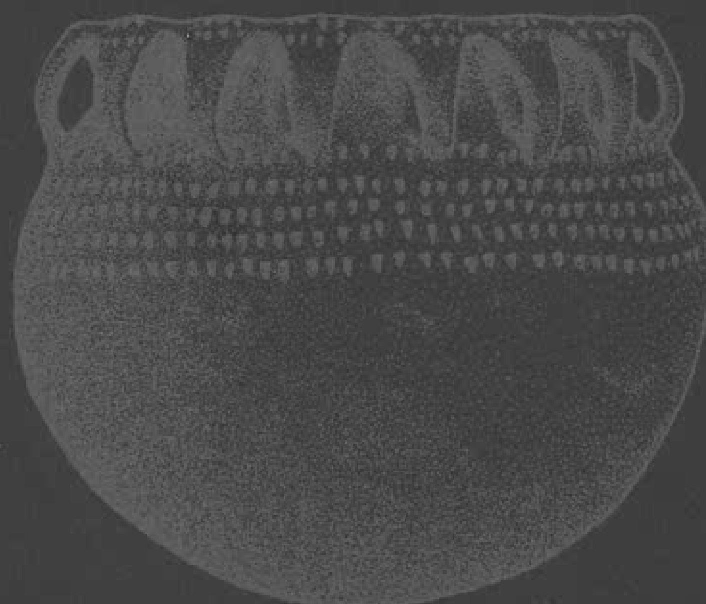
CURRENT ARCHAEOLOGICAL RESEARCH IN KENTUCKY

Volume Five



Edited by

Charles D. Hockensmith
Kenneth C. Carstens
Charles Stout
Sara J. Rivers

KENTUCKY HERITAGE COUNCIL

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KENTUCKY HERITAGE COUNCIL
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This publication has been funded in part with state funds and federal funds from the National Park Service, Department of the Interior. However, the contents do not necessarily reflect the views or policies of the Department of the Interior.

Drawing of a Campbell Punctate Ceramic Vessel from Pollack and Munson, 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 staff works with a variety of federal and state agencies, local governments, and individuals to assist in 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; organizing this conference, including the editing and publication of selected papers; the dissemination of educational materials, such as the Kentucky Before Boone poster and booklet; and the Kentucky Archaeological Registry, which is designed to provide information of site management and protection to the owners of Kentucky's most important archaeological sites. On occasion, the Site Protection and Archaeology Program staff undertakes field and research projects, such as emergency data recovery at threatened sites. Two reports about their salvage work are included in this volume: the Shelby Lake Site (15Sh17) in Shelby County and the Elijah Foley House (15Fa231) in Fayette County.

The Twelfth Annual Kentucky Heritage Council Archaeological Conference was held at Eastern Kentucky University in Richmond, Kentucky during the spring of 1995. Dr. Kelli Carmean was in charge of conference details and local arrangements. Her efforts are greatly appreciated. We are also very grateful to Eastern Kentucky University for graciously hosting the conference. Their excellent facilities made for a very pleasant conference. Kentucky Heritage Council staff assisting with conference proceedings included Site Protection Program Manager Thomas N. Sanders, as well as Staff Archaeologists David Pollack and Charles D. Hockensmith. Finally, the editors for this volume, Charles Hockensmith, Kenneth Carstens, Charles Stout, and Sara Rivers are to be commended for an excellent job in producing this volume.

A total of 26 papers were presented at the Twelfth Annual Kentucky Heritage Council Archaeological Conference. Twelve of those papers are included in this volume. Two additional papers were later submissions. These include Mark R. Schurr's paper entitled "Assessing the Maize Consumption of Fort Ancient and Middle Mississippian Populations of the Ohio Valley: New Stable Isotope Evidence" and the paper by Andrew C. Kellie, Kenneth C. Carstens, and Daryl Orth entitled "Archaeological Investigations Incorporating Digital Terrain Models". Figure 1 illustrates the locations of major sites discussed in this volume.

