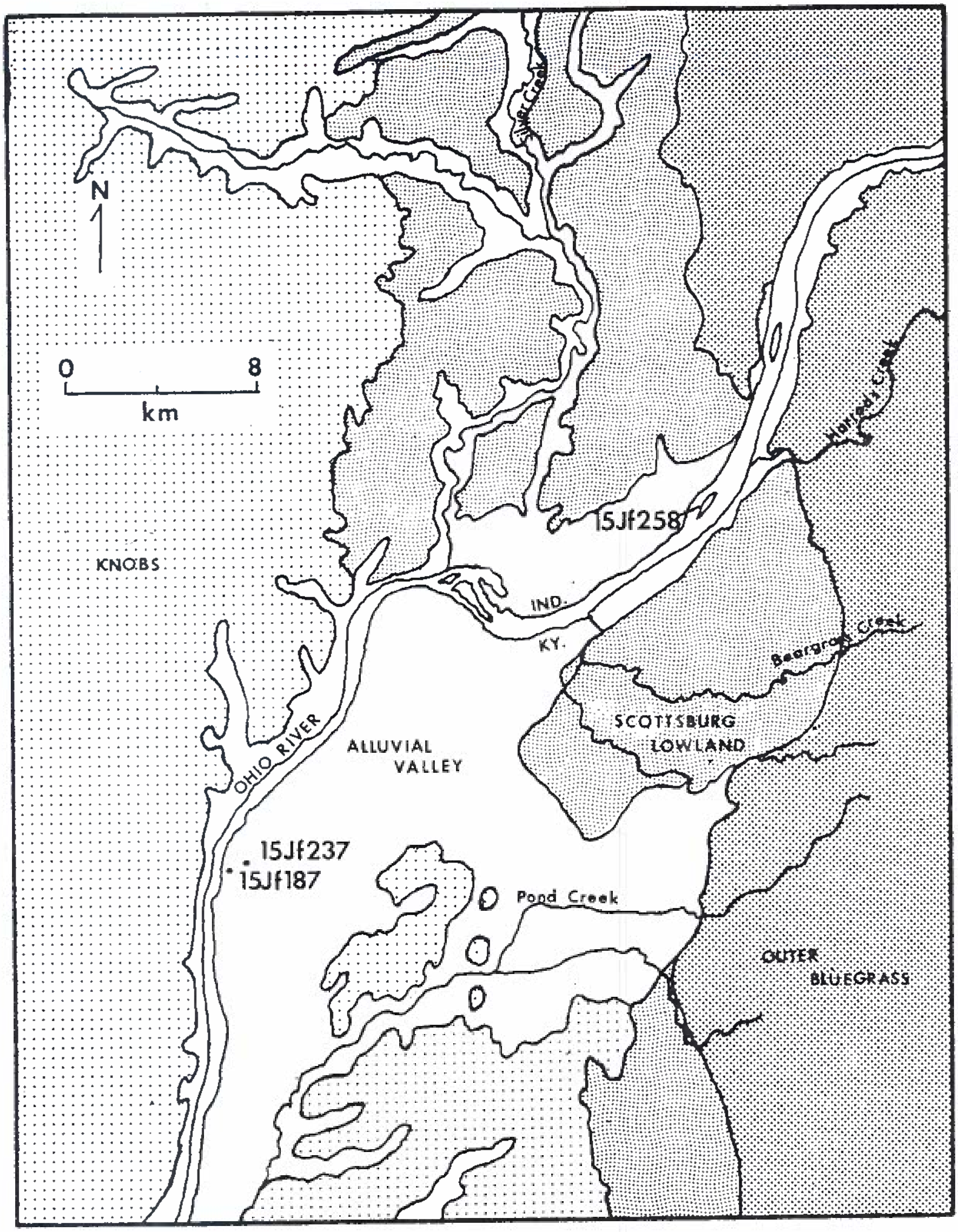


Figure 1. Location of 15Jf187, 15Jf237, and 15Jf258 within the physiographic zones of the Falls of the Ohio River Region. (after Powell 1970).

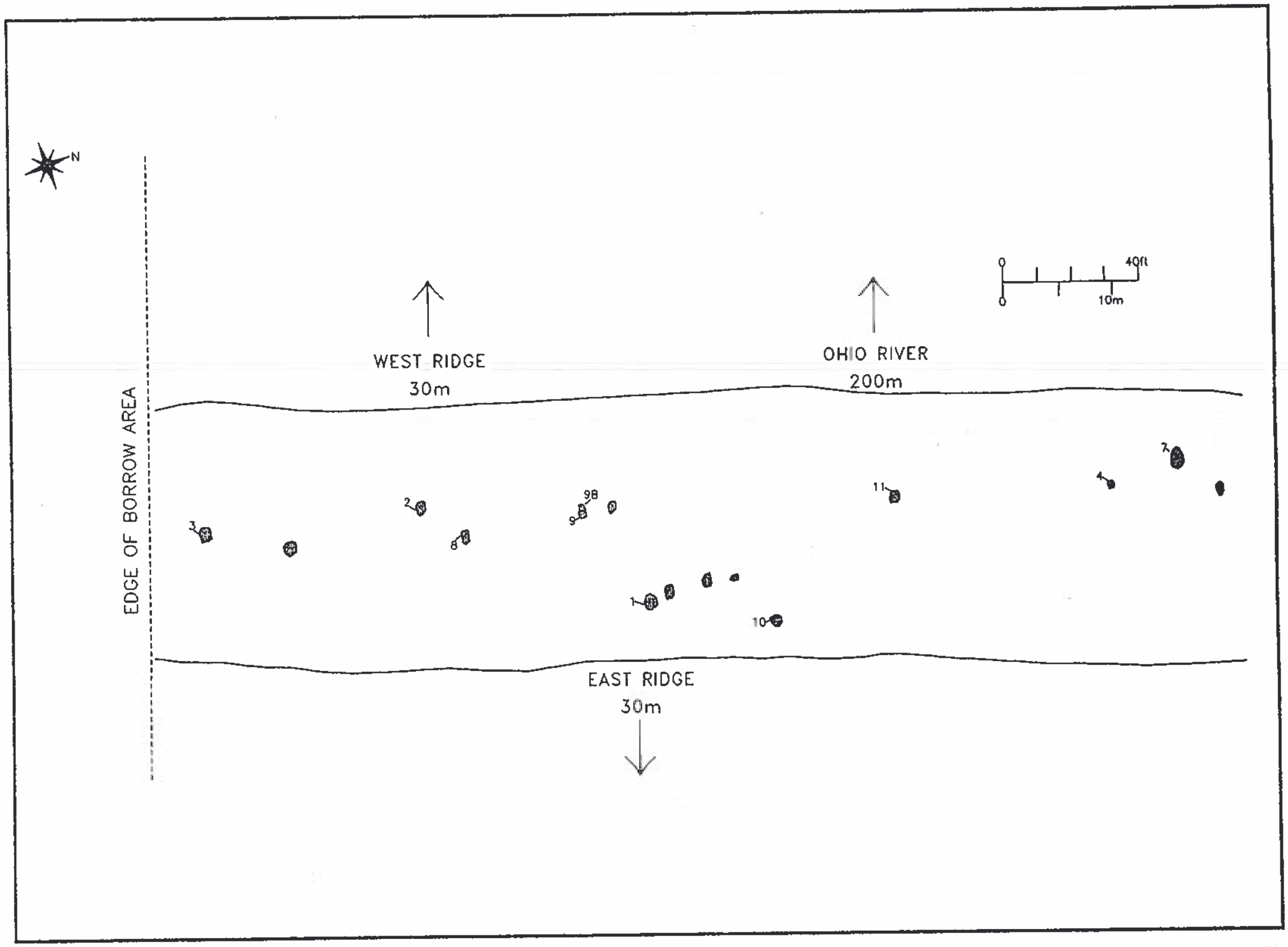


Figure 2. Approximate outline of the sand ridge upon which 15Jf187 is located and location of the features. Features referred to in the text have been numbered.

This paper is organized in the following manner. There is a discussion of the ceramics, followed by an examination of the morphological and functional attributes of the chert tools and debitage. The botanical analysis adds seasonality and subsistence information to the subsequent synopsis of the features and their contents and assessment of their potential significance. The data derived from the various analyses are combined to yield an overview of the site, and an approximate temporal and cultural placement of the site is calculated by the absolute and relative dating. The possible relationships of the SARA Site and its cultural materials to local and regional sites are evaluated, and the paper concludes with a summary of the results of the study.

CERAMICS

METHODOLOGY

Six features at the SARA Site yielded ceramics (Table 2). With the exception of one rim sherd from Feature 11, only sherds larger than 4 cm^2 were included in the analysis. All sherds were examined to determine surface treatment and temper. The use of limestone to temper ceramic vessels was indicated by the presence of irregular cavities in the paste formed by the dissolution of limestone particles. It also should be noted that it is often difficult to distinguish siltstone from clay ("grog") temper, and it is possible that some ceramics classified as clay-tempered by other researchers may in fact be siltstone-tempered.

The SARA Site yielded six rim sherds, 173 analyzable body sherds, and 137 sherdlets too small for analysis. Reconstructed fragments of vessels were assigned one catalog number and considered single sherds for statistical purposes, though the large vessel fragments from Features 1, 2, and 11 are composed of a total of slightly more than 100 sherds. Approximately 78 percent of the sherds represent only four vessels, and the remaining pottery probably derives from fewer than eight vessels. The forms and orientations of the rims and upper body fragments and the curvature of the body sherds and basal sherds were used to ascertain the form of each vessel.

CORDMARKED CERAMICS

Paste and Temper

The ceramics from the SARA Site are composed of a fine-textured, well-compacted paste, and the clay used in all the vessels appears to have come from the same source, though there are minor variations in the ferric mineral and sand content and sand and crushed rock have been added to the bases. Sixty-three percent of the ceramics are characterized by small to moderate numbers of empty cells, 0.5-5.0 mm in diameter, created by the thorough leaching of limestone from the paste. The remaining ceramics have small to moderate amounts of siltstone in the paste. The pieces of siltstone are generally 2 to 3 mm in size, though the particle size ranges from 1 to 6 mm. Several sherds have small quantities of both limestone and siltstone in the paste. The vessels predominantly tempered with siltstone show almost no limestone pits, but limestone-tempered vessels occasionally contain siltstone particles.

Tables 1. SARA Site Features.

Feature	Size E-W x N-S	Feature Type	Cultural Affiliation
1	1.37 x 1.15m	Refuse Pit	Middle or Late Woodland
2	1.15 x 0.94m	Refuse Pit	Late Woodland
3	0.79 x 0.67m	Fire Pit	Late Woodland?
4	0.60 x 0.70m	?	?
7	1.52 x 1.06m	Fire Pit	Late Woodland
8	1.03 x 0.88m	?	Late Woodland
9	ca.0.88 x 0.64m	Refuse Pit	Late Woodland
9B	ca.0.60 X 0.60m	Refuse Pit	Late Woodland
11	0.79 X 0.70m	Refuse Pit	Late Woodland

Color

Individual vessels are relatively consistent with respect to color; however, mottled patches caused by differential oxidation and reduction are evident on the larger specimens. For instance, the interior and exterior of one vessel was reddish yellow (7.5YR 6/6), with smudges of black (7.5YR 3/0) and dark gray (7.5YR 4/0) on the exterior and pinkish gray (7.5YR 6/2) patches on the interior. Most of these color variations may be due to differential oxidation and reduction when the vessel was initially fired. If a vessel was laid on its side during the firing process, the black area on the exterior would have resulted because there was a restricted flow of oxygen to this portion of the vessel. A reddish yellow (10YR 7/8) interior is indicative of moderate heat in an oxygen-rich atmosphere, whereas a pinkish gray upper interior suggests moderate oxidation, which indicates the mouth of the vessel was not downward. The portion of the exterior adjacent to the black spot is relatively well oxidized, due to exposure to air flow during firing. Several dark gray areas on what would have been the upper side of the recumbent vessel may represent areas where the fuel was in contact with the surface. The base of the vessel is white on the interior and exterior and in the core. This is an indication of intense heat, apparently the result of the placement of the vessel over a fire during cooking. This analysis suggests the number of vessels cannot be accurately estimated on the basis of sherd color.

Surface Treatment

The only surface treatments identified are cordmarked (cord-wrapped paddle impressed) (84 percent) and plain (16 percent) (Figures 3, 4, and 5). At least 82 percent of the sample of cordmarked sherds are attributable to three vessels.

The exterior surfaces of cordmarked vessels were malleated with paddles wrapped with thin (0.5-2.0 mm), closely-spaced (0.5-4.0 mm apart), two-ply, S-twist cords. Different combinations of cord width and spacing were present within the ceramic samples from some pits.

The cords on all the rims at the SARA Site were oriented vertically. Of the five cordmarked rims, two have plain lips and two are cordmarked on the lip, one diagonal and one (Figures 5d and Figure 7d) parallel to the exterior. It is not certain whether the fifth cordmarked rim (Vessel 11-2) has a coil break or a rounded lip on the upper edge. Although some vessels, especially the limestone tempered ones, have light cord impressions, this does not appear to be the result of intentional smoothing.

Table 2. Ceramics

FEATURES

	1	2	7	8	9	9b	11	Total	%rims	%body
Plain Limestone Tempered										
rim sherds	1	0	0	0	0	0	0	1	16.7%	-
body sherds	20	1	0	0	1	0	4	26	-	15.0%
Plain Siltstone Tempered										
rim sherds	0	0	0	0	0	0	0	0	0.0%	-
body sherds	0	1	0	0	0	0	0	1	-	0.6%
* CWP Limestone Tempered										
rim sherds	0	1	0	0	0	0	1	2	33.3%	-
body sherds	0	51	0	0	23	0	10	84	-	48.6%
CWP Siltstone Tempered										
rim sherds	0	0	0	0	0	1	2	3	50.0%	-
body sherds	0	1	0	1	2	9	47	60	-	34.7%
CWP* Siltstone/Limestone/ Quartz/Sand Tempered										
rim sherds	0	0	0	0	0	0	0	0	0.0%	-
body sherds	0	1	0	0	1	0	0	2	-	1.2%
Total sherds	-	-	-	-	-	-	-	179	-	-
Total rim sherds	1	1	0	0	0	1	3	6	-	-
Total body sherds	20	55	0	1	27	9	61	173	-	-
sherdlets	11	57	1	1	37	10	20	137	-	-

*CWP - cord-wrapped paddle impressed

The unanimity and precise alignment of the vertical cordmarks on the rims and the consistent orientation of the cords on the upper body of individual vessels may indicate an aesthetic intention or adherence to a mental template. Cordmarking of the middle and lower portions of the vessel bodies may be of a more functional nature, since more than one application of the cord-wrapped paddle to a particular area is generally evident, and the cords are not carefully and consistently aligned. Four vessels show a transition from a cordmarked lower body to a plain bottom. The interiors of most vessels appear to have been smoothed with a yielding tool while still moist (Shepard 1956:187-191), and some vessels display depressions from the use of fingers as an anvil when the exterior was malleated.

Thickness

Body sherd thickness was measured along the thinnest edge of the sherd. All thickness measurements were rounded to the nearest 0.5 mm. The body sherds (n=173) range from 3.0 to 11.5 mm in thickness and have a mean of 6.3 mm and a median of 6.5 mm. The rims (n=5) range from 5.0 to 6.5 mm at the lip and have a mean of 5.9 mm and a median of 6.0 mm. Measured 1 cm below the lip, the rims range from 5.0 to 7.0 mm and have a mean of 6.2 mm and a median of 6.5 mm.

The vessels display considerable uniformity in thickness. For instance, one of the vessels, which has a lip thickness of 6 mm, maintains a body thickness of 5-7 mm (mean thickness of 6.4 mm) until it abruptly thickens to 11 mm at the rounded bottom of the vessel. Thin body sherds (3-4 mm thick) with marked curvature indicate the presence of small vessels in addition to the large pots exemplified by the vessel in Figure 3.

Vessel Form

The alignment and layering of the temper particles and clay in the basal sherds indicate that construction of some vessels began with the formation of a circular disk of clay. The sides of this disk were expanded upward to produce a round base and round basal-lateral juncture. The body of the vessel was formed by the addition of successive coils to produce a globular body, which is characterized by continuous convex curvature. Other vessels have conical bodies, which are widest near the top, have little vertical curvature, and taper to a pointed or relatively small base.

The upper body of one vessel (see Figure 3) is strongly constricted, and another (see Figure 7b) is moderately constricted. The rims of both vessels are very slightly concave in form and very slightly everted in orientation. The former has an orifice diameter of 29 cm, an estimated height of 36-38 cm, and a maximum body diameter of 39-41 cm, whereas the latter has an orifice diameter of 28 cm and a body diameter of at least 34 cm. The only other rim (see Figure 7c) that could be oriented is inverted and has a slightly convex form. It has an orifice diameter of approximately 28 cm and appears to represent a conical vessel or a bowl.

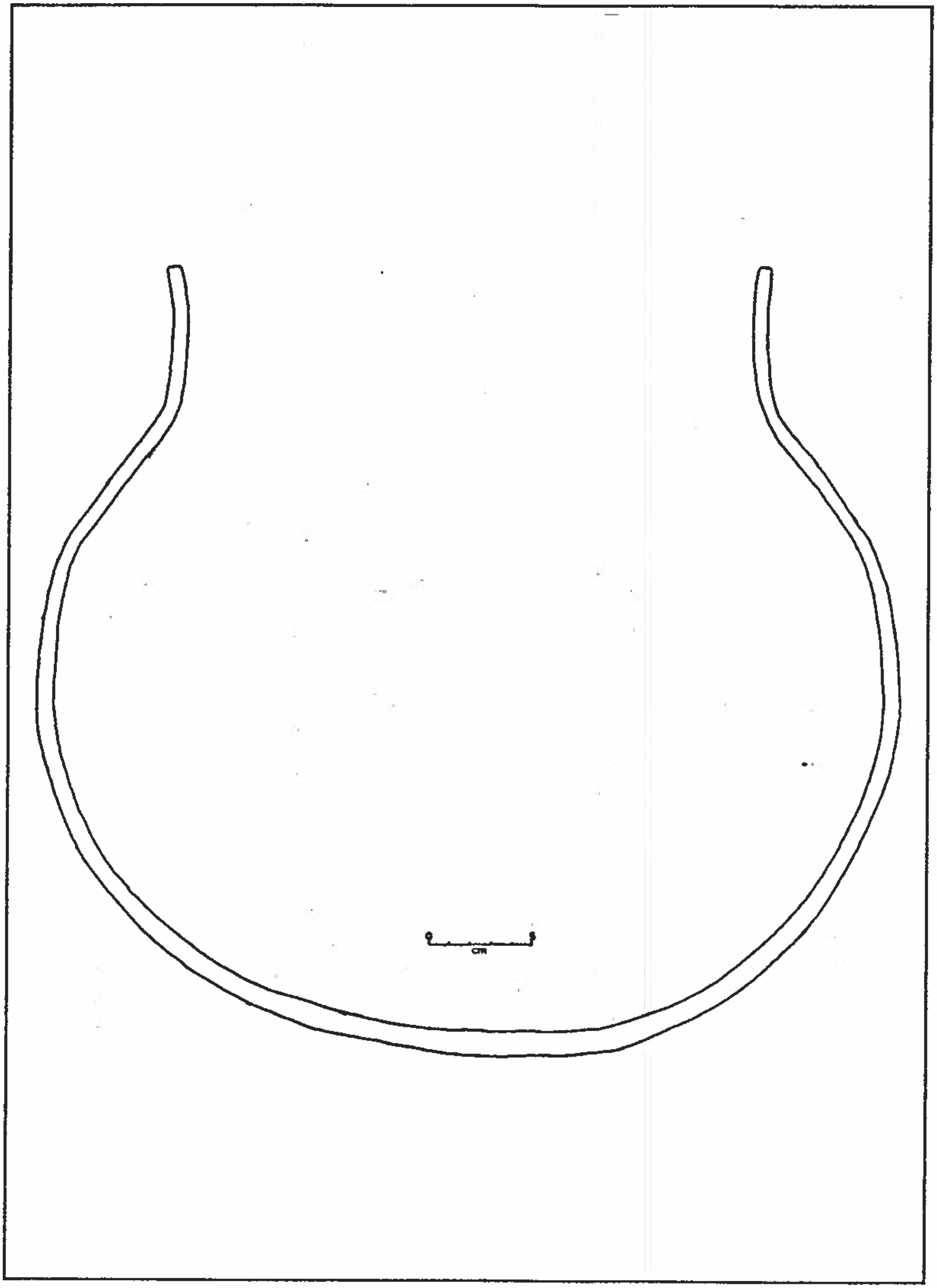


Figure 3. Reconstructed vessel profile of Vessel 2-1.

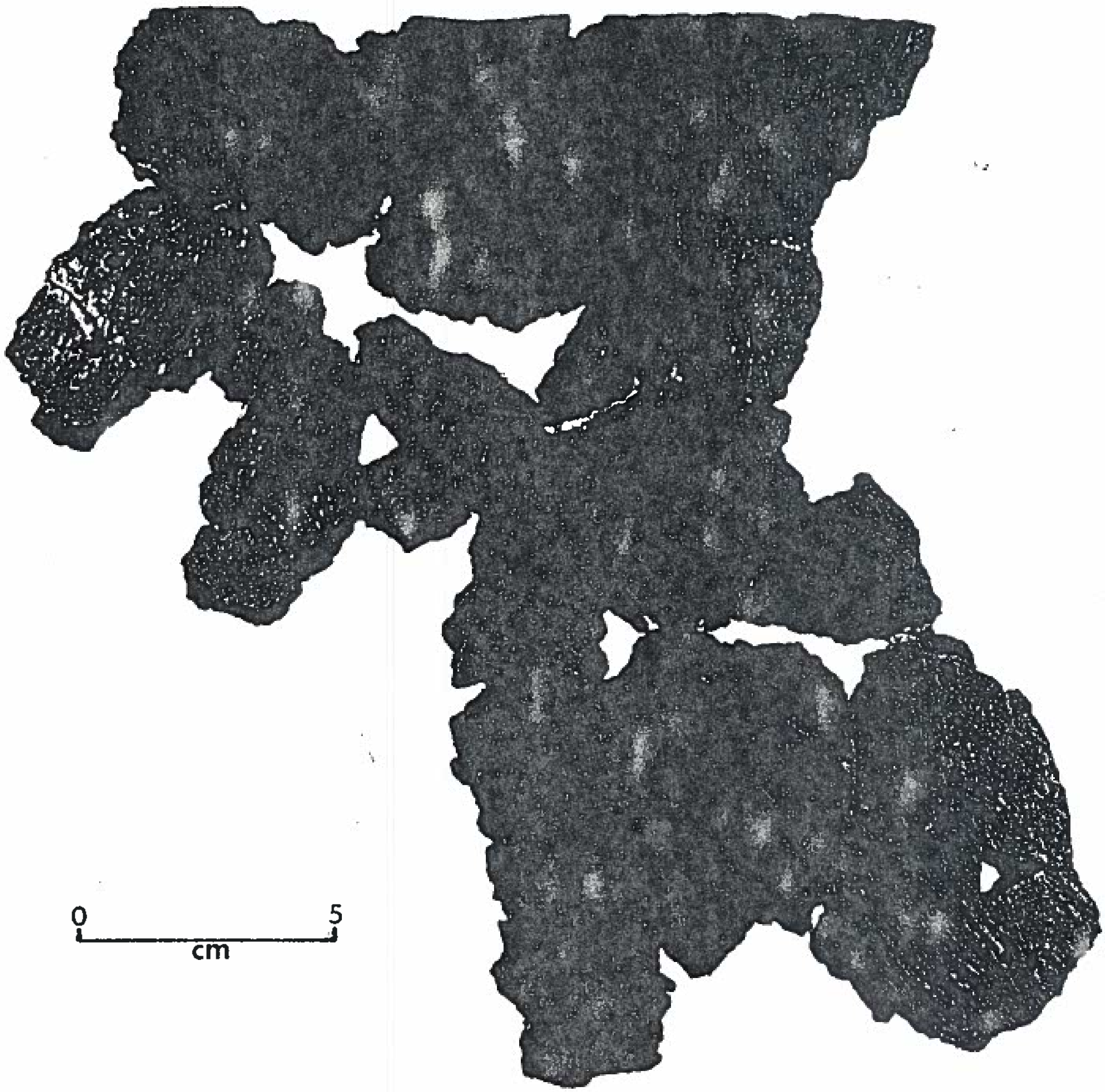


Figure 4. Rim and upper body of Vessel 2-1.

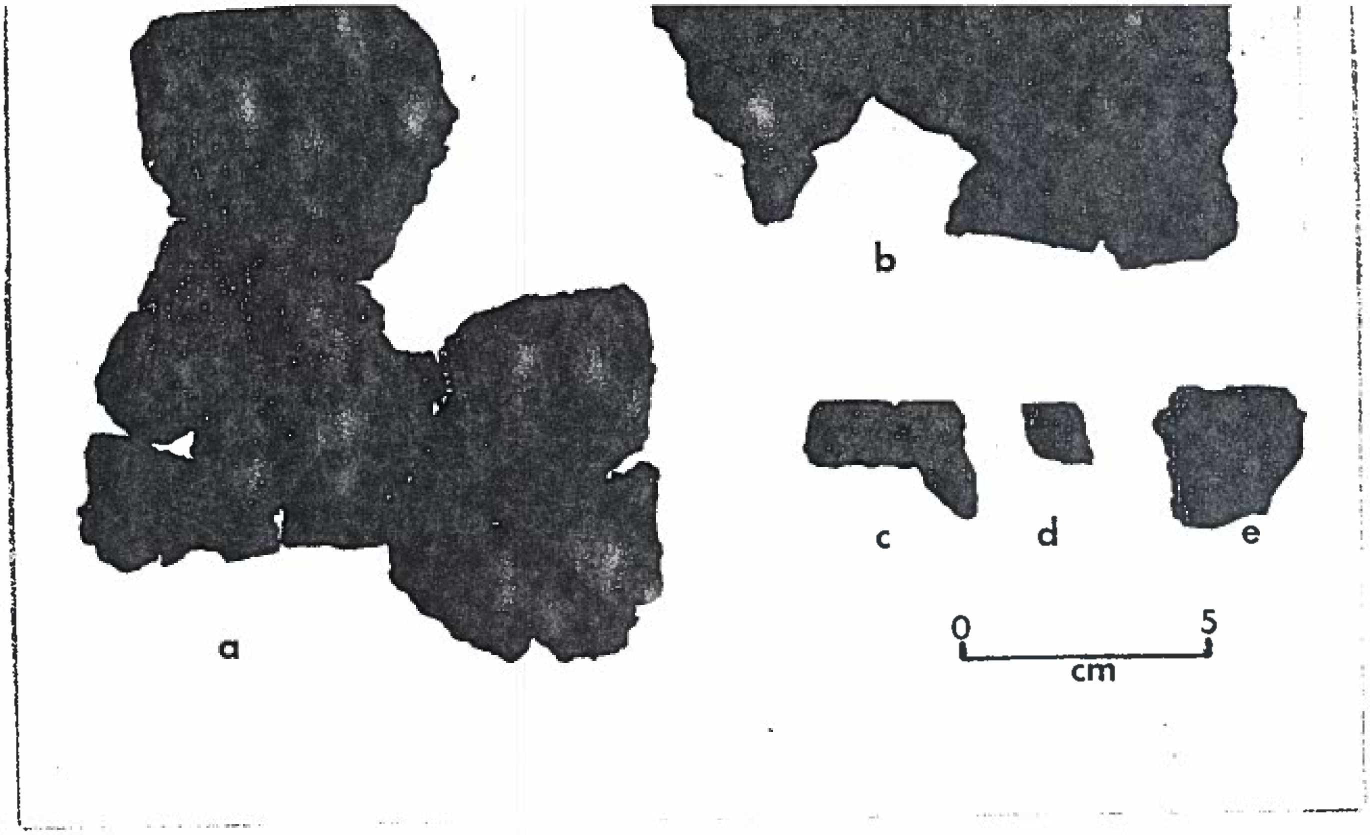
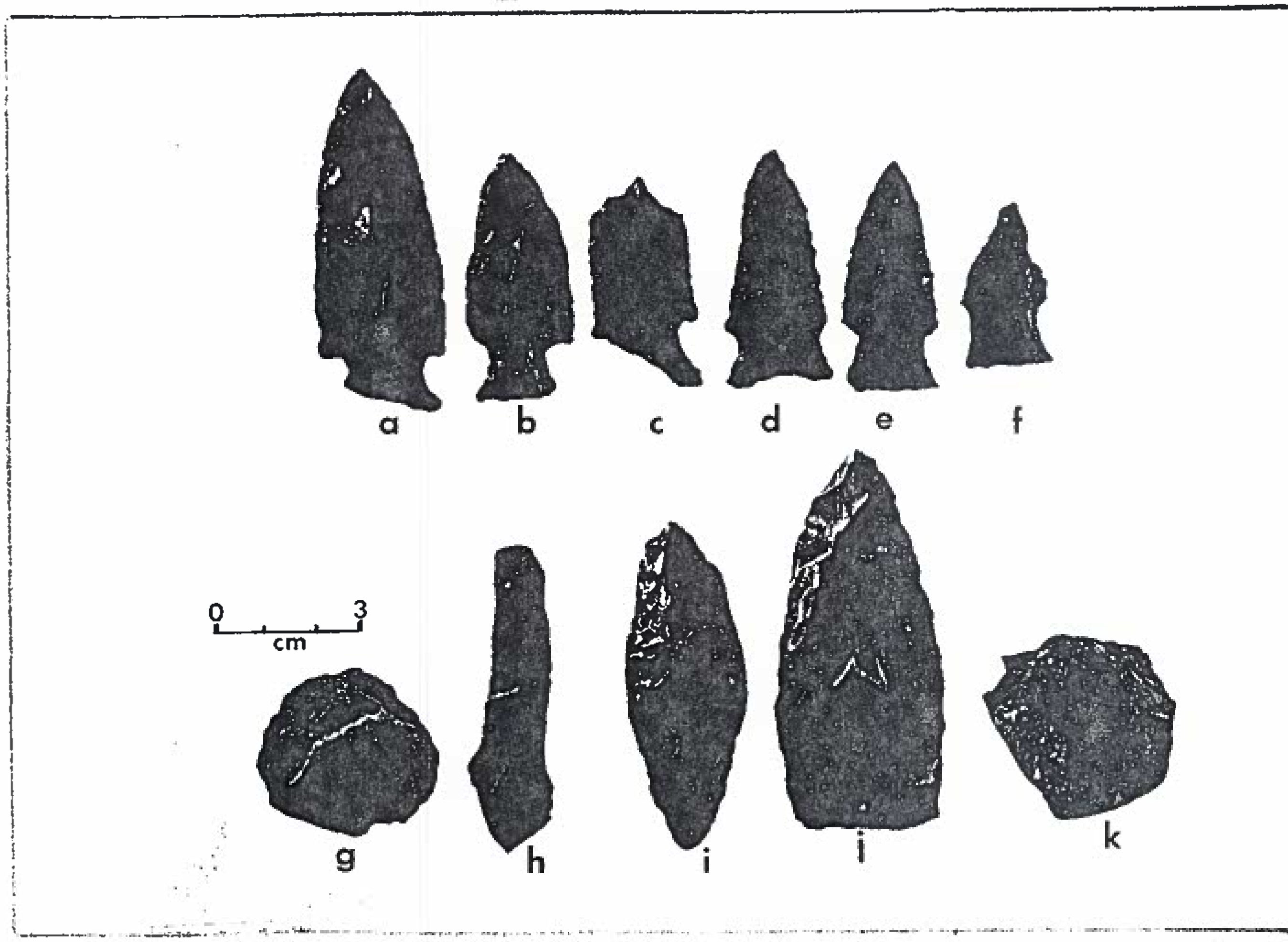


Figure 5. Rims: a, Vessel 11-1; b, Vessel 1-1; c, Vessel 9B-1; d, Vessel 11-3; e, Vessel 11-2.



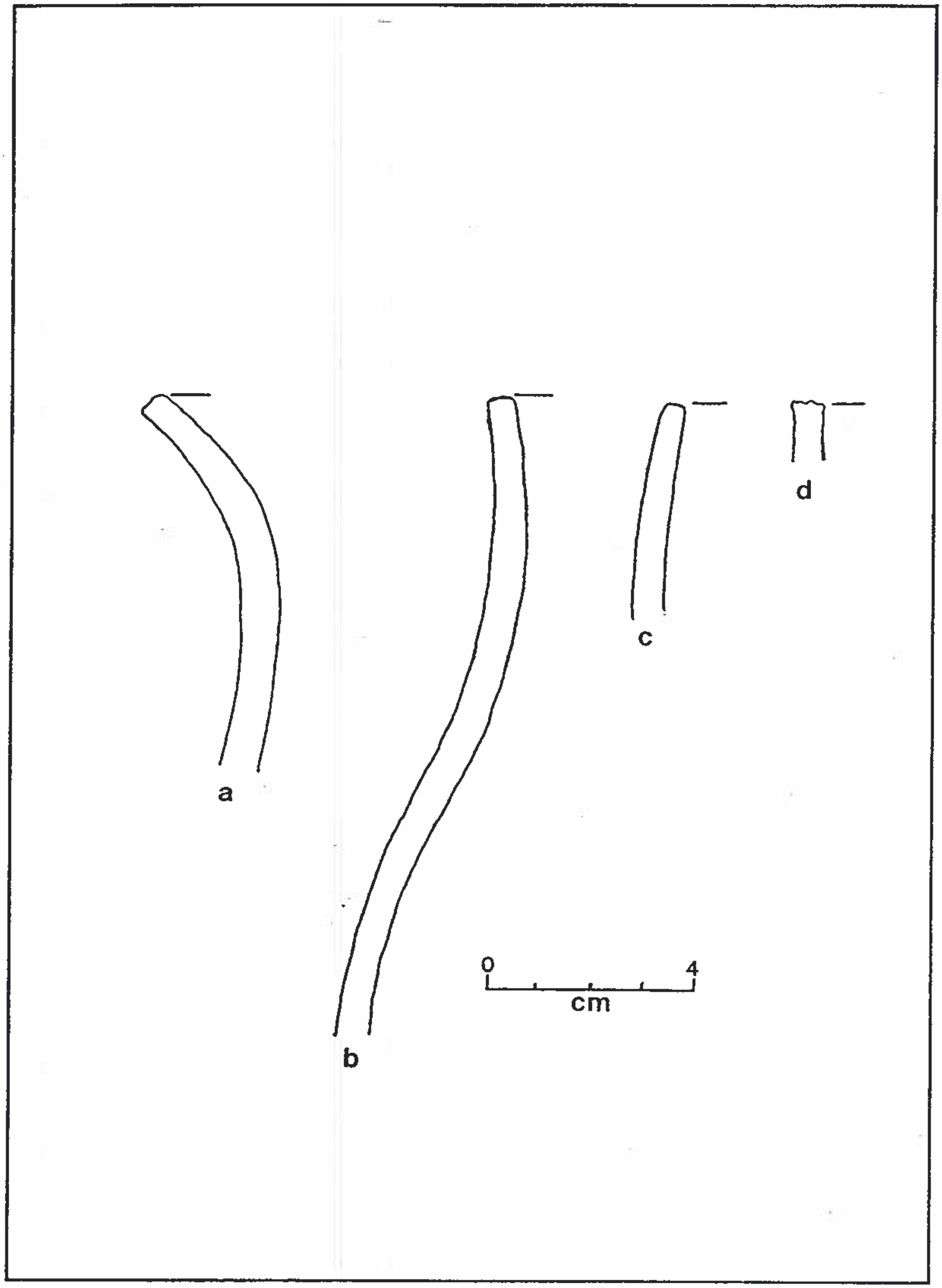


Figure 7. Rim profiles: a, Vessel 1-1; b, Vessel 11-1; c, Vessel 9B-1; d, Vessel 11-3.

PLAIN POTTERY

Twenty-one of the 27 plain sherds appear to belong primarily to one plain-surfaced, limestone-tempered vessel (see Figures 5b and 7a). The vessel has a strongly everted rim with a concave form, and the curvature of the body sherds suggests the body was globular. The orifice diameter is 28 cm, and the rim is 6.0 mm thick at the lip, and the sides have a median thickness of 6.5 mm and range from 4.5 mm near the point of maximum diameter to 11.5 mm in the lower body.

The interior and exterior surfaces of the vessel are well-smoothed and have even contours and few grooves or ridges. This suggests they may have been scraped or rubbed with a rounded tool before smoothing with a yielding tool while still moist (Shepard 1956:187-191). A few sherds show evidence of having been rubbed with a round, hard tool on the exterior and interior while leather-hard. One large fragment from the middle of the vessel has been thoroughly polished with a round tool after it became dry. This resulted in a lustrous, extremely smooth exterior.

The exterior of the rim sherd, and many of the body sherds, is pink (7.5YR7/4) with grayish brown (10YR5/2) reduced or smoke-smudged areas. The burnished sherd is black (5YR2/0) on the exterior. The interiors are relatively consistent in color. They range from grayish brown (10YR5/2) to dark gray (5YR4/0). The reduced interior surfaces may indicate the vessel was inverted during firing. Mottled areas on the interior and exterior of the rim support this suggestion. Several sherds are light red (2.5YR6/6) on the interior and exterior, which may indicate they were broken and became thoroughly oxidized when discarded into an open fire.

LITHICS

The technological attributes of the chert tools and debitage from the five features at the SARA Site that yielded lithic artifacts were analyzed to gain a better understanding of the types of activities performed by the Late Woodland inhabitants of the site. The lithic analysis focused on several questions. Do the chert types indicate exploitation of the most readily available lithic resources? Was chert tool manufacture an important activity at the SARA Site? Do the chert tools and debitage indicate a specialized function for the site?

Location of the sources of raw material for lithic reduction facilitates recognition of the importance of particular types of chert for certain tools, and the identification of non-local sources delineates areas used for specialized exploitative tasks or trade. All the chert recovered from the SARA Site (Table 3) could have been obtained within 25 km of the site. Muldraugh chert is abundant in the lower to middle Mississippian limestone on both sides of the Ohio River in the Falls of the Ohio area, and Boyle chert is present in the gravels of the Salt River; both are present in the gravels of the Ohio River. Wyandotte chert occurs in the middle Mississippian limestone of Harrison and Crawford Counties, Indiana, and west of Otter Creek in Meade County, Kentucky. Chert from the Salvisa bed of the Perryville limestone formation could have been obtained from the gravels at the mouth of the Salt River (Thomas Gatus, personal communication 1991).

Table 3. Chert Types.

	Wyandotte	Muldraugh	Boyle	Salvisa	unident.	Total
Tools	15	1	0	0	1	17
burnt tool fragments	11	0	0	0	0	11
Cores	6	0	0	0	0	6
Decortication flakes	18	2	1	0	0	21
tranverse working edge	2	1	0	0	0	3
lateral working edge	11	1	0	0	0	12
tool blanks	1	1	0	0	0	2
Flakes from cores	47	1	0	0	0	48
transverse working edge	16	2	1	2	0	21
lateral working edge	15	1	0	1	0	17
Bifacial reduction flakes	5	3	0	0	0	8
transverse working edge	1	0	0	0	0	1
lateral working edge	3	0	0	0	0	3
Resharpening/fine retouch	25	2	0	0	0	27
Burnt, blocky, shattered	28	24	2	48	7	109
Tested raw material	0	1	2	0	0	3
Total Debitage	183	39	6	51	7	286
Percent of Debitage Sample	64.0%	13.6%	2.1%	17.8	2.4%	99.9%
Total Tools and Cores	21	1	0	0	1	23
Percent of Tools and Cores	91.3%	4.3%	0.0%	0.0%	4.3%	99.9%

Table 4. Tools and Debitage in Woodland Features.

	Feature 1	Feature 2	Feature 8	Feature 9	Feature 11	Total
Tools	1	2	0	9	5	17
heat-fractured frags.	3	8	0	0	0	11
Cores	0	0	1	3	2	6
Decortication flakes	0	0	1	9	11	21
possible tool blanks	0	0	2	0	0	2
transv. working edge	0	0	0	0	3	3
lateral working edge	0	0	0	1	11	12
Flakes from cores	0	0	0	18	30	48
transv. working edge	8	0	0	9	4	21
lateral working edge	2	1	0	8	6	17
Bifacial reduction flakes	1	0	0	4	3	8
transv. working edge	0	0	0	1	0	1
lateral working edge	0	0	0	2	1	3
resharpening/fine retouch	3	3	0	6	15	27
Burnt,blocky,shattered flakes	4	49	0	32	24	109
Tested raw material	2	0	0	0	1	3
Total Debitage	23	61	3	90	109	286
Total Tools and Cores	1	2	1	12	7	23

There is an overwhelming preference by the SARA Site occupants for high-quality (fine cryptocrystalline structure) chert available to the south and west of the Falls area. Ninety-one percent of the tools and cores and 90 percent of the non-blocky, non-fire-shattered flakes on the site are Wyandotte chert (Table 4). Boyle chert occurs in pebbles and small cobbles, but is of relatively high quality. Salvisa and Muldraugh chert are fairly high quality when heat treated. These two types represent 31 percent of the chert sample, but 94 percent of the Salvisa and 62 percent of the Muldraugh chert are blocky fragments obtained from several highly fragmented pieces of raw material.

The quantities and types of lithic reduction debitage provide a measure of the relative importance of tool manufacture and insights into the types of activities being carried out using chert tools. Thirty-six percent of the chert sample recovered from the Late Woodland features is not debitage from the manufacture of tools. Refitting and matching of distinctive colors and patterns in the chert indicate these are weathered or fire-fractured blocky pieces, derived from as few as five pieces of raw material. Only 14 percent of the debitage comes from production of bifacial tools (Table 4). Three large flakes are the only potential tool blanks found on the site, and there were no whole or fragmentary crude bifaces associated with any of the features. It is plausible that many or most of the tools used at the site were made elsewhere, although it is also possible that the tools were made elsewhere on the site and the manufacturing debris discarded at a distance from the excavated features.

The main lithic reduction activities appear to have involved flaking small nodules of chert to obtain sharp flakes for specialized cutting and scraping tasks. There was a marked preference for Wyandotte chert for these purposes (64 percent of debitage and all the cores). Flakes from cores constitute 35 percent of the debitage, and another 7 percent of the sample are decortication flakes from small nodules similar to those used as cores. Cores of Wyandotte chert compose 26 percent of the tool sample and 100 percent of the core sample. Fifty-four percent of the flakes from cores have been utilized for scraping or cutting. The position of the working edge of individual flakes suggests that flakes were selected for specific tasks based on morphological characteristics, and to some extent the shape of the flake may have been predetermined by its intended function (e.g., steeply hinge fractured flakes with transverse scraping edges). Although the sizes and shapes of flakes and small cores do not correlate exactly with lamellar blade technology of the Middle Woodland, the method of manufacture and high percentage of utilized flakes appear to reflect continuity with this earlier lithic technology.

All the bifacial cutting, perforating, and scraping tools from the site have been resharpened to some extent, and many appear to have been used for more than one task. Resharpening and fine retouch flakes compose 9 percent of the chert sample, although excavation techniques did not favor their recovery. Flint knapping activities evident on the site were largely confined to the manufacture of specialized flake tools and reworking of tools. The excavated pits provided no indication of large scale lithic reduction activities, though such activities could have occurred elsewhere on the site.

BOTANICAL REMAINS

An attempt was made to gather as much botanical material as possible during excavation of the site, but limitations of time, personnel, and equipment prevented a formalized program of feature sampling. A small sample of botanical remains was recovered from three features during the brief time available for salvage excavation. The only flotation sample consisted of two liters of fill taken from one of the pits; charred botanical remains also were recovered during trowel excavation of Features 1, 2, and 9.

Wagner (1991) reported that the seeds from Features 1 and 2 represent cultigens, wild plants, and domesticated plants. Feature 1 contained carbonized pieces of hickory nut shells (Carya sp.), acorn (Quercus sp.) shells, and sunflower (Helianthus annuus) kernels. Feature 2 yielded hickory nut shells, acorn shells and cotyledons, sumac (Rhus sp.) seeds and purslane (Portulaca sp.) seeds. The latter two plants grow in open, sunny areas and both are potential food/drink plants (Wagner 1991). The measurements of the sunflower achene indicate it is within the size range of other domesticated Late Woodland sunflower achenes (Wagner 1991). Black walnut (Juglans nigra) and hickory nut shells were present in Feature 9. These data suggest use of the site during at least the fall since sumac is available in the autumn, and purslane can be obtained from May to November.

FEATURES

Based on the presence of thin, cordmarked ceramics (see Table 2), seven of the ten features excavated were assigned to the late Middle Woodland/early Late Woodland period. Four of these features also yielded diagnostic late Middle Woodland/early Late Woodland projectile points (Table 5). Feature 3, though lacking diagnostic material, is believed to be contemporaneous with the other dated features because it exhibits characteristics similar to those of Feature 7, which contained pottery. Feature 4 could not be assigned to a component. It did not contain diagnostic materials or have morphological characteristics that could be used to assign it to the site's Archaic or Woodland components.

It is unlikely that the contents of the excavated pits represent an adequate sample of the cultural debris or reflect the variety of activities on the site. It was possible, however, to gain an impression of the amount of cultural material present. An extensive portion of the habitation surface along the ridge had been exposed, but not removed, and it was examined for features and cultural debris. The features were widely separated, and there was only a thin scatter of debris between them. The excavated pits were of moderate size and depth, and some contained very little refuse. A significantly larger amount of midden would be expected from an intensively occupied site. The limited amount of cultural debris encountered at the SARA Site may indicate it was occupied by a small group, perhaps seasonally.

The types of refuse (pottery, a diverse array of chert tools, debitage, burnt nuts and seeds, baked clay, burnt wood, and fire-cracked rock) associated with several features suggests they were located near living areas or shelters. The two fire pits (Features 3 and 7) may represent communal facilities. There is evidence that relatively specialized activities that involved chert tools were carried out in the vicinity of Features 9 and 11. Feature 9 contained a scraper (Figure 6g), two core fragments, nine flakes from cores, and one bifacial reduction flake, all with transverse scraping edges. The feature also had eight small, thin, rectangular and triangular flakes from cores and two bifacial reduction flakes with lateral cutting edges, a secondary decortication flake used as a backed knife, two knives (one made from a projectile point [Figure 6b]), a biface tip, and six resharpening or fine retouch flakes from bifacial tools.

Of particular interest are the perforating tools from Feature 9. Two Lowe Cluster projectile points (Figure 6c, f) were reworked to produce perforators with bits capable of penetrating 5 mm and 10 mm. A decortication flake was worked into a bifacial perforating tool. A narrow, thick tool (Figure 6i), triangular-convex in transverse cross section, has the convex (ventral) surface thoroughly flaked, and only the ends of the other two surfaces worked. The edges of the medial portion show extreme rounding due to grinding, apparently to facilitate grasping. Hinge-fractured flake scars on the convex surface, on opposite sides at the distal and proximal ends, indicate that the tool was used in a twisting motion as a two-ended perforator.

The lithic contents of Feature 11 reflect cutting and scraping activities. The pit contained two projectile point/knives (Figure 6d, e), one abandoned projectile point/knife preform (Figure 6j) and a basal fragment of another, and a medial fragment of a biface. Sixteen flakes, 20-50 mm in length, from cores (Figure 6k), core decortication flakes, one tabular decortication flake, and one bifacial reduction flake have lateral cutting edges, and seven flakes from cores have transverse scraping edges. Fifteen resharpening or fine retouch flakes from bifacial tools also were present.

Table 5. Lithics.

Tools	Feature 1	Feature 2	Feature 8	Feature 9	Feature 11	Total
projectile point/knife	1	1	0	2	2	6
preform	0	0	0	0	2	2
flake knife	0	0	0	1	0	1
biface	0	1	0	2	1	4
perforator	0	0	0	4	0	4
scraper	0	0	0	1	0	1
core	0	0	1	3	2	6
utilized flakes	10	1	0	21	25	57

The botanical refuse attests to the importance of vegetal resources, but no tools, other than pottery, or specific areas for their processing were identified.

Feature 1 yielded only plain-surfaced, limestone tempered pottery; therefore, its relation to the Late Woodland features that contained cordmarked pottery is somewhat tentative. Plain body sherds occurred in three features that contained cordmarked pottery; however, these plain sherds could not be attributed positively to plain-surfaced vessels. At least four cordmarked vessels were determined to have plain bases, but several of the plain sherds from Feature 11 do not appear to be body sherds from the lower portions of vessels.

Although no incontrovertible evidence exists, there are indications Feature 1 may be coeval with the other features. The rim orientation of the plain vessel from Feature 1 differs from the orientation of other rims on the site, but the rim and body thickness, paste, and temper are consistent with those of some of the cordmarked vessels. The projectile point fragment from Feature 1 is extremely heat-fractured, but the blade width and the flaking pattern are similar to those of the Lowe Cluster projectile points from the Late Woodland features.

There are several possible explanations for the presence of the plain-surfaced vessel in Feature 1. It is possible that the feature is from an earlier occupation of the site that was not detected by the limited salvage excavations. The rim orientation, body form, and temper of the vessel are within the range of variation of Middle Woodland Falls Plain ceramics from the area (Mocas 1992). It also is plausible that Falls Plain ceramics were still being produced when cord-wrapped paddle impression was the predominant surface treatment. There is evidence that Falls Plain pottery at Site 12Cl103 was associated with a Lowe Cluster projectile point similar to those recovered from the SARA Site (Sieber 1989). The ceramics from the nearby

Arrowhead Farm Site were not clearly stratified, but plain and cordmarked ceramics similar to those found at the SARA Site co-occur in the plowzone.

ABSOLUTE AND RELATIVE DATING OF THE SARA SITE

Of the three samples submitted for radiocarbon dates, two do not accurately reflect the age of the Late Woodland component identified through the ceramic analysis. However, the third does appear to be a good Late Woodland date. One of the unacceptable dates was obtained from 15 g (unprocessed) of burnt hickory nut shells from Feature 2. It yielded an uncorrected radiocarbon age of 115±80 B.C. (UGa 1231). The other early date was derived from a sample of burnt nut shells from Feature 1. It was noted by Beta Analytic (personal communication, Murry Tamers 1985) that the processed sample was particularly small (0.65 g carbon) and was subjected to extended counting (four times normal counting time). It produced an uncorrected radiocarbon age of 300±70 B.C. (Beta 12721). Both assessments appear to be too early to be associated with the ceramic and lithic materials found in the sampled features.

A third sample, which consisted of burnt walnut and hickory nut shells from Feature 9, also was submitted to Beta Analytic for dating. This sample yielded an uncorrected radiocarbon age of A.D. 550±70 (Beta 12720). This date appears to be an accurate reflection of the age of the Late Woodland component based on known dates for Lowe Cluster projectile points and cord-wrapped paddle impressed pottery in the Ohio River Valley. Lowe Cluster projectile points and preforms are considered diagnostic of the terminal Middle Woodland and early Late Woodland (Justice 1987:207-213). Regional pottery types with characteristics similar to those of the ceramics from the SARA Site, especially Newtown ceramics (Henderson and Pollack 1985; Kreinbrink 1992; Reidhead 1976; Riggs 1986; Seeman 1980), have been determined to have comparable terminal Middle Woodland/early Late Woodland temporal spans.