Several papers presented at the conference are not included in this volume. For the record, they are listed below in the same order as they appeared on the conference agenda: "The Plant Subsistence Transition of A.D. 1000: The View from Boone County, Kentucky" by Jack Rossen and Rebecca Hawkins; "The Application of Fluride Ion Dating at the Slack Farm Site, Union County, Kentucky" by Wayna Roach: "Analysis of Feature 1, A Brick and Wooden Structure Within the Parapets of Fort Smith, Smithland, Kentucky" by Kathleen Tucker: "Investigating Late Eighteenth Century Frontier Stations in Kentucky Using Geophysical Methods" by Nancy O'Malley; "Looking Below the Surface: Recent Investigations at the Adams Site" by Charles Stout, Kathleen Tucker, and Scott Kayse; "Historical Archaeology at the Neal Site: An Upland Black Farmstead in Nicholas County, Kentucky" by W. Stephen McBride, A. Gwynn Henderson, and Cheryl Berrsaglia; "Fuqua Village from the Perspective of the Lithic Assemblage" by Charles Stout, Kathleen Tucker, Sara R. Mills, and Kenneth Carstens; "The Dillow's Ridge Site: An Upland Unplowed Mississippian Village in the Mill Creek Chert Quarry Area of Southern Illinois" by Brian M. Butler; "A Primer of Rock Art" by Fred E. Coy, Jr.; "Preliminary Report of the Phase III Investigations of the Hedden Site, Late Archaic Habitation and Mortuary Sites in McCracken County, Kentucky" by Betty J. McGraw and William A. Huser, Jr.; "An Analysis of the Foust Site Complex (Sites 15Ml91-93 and 15Ml104), Marshall County, Kentucky" by Paul Bundy, Kenneth Carstens, and Charles Stout; and "A Reexamination and Description of the Hardin Village Mortuary Data Set" by William F. S. Holmes.