LOCAL CONTEXT OF THE SARA SITE AND ITS CULTURAL MATERIALS

The earliest ceramics identified for the Falls region are variants of the ubiquitous cordmarked, grit-tempered ceramic complex of the Ohio River Valley such as Fayette Thick (Mocas 1988; see Duerksen et al. this volume). These ceramics were cordmarked with a handheld piece of fabric or a fabric-wrapped paddle, or, infrequently, single cords. The pottery from the SARA Site has a distinctly different type of cordmarking, made exclusively with closely-spaced, parallel individual cords. The use of cordmarking diminishes greatly during the middle portion of the Middle Woodland, when it is supplanted by plain surface treatment, as exemplified by Falls Plain pottery (Mocas 1992).

The exact temporal span of Falls Plain pottery is not known, but the available data (Mocas 1992) suggest these ceramics were the predominant pottery type in the Falls of the Ohio region during the middle portion of the Middle Woodland period and may have been present until the early Late Woodland. Most of the ceramics from the SARA Site differ markedly from Falls Plain pottery and can be considered to postdate most of its temporal span, based on relative dating and on stylistic criteria; however, the two ceramic groups appear to display morphological continuity. The form and orientation of some of the SARA Site rims are similar to those of Group 3 and 4 Falls Plain rims from the Zorn Avenue Village Site (Mocas 1992). Globular bodies are prevalent among both Falls Plain vessels and SARA Site vessels, but the vessel bases from the SARA Site show more rounded bottoms than Falls Plain bases. The similarities of these ceramic traits may indicate these are sequential forms.

The recovery of a Lowe Cluster projectile point in possible association with Falls Plain pottery at Site 12Cl103 and the presence of numerous Lowe Cluster points and Falls Plain pottery at the Zorn Avenue Village Site, where Falls Plain pottery was abundant, suggests that the manufacture of Lowe Cluster points spans the transition from Falls Plain to the cordmarked ceramic vessels found at the SARA Site.

The Arrowhead Farm Site (15Jf237) (Mocas 1976) was located on a floodplain ridge approximately 100 m east of the SARA Site (see Figure 1) and 3-4 m higher in elevation. The site contained cord-wrapped paddle impressed, limestone tempered and siltstone tempered pottery and plain-surfaced, limestone tempered pottery, including one rim sherd similar to a rim from Feature 1 at the SARA Site. The stratigraphic and provenience data of the Arrowhead Farm Site pottery were of little value because of the plowzone context of most of the ceramics, but the vertical distribution of the few plain and cordmarked sherds recovered from non-plowzone contexts suggests the surface treatments may have been in use concurrently. A thick lining of burnt wood at the bottom of Feature 7 at Arrowhead Farm yielded a date of A.D. 665 ± 70 years, but there were no diagnostic materials associated with the pit.

The Arrowhead Farm Site excavations yielded several Lowe Flared Base projectile points, and two other Lowe Cluster points were uncovered less than 100 m to the north of the main excavation during earthmoving activities. Approximately 840 m south of the Arrowhead Farm Site, on the same ridge, 11 cord-wrapped paddle impressed, siltstone tempered sherds, possibly from one vessel, and a Lowe Flared Base projectile point were recovered from a pit exposed by earthmoving machinery.

The Bates Island Site (15Jf258) is located 20 km upriver from the SARA Site (see Figure 1), in the floodplain on the north side of the Ohio River, separated from the the north bank of the Ohio River by a narrow, shallow channel (Bassett 1989:40). A small number of plain and cordmarked, siltstone tempered and limestone tempered sherds, similar to the pottery from the SARA Site, were recovered from the site (Henderson 1989:187-206).

The aforementioned are the best documented local sites with ceramics comparable to those from the SARA Site. The similarity of the site locations provides a basis for future comparative research focused on exploitative and economic activities of transitional Middle/Late Woodland groups in the Falls of the Ohio River region. Survey data are limited in the uplands, and few sites with comparable ceramic assemblages have been reported.

COMPARISON WITH REGIONAL SITES

The SARA Site displays characteristics consistent with late Middle Woodland/early Late Woodland sites in the central Ohio River Valley. The lack of rim and body decoration and the predominance of cordmarked vessels are consistent with regional types to the east and west, but the ceramics exhibit no distinctive morphological forms or specialized decorative techniques that link them with a particular regional group. The globular body and rounded basal form identified among the SARA Site vessels may have antecedent forms in McGraw (Prufer 1965) or Adena ceramics (O'Malley 1988), but it is equally feasible that they are derived from local Falls Plain pottery.

The cultural materials from the SARA Site most closely resemble materials from the Newtown sites of southern Ohio, southeastern Indiana, and northeastern Kentucky. The ceramics from the SARA Site, however, lack the characteristic angular shoulders and inslanting rim forms of Newtown pottery, but vessels lacking angular shoulders also occur on Newtown sites (Reidhead 1974; personal communication, 1979). The rim form and orientation, the lip form and cordmarking, the rim and body cordmarking method, and cord orientation of the vessels from the SARA Site are within the range of variation displayed by vessels from the Haag Site and other Newtown sites (Reidhead 1974:9, 13, Figure 3c, Figure 7a, b; Railey 1984:Plate 28a-h). Grit and limestone are the most common tempering materials in Newtown vessels (Reidhead 1976:48), but a variety of other materials also appear to have been used (Ahler 1992:31); thus the siltstone-tempered ceramics from the SARA Site may represent a similar local preference.

Lowe Cluster projectile points and preforms like those from the SARA Site are the dominant types found on Newtown sites (e.g., Reidhead 1974:Figure 5a-f). The radiocarbon date from the site also is well within the temporal span of Newtown, A.D. 300-400 to A.D. 800 (Ahler 1992). Though the author does not posit that the SARA Site should be assigned to the Newtown phase, its tools bear resemblances to the cultural materials of these sites and may reflect a different localized developmental sequence, as well as interregional interaction. The SARA Site fits well within Seeman's (1980) proposed "Central Ohio Valley Early Late Woodland," which subsumes Newtown sites (if the the Falls area can be considered on the periphery of the "Central Ohio Valley").

CONCLUSIONS

Investigation of the SARA Site generated important information on the Late Woodland period in the Falls of the Ohio River region. The co-occurrence of Lowe Cluster projectile points and cordmarked, limestone-tempered or siltstone-tempered pottery was documented at the site. The projectile points and pottery provide a relative date for the site, and a radiocarbon assay furnished an absolute date to substantiate the temporal position of the site and its diagnostic materials. Continued use of limestone temper and the morphological characteristics of the pottery demonstrate cultural continuity, whereas the introduction of siltstone temper and conical vessels and the predominance of cord-wrapped paddle impression denote new influences and possibly technological innovation.

The occupants of the SARA Site are comparable to groups at regional transitional Middle/Late Woodland sites in their subsistence activities, as exemplified by the exploitation of nut resources and supplementary use of domesticates and cultigens, the preference for fertile floodplain environments, the selectivity for high-quality chert, and the use of flake tools. Although data from the SARA Site reflect participation in regional trends, there is no evidence of the sudden influx of new ideas into the Falls area. The cultural materials show the same developmental forms seen elsewhere in the Ohio Valley, and the ceramics exhibit continuity with earlier vessel forms and manufacture techniques in the Falls area (Mocas 1988, 1992). The aboriginal residents of the area appear to have utilized consistently the advantageous position of the Falls region to maintain contact with regional trends and continue stable, yet vibrant, adaptations.

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EXCAVATION OF A PREHISTORIC FEATURE AT BIG BONE LICK, BOONE COUNTY, KENTUCKY

By
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ABSTRACT

The accidental discovery of a prehistoric cultural feature bisected by the natural erosion of the bank of Big Bone Creek prompted volunteer efforts to salvage data from the feature before further destruction. Artifacts attributed to both the Late Woodland and Late Prehistoric periods were recovered from these limited excavations. The feature was a large thermal pit filled with quantities of limestone fire-cracked rock, but essentially lacking charcoal. It is proposed that the feature functioned as a roasting pit or earth oven.

INTRODUCTION

In May 1993, archaeologists from 3D/Environmental of Cincinnati, Ohio, encountered the exposed profile of a large pit feature, marked by burned limestone slabs and an 8 to 10 cm thick band of oxidized earth. This feature was located at the top of a nearly vertical bank, almost 4 m above the present channel of Big Bone Creek, at the southern periphery of previously recorded Site 15Be269. The authors and their colleagues thought that measures should be taken to document the feature before its loss to erosion.

Prior to initiation of fieldwork, contacts were made with R. Berle Clay of the Office of State Archaeology and Carey Tichenor of the Kentucky Department of Parks. The scope of fieldwork submitted to these individuals included the excavation of no more than nine 1 x 1 m units, with the goal of recovering the remnants of the feature in their entirety. Appropriate permits were issued by both offices to begin salvage of the feature. Subsequent contacts were made with David Pollack of the Kentucky Heritage Council, Susan Cabot of the Boone County Historic Preservation Review Board, and Bob Lindy of Big Bone State Park to discuss the excavation methodology and coordinate any and all questions concerning the salvage of the feature.

Field operations began in late July 1993 and continued for a period of 14 days. Excavation of the feature resulted in the recovery of ceramics and projectile points associated with the Late Woodland and Fort Ancient periods, as well as a large debitage assemblage, and a faunal assemblage composed of fragmentary and unspecified mammal bone, one deer molar, and two bison teeth. The chronology and function of the feature are not unequivocally established by the excavation results, but several hypotheses concerning these issues are offered.

The importance of Big Bone Lick State Park to archaeological research in Kentucky is apparent from several perspectives. First, the park area was by all accounts a focal point for a variety of economic and subsistence activities throughout the prehistoric and early historic

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periods of the region. Second, the depositional processes of the area have operated in such a way that deeply stratified archaeological records of these activities have been preserved along Big Bone Creek. Finally, the name recognition of the park should not be discounted as Big Bone figures prominently in several popular historical novels and appears in textbooks of history and geology associated with such names as Thomas Jefferson and Charles Lyell.

The opportunities for increased public exposure to archaeological issues offered by this existing foothold on the public consciousness fueled the volunteer efforts. The authors believe that such exposure will further solidify public interest in Big Bone Lick and highlight the need for its continuing protection.

FEATURE DESCRIPTION

When first encountered, the feature appeared in profile near the top of a 4 m high southeast-facing bank of Big Bone Creek (Figure 1). Lithic debitage, prehistoric ceramics, and small bone fragments protruded from the feature fill, and numerous flakes as well as large slabs of burned limestone were lying at the base of the bank immediately beneath the feature. The top of the feature was approximately 30 cm below the present day ground surface and measured 1.6 m across along the point of erosional bisection. No discernable prehistoric living surface could be identified in association with the feature, and the lower reddened band of soil faded away as it approached the outer edges of the jumble of limestone slabs in the feature fill.

Although artifacts, burned limestone, and burned clay from the feature were found redeposited all the way down the creek-bank's face, cultural material was also noted embedded, *in situ*, at various points vertically across the exposure. Most interestingly, several flakes were found to define a horizontal line across the eroded bank face approximately 1.5 m below the present ground surface (Figure 1). These flakes are observable at this general level for 10 to 15 m along the bank, roughly centered on the location of the feature. All of the flakes appear to be positioned horizontally, as related to their length and width. To the south (upstream) of the feature location, this line of flakes intersects a deposit of dark soil, lithic debitage, charcoal, and bone fragments. Water screening of the slump area at the base of the stream bank directly below recovered a Kirk corner notched point (Figure 7c), which possibly derived from this level.

ENVIRONMENTAL SETTING

The feature is located approximately 50 m southeast of an intact saline spring that is still frequented by game in the area (Figure 2). A mineral-rich wetland environment is seasonally created by rising water tables due to spring snow melts and rain (Tankersley 1986). In the past, this spring may have been much larger, but historic drainage of the area and increased demands on ground water have affected the magnitude of this natural cycle. According to older local residents, the area surrounding the feature was "like walking on jelly" until the mid-20th century (Bob Lindy, personal communication 1993). Today, certain low-lying areas within the park, particularly the bison pen, periodically retain standing water, but at much lower levels than in previous decades.

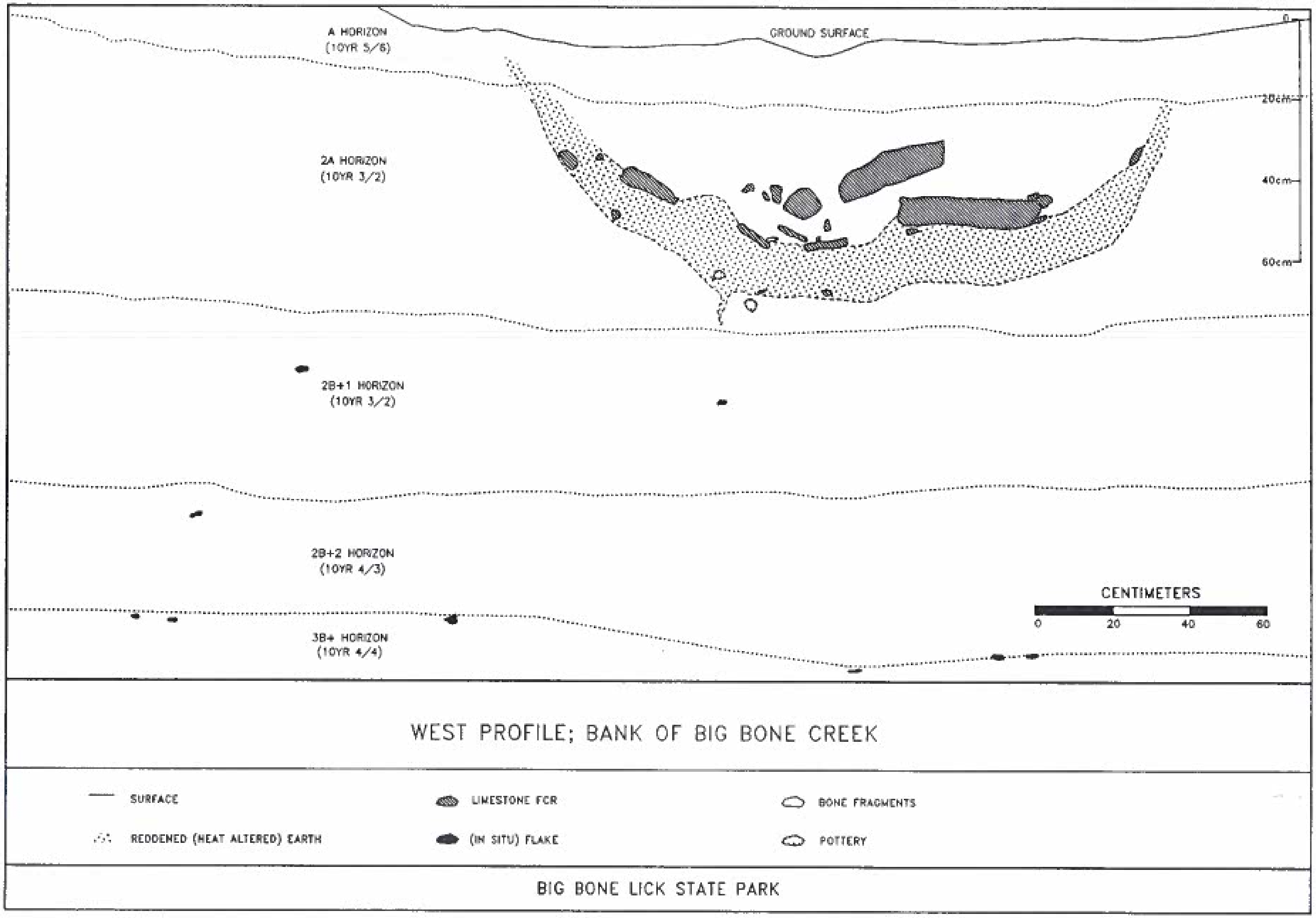

Figure 1. West Profile of Feature.

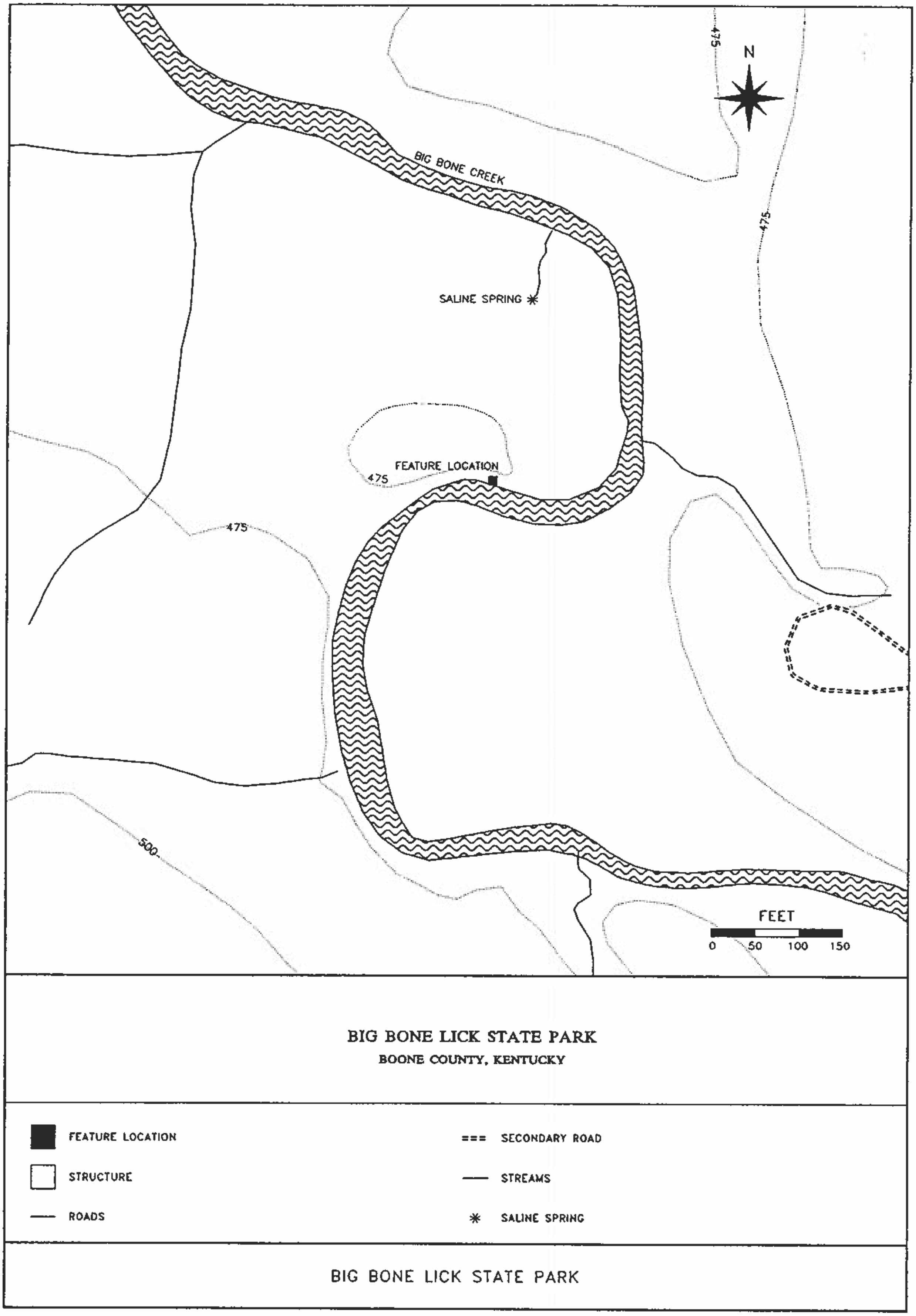

Figure 2. Map Showing General Location of Feature along Big Bone Creek.

The site locality lies in the Outer Bluegrass physiographic region, on the south bank of Big Bone Creek, approximately 200 m upstream from the mouth of Gum Branch. The Big Bone Creek floodplain is underlain by alluvium that has been generally described as consisting of dark gray silty clay and sandy silt, in some places to a depth of 10 m (Schultz et al. 1963). The uplands bordering Big Bone Creek are primarily composed of interbedded limestone and shale of the late Ordovician Kope and Fairview formations. These uplands consist of long, winding, narrow, rolling-to-hilly ridges and steep-walled, "V"- shaped valleys. Restricted water flow in this area dissolves salts located in the shales, thus resulting in salt-laden springs and seeps (Boisvert and Cordiviola 1982). Isolated remnants of Wisconsin-age lacustrine deposits occur at the base of the slopes surrounding the park (Swadley 1971).

Boone County lies near the southernmost margin of the advance of the Laurentide Ice Sheet during the Quaternary period. There is no evidence that the most recent advance, the Wisconsinan, ever reached this area, and Illinoian glaciation of extreme northern Kentucky is a matter of debate. However, it does appear that an ice sheet did enter southern Illinois, southern Indiana, southwestern Ohio, and northern Kentucky during the Kansan Stage. Till fabric analysis of deposits in northern Kentucky and southwestern Ohio indicates that the direction of the ice flow was from the northwest. It is difficult to assign an age to this glaciation since it is well beyond the range of radiocarbon dating. However, it is suspected that the Kansan Stage occurred about 600,000 to 700,000 years ago based on two deposits associated with this event (Ford 1967).

The area also appears to have been glaciated during the earlier Nebraskan Stage (Durrell 1965; Leighton and Ray 1965; Swadley 1980). Till associated with this advance of the ice sheet has been identified in various locations in the northern Kentucky uplands, including the vicinity of Big Bone Lick State Park. Deposits of chert-bearing glacial outwash of Wisconsin age and glacial drift of Illinoian or pre-Illinoian age (Price 1964; Swadley 1971) occur 8 to 10 km to the north of the feature's location on a large section of Ohio River floodplain known as the Upper East End Bottom. A much smaller deposit identified as Illinoian drift is mapped in the uplands less than 2 km from the site. The Wisconsinan outwash is known to contain chert pebbles, however the Illinoian drift deposits are more likely to contain larger blocks of material (Swadley 1971), better suited for human use. These areas to the east are a probable source of the most of the lithic material recovered from the site.

FIELD METHODS

The first task undertaken in the investigation of the feature was the establishment of a permanent site datum. This datum consisted of a meter-long section of conduit driven into the ground several meters north of the planned excavation area. Next, the topography of the immediate site area and the adjacent creek bed, as well as selected readings of more distant, permanent landmarks, was recorded using a Topcon CTS-1 total station. A benchmark was located, and a series of transit shots was made to establish the absolute elevation of the site's permanent datum at 144.85 m above mean sea level (mamsl). Two secondary datums were then set, and from these all relative elevations were taken during the excavation. Before excavation, the eroded creek bank was mapped in profile, including the bisected feature and other *in situ* cultural materials exposed at various points.

With the goal of recovering the feature itself, as well as any evidence of immediately associated activity area(s), a 3 x 3 m block was marked out on top of the creek bank, directly above the exposed feature. The central 1 x 1 m unit of this block (Unit 5) was occupied by an elm tree approximately 35 cm in diameter and, for this reason was excluded from excavation. Only five of the remaining eight units were eventually opened, but these totally encompassed the surviving portions of the feature, as well as over 3 m^2 of the feature's immediate surroundings.

Each unit was further subdivided for excavation purposes into 50 x 50 cm horizontal units, or "quads." Each quad was excavated by hand troweling in 5 cm arbitrary levels, in the absence of natural or cultural stratigraphy. Hand excavation proceeded with the goal of point-proveniencing all artifacts larger than 1 cm in any single dimension. In the case of point-provenienced debitage, faunal remains, and ceramics, data were recorded concerning horizontal orientation of the artifacts' long axis, as well as the degree and the direction of dip.

All feature fill was collected for flotation and wet screening procedures, in hopes of recovering faunal material, paleobotanical remains, and microdebitage. As the burned limestone was uncovered, its density and large block size impeded excavation in regular 5 cm levels. Instead, excavation proceeded until the density of exposed limestone obstructed further excavation. The exposed limestone was then mapped and removed before proceeding further. Each such operation defined a single arbitrary level, with irregular contours and thickness. The limits of each level were recorded by a series of elevations taken from high and low points of each limestone block and the intervening fill. As a result, two such levels were defined within the feature.

SITE STRATIGRAPHY AND TRANSFORMATIONAL PROCESSES

Three strata were recognized during the excavations. Stratum I was represented by 40 cm of bioturbated silt loam. It was excavated in eight 5 cm levels. In all portions of the area opened, with the exception of the feature proper, excavation terminated at the base of Level 8. The feature itself was designated Stratum II, and the band of heat-altered (reddened) earth surrounding the feature's base was labeled Stratum III.

Most of the artifacts, with the exception of fire-cracked rock, were found in Stratum I. Sixty-seven artifacts were recovered from within the feature itself, including debitage, faunal remains, one core, one biface, 11 ceramic sherds, and a Late Woodland Raccoon Notched projectile point. No cultural materials were recovered from Stratum III, although this 8 to 10 cm thick deposit was hand excavated, and more than 50 liters of its soil was subjected to wet screening through 1/8-inch mesh.

During the excavation, bioturbation was perceived as having been a force in the formation of these cultural deposits, primarily in Stratum I. Apart from the highly visible network of roots that characterized the upper 40 cm of the excavations, and the uniform distribution of material throughout Stratum I (Figure 3), a lack of continuity was observed in the orientations of artifacts as they were encountered. Post-field synthesis of artifact orientation data confirms this observation, suggesting that root action over time altered the *in situ* condition of these deposits. Figure 4 represents, by arbitrary level, the dip of each point-provenienced lithic artifact recovered from Stratum I. With the exception of Level 1, these graphs show no preferred position of repose for individual artifacts. The tendency noted within Level 1 of Stratum I for artifacts to be resting horizontally in respect to their long axes can be explained by the fact that a heavily used footpath crosses much of the excavated area. Traffic along this path is no doubt responsible for compacting and reworking the upper portions of Stratum I.

When the feature was first visible in plan at the base of Level 8 in Units 6 and 9, its dimensions were approximately 130 cm from north to south, and 120 cm east to west (Figure 5). These measurements were taken from the outer edge of the reddened band, where it existed, and from the erosional bank-cut that had impacted the feature's eastern portions. Along the southwestern edge of the feature, this reddened band pinched out amid a dense jumble of fire-cracked rock, and became visible again approximately 30 cm to the southeast. The boundary between the feature fill (Stratum II) and the overlying Stratum I was marked by the dense cluster of fire-cracked rock, but it is highly likely that materials from the lower levels of Stratum I in Units 6 and 9 reflect feature-related activities.

Although some effects of bioturbation are evident within and below the feature, these are not considered to have had any great impact on this deposit. Only a few roots penetrated the feature's compact fire-cracked rock concentration, and a single infilled krotovina was noted, in the original eroded profile, extending 10 cm below the reddened band. In general, however, it seems that the dense occurrence of large blocks of limestone fire-cracked rock in the feature fill acted as a barrier to the inroads of biological agents of disturbance. As mentioned previously, the reddened band (Stratum III) persists only in areas where it is directly overlain by the mass of fire-cracked rock within the feature. Around the perimeter of the feature, this heat-altered deposit has been truncated, most likely by the action of roots.

ANALYTICAL METHODS

LITHIC ANALYSIS

Each artifact in a lithic assemblage can be viewed in terms of its place within a continuum of production, use, repair, and discard of chipped stone tools. This process-oriented conceptual system, or *chaine operatoire* (Geneste and Plisson 1986; Sellet 1994), links the cultural material debris at any prehistoric site with the specific events that determined its physical characteristics. In turn, production episodes are perceived as responses to specific needs which, when identified, can provide a basis for commentary on wider synthetic issues, such as the settlement or subsistence patterns of particular temporal/cultural units. Such conceptual linkages help to present the lithic technology observed at this Big Bone Lick locality as part of a complex system tied inextricably to other locales on the Late Woodland and Late Prehistoric landscapes of this part of northern Kentucky.

In applying the *chaine operatoire* concept to the analysis of the lithic material from this excavation, the first issue addressed was the identification of specific raw materials represented in the assemblage. The frequencies with which local or non-local materials occur at archaeological sites have been shown to be relative to a particular group's degree of sedentism (Andrefsky 1991; Tankersley 1991), or indicative of the presence or absence of extraregional contacts (Kelley 1991). Additionally, the size and morphology of naturally occurring raw material blocks necessarily exert some proportional and processual restrictions on potential knapping trajectories (Andrefsky 1994).

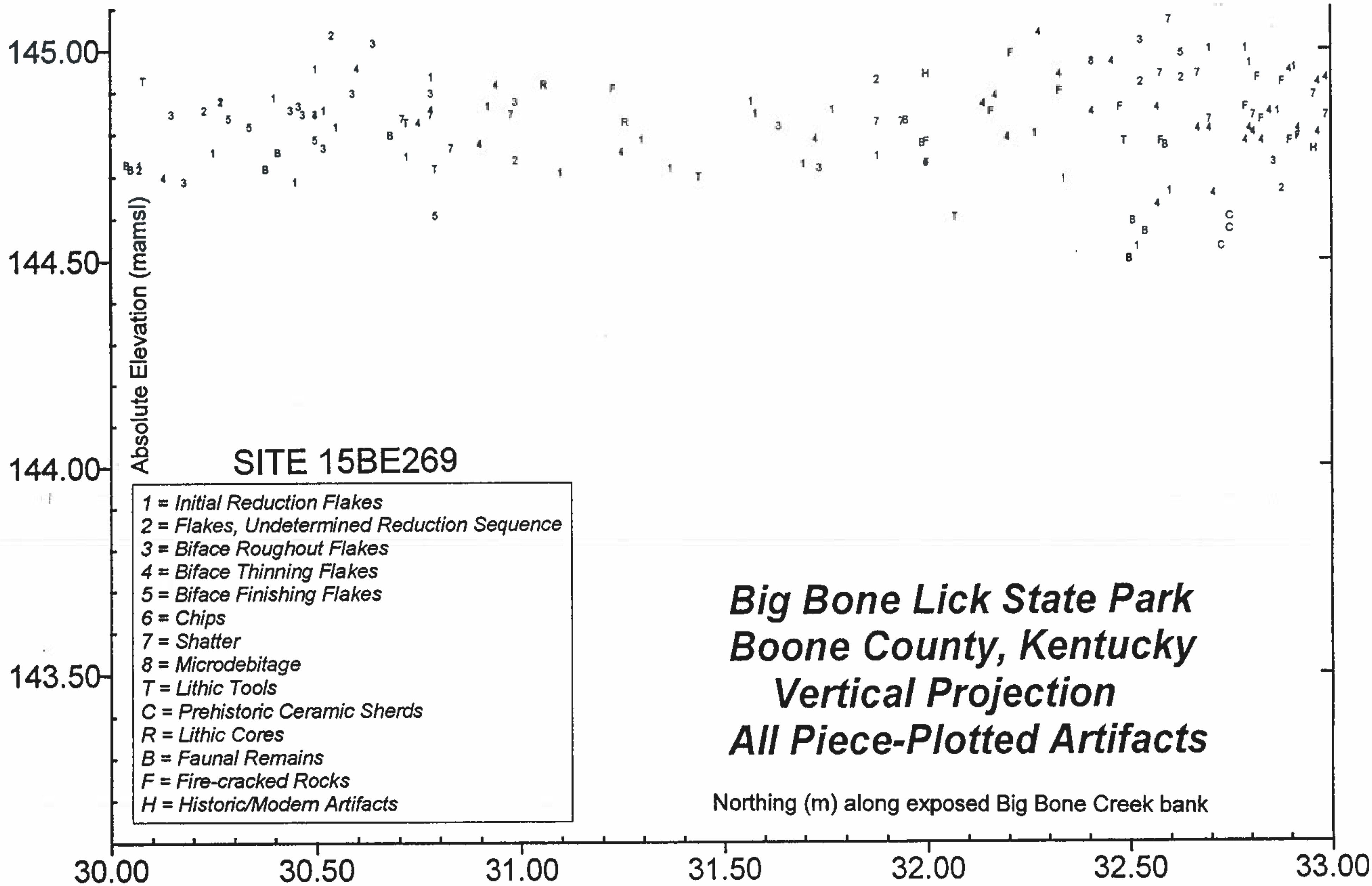

Figure 3. Distribution of Artifacts within Excavation Area.

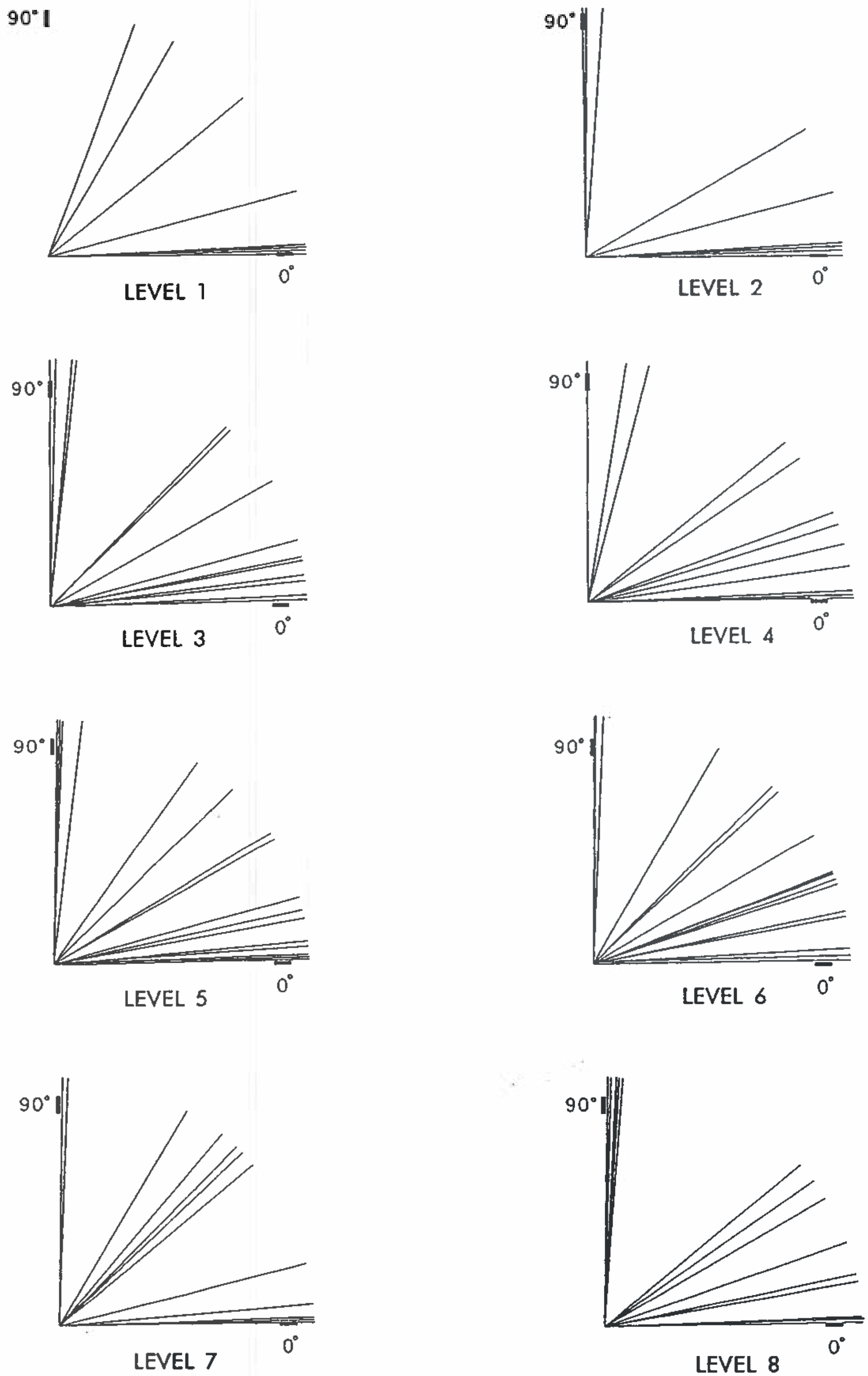

Figure 4. Degree of Dip for Point Provenienced Artifacts within Stratum I.

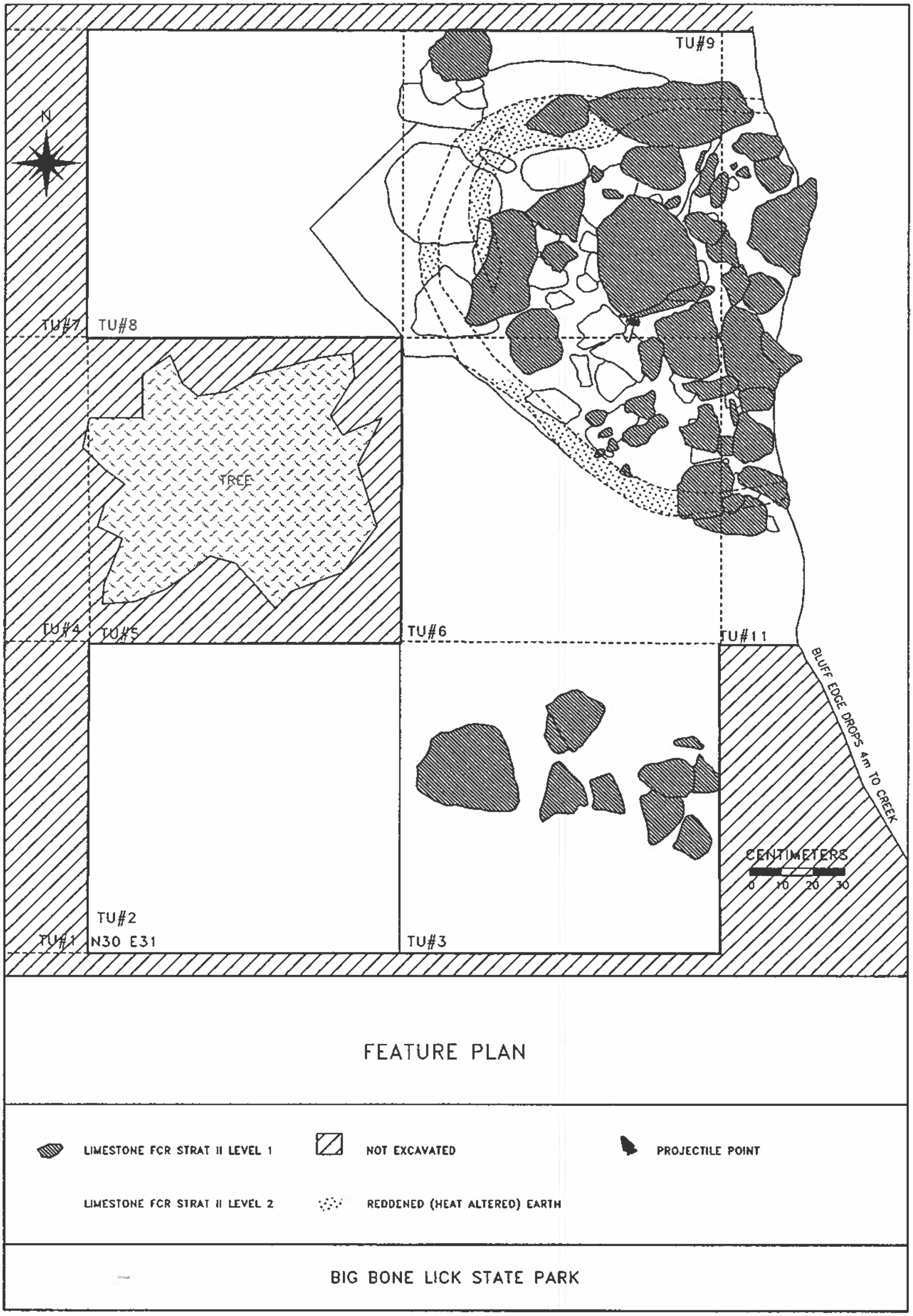

Figure 5. Planview of Feature.

Prehistoric lithic artifacts were then sorted by artifact type (e.g., projectile point, core, and debitage) and described based on standard references such as Bell (1958) and Justice (1987). Debitage categories were based on classification schemes currently used by both Old and New World prehistorians (Bordes 1961; Frison 1974; Purdy 1981; Tixier et al. 1980). The first level of analysis involved separating flakes, cores, and fragments (shatter and "chunks" of raw material) and listing the presence or absence of features such as cortex. The flakes were then further subdivided, in as much as was possible, into groups that more specifically identify the reduction sequence to which they belonged. In the case of the Site 15Be269 assemblage, these groupings consist of debitage related to biface production (biface initial reduction flakes, biface thinning flakes, and biface finishing flakes) and flakes for which no specific reduction sequence can be determined (initial reduction flakes, chips, and microdebitage). Determinations of this sort were made on the basis of several morphological attributes observed on individual flakes, such as dorsal scar patterns, butt and bulb characteristics, and flake profile.

The categories used to describe biface reduction follow in a broad sense those proposed by Newcomer (1971), Callahan (1979), and Bradley and Sampson (1986). It should be noted, however, that rigid schemes of reduction such as those cited, which break up into stages a process that is in fact an unbroken continuum from raw material selection to the final abandonment of the tool, can only approximate the course of a manufacturing trajectory used by prehistoric knappers.

IDENTIFICATION OF OTHER MATERIALS

In contrast with the lithic artifacts, the other cultural materials recovered from this excavation at Site 15Be269 were not suitable for the application of rigorous analytical techniques. Although faunal remains were a frequent occurrence both within and surrounding the feature, they are almost universally too fragmentary and poorly preserved for specific classification. However, a small number of analyzable faunal specimens were identified through reference to comparative collections at the University of Kentucky Museum of Anthropology and the Cincinnati Museum of Natural History. David Pollack of the Kentucky Heritage Council identified the few ceramic sherds recovered.

MATERIAL RECOVERED

Excavation of this prehistoric feature and its immediate surroundings at Site 15Be269 resulted in the recovery of a total of 756 artifacts (Table 1). Types of prehistoric cultural material encountered include lithic tools, cores, and debitage; ceramics; faunal remains; and fire-cracked rock. Additionally, a small number of historic artifacts, including a .22 caliber bullet, several glass shards, and a chunk of rusted metal, were recovered from intrusive contexts and/or near the surface of the excavation area.

Table 1. Artifacts Recovered from Excavation Block

CLASS	LV 1	LV 2	LV 3	LV 4	LV 5	LV 6	LV 7	LV 8	LV 9	LV 10	TOTAL
Biface Finishing Flake	4	0	6	8	4	11	8	8	0	0	49
Biface Roughing Out Flake	3	3	7	7	6	8	8	8	0	0	50
Biface Thinning Flake	8	9	12	16	28	21	17	14	3	2	130
Bifacial Tool	0	1	0	1	2	2	0	1	0	0	7
Ceramic	1	0	0	0	2	3	8	11	0	1	26
Chip	1	1	5	3	9	8	0	3	1	0	31
Core	0	0	0	1	1	0	1	0	1	0	4
Faunal	1	3	2	4	8	9	42	55	3	1	128
Fire-Cracked Rock	1	4	4	9	20	12	7	6	0	1	64
Flake Undetermined Reduction	6	8	12	15	17	20	9	17	1	0	105
Historic	8	10	0	0	0	0	0	2	0	0	20
Initial Reduction Flake	5	2	4	12	8	12	4	12	0	0	59
Microdebitage	1	0	0	1	0	1	0	0	0	0	3
Shatter	6	8	8	13	14	17	10	4	0	1	81
Total	45	49	60	90	119	124	114	141	8	6	756

LITHIC ASSEMBLAGE

With the exception of the nearly ubiquitous burned limestone, prehistoric lithics were the most frequently occurring artifact type recovered from these investigations. In addition most of the debitage and tools are derived from local chert cobbles obtained from Illinoian or pre-Illinoian drift deposits. However, small quantities of other cherts, including Wyandotte and Flint Ridge, are represented in the assemblage.

The four recovered cores illustrate the characteristics of the locally available raw material (Figure 6). The largest (Figure 6a) of the cores weighs 62.4 g and measures 55 x 41 x 21 mm. Cortex, or natural surface, occurs at both ends of its long axis and on a large portion of one intervening face. Flake scars occur randomly across this artifact, with the longest removal measuring 41 mm in length. This specimen was the only core from the site exhibiting signs of heat alteration. The smallest of the four (Figure 6b) recovered cores weighs 32.6 g, and has only three unidirectional flake scars across the full 37 mm length of the artifact's two faces, as well as one smaller removal scar originating from an opposing platform. The narrow range of raw material block size illustrated by these cores would certainly have an effect on knapping strategies.

Debitage indicative of biface reduction constitutes most of the artifacts recovered (n=229). Generally, the debitage is relatively small in length and width, further reinforcing the observation that raw material selection was restricted to local secondary source cobbles. Although debitage relating to all stages of biface reduction is included in this assemblage, biface thinning flakes are the most frequently represented debitage class from the excavation (n=130). Earlier and later stage biface debitage occur much less frequently.

A total of seven bifacial tools were recovered during the excavations, nine from Stratum I and two from within the dense fire-cracked rock concentration in the upper level of the feature fill. Three Fort Ancient projectile points (Figure 7f-h) and two Raccoon Notched points (Figure 7d-e) are the only temporally diagnostic stone tools recovered during the excavations. Of the two Raccoon Notched points, one was point-provenienced within Stratum I (Figure 7e). The other was found near the base of the upper level of the feature (Stratum II). Both of these points are missing their tips as a result of flexion breaks, and both exhibit remnants of percussion flaking scars from the thinning stage of reduction. Evidence of pressure flaking on these artifacts is generally limited to the basal areas, notches, and edge margins.

The Fort Ancient points were all found within Stratum I. One of these, from Level 4 of Unit 2, is a small specimen resembling Railey's (1992) Type 4 Fine Triangular points (Figure 7f). Another example, point-provenienced within Level 4 of Unit 3, is missing its tip and exhibits flute-like impact damage emanating from its base toward the point's midsection (Figure 7g). This point was found lying horizontally lengthwise, with its lateral edges oriented vertically at 90 degrees. Although there are insufficient data for a classification of this artifact, its size and slightly convex edges are suggestive of Railey's Type 5 Fine Triangular points. The third artifact classified as a Fort Ancient point (Figure 7h) was encountered immediately beneath a large piece of limestone in Level 6 of Unit 3, its length and width oriented horizontally. This point is broken at the base, but has the narrow, elongated planview and the slightly concave lateral margins that characterize the Hamilton Incurvate (Justice 1987:229), or Railey's Type 2 Fine Triangular. These three points are all made from local cobble cherts, are apparently unheated, and exhibit pressure flaking scars across the entirety of their intact surfaces.

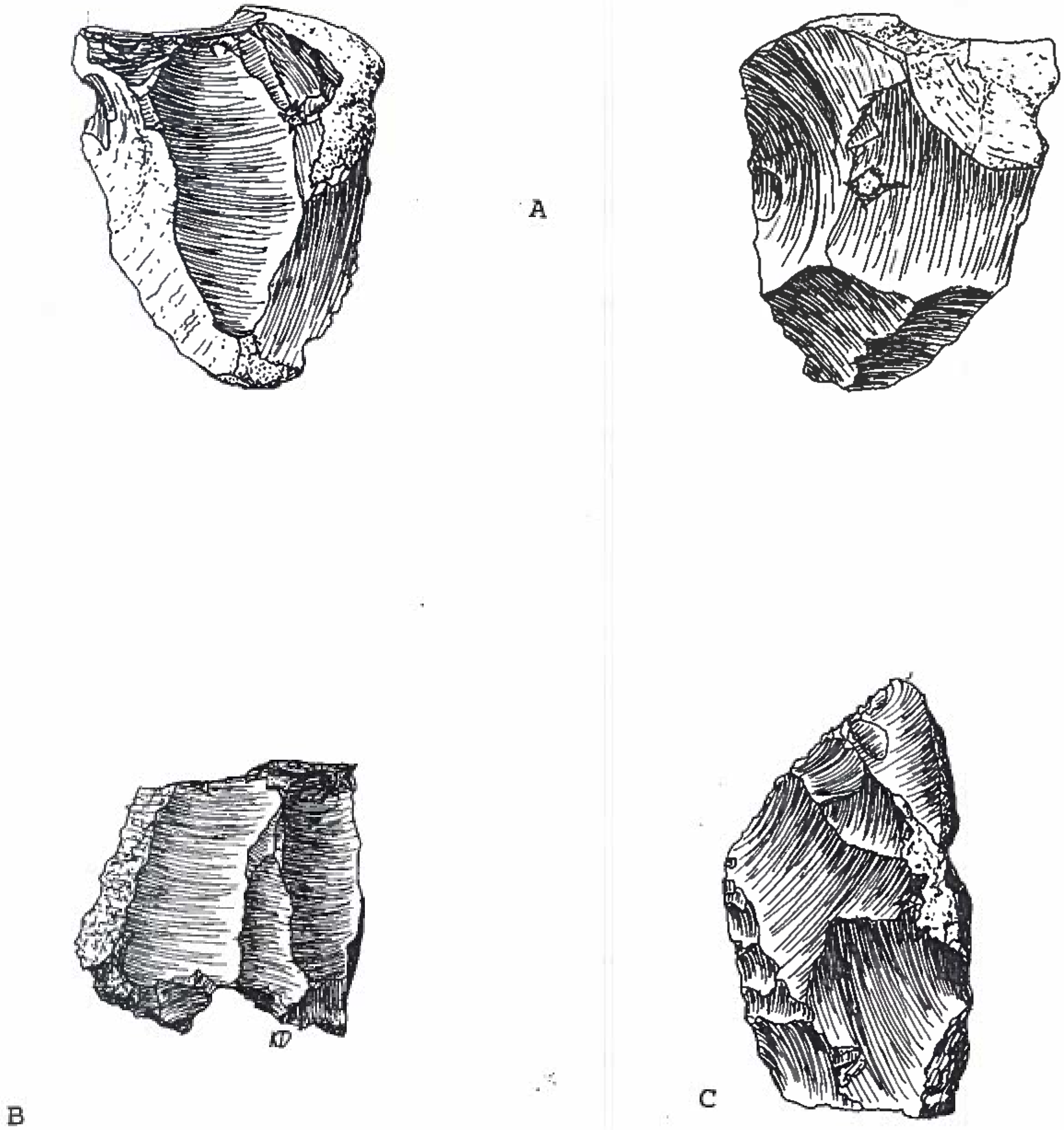

Figure 6. Cores Recovered from Excavations.

Several bifaces and biface fragments in various stages of manufacture and condition were located in and around the feature. Most of these are broken and fragmentary. Two early-stage bifaces (Figure 7a-b), one from Level 5 of Unit 6, and the other from the base of the upper level of the feature fill, provide evidence of reduction continuity between the cores and finished projectile points at this site.

CERAMIC ASSEMBLAGE

The feature and its surroundings yielded a total of 36 prehistoric ceramic sherds. Two distinct varieties are recognized within this assemblage (David Pollack, personal communication 1994). One ceramic type is represented by body sherds of thin-walled, limestone tempered cordmarked pottery resembling wares associated with the early portions of the Late Woodland period. The second type is likewise thin, exhibiting plain surface treatments and shell tempering. This variety is similar to Fort Ancient ceramics from the post A.D. 1400 Madisonville Horizon (Henderson 1993). These two types have roughly equal representation within the assemblage, and both are found within the feature fill and throughout the lower half of Stratum I.

FIRE-CRACKED ROCK

A total of 198.8 kg of burned limestone was recovered from within the feature. A considerable amount of similarly reddened limestone was noted at the base of the stream-bank immediately below the eroded feature, but this material was not collected or weighed. The condition of the fire-cracked rock within the feature ranged from slabs with water-rounded edges, weighing as much as 15 kg to large quantities of minute rubble. In many instances, fragments of larger pieces that had been cracked were found resting in conjoined position. This indicates that the event causing their fracture, whether intense heating or rapid cooling, occurred within the feature, and that these pieces were not disturbed after this incident of thermal stress.

A linear pile of burned limestone slabs was located across the middle of Unit 3, approximately 1 m south of the feature. The lowest of these stones rested at the base of Level 8, although some of them were first identified in Level 6. This arrangement and its proximity to the feature may reflect an expedient discard behavior related to feature utilization or cleaning.

FAUNAL REMAINS

Faunal remains were frequently encountered during this excavation (n = 128). Because of their generally fragmentary and decomposed condition, most of these specimens can only be classified as mammal. The exceptions were two bovid teeth, one cervid molar, and a phalange of a very large ungulate. One of the bovid teeth, a lower incisor, was recovered from within Stratum I, just above the top of the feature. The larger specimen, a molar, was recovered from within the cluster of burned limestone in Unit 3, in Level 7 of Stratum I. An AMS radiocarbon date of A.D. 1830$\pm$55 (Beta 67833/ETH-11604) was obtained from this large molar. These teeth, when compared with museum collections, proved to be too large to be from domestic cattle, with the possible exception of oxen. In size and other characteristics, both of these teeth are identical with bison remains in the comparative collections.

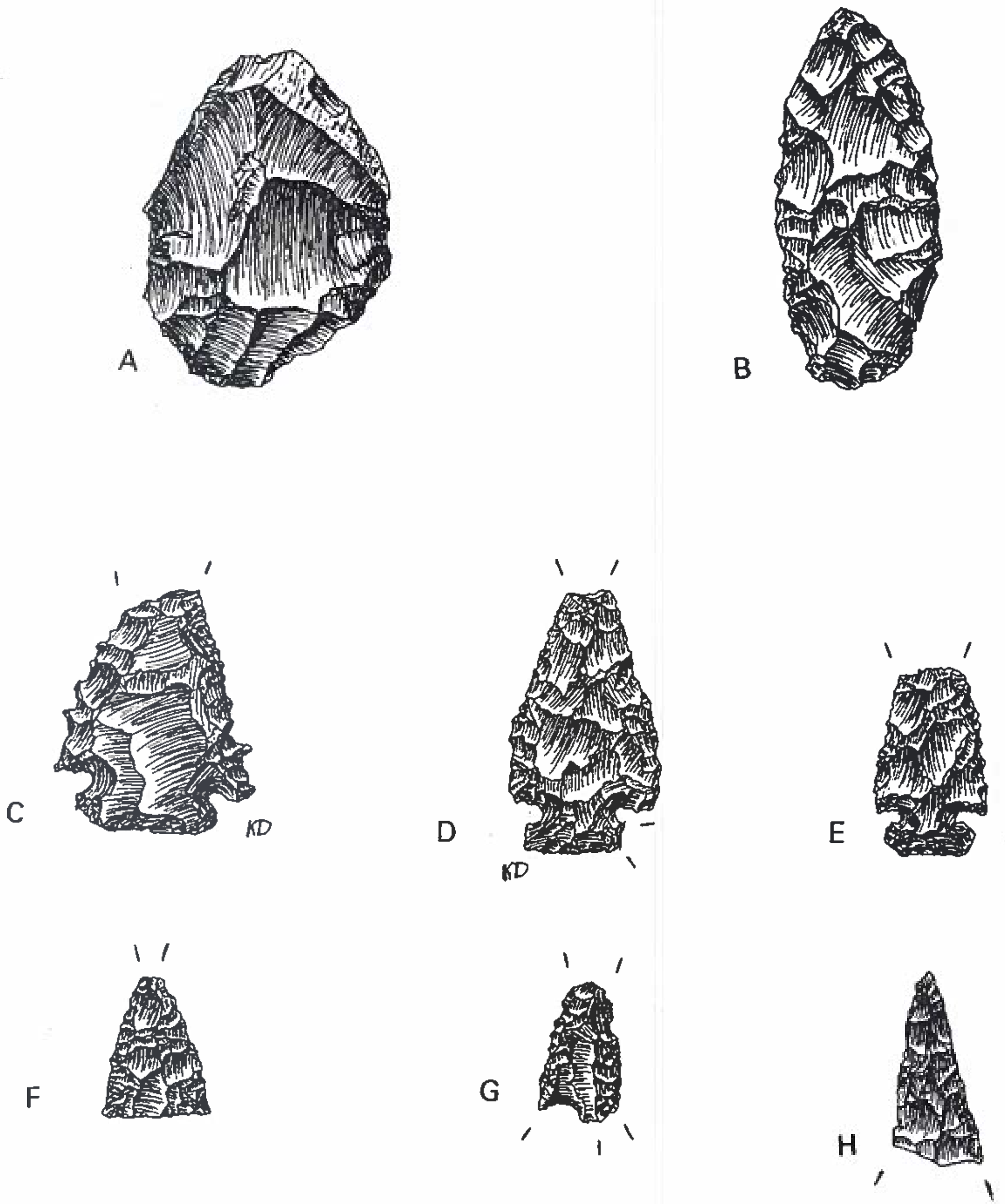

Figure 7. Bifacial Tools: a-b, Early Stage Bifaces; c, Kirk Corner-Notched Point; d-e, Raccoon Notched Points; f-h, Fort Ancient Points (Scale 1:1).

DISCUSSION

LITHIC REDUCTION

The lithic reduction continuum at Site 15Be269 begins at the source locations of the raw materials utilized. Secondary source cobbles of pre-Illinoian or Illinoian glacial till, both of which occur in close proximity to Big Bone, are represented by most of the debitage recovered from the excavation. These data, as well as data from sites such as the West Runway Site (Duerkson et al. this volume, Petersburg (Henderson 1993) and Arrasmith (authors' personal observations of material), suggest that these cobbles were a major source of raw material for the aboriginal inhabitants of northern Kentucky from the Early Woodland to Late Prehistoric periods. Due to the small area excavated, little can be said about the overall reduction strategies utilized by Late Woodland and Fort Ancient peoples throughout the park, yet observations on available raw materials and debitage class distributions at the site shed light on knapping activities performed in the immediate vicinity of this feature.

It is unclear whether or not the Fort Ancient and Raccoon Notched points from this site were made on flakes. The cores and non-diagnostic bifaces, however, indicate that biface reduction at this site often proceeded directly from naturally occurring blocks to a finished or nearly finished tool, without the additional stage of producing a flake blank. Various characteristics of the cores and initial reduction debris demonstrate the generally small size of the natural chert cobbles locally available to prehistoric knappers in the site area. The low frequency of initial reduction flakes and finishing flakes in relation to biface thinning debitage may indicate that mid-stage reduction was more frequently performed at the site, whereas the other stages were carried out elsewhere. However, the number of cores from the area excavated suggests that this is not the case. More likely, perhaps, is the interpretation that limited raw material block size influenced a conservative approach to reduction: a strategy in which decortication was executed as efficiently as possible, and in which thinning and shaping of the piece accounted for most of the individual flake removals. The site's four cores show a tendency for the removal of substantial areas of cortical surface with a limited number of large initial reduction flakes. The apparently random pattern of these removals represented on the three largest cores would have the combined effect of reducing edge thickness, creating a biconvex cross section, and forming an irregular network of flake ridges. All of these factors combine to offer a wider range of thinning opportunities than would be presented on a core which had been reduced unidirectionally. By comparing the cores and early stage bifaces from this site, one can see how such a strategy could facilitate the production of bifaces from small cores with a minimal sacrifice of material.

Additionally, the limitations of the potential maximum size of flakes removed from these small cores may have adversely affected their efficient use for particular tasks. In such a situation, the production of multifunctional bifaces may have been the only goal of the knapping process. The absence of retouched flakes in the assemblage suggests that the lithic technology may have been organized in just such a way.

FEATURE FUNCTION

The excavators' first impression of this feature was that it had served as a hearth. The band of reddened earth immediately below the pit's interface with underlying deposits, the massive quantities of burned limestone that constituted most of the fill, and the fragments of ceramics and bone that were visible in the initial eroded section, all conformed with the investigators' expectations of prehistoric fire-pit morphology. However, during the excavation, it soon became apparent that charcoal was absent from the feature deposits, though it was present as ubiquitous flecking in Stratum I. The three samples of carbon recovered from within the feature amounted to less than 2 g. This situation raised the following questions. How did the limestone become burned? What caused the oxidization of the underlying soil? If a fire had occupied this large pit, what happened to the charcoal?

One possible answer to all of these questions is that the pit served as an oven in which limestone slabs - heated in a separate facility nearby - were placed in a pit as the heat source for slow-cooking. The frequency of highly fragmentary mammal bone recovered from this excavation indicates that the intensive processing of animal products was an important activity at this locality.

A similar prehistoric feature was excavated at the nearby Glacken Site (15Be272). Boisvert's (1986) interpretation of this large pit feature as an "oven" is based primarily on the amount of fire-cracked rock, and the fact that there were no signs of reddening of the soil beneath the fire-cracked rock. His hypothesis is that the stones were heated nearby and then moved, possibly with a white-tailed deer scapula, that was found in the feature fill (Boisvert 1986). An informal experiment conducted by Boisvert indicated that direct contact with a small fire brings about a noticeable transformation of the soil in the area, but the converse situation, whether soil can be visibly altered by an indirect, less intense heat source, has yet to be demonstrated.

In addition, the fire-cracked rock recovered from the Glacken feature was much smaller than that from Site 15Be269. The size of many of the burned slabs from Site 15Be269, and the total quantity of limestone involved, indicates that use of this pit as an earth oven would have constituted a labor-intensive activity.

No direct evidence of salt processing such as pan fragments was recovered; however, the feature's close proximity to the saline springs suggests some relationship to this geological resource. The most likely interpretation is that the minerals of the springs were important to the locality's prehistoric occupants for their attractiveness to game. If this is the case, then the feature possibly reflects the cooking of game near the location of its procurement.

CHRONOLOGY

Although the feature itself (Stratum II) probably represents an intact, sealed cultural deposit, the degree to which the feature and Stratum I are related is uncertain. The only culturally diagnostic material recovered from the feature consists of a single Raccoon Notched projectile point and 11 ceramic sherds. The Raccoon Notched variety has been associated with the terminal Late Woodland period, dating between around A.D. 800 and about A.D. 1200 (Justice 1987:219-220; Seeman 1992). In the northern Kentucky area, the precise phase affiliations of the Raccoon Notched type have not been established, but the associated Jack's Reef point type is assigned to the general descriptor of

Late Woodland (Railey 1990). The small ceramic assemblage from Site 15Be269, both within and surrounding the feature, exhibits characteristics of both early Late Woodland wares and later Fort Ancient pottery (David Pollack, personal communication 1994).

As stated previously, a radiocarbon date of A.D. 1830±55 was derived from the large bison molar recovered in Unit 3, Stratum I, Level 7. Although inconclusive, this determination more strongly supports bison exploitation at this site during Protohistoric times rather than during the early and middle Fort Ancient or Late Woodland periods. The association of the linear pile of fire-cracked rock in Unit 3, where the molar was recovered to the feature is somewhat problematical. However, similar dates for bison remains have been reported from the middle Ohio Valley, including a radiocarbon determination from the northern edge of Site 15Be269. Bison remains, in association with a few cordmarked ceramic sherds, were reported by Tankersley (1986:295) from between 3.08 and 3.38 m below the surface in a stratigraphic column excavated into the creek-bank face. A radiocarbon determination of A.D. 1420±105 (UGa 4291) was obtained from this deposit, although the exact nature of the material dated, and of the association between the cultural and faunal material, has never been clearly reported. Tankersley (1986:299) also reports additional dates for bison remains from the Big Bone area as around A.D. 1700 (W 908), and slightly earlier than A.D. 1750 (W 1351). Similarly, bison remains from the Clyde Site in Ohio yielded a date of A.D. 1800±100 (M 1518).

The fact that one Raccoon Notched point was found in Level 1 of the feature fill, while another was recovered from Level 6 in Unit 2, and a non-feature ceramics cluster was found in the lower half of Stratum I indicates that at least these lower levels of Stratum I contain materials potentially associated with the use of the feature. Three projectile points generally considered to be of more recent age, the Fort Ancient triangulars, were recovered from Levels 2, 4, and 6. Although the temporal ranges of the Raccoon Notched and Fort Ancient point types are believed to overlap by 200 or 300 years in some areas of the Midwest, this vertical seriation appears to reflect two separate occupations of this locality, one during the Late Woodland period, and the other being represented by a scatter of Fort Ancient materials.

The proveniencing of the diagnostic lithic assemblage, taken alone, suggests that the feature was established and used by Late Woodland people, and that the locality was subsequently occupied by Fort Ancient people after an indeterminant period of soil formation. The vertical distribution of prehistoric ceramics recovered from this excavation, however, forces an alternative interpretation. As discussed previously, two temporally distinct ceramic types occur together in Stratum I, as well as in both levels within the feature, a situation in contradiction with the vertical distribution of projectile points. The apparently stable context of the feature fill suggests that the mixing of Late Woodland and Fort Ancient ceramics occurred during the period of the feature's establishment, use, and in-filling. Stratigraphic interpretation of this situation would suggest that the pit was initially excavated by Fort Ancient peoples, and that this excavation impacted, and incorporated portions of, a deposit bearing Late Woodland cultural materials.

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MISSISSIPPIAN SECONDARY CENTERS ALONG THE LOWER OHIO RIVER VALLEY: AN OVERVIEW OF SOME SOCIOPOLITICAL IMPLICATIONS

By
Paul P. Kreisa[1]

ABSTRACT

The results of 1989-1990 University of Illinois at Urbana-Champaign Western Kentucky Project fieldwork concentrating on Mississippian secondary centers along the lower Ohio River valley are reviewed. Eleven sites were investigated during this fieldwork, including three sites, Rowlandtown (15McN3), Crawford Lake (15McN18), and Tolu (15Cn1), at which test excavations were conducted. Results of this project indicate that fewer secondary centers are present in the study area than was first thought, and that many are in a state of poor preservation. The origin of the secondary centers as being a post A.D. 1200 phenomenon is discussed in terms of the entire settlement system for the area. Secondary centers are viewed as being one result of the expansion of the Kincaid chiefdom after A.D. 1200.

INTRODUCTION

In 1989 the Western Kentucky Project of the University of Illinois at Urbana-Champaign began an investigation of small Mississippian mound sites, referred to here as secondary centers, on the Kentucky side of the lower Ohio River (Figure 1). The area investigated consists of the Ohio River Valley floodplain and the adjacent terraces and uplands in Ballard, McCracken, Livingston, and Crittenden counties (Kreisa 1991). Based on a review of the Office of State Archaeology site files, Funkhouser and Webb's (1932) statewide survey, and the archaeological literature of the region, 17 potential secondary centers were identified. Two had been investigated previously: Twin Mounds (Kreisa 1988a) and Tolu (Webb and Funkhouser 1931). Five of the potential secondary centers were in Ballard, two in McCracken, five in Livingston, and five in Crittenden County (Figure 2). Time and funds were available to investigate eleven sites during the project.

At each site, either a sketch or topographic map was prepared, a representative artifact collection was obtained, and soil coring was performed to identify the presence and condition of midden deposits. Based on the results of preliminary investigations, three sites were selected for additional investigations: Crawford Lake (15McN18) and Rowlandtown (15McN3) in McCracken County, and Tolu (15Cn1) in Crittenden County. At these sites one to two test units were excavated to obtain stratigraphic profiles, information on the dating and nature of the Mississippian occupation, and representative artifact, faunal, and floral samples. In addition, the excavations were needed to determine site integrity for National Register of Historic Places nominations.

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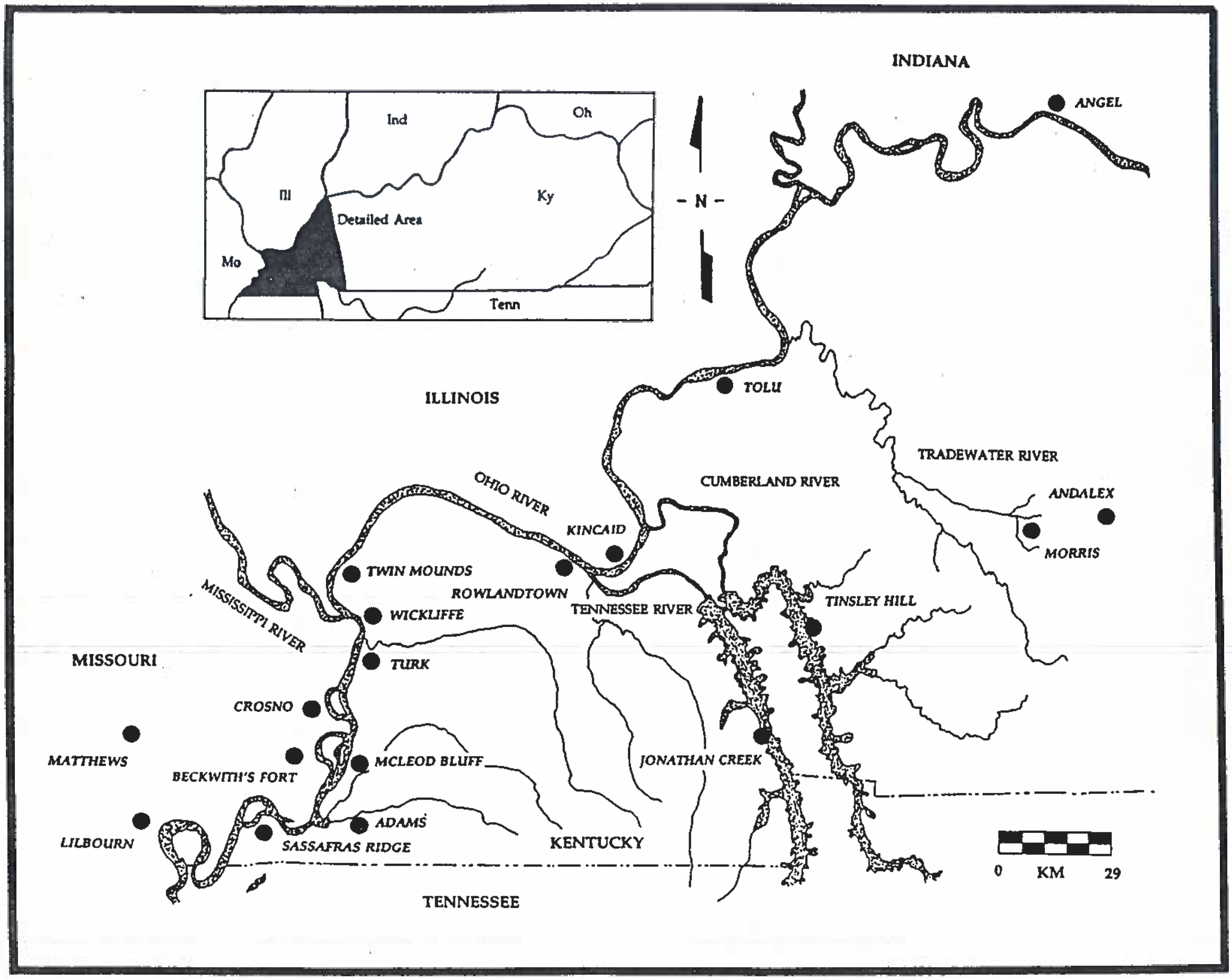

Figure 1. Selected Mississippian Sites in the Confluence Region.

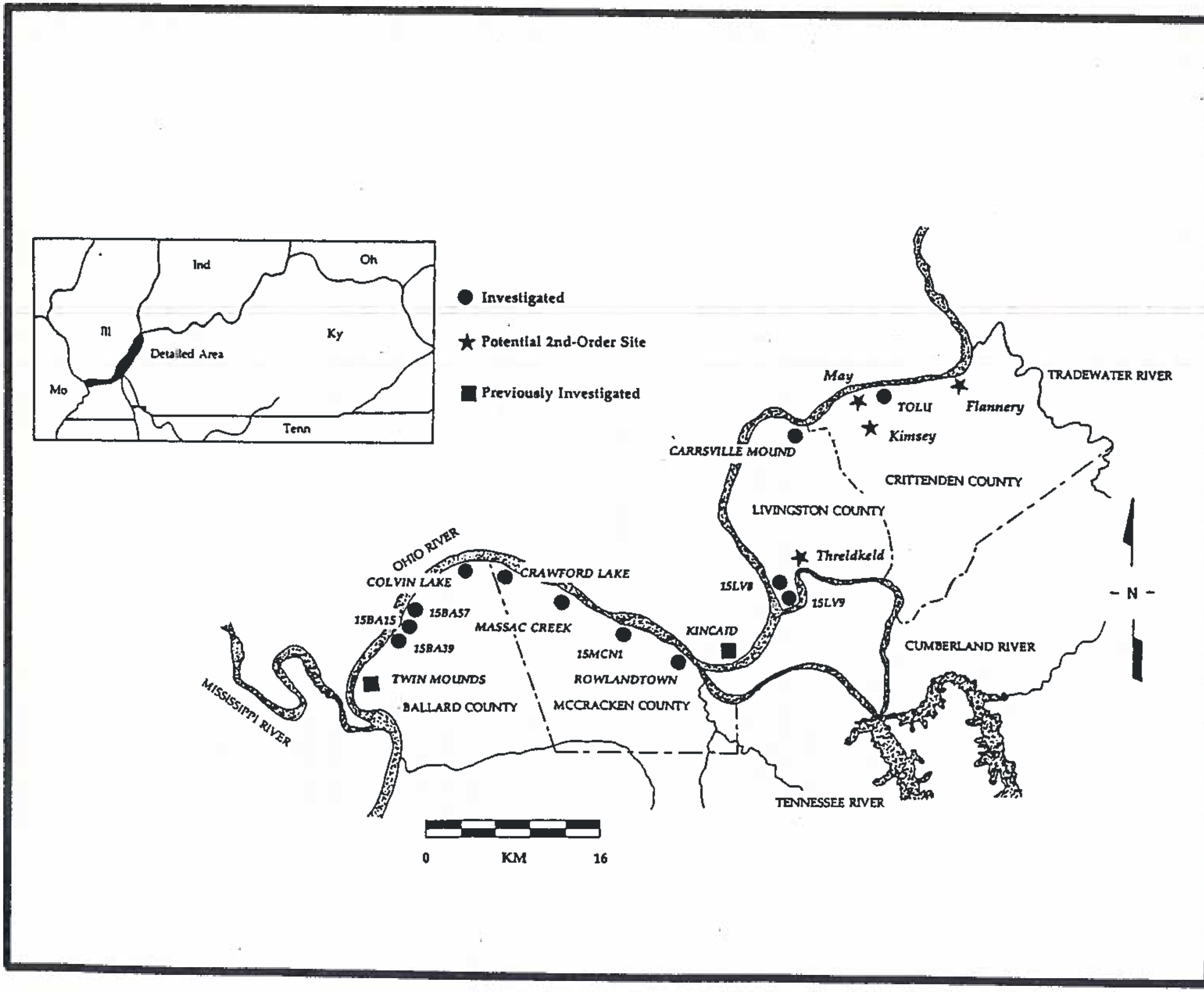

Figure 2. Potential Secondary Mississippian Centers in the Study Area.

The investigation of Mississippian secondary centers along the Lower Ohio River was prompted by two different observations. First, Brian Butler (1977) hypothesized that Mississippian sites in Ballard and McCracken counties were part of the Kincaid chiefdom. Furthermore, sites east of the Tennessee-Cumberland rivers, such as Tolu, were thought to be part of the Angel chiefdom (Railey 1984). For the most part, these hypotheses could only be supported by surface-collected data. In essence, it was postulated that the Mississippian settlement system of the lower Ohio River consisted of the major regional centers of Kincaid and Angel, secondary centers such as Twin Mounds, Colvin Lake, Rowlandtown, and Tolu, and villages, hamlets, and farmsteads. Within this settlement system it was suggested that the smaller sites were socially and politically dependent in the west upon Kincaid and in the east upon Angel.

Second, my own comparison of mound sites between the Ohio and Mississippi River valleys suggested some major settlement differences between the two regions (Kreisa 1988b; for similar observations, see also Clay 1976). Along the Mississippi River in western Kentucky, the largest Mississippian sites were often 10 hectares or more in size, had 8-10 mounds, and a plaza, and were either palisaded or located in easily defensible positions. In contrast, along the lower Ohio River Valley only Kincaid and Angel rival the Mississippi River mound centers. Other Mississippian mound sites along the lower Ohio River are relatively small in size, having only one or two mounds, and show little evidence of plazas or palisades.

RESULTS

At the start of this project, a literature and records search indicated that 17 potential secondary centers were present in the project area (see Figure 2). All but four have been investigated (Table 1). Of the 13 sites field-checked, only three or possibly four are actually secondary Mississippian centers. These are Rowlandtown, Twin Mounds, Tolu, and possibly Colvin Lake. Others could not be relocated, such as 15Lv9 and 15McN1, or were not Mississippian sites such as 15Lv8, 15Ba39, 15Ba15, and 15Ba57. Finally, Crawford Lake and the Carrsville Mound site, while having Mississippian components, are not secondary centers. The four sites not investigated were May, Flannery, and Kimsey in Crittenden County, and Threldkeld in Livingston County.

One initial conclusion of the project is that there are far fewer secondary Mississippian centers along the lower Ohio River Valley than was originally thought. Based on a rate of 25 percent accuracy between potential and actual secondary centers, a total of four to six such sites may actually exist, and those are in various states of preservation (Table 1). In conclusion, there are few examples of this site type, and of those that exist, most have been severely impacted by various modern disturbances (Kreisa 1991).

The place of the Ballard and McCracken County secondary centers within the local Mississippian settlement system is the focus of the remainder of this discussion. The area dealt with here consists of only a portion of the overall project area. It extends east from the Twin Mounds site to the confluence of the Ohio and Tennessee-Cumberland rivers. Too few data exist at present to include the area east of the Tennessee-Cumberland rivers in the present discussion. Although many Mississippian sites have been identified in Ballard and McCracken

Table 1. Potential Secondary Centers Within the Project Area.

Site	Investigation Method	Temporal Components	# of Mounds	Comments
Ballard Co.				
Twin Mounds	Test Excavations	LW/Miss	2	Well preserved, midden up to 2 meters in depth
Colvin Lake	Surface Survey	Miss	1	Midden present, mound destroyed
Site 15Ba15	Surface Survey	LA	1?	Mound not mentioned be Clay in 1961 notes
Site 15Ba39	Surface Survey	MA	0	Site confused with Ba15 in lit.
Site 15Ba37	Surface Survey	Unknown	1?	Profile suggests this is not a prehistoric mound
McCracken Co.				
Site 15McN1	Surface Survey	Miss?	0	Material not found in site area-reports of stone box graves at site
Rowlandtown	Test Excavations	MW/Miss	1	Single mound and midden, mound disturbed
Massac Creek	Surface Survey	LW/Miss	0	Site badly eroded, reported mound not relocated
Crawford Lake	Test Excavations	LW/Miss	0	No mound located--site is hamlet-sized
Livingston Co.				
Site 15Lv8	Surface Survey	MW	0	Midden present
Site 15Lv9	Couldn't Locate	Unknown	?	Quarry located in site area
Carrsville Mound	Surface Survey	MW/Miss	0	Mississippian stone box cemetery adjacent to a hamlet
Threldkeld	Not Investigated	Unknown	?	
Crittenden Co.				
Tolu	Test Excavations	Miss	3	Mounds destroyed, much of site disturbed
Flannery	Not Investigated	Unknown	?	
May	Not Investigated	Unknown	?	
Kimsey	Not Investigated	Unknown	?	

counties, most are known from surface collections. Excavations conducted at six sites in these two counties form the archaeological record on which this discussion is based.

THE MISSISSIPPI PERIOD IN WESTERN KENTUCKY

To place the discussion of the origin of secondary Mississippian centers along the lower Ohio River Valley into a cultural and temporal context, an overview of the Mississippi period in western Kentucky is presented here. Within the Ohio-Mississippi Rivers Confluence region, several Terminal Late Woodland or Emergent Mississippian complexes have been described. The most important of these phases are Dillinger of southern Illinois (Maxwell 1951), Douglas of the Black Bottom (Butler 1991; Muller 1986), and Yankeetown of southern Indiana (Blasingham 1953). Each complex is a more or less contemporaneous regional variant of a terminal Late Woodland culture.

Briefly, each phase has a settlement system consisting of large villages and smaller sites. The Douglas phase may have been associated with the construction of a platform mound at Kincaid, a phenomenon not present at any other known Dillinger or Yankeetown site (Kreisa 1990a). This relatively non-hierarchical settlement system has been interpreted to indicate that groups were not organized as true chiefdoms (Kreisa 1990b; Kreisa and Stout 1991). Settlements appear to be oriented mainly toward riverine and other aquatic resources, although sites were also placed at the margins of several environmental zones, such as at bluff crests between uplands and river bottoms (Muller 1986; Redmond 1986).

There are certain similarities in the ceramics of these phases. Grog or grog-with-shell was a commonly used tempering agent. Vessels include bowls, pans, and funnels, but globular jars are the most common form. Stumpware is found at a few locations. The rectilinear incised decorations found on jars have been classified as Dillinger Decorated and Yankeetown Incised. Red slipping occurs infrequently at Dillinger and Yankeetown sites. Plain grog-tempered pottery is most common at Douglas phase sites (Muller 1986).

The initial Mississippi Period phase in the region is Jonathan Creek dating to ca. A.D. 1000-1100 (Clay 1984; see also Butler 1991; Muller 1986). The ceramic assemblage is dominated by plainwares, Old Town Red, and McKee Island Cordmarked. Initial mound building began at Kincaid during this phase (Butler 1991). Roughly correlated with the Jonathan Creek phase is the James Bayou phase (A.D. 900-1100), defined for the Mississippi River section of western Kentucky. Settlements there consist of large villages, some potentially with one or two mounds, and smaller habitation sites. Subsistence was based on maize, squash, nuts, and fruits, in addition to deer, smaller mammals, waterfowl, and fish (Kreisa 1988a).

During the next phase, Angelly (A.D. 1200-1300), an increase is seen in the amount and number of types of decorated ceramics present at Mississippian sites on the Black Bottom, and include Nashville Negative Painted, O'Byam Incised, and Matthews Incised (Butler 1991; Muller 1986; Riordan 1975). Butler (1991) contends that there was an increase in mound building activity and the construction of a palisade at Kincaid during this phase. In addition, there appears to have been an increase in the number of smaller sites in the Black Bottom. The Dorena phase (A.D. 1100-1300) is a rough counterpart to Angelly along the Mississippi River. Maize is ubiquitous in Dorena phase features and middens. Settlement locale is similar to that for the James Bayou phase, although internal patterns and the settlement hierarchy changed greatly (Kreisa 1990b). During this phase, the florescence of towns, often with eight or more mounds, a central plaza, habitation areas of 10 hectares or more, and at times palisaded, took place. Smaller settlements include moundless villages, hamlets, and farmsteads. Material culture differs little between the site types (Kreisa 1990b).

The final lower Ohio River phase is called variously Kincaid (Riordan 1975) or Tinsley Hill (Muller 1986) after Clay's (1984) construct. In either case, this segment of time, A.D. 1300-1600 by Muller or A.D. 1300-1450 by Butler (1991), witnessed the efflorescence and decline of the Kincaid site in the Black Bottom. Paralleling this phase on the Mississippi River is the Medley phase, dating from A.D. 1300 to 1500. It has been suggested that populations became concentrated in larger settlements at this time, although the number of different site types inhabited remains similar to the preceding phase (Kreisa 1990b). In addition, there is a greater differentiation of material culture assemblages between towns and the smaller site types. This pattern suggests that there was an increase in the hierarchical nature of Mississippian settlement and social systems during the Medley phase (Kreisa 1990b).

BALLARD-McCRACKEN COUNTY SITES

The Mississippian sites in the study area can be placed within one of three general settlement types. These are the 1-2 mound sites with associated habitation areas, small villages or hamlets, and farmsteads. Since 1980, test excavations have been conducted at examples of each site type. Emphasized below is data on ceramics and radiocarbon assays from each of the site types.

FARMSTEADS

Excavations have been conducted at one farmstead (Site 15McN38) located to the west of Paducah (Butler et al. 1981). The investigation by Southern Illinois University revealed that the site is 65 m in diameter and contains the remains of a single house. The nature of the occupation and density of materials at Site 15McN38 led investigators to suggest a short occupation. All of the ceramics are plain, with no decorated types present, although a single scalloped plate rim was recovered (Table 2). A calibrated radiocarbon assay dates Site 15McN38 to the seventeenth century (Figure 3), but this has been discounted based on the ceramic assemblage, which appears to date around A.D. 1200-1300 (Butler 1991).

HAMLETS

Test excavations have been conducted at two hamlets, the Steam Site (15McN24) by crews from Southern Illinois University (Butler et al. 1981), and Crawford Lake (15McN18), by crews from the University of Illinois at Urbana-Champaign (Mehrer 1991).

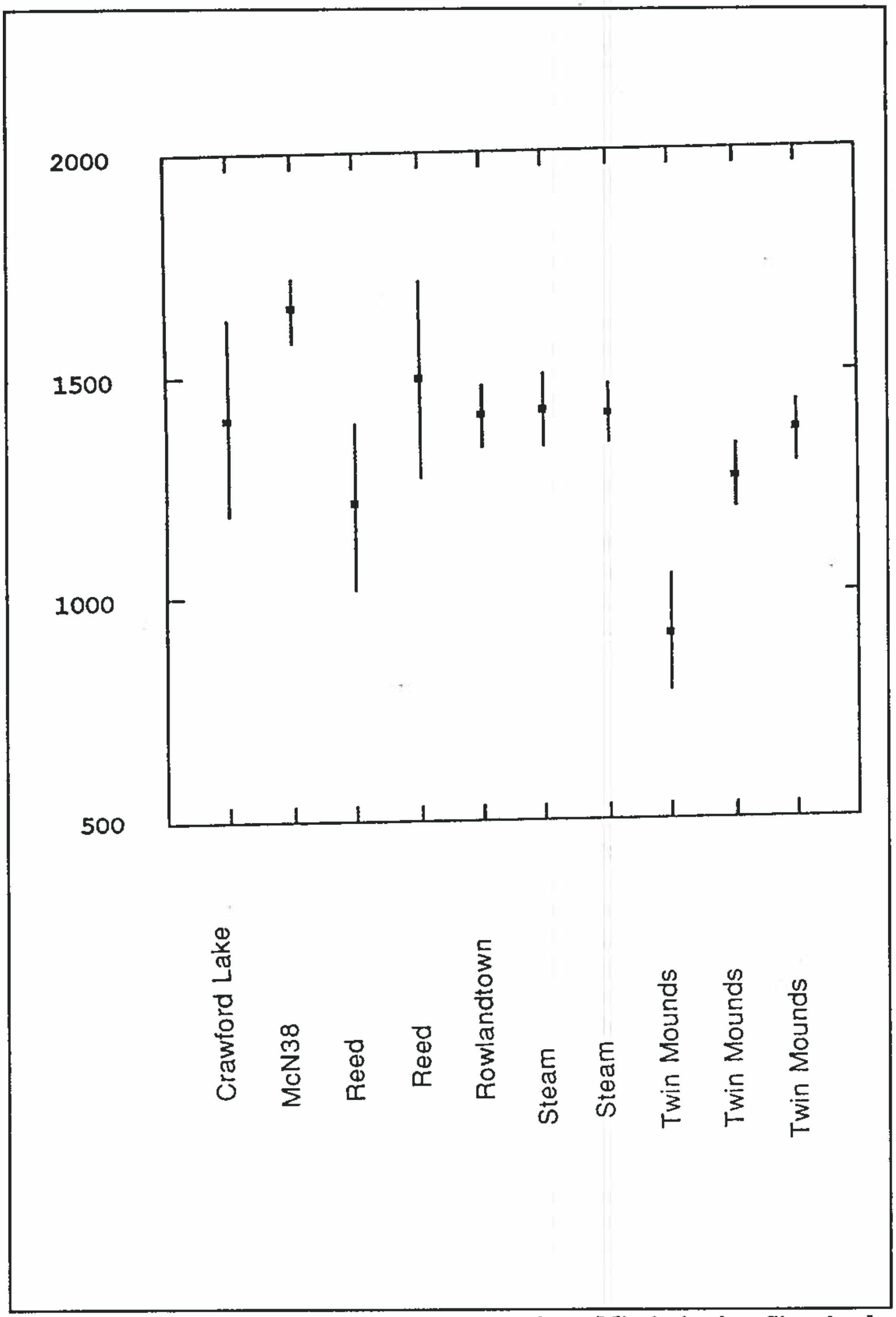

Figure 3. Calibrated Radiocarbon Assays from Mississippian Sites in the Study Region.

Table 2. Mississippian Ceramics Present at Ballard-McCracken County Excavated Sites.

Ceramic Type	Site 15McN38	Crawford Lake	Steam	Rowlandtown	Twin Mounds
Mississippi Plain	X	X	X	X	X
Bell Plain	X	X	X	X	X
Kimmswick Fabric Impressed		X	X	X	X
Old Town Red			X	X	X
Wickliffe Thick				X	X
Matthews Incised			X	X	X
O'Byam Incised				X	X
Other Mississippian Incised				X	X

X denotes presence of type

The Steam Site is located west of Paducah near Site 15McN38. The site encompasses roughly a half hectare and contains two distinct areas of artifact concentration. Examination of those two areas revealed numerous wall trenches and pits, suggesting a longer and more intensive occupation at the Steam Site than was documented for Site 15McN38. The ceramic assemblage is primarily plain, although Kimmswick Fabric Impressed, Old Town Red, and a small amount of Matthews Incised ceramics were recovered (Table 2). The two calibrated radiocarbon dates obtained from this site indicate a potential occupation ranging from A.D. 1275 to 1500 (Figure 3). Based on the ceramics, an occupation between A.D. 1200 and 1300 is suggested.

Crawford Lake is located on the banks of an oxbow lake south of the Ohio River and west of Paducah. The Mississippian occupation at the site is about 1 hectare in size. Limited excavations have revealed the presence of a Mississippian midden, wall trench structures, and pit features. The ceramic assemblage is plain, consisting of Mississippi, Bell Plain, and Kimmswick Fabric Impressed sherds (Table 2). One radiocarbon assay from the Mississippian component of this site was submitted, but unfortunately the sample was so small that it resulted in a large standard deviation (Mehrer 1991). The assay yielded a calibrated date of A.D. 1404 $\pm$220 (Figure 3). Based on the ceramic assemblage, the lower end of the estimate, about A.D. 1200-1275, is closer to the actual date of the Mississippian occupation.

Another Mississippian site in the area is Reed (15McN51). Based on the site area as defined, Reed is rather large, and perhaps represents a village-sized site. It is located between Paducah and Massac Creek. Excavations conducted there have not been reported to date, but two components were encountered. Earliest was a Lewis-like Woodland occupation (Railey 1990:262). Similar occupations elsewhere date to between A.D. 600 and 800 (Muller 1986). Two radiocarbon samples from the Mississippian occupation were assayed, both yielded dates with large standard deviations (David Pollack, personal communication 1991). The first is A.D. 1210 ±180 and the second is A.D. 1490 ±220 (Figure 3), both are plausible dates for the area. Until more information is available, little else can be said about the Reed Site.

SECONDARY CENTERS

Data on secondary centers in the lower Ohio River Valley have been obtained from a number of sites, and several characteristics can now be noted. Typically, this site type is limited to one to three mounds, most of which functioned as substructural platforms, although at least one, at Tolu, was a burial mound (Webb and Funkhouser 1931). Plazas are generally present only at the larger secondary centers such as Twin Mounds and Tolu. Situated around the mounds was a densely packed habitation area, which at two of the sites ringed the mound-plaza area in a semicircle. The occupation at each was both dense and continuous enough to create a midden between 80 and 200 cm in depth. The main occupation of all these sites appears to start at A.D. 1200 and last to A.D. 1400-1500. Antecedent terminal Late Woodland or emergent Mississippian occupations are uncommon at these sites. Based on this line of evidence, it is unlikely that the mound and plaza complex grew from an earlier Mississippian occupation at these sites.

Aside from Wickliffe (15Ba4), all Mississippian mound sites in Ballard and McCracken counties have one or two mounds and habitation areas. Excavations have been conducted at two such sites, Twin Mounds (Kreisa 1988a) and Rowlandtown (Kreisa 1991).

The smaller of the two is Rowlandtown, which is located on the western edge of Paducah on a terrace along Perkins Creek. The site measures a little more than 3 hectares in size, and has been greatly impacted by the modern use of the locale as a farm, greenhouse, and steel mill. The site contains one mound and a fairly substantial habitation midden, up to 80 cm thick. Portions of wall trench structures have been found in the small area excavated to date. The ceramic assemblage contains Mississippi Plain, Bell Plain, Kimmswick Fabric Impressed, and Old Town Red ceramics, as well as varieties of O'Byam Incised and Matthews Incised (see Table 2). It is interesting to note that the incised types were found at all levels of the midden (Kreisa 1991). The one assay from the site, taken from a beam uncovered in the upper portion of the midden, dates to around A.D. 1400, not out of line with the ceramic assemblage (see Figure 3). Based on the ceramics, the occupational span at the site could range from A.D. 1200 to 1400.

To the west of Rowlandtown is Twin Mounds, located on the Ohio River floodplain opposite its confluence with the Cache River in southern Illinois. Twin Mounds is larger and more complex than Rowlandtown. The site consists of two distinct areas: 1) a Mississippian mound complex to the north; and 2) a Late Woodland/Emergent Mississippian village to the south. Excavation units were placed in both areas (Kreisa 1988a).

The northern area consists of two platform mounds and an adjacent plaza, with a semicircular habitation area to the south and west of the mound and plaza complex. The midden in this area is up to 2 m deep, indicating a long-term and intensive Mississippian occupation of the site. Represented in one test unit were repeated occupation floors, numerous wall trenches, pit features, and hearths. Two radiocarbon assays, one from an upper and the other from a lower level of the midden, suggest an occupation span of A.D. 1200-1450 (see Figure 3). The ceramics reflect this sequence. The assemblage at the lower levels consists mainly of Mississippi Plain, Bell Plain, Old Town Red, Wickliffe Thick, and Kimmswick Fabric Impressed ceramics, with few decorated sherds present (see Table 2). The upper levels, in addition to the types found in the lower levels, contains a wide variety and larger percentage of decorated types (see Table 2). Spatially, the occupation associated with the late Mississippian decorated sherds expanded southward, indicating that an increase in site size and population took place sometime after A.D. 1300. Virtually no Terminal Late Woodland-Emergent Mississippian or early Mississippi period materials were found in the northern part of the site.

The southern part of the site contains features and a single-set post house dating from ca. A.D. 800 to 1000 (see Figure 3), based on a radiocarbon assay and cross-dating of the ceramics (Kreisa 1988a). A post-A.D. 1300 occupation was also documented in the upper levels of the unit excavated there (Kreisa 1988a). The Late Woodland/Emergent Mississippian material compares quite favorably with that from southern Illinois (Kreisa and Stout 1991). An interpretation of the stratigraphic sequence from the test excavation unit indicates that there was an abandonment of the southern part of the Twin Mounds locale around A.D. 1000, with the establishment of a mound, plaza, and habitation area to the north by A.D. 1200. The northern area grew in population sometime after A.D. 1300, and expanded to include both the northern and southern sections of the site. The entire site area appears to have been abandoned between A.D. 1450 and 1500. There does not appear to be a developmental sequence from the Terminal Late Woodland-Emergent Mississippian component to the post-A.D. 1200 Mississippian occupation of the site. These components are temporally and spatially separated. Rather, the site appears to have been abandoned between the Emergent Mississippian and post-A.D. 1200 Mississippian occupations.

DISCUSSION

Based on the results of the past decade of investigations at Mississippian sites in Ballard and McCracken counties, a preliminary model on the nature of the Mississippian occupation can now be proposed. In creating this model, two lines of evidence are emphasized: first, the available radiocarbon dates for Mississippian occupations in the two counties; and second, evidence concerning potential interpretations of the Mississippian settlement system in this region. Within this latter discussion I am mainly concerned with the issue of whether the sites represent independent chiefdoms, secondary chiefdoms, or were part of the Kincaid chiefdom.

RADIOCARBON EVIDENCE

At present, apart from the Wickliffe Mounds assays, nine radiocarbon dates from Mississippian sites in Ballard and McCracken counties are available (see Figure 3). One, from 15McN38, is considered too late given the material with which it is associated (Butler 1991), and three others (one from Crawford Lake and two from Reed) have large standard deviations that greatly limit their interpretive utility. The remaining five dates range between A.D. 1262 and 1420. At one standard deviation this range is increased to A.D. 1192 and 1505. These radiocarbon date ranges are in agreement with the ceramic assemblages from the sites, and support an occupational range of A.D. 1200 and 1450 for Mississippian populations in this area. Absent are dates between A.D. 1000-1200, or evidence of an early Mississippi period occupation. Earlier occupations, such as those at Twin Mounds, have radiocarbon and ceramic evidence that dates the complex to the Terminal Late Woodland-Emergent Mississippian periods or before A.D. 1000.

SETTLEMENT SYSTEMS

Mississippian mound sites along the Lower Ohio River Valley may potentially have been part of one of three different settlement system configurations. The role of these sites could have been as: 1) the main towns of small independent chiefdoms; 2) secondary centers of the Kincaid chiefdom; or 3) secondary centers of secondary chiefdoms created by the influence of Kincaid. In order to identify which of these factors contributed to the creation of the Lower Ohio River mound sites, a test of these three possible settlement systems is necessary. Ideally, an entire range of settlement system data is needed (Price 1978). Those data that are available concerning the role of the secondary centers are used here in an attempt to determine their sociopolitical context.

Seen in terms of a settlement system, if a group of sites represent an independent polity, there should be little evidence of outside influence. The sites should be part of a complete settlement system, as viewed from the region as a whole. If an incomplete settlement system has similarities to a nearby chiefdom in terms of material culture, site plan, structures, and settlement patterns, it is plausible that the sites are part of a larger chiefdom. The primary characteristic of settlement systems in the Confluence Region is the Mississippian town with its multiple mounds, plazas, large habitation areas, and palisades.

Alternatively, powerful chiefdoms such as Kincaid or Angel may have manipulated external populations in an attempt to control strategic resources or areas. The final result of this process may have been the transformation of non-chiefdom groups into dependent secondary chiefdoms. Contact between a chiefdom and surrounding non-chiefdom groups is typically a two-way interaction. Non-chiefdom leaders may try to increase their power by interaction with a chiefdom through military, trade, or other forms of support. In return, the chiefdom obtains easy access to raw materials, tribute, or other avenues of co-operation (Price 1978). Such interaction can also be used to neutralize potential competitors.

The result of these interactions depends ultimately on the goals of the chiefdom. If the goal is to control and increase the availability of a given resource, chiefdoms may stimulate internal population growth in order to intensify production in the newly created secondary chiefdom. The transformation of the non-chiefdom group into a secondary chiefdom may involve the creation of institutions to regulate the newly increased production. Such a transformation would require local ecosystemic support, in that production must be capable of intensification. But this can only succeed if the target area, now a secondary chiefdom, is energetically capable of supporting new institutions. If the secondary chiefdom is unable to provide such support, it will prove to be inherently unstable.

In the secondary chiefdoms, the creation of these new institutions may be archaeologically visible by a sudden site stratification, including contrasts in site plans, size, elite residences, and the elaboration of the contents of certain communities. Elite residences may signal the differential ability of certain individuals or co-residential groups to divert a portion of production into private use, in other words, to have differential access to resources. The creation of new institutions may also be evidenced by the presence of non-local forms of buildings or site plans on previously existing sites (Price 1978). A chiefdom such as Kincaid may have manipulated a secondary chiefdom in the study area for defense against the polities along the Mississippi River, to help in the control of trade at the confluence of the Mississippi and Ohio rivers, or to obtain foodstuffs or other goods as tribute.

The final possible settlement system model is that the Mississippian sites of Ballard and McCracken counties may represent an expansion of the Kincaid chiefdom and its hinterland communities at about A.D. 1200 (Butler 1991). Before this date, mound construction at Kincaid was infrequent and few sites were occupied in the Black Bottom (Butler 1991). Butler views the period of ca. A.D. 1200-1300 as the peak of secular power and sociopolitical integration at Kincaid. It was during this time that most of the small sites surrounding Kincaid in the Black Bottom were occupied. After A.D. 1300, Kincaid continued to be occupied as evidenced by the large amount of decorated ceramics found at the site, but mound construction decreased. Fewer sites surrounding Kincaid were occupied (Butler 1991). By A.D. 1400-1450, Kincaid ceased to function as a mound center, and a redistribution or reduction of the population took place.

It is most probable that the Ballard-McCracken County Mississippian sites are not in and of themselves independent chiefdoms. One part of all settlement systems in the Confluence Region, the Mississippian town, is not present in Ballard and McCracken counties outside of Wickliffe (15Ba4) on the Mississippi River to the southwest. It is also unlikely that the Ballard-McCracken County sites were part of secondary chiefdoms. Not only do these sites not form a complete settlement system, there is also no record of a predecessor population that could have been co-opted into forming a chiefdom. As discussed above, there is at least a 200-year interval during which the sites were unoccupied before the establishment of the second-order Mississippian communities in the Ballard-McCracken County area. There exists evidence of local Terminal Late Woodland-Emergent Mississippian populations in the region, but little conclusive data concerning the occupation of the study area during the early Mississippi period, A.D. 1000-1200, are available. This suggests that a termination of the local, *in situ*, Mississippian development took place in these two counties.

There are three lines of evidence that support the proposition that the Ballard-McCracken county sites were part of the Kincaid chiefdom. First, the radiocarbon dates and ceramics from the Mississippian components point to an initial occupation of post-A.D. 1200, or the period of Kincaid expansionism in the Black Bottom proper. In addition, both the radiocarbon dates and the ceramics point to an occupation, at certain sites, to perhaps as late as A.D. 1450. Second, there is no link between the post-A.D. 1200 Mississippian components and Terminal Late Woodland-Emergent Mississippian occupations. This suggests that the area may have been thinly populated during the early Mississippi period. Finally, together with the Kincaid site, these secondary centers form a complete settlement system. The material culture at these sites is also similar to that of Kincaid, but it is extremely difficult to distinguish materials from lower Ohio River Valley sites from those located along the Mississippi River. Such an expansion would have led to direct control of trade routes along the Mississippi and Ohio rivers, a stronger defensive stand against nearby polities, or increased access to agricultural land and faunal resources.

It is probable that an *in situ* developmental sequence can be constructed for Ballard-McCracken County prehistoric populations to A.D. 1000, after which the area was essentially depopulated, and remained so until ca. A.D. 1200. The repopulation of the area appears to be associated with an expansion of the Kincaid chiefdom, and no doubt took place for a number of reasons. At present, there is a lack of data on the causes of these events, but two issues are critical. First, what caused the depopulation at A.D. 1000? Second, why was the area repopulated at A.D. 1200? Concerning the second issue, a number of reasons for repopulation of the study area have been advanced, from defense, to control of trade, to the need to increase the output of agriculture or meat yields.

The more difficult question to answer is why the study area was depopulated around A.D. 1000. This is a particularly strange event given that Ballard and McCracken counties contain highly productive meander belt zones that were typically selected by Mississippian populations (Smith 1978). Although no definitive answer is available at this point, several possible factors can be noted. It was during the period between A.D. 1000 and 1200 that a number of nascent polities were emerging in the Confluence Region. In such a political climate, polities would have been attempting to maximize control over their populations internally while defending against external threats. Vacant zones were noted in the Southeast during the Contact period, often acting as a buffer between polities (Swanton 1946). In that sense, the depopulation of the area may have been a response to political competition (see also Clay 1976). Alternatively, it may also have been a strategic decision by the Kincaid polity in order to maximize the efficient use of local resources, for defensive concerns, and to control its own population (Clay 1976).