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

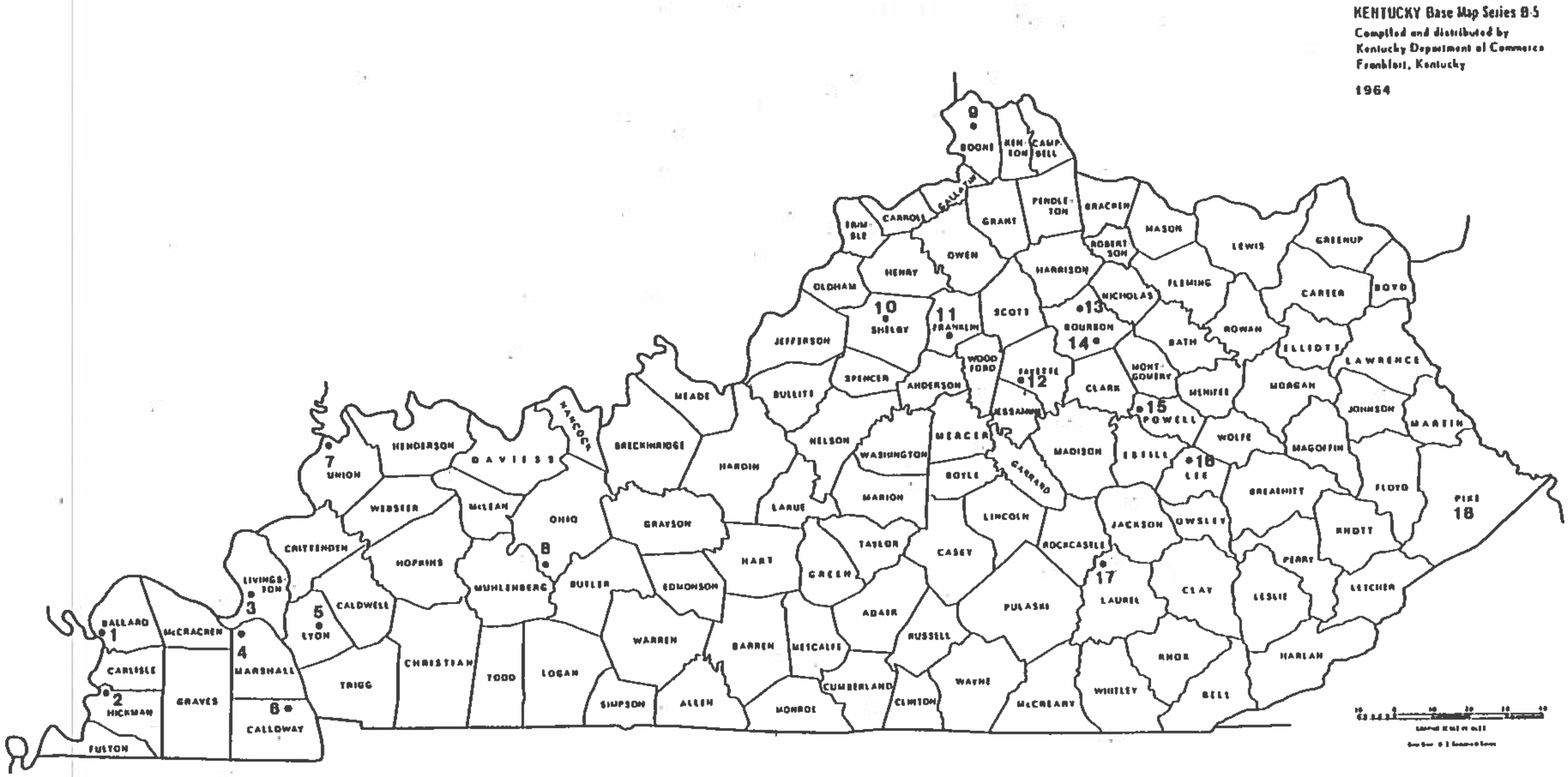

Figure 1. Sites Discussed in this Volume: 1) Wickliffe Mounds, 2) Fort Anderson, 3) Fort Star, 4) Hite Site, 5) Tinsley Hill Site, 6) Crick Site, 7) Slack Farm Site, 8) Chiggerville Site, 9) Crisler-Gulley Grist Mill, 10) Shelby Lake Site, 11) Capitol View Site, 12) Elijah Foley House Site, 13) Larkin Site, 14) Buckner Site, 15) Rhondle Lee Site, 16) Cold Oak Shelter, 17) Groovey, Rising Sun and Big rockshelters, and 18) Martin Justice Site.

EDITORS' INTRODUCTION

This volume contains a series of papers about very diverse topics. After careful consideration, a decision was made to organize these papers chronologically by cultural period from the earliest to the latest. The papers include both prehistoric and historic topics. Papers about prehistoric topics include Archaic, Woodland, and Late Prehistoric period sites. Topics explored include site reports, regional studies, labor by women and children, degenerative bone disease, maize consumption, surface collections, Digital Terrain Models, among many others. The historic period papers focus on residential sites, Civil War forts, grist and saw mills, and medicines used on the 18th century frontier.

The papers presented in this volume will be welcome additions to the growing body of archaeological literature in the Commonwealth of Kentucky. These papers present new information about sites from western Kentucky to extreme eastern Kentucky and from northern Kentucky to southern Kentucky. Undoubtedly, papers in this volume will be cited by researchers for many years to come. We express our appreciation to each of the authors for submitting the papers that comprise this volume and for their patience during the long editorial process. Special thanks is due David L. Morgan, Director of the Kentucky Heritage Council and the State Historic Preservation Officer, for his long term support of the annual archaeological conferences and the publication of edited conference volumes. Thomas N. Sanders, Manager of the Site Protection Program, provided encouragement and assistance during the preparation of this volume.

Charles D. Hockensmith
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December 1998

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3,000 YEARS OF HUMAN ACTIVITY AT THE COLD OAK SHELTER

By

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ABSTRACT

The Cold Oak Shelter in Lee County, first investigated in 1984, has yielded evidence of human activity from ca. 3,000 B.P. until the present day. The current sequence of radiocarbon dates indicates a strong probability of continuing use spanning the Terminal Archaic, Early Woodland, and early Middle Woodland periods. The absence of significant gaps in the radiocarbon chronology within this time frame suggests that division of assemblages from this site into "components" may obscure relevant chronological variability. Analysis of later activity at Cold Oak, during the Late Woodland and Historic periods, sheds light on how anthropogenic disturbance (including that of archaeologists) has shaped the archaeological record of the site.

INTRODUCTION

The Cold Oak Shelter (15Le50) in Lee County, Kentucky is one of many dry rockshelters on the Daniel Boone National Forest that lies within the Big Sinking Creek drainage. The rugged country around Big Sinking Creek has experienced considerable anthropogenic disturbance at the hands of Euro-American settlers and their descendants during the last two centuries. Logging and oil drilling have caused disruption of plant cover and erosion, resulting in multiple episodes of forest replacement and regeneration. In contrast to the broad expanses of ridgetop, slope, and bottomland that yielded these resources, dry rockshelters represent points on the landscape that attracted people for very different reasons. In the historic period, they have been havens for hunters and campers, magnets for artifact collectors, and sources of niter for the manufacture of explosives. In prehistory, shelters like Cold Oak made comfortable refuges for small groups of people, as well as naturally dry facilities for the storage of crops and nut harvests.