SUMMARY

It appears that the Ballard-McCracken County area was incorporated into the Kincaid chiefdom during the thirteenth century and remained as such until the fifteenth century A.D. If this interpretation is correct, it points to the Confluence Region as having a rather dynamic sociopolitical construct during the Mississippi Period. Other research has pointed to a complex pattern of social systems in the Confluence Region, including the large and complex chiefdoms of Kincaid and Angel along the lower Ohio River (Butler 1991; Muller 1986), to the many small, compact chiefdoms, each represented by a town along the Mississippi River (Kreisa 1990b), to the secondary chiefdoms east of the Tennessee-Cumberland rivers (Clay 1991). With such a diversity in chiefdom forms in a relatively small area, there is great potential for investigating the rise and fall of polities, as well as their interaction. Certainly, continued research at Mississippian sites in Ballard and McCracken counties will enhance our understanding of the cycles of growth and decline of the Kincaid chiefdom.

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MOUND C AND THE MISSISSIPPIAN DECLINE: A VIEW OF CULTURE PRESERVED IN WICKLIFFE'S MORTALITY DATA

By
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ABSTRACT

Human remains from Wickliffe's (15Ba4) Mound C were examined to learn how the decline of the Mississippian Culture was reflected in mortality patterns. A life table was constructed from 231 individuals defined in interments post-dating the mound group's formal abandonment. Despite differences in grave form and historic curation strategies, no significant age or sex variation was detected. Infant under-numeration in the cemetery followed patterns observed in other late prehistoric cemeteries. The mortality probability (Qx) indicated that the opportunity for death was highest between the ages of 30 and 40 years with a mean age of death calculated at about 31 years. Only minor differences between males, females, and grave forms were noted. These results tend to reflect a more depressed mortality probability than observed in Mississippian, Woodland, or Archaic Cultures. Following a model of "Post-Mississippian" occupation of the confluence region, these data indicate that cultural activity may have changed, but not drastically enough to have grossly affected the mortality pattern within a cemetery.

INTRODUCTION

Death is generally considered as the cessation of an organism's physiological systems (Sheldon 1988). Death, however, is not purely a biological process; recognition that human mortality patterns vary by sociocultural affiliation has been a mainstay of social analysis since the mid-seventeenth century (Namboodiri 1991). This fundamental concept emphasizes that cultural behavior has a profound effect on human physiological systems. When aspects of human biology are examined, the data obtained identify as much about the subject's biocultural environment as it does of their physiology. Among archaeological populations, age and sex data preserved in human bone enable important attributes about the cemetery community to be inferred.

Angel (1969) identified paleodemography's principal goal as the reconstruction of a population's biological organization from evidence preserved in the archaeological record. These reconstructions can be facilitated through construction of a life table. A life table is a mathematical model portraying mortality conditions of a population during a particular period of time (Bogue 1969). Its use is based on the observation that all organisms must eventually die; a life table, therefore, describes life experiences members of a community pass through before their own demise (Weiss 1973). It is assumed that if all members of a particular cemetery population are exposed to the same probability of death, then an examination of mortality trends would identify when death is most likely to occur (Bogue 1969). This information is extremely useful for comparing cultural forms and understanding how they change.

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Determining the population structure of cultures represented in the archaeological record has been an integral part of understanding human adaptation to physical and cultural environments (Buikstra et al. 1986; Owsley and Bass 1979; Ubelaker 1974). In general, studies of Archaic, Woodland, and Mississippian Cultures in the Mississippi River Drainage Basin show that increases in size and longevity coincide with shifts in pathological and degenerative patterns (Adkins 1988; Frankenberg et al. 1988; Herrmann 1993; Mensforth 1990; Snow 1942, 1948; Webb and Snow 1945). These changes accompany shifts in subsistence (Armelagos and Hill 1990; Blakely 1971; Buikstra et al. 1986). Differences in the way culture affects the human frame prevent all but very generalized biological inferences to be made between major cultural groups (Blakely 1971).

Most mortality research settings have the luxury of pre-determined cultural, temporal, and geographic ranges. Mortality data often serve as an independent test for archaeological inferences obtained from other sets of information. Rarely does the cemetery serve as the only source of knowledge available about a particular group. In western Kentucky, re-examination of the cemetery found at the Wickliffe Mound Group (15Ba4) has confirmed the presence of prehistoric human activity post-dating the Mound Group's central occupation period. Although the presence of aboriginal Native Americans in western Kentucky after abandonment of the Middle Mississippian mound complexes has been suggested, little more than their presence has been detected. Mortality data preserved in the Mound C cemetery's skeletal assemblage are an avenue that can identify major trends in the late prehistoric cultural and biological environment.

THE CEMETERY'S CULTURAL AFFILIATION

Mound C and its accompanying cemetery are one component of a Middle Mississippian complex found on the outskirts of Wickliffe, Kentucky. These structures occupy the bluffs overlooking the Ohio and Mississippi River confluence. Although recognition of Mound C as a manmade feature can be traced to the late nineteenth century, documented archeological inquiry did not commence until efforts by Fain King, the site's developer, and Walter Jones of the Alabama Museum of Natural History, opened most of the mound's southern slope (Wesler 1988). King (1936) estimated that 153 individuals were encountered. No evidence has been found to substantiate that more than a cursory inventory recorded the materials encountered. These excavations were left partially exposed and largely undocumented until donation of the site to Murray State University (Wesler 1988). Archaeological investigations of the cemetery were resumed to define its cultural and geographic perimeters (Wesler 1991a, 1992). As a result, 80 additional interments were encountered. These indicate that unexcavated aspects of the cemetery are located along the mound's north, east, and western slopes (Matternes 1993; Wesler 1992).

Wickliffe's affiliation within the regional cultural sequence has emerged largely as a result of more recent investigations. Williams (1954, 1985, 1990) concluded from his analysis of the Confluence Region concluded that the Middle Mississippian Culture gradually underwent a population decline. He implied that sociopolitical change was reflected in patterns of site abandonment, population reorganization, and transformations within artifact assemblages. Lewis' (1988, 1990) interpretation of western Kentucky's artifact assemblages challenge Williams' "Vacant Quarter Hypothesis." Lewis does not view regional depopulation as analogous to area abandonment; he suggests that a Mississippian cultural presence is definable within an artifact assemblage transformation.

Aside from Mound C, Wickliffe's stratigraphic sequence does not feature a strong representation of prehistoric human activity beyond village abandonment. Wesler's (1989, 1991b) assessment of the Wickliffe deposits place it within the Dorena phase, with some materials extending into the James Bayou and Medley phases. The village occupation sequence has been divided into distinct Early (A.D. 1000-1100), Middle (A.D. 1100-1260), and Late (A.D. 1260-1350) periods (Wesler 1989, 1991c). A light scatter of ceramics, recovered during the King era, has been identified by Wesler (1991a) as evidence that aboriginal activities did not cease with abandonment of the village. The full nature of these artifacts do not define whether the models proposed by Williams or Lewis are supported at Wickliffe Mounds.

Excavations in Mound C record the presence of a number of subsurface features overlain by several small "proto-mounds" that date to the site's Middle period (Wesler 1993). These were later combined into the single platform structure referred to as Mound C. During the Late period, the mound was used as a trash pile. Most graves appear to have intruded through the mound's last known occupational deposits. This suggests that the burial accumulation phase could have terminated no earlier than final deposition of the late Wickliffe midden (Wesler and Matternes 1991).

This places the cemetery in a critical period of cultural transformation between abandonment of a western Kentucky regional center and the start of the historic period. Grave goods are extremely sparse within the cemetery and display no useful temporally diagnostic features. Radiocarbon dates are currently unavailable; as such, the best estimate encompasses a period of about 200 years (ca. A.D. 1350-1550), largely encompassing Williams' temporal estimate of area abandonment. Although it is unclear whether the cemetery actually is a population occupying the "Vacant Quarter," it minimally represents a community subsisting during a time of Mississippian cultural decline. Cultural patterns observed in the mortuary data would be expected to reflect conditions present during Mound Group abandonment/post-abandonment period.

In western Kentucky, regional mortality data from numerous Mississippian sites have been recorded, but only a few have been investigated by the anthropological community (Edging 1985; Funkhouser and Webb 1932; Stout 1987; Sussenbach and Lewis 1987; Weinland and Gatus 1979). Although human remains are frequently encountered, they are often poorly preserved and too under represented for use in constructing a valid demographic profile. As a result, Mississippian skeletal biology has been limited to summary analyses of the few infants and fragmentary adult remains that have been encountered (Allen 1986; Cooper-Cole et al. 1951; McGill 1985). At the only notable exception, Tinsley Hill (15Ly18B), Schwartz (1961) reported encountering a large stone box cemetery containing 82 interments. The recovery of historic artifacts at Tinsley Hill suggests that the mortuary accumulation phase may have extended to more recent times than the period coinciding with the Mississippian cultural decline at Wickliffe.

Across the Mississippi River, several late prehistoric cemeteries have been investigated. More than 50 burials were recorded in Hearne's Mound 1, but poor preservation precluded any skeletal data recovery (Klippel 1969). Excavations at the Turner site (23Bu21A) produced an impressive 118 individuals; however, preservation limited demographic analysis to only 54 percent of the sample (Black 1979). Powell's (1990) analysis of the Nodena sample indicated a curation bias toward complete and pathological specimens, whereas Morse and Morse (1983) identified that private collections, such as those from Beckwith's Fort (23Mi2), are poorly provenienced. Other samples, like those at St Francis Bayou or Snodgrass (23Bu21B), are too small to support construction of accurate demographic profiles (Black 1979; Morse and Morse 1983).

Within the Mississippi drainage system, late prehistoric cemeteries portray a fluctuating relationship between age and life expectancy. Blakely's (1971) examination of the Dickson Mound skeletal series documents that a high incidence of infant mortality was followed by a relatively low juvenile death rate. Mortality gradually increased among adults as the sample aged. Samples from Turner (Black 1979), East St. Louis Stone Quarry (11S468) (Milner 1983), Kane (11Ms104) (Milner 1982), and Averbush (40Dv60) (Berryman 1981) produced similar results. Since these cemeteries do not exhibit the physiographic or cultural conditions found in western Kentucky, their results can only serve as a general model for what might be expected in the Mound C skeletal sample.

There is almost no information available documenting how any populations remaining in the area during or after the decline of the Mississippian cultural pattern were affected. Examination of the Wickliffe skeletal sample has the potential of indicating how agrarian populations living in the Central Mississippi Valley were impacted by the decline of this late prehistoric cultural complex.

SKELETAL DATA COLLECTION

Since all individuals in a community will eventually die, every member's death contributes to learning how cultural patterns affect mortality. Increased ability to draw data from this "mortality pool" improve precision in reconstructing the cultural pattern. Optimally, construction of realistic demographic profiles should include all individuals constituting the biological population. Unfortunately, mortality data obtained from most cemetery accumulations are incapable of meeting this requirement (Cadien et al. 1974). There are also plenty of taphonomic reasons why an individual, or age and sex data, may not be represented adequately in an archaeological assemblage such as the Wickliffe sample. It is recognized that the precise answer obtained from examining an entire biological population is, at best, reduced to an estimate. This approximation is only as valid as the information obtainable from a skeletal assemblage. Data acquisition was aimed at maximizing information retrieved in order to increase the precision of this estimate. Every archaeologically definable individual encountered in Mound C's mortuary sequence was included in this project.

Human bones in the cemetery were not uniformly distributed throughout the facility, rather they resulted from discrete mortuary activities, defined as burials. Interments accomplished before the deceased reached advanced degrees of decomposition were represented by supine articulated skeletons. These extended burials constituted 78 percent of the demographic sample. Undisturbed, completely excavated extended interments provided the greatest information recovery. Human remains in which advanced decomposition reduced the body form to disarticulated skeletal elements comprised the remaining 22 percent of the sample. These bundle burials represent cultural decisions to retain the body form beyond or after a period of soft-tissue reduction. Morphologically, bundle burials are rectangular dense concentrations of bones. These remains are often very fragmentary, suggesting that they had been exposed for some time. Since bundled interments often contain elements from several individuals, it is difficult to tie any particular skeletal element to a single individual. They typically represent the least amount of information recovered for an individual.

Burials were examined independently to determine the age and sex of each individual present. The Minimum Number of Individuals (MNI) for each interment was determined by counting the number of duplicated elements and contrasting these across age and sex differences.

An inventory of skeletal elements excavated by the Wickliffe Mounds Research Center (WMRC) served to identify the number of individuals in each burial activity; however, definition of the MNI from the loose, out-of-context remains in the King excavation required a considerably greater amount of data resolution. Clarifying the number of archaeologically verifiable individuals present followed procedures outlined in Matternes (1992a). Each individual identified as a component of the cemetery assemblage underwent further analysis to determine sex and approximate age at death. Optimally, evaluations of age and sex parameters are conducted using techniques that could be uniformly applied to the entire population; however, within the Mound C skeletal sample no single technique could be found that was capable of evaluating more than half of the total sample. As a result, age and sex evaluations required the use of a variety of methods in order to provide useable demographic information (Matternes 1994). Ages for infants, children, and adolescents were determined by examination of dental and skeletal development, whereas age estimates for adults concentrated on evaluations of the general biological deterioration of the skeletal frame. Sex was determined for adults and older adolescents using a composite estimate, based on pelvic, cranial, and limb morphology.

Optimal age estimates can clearly place an adult individual within a 5 or 10 year interval, and children can often be classified to within a year of death. This creates suitable mortality profiles for each successive period of life. Unfortunately, poor skeletal representation in the Wickliffe cemetery tended to reduce the visibility of age-sensitive skeletal morphology. For those whose age range spanned more than one age cohort, attention was paid to the distribution of man-years within each category. Following Asch (1976), the age representation of these individuals was divided into proportions and distributed between cohorts according to the number of man-years common to both the age range and the category.

Determination of an individual's sex involved reducing the independent estimates obtained from various skeletal observations to one of two categorical variables - male or female. The representation of individuals with probable sex estimates was divided into thirds and distributed with two-thirds of the representation added to the sex thought to be expressed and the remaining third included with the opposing category. Representations from individuals of indeterminate sex were divided in half and added to both male and female categories.

CURATION BIAS

All human remains found in Mound C were examined. Numerous skeletal elements were encountered whose original provenience was lost as a result of historic and prehistoric disturbance. Evidence has been presented by Matternes (1992b, 1993) indicating that non-site-affiliated human bone was used to enhance the cemetery exhibit's visual impact and that aboriginal cross-cutting through pre-existing graves transposed the location of some skeletal material. Since inclusion of these remains would artificially inflate the number of individuals present, questionable accumulations were removed from the demographic sample. Inventory records indicate that a minimum of 231 individuals could be verified as part of the archaeological assemblage. One hundred and ninety-five adults, consisting of 104 males and 91 females, were apportioned; the remaining 36 skeletons were classified as subadults.

Most demographic surveys pool individuals into a single sample to obtain the most reliable picture of how a community was structured. Although elimination of historically questionable accumulations of human bone eradicated the effects of intrusion into the sample, it did not remove all biases. Mound C's archaeological skeletal assemblage possesses two distinct sub-samples: one excavated during the 1930's (King sample) and the other representing more recent work by the WMRC sample.

These two samples have been subjected to drastically different curation strategies. The King sample was exposed and has remained on the ground surface for over half a century. Large quantities of loose, unassociated skeletal material indicate that the cemetery's pristine deposits had clearly been compromised (Haskins 1990). The WMRC materials, on the other hand, were curated under more stringent conditions. Materials not examined within days of exposure were stored in the WMRC laboratory. Analysis usually occurred within a short period after exposure. Data loss is believed to have been considerably less among the WMRC skeletons than the King sample. Differences between the near pristine WMRC and compromised King samples were recognized as avenues for curation biases to enter this investigation. As noted earlier, data gathered from extended burials tended to be slightly more complete than information acquired from the bundled sample; pooling these groups to test for differences between curation samples could potentially identify the wrong causal agent. This additionally required determining whether age differences were present between grave forms.

Although there is little information present to support this concept, hypothetically, the drastic differences between pre-burial body treatments could indicate the presence of two distinct social entities. It cannot necessarily be assumed that burials of differing treatments would possess the same mortality distributions. The number of burials present suggests there are important differences within the cemetery with a small proportion of the community segregated for additional funerary treatment. In many cultures, the application of additional manpower can be translated into differences in social affiliation (Miles 1965). Mississippian communities have traditionally been viewed as ranked societies, consisting of elite and more plebeian social orders (Peebles and Kus 1977). These groups typically display divergent burial, health, and disease patterns that reflect sociocultural differences within their community (Langdon 1989; Powell 1988). Despite burial in the same location (Mound C), it is possible that differences in body treatment may reflect differences in social ranking. It is tempting to view the small number of bundled interments as evidence for an elite; computation of the MNI for each burial form, however, indicates that the divergence is not as extreme as it appears. One hundred and forty-one individuals were represented among the extended interments, and 90 were present in the bundled burials. Although these figures do not preclude the possibility that social differences are represented by differing burial treatments, the high percentage of the population (39 percent) interred in the least common burial form would suggest that either the community was composed of a very high number of elite individuals or that bundling implied some alternative social affiliation besides rank. Segregation, of any type, is suggested as a likely candidate for expressing social rank. Wesler (1990) has proposed that lavishly adorned interments placed in other mounds at Wickliffe represent elite burials.

This does not invalidate the possibility that mortality differences are present between burial forms. To determine whether curation and grave form affected age distribution, age estimates were sorted by grave form and curation sample. These graves were then compared. The cumulative proportionate differences between like age categories were examined for statistically valid differences using a Two-Sample Kolmogorov-Smirnov test (Thomas 1976).

In Test 1, grave forms were pooled within samples to learn whether overall distribution between the WMRC and King samples were the same (Table 1). "D" was calculated to be 0.222; this value indicated that the samples were virtually identical (Table 2). The probability that variation was random was calculated to be 0.979. This value indicated that no strong biases were present.

Tests 2 and 3 were conducted to learn whether extraneous variability was the result of differences in grave form. In Test 2, extended and bundled burials obtained from the King sample were examined to learn whether the age distributions were diverse. The resulting "D" of 0.555 indicated that the samples were very similar. The probability that variation between samples could be attributed to random occurrence was calculated to be 0.124. Material obtained from within the King sample could therefore be considered to be homogeneous in terms of age and grave form. Test 3 examined the same relationship as reflected in the WMRC sample. The "D" statistic had a value of 0.555 and a probability of 0.124. These results were interpreted to mean that each curation sample was the same. The identical results obtained from Tests 2 and 3 suggest that spatial differences between the King and WMRC samples have little to no influence on the data. It was concluded that although curation and grave form differences may have influenced the distribution of age within each subgroup, its overall effect did not significantly influence age representation within the assemblage.

Distributions between WMRC and King sample extended burials were compared to learn whether age distribution was uniform within grave forms. In Test 4, "D" was calculated at 0.333, suggesting that the samples were very comparable. The probability was calculated to be 0.699, indicating that variability between samples was probably random. Test 5 compared bundle burials from both samples. The "D" statistic again provided a value of 0.333 and a probability of 0.699, indicating that the largest amount of variability within the age structure was found between extended and bundled treatments. These differences are consistent between both curation samples; however, they lack sufficient probability to indicate any strong bias. Agents biasing age variation cannot be distinguished from random variability.

Frequencies of male and female representation within curation and grave form samples were tabulated to learn whether distribution of the sexes varied against expected frequencies (Table 3). The chi-square test of independent samples is well suited to accommodate the categorical nature of these data (Zar 1984). Separate tests were conducted to determine a) if the distribution of males and females varied significantly between the curation samples; b) whether sex differences could be identified within grave forms; and c) whether grave form and curation sample varied within each sex. The results of each test showed no statistical significance at the 0.001 level (Table 4). It can be confidently stated that sex differences do not appear to have been affected by how materials were maintained historically or during aboriginal times. No strong evidence could be found to support segregation of any aspect of the cemetery. Pooling the entire cemetery sample thus realistically defines the mortality pattern created by the Mound C population.

Table 1. Age Distribution by Curation and Grave Form.

Context/ Form	Age Group (Years)								
	0-1.9	2-11.9	12-17.9	18-20.9	21-29.9	30-39.9	40-49.9	50-64.9	65-80
King									
Ext*	0.67	6.05	2.82	2.74	10.50	16.14	13.86	13.72	6.87
Bun.	1.35	6.21	4.67	2.82	4.30	7.90	8.74	6.98	6.89
Pooled	2.02	12.26	7.49	5.56	14.80	24.04	22.60	20.70	13.76
WMRC									
Ext*	1.05	3.06	2.05	2.43	9.34	15.93	13.79	9.17	8.80
Bun.	0.42	3.20	1.40	1.21	4.17	7.86	7.90	6.34	6.25
Pooled	1.47	6.26	3.45	3.64	13.51	22.79	23.69	15.51	15.05

* Ext.=Extended, Bun.=Bundled

Table 2. Age and Curation Differences in Mound C's Age Distribution Data Revealed by Komolgorov-Smirnov Testing.

Test	D	Probability
1. (King Pooled/WMRC Pooled)	0.222	0.979
2. (King Ext/King Bun)	0.555	0.124
3. (WMRC Ext/WMRC Bun)	0.555	0.124
4. (WMRC Ext/King Ext)	0.333	0.699
5. (WMRC Bun/King Bun)	0.333	0.699

* Ext=Extended; Bun=Bundled

Table 3. Sex Distribution by Curation and Grave Form.

Context/Form	Male	Female
King		
Extended	33	31
Bundled	22	16
Pooled	55	47
WMRC		
Extended	30	29
Bundled	18	16
Pooled	48	45

Table 4. Age and Curation Differences in Mound C's Sex Distribution Revealed by Chi-Square Testing.

Test	Chi Square Value	Degrees of Freedom	Probability
WMRC Pool/King Pool	2.04	1	0.137
Female: King by Form/WMRC by Form	0.033	1	0.859
Male: King by Form/WMRC by Form	0.469	1	0.493
Bundled: King by Sex/WMRC by Sex	0.195	1	0.658
Extended: King by Sex/WMRC by Sex	2.939	1	0.086

LIFE TABLE CONSTRUCTION

Fluctuations in population morphology have a considerable influence on the structure of a cemetery sample. Normally, rates of migration, fertility, and mortality can be factored into an analysis. Among archaeological samples, an absence of evidence to support any estimation of these features makes correcting for these variables impossible. The Stable Population Theory is commonly used to ground archaeological demographic models (Acsadi and Nemeskeri 1970; Asch 1976). This theory assumes that all population rates are fixed; the cemetery sample is considered to have no population growth, equal birth and death rates, an absence of migration, and a lack of population size constraints (Acsadi and Nemeskeri 1970; Bogue 1969; Weiss 1973). Populations rarely achieve such a state of ubiquitous balance, and the assumptions of this theory are accepted as known inaccuracies. Holland (1991), however, has suggested that this error may not fluctuate strongly from conditions present during the late prehistoric period. From a more practical perspective, universal acceptance of the Stable Population Theory by paleodemographers enables a comparable medium to be applied to diverse populations.

The age at death among individuals in the sample was used to track mortality and survivorship through a life table. All calculations were based on the number of deaths recorded in each age cohort (Dx). For each cohort, the percentage of deaths (dx), survivorship (lx), probability of death (Qx), total number of years lived (Lx), total number of years lived after leaving (Tx), and life expectancy (Ex) were calculated, following the equations presented in Ascadi and Nemeskeri (1970).

A life table was constructed for the entire cemetery sample (Table 5). It was immediately observed that the percentage of deaths (dx) among subadults under age 12 years approached zero. Graphic representation of dx portrayed the low incidence of infant mortality (Figure 1). Infant survivability is extremely dependent on the quality of health care available and generally reflects the health of the community as a whole (Quine 1990). From these results one would have to infer that the population had created an extremely healthy environment and provided excellent natal care. A review of mortality results obtained from both industrial and pre-industrial societies by Coale and Demeny (1966) noted that like conditions do not occur until a population adopts a more industrialized cultural form. Blakely (1971) reported that sub-adults (<10 years) of the Dickson Mounds population were included in the cemetery and comprised almost 65 percent of the entire sample. Only about 11 percent of the Wickliffe cemetery is represented by a similar age complement. The possibility of infant under-numeration was considered as a likely explanation.

Table 5. Life Table Constructed from the Entire Mound C Sample.

Age	Dx	dx	lx	Qx	Lx	Tx	Ex
0-1.9	3.97	0.017	1.000	0.014	1.883	30.970	30.97
2-11.9	18.76	0.081	0.983	0.082	9.429	29.092	29.59
12-17.9	12.38	0.053	0.902	0.058	5.165	28.150	31.20
18-20.9	9.22	0.040	0.849	0.047	2.404	22.285	27.07
21-29.9	28.32	0.123	0.809	0.152	6.652	20.581	25.44
30-39.9	47.84	0.208	0.686	0.303	6.761	13.929	20.30
40-49.9	44.30	0.180	0.478	0.376	3.841	8.168	17.087
50-64.9	36.19	0.157	0.298	0.526	3.270	4.327	4.62
65-80	28.82	0.125	0.141	1.000	1.057	1.057	1.198

Mean Age at Death: 30.97. Crude Death Rate: 32.28.

Cultural segregation of infant burial areas from adult cemeteries has been observed in graveyards formed throughout the Midwest's late prehistoric period (Buikstra et al. 1986). Similar findings have been reported at the Campbell (23Pm5), Turner, and Averbush sites (Berryman 1981; Black 1979; Holland 1991). At Wickliffe, village period houses and infant burials are encountered in similar portions of the site. Robinson's (n.d.) examination of non-cemetery infant burials concluded that none of these subadults could have developed much beyond the age of two years. These practices suggest that age dependent complementary mortuary deposits were formed by both village-occupation and post-occupation mortuary behavior patterns. Abandonment of the village does not equate with abandonment of this aspect of cemetery patterning.

As predicted by Moore et al. (1975), infant under-numeration grossly exaggerated subadult survivorship estimates, but affected little else. Percentages of individuals dying in a given cohort (dx) demonstrate a mortality pattern similar to that of other late prehistoric groups (see Figure 1). Death remains relatively uncommon among young adults. Its effect on the population gradually increases after individuals reach age 21 years. Peak incidence for death is found among the 30 to 40 year-old cohort with more than 20 percent of all deaths recorded. A mean age of death of 30.97 years indicates that the cumulative loss of younger members of the population was substantial enough to outweigh the effects of attrition due to advanced age. Selective pressures on the population were minimized to a point where members of the culture were able to reach

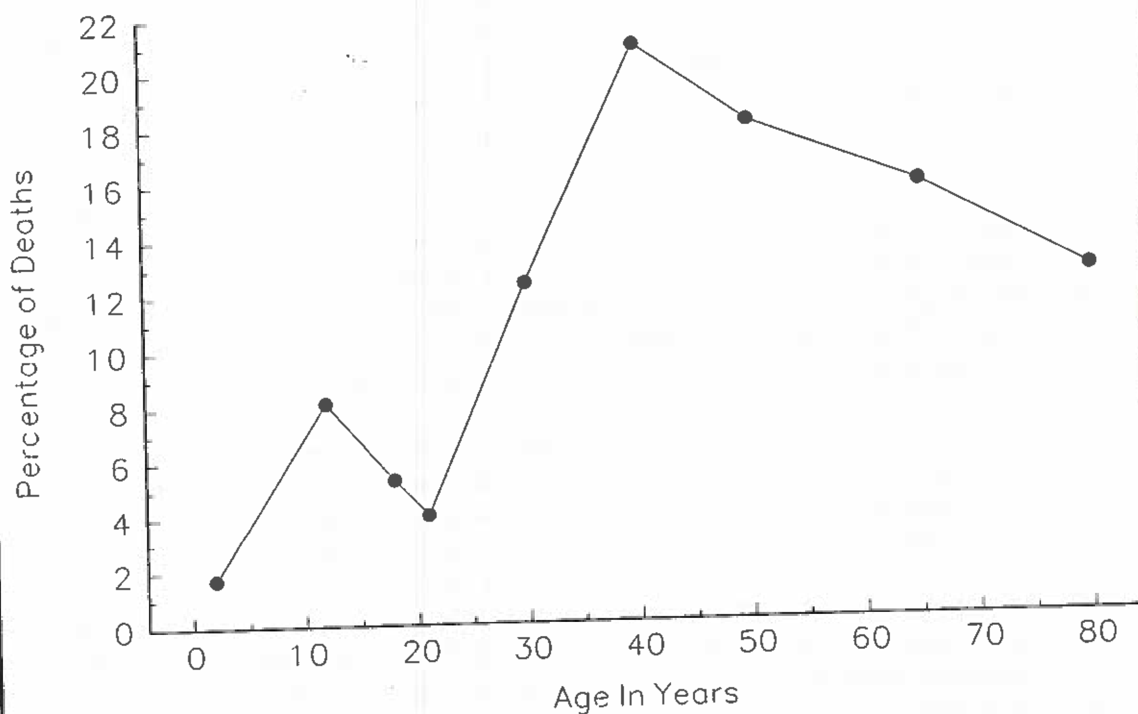

Figure 1. Mortality Curve (Dx) for the Mound C Sample.

were able to reach old age. People buried within the cemetery tend to represent older aspects of the burial community's population structure. More than 65 percent of the representative population was aged greater than the mean age of death. In order for an individual to have survived to this point, they would have had to pass through all previous age cohorts. This means that the living population would have contained a great number of younger adults.

The proportion of individuals surviving to an older age cohort (lx) indicated that rates of survival were extremely high for individuals under the age of 30 years (see Table 5). The probability of dying within a cohort (Qx), however identifies that the risk of death changes between young adulthood and middle age. Comparison of Qx to Weiss' (1973) non-western model indicates that adulthood is more perilous among adults than seen in most cultures (Figure 2). From this chart, it can be demonstrated that adolescence is the least likely time to die. Non-western cultural relationships between age and mortality show a gradual curve that increases with age once puberty is reached. Adolescents in Mound C, however, display a decrease in probability of death. This indicates that factors other than age may be influencing the age-mortality relationship. Steady increases in the chance of death do not commence until full maturity (age 21 years) is reached. It would appear that the selective pressures that result in an adult mortality curve have managed to be displaced. When comparing these phenomena to the model life table (and the Qx of cultural groups presented below), the possibility that Wickliffe's teenagers may be stronger and healthier than most cultural forms is a reasonable explanation. It can also be suggested that adult activity patterns may not have extended into the pre - adult Acceptance of adult responsibilities may been postponed until developmental maturity was completed. Although a third alternative, adolescent under-numeration is a possibility, no archaeological or ethnographic evidence could be found to support this possibility.

Values for Lx, the total number of years lived within a cohort, approximate the decline seen in the survivorship curve, produced by lx; these data indicate that age-related life experiences are most commonly shared among adults before they reach age 30 years (see Table 2). The least amount of common life experience occurs after age 65 years. The total number of years lived after leaving the cohort (Tx) shows an abrupt drop during adolescence. After reaching age 30 years, adults exhibit a more gradual decline. The least amount of common life experience within the population is found among the older individuals; although the population tends to reflect a significant older adult composition, extreme old age was a phenomenon shared by only a small portion of the sample. This indicates that extreme old age was achieved by only a small portion of the living community. Examining the different life expectancies by age group identified a gradual decline once age 20 years was passed. These data would generally suggest that passage to adulthood served to increase the amount of selection against the individual.

The mortality data were also assessed to see whether life histories differed between males and females. Data obtained from life table construction indicated considerable uniformity between sexes (Tables 6 and 7). Adults from both sexes appear to die on average around age 26 years. Examination of life tables constructed on the basis of grave form produced nearly identical results. Patterns of behavior that might have been represented by differing sexes or grave forms do not appear to have been profound enough to have influenced the community mortality rate.

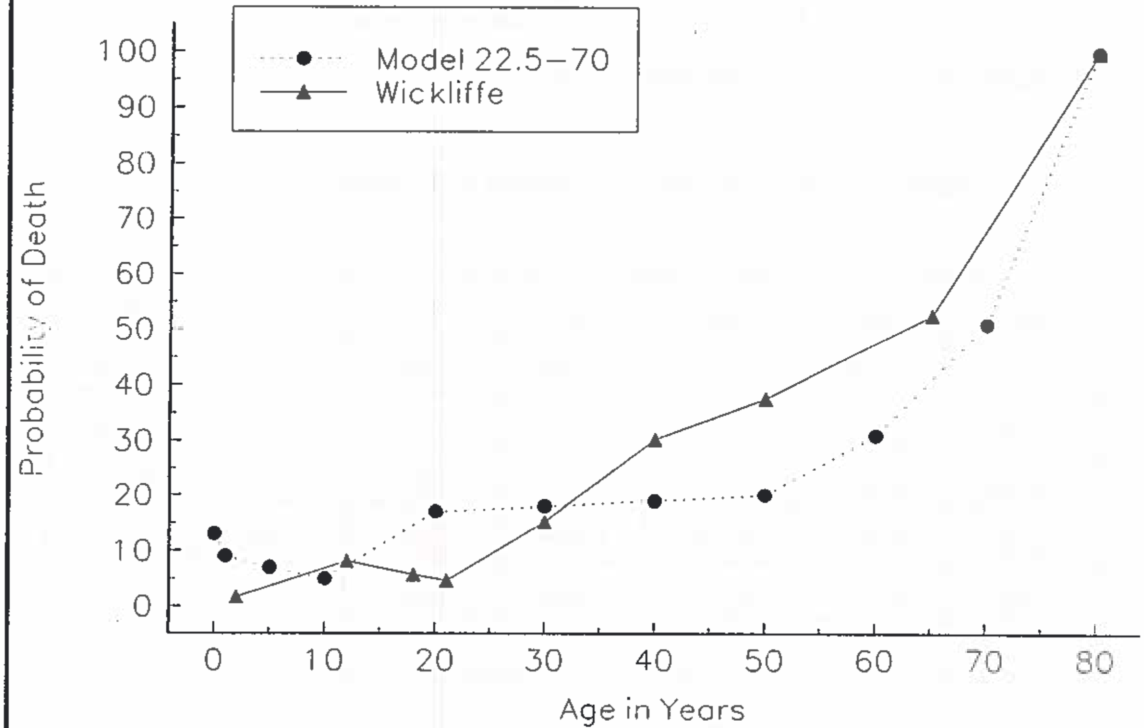

Figure 2. Comparison of the Mound C Mortality Probability Curve (Qx) to that of MT 22.5-70 [Data from Weiss (1973)].

Table 6. Life Table for the Mound C Males.

Age	Dx	dx	lx	Qx	Lx	Tx	Ex
18-20.9	4.57	0.044	1.000	0.044	2.935	27.183	27.18
21-29.9	13.40	0.130	0.956	0.135	7.934	24.248	25.36
30-39.9	24.78	0.241	0.826	0.291	6.984	16.314	19.75
40-49.9	25.50	0.248	0.585	0.423	4.563	9.330	15.94
50-64.9	19.18	0.186	0.337	0.551	3.635	4.767	14.14
65-80	15.25	0.148	0.151	1.000	1.132	1.132	7.49

Mean Age at Death: 27.18. Crude Death Rate: 36.78.

Table 7. Life Table for the Mound C Females.

Age	Dx	dx	lx	Qx	Lx	Tx	Ex
18-20.9	4.65	0.050	1.000	0.050	2.920	26.257	26.25
21-29.9	14.92	0.162	0.950	0.170	7.734	23.332	24.56
30-39.9	23.06	0.250	0.788	0.317	6.563	15.608	19.81
40-49.9	18.80	0.204	0.538	0.379	4.310	9.045	16.81
50-64.9	17.01	0.184	0.334	0.550	3.605	4.730	14.16
65-80	13.57	0.147	0.150	1.000	1.125	1.125	7.50

Mean Age at Death: 26.25. Crude Death Rate: 38.0.

Mortality curves from representative Archaic (Carlson-Annis [Mensforth 1990]) and Woodland (Gibson-Klunk Mound Complex [Asch 1976]) cultural periods were examined. When compared with the Archaic sample, the Mound C data demonstrate a decrease in morbidity throughout life (Figure 3). Although it is recognized that differences in age assessment techniques can influence Qx values, there is a tendency toward increased risk of death among Archaic populations. This probably reflects a shorter lifetime than found during the post-village occupation phase. The probability of death among middle-aged Archaic individuals (ages 35-50 years) closely parallels that from Wickliffe. It is possible that many selective agents for these cohorts are the same. Death among young and older adults varies enough to suggest that Mound C's mortality data do not overly reflect a hunting-gathering lifestyle.

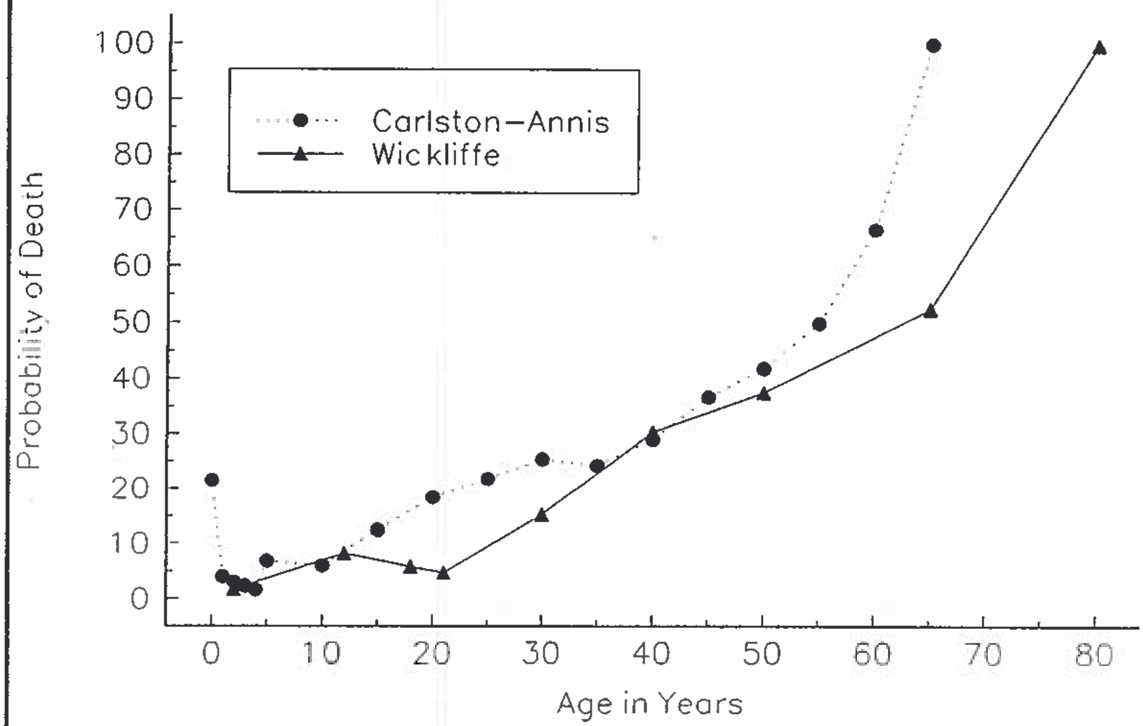

Figure 3. Comparison of Mound C's mortality probability curve (Qx) to that of an Archaic sample from Carlston-Annis [data from Mensforth (1990)].

Comparisons between the Mound C and Gibson-Klunk Woodland samples reveal that life among the Mound C inhabitants was far less dangerous as well (Figure 4). Woodland adults experience a higher probability of death and die much sooner than Wickliffe's adults. This pattern suggests that the Woodland semisedentary lifestyle may not have been part of the post-occupation cultural pattern.

Mound C's mortality data were compared to information from Mississippian populations interred at Campbell (Holland 1991), Averbush (Berryman 1981), Turner (Black 1979), and Dickson (Blakely 1971) (Figure 5). Overall, these populations display a wide range of variation, suggesting that within Mississippian culture, there is considerable diversity in cultural interactions with the socio-environmental conditions. Although differences in methodological approaches preclude the possibility of making precise comparisons between these groups (see Ubelaker 1974), the distribution indicates that Wickliffe follows a generalized mortality pattern found in most other Mississippian populations. Samples obtained from large population centers, such as Campbell and Averbush, show the least amount of agreement with Wickliffe, whereas the smaller (and closer) cemetery from Turner exhibits the greatest concordance. Population densities for the Lower Ohio River and western Kentucky region are believed to have been low, and it can be inferred that population pressures would have been minimal (Butler 1977; Muller 1978). Wickliffe's lower mortality probabilities may reflect less competition for resources.

CONCLUSION

The Wickliffe cemetery and most of the mound/village complex and the Mound C cemetery represent different aspects of a late prehistoric occupation. The cemetery does not appear to overlap any existing mortuary deposit formed during the village occupation sequence. It does, however, intrude through the village's last known occupation deposits. The most reasonable interpretation of this phenomenon places cemetery formation during and after the village's abandonment period (Wesler and Matternes 1991). Recognizing that the Mississippian occupation phase spans no less than 200 years, these bones cannot represent the remains of those who built the village; but the cemetery could contain the remains of those who abandoned it. Without an adult mortuary sequence clearly associated with the village occupation period, there is no certainty that the Mound Group and the cemetery encompass different phases of the same community. It is just as likely that two or more distinct communities are represented.

In general, Lewis' view, that an indigenous people still occupied the region after the Mississippian cultural decline, is the most reasonable model to explain the presence of this cemetery. The Mound C cemetery was probably formed by people who did not leave the area when the Mound Group was abandoned (Wesler and Matternes 1991). Lack of definitive evidence for a "post-Mississippian" habitation on the mound site proper suggests that these people lived close enough to accommodate transport of the dead to the cemetery.

No one really knows much about these post-Mississippian people. Any indigenous group surviving the Mississippian cultural decline would be expected to respond to the socioenvironmental demands formerly fulfilled by the previous culture with some form of cultural accommodation. In the absence of well-defined post-Mississippian habitation areas, there is little evidence to interpret what cultural patterns were used. The most definitive information currently available to document post-Mississippian activity is found in the Mound C cemetery.

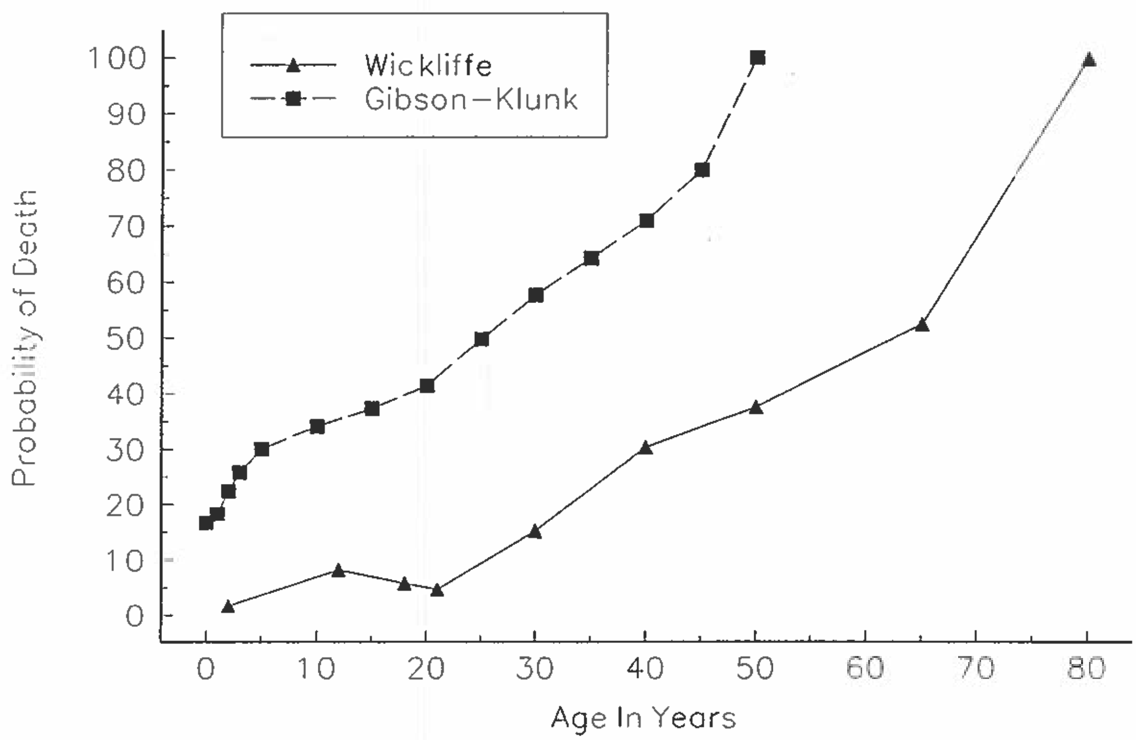

Figure 4. Comparison of Mound C's Mortality Probability Curve (Qx) to that of a Woodland Sample from Gibson-Klunk Mounds [Data from Asch (1976)].

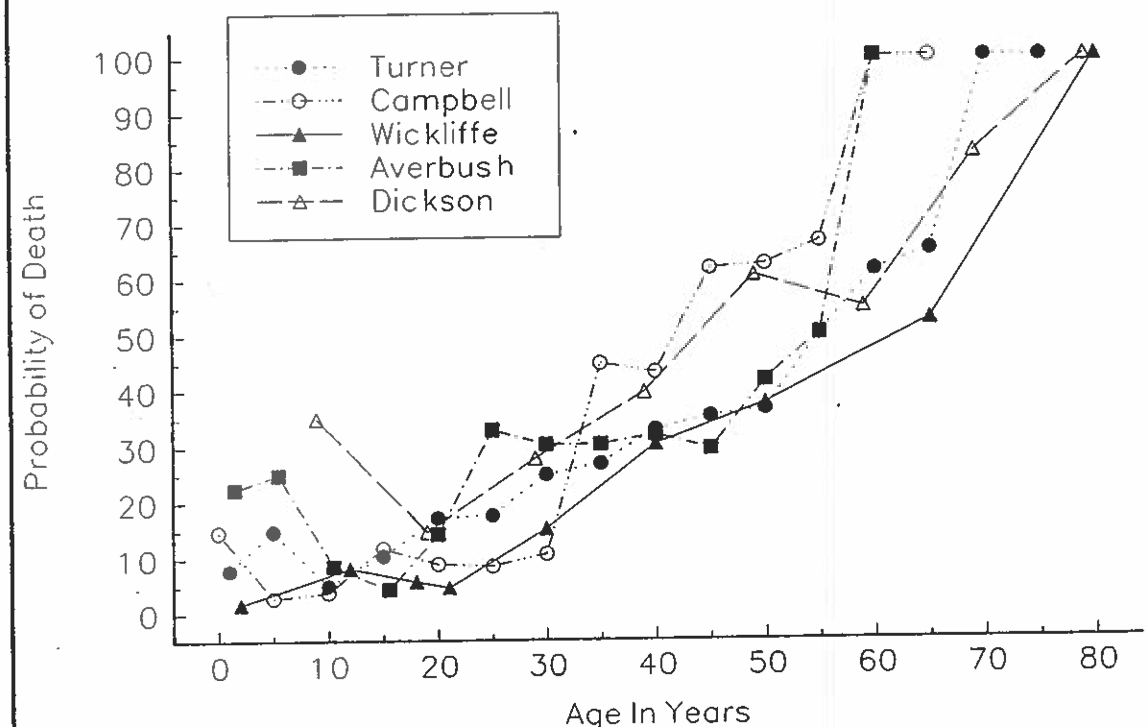

Figure 5. Comparison of Mound C's Mortality Probability Curve (Qx) to those from other Mississippian Cemetery Samples [Data from Turner (Black 1979), Campbell (Holland 1991), Averbush (Berryman 1981), and Dickson (Blakely 1971)].

Through examination of the various biocultural aspects extracted from the skeletal data, several important features of post-Mississippian cultural expression can be formulated.

This examination of the cemetery demonstrates a high degree of homogeneity. Although mortuary data loss occurred, it does not appear to have greatly affected the overall structure of the mortality profile. Taphonomically, destructive events acted on individual bones more than entire skeletal assemblages. In this manner, the relative frequency of age and sex was still preserved. No evidence could be found indicating how individuals with different grave forms varied greatly by age or sex. Generally, the population displays a high degree of uniformity. Social and sexual differences do not appear to have created any appreciable dichotomy in lifestyle. This is not to say that such differences were absent; undoubtedly sexual and social divisions of labor occurred, but these divisions were not strong enough to alter life expectancy.

Mississippian cemeteries are not simply places where the dead were buried; they also reflect how the community perceived itself. Segregation of infant burials from the adult cemetery not only follows mortuary patterns observed in other late prehistoric cemeteries, it coincides with complementary deposits found in the site's Mississippian occupation. Interment in a cemetery implies a social relationship between the deceased and other community members, both living and dead (Warner 1959). Segregation of the young would suggest that infants were not given the same identity as other members of the community. Recognizing that infant mortality rates in many pre-industrial societies are extremely high, community membership among the post-occupation culture appears to be dependent on the ability to survive to a less lethal period of development.

This cemetery is composed mostly of older individuals, reflecting a relatively young living population. These younger individuals would have borne the responsibility for population survival. With increased infirmity among the elderly, these community members would have become more dependent on the young adults and placed a greater burden on the resources available to the community. The presence of old people in the cemetery indicates that enough food, clothing, and other resources were available not only for survival, and as the elderly's capacity to contribute diminished, it was assumed by others. The manpower necessary to obtain life's necessities was adequate enough to help provide for others.

Cross-cultural comparisons suggest that Mound C may reflect a unique life history. Although methodological differences in how age estimates are typically obtained from each individual in a sample are admittedly a potentially biasing influence, the distribution across the Mound C sample does suggest that individuals may have been able to survive longer than in other cultural contexts. Mortality patterns produced by nomadic and semisedentary cultures lack concordance with Mound C; there is enough evidence present to suggest that these behavior patterns were not implemented. When compared with other Mississippian assemblages, Mound C shows a depressed probability of death. People apparently lived longer than in other Mississippian communities. This would imply that the cultural decline resulted in allowing for a healthier re-arrangement of the culture with the environment. Recognizing that the decline is associated with abandonment of the densely occupied mound groups, redistribution of the population across the landscape could easily result in a decrease in mortality.

It does not seem all that unreasonable to expect that in the absence of viable cultural alternatives, communities would choose to continue to use many of the same practices that historically served them well. There is little evidence that suggests that other cultural systems were available to replace or assimilate the extant populations. Evidence found in Mound C suggests that, for the most part, a continuum of behavior existed between Mississippian and post-abandonment period cultures. These conclusions do not preclude the possibility of cultural change, but considerable fluctuation in demographic frequencies is needed to produce major changes in mortality data (See Lamphear 1989); it is therefore probable that dramatic cultural transformation did not occur.

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AN ANALYSIS OF MISSISSIPPIAN FAUNAL EXPLOITATION PATTERNS AT WICKLIFFE MOUNDS

By
Paul P. Kreisa and Jacqueline M. McDowell[1]

ABSTRACT

Recent investigations at Wickliffe Mounds (15Ba4) have recovered a large faunal assemblage (more than 32,000 elements) from village and mound deposits. These materials are used to address a number of issues regarding faunal exploitation patterns during the Mississippi period at Wickliffe Mounds. The issues addressed in this paper include the identification of species and environmental zones utilized, changes in the exploitation pattern through time, and the differential access to faunal resources between elite and nonelite groups. The assemblage is also compared with those from other Mississippian sites in the Confluence Region. Analysis results indicate that the Wickliffe Mounds faunal assemblage exhibits internal temporal and social differences, but has an overall similarity to assemblages from other Mississippi River sites.

INTRODUCTION

The Wickliffe Mounds Site (15Ba4), a Mississippian mound complex in Ballard County, is located on the bluffs near the confluence of the Mississippi and Ohio rivers. Known previously as Ancient Buried City, the site was donated to Murray State University in 1983 and renamed the Wickliffe Mounds Research Center. Since its dedication as a research center, a long-term research program centering on the development and growth of Mississippian towns in western Kentucky has been undertaken. As a result of this program, nearly a decade of test excavations has recovered a large quantity of faunal material from different contexts and time periods at Wickliffe Mounds.

The Wickliffe Mounds Site is located on the bluff crest overlooking the Mississippi River, a few kilometers south of its confluence with the Ohio River. A rather narrow floodplain of the Mississippi River lies below and west of the site, with the present-day channel positioned less than a .4 km from the bluff base. The floodplain contains a diverse array of plant and animal communities, often dependent on minor changes in elevation and the amount of time a locale is inundated each year by flooding (Butler 1977; Lewis 1974). The uplands to the east of the site have mixed oak-hickory forests (Lewis 1974). Smith (1975, 1978a) has noted that the floodplain of the Mississippi River is perhaps one of the richest environments in eastern North America.

In this paper, the results of analysis of a small portion of the faunal material from the modern Wickliffe Mounds excavations, over 32,000 vertebrate and invertebrate elements from village and mound deposits, is presented. The analysis was carried out between 1989 and 1991 using comparative skeletal collections from the Department of Anthropology of the University

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of Illinois, the Department of Zoology of the University of Wisconsin, and the laboratory facilities of the State Historical Society of Wisconsin.

The faunal materials analyzed here were recovered from seven proveniences, consisting of samples from Mound B, Mound D, Mound F, and the East Midden (Figure 1) by dry-screening through 6 mm mesh. The internal chronology developed by Wesler (1991) for the Wickliffe Mounds Site allows the temporal separation of remains from these proveniences. Using this chronology, material from the seven proveniences was divided into three temporally distinct data sets: one provenience dates to early Wickliffe (A.D. 1100-1200), two to middle Wickliffe (A.D. 1200-1250), and three to late Wickliffe (A.D. 1250-1350). One is from a disturbed provenience.

For this analysis, the minimum number of individuals (MNI) was calculated as the most frequently occurring sided element for each species (Grayson 1984). The MNI values were generated for taxa identified below the family level, and MNI was determined separately for each of the seven proveniences. The figures reported in Tables 2 through 6 are aggregates of MNI and NISP of all data sets for each particular time period.

Perhaps the most influential investigations of Mississippian faunal exploitation patterns are those of Smith (1975) and Lewis (1974), who for the most part utilized data from floodplain and adjacent bluff crest sites between southeast Missouri and the Memphis area. They found that Mississippian faunal procurement emphasized floodplain resources, and included deer, waterfowl, turkey, small mammals, fish, and turtles. Given the large Wickliffe Mounds data set, this analysis not only can provide additional data to supplement previous work, but also can eventually be used to refine previously constructed models of Mississippian exploitation patterns. This paper addresses a number of issues regarding faunal exploitation during the Mississippi period at Wickliffe Mounds. These include the identification of the species and environmental zones exploited, changes in exploitation patterns through time, and the differential access to faunal resources between elite and nonelite groups. Finally, the Wickliffe Mounds faunal assemblage is compared with those from other Mississippian sites in the Confluence Region.

RESULTS

The present analysis has resulted in the identification of 20 percent of the elements in the sample to the level of family, genus, or species. Most numerous are mammals, followed by fish, herptiles, birds, and mussels (Table 1), with at least 76 different species identified. The most important species include deer, waterfowl, turkey, catfish, suckers, and box turtles. These data evidence changes through time, including a greater reliance on deer and a decrease in the use of fish. Part of this change may be related to a shift in the environmental zones located in close proximity to the Wickliffe Mounds Site.

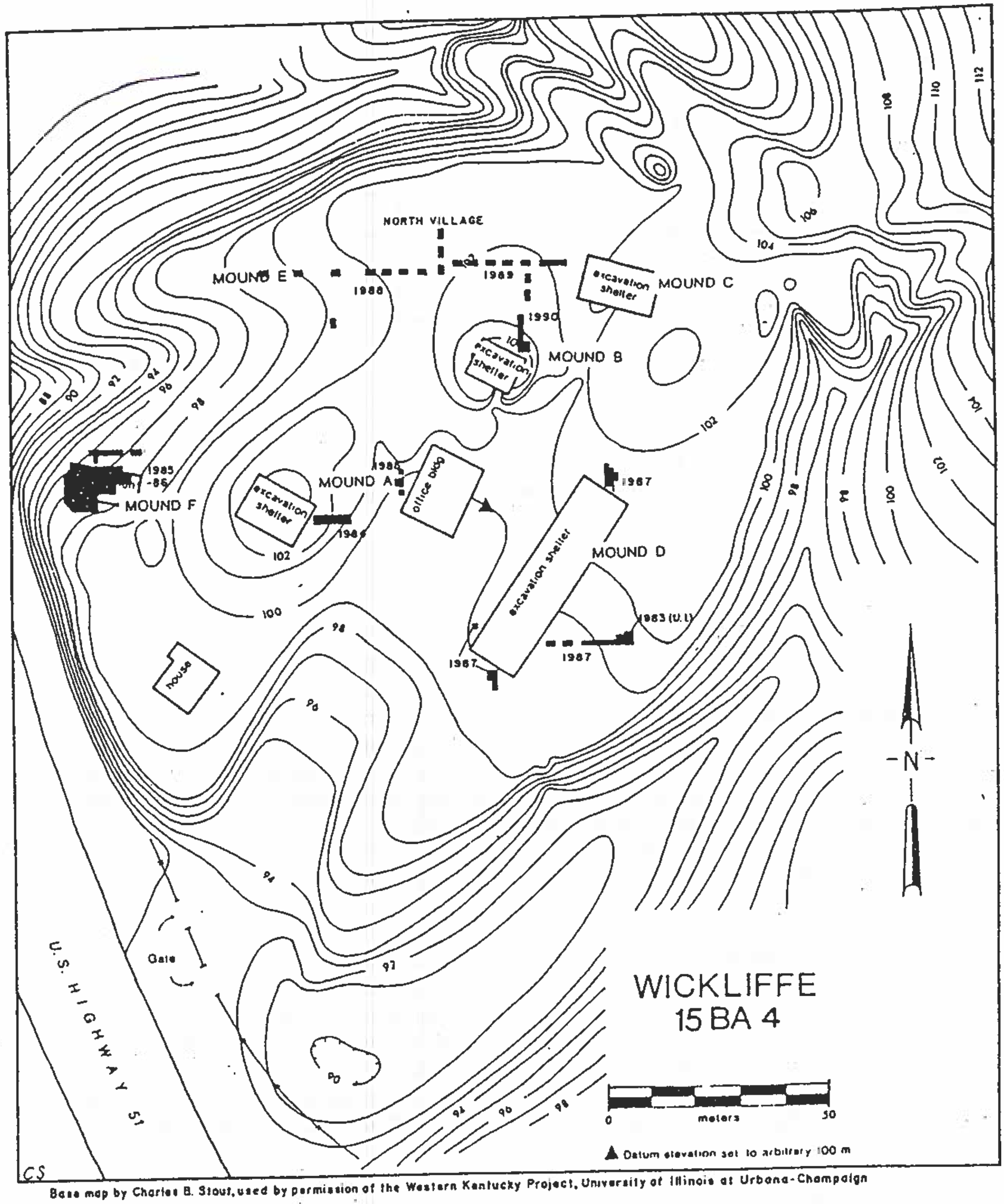

Figure 1. Locations of Excavation Units Mentioned in Text.

Table 1. Identified and Unidentified Faunal Remains by Taxonomic Class.

Class	Number of Identified Elements	Percent of Identified Elements	Number of Unidentified Elements	Totals	Percent of all Elements
Vertebrates	--	--	1152	1152	4
Mammals	2936	45	14688	17624	55
Birds	289	4	1770	2059	6
Herptiles	1231	19	5572	6803	21
Fish	1961	30	2157	4118	13
Mussels	50	1	445	495	1
Totals	6467	99	25784	32251	100

MAMMALS

Of the more than 32,000 vertebrate elements in the Wickliffe Mounds assemblage, over half are mammals, making this the most common class (see Table 1). At least 18 species, including humans, were identified (Table 2). Not surprisingly, deer elements are most abundant, comprising 55 percent of all identified mammalian elements, and there is no doubt that deer provided the largest portion of meat to the diet. Smaller mammals such as squirrel, raccoon, rabbit, and canids are also well-represented. The diversity of mammal species at Wickliffe Mounds is similar to that identified at other Mississippian sites in the Confluence Region such as Twin Mounds, Adams, Callahan-Thompson, Rowlandtown, Turk, and others (e.g., Kreisa 1988; Kruger et al. 1990; Lewis 1974, 1986; McDowell 1991; Smith 1975).

Many of the identified mammalian species are adapted to forested floodplains near sources of water such as tributary streams. Such species include swamp rabbit, beaver, muskrat, raccoon, and opossum (Jones and Birney 1988). Other species, including deer, woodchuck, squirrels, fox, raccoon, and skunk, prefer forest-grassland edge areas or brush edge areas (Jones and Birney 1988). A few species, such as bear, gray squirrel, and opossum, inhabit forested areas (Jones and Birney 1988). Many of the mammal species identified at Wickliffe Mounds inhabit all three of these environments. All three zones, the floodplain forests, uplands, and floodplain forest-grassland or brush edge areas, and bluff crest forests, are present within 1 km of Wickliffe Mounds.

In the early Wickliffe deposits, mammals comprise just over one-third of the assemblage. By middle and late Wickliffe, they replace fish as the most common class, representing over half of the assemblage. The number of mammal species also increases through time, from 14 to 17. Most of this, however, is related to an increase in the number of identified rodents and small insectivore species. Throughout the sequence, deer elements are always the most numerous. When human remains are removed from the sample, deer increase from about 40 percent of all identified mammal elements during early Wickliffe, to over 50 percent by middle Wickliffe,

Table 2. Identified Mammalian Faunal Remains by Time Period.

	Early		Middle		Late		Disturbed	
Taxon	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
Didelphis virginiana (opossum)	1	2	2	5	2	8	2	10
Scalopus aquaticus (Eastern mole)	0	0	1	10	0	0	2	2
Sylvilagus spp. (rabbits)	1	1	1	3	2	5	1	13
Sylvilagus floridanus (Eastern cottontail)	1	1	2	8	5	25	3	18
Sylvilagus aquaticus (swamp rabbit)	0	0	1	2	3	7	3	10
Sciuridae (squirrels)	--	0	--	0	--	15	--	10
Marmota monax (woodchuck)	0	0	2	5	2	3	1	9
Sciurus spp. (tree squirrels)	3	21	6	65	8	130	8	164
Sciurus carolinensus (gray squirrel)	2	4	3	8	6	27	5	25
Sciurus niger (fox squirrel)	2	11	3	29	7	49	10	68
Castor canadensis (beaver)	1	1	2	3	3	16	1	6
Cricetidae (mice, rats)	—	23	--	47	--	53	--	176
Ondatra zibethicus (muskrat)	1	1	1	2	2	10	1	3
Canidae (dogs, wolves, foxes)	--	0	--	0	--	2	--	0
Canis spp. (dogs, wolves)	1	3	2	5	3	10	2	7
Canis familiaris (dog)	0	0	1	1	1	3	1	1
Vulpes vulpes (red fox)	1	1	1	1	0	0	0	0
Urocyon cinereoargenteus (gray fox)	1	4	1	1	3	3	1	5
Ursus americanus (black bear)	0	0	0	0	2	2	1	1
Procyon lotor (raccoon)	2	5	3	26	6	37	2	28
Mustelidae (skunks, minks, weasels)	--	2	--	0	--	0	--	1
Mephitis mephitis (striped skunk)	0	0	1	1	0	0	1	1
Odocoileus virginianus (white-tailed deer)	3	52	6	300	14	762	10	495
Homo sapiens (humans)	1	6	2	10	3	26	1	20

and to 65 percent by late Wickliffe. Associated with this trend is a decrease through time in the use of squirrels and other smaller mammals, such as raccoon, rabbits, mustelids, muskrat, beaver, and canids.

This change in exploitation patterns could be due to population increases and a resultant need to focus hunting patterns on larger species such as deer that provide larger amounts of usable meat. Alternatively, an environmental change, such as a decrease in the size of the floodplain near Wickliffe Mounds, could have reoriented hunting patterns toward the uplands. Many of the small mammals that decrease in number are floodplain inhabitants.

REPTILES AND AMPHIBIANS

Reptiles and amphibians are the second most common class based on the number of identified elements, but they rank third behind fish when based on the total number of all elements. Herptiles could not be identified to species as often as could fish. Reptiles and amphibians represent about one-fifth of the sample (see Table 1). At least 10 species are present, most of which are reptiles. Toads are the only amphibian elements that could be identified to the level of genus (Table 3). As for reptiles, the Eastern box turtle was most frequently identified, followed by pond, musk, and mud turtles (Table 3). Snakes are the only other reptiles identified and are represented only by vertebral elements, making species identification difficult. Both poisonous and nonpoisonous snakes are present in the assemblage.

In terms of habitat preference, the turtles can be divided into two groups. The first group, which prefers slow-moving water, soft to muddy bottoms, and abundant vegetation, includes snapping turtles, mud and musk turtles, false map turtles, and cooters and sliders (Behler and King 1987). These species most probably were being taken in the backwater ponds and sloughs of the floodplain. They may have been collected in the spring after floodwaters receded from the floodplain, or perhaps during periods of hibernation. Pond and snapping turtles, for example, hibernate in large groups during droughts or in winter (Cagle 1942; Clark and Southall 1920). The second and most numerous group consists of box turtles. Box turtles are terrestrial, but inhabit a number of environments --floodplains, moist forested areas, or grassy areas-- and would be present in both the floodplain and uplands surrounding the site (Behler and King 1987). Softshell turtles, a minor species, are found in either small marshy creeks, or larger, fast moving rivers (Behler and King 1987).

Reptiles and amphibians constitute less than one-fourth of the early Wickliffe assemblage, with box turtles comprising over half of the identified elements. Slightly less common are a number of species of water turtles, including musk, mud, map, softshell, and pond turtles. By middle Wickliffe, and continuing into late Wickliffe, herptile remains increase in number to rank second in the sample, accounting for about one-fourth of the total assemblage (Figure 2). This change is associated with an increase in the number of box turtle remains to almost three-quarters of the reptile assemblage, with a concomitant decrease in water turtles to only about 20 percent of the assemblage. There is also a slight increase in the number of herptile species taken through time.

Table 3. Identified Herptilian Faunal Remains by Time Period.

	Early		Middle		Late		Disturbed	
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**
Amphibians	--	0	--	2	--	12	--	2
Bufo spp. (frogs)	0	0	0	0	0	0	1	3
Chelydridae (snapping turtles)	--	0	--	0	--	2	--	0
Chelydra serpentina (snapping turtle)	0	0	0	0	0	0	1	1
Kinosternidae (musk, mud turtles)	1	3	--	4	--	8	--	5
Kinosternon subrubrum (mud turtle)	1	3	1	3	3	24	1	16
Sternotherus odoratus (stinkpot)	2	8	1	4	2	6	1	8
Emydidae (pond, marsh, box turtles)	--	0	--	0	--	0	--	1
Chrysemys spp. (cooters, sliders)	1	7	1	27	4	55	2	38
Chrysemys scripta (pond slider)	1	1	1	2	1	8	1	11
Graptemys spp. (map turtles)	1	1	0	0	0	0	1	1
Graptemys psuedogeographica (false map turtle)	0	0	0	0	1	1	1	1
Terrapene carolina (Eastern box turtle)	4	31	9	150	26	466	15	239
Trionyx spp. (softshell turtles)	0	0	1	2	1	31	1	14
Trionyx spiniferus (spiny softshell)	0	0	0	0	1	2	0	0
Serpentes (snakes)	--	2	--	4	--	13	--	12
Colubridae (colubrid snakes)	--	0	--	0	--	1	--	1
Viperidae (pit vipers)	--	3	--	7	--	14	--	8

FISH

Fish represent 13 percent of the total assemblage (see Table 1). They rank second in percentage of elements identified, but third in percentage of all elements in the assemblage. There is a higher rate of identification for fish than for herptiles. Minimally, 16 fish species are present, with bowfin, gar, sucker, drum, catfish, and sunfish most commonly identified (Table 4).

The identified fish inhabit floodplain lakes, sloughs, and ponds, and rivers. Many species can inhabit both zones. Those taken from the lacustrine floodplain environments are bowfin, black buffalo, bullhead, bass, drum, crappie, and sunfish (Smith 1979). The river species include bowfin, gar, buffalo, redhorse, blue catfish, channel catfish, bass, crappie, and drum (Smith 1979). Flathead catfish are common in especially deep holes in rivers (Smith 1979). Many of these riverine species may have been trapped in the floodplain lakes and ponds after spring floods (Yerkes 1981).

Fish make up nearly half of the early Wickliffe assemblage, a figure similar to that of the early Twin Mounds deposits (Kreisa 1988). Most important are catfish, sucker, and sunfish species, and to a lesser extent gar, bowfin, and drum. Beginning in middle Wickliffe and continuing through late Wickliffe, fish decrease in importance, falling to the third most common class (see Figure 2). Species adapted to riverine environments increase from about 20 percent in early Wickliffe to over 35 percent in late Wickliffe. There is a concomitant decrease in those species found in either backwaters or both riverine and backwater zones from over 75 percent in early Wickliffe to less than 65 percent of the identified sample in late Wickliffe. Furthermore, the use of suckers, catfish, and sunfish decreases, with gar and bowfin becoming increasingly important species. Through time, there is a slight increase in the number of fish species taken.

BIRDS

Birds are not well-represented in the Wickliffe Mounds faunal assemblage. Although at least 14 species are present, they comprise only 6 percent of the sample (see Table 1). Throughout the sequence, birds are the lowest ranked vertebrate class both in terms of total number of elements and number of elements identified. Dabbling ducks, turkey, and passenger pigeon are most common (Table 5). Based on the size of the duck elements, both large and small species were being taken.

The avifauna from Wickliffe Mounds can be broken into three groups: waterfowl, terrestrial species, and forest birds. The waterfowl include geese, ducks, and mergansers. Since the Confluence Region is a major wintering area for waterfowl, these species would be abundant from late fall through early spring (Bellrose 1976). Waterfowl would have been numerous in the floodplain lakes, ponds, and sloughs (Ehrlich et al. 1988). The terrestrial species include grouse, turkey, bobwhite, and prairie chicken. The habitat for these birds ranges from grasslands and prairie to open woodlands and forest clearings (Ehrlich et al. 1988). Such environments would be found mainly in the uplands of western Kentucky, although turkeys also are present today along the bluff crest and in the floodplain (Kreisa, personal observation). Finally, forest dwelling species, including songbirds, woodpeckers, owls, passenger pigeon, and

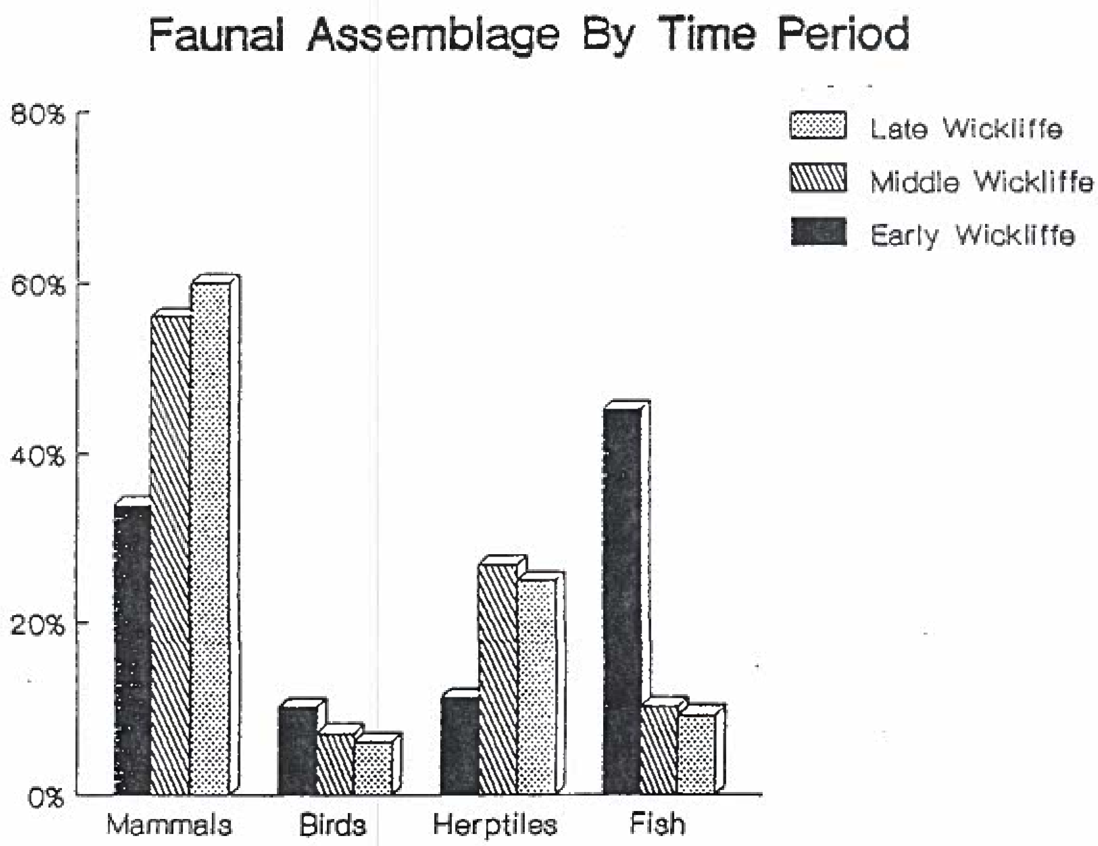

Figure 2. Comparison of the Contribution of Faunal Classes by Time Period.

Table 4. Identified Fish Remains by Time Period.

	Early		Middle		Late		Disturbed	
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**
Scaphirhynchus spp. (river sturgeons)	0	0	2	5	1	4	1	3
Lepisosteus spp. (gars)	1	40	2	71	4	201	2	154
Lepisosteus platostomus (shortnose gar)	1	2	0	0	1	1	0	0
Amia calva (bowfin)	2	31	2	86	3	167	4	249
Catostomidae (suckers)	--	49	--	44	--	78	--	104
Ictiobus spp. (buffalos)	1	3	1	1	0	0	0	0
Ictiobus bubalus (smallmouth buffalo)	1	1	0	0	0	0	0	0
Ictiobus niger (black buffalo)	6	9	1	1	1	1	2	5
Carpiodes spp. (carpsuckers)	1	1	1	1	1	2	2	3
Moxostoma spp. (redhorses)	0	0	2	4	2	2	1	1
Moxostoma macrolepidotum (shorthead redhorse)	0	0	0	0	1	1	0	0
Ictaluridae (freshwater catfishes)	--	27	--	20	--	45	--	86
Ictalurus spp. (catfish, bullheads)	3	37	2	4	2	17	2	29
Ictalurus furcatus (blue catfish)	1	2	0	0	1	2	0	0
Ictalurus melas (black bullhead)	0	0	0	0	0	0	1	2
Ictalurus punctatus (channel catfish)	3	14	0	0	2	3	2	9
Pylodictus olivaris (flathead catfish)	0	0	0	0	1	1	0	0
Percichthyidae (temperate basses)	--	1	--	3	--	1	--	0
Centrarchidae (sunfishes)	--	21	--	10	--	27	--	58
Micropterus spp. (basses)	2	5	1	3	1	1	2	5
Micropterus salmoides (smallmouth bass)	1	1	1	1	1	1	2	9
Lepomis spp. (sunfishes)	0	0	1	1	1	1	1	1
Pomoxis spp. (crappies)	1	2	0	0	0	0	1	2
Pomoxis nigromaculatus (black crappie)	1	1	0	0	0	0	1	4
Aplodinotus grunniens (freshwater drum)	1	12	2	30	4	45	4	93

Table 5. Identified Avian Faunal Remains by Time Period.

	Early		Middle		Late		Disturbed	
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**
Anatinae (ducks)	--	2	--	4	--	2	--	8
Anserini (geese)	--	1	--	2	--	4	--	0
Chen caerulescens (snow goose)	1	1	0	0	0	0	0	0
Anas spp. (dabbling ducks)	1	12	2	17	7	38	5	69
Aythya spp. (bay ducks)	1	1	1	2	0	0	1	1
Merginae (sea ducks)	--	0	--	0	--	2	--	0
Tetraoninae (grouse)	--	0	--	1	--	3	--	2
Tympanuchus cupido (greater prairie chicken)	0	0	0	0	2	2	0	0
Bonasa umbellus (ruffed grouse)	0	0	0	0	0	0	1	1
Meleagris gallopavo (wild turkey)	1	1	2	9	2	14	2	19
Colinus virginianus (bobwhite)	1	2	1	1	1	1	1	1
Fulica americana (American coot)	0	0	1	1	0	0	0	0
Ectopistes migratorius (passenger pigeon)	2	10	1	5	3	8	8	28
Zenaida macroura (mourning dove)	0	0	0	0	1	1	0	0
Asio sp. (long-eared, short-eared owls)	0	0	1	1	0	0	0	0
Picidae (woodpeckers)	--	1	--	0	--	0	--	0
Passeriformes (perching birds)	--	3	--	1	--	2	--	5

Table 6. Identified Mussels by Time Period.

	Early		Middle		Late		Disturbed	
Taxon	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**	**MNI**	**NISP**
Amblema plicata	1	1	1	1	0	0	0	0
Elliptio dilatatus	0	0	1	1	2	2	0	0
Elliptio crassidens	1	1	0	0	1	1	0	0
Fusconaia ebenus	2	3	2	5	9	13	9	18
Quadrula pustulosa	0	0	0	0	0	0	1	1
Tritogonia verrucosa	1	1	0	0	0	0	0	0
Actinonaias sp.	0	0	0	0	0	0	1	1
Ligumia recta	0	0	0	0	0	0	1	1

mourning dove, have been identified (Ehrlich et al. 1988). Most important of these is the passenger pigeon. This species, now extinct, preferred deciduous forests (Ehrlich et al. 1988), which are present in the Wickliffe Mounds vicinity either along the bluff crest or in the floodplain of the Mississippi River or its tributary streams.

Birds are the least common class throughout all of the Wickliffe periods, with their percentage of the total assemblage remaining fairly constant (see Figure 2). There is a slight increase through time in the number of bird species taken. Birds comprise about 10 percent of the sample in the early Wickliffe deposits, with ducks and passenger pigeon most numerous. After early Wickliffe, birds represent less than 10 percent of the remains. Ducks and turkey become more important, while the number of passenger pigeons declines. Providing a minor component of bird remains throughout the sequence are grouse, prairie chicken, and bobwhite.

MUSSELS

Mussels are poorly represented at Wickliffe Mounds (see Table 1). Fifty elements were identified, with at least eight species present (Table 6). Over three-fourths of these elements belong to a single species, Fusconaia ebenus.

All the mussel species are either specifically adapted to sand-gravel bottoms or can be found in that habitat (Parmalee 1967). The mussels identified at Wickliffe Mounds tend to be adapted to larger rivers such as the Mississippi, with only a few found in small creeks and rivers. Most of the species prefer a swifter current as well. The mussels may have been gathered from the numerous small streams located within 1 km of Wickliffe Mounds. These streams drain the uplands to the south, and floodplain to the north, into the Mississippi River. The mussels also may have been collected from sand bars located along the Mississippi River.

TEMPORAL TRENDS

A number of temporal patterns are evident in the Wickliffe Mounds faunal data. The importance of mammals and reptiles increases through time while the use of fish declines. The proportion of bird elements is relatively unchanged (see Figure 2). Several changes in resource use over time were also identified within each of the vertebrate classes.

The early Wickliffe faunal assemblage, dating before A.D. 1200, is much like that found at other Mississippian riverine sites, which emphasize deer, fish, small mammals, ducks, turkey, and turtles (e.g., Kreisa 1988; Smith 1975; Webb 1988). After A.D. 1200, however, the assemblage increasingly deviates from this pattern. Deer comprise an ever larger proportion of identified mammals, increasing from 40 percent before A.D. 1200 to 65 percent after A.D. 1250. Fish comprise a smaller part of the assemblage after A.D. 1200. Those species identified indicate a change in exploitation patterns toward species adapted to the Mississippi River channel and away from backwater lakes and sloughs. Box turtles are increasingly common after A.D. 1200 as well.

One potential explanation for this shift from riverine/floodplain-adapted species to more terrestrial/uplands species is a decrease in the total area of floodplain in the Wickliffe Mounds locality. At present, there is relatively little floodplain area in or around Wickliffe Mounds.

While greater amounts of floodplain are present north and south of Wickliffe Mounds, so too are contemporaneous Mississippian population centers: Twin Mounds to the north and Turk to the south. Their existence might have limited access by populations from Wickliffe Mounds to resources located in these broader floodplains. Saucier (1974) identifies a broad landform to the west of Wickliffe Mounds in southeast Missouri as the modern Mississippi River meander belt zone. This meander belt zone has been occupied since 900 B.C., with the channel of the Mississippi River having moved from the west to east in the Wickliffe Mounds vicinity since that time. Presumably, the river channel would have been diverting eastward through an earlier meander belt zone, thus destroying fertile floodplain environments. Data are not currently at hand, unfortunately, to indicate whether such an eastward shift occurred between A.D. 1100 and 1300, the time when the changes in habitat exploitation discussed above were taking place at Wickliffe Mounds.

STATUS DIFFERENCES

Faunal remains are also a potential indicator of differences in status between the inhabitants of Wickliffe Mounds. Research (e.g., Fowler 1978; Peebles and Kus 1977; Price 1978) has indicated that Mississippian societies were composed of elite and nonelite populations. These populations were separated spatially and had access to different material resources, including subsistence items. Rural populations of farmers were located in numerous, small farmsteads and hamlets, which supplied foodstuffs to the larger population aggregates located in the towns. Elite and other nonelite segments of the population were located within the towns. The presence of deposits from elite and nonelite households at Wickliffe Mounds provides an opportunity to test this model of Mississippian society.

In 1990, Wesler (1991) excavated a portion of platform Mound B, revealing two middens dating between A.D. 1200 and 1250. The artifacts from Mound B are similar to those from other areas, except that there is a higher ratio of serving bowls to cooking and storage vessels. Wesler (1991) has interpreted these deposits as the accumulated refuse of an elite family.

The faunal assemblage from Mound B can be compared with that from a contemporaneous village deposit near Mound D in an attempt to determine whether dietary differences existed between postulated elite and nonelite segments of the Wickliffe Mounds population. Assemblage sizes between the two proveniences differ, with about 700 elements recovered from Mound B as compared to more than 4100 elements from the Mound D area. It is therefore not surprising that a greater number of identified species are present in the Mound D area assemblage. This can generally be explained as a result of sample size effects (Grayson 1984).

The two assemblages also can be compared with respect to the emphasis placed on different animal classes, and to the contribution of deer to the diet. Mammals constitute the single most important group in both assemblages, although slightly more so for Mound B (Figure 3). Bird exploitation is similar between the two assemblages as well. In contrast, there is a far greater percentage of reptiles and amphibians, mainly box turtles, in the Mound D area assemblage, whereas there are greater numbers of fish in the Mound B assemblage.

A comparison of deer use between the two samples indicates that deer represent 28 percent of all mammal elements in Mound B, but 64 percent in the Mound D assemblage

(Figure 4). Deer constitute 14 percent of all vertebrate Mound B elements, against 32 percent of all Mound D vertebrate elements.

The deer elements present in the two assemblages, possibly indicating differential access to various cuts of meat, were also compared. Purdue et al. (1989) have constructed a food utility index (FUI) based on ethnographic evidence from Binford (1981). An FUI provides a ranking of deer skeletal elements based on the amount of meat potentially associated with that element. Based on the FUI rankings, half of the deer elements from Mound B are rated as having a medium-to-high food utility (Figure 5). In contrast, only 34 percent of the Mound D area deer elements have a medium-to-high food utility (Figure 5). Most of the Mound D area deer elements have a low food utility.

This comparison suggests some interesting points of difference between the two assemblages. Although deer elements are more frequent in the Mound D sample, they appear to represent lower quality cuts of meat. Deer elements are less frequent in the Mound B sample, but, in contrast, they represent higher quality cuts of meat.

This pattern of differential distribution of quality cuts of meat has been identified elsewhere. Scott (1981) has suggested that a different distribution of deer elements exists between Mississippian farmsteads and villages in Alabama. The elements found at farmsteads are equated with poorer quality cuts of meat, whereas those found at the villages are representative of higher quality cuts of meat. This pattern of differential access to quality cuts of deer meat is seen as mirroring an economic interrelationship between the various levels of the settlement system (e.g., Smith 1978a, 1978b). Scott(1981), in an explanation of the pattern of deer element distribution, suggests that the farmsteads sent higher quality portions of the meat to the villages.

The Wickliffe Mounds samples compared above are from two different areas within a single settlement. If field butchering of deer yields consistently different patterns of bone distribution between towns and rural communities, the pattern within towns should be uniform. The samples analyzed from Wickliffe Mounds are not uniform, however, and could represent a further division, perhaps along status lines, of field-butchered deer. The caveat, though, is that differences in sample size skew not only diversity estimates, but richness estimates as well. Larger faunal samples from Mound B could reveal a pattern of element presence more similar to that found in the Mound D area.

COMPARISON WITH OTHER SITES

Earlier syntheses of Mississippian faunal exploitation patterns were based on the analysis of material from a number of sites in the Cairo Lowland of southeast Missouri and the Memphis area (e.g., Lewis 1974; Smith 1975). Those data indicate an emphasis on deer, fish, ducks, turkey, turtles, and small mammals. Recent research in western Kentucky has yielded several large data sets from a number of different environmental zones. The Wickliffe Mounds data reported here are compared with this expanded data base of material from Mississippian sites in the Confluence Region (Table 7). The sites include Turk (Kruger et al. 1990), Twin Mounds (Kreisa 1988), Adams (Lewis 1986), Callahan-Thompson (Lewis 1974), Lilbourn (Smith 1975), Chambers (Tune 1987), Andalex (Kreisa 1991), Gooseneck (Smith 1975), and

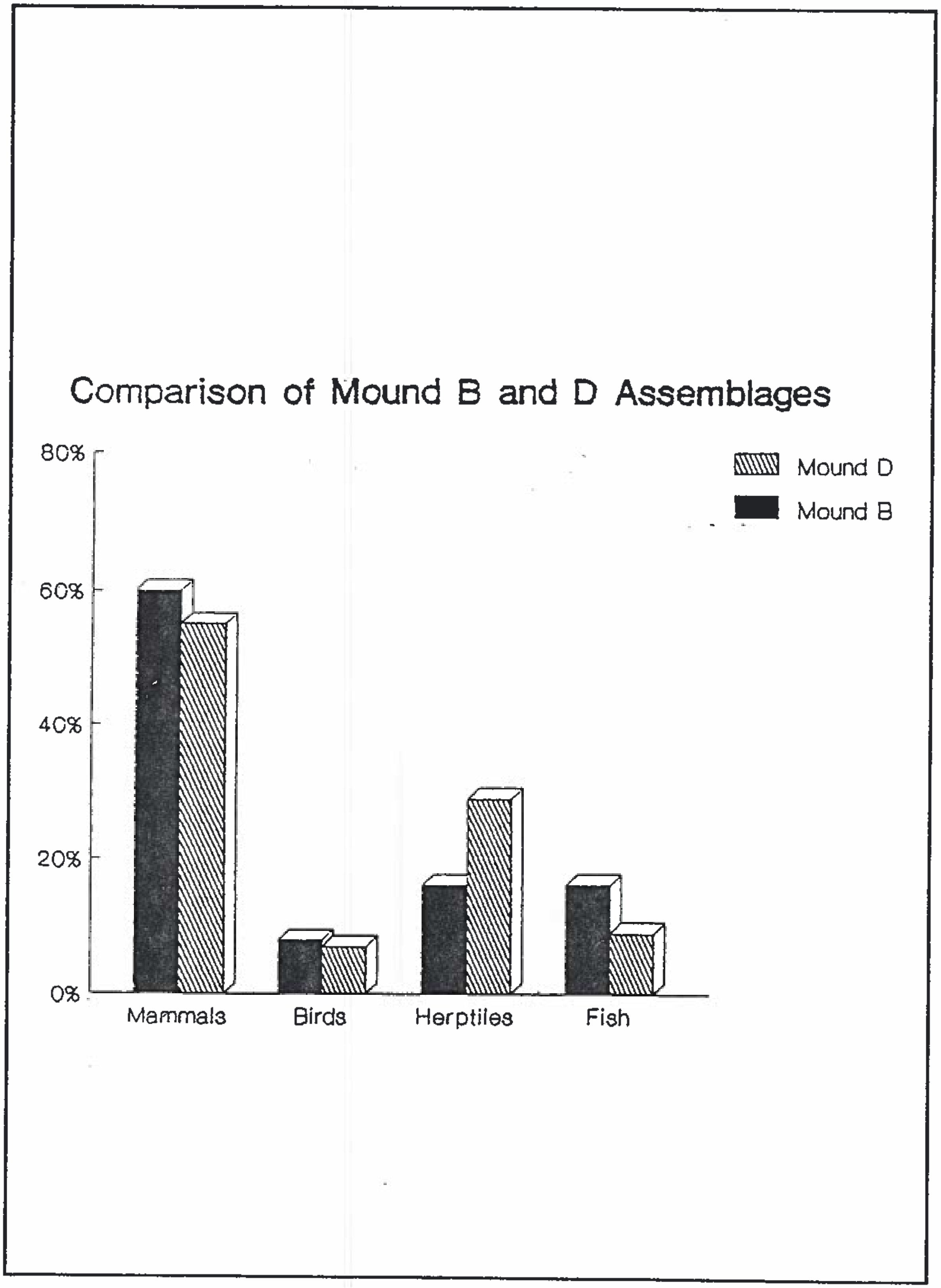

Figure 3. Comparison of the Contribution of Faunal Classes for Middle Wickliffe Deposits Between Mounds B and D.

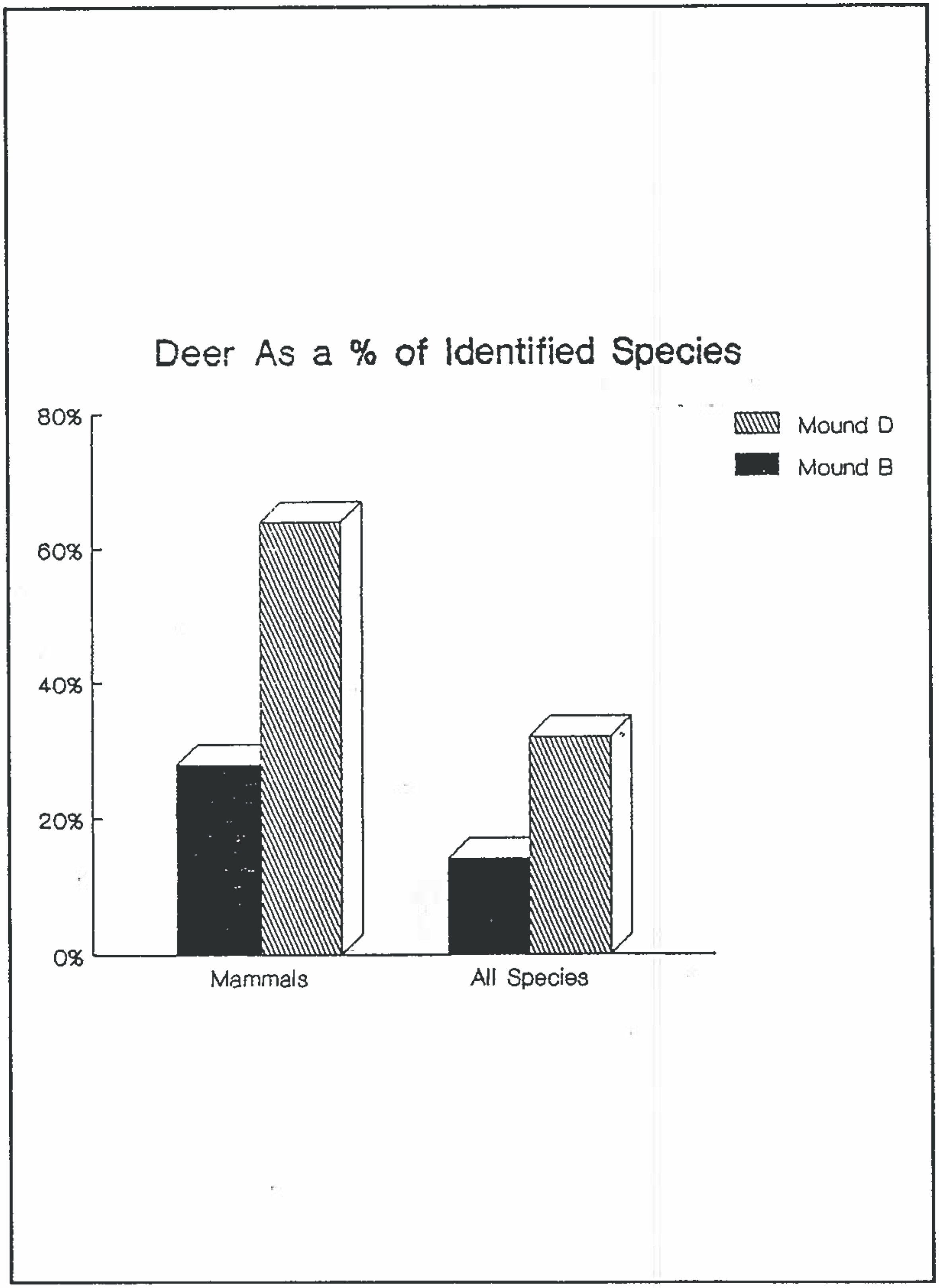

Figure 4. Comparison of Deer as a Percentage of Mammals and all Identified Species for Middle Wickliffe Deposits in Mounds B and D.

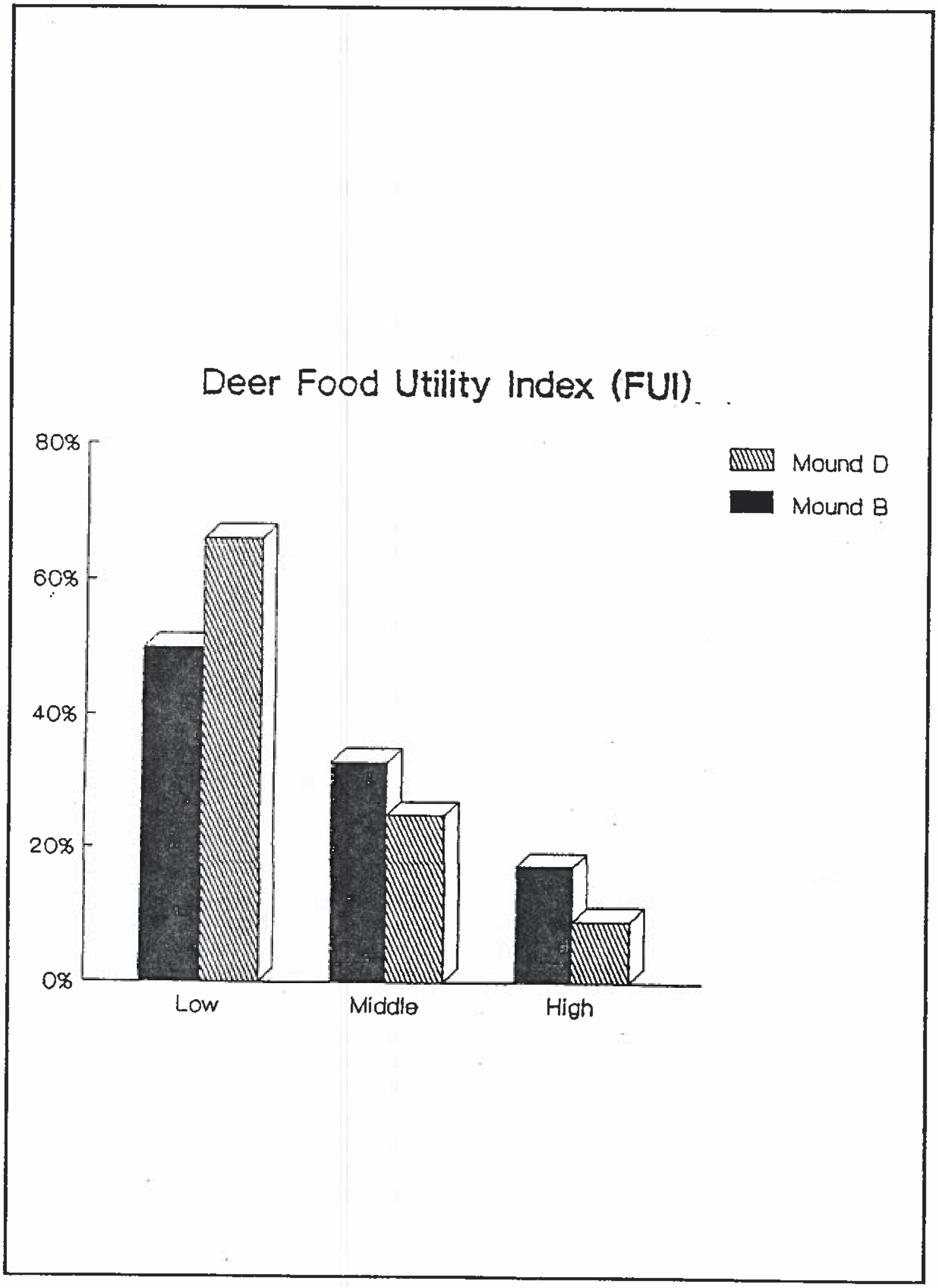

Figure 5. Comparison of the Deer Food Utility Index for Middle Wickliffe Deposits in Mounds B and D.

Rowlandtown (McDowell 1991). For the purpose of this analysis, which is based only on the identified elements, the Wickliffe Mounds data have been divided into early and middle-late components.

Table 7. Distribution of Faunal Remains by Class at Selected Confluence Region Sites.

Sites	Setting	Mammals (Percent)	Birds (Percent)	Fish (Percent)	Reptiles (Percent)
Interior					
Chambers	Bluff crest	61	11	7	21
Andalex Village	Bluff crest	87	6	1	5
Gooseneck	Stream bottom	86	4	2	8
Rowlandtown	Terrace	75	8	8	9
Mississippi River					
Turk	Bluff crest	49	10	29	13
Twin Mounds	Floodplain	56	10	27	6
Adams	Floodplain	52	11	21	15
Callahan-Thompson	Floodplain	49	7	41	3
Lilbourn	Floodplain	16	10	69	4
Early Wickliffe	Bluff crest	28	1	52	14
Late Wickliffe	Bluff crest	48	3	25	24

Compared with other sites in the region, the early Wickliffe deposits have a low frequency of mammals; only Lilbourn, a floodplain site in southeast Missouri, has a comparable frequency. The proportion of birds in the early Wickliffe assemblage is also low, which is similar to some of the floodplain and bluff crest Mississippi River sites and those interior sites with a high rate of bird usage. The high frequency of fish in the early Wickliffe faunal assemblage, generally higher than at most sites, is similar only to that of Lilbourn and Callahan-Thompson in southeast Missouri. Reptile and amphibian numbers for the early Wickliffe deposit fall within the norm of most Mississippian sites in the Confluence Region.

Mammals comprise a higher percentage of the middle-late Wickliffe assemblage, a pattern more similar to that found at other Mississippi River sites in the Confluence Region. In contrast, there is a lower frequency of bird remains in the middle-late Wickliffe assemblage than at the other Mississippi River sites, but it is similar to that found at the interior sites. The proportion of fish remains declines from the levels of the early Wickliffe assemblage. The percentage of fish from the middle-late Wickliffe deposits is within the range of most Mississippi River sites and higher than that of the more interior sites. Finally, the middle-late Wickliffe reptile and amphibian assemblage is highest among all sites, both those along the Mississippi River and those in interior areas.

This comparison highlights the fact that the Mississippian faunal exploitation pattern at Wickliffe Mounds is generally similar to that of other Mississippi River sites. Changes do occur through time, with the data more similar to riverine-oriented sites like Lilbourn and Callahan-Thompson during the early Wickliffe occupation. By the middle-late Wickliffe occupation, the assemblage has a somewhat more terrestrial orientation, similar to that of Turk, Twin Mounds, and Adams. Throughout the sequence, though, the Wickliffe Mounds faunal pattern does evidence individual variation; in particular the assemblage has fewer birds and a greater proportion of reptiles than most sites in the Confluence Region.

SUMMARY

This paper provides a general overview of the pattern of Mississippian faunal exploitation at Wickliffe Mounds. The Wickliffe Mounds faunal exploitation pattern is broadly similar to that identified at other riverine Mississippian sites in the Confluence Region. Deviations from that pattern include a greater use of reptiles, specifically box turtles, and a lesser use of fish. Part of this may be due to its bluff crest location or possible changes in the course of the Mississippi River. In general, there is an increasing importance of mammals through time, especially deer, while at the same time there is a decreasing emphasis on fish. Bird use in general remains stable, while herptile use, especially box turtles, increases. There is also potential evidence for status-related differences in diet at Wickliffe Mounds, centering for the most part on differences in the cuts of deer meat available to different segments of the population.

Beyond this discussion, the Wickliffe Mounds faunal assemblage holds great potential for yielding further information on Mississippian faunal exploitation patterns in the Confluence Region. Attention will be focused on refining and expanding the analysis of spatial and temporal patterns of faunal use in this area. Such a large data set as that from Wickliffe Mounds also provides an opportunity to analyze the effects of sample size and depositional processes on measures of species diversity and abundance. Information on a number of other variables has also been collected including patterns of burning, carnivore and rodent gnawing, manufacture and use of tools, and the age of animals exploited, and hence to some extent seasonality. More detailed discussions of these topics are forthcoming.

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PRELIMINARY ASSESSMENT OF MISSISSIPPIAN SETTLEMENT AT THE CROLEY-EVANS SITE (15KX24), KNOX COUNTY, KENTUCKY

By
Richard W. Jefferies[1]

ABSTRACT

Over the past 20 years, efforts to achieve a better understanding of the nature of Mississippian societies in the Southeastern and Midwestern United States have shifted away from the issues of cultural chronology and the ultimate origin of Mississippian culture (Fairbanks 1956; Lewis and Kneberg 1946; Willey 1966) and toward the investigation of the adaptive strategies, social organization, and functioning of regionally specific Mississippian groups (Anderson 1994; Lewis 1990a; Milner 1989, 1990; Smith 1990). As part of this growing trend, the Upper Cumberland River Archaeological Project was initiated in 1991 to investigate the development of Late Prehistoric societies that once inhabited the Upper Cumberland River drainage in southeastern Kentucky (Jefferies 1992; Jefferies and Flood 1993). During the past two years, project personnel have surveyed over 400 hectares of the Cumberland River floodplain and adjacent uplands, tested three sites containing Mississippian cultural material, and excavated part of the Croley-Evans Site (15Kx24), a village and mound complex located in southwestern Knox County. This paper describes the results of the 1993 field investigations at the Croley-Evans Site and presents a preliminary discussion of the cultural deposits and materials recovered.

MISSISSIPPIAN SETTLEMENT IN SOUTHEASTERN KENTUCKY

Before the initiation of the Upper Cumberland River Archaeological Project, relatively little was known about the character of Mississippian adaptation in this marginal area of the Mississippian "world" (Jefferies and Flood 1993). Scattered reports of Mississippian mounds and habitation sites existed for southeastern Kentucky (Dorwin 1970; Haag 1947; Lewis 1990b; Funkhouser and Webb 1932), but most of these sites were poorly documented or known only to artifact collectors. Research in the project area conducted by Hockensmith (1980) and DeLorenz and Weinland (n.d.) in the late 1970s provided important new information on the kinds and distribution of Mississippian sites in the Upper Cumberland region. The emerging picture suggested that a variety of Mississippian site types existed, with the majority concentrated, not surprisingly, along the Cumberland River floodplain (Figure 1). At least three of these sites consisted of habitation areas with associated platform mounds (15Bl5, 15Kx24, 15Wh14) that were distributed along the Cumberland River from Pineville down river to the Kentucky-Tennessee border. Large habitation sites without mounds are also known (15Kx10, 15Kx96), as well as numerous smaller sites reflecting a wide range of extractive, maintenance, and ceremonial activities (Hockensmith 1980:228-230, 238). Virtually nothing was known about the chronological placement of the Mississippian components at these sites or the nature of Mississippian groups that once inhabited them.

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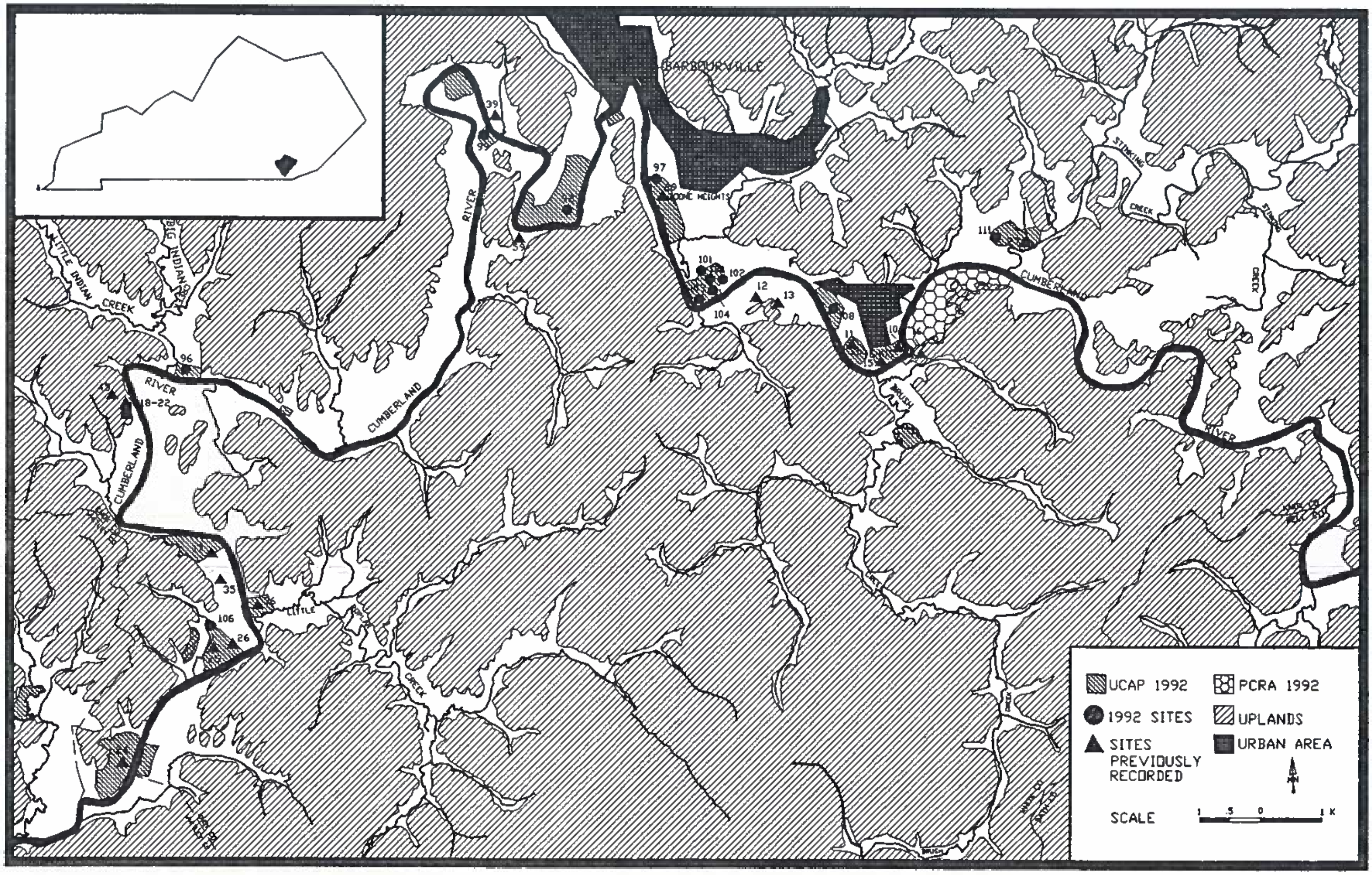

Figure 1. Location of Survey Tracts and Mississippian Components in the Vicinity of Barbourville, Kentucky.

DESCRIPTION OF THE PROJECT AREA

The Croley-Evans Site is located in southwestern Knox County, near the Knox-Whitley County line. The topography of the project area (Knox and eastern Whitley counties) generally consists of narrow, long, steep to very steep ridges and narrow to broad valleys. Approximately 11 percent of the area consists of nearly level to gently sloping floodplains and terraces. The remainder of the project area consists of steep ridges and valleys (76 percent) or gently sloping to moderately steep ridges, alluvial fans, or high stream terraces (13 percent) (Love 1984:2). Elevations in the project area range from approximately 300 m along the Cumberland River to more than 700 m at the top of Pine Mountain in eastern Knox County. The Cumberland River roughly bisects the project area, flowing in a generally westward direction in a meandering pattern (Love 1984:2).

Much of the project area lies in the Mountain and Eastern Coal Fields Physiographic Region, a subdivision of the Cumberland Plateau. The geology of this region consists of the Lower and Middle Pennsylvanian strata, with the exception of the north side of the Pine Mountain overthrust fault. The bedrock of the area north of Pine Mountain, including most of Knox County, is the Breathitt Formation, consisting of interbedded sandstone, siltstone, and shale. The north side of Pine Mountain consists of Mississippian System Newman limestone (Love 1984:2). The exposed Mississippian strata represent the major source of chert in the Knox County vicinity. Chert also occurs in the beds of streams that flow down the north slope of the mountain.

SITE DESCRIPTION

As a means of learning more about Upper Cumberland River Mississippian society, archaeological investigations, funded by the Kentucky Heritage Council, were carried out at the Croley-Evans Site during the summers of 1992 and 1993. The primary purposes of this research were to collect information and materials with which to determine the temporal placement of the site's Mississippian component(s); to gain a better understanding of the technology, subsistence, and social and economic organization of the site's inhabitants; and to investigate the nature of interaction between Upper Cumberland Mississippian groups and contemporary groups living in adjacent parts of the Southeast (Jefferies 1992).

The Croley-Evans Site is situated along an approximately 300 m section of a low terrace and back slope on the west side of the Cumberland River between present day Barbourville and Williamsburg, Kentucky. The site consists of a platform mound and "village" covering approximately 5 hectares, making it one of the largest Mississippian sites in the region.

The Croley-Evans mound is approximately 26 m in diameter and 3 m high (Figure 2). The mound's size and shape have undoubtedly been altered through the years, primarily by the digging of artifact collectors and the impact of more than 100 years of cultivation. The current landowner has recently filled in the pothunter pits and placed the mound surface in pasture, providing increased protection for the mound and its contents. According to both local tradition

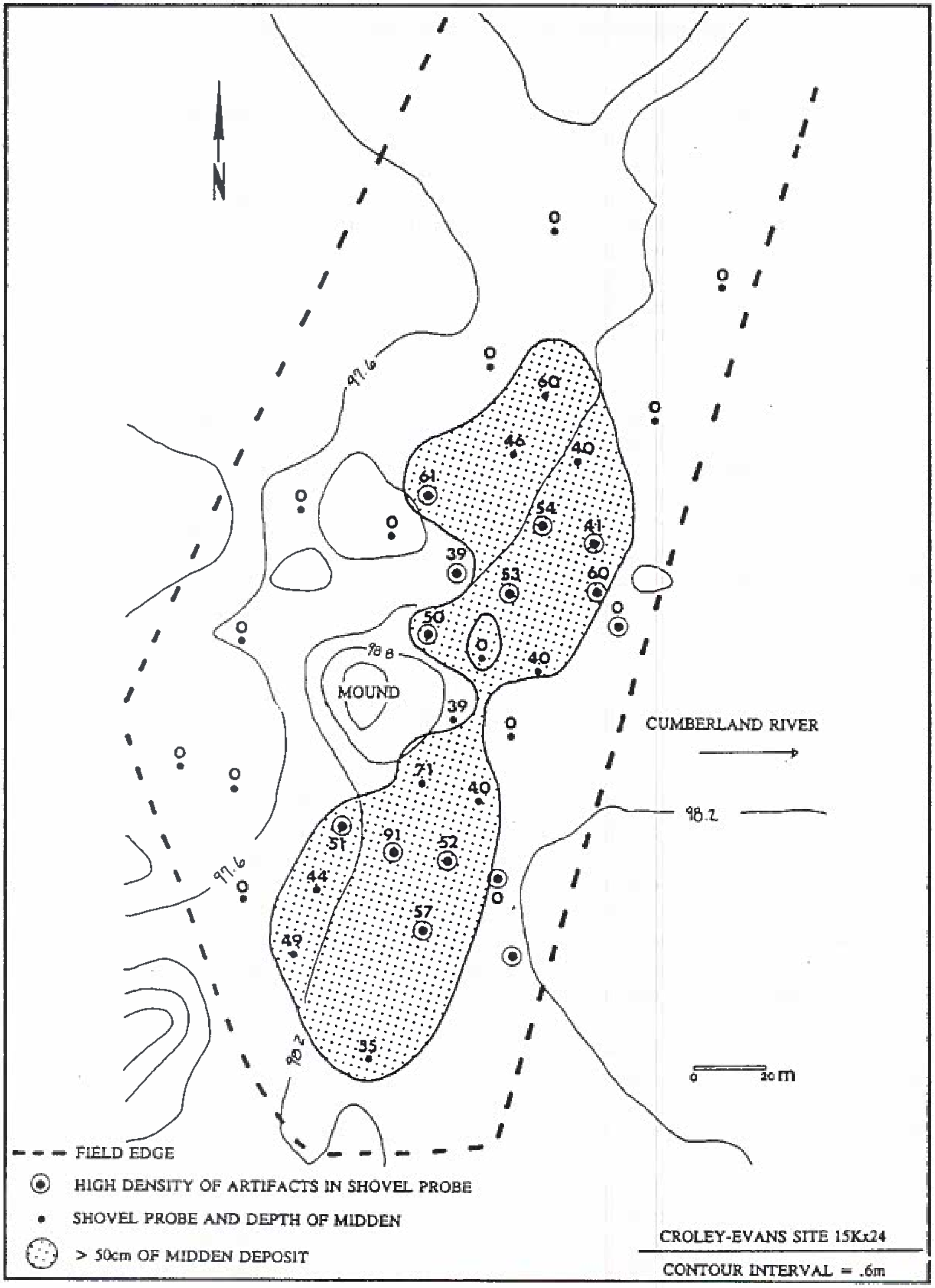

Figure 2. Location of 1992 Shovel Probes at Croley-Evans Site (15Kx24).

and scholarly research (Dupier, personal communications), the Croley-Evans Site corresponds to one of the Native American settlements described by Dr. Thomas Walker during his brief visit to Kentucky in 1750 (Walker n.d.:17).

The Croley-Evans Site is located on an area of Huntington Silt Loam soil that extends from the bank of the Cumberland River westward to the base of the ridges that flank the river valley. Huntington Series soils consist of deep, well-drained, moderately permeable soils that form in alluvium washed from limestone, sandstone, shale, and siltstone. These soils occur on level stretches of the Cumberland River floodplain and are subject to brief flooding episodes in the winter and spring (Love 1984:79).

A systematic surface collection conducted during the summer of 1992 indicated that the areas of most intensive Mississippian activity were located along the low terrace between the mound and the Cumberland River. Three areas occupying the highest parts of the terrace contained the highest densities of surface material and were designated as Areas 1-3 (Figure 3).

As a means of further investigating the intensity of on-site activity, shovel probes were excavated along transects through the midden, revealing up to 90 cm of cultural deposits in some parts of the site (see Figure 2). The deepest midden accumulation is located in the eastern part of the site between the mound and the river, corresponding to those areas containing higher densities of surface material (Areas 1 and 2). Relatively little midden accumulation was observed west of the mound, perhaps because this part of the site serves as an overflow channel for the Cumberland River when the river is at flood stage. The lack of midden may be the result of erosion caused by the flow of flood water from the river through this part of the site or by the intermittent wet conditions that probably made this area undesirable for many prehistoric activities. Diagnostic artifacts collected from the shovel probes and the surface collection dated almost exclusively to the Mississippi period (A.D. 1000-1600) (Jefferies and Flood 1993).

1993 FIELD INVESTIGATIONS

Data provided by the 1992 field investigations indicated that the areas of greatest midden accumulation were located ca. 25-50 m to the southeast (Area 1) and northeast (Area 2) of the mound (Figure 3). Based on these observations, six of the 1993 1 x 2 m excavation units were placed in these two parts of the habitation area. An additional 1 x 2 m test unit was excavated on the platform mound.

HABITATION AREA

Five 1 m x 2 m excavation units (Units 1, 2, 3, 6, and 7) were placed in the southern part of the habitation area designated as Area 1 (Figure 4). An additional 1 x 2 m excavation unit (Unit 5) was placed to the north in Area 2 (Figure 4). Excavation of these six units collectively exposed 12 m^2 of the site and removed approximately 10 m^3 of soil matrix.

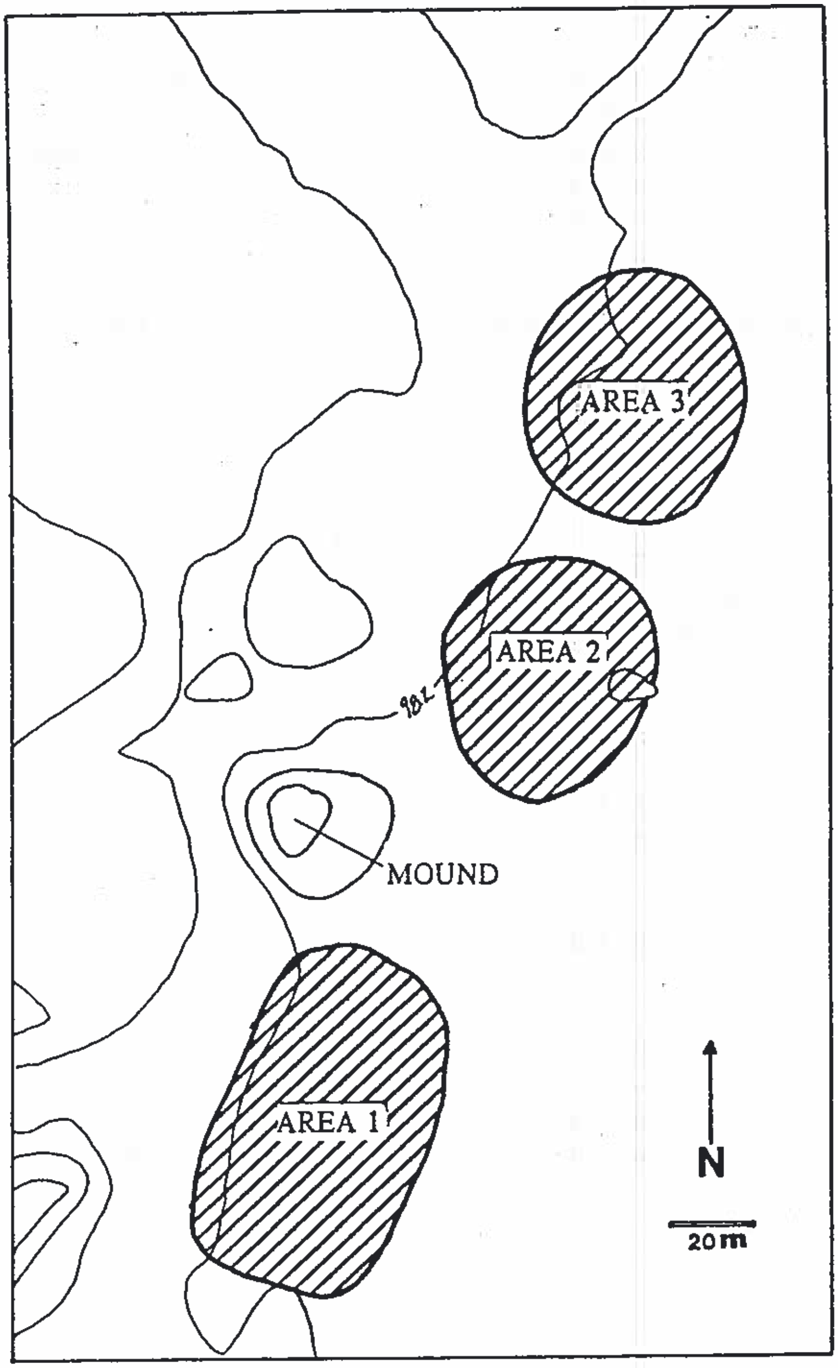

Figure 3. Approximate Locations of High-Density Artifact Areas at the Croley-Evans Site.

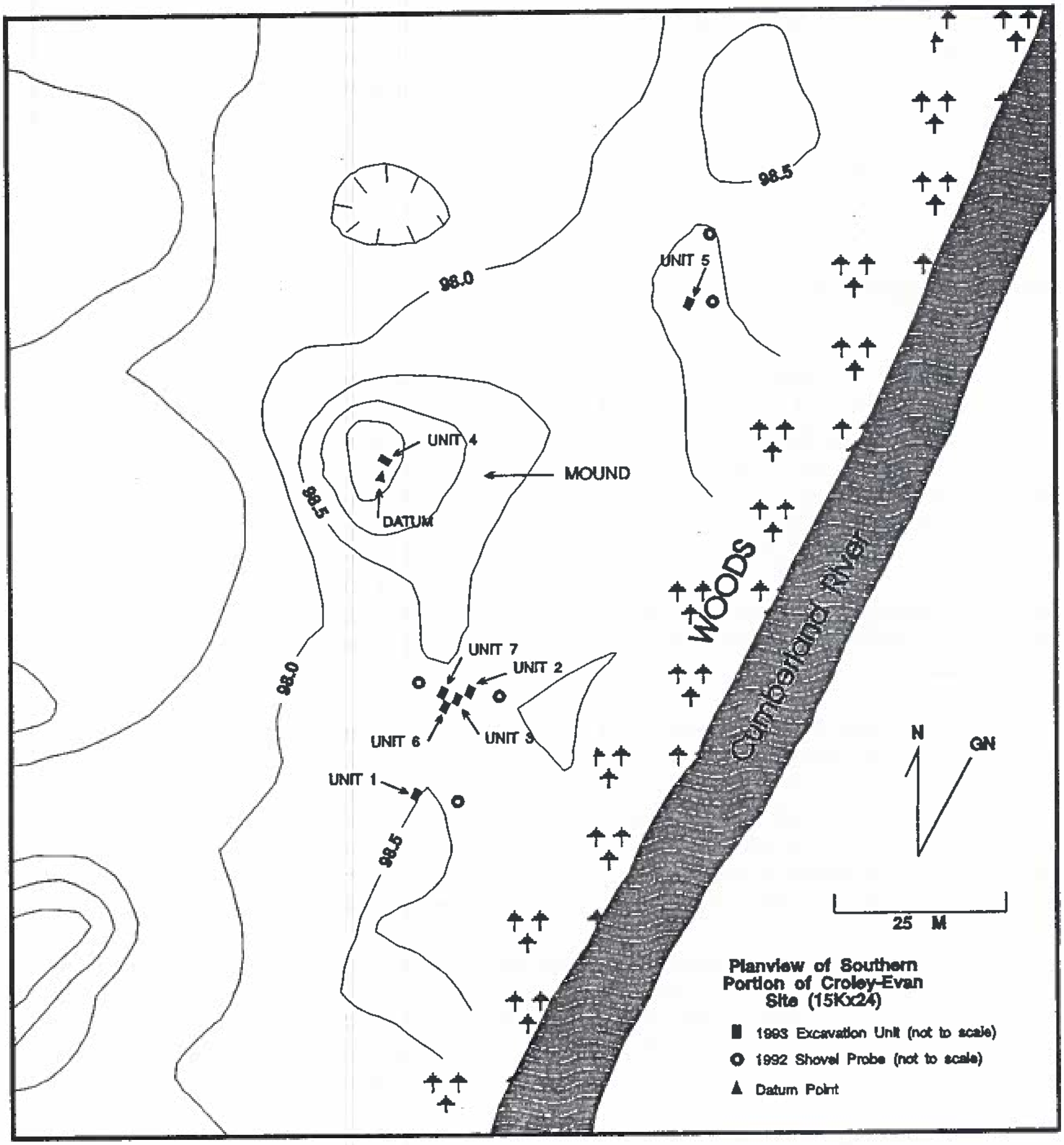

Figure 4. Location of 1993 Excavation Units.

Excavation of all cultural deposits was accomplished using shovels and trowels. Unit excavation was initiated with the removal of a 20 cm thick plowzone level. The plowzone from the first units excavated in Areas 1 and 2 was screened through 6 mm hardware cloth. Plowzone deposits from subsequent excavation units were hand-sorted to recover temporally and functionally diagnostic artifacts. Excavation of all subplowzone cultural deposits was done by removing 10 cm thick levels. All subplowzone deposits were screened using 6 mm hardware cloth. All materials retained in the screens were bagged by provenience and returned to the University of Kentucky Museum of Anthropology for processing and analysis. Flotation samples were collected from each subplowzone excavation level and from all cultural features. During excavation, vertical and horizontal control was maintained through the use of a datum stake placed at the northwest corner of each excavation unit. A datum established on the mound was used to record horizontal and vertical provenience data on a site-wide basis.

Area 1 Excavation Units

Initially, two units (Units 1 and 2) were opened in midden Area 1 located to the southeast of the mound. Excavation of Unit 1 (142N 126W) extended to a depth of 70 cm, exposing 30 cm of midden deposit (Figure 5). The midden zone contained shell tempered plain and cordmarked pottery, chert debitage, animal bone, and carbonized cane and cane matting. Examination of the unit floor at 30 cm below surface revealed an area of charcoal and daub in the southern two-thirds of the unit that was designated as Feature 1. Examination of the western wall profile revealed that Feature 1 coincided with a layer of brown clay that extended into the south wall. The discontinuity in the wall profile, the presence of postmolds, and the burned cane and cane matting suggest the possibility of a structure in this area. Unfortunately, the unit's small size prevented a better assessment of the possible structure's size or architectural characteristics.

Unit 2 (165N 126W) was placed 23 m north of Unit 1 in an area where the 1992 shovel probes had yielded charcoal, daub, and burned clay. Removal of the 22 cm thick plowzone revealed a 30 cm thick midden deposit containing areas of reddened clay and charcoal. Examination of the southern wall profile disclosed that the greatest concentration of burned material occurred in a 10 cm thick stratum located at ca. 50 cm below surface. Unfortunately, much of Unit 2 appeared to have been disturbed by tree roots or other kinds of bioturbation, making interpretation of the profiles difficult. Unit 2 was excavated to a depth of 80 cm.

In an attempt to investigate further the burned stratum, three additional excavation units were opened to the south and west of Unit 2 (Figure 6). Excavation of these three units, consisting of Units 3 (163N 127W), 6 (161N 128W), and 7 (163N 129W), revealed generally similar stratigraphy -- a 25 to 30 cm thick plowzone, a well-defined 25 to 30 cm thick midden zone below the plowzone, and subsoil at greater than 60 cm below surface (Figure 7).

Although the burned stratum was present in all three of these units, it was best defined in Unit 6. This stratum, referred to as Feature 5, consisted of a 5 to 10 cm thick zone of carbonized wood and cane, burned clay, and ash that extended over most of the unit floor at depths of 50-60 cm below surface (Figure 6). Careful examination of the upper surface of Feature 5 revealed fragments of burned cane matting and burned cane and wooden poles. In

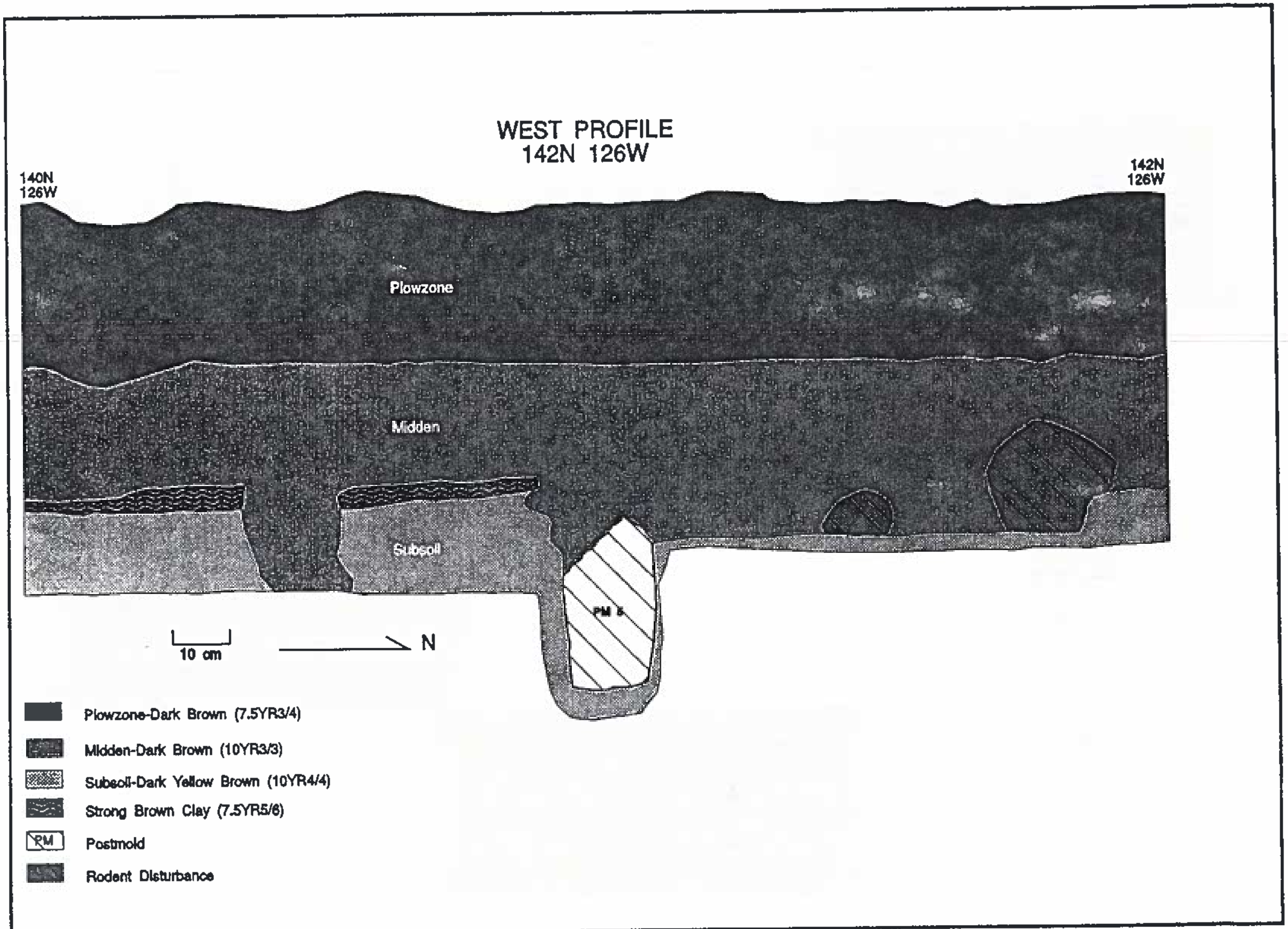

Figure 5. Composite West Profile of Unit 1 Along 126W Line.

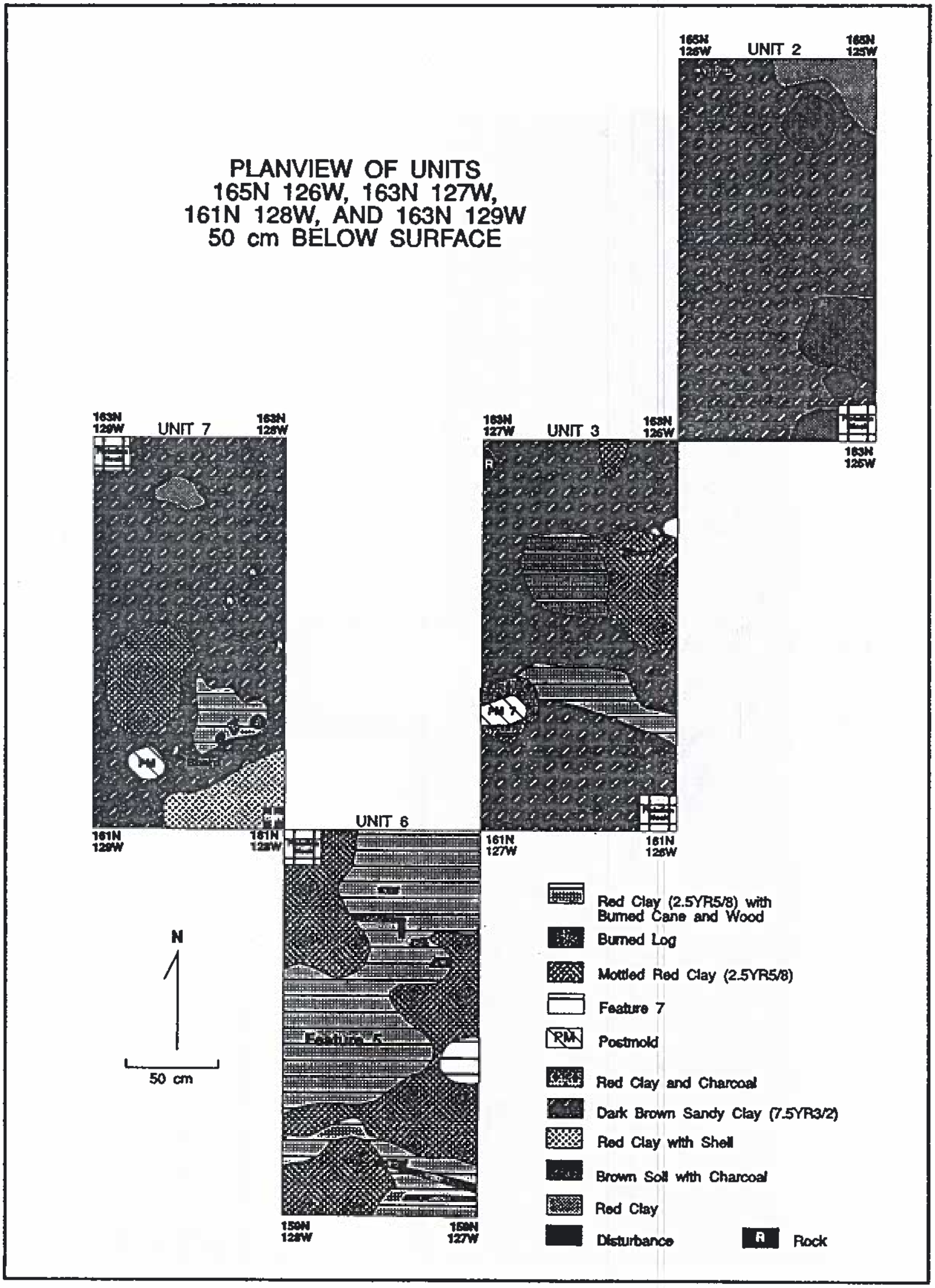

Figure 6. Planview of Units 2, 3, 6, and 7 at 50 cm Below Surface.

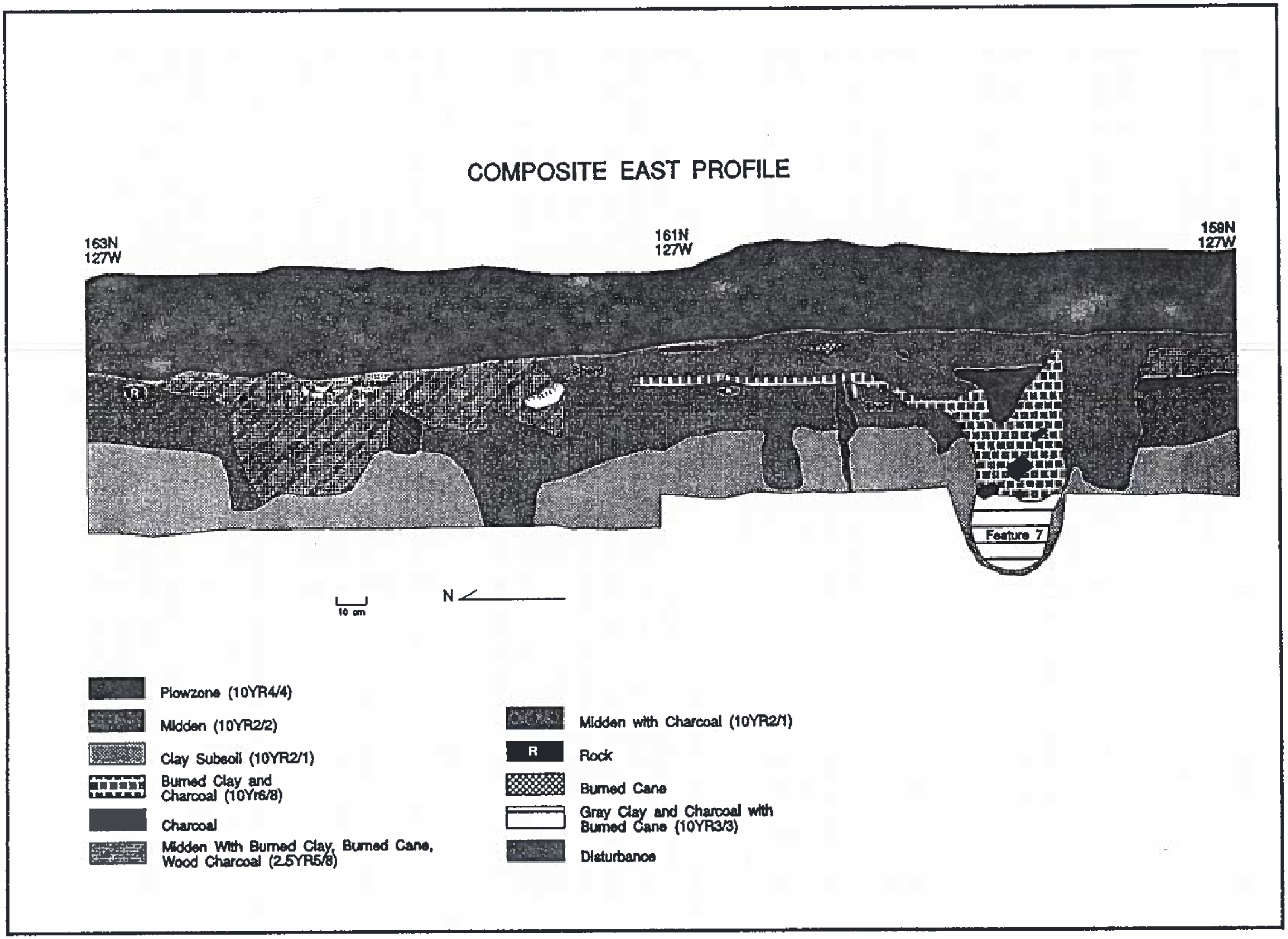

Figure 7. Composite East Profile of Units 2 and 3 Along 127W Line.

several areas, the burned poles were positioned at right angles to each other suggesting that they were part of a structure wall. The numerous postmolds visible at the midden-subsoil interface provide additional support for the presence of a structure in this part of the site.

The recovery of a large piece (107 g) of daub from the portion of Feature 5 extending into Unit 7 provides some limited insights on the architectural characteristics of the structure. Impressions of a cane pole and a larger wooden post suggest that the primary wall components consisted of 16-18 cm diameter wall posts with smaller cane poles placed in between the wooden posts. Clay used to plaster the walls appears to have contained strands of grass and other vegetal matter. The diameter (17 cm) of the wooden wall post that left its impression in the daub is close to the mean diameter (15 cm) of excavated postmolds in the vicinity of Feature 5.

Because of the relatively small area excavated (8 m^2) and the large size of many Mississippian structures in the region, the size and shape of the possible structure cannot be determined presently. Domestic structures excavated at the Toqua Site, located 150 km south of the project area in the Upper Tennessee River valley, were as large as 12 x 12 m, and were constructed using wall posts up to 30 cm in diameter and spaced 30-60 cm apart (Polhemus 1987:247-259). Excavation of a comparable area (8 m^2) of most of the Toqua structures would have made a determination of their size and shape difficult as well.

Analysis of soil samples collected from the cultural strata in the Unit 6 wall profile indicated that the soil ranged from mildly to moderately alkaline, having a pH ranging from 7.4 to 8.2 (Table 1). Relatively high levels of calcium, zinc, phosphorus, and magnesium were also noted. Particularly high levels of calcium were recorded in the vicinity of Feature 5 where concentrations from 5530 to 6625 ppm were detected. In contrast, soil samples taken from fields adjacent to the site yielded much lower concentrations of these chemicals. For example, the concentrations of calcium, zinc, and phosphorus at ca. 40 cm below surface were 600, 1.0, and 12, respectively. Off-site soil acidity averages about 5.8.

The relatively high level of calcium associated with Feature 5 in particular, and the midden deposit in general, is probably attributable to on-site cultural activity. Cultural calcium additives are often derived from human and animal excreta, as well as a variety of organic and inorganic residues (Woods 1982:1398). Woods (1982:1398) indicates that wood ash can also contribute significant quantities of calcium to soils. The high calcium levels associated with Feature 5 appear to reflect the presence of layers of charcoal and ash in that part of the midden.

The midden deposit underlying Feature 5 also contains relatively high levels of calcium (6390/ppm), magnesium (124/ppm), and zinc (17/ppm) (Table 1). High concentrations of magnesium can often be attributed to wood ash, as well as human urine and dry plant and animal tissue. Zinc also occurs in plant and animal tissue (Woods 1982:1399). The relatively high levels of these elements generally reflect the intensity of a variety of human activities at the Croley-Evans Site. Charred cane matting collected from Feature 5 yielded a calibrated radiocarbon date date of A.D. 1414 with a range of A.D. 1397 to 1434 at one sigma.

Table 1. Croley-Evans Soil Attributes - Unit 6 (161N 128W).

Stratum	Description	Depth	pH (cm)	Ca* (ppm)	Zn* (ppm)	P* (ppm)	Mg* (ppm)
A	Plowzone	0-30	7.4	3350	11.3	235	93
B	Midden and charcoal	30-40	7.9	6625	12.1	320	119
C	Mottled burned clay	40-50	8.0	5530	13.1	325	121
D	Midden	50-66	8.2	6390	17.0	385	124
E	Subsoil	66-88	8.2	4415	6.2	220	98
F	Unit floor	>88	8.0	2795	3.0	180	90

* Ca=Calcium; Zn=Zinc; P=Phosphorus; Mg=Magnesium

Table 2. Summary of Croley-Evans Radiocarbon Dates[1]

Laboratory Number	Provenience	Radiocarbon Age B.P.	Calibrated Age Range* (one Sigma)	Calibrated Age*	Material Dated
67660	Feature 5	520 ± 50	1397-1434	1414	cane matting
67661	Feature 6	730 ± 50	1259-1283	1272	wood charcoal and nut shells
67662	Feature 9	690 ± 60	1267-1375	1281	wood charcoal and nut shells

[1] Dates reported as RCYBP using a half-life of 5568 years. Carbon 13/12 analyses conducted on all samples. Calibrated dates based on Stuiver and Pearson (1986).

Removal of the burned strata revealed additional midden and several large pit features. Feature 6 was a large basin-shaped pit located in the northwest corner of Unit 6 (Figures 8 and 9). The portion of the feature contained in Unit 6 measured 70 cm in diameter and 25 cm deep. Feature 6 was positioned immediately below the burned strata identified as Feature 5, indicating that Feature 6 slightly predates the burned structure. Feature 6 contained a diverse assortment of cultural materials including shell-tempered pottery, chert debitage, triangular projectile points, and charcoal. Carbonized plant remains included maize kernels and cupules, chenopodium, and maygrass, as well as hickory and acorn shell. A Feature 6 charcoal sample yielded a calibrated date of A.D. 1272 with a range of A.D. 1259 to 1283 at one sigma (Table 2).

Feature 7 consisted of an approximately 30 cm diameter post hole located along the east wall of Unit 6 (Figures 7 and 8). Feature 7 appeared to originate at the same level as Feature 5 and contained large fragments of burned wood and smaller fragments of burned cane matting resembling those associated with Feature 5. If Feature 5 represents the remains of a burned structure, the post that once occupied Feature 7 was probably associated with the same structure.

Feature 9, located 2 to 3 m north of Feature 6, was a large basin-shaped pit found in the northwest corner of Unit 7 (Figure 10). The point of origin of Feature 9 was approximately 50 cm below surface, conforming to that of nearby Feature 6. The excavated portion of Feature 9 measured 104 cm long, 95 cm wide, and 50 cm deep. If the feature is symmetrical in outline, the pit would be at least 2 m in diameter. The exposed portion of Feature 9 may also represent the rounded corner of a much larger feature, such as a structure basin. Examination of the pit wall profile disclosed that the feature contained multiple fill episodes consisting of charcoal, ash, and a variety of botanical and animal remains.

A Feature 9 charcoal sample yielded a calibrated date of A.D. 1281 with a range of A.D. 1267 to 1375 at one sigma (Table 2). The similar calibrated dates for Features 6 and 9, separated by only 9 years, strongly suggest that they are associated with the same occupation, and slightly pre-date the overlying burned structure (Feature 5).

Area 2 Excavation Units

Excavation Unit 5 (242N 117W) was placed approximately 35 m to the northeast of the mound in a portion of the habitation area known as Area 2 (Figure 4). Like Area 1, Area 2 is characterized by a dark surface stain and 50-60 cm of midden (Figure 3). Removal of the 20 cm thick plowzone exposed a large circular stain extending from the eastern and southern sides of the unit. Investigation of the stain revealed the undisturbed lower portion of a large basin-shaped pit designated as Feature 2 (Figures 11 and 12). The excavated portion of Feature 2 measured 122 x 83 cm, and was 36 cm deep. Like Feature 9, Feature 2 may represent part

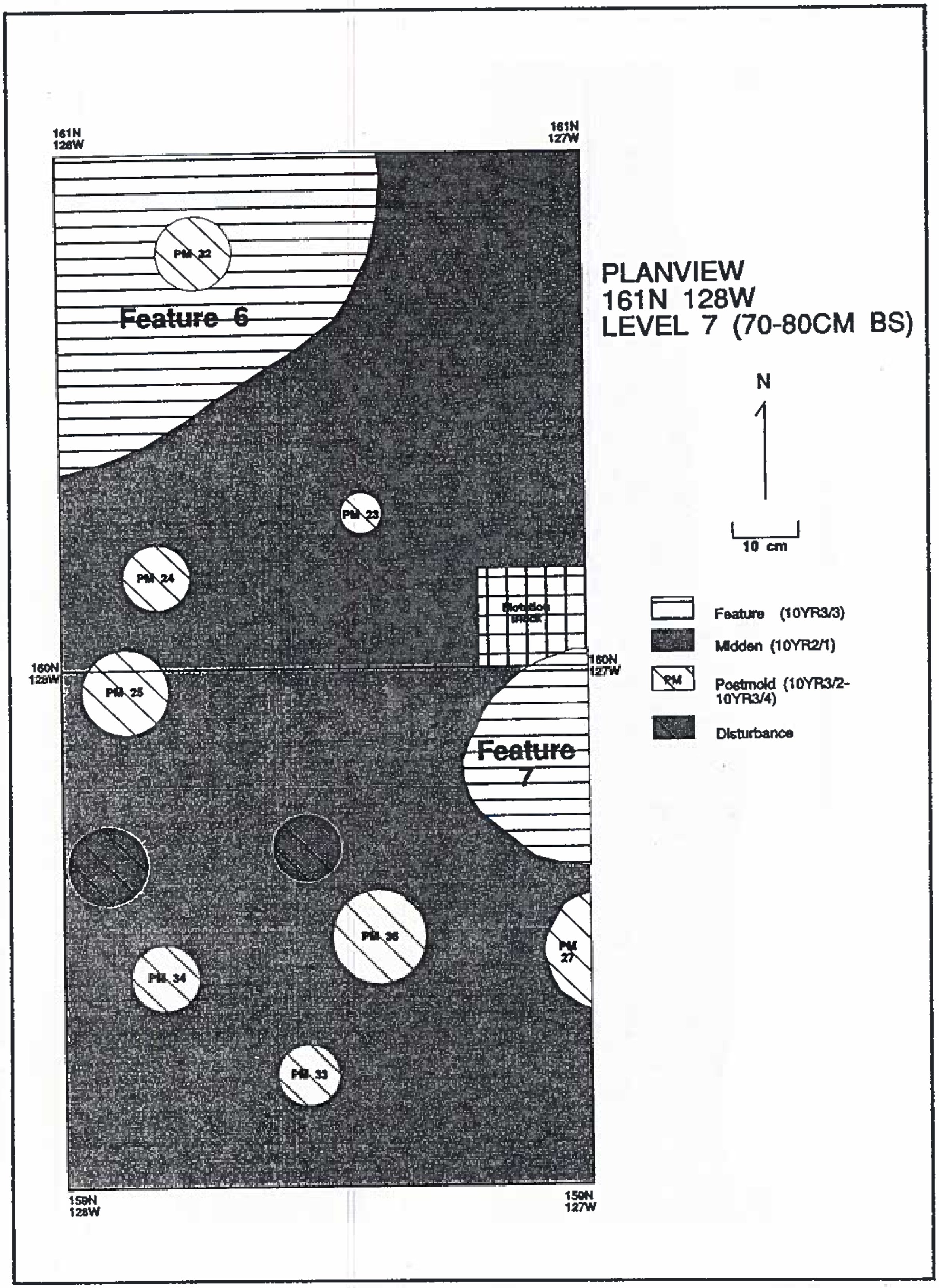

Figure 8. Planview of Level 7 in Unit 6 (161N 128W).

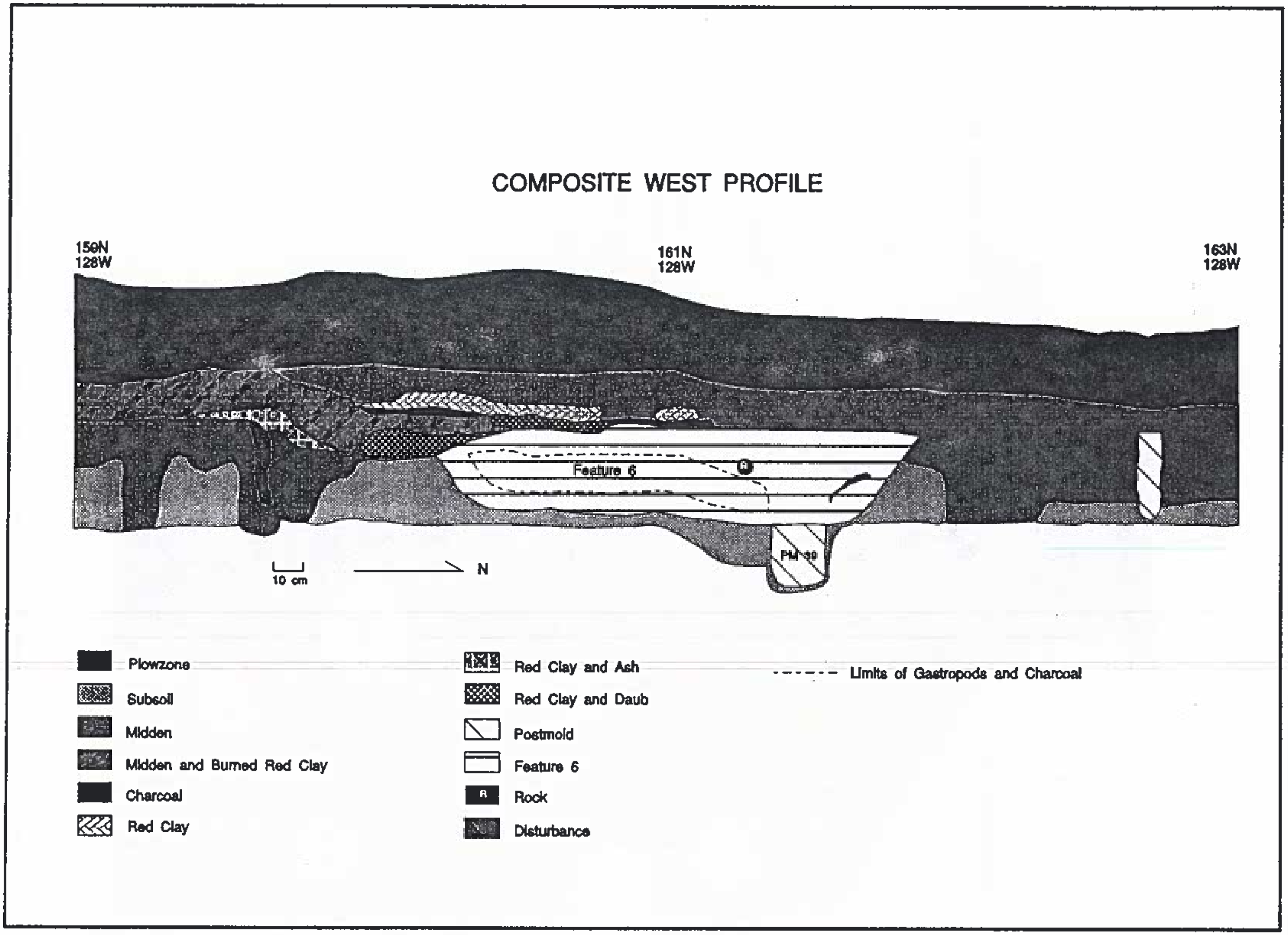

Figure 9. Composite West Profile of Units 6 (161N 128W) and 7 (163N 129W).

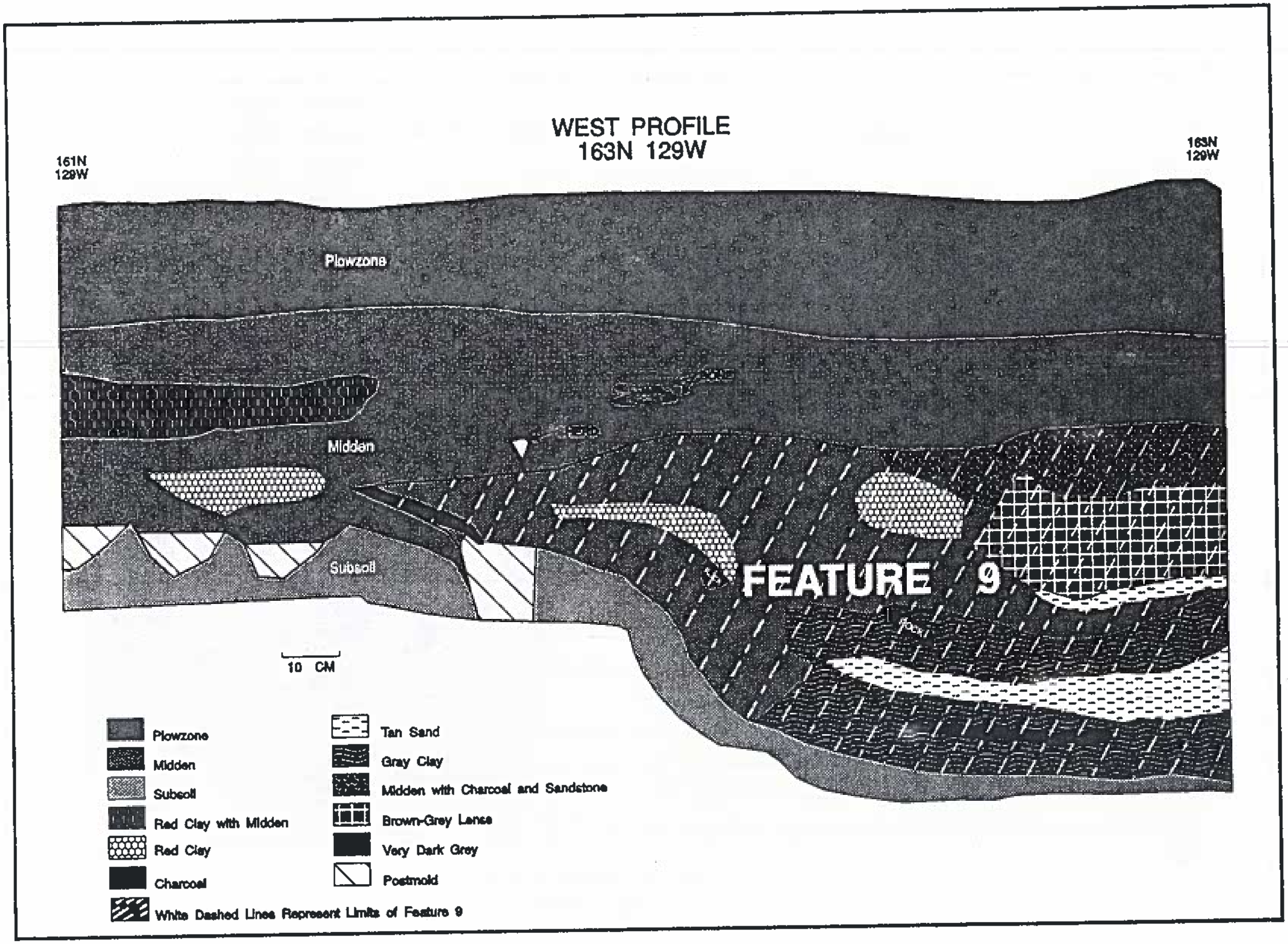

Figure 10. West Profile of Unit 7 (163N 129W) Showing Feature 9.

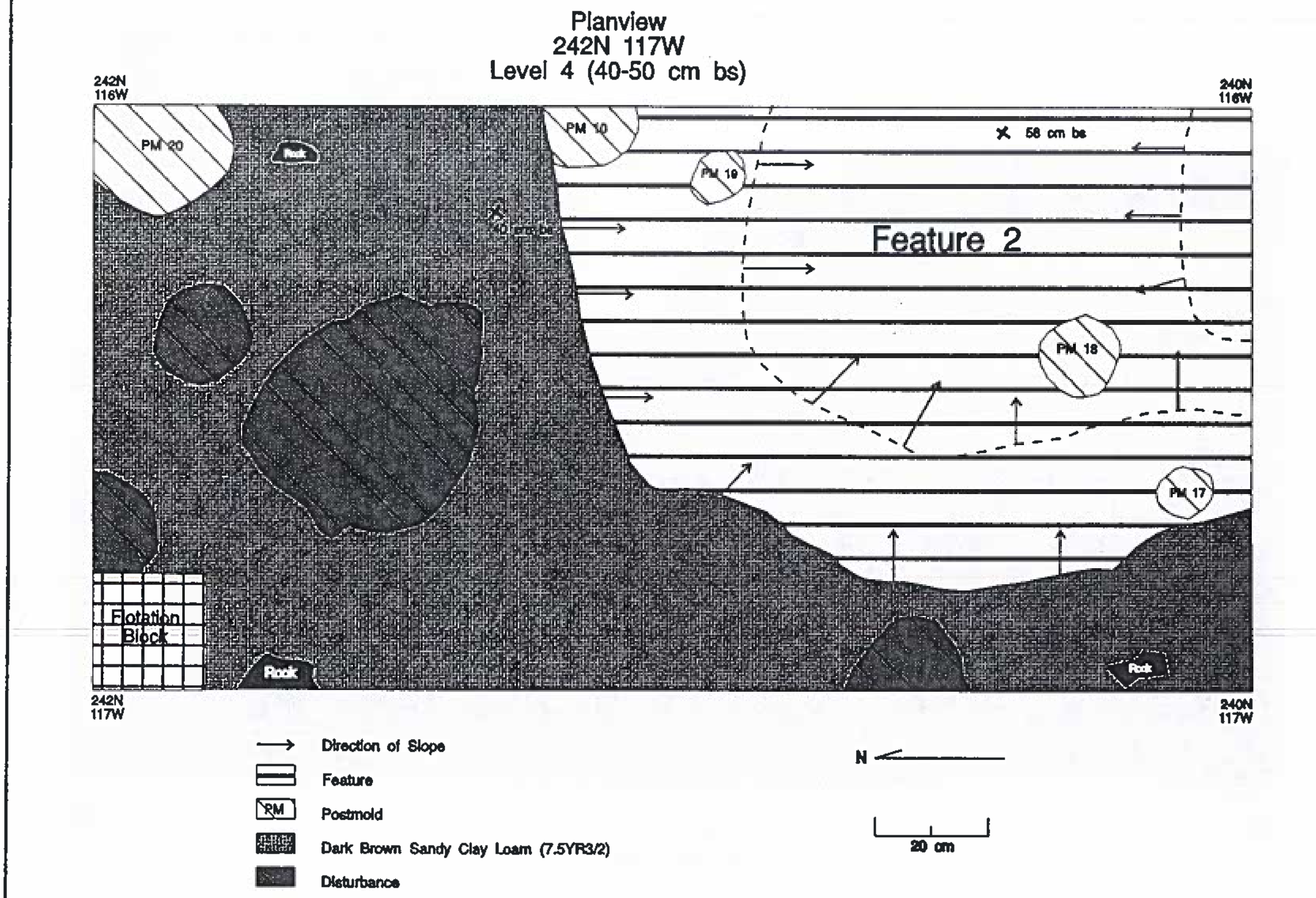

Figure 11. Planview of Unit 5 (242N 117W) at 50 cm Below Surface Showing Feature 2.

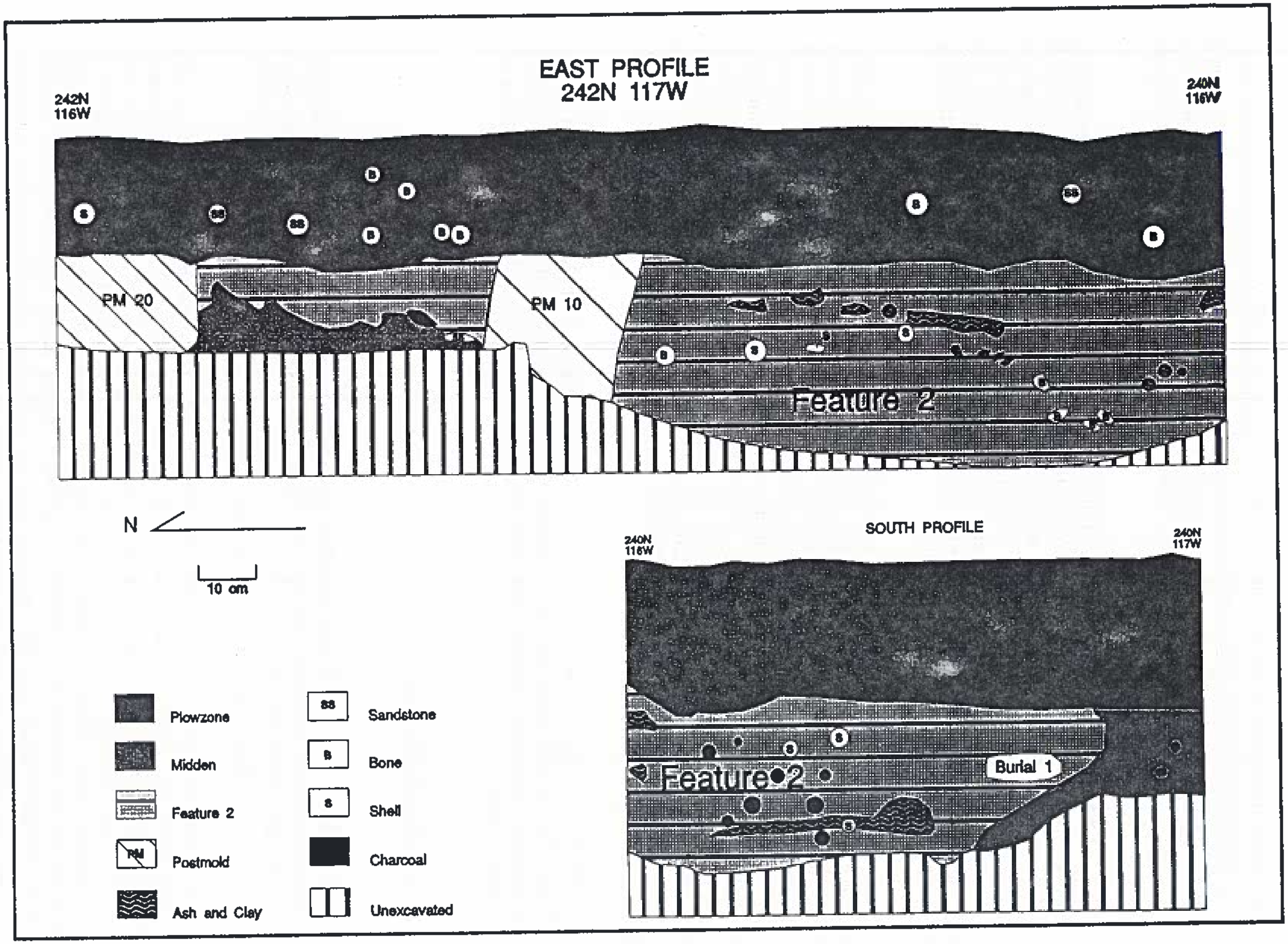

Figure 12. East and South Profiles of Unit 5 (242N 117W) Showing Feature 2 and Burial 1.

of a much larger feature or structure. Feature 2 fill contained large quantities of animal bone, sandstone, and shell tempered plain, cordmarked and check-stamped pottery, as well as ash and clay. Investigation of a concentration of bone in the upper portion of the feature fill near the unit's south wall revealed the skeletal remains of an infant, designated as Burial 1 (see Figure 12).

Burial 1 was the primary inhumation of an infant that was interred in the upper portion of Feature 2. The infant's age at the time of death is estimated to be approximately 9.5-10.5 fetal months. The nearly complete skeleton was articulated, lying on the right side with the legs placed in a semi-flexed position, arms folded under the body, and the head oriented to the south. Close examination of the Burial 1 skeletal elements revealed few pathological conditions and none that could indicate cause of death. An engraved shell gorget, described below, was the only artifact associated with Burial 1 (Wilson 1994).

Excavation of Burial 1 revealed an engraved shell gorget located on the infant's chest (Figure 15). The roughly oval-shaped gorget measures 70 x 60 cm and is engraved on one surface. The engraved design consists of a central cross surrounded by three concentric ovals with engraved lines radiating from the outer oval to the edge of the gorget. The gorget appears to be a variant of a scalloped triskele gorget similar to those of the Nashville Basin in Tennessee (Jon Muller, personal communication 1993). Although the Croley-Evans gorget is not one of those forms that are a good short-term horizon marker, Muller thinks that a good age estimate for the gorget would be in the A.D. 1350-1450 range, although it may date slightly earlier. This time range corresponds nicely with the calibrated radiocarbon dates from other parts of the Croley-Evans Site (see Table 2).

Excavation of the six habitation area test units confirmed that the eastern part of the Croley-Evans Site is well preserved and contains abundant evidence of Mississippian activity including possible structural remains, botanical and faunal materials, and a full inventory of material culture items.

MOUND INVESTIGATIONS

A single 1 x 2 m test unit was placed in the top of the mound as a means of collecting data on mound structure, function, and age (see Figure 4). Before excavation, soil cores were taken from the mound to identify areas of looter disturbance and aid in the placement of the unit in a relatively undisturbed part of the mound.

The mound test unit (Unit 4 - 190N 159W) was excavated to a maximum depth of 110 cm, providing stratigraphic data on the upper portion of the mound (Figure 13). Although much of the eastern one-third of the unit contained a pothunter's pit, the western part of the unit encountered intact stratigraphy. The wall profiles exhibited horizontal strata composed of a variety of colored soils. Many of these strata appear to represent discrete building stages, whereas some of the smaller ones probably represent basket loads of soil used for mound construction. Much of the mound fill contained artifacts and other cultural materials, indicating the habitation area midden was used to build parts of the mound.

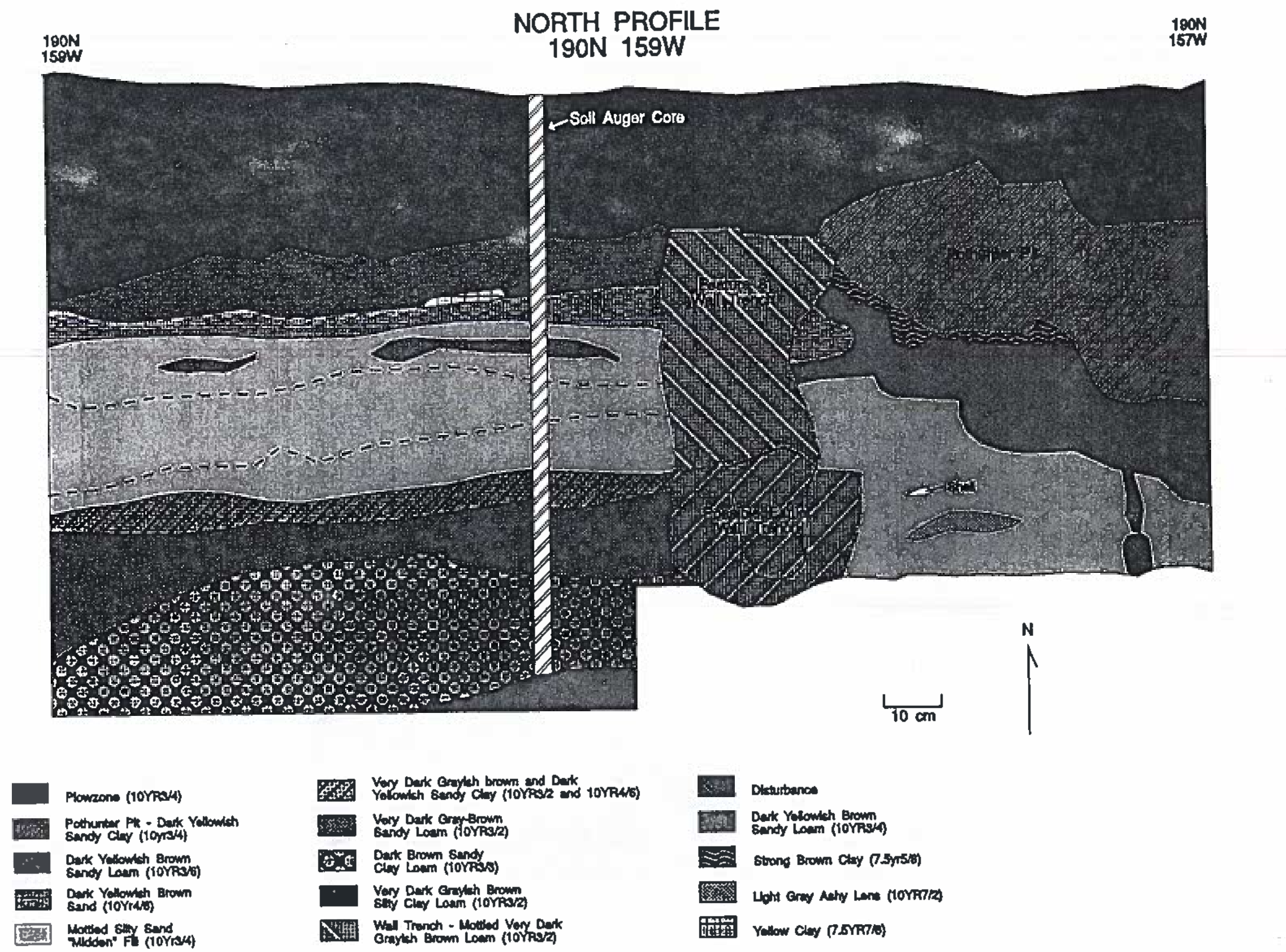

Figure 13. Profile of Mound Unit (Unit 4, 190N 159W).

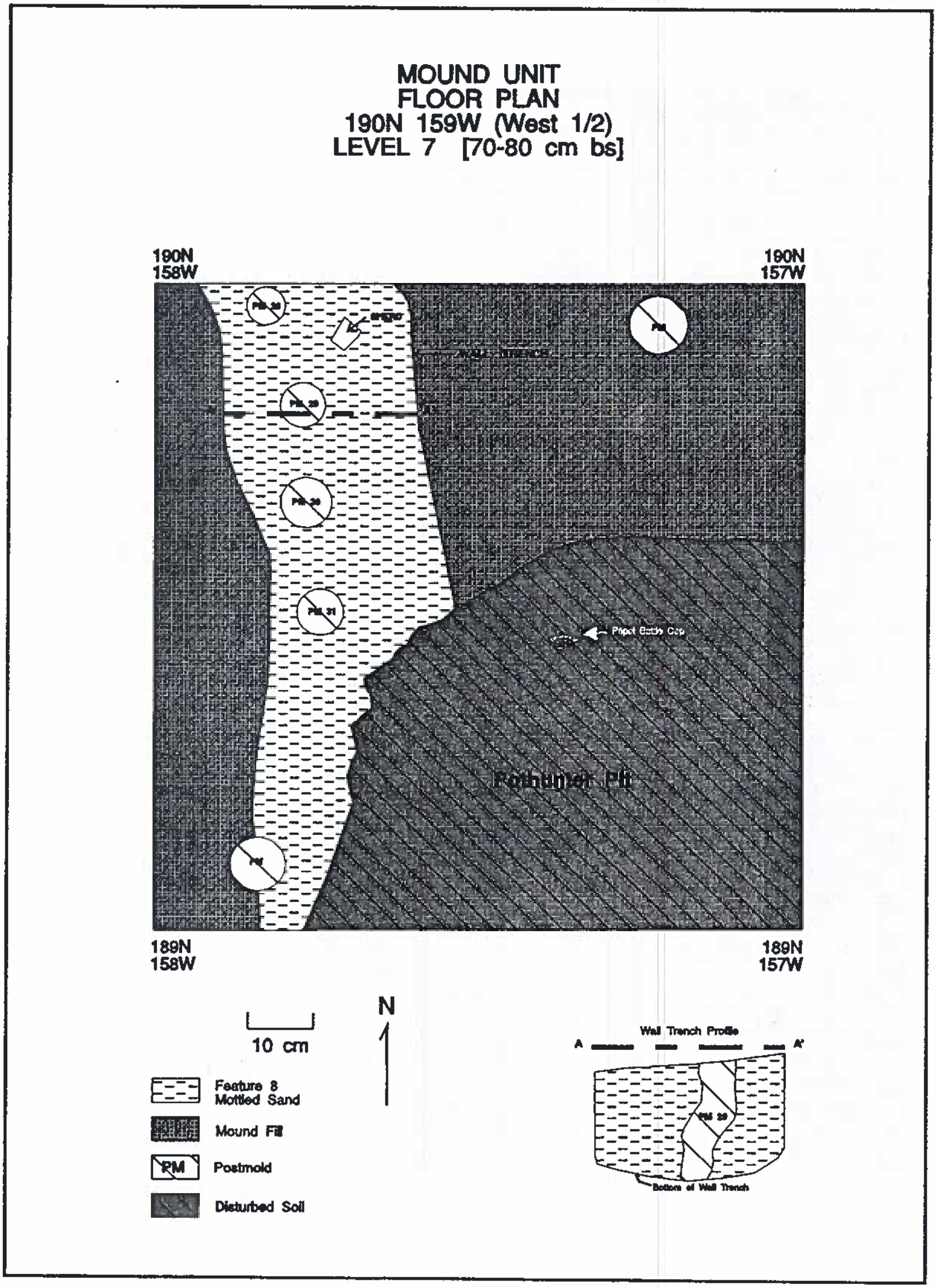

Figure 14. Planview of Level 7 in Unit 4 (190N 159W) Showing Location of Wall Trench.

Figure 15. Shell Gorget from Burial 1.

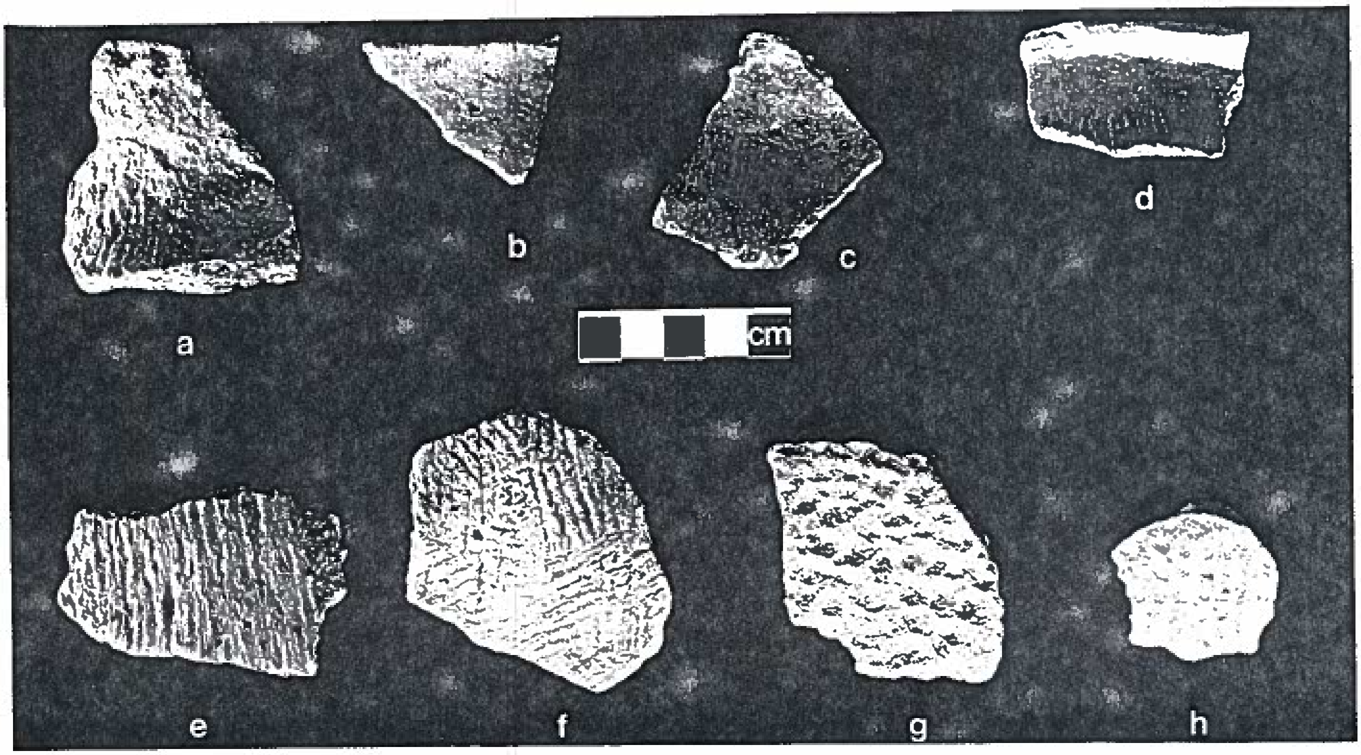

Figure 16. Shell Tempered Ceramics: a-d, Rim Sherds; e-h, Body Sherds.

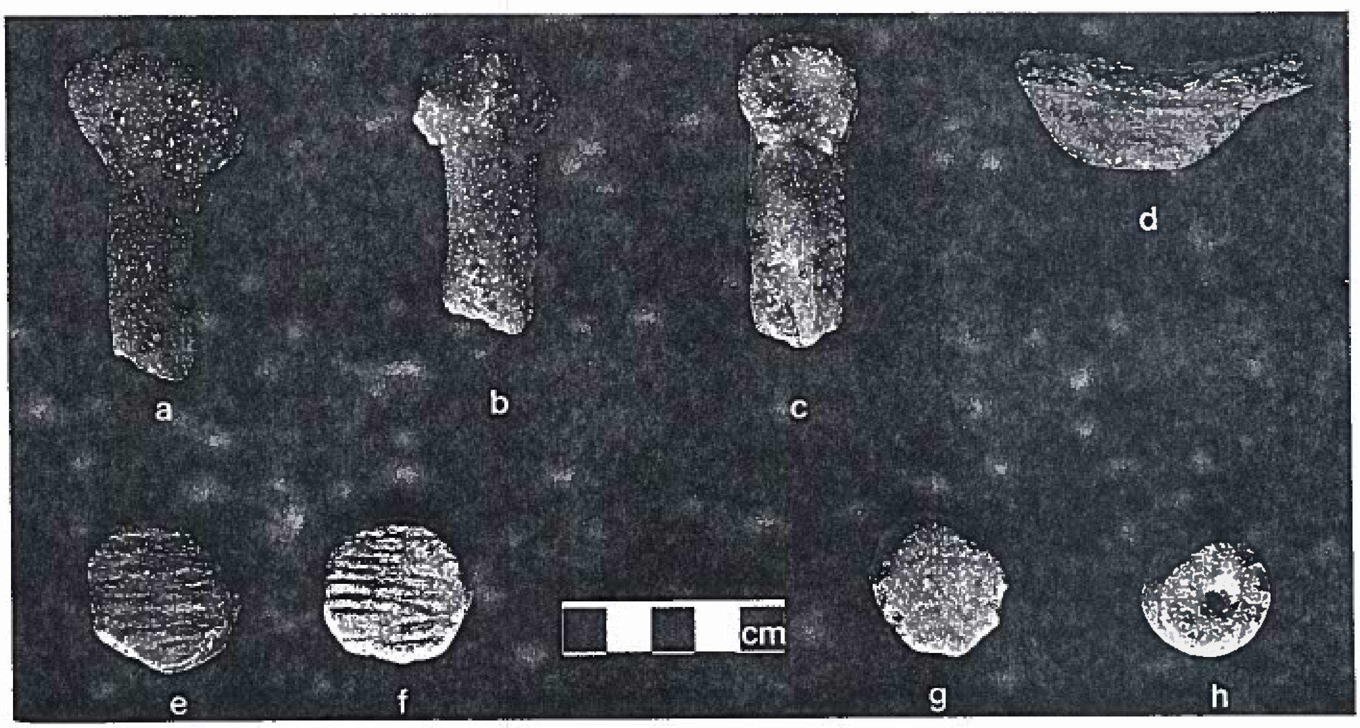

Figure 17. Additional Shell Tempered Sherds: a-c, Handles; d, Lug; e-h, Discoidals.

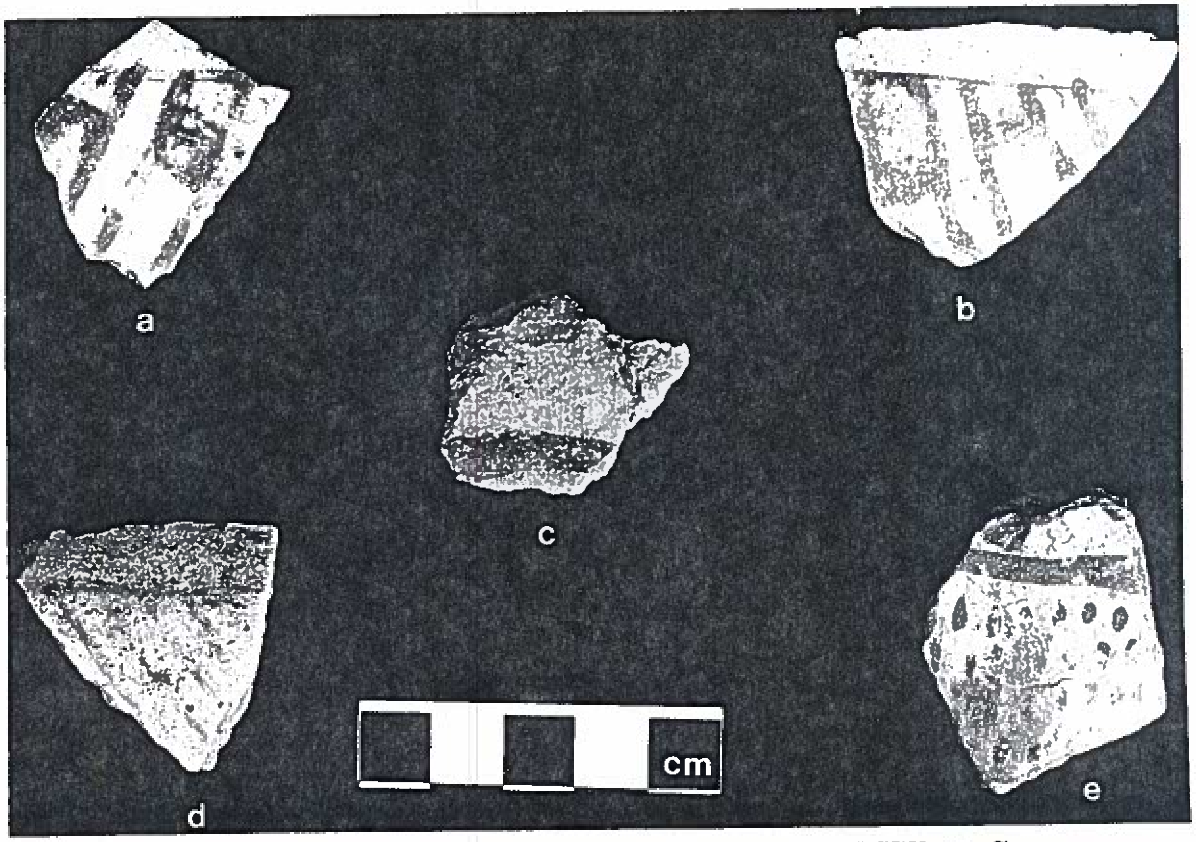

Figure 18. Painted Shell Tempered Sherds from Mound and Village Contexts.

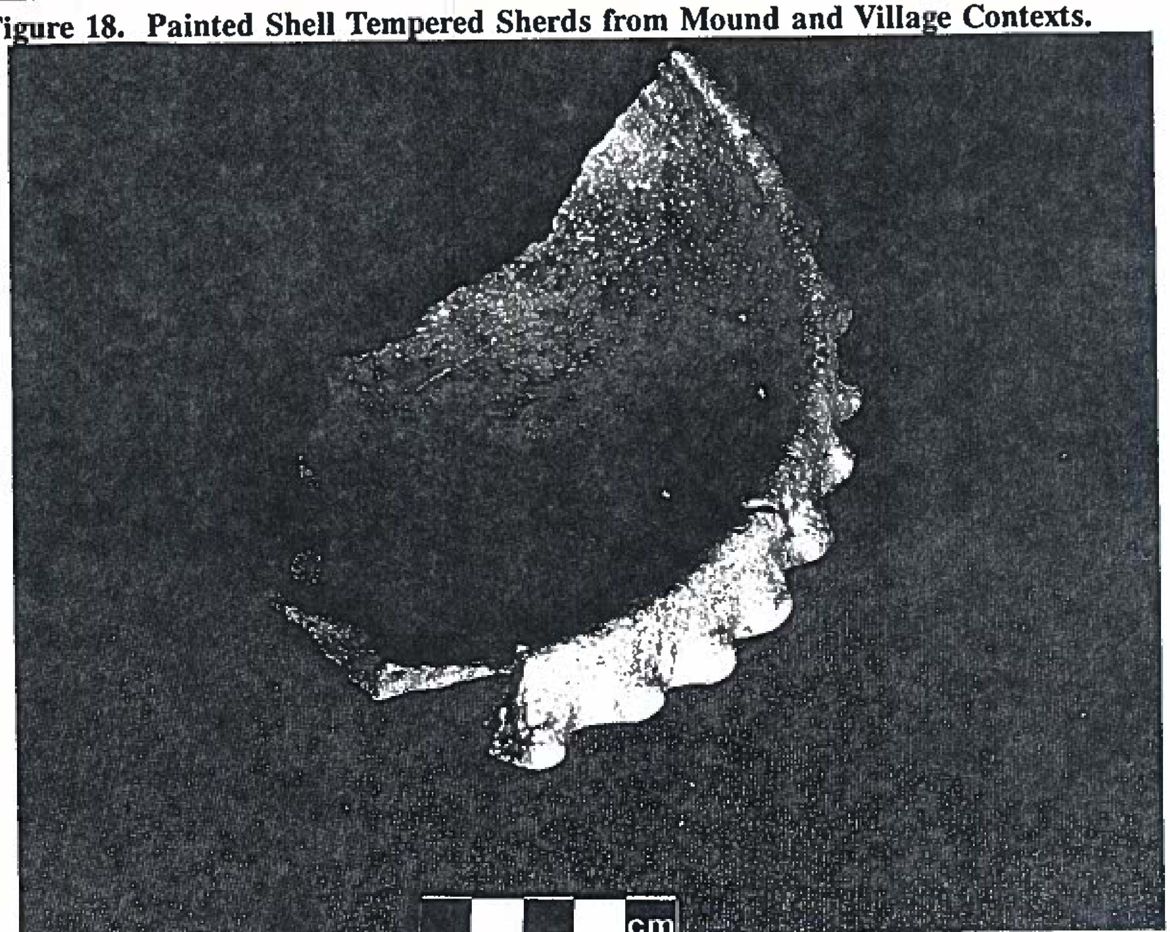

Figure 19. Section of a Shell Tempered Bowl from Village Area.

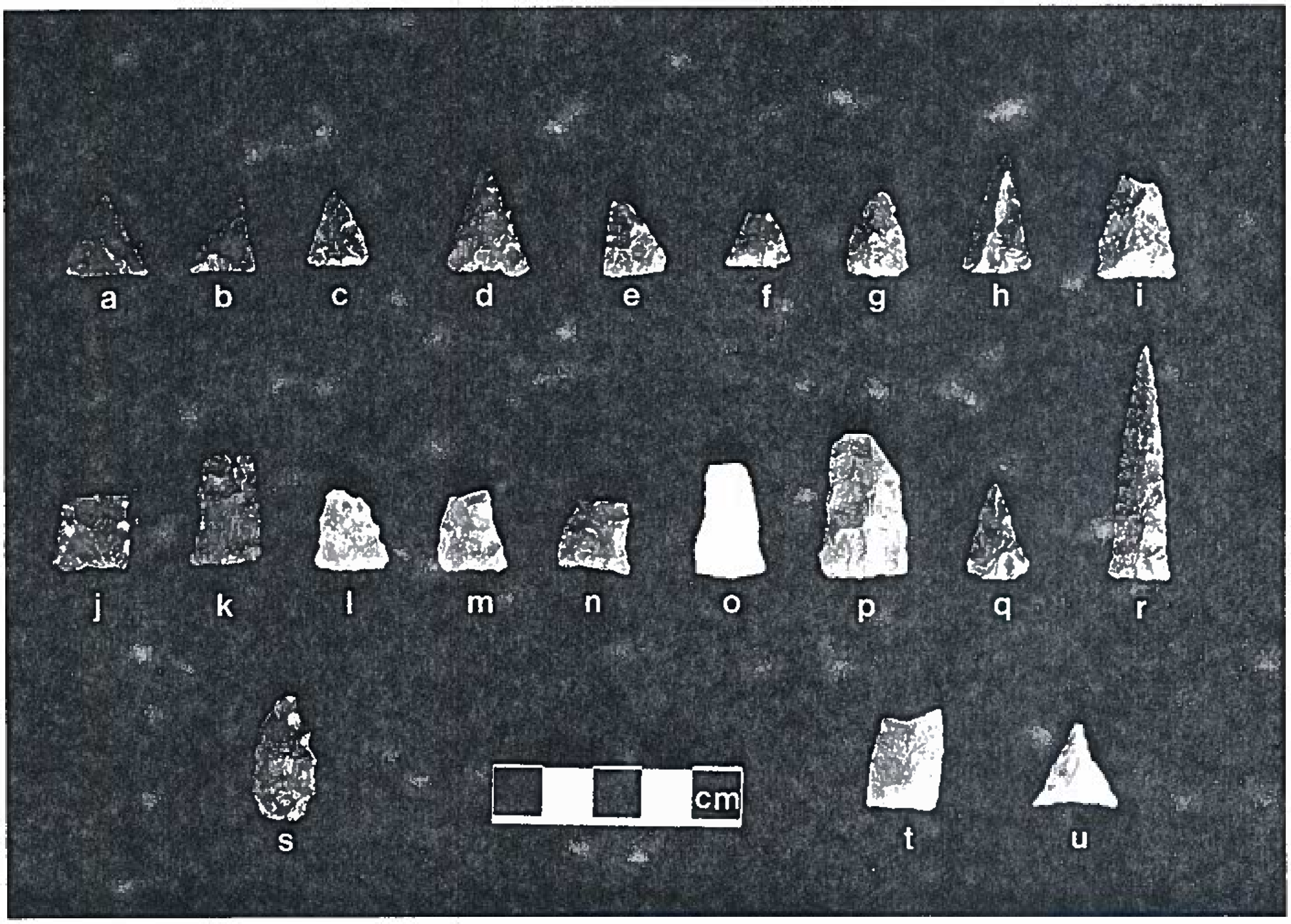

Figure 20. Mississippian Projectile Points.

Removal of excavation Level 7 (70-80 cm bs) exposed a linear feature (Feature 8) that extended north to south across the unit. Part of the feature was disturbed by an intrusive looter pit, but at least five postmolds were visible on the feature's surface, indicating that the feature was a wall trench (Figure 14). The five postmolds ranged from 6 to 8 cm in diameter (mean = 6.8 cm), and were spaced from 15 to 40 cm apart (mean=21.8 cm). The intact portion of the feature revealed that it was approximately 28 cm wide and 40 cm deep, and rectangular in cross section. Based on stratigraphic evidence, it appears that this wall trench was associated with a structure on an upper mound stage and that one wall was oriented in a roughly north to south direction. A layer of yellow-brown sand (see Figure 13) extending to the west of the wall trench may be associated with the structure floor. This same yellow-brown sand layer is clearly visible in the west wall profile of Excavation Unit 4.

Examination of the Unit 4 wall profile revealed a possible second wall trench located immediately below the one just described. This feature may be part of a structure associated with a lower mound stage.

The excavation of Unit 4 confirmed that the Croley-Evans mound is a Mississippian platform mound and that portions of it are still intact. Unfortunately, insufficient charcoal was recovered from the mound to provide a radiocarbon date, but painted pottery resembling Hiwassee Island Red on Buff (Lewis and Kneberg 1946:104) recovered from Level 6 resembles pottery associated with Feature 9 in the habitation area. Feature 9 has an associated radiocarbon date of A.D. 1281 (calibrated). In east Tennessee, Hiwassee Island Red on Buff pottery generally dates from A.D. 1000 to 1300 (Polhemus 1987:628-629).

CULTURAL MATERIALS

Although cultural materials recovered during the 1993 field investigations are still being analyzed and definitive statements concerning their type, frequency, and distribution cannot be made at this time, some preliminary observations and descriptions are possible.

CERAMICS

A total of 5,381 sherds was recovered from the Croley-Evans Site during the 1993 field investigations. Of this total, 5,348 specimens (99.4 percent) were shell tempered, 24 (0.5 percent) were limestone tempered, 8 (0.2 percent) were grit tempered, and 1 (0.02 percent) was tempered with an unidentified material (Table 3). All body sherds measuring greater than 4 cm^2 and all rims, appendages, and decorated sherds are being analyzed to assess their technological and stylistic attributes. All body sherds smaller than 4 cm^2 were counted and weighed. Elimination of the small sherds left a total of 1,000 body sherds for further analysis, along with 154 rims, eight lugs, 27 handles and 11 other vessel parts.

Shell tempered material consists of 990 body sherds, 151 rims, eight lugs, 27 handles, and six miscellaneous vessel parts (Figures 16 and 17). Sherds with plain exteriors constitute 43.3 percent of all body sherds, followed by cordmarked (26.6 percent), check stamped (8.4 percent), fabric impressed (0.5 percent), and decorated sherds (1.3 percent) (see Table 3). The exterior surfaces of 19.9 percent of the body sherds were eroded, preventing their accurate assignment to one of the above surface treatment categories. The remaining shell tempered sherds include a variety of miscellaneous items.

Preliminary analysis of the spatial distribution of shell tempered pottery in the habitation area has provided some interesting insights. Examination of the percentage distribution of plain, cordmarked and check-stamped pottery from the four units placed in the northern part of Area 1 (Units 2, 3, 6, and 7) reveals that the percentage of plain pottery ranges from a low of 37.6 percent in Unit 7 to a high of 45.8 percent in Unit 2, with an average of 41.5 percent for the four units. The percentage of cordmarked sherds is also relatively consistent, ranging from a low of 18.2 percent in Unit 3 to a high of 32.1 percent in Unit 7, with a mean of 22.7 percent for all four units. Check stamped sherds were recovered in small quantities from all four excavation units, representing from 5.1 to 13.7 percent of the shell tempered body sherds.

As a means of investigating any diachronic trends in surface treatment, the sherds from equivalent stratigraphic levels from these four excavation units were combined to increase the sherd count. Examination of the percentages suggests that there is a tendency for plain sherds to decrease through time (Table 4). In the lower portion of the midden, plain sherds constitute over 60 percent of shell tempered sherds. This percentage drops to below 35 percent in Levels 3 and 2. In contrast, the percentage of cordmarked sherds increases through time from a low of about 27 percent in the lower levels to more than 50 percent in Level 2. The percentage of check stamped sherds also increases through time from a low of about 7 percent in Levels 6 and 5 to more than 23 percent in Level 3, before decreasing to 13 percent in Level 2. The association of Feature 5, dated to A.D. 1414, with Level 5 suggests that these shifts took place around or shortly after A.D. 1400. The five fabric-impressed sherds from these units (see Table 3) also came from above Feature 5, suggesting that the use of fabric-impressed salt pans post-dates A.D. 1414 at this site. Obviously, much more information is needed to assess fully the temporal significance of these trends.

The percentage distribution of shell-tempered sherds from Unit 1, located approximately 20 m south of the four units discussed above, presents a slightly different picture. Unit 1 yielded a lower percentage of plain sherds (26.3 percent) and a higher percentage of cordmarked sherds (42.1 percent) than the four northern units. Also, Unit 1 yielded no check stamped or fabric impressed sherds. Unit 5, located in Area 2, approximately 100 m north of the Area 1 units, produced a similar percentage of plain and cordmarked sherds as Unit 1, however, check stamped pottery constituted 11 percent of the Unit 5 sherds.

The cultural significance of the differences in the percentages of surface treatment described above, if any, is currently unclear. This variability could reflect temporal or functional differences in activities within the site or it may simply represent the normal variation in the ceramic assemblage composition across the site. Much more excavation will be needed to clarify the full significance of this spatial variability in surface treatment.

Table 4. Distribution of Plain, Cordmarked, and Checked-Stamped Sherds in Units 2,3,6 and 7.

Level	Plain	Cordmarked	Check-Stamped	Total
2	11 (34.4%)	17 (53.1%)	4 (12.5%)	32
3	35 (31.5%)	50 (45.0%)	26 (23.4%)	111
4	68 (61.8%)	30 (27.3%)	12 (10.9%)	110
5	75 (65.8%)	30 (26.3%)	9 (7.9%)	114
6	40 (66.7%)	16 (26.7%)	4 (6.7%)	60
7	7 (87.5%)	--	1 (12.5%)	8
8	2 (66.7)	1 (33.3%)	--	3
Total	238	144	56	438

Since the ceramic analysis is still ongoing, little can be said about the stylistic, morphological, or technological attributes of the Croley-Evans ceramic vessels. Nevertheless, several of the specimens are worthy of additional comment at this time. The exterior surface of four of the decorated shell tempered sherds are painted with a red (ferric oxide?) pigment. Two specimens came from Level 6 in Unit 4 on the mound, and two additional painted sherds came from the midden overlying Feature 6 (Unit 6) in the habitation area (Figure 18). The decoration on three of these painted sherds consists of a band of parallel diagonal lines bordered by a horizontal line. In two cases, the diagonal lines are linked by broader bands oriented perpendicularly to the diagonal lines (Figure 18a and b). The similar decoration and paste of these two sherds, combined with their close proximity in the midden, suggests that they are parts of the same vessel. The decoration on the third sherd is similar to that on the first two, except that the painted lines are thinner and the color of the sherd's exterior surface is redder (Figure 18d). The fourth red painted sherd is decorated by an area of dots bordered by a horizontal line (Figure 18e). A fifth painted sherd, also from Unit 6, exhibits a single curved line painted using a black pigment (Figure 18c).

In addition to their decorative attributes, these sherds are distinguished from most of the other Croley-Evans shell tempered sherds by their hardness and finer shell tempering. Although it has not yet been substantiated with technological data, these painted sherds may represent non-locally produced vessels reflecting the interaction of Croley-Evans inhabitants with other Mississippian groups. Some of these sherds appear to resemble specimens of Hiwassee Island Red-on-Buff pottery (Lewis and Kneberg 1946:104). This ceramic type occurs as a minority type on many Mississippian sites in east Tennessee and has been dated from A.D. 1000 to 1300 period (Polhemus 1987:628-629; Table 1.3). The calibrated radiocarbon dates from two Croley-Evans features (Features 6 and 9) fall in the latter portion of this time range. In contrast, these sherds may represent high-quality ceramics that were locally produced.

Figure 19 shows a portion of a shell-tempered bowl found in the upper portion of Feature 5. This specimen, which would have an orifice diameter of about 20 cm if complete, is characterized by a series of nodes located just below the vessel rim. Similar bowls are reported from the Tennessee River valley of east Tennessee (Polhemus 1987:616-617; Webb 1938:Plate 79a). Polhemus (1987:616-617) placed similar noded bowls from the Toqua Site in the Dallas Noded type (Lewis and Kneberg 1946:105) dating to the A.D. 1300 to 1600 period. The A.D. 1414 calibrated radiocarbon date from Feature 5 at Croley-Evans falls in the earlier portion of this range.

In addition to sherds, six complete and five fragmentary clay discoidals were recovered (see Figure 17e-h). All the discoidals were apparently manufactured from pieces of shell-tempered pots. The six complete specimens have a mean diameter of 30 mm, ranging from 26 to 34 mm.

LITHIC MATERIAL

Preliminary analysis of the Croley-Evans lithic material (n=6,620) identified 2,704 flaked stone and 23 ground stone artifacts, and 3,899 pieces of unmodified sandstone and other miscellaneous rough rock. The flaked stone artifact collection largely consists of chert debitage (n=2,634), followed by projectile points (Mississippian and other) and projectile point fragments (n=43), drills (n=10), miscellaneous bifaces (n=15), and unifaces (n=2). Although analysis of the lithic artifacts is ongoing, it appears that the Croley-Evans lithic industry was based largely on locally available stream gravel and cobbles. Chert deposits on nearby Pine Mountain, as well as in the beds of streams originating in that area and gravel bars in the Cumberland River, appear to be the primary sources for chert (Kip Sulham, personal communications 1994).

The debitage collection is characterized by very small chert flakes. The mean weight of all flakes recovered during the 1993 field investigations was only 0.64 g. Analysis of the spatial distribution of chert debitage revealed that the size of flakes associated with levels in each of the seven excavation units, as reflected by weight, is relatively consistent ranging from 0.21 to 1.40 g. Within the four-unit block excavation in Area 1, excavation levels yielding more than 20 pieces of debitage have a mean flake weight of 0.62 g, ranging from 0.40 to 1.08 g. The density of flakes per cubic meter of midden in these levels ranged from $165/m^3$ in Level 6 to a high of $325/m^3$ in Level 2. Flake density ranged from 270 flakes/m^3 to 325 flakes/m^3 in the upper 60 cm of the midden deposit. The similar size of flakes in these levels, along with the relatively consistent density of debitage, suggests that the nature and intensity of flaked stone tool production and maintenance activities in this part of the site were relatively constant through time. The small size of the flakes suggests that chert was brought to the Croley-Evans Site in a substantially reduced form (i.e., as preforms or finished tools) or that most of the flakes were produced by the manufacture of small flake tools and tool maintenance activities. A more thorough investigation of flake attributes will be needed to substantiate this initial assessment.

The 1993 field investigations yielded 68 bifaces consisting of projectile points and point fragments, drills, and a variety of other miscellaneous bifaces. Most of the projectile points (n=30) are small triangular points commonly associated with Mississippian occupations in the Southeast and Midwest. Although most of these points can be subsumed under the broad heading of Madison projectile points (Justice 1987:224-227; Scully 1951:14), there is some morphological variability within the collection.

Twelve small triangular projectile points are characterized by straight lateral margins and a straight base (Figure 20a-i). Projectile points resembling these specimens have been documented at the Toqua site and other Mississippian sites in eastern Tennessee and are generally assigned to the Middle Mississippian Madison type or the Late Mississippian Triangular type (Polhemus 1987:729). The Croley-Evans specimens had a mean length of 17.5 mm, a mean width of 14.3 mm, and a mean thickness of 4.1 mm, making them slightly smaller than the Toqua specimens. Madison projectile points generally date from A.D. 800 to the beginning of the Historic period (Justice 1987:224-227).

A second group of 11 small triangular points resembles those described above, except that one lateral margin flares outward at the base, creating a slightly asymmetrical outline (Figure 20j-q). Some of these points resemble Railey's Fine Triangular:Flared Base point type associated with early Fort Ancient components in northeastern Kentucky and southern Ohio. Fine Triangular:Flared Base points generally date from A.D. 1000 to 1300 (Railey 1992:156-158). Croley-Evans projectile points assigned to this group have a mean length of 20.8 mm, a mean width of 15.1 mm, and a mean thickness of 5.0 mm, making them slightly larger than those points assigned to the first group.

One elongated triangular point vaguely resembles the Fort Ancient point type as described by Justice (1987:227; Figure 49e). This point is 48.5 mm long, 12.9 mm wide, 4.6 mm thick, and slightly serrated along both lateral margins (see Figure 20r). The absence of deep serration makes it more likely that this point should also be assigned to the Madison type (Justice 1987:227).

One triangular point was assigned to the Nodena type based on its convex lateral margins and convex base (see Figure 20s). Nodena points are associated with the Dallas phase (A.D. 1300-1600) in Tennessee (Justice 1987:232; Lewis and Kneberg 1946).

The final group of five small triangular projectile points contains a diverse assortment of specimens. One point appears to be the base of a Dallas Excurvate point (Lewis and Kneberg 1946:113) dating to the late Mississippian period (see Figure 20t). A second specimen has concave lateral margins and a concave base (see Figure 20u). Polhemus (1987:730-731) assigns similar triangular points from Toqua to the Hamilton type, associated with the Late Woodland and Mississippian periods in east Tennessee.

Other kinds of flaked stone artifacts found during the 1993 field investigations include a corner-notched and two side-notched projectile points. These may reflect an earlier Archaic presence at the site or the recycling of Archaic projectile points by Mississippian people. Also recovered were projectile point distal tips (n=10), projectile points modified into drills (n=5), bifacial drills (n=4), an expanded base drill (n=1), triangular preforms (n=2), and miscellaneous large and small bifaces (n=13). No hoe flakes or fragments were collected, suggesting that flaked stone hoes were not an integral part of the horticultural technology.

Very few ground stone artifacts (n=23) were recovered during the 1993 field investigations. This total consists of seven grinding/nutting stones, one grooved abrader, two other abraders, two adze fragments, two beads, one possible chunky stone fragment, one possible pipe bowl fragment, three discoidals, and four miscellaneous pieces of ground stone.

The three ground stone discoidals range from 29 to 42 mm in diameter and from 11 to 15 mm thick. Two of the discoidals were found on the surface; the third was associated with the possible structure (Feature 5) in Area 1 of the habitation area. The Feature 5 specimen is 42 mm in diameter, has concave surfaces, and a 12 mm diameter hole passing through the center of the concavities. A shallow groove encircles the central hole on one surface.

BONE AND SHELL

Twenty-six pieces of modified bone were recovered. Bone tools and ornaments were relatively rare, but several specimens including an awl, a fishhook, and seven cut bone beads were found. Modified shell items include one bead and the engraved shell gorget (see Figure 13) associated with Burial 1 described earlier.

OTHER

Two small fragments of copper were found in a midden context directly above Feature 9. The two pieces, measuring 10 x 11 mm and 19 x 13 mm, respectively, have a total weight of only 0.65 g. The two fragments are flat and appear to have been part of a sheet copper object.

SUBSISTENCE REMAINS

BOTANICAL MATERIALS

To recover botanical remains, soil samples were collected from midden excavation level and feature contexts and processed by flotation. Margaret Scarry has identified the plant remains from five midden levels within the midden and from three features. She reports that remains of food plants are abundant in the samples from both the midden and the features (Table 5).

The analysis of plant data is not yet complete, but some preliminary results are available to report. Scarry has identified remains of 13 food plants and 10 miscellaneous taxa. Nutshells are by far the most abundant food remains. Hickory and acorn shells number in the thousands. Two other types of nuts, walnut and pecan, occur sporadically in small numbers. Fragments of corn kernels and cupules are present in every sample, but corn remains are consistently much less abundant than nutshell. Seeds from the native crops chenopod and maygrass occur in small numbers in several samples. Two other native crops, knotweed and sunflower, are each represented by a single specimen. Finally, seeds of four wild fruits, persimmon, grape, blackberry, and blueberry, are present.

Overall, the data suggest that the residents of the site practiced a mixed foraging and farming subsistence strategy. The striking aspect of the food plant assemblage is the overwhelming dominance of nut remains. This stands in marked contrast to assemblages from contemporary Fort Ancient sites elsewhere in Kentucky and surrounding areas. It is our initial impression that the residents of the Croley-Evans Site were less involved in crop production than many of their counterparts in nearby regions. The lack of evidence for the use of stone hoes at the Croley-Evans Site supports this interpretation.

Table 5. Summary Data on Croley-Evans Plant Remains. (Data are count/gram plant weight.

Common Name	Taxonomic Name	Raw Count	Standardizes Count
Hickory	Carya sp.	4097	15.747
Pecan	Carya illinoiensis	12	0.046
Walnut	Juglans nigra	40	0.154
Walnut family meat	Juglandaceae	4	0.015
Acorn	Quercus sp.	3620	13.913
Acorn meat	Quercus sp.	231	0.888
Corn cupule	Zea mays	133	0.511
Corn kernel	Zea mays	143	0.550
Chenopod	Chenopodium berlanderi	56	0.215
Knotweed	Polygonum sp.	2	0.008
Maygrass	Phalaris caroliniana	15	0.058
Sunflower	Helianthus annuus	1	0.004
Blackberry	Rubus sp.	1	0.004
Blueberry	Vaccinium sp.	3	0.004
Grape	Vitis sp.	3	0.012
Persimmon	Diospyros virginiana	3	0.012
Carpetweed	Mollugo sp.	4	0.015
Chenopos/amaranth	Chenopodium/Amaranthus	1	0.004
Copperleaf	Acalypha virginica	1	0.004
Grass family	Poaceae	8	0.031
Morning glory	Ipomoea/Convolvulus	1	0.004
Pepperweed	Lepidium sp.	24	0.092
Purslane	Portulaca sp.	3	0.012
Sumac	Rhus sp.	1	0.004
Bean family	Fabaceae	3	0.012
Composite family	Compositae	3	0.012
Unidentified		9	0.035
Unidentifiable		245	0.942

FAUNAL MATERIALS

The 1993 field investigations yielded a total of 12,325 faunal specimens consisting of 64.8 percent (n=7,982) mammal, 12.7 percent (n=1,569) bird, 15.1 percent (n=1,864) reptile, 0.5 percent (n=65) fish, 0.3 percent (n=37) amphibian, and one specimen of conch. Approximately 6.6 percent (n=807) of the specimens were undifferentiated, indeterminate bone and shell fragments. White-tailed deer is the most common mammal (963 specimens), representing a minimum of 10 individuals. Gray squirrel is the second most common (n=132, MNI=6), followed by black bear (n=28, MNI=1), raccoon (n=26, MNI=2), cottontail rabbit (n=22, MNI=4), opossum (n=19, MNI=4), fox squirrel (n=17, MNI=2), woodchuck (n=16, MNI=2), with smaller numbers of bobcat, gray wolf, stripped skunk, and a variety of rodents (Breitbury 1994).

Turkey is the most common specimen of avifauna (n=158, MNI=10), followed by passenger pigeon (n=14, MNI=4). The eastern box turtle is the most abundant reptile, accounting for at least four individuals. Other turtle species represented in the collection include softshell, snapping, and map turtles. The ribs and vertebrae of poisonous and nonpoisonous snakes account for nearly 46 percent (n=413) of the identifiable reptile specimens. Amphibians are represented by leopard frog, bullfrog, and indeterminate frog/toad species, along with hellbender salamander and mudpuppy remains (Breitburg 1994).

Fish fragments were assigned to family (bass, catfish, minnow, and sucker) in 11 cases. Two specimens of drum fish are attributable to two different sizes of fish.

As to food potential based on meat weight, the white-tailed deer was the main source of meat, accounting for 55.2 percent. Black bear contributed more than 11 percent of meat. Small mammals collectively contributed about 13 percent, followed by bird at 11 percent. Turkey was the most important bird, accounting for almost all (97 percent) of the bird contribution. Despite the proximity of the site to the Cumberland River, fish account for less than 1 percent of the diet. Resource variety, as a measure of econiche breadth, suggests that a small number of species actually contributed to the Croley-Evans inhabitants' diet. The most significant of these animals were deer, bear, and turkey, followed by small mammals as a group (Breitburg 1994).

All of the potentially edible animal species found at the Croley-Evans Site are associated with forest edge or open forest, rugged forested upland, and aquatic/riparian habitats. Of the three, forest edge and open forested areas were the most important, accounting for 68 percent of the edible meat. Animals procured from these habitats include deer, fox squirrel, woodchuck, cottontail rabbit, and turkey. Rugged forested uplands and denser wooded areas contributed 26 percent of the edible meat (bobcat, black bear, gray squirrel, gray wolf, gray fox, passenger pigeon, box turtle, and snake). Aquatic/riparian habitats account for almost 6 percent of the total meat, coming from a variety of birds, reptiles/amphibians, and fish (Breitburg 1994).

The preliminary results of the faunal analysis suggest a unique pattern of faunal exploitation and spatial use when compared with other Cumberland River Mississippian groups. This pattern reflects the location of the Croley-Evans Site in the upper reaches of the Cumberland River where there was sufficient forest edge habitat to support abundant deer and bear populations. This area also provided an excellent habitat for small mammals and birds along the dense forest and forest openings (Breitburg 1994).

SUMMARY AND CONCLUSIONS

Although the analyses of the Croley-Evans material are still in their preliminary stages, an initial assessment of Upper Cumberland Mississippian adaptation is possible. Existing radiocarbon dates indicate that much of the Mississippian occupation of the Croley-Evans Site occurred from about A.D. 1250 to 1450. The residents of the Croley-Evans Site had many of the trappings of Mississippian society including platform mounds, shell tempered pottery, maize horticulture, and the presence of "exotic" items that appear to reflect interregional interaction.

Despite these attributes, the marginal position of the Croley-Evans Site to the rest of the Mississippian "world" is reflected in the ways that these traits are manifest at this site. For example, although shell-tempered ceramics are present, the diversity of the ceramic vessels appears to be relatively limited, with jars and a few bowls being the predominant vessel forms. Evidence of more exotic vessel forms like bottles, plates, and pans appears to be absent, although this may be partially influenced by the relatively small sample of ceramics from the site. Ceramic decoration, with the exception of the few painted sherds and the noded bowl, is rare. However, even on much larger late Mississippian Dallas phase sites in Tennessee, decorative embellishments comprise less than 2 percent of all sherds (Polhemus 1987:653).

The "parochial" nature of the Croley-Evans assemblage is also reflected by the food plants and the pattern of animal exploitation. Although maize occurs at the site, it is much less abundant than nutshell, suggesting that Croley-Evans residents practiced a mixed foraging and farming subsistence strategy, and that they were less involved in crop production than were contemporary Mississippian and Fort Ancient groups in surrounding regions.

Despite the rather "conservative" nature of some aspects of the Croley-Evans assemblage, the presence of certain exotic items, such as copper, the engraved shell gorget, and possibly certain types of decorated pottery, indicates that some residents participated in interregional social networks involving the exchange of certain desired exotic items. Although little is known about the extent or scale of their involvement in this interaction, it appears that, minimally, they had ties with groups living to the south along the Upper Tennessee and Middle Cumberland rivers. Nearby Cumberland Gap and its associated network of trails, as well as the Cumberland River itself, provided relatively easy lines of transportation and communication to these areas. The Croley-Evans social network may have extended to the north as well, but evidence of interaction with Fort Ancient groups is not readily apparent at this time.

It is anticipated that the continued analysis of the Croley-Evans cultural and environmental data will provide new insights into how Upper Cumberland Mississippian groups adapted to the social and physical environment of Late Prehistoric southeastern Kentucky. Ultimately, this research should provide data to help explain the processes leading to the emergence of Mississippian society in the Southeast and clarify the regional variability of these Late Prehistoric groups.

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ARCHAEOLOGY AT LOCUST GROVE PLANTATION, JEFFERSON COUNTY, KENTUCKY

By
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ABSTRACT

Locust Grove Historic Home is located just outside Louisville, Kentucky, on the Ohio River. It is the remnant of a plantation established in the 1790s by the Croghan family. This paper reviews the documentary record of the Croghans and their slaves, and describes three seasons of archaeological field investigations centered on three slave cabin sites located some 200 m from the main house.

INTRODUCTION

Locust Grove, located about 8 km east of the city of Louisville, Kentucky, on the Ohio River, was established in the late eighteenth century by Major William Croghan and his wife Lucy Clark Croghan. The property was continuously occupied from that time until the 1960s when it was purchased by Jefferson County, Kentucky, and restoration began. It is now operated as a museum.

The Croghan family and Locust Grove are documented extensively in deeds, wills, tax records, and in an edited collection of surviving family letters (Thomas 1967). When restoration of Locust Grove began in the early 1960s, archaeological investigations of the plantation dependencies were conducted in order to learn more about the influential occupants of the property. Unfortunately, no report of this early archaeological work exists. Concerning the slave inhabitants at Locust Grove, who at one time numbered 41, the documentary record is, not surprisingly, meager. In the 1980s, archaeological work was resumed and aimed at uncovering the remains of the material culture of the slaves at Locust Grove.

This paper reviews the documentary record of the Croghan family of Locust Grove, as well as the early archaeological investigations at the kitchen and dairy near the main house (Figure 1). In addition, the scant documentary record of the enslaved African Americans at Locust Grove is reviewed, three field seasons centered on three slave house sites are described, and some interpretations concerning the everyday lives of the slaves are offered.

LOCUST GROVE AND THE CROGHAN FAMILY

Locust Grove plantation was established ca. 1790 when Major William Croghan purchased 15.5 ha (387 acres) from Hancock Lee (Jefferson County Deed Book 6:249). From 1790 until 1811, Major Croghan increased and improved his land holdings. By 1791, a mill was in operation, located about .8 km from the main house. A road from Louisville to Croghan's mill was proposed by

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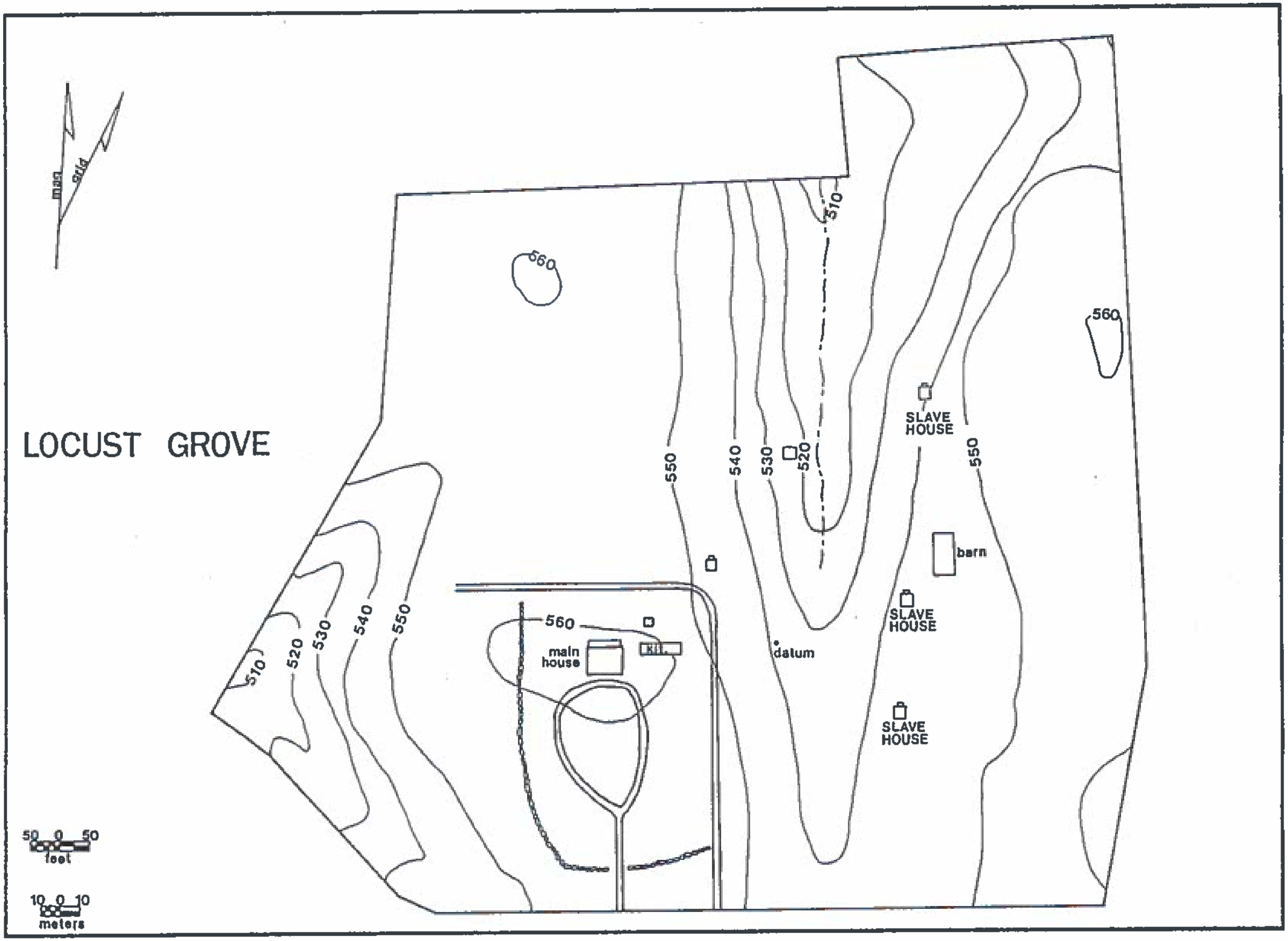

Figure 1. Layout of Locust Grove Plantation (15Jf541).

Jefferson County for easier access to those living in the area (Jefferson County Minute Book 5:64). The 1792 Jefferson County Tax List shows Major Croghan as having 20.6 ha (516 acres) in Jefferson County.

The main house was built in the 1790s, probably by 1792. It is a brick four-over-four late Georgian style house situated on a small knoll, one of the highest points on the property. While the brick main house was being built, the Croghans lived in a log house on the property. According to family letters, the eldest son of Major William and Lucy Croghan, John Croghan, was born in this cabin on April 23, 1790 (Thomas 1967). To the north and east of the main house, a kitchen complex was built. Just north of the kitchen sits a dairy, restored in the 1960s. A spring house was located about 100 m northeast of the main house area. This also has been restored.

In 1791, Major Croghan announced the opening of a land office at Locust Grove in the Kentucky Gazette (April 26, 1791). This office was described later (Craik 1862:31; Thomas 1969:50) as being situated in the garden.

Major Croghan also owned and operated a ferry on the Ohio River below Six Mile Island. In 1792, an additional 41.8 ha (104.5 acres) west of and adjoining Locust Grove was purchased by Croghan (Thomas 1969:59; Jefferson County Deed Book 6:544). In 1811, Major Croghan purchased 80.8 ha (202 acres) south and east of Locust Grove, making the total area of his plantation 277.4 ha (693.5 acres). Thomas (1969:51) suggested that the upper 160 ha (400 acres) were under cultivation and the area near the river was left for timber and woodland pasture.

In addition to John Croghan, Major William Croghan and Lucy Clark Croghan had eight other children, in all seven sons and two daughters. Lucy Clark Croghan was sister to General George Rogers Clark ("Conqueror of the Northwest Territory") and General William Clark (of Lewis and Clark fame). The ailing General George Rogers Clark actually spent the last years of his life at Locust Grove cared for by his sister and her family. Thomas (1969) believes that Major Croghan's standing in the community and the presence of General Clark made Locust Grove an important gathering place for national, political, and social figures. Important visitors to Locust Grove included John James Audubon, James Monroe, and Andrew Jackson (see Thomas 1967).

Major Croghan died at Locust Grove in September 1822. He was buried in the family cemetery on the property. William Croghan, Jr. eventually took possession of Locust Grove, although his mother Lucy divided her residence between Locust Grove and the home of her daughter, Ann Jesup, in Washington, D.C. In 1828, William Croghan, Jr. sold the plantation to his sister Elizabeth Croghan Hancock and her husband George Hancock (Conner and Thomas 1966:215). Dr. John Croghan, eldest son of Major William and Lucy, bought Locust Grove from his brother-in-law (Conner and Thomas 1966:230) just after his sister, Elizabeth, died. John Croghan was a physician. He never married, but lived at Locust Grove until his death in 1849.

According to Dr. Croghan's will, Locust Grove was to be held in trust to support his brother George (who died just a few days after John), or to support George's son St. George (Jefferson County Will Book 4:121). St. George had actually begun managing Locust Grove in 1847 for his uncle. Dr. John Croghan's estate inventory assessment lists farming utensils for wheat and corn agriculture, eight horses, and fourteen cattle among his personal property.

St. George Croghan rented Locust Grove out until his death in 1861 when his son George inherited the plantation. Although Locust Grove was held in trust until 1868, it was still rented out. In 1878, James Paul purchased Locust Grove. He sold it in 1883 to Richard Waters who operated

Locust Grove as a general family farm. The farm was held by the Waters family until 1961 when it was sold to Jefferson County, Kentucky. Restoration work began in 1962. Currently, Jefferson County owns 22 ha (55 acres) of the original 277.4 ha (693.5 acres) that was once the Locust Grove plantation. The surrounding acreage has been developed into suburban neighborhoods.

ARCHAEOLOGY AT LOCUST GROVE - THE MAIN HOUSE

The earliest archaeological work at Locust Grove began in the 1960s and was centered on the main house area. Work was conducted in order to aid reconstruction of early nineteenth century buildings. The kitchen complex was uncovered and found to consist of three pens: presumably a kitchen, a smokehouse, and so-called "servants quarters." The "dairy" was also excavated. The kitchen and dairy have both been reconstructed. How function was determined for these buildings is unknown. No report exists concerning this early archaeological work, although the recovered artifact assemblages are curated at the University of Louisville, Program of Archaeology. Provenience information is poor and difficult to reconstruct, and the excavation methods remain a mystery. It appears that the soil was shovel sorted and no screens were used. Very few small items like buttons are included in the assemblage. Some animal bone was curated, but whether all faunal material was kept is unclear.

Refined ceramics from excavations at the kitchen complex and dairy include creamwares (mainly undecorated), pearlwares, whitewares and ironstones, and porcelains. A type collection of eighteenth and nineteenth century ceramics based on decoration was constructed. At least 130 different decorative patterns make up this collection of ceramics used by the Croghan family and other inhabitants of the main house. The most prominent ceramic type is Canton porcelain dating from 1800 to 1830. Green and blue shell edge, and blue transfer-prints are very common decorations among the pearlwares. Early teas include blue handpainted pearlware, polychrome handpainted pearlware cups and saucers, as well as enamelled porcelains. A refined red-bodied luster tea cup was also recovered within the main house complex, along with a black basalt tea pot sherd. Banded and mocha wares from the main house are rare, but these decorative patterns are found in creamware, pearlware, and whiteware.

Other decorated whitewares from the kitchen include numerous blue transfer-prints, but brown transfer-prints are also fairly common. A few green transfer-printed plate and cup fragments are associated with the main house. Yellowware is relatively uncommon.

A single sherd of Westerwald stoneware dating from 1700 to 1775 was recovered from around the kitchen. Decorated with cobalt blue bands, this grey Rhenish stoneware sherd is most likely from a mug, although Westerwald chamber pots and pitchers were also manufactured.

Early glass tableware was also recovered from kitchen excavations. Items include a leaded cut glass tumbler, a cut glass vessel, possibly a celery vase, an early leaded pressed glass tumbler with a design on the base (probably dating around 1830), and a leaded pressed glass hollow piece, possibly a cruet or small decanter. Later pressed glass tumblers, not leaded, dating after 1870 were also recovered.

Tobacco pipes are very rare in the main house area assemblage. One example is a stub-stemmed glazed piece decorated with black enamel under the glaze. The occupants of the mansion likely used snuff or smoked cigars instead of using tobacco pipes.

Surviving family letters (Thomas 1967) indicate that the Croghans considered themselves part of the Southern landed gentry class. As mentioned, Locust Grove occupants entertained visiting dignitaries, a necessity in order to gain entrance into, and maintain membership within, the Southern gentry (Clark 1987). The extent to which the Croghans participated in this lifestyle is evidenced in the estate inventory of John Croghan, who died in 1849. The inventory lists 85 cut glass vessels and a "French China Set" consisting of 242 pieces including 149 large plates (Jefferson County Will Book 4). The brick Georgian style mansion as well as the glassware and ceramics excavated around the main house certainly support this conclusion.

THE SLAVES AT LOCUST GROVE

As indicated by the previous discussion, a considerable amount of information is available about the property and about the owners of Locust Grove. However, virtually nothing is known about the slaves who also resided there. The documentary record of slaves at Locust Grove does provide some limited information about the Croghan's slaves. Jefferson County tax lists from 1789 to 1819 enumerate Major William Croghan's slaves. In 1789, Croghan paid taxes on two male slaves. In 1791, he owned six slaves, all over age 16 years. By 1794, the slave population at Locust Grove had increased to 12 individuals. From 1795 until 1819 the slave population increased from 15 to 41 (Figure 2) with an average increase of one slave per year. The 1820 census of Jefferson County, Kentucky, indicates that Major William Croghan owned 40 slaves; 22 males and 18 females, including 8 males and 2 females age 20 years or older (United States Bureau of Census 1820).

The will of Major Croghan, who died in 1822, mentions his slave property. It states:

> ...It is my will that my negroes continue under the direction of my wife & Executors untill [sic] my children are of age are married or may require them, in which case I wish equal distribution of them to take place, Except Malinda and her children, which I have given to Mrs. Emilia Clarke, such of my children as have received any of my negroes will account for them and allow their valuation when distribution takes place (Jefferson County Will Book 2:229).

No estate inventory listing the slave property of Major William Croghan has been found.

John Croghan, the eldest son of Major William Croghan and Lucy Clark Croghan who owned Locust Grove from 1836 until he died in 1849, discusses in his will his wishes as to the disposition of the slaves:

> ...I direct my said Trustees to hire out all my slaves except Isaac for three years so as to prepare them for freedom & to provide the means for their support & removal to Liberia or elsewhere; and at the expiration of said three years to Emancipate the said slaves and all their increase. I direct my Executor to Emancipate & set free from bondage immediately my slave Isaac, who has served me so faithfully (Jefferson County Will Book 4:121).

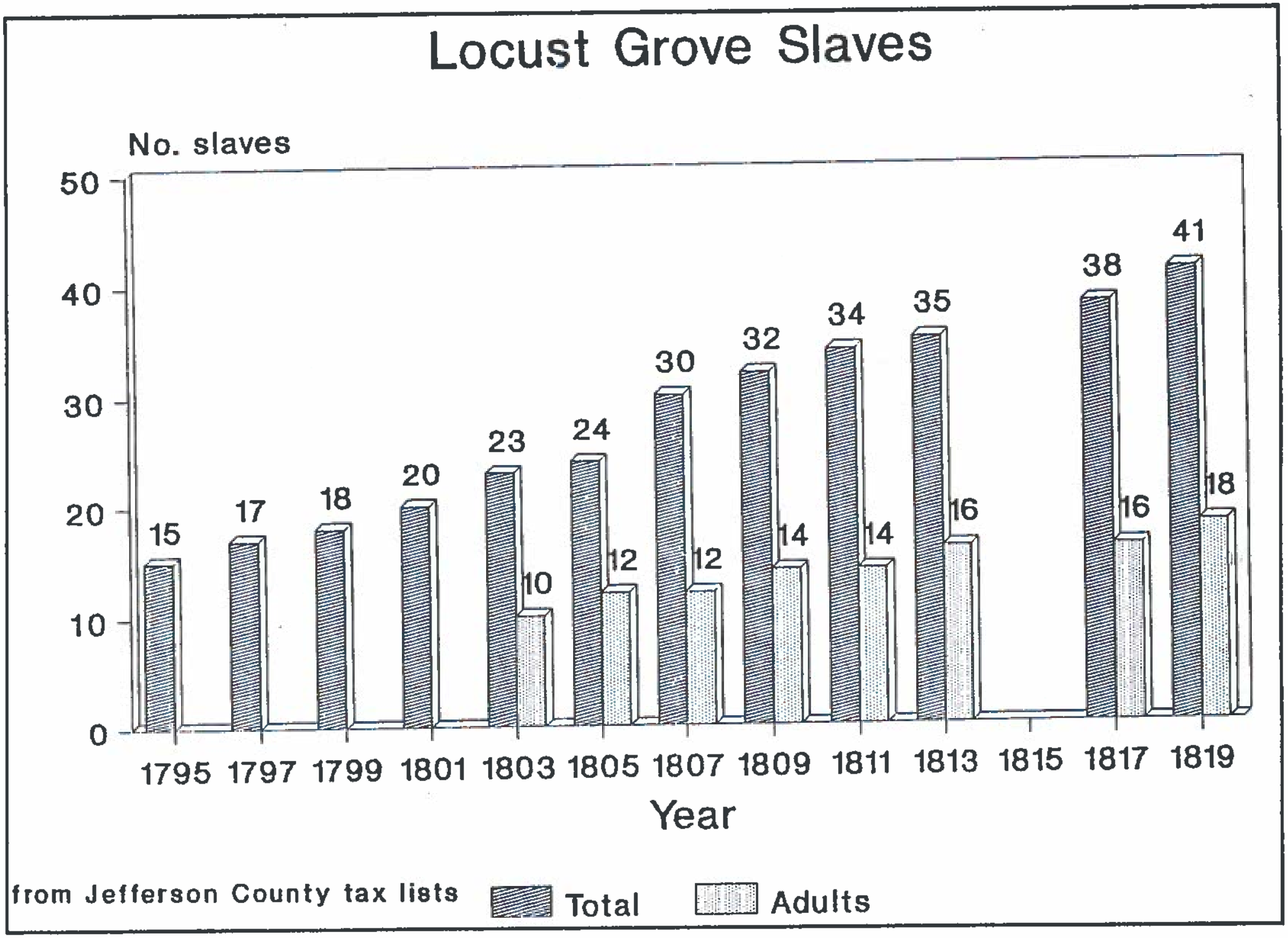

Figure 2. Slave Population at Locust Grove from 1795 to 1819.

The estate inventory of Dr. Croghan provides some information about the slaves. The names, ages, values, and remarks of the 22 slaves owned by John Croghan at his death are included in the estate inventory (Table 1). Eleven of the slaves are male, and 11 female. There are five adult males, and seven adult females listed.

Table 1. Slaves Listed on John Croghan's Estate Inventory (1849).

Name	Age-Years	Age-Months	Value	Remarks
Jeke	45		$300	
Gabriel	35		$450	
Peter	45		$400	
Humphrey	48		$300	
Tom	24		$600	
David	15		$450	
Peter	10			Idiot
Tom	10		$300	
Gibson	7		$225	
Jake	5		$200	
James		8	$100	
Melinda	4		$175	
Susan	1	6	$125	
Silvie	51		$150	
Maria	40		$250	
Louisa	40		$300	
Sarah	22		$500	
Cinthia	13		$350	
Mary	55			Cripple
Rachel	40			Blind
Hannah	42		$300	
Hannah	11		$300	

The Croghan slaves were occasionally mentioned in their family correspondence. In a letter to her brother William Croghan, Jr., dated December 25, 1810, Elizabeth Croghan writes:

> ...what deverted me most was the blusxder Coock Robin made Aunt hade a large cak made of brown sugar for the servoants and Coock Robin thru mistake toock one of Aunts best cakes and left her the one that was made of brown suger [*sic*]... (Thomas 1967).

Other such anecdotes include those in a letter by William Croghan, Jr., to his young son William Croghan III:

> ...Little Abe & Al, find the most [eggs] & Al comes in & says "here old mister here is egg, now give me cake" & then he runs away & Abe he comes in with his...(Thomas 1967).

> ...Little Harvey wants to go with me to Pitts: [Pittsburgh] he says he belong to you. Little Bob lives in town & is learning to be a barber. he lives with the black Barber that once cut your hair...(Thomas 1967).

George Hancock, who married Elizabeth Croghan, wrote to his brother-in-law Thomas Jesup on December 25, 1822:

> ...and I feel unwilling that negroes that I am anxious to keep should be sold for half their value...(Thomas 1967)

One wonders if Hancock did not want to part with property for whom he felt affection, or simply did not want to loose money!

The health of the slaves at Locust Grove was occasionally discussed in Croghan letters. In the 1820s some of the slaves had influenza (letter by John Croghan to Thomas Jesup dated February 17, 1826). During the cholera epidemic of the 1830s, several slaves were ill, but evidently all survived. In a letter to Thomas Jesup dated May 15, 1841, Dr. Croghan wrote:

> ...I hired Harriett again to Mrs. Clark; but before the expiration of the quarter she was sent here [Locust Grove] with a Note stating that "her physician said she had consumption and ought to be in the country." Tubercles had formed in her lungs before I heard of her sickness, and although I do all I can for her, yet she is fast declining...(Thomas 1967)

By 1845, the slave Harriett had died.

Hiring out was evidently fairly common for slaves at Locust Grove. In a letter to his brother-in-law dated February 7, 1845, John Croghan wrote:

> ...Betsy is again living with George Gwathmey. He offered $30 for her, and stated that "in consequence of her having a child, it was a higher price than $60, without such an incumbrance." I thought so too, but upon proposing $40, he agreed to give it. Susan, Mr. Goodwin has, I presume hired out, he being instructed so to do. Her hire last year 1843 $50, I paid on your note in the Northern Bank; all of last year's hire, 1844, has not been collected. One of her children (Lucy) a smart little girl is living with Mr. Duncan, the other is here. Harriet, who died, has a boy living here. I thought it best to hire Silva out to a neighbor - he agreed to give $30 a year - payments quarterly. As yet nothing has been paid & I expect to take her home. Isaac is living here -So much for the Darkies - decidedly the most troublesome and worst property a man can have...(Thomas 1967).

A slave Isaac is mentioned as living at Locust Grove in a letter dated September 6, 1810, written by Ann Croghan (who later married Thomas Jesup). This is the earliest reference of a slave in the Croghan letters. This may be the same slave named Isaac whom John Croghan freed according to his will in 1849. Isaac is again mentioned in a letter dated January 18, 1849, from George Gwathmey to Thomas Jesup describing Dr. Croghan's death:

> ...The Doctor [John Croghan] called his Boy, Isaac who slept in a chair at the fire place. The judge got up and sent the Boy to his Master - just as he got to the

bed side, the Doctr was seen to throw up his hands and before the judge got to him he was no more...(Thomas 1967).

So his slave, Isaac, was the last person Dr. Croghan saw as he died.

Of the 261 surviving letters of the Croghan family included in Thomas's (1967) collection, only 21 letters mention the slaves (about 8 percent of the total). Extant documents reveal very little concerning the everyday lives of the slaves at Locust Grove.

ARCHAEOLOGY AT THE SLAVE CABINS

In order to gather data concerning the slaves' lifeways, archaeological investigations resumed at Locust Grove in the summer of 1987. During that summer and in two subsequent summer field schools, three house sites (see Figure 1) were excavated intensively by the University of Louisville Program of Archaeology under the direction of Dr. Joseph Granger, Principal Investigator. In 1987, archaeological study centered on an area approximately 150 m across an intermittent stream south and east of the main house. In 1988, work was conducted in an area about 160 m east of the main house while in 1989, the northern house site, about 200 m northeast of the mansion, was excavated. Each of these three investigations will be discussed in detail.

In June 1987, intensive archaeological investigations began in an area where nineteenth century decorated ceramics were found eroding onto the surface earlier that spring. Patchy vegetation in March prior to the field school suggested that a foundation of a building might be just below the surface. In all, 53 one by one meter units covered the area. Given the very dry weather of the summer of 1987, stratigraphic soil color and texture changes were not apparent, and excavations proceeded in 10 cm arbitrary levels. Soils were dry screened through 6 mm (1/4 inch) mesh. No samples were saved for flotation or water screening. This accounts for the scarcity of small artifacts like egg shell, beads, and straight pins.

Excavations revealed a single pen structure, measuring 5 x 6 m had been built on a continuous limestone foundation. A limestone chimney pad was located on the north wall. The hearth was constructed of roughly dressed limestone, like the wall foundation, and filled with soil. An unlined pit cellar measuring approximately 1.0 x 1.5 m was placed directly in front of the hearth. Very little area actually outside the walls was excavated so almost nothing is known of the surrounding house yard. Preliminary analysis using Ball's (1984) method of categorizing artifacts (a derivative of South's [1977] artifact pattern), shows that architectural artifacts (mostly cut and wrought nails and flat glass) make up about 50 percent of the assemblage, whereas kitchen-related artifacts represent slightly more than one-third (33.72 percent) of the total. Window glass was very common; 839 sherds were recovered. In-depth analysis of artifacts from this house ruin is in progress, but a few preliminary finds can be discussed.

Early artifacts, those dating primarily to the eighteenth century were recovered from this area. These include a sherd of Caneware, a refined buff or cane colored stoneware molded in relief dating from the 1780s to the 1820s. Two sherds of a tin-glazed blue handpainted (delft) plate were also recovered. From a pit cellar located in front of the hearth, two sherds of a tin-glazed polychrome vessel were found, and may represent an Italian-made vase.

Most of the artifacts date from the late eighteenth century until the mid-nineteenth century. These artifacts include some creamware, as well as pearlware and whiteware ceramics. Many of the ceramics are decorated; numerous sherds of blue transfer-printed teas were recovered, as well as transfer-printed plates. Most of the utilitarian ceramics are salt-glazed stoneware; however, redware sherds are also fairly common. Most of the nails are cut, and a few are wrought; wire nails are quite rare.

Buttons were common on the site with a total of 83 recovered (Table 2). Eighteen are plain milk glass, and six decorated milk glass including a blue transfer-printed (calico) button. Nineteen are metal shank buttons, eight shell, fifteen bone, four plain four-hole metal buttons, and six domed buttons.

Table 2. Buttons and Marbles from the Three Slave House Sites at Locust Grove.

Buttons	South	Central	North
Shell	8	7	12
Milk glass	24	14	13
Bone	15	13	10
Metal shank	19	16	8
Domed	6	3	5
Metal 4 hole	4	6	2
Other	7	4	1
Total	83	63	51
Marbles			
Plain clay	8	11	8
Painted clay	4	3	1
Glass	1	0	2
Stone	3	0	1
Total	16	14	12

Tobacco pipe fragments were also fairly common and a total of nineteen were recovered. Most of these are stub-stemmed stoneware pipes, whereas four fragments are glazed earthenware.

Sixteen marbles were found during excavations (see Table 2). Four are handpainted ceramic, eight undecorated clay, one glass, and three are actually marble. Other toys include several porcelain doll fragments and two metal wagon wheels about 1 inch in diameter.

Several coins were also recovered and two of these are two-cent pieces. One of the two-cent pieces is notched in four places, suggesting that the coin was used as a pendant. One of the coins is a dime dated 1857. A small cent dated between 1860 and 1864 was also found, as well as a perforated Chinese coin of unknown date. Other personal items include a watch key, four slate pencils, and a decorative hair comb.

As can be seen from this preliminary description of the artifacts recovered from the slave house excavated in 1987, many of the items are fancy, expensive household and personal goods, difficult to distinguish from those that were used by the white owners of Locust Grove. In fact, a study of the decorated ceramics recovered from this house site and compared to those from the main house shows that more than 12 percent of the decorated ceramics matched patterns found at the main house (Young and Andrews 1992).

In the spring of 1988, an area north of the 1987 slave house excavation was tested with a soil resistivity meter. Anomalous readings suggested the presence of subsurface features, so excavations were scheduled for later that spring and summer to test the area. During the 1988 summer field season, a total of 78 m^2 were excavated by University of Louisville field school students. The field methods were the same as the previous year. Unfortunately, the drought of 1987 extended into 1988 and dry conditions prevented the easy detection of soil color changes, thus making stratigraphic definition difficult.

Two notable features were uncovered during the fieldwork. One is a macadamized road. The second, just to the north of the road, is a small brick-lined pit cellar. The cellar was aligned in a similar manner to the house and pit cellar excavated in 1987. In fact, the dimensions of the second cellar were quite similar to those of the first. Because of the difficulty in detecting soil color changes, the feature was excavated by piece-plotting all artifacts possible. Arbitrary 5 cm levels were excavated in case some artifacts were missed *in situ*.

Unfortunately, no wall foundations were revealed during the excavations. Evidently, the foundation, or piers, were removed once the house was abandoned. These could have been robbed and reused when the road was macadamized. However, the pit cellar, 416 window glass sherds, and the quantities of other domestic materials show that a house once stood over the area.

More than likely, the house that sat over the brick-lined cellar measured 5 x 6 m. These are the dimensions of the house site excavated the previous year to the south, as well as those of a house site located north and excavated in 1989.

In many ways, the artifact assemblage from the second slave house is similar to that of the first. However, the ceramics revealed some important differences in that virtually no eighteenth century ceramics were recovered. The exceptions to this are two fragments of Westerwald stoneware dating between 1700 and 1775. Creamware was quite rare on the site, with only two fragments representing a single vessel. This vessel is a very late creamware fingerpainted bowl. Pearlware is also less common from this second cabin.

Excluding ceramics from the cellar, a total of 466 decorated ceramics were recovered during the 1988 field season. Most of these (35 percent) are blue transfer-printed whitewares and pearlwares. Handpainted whiteware and pearlware vessels account for approximately 13 percent of the assemblage. Decorated porcelain and bone china are fairly common, accounting for 56 sherds. Tea cups and saucers are common, as well as plates and platters. Over 12 percent of the decorated ceramics from this slave house matched ceramics from the main house area (Young and Andrews 1992). This is similar to the proportion of the decorated sherds from the south slave house site that also match the main house ceramics.

Tobacco pipes, mostly stub-stemmed, were recovered from the slave house site. Only one of the 13 fragments recovered is kaolin. One pipe is a glazed redware face pipe, and the rest are stoneware.

A total of 63 buttons are included in the assemblage (see Table 2). Most (16) are metal shank buttons; seven are shell buttons. There are 13 bone buttons, 10 white milk glass, three domed, and one transfer printed calico button that matches the calico button found in the south slave house excavations. There are also four colored glass buttons, six metal four hole, and one two-hole button of unknown material. Fourteen clay marbles were recovered (see Table 2). Three are handpainted. There were no glass or stone marbles from this cabin. Four coins were found. Two are half dimes, one dating to 1858. A large cent dating to 1842 was recovered from the cellar. A dime, either dating to 1822 or 1832, was found, heavily worn and etched with a cross or "x" on one side.

Other interesting artifacts include three whetstones, one possible shell bead, and a bone comb. Two thimbles, one iron and the other brass, were also recovered. A single eyeglass lens was found near the cellar. In addition, several straight pins were recovered in the cellar.

The third slave house location was excavated in 1989, also by University of Louisville summer field school students. The limestone foundation and chimney pad along the north and west walls were partially exposed. As in the other two cabins previously excavated, this house contained a pit cellar in front of the hearth. The house measured approximately 5 x 6 m, showing the slave houses at Locust Grove to have been uniform in size.

Excavation methods for this north slave house site were similar to those of the previous years. A total of 42 m^2 were excavated in and around the foundation, using arbitrary levels. Soil was dry-screened through 6 mm (1/4 inch) hardware cloth. No soil samples were collected for water screening or flotation.

Analysis of the artifacts from this house site is still underway. However, some preliminary results can be discussed.

Analysis of the decorated ceramics illustrates some of the differences between this slave house and the other two. Eighteenth century ceramics are virtually absent from the assemblage from the north house. Pearlware is present, but whitewares dominate the assemblage. Only 7.25 percent of the decorated ceramics match those from the main house. Additionally, some very late nineteenth and early twentieth century ceramics were recovered. The ceramic assemblage suggests that perhaps the cabin was occupied early in the nineteenth century until sometime around the Civil War and then abandoned. It was reoccupied again in the 1890s. Oral history of Locust Grove indicates that a former slave named Uncle Bob was living in the north house until he died in the 1920s.

Ceramics include polychrome pearlware and whiteware tea cups and saucers, blue and red shell edge plates (green shell edge is very rare). Transfer-printed plates, platters, tea cups and saucers, Chinese export porcelains, and bone china are common. Yellowware is more prevalent at the north cabin than at the other two house sites. Early curved glass was present on the site in small quantities. One example is a pressed lacy glass vessel, probably a small compote.

Tobacco pipes were notably rare on the site. A complete red clay stub-stemmed pipe was recovered, as well as a single fragment of a stoneware pipe bowl and one kaolin stem.

Only 12 marbles and marble fragments were collected (see Table 2). One is a handpainted clay marble. Two are glass: one is complete, and the other is fragmentary. One marble fragment is made of stone. The rest are plain clay.

Spoons were quite common on the site. A complete coin silver teaspoon was recovered. The handle of this spoon is marked with a cross or "x." Also, six spoon bowls (one is pewter), two decorated metal spoon handles, and one plain pewter handle were found. A carved bone handle, probably from a knife, is also part of the assemblage.

The north house site yielded a total of 51 whole buttons or fragments (see Table 2). The most common type (n=12) is the shell button. In addition to the shell button, 10 bone, 10 plain milk glass, and 8 metal shank buttons were collected. A Civil War Union Infantry Officer's cuff button was found, as well as two Waterbury buttons.

Three coins came from the north cabin site. One is a 1898 Indian head cent. A half-dime dating to the 1840s was also found. The third example is a perforated Chinese coin of unknown date.

Other interesting items collected from the site include a scissors handle, a key, and a pistol hammer and handle in very poor condition. A single relatively unused gun flint was also found, the second gun flint identified from Locust Grove.

Apart from the late-nineteenth and early-twentieth century artifacts, this northern house site is remarkably similar to the other two. Fancy earthenware teas and porcelains, coins, buttons, and marbles are just a few of the artifacts recovered from the slave house site.

SUMMARY AND CONCLUSIONS

Archaeology at Locust Grove began in the 1960s when work was centered on the area around the brick main house. The owners of Locust Grove, the Croghan family, are well documented in censuses, tax lists, deeds, wills, and surviving family letters. Documentary information about the slaves who lived and worked there is scarce. In the 1980s, archaeology was resumed on the site. This time, however, field work was aimed at collecting data about the enslaved African Americans. Three field seasons uncovered the remains of three separate single-pen house sites.

Two of the houses were built on continuous limestone foundations and measured approximately 5 x 6 m. The chimneys were located on the north walls. The other slave house probably had similar dimensions; however, no foundation or piers were discovered. It is believed that the piers or foundation stones were robbed when a macadamized road was built nearby.

The high frequencies of window glass from each of the three slave house locations indicates the presence of glazed windows, something of a rarity in slave houses of other regions of the South (Adams 1987:173-198, 314; Singleton 1991:170). Analysis of the nails from the south cabin location indicate that, while the cabin itself was log, it was likely clapboarded and had a wood floor (Young 1991). This is also somewhat surprising when compared to other slave house sites excavated in other regions of the South (e.g., Adams 1987). Coleman (1940) suggested that slave housing in Kentucky was usually more than adequate, whereas Lucas (1992) concluded that only slaves on wealthy plantations were adequately housed. Research concerning the Croghan family, and the analysis of architectural artifacts from the three slave houses, supports Lucas's (1992) conclusion and indicates that Locust Grove slaves may not have been typical of slaves in Kentucky.

Preliminary analysis of the artifacts shows that each of the three slave house sites had fancy earthenware teas and porcelains, some matching decorated ceramics from the main house. These ceramics were evidently parts of sets once used by the main house occupants. The even distribution of matched hand-me-down ceramics in the three slave houses suggest equal access by all slaves to the Croghan family and may reflect how labor was organized at Locust Grove (Young and Andrews 1992). Perhaps, instead of being organized into gangs, typical of cotton plantations, or using the task system, usually associated with rice plantations, Locust Grove slaves performed as field hands and domestics as season or whim of the owners dictated. This indicates that all slaves, or at least each slave household, had equal access to the main house and the Croghan family.

Each house site yielded numerous buttons and marbles (see Table 2). Coins were found in each of the house sites, whereas tobacco pipes were common in only two.

The pit cellars, or root cellars, found in each of the three slave house sites resemble those found in other slave sites in the Upland South (Young 1994; Singleton 1991). They may indicate that the slaves had some degree of control over their own subsistence rather than relying solely on rations from the master. These small features have not been identified on any South Carolina or Georgia plantations, but have been found at the Hermitage near Nashville, Tennessee (McKee 1991, 1992) and at Monticello (Kelso 1986). In addition to having been used to store root crops for subsistence, these features may have been used to store a family's valuables. Iron tools such as hoes seem to be fairly common items recovered from these features (Kelso 1986:121; Young 1994). Mrs. Mary Emily Eaton Tate, a former slave living in Indiana interviewed by WPA worker Martha Freeman, described this type of feature in her cabin back on her plantation or farm in Jefferson County, Tennessee, about 30 miles from Knoxville:

> Every day spies were making their rounds and often soldiers, both Yankee and Rebel, visited our cabin taking what they could find...The cellar, a hole dug out under some boards in our cabin contained our supplies...(Rawick 1977a:212-219)

Some historical archaeologists investigating slavery and slaves in the New World are beginning to turn their attention to evidence of religious belief and practices (Brown and Cooper 1990; Ferguson 1992; Orser 1991; Singleton 1991). Scholars believe that the religious system was kept hidden from slaveholders and other whites (Orser 1994; Raboteau 1978), allowing slaves to empower themselves beyond the reach of slavery.

A number of items recovered from the Locust Grove slave house locations appear to fall into the category of religious objects. These items include marked American coins, a spoon incised with a cross or "x" on the handle, and two perforated Chinese coins. A plain clay marble incised with an "x" or cross before being fired was also recovered. The marks are all crosses or "x"s similar to those described by Ferguson (1992) found on the bases of colonoware bowls and spoon bowls. These marks, according to Ferguson, are like those associated with Bakongo religious practices in West Africa. Another interpretation could be that the marks show ownership among the slaves on the plantation. Ferguson (1992) believes that a cross or "x" is too common to show ownership. That this method of marking shows up on objects from all three Locust Grove cabins also argues against using an "x" to show ownership. A two cent coin that had been altered was found in the central house site. The coin was notched in four places and could also have been used as a pendant. Interestingly, wrapping twine or string would have formed a cross or "x." The presence of Chinese coins is remarkable. Similar seventeenth century Chinese coins have been recovered from slave pens in Alexandria, Virginia. Because these are perforated with square holes in the center, they, too, could have been worn as pendants.

The practice by slaves of using charms was described by a former slave living in Wayne County, Kentucky, interviewed by a WPA worker:

> Every one of my children wears a silver dime on a string around their leg to keep off the witches spell. One time, before my daughter Della got to wearing it, she was going down the road, not far from our house, when all at once her leg gave way and she could not walk. Of course I knowed [sic] what it was. So I went after Linda Woods, the witch doctor...(Rawick 1977b: 35)

The witch doctor bathed Della's leg in "life everlasting," an herb, and told Della to stay off that road for nine days. Her mother made Della wear a silver dime around her leg. Evidently, Della, once she wore her charm and followed the witch doctor's advice, never suffered from the witches spell again (Rawick 1977b:35-36).

At present, very little is known about slave lifeways on plantations that were not raising traditional crops like cotton, rice, or sugar. Locust Grove is one of the few such sites extensively excavated, where, at one time, 40 slaves formed their own community; labored to raise corn, wheat, and hogs; and performed other services for their owners. As such, it has enormous potential to yield a great deal of information concerning slave lifeways on diversified agricultural Upland South plantations.

Analysis of artifacts from the three slave house sites at Locust Grove has begun to provide numerous clues concerning the daily lives of the African-American occupants. The house remains excavated likely represent fairly substantial log structures with wood floors and clapboarding. Each cabin had at least one glazed window. Also, each family had a small root cellar to store food and other valuables. Each slave family had fancy, hand-me-down ceramics from the main house, suggesting equal access to the Croghans. Finally, evidence of an alternative, underground belief system is indicated by marked coins and other objects.

The archaeological research conducted at Locust Grove has corroborated what was known from documents concerning the Croghan family while providing evidence of the slave lifeways unobtainable from documents. Even though the Croghans did not raise typical plantation crops, the family was wealthy, and no doubt considered themselves part of the Southern planter class. In contrast, archaeological evidence suggests that slave lifeways at Locust Grove were, in some ways, a unique adaptation to the Upland South, such as with the use of pit cellars for storage of a slave family's valuables. With regard to the slaves' religious system, there appears to be a remarkable continuity with African and colonial African American beliefs and symbols.

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