The dry conditions that made Cold Oak Shelter so attractive as a habitation site also contributed to the long-term preservation of organic artifacts and refuse. Because of the abundance and quality of plant and animal remains recovered from it, the site's potential for advancing understanding of early food production during the Terminal Archaic and Early Woodland periods was quickly recognized. Accordingly, Cold Oak was targeted for test excavation by the Forest Service in 1984 in order to assess its eligibility for National Register nomination (O'Steen et al. 1991). These excavations revealed that, although the site had been disturbed by recent vandalism as well as earlier logging and niter mining, intact prehistoric deposits were extensive. Temporally diagnostic artifacts (such as Wade and Cogswell projectile points) and radiocarbon dates indicated the presence of a Terminal Archaic horizon associated with the Cogswell phase. A range of Early Woodland dates was obtained from more recent strata (Ison 1988; O'Steen et al. 1991).

Domesticated plants were used by inhabitants of Cold Oak as early as ca. 3000 B.P., but the remains of domesticates are abundant only in later contexts (Gremillion 1993; O'Steen et al. 1991). Domesticated gourd/squash (*Cucurbita pepo*) directly dated to ca. 3000 B.P. is some of the earliest evidence in the region for morphological change in this taxon. Other crop plants recovered from Terminal Archaic and Early Woodland deposits at the site include maygrass (*Phalaris caroliniana*), sumpweed (*Iva annua*), and chenopod (*Chenopodium berlandieri*). These findings provided important confirmation of the temporal patterns of initiation and intensification of food production noted by Cowan for the nearby Cloudsplitter shelter in the Red River drainage (Cowan 1985; Cowan et al. 1981).

The work at Cold Oak begun in 1994 builds on earlier research to refine understanding of the early development of agriculture in the uplands of eastern Kentucky. Collection of numerous fine-screened and soil samples was undertaken in order to provide a large collection of plant and animal remains dating to the Archaic/Woodland transition. The information obtained will document changes in human-plant relationships, including the subsistence importance of crops, and to determine whether the growing importance of farming was accompanied by changes in foraging patterns. It is hoped that the pollen record from Cold Oak will reflect any forest clearance that may have accompanied the establishment of crop gardens. Analysis of deposits, including cultural features, will provide a basis for assessing the importance of food storage to the prehistoric forager-farmers who used Cold Oak and for documenting changes in the frequency, duration, and/or intraannual patterning of the site's use. Ultimately, it is hoped that these data can be used to identify causal relationships between food production, storage, and use of rockshelters in this region.

For this paper, however, a more modest goal is proposed: to focus on the Cold Oak Shelter as a long-term record of human use of a sheltered spot on the landscape. Even given a primary interest in prehistoric use of the site, the impact that activities such as vandalism have had on the archaeological record requires attention to what happened later. In particular, interpretation of the sequence of occupation and use of Cold Oak demands consideration of how trampling, mining, vandalism, and even archaeology have affected prehistoric deposits. The large set of chronometric dates now available from the site make it possible to assess the degree of correspondence between theoretical constructs such as Terminal Archaic and Early Woodland and the archaeological deposits they are said to represent. This reconstruction of the various influences on archaeological deposits at Cold Oak is offered as a hypothetical one that is likely to be revised. Rockshelters are notoriously difficult to excavate and interpret, particularly when they have been affected by historic disturbance, and Cold Oak (although its deposits are shallow) is no exception.

STRATIGRAPHY

Field investigations in the summer of 1994 consisted of excavation of a 1 x 5 m trench parallel and adjacent to the 1984 trench (Figure 1). Using the cleaned profile from the earlier excavation, to follow previously identified strata proved very difficult. Frequent lensing and changes in the texture and color of sediments over short distances made it difficult to trace specific deposits. Disturbance was greater than expected in this part of the site. In addition to a previously noted trench along the back wall, several holes had been dug by looters along a line from the back wall to the cliff edge. Interruptions in the prehistoric deposits by these disturbances made it difficult to correlate discontinuous strata.

Our methods represented a compromise between purely stratigraphic and purely arbitrary excavation. Deposits that appeared to be undisturbed were excavated in 5 cm levels, but different fill zones within each level were designated and bagged separately. This technique allowed us to maintain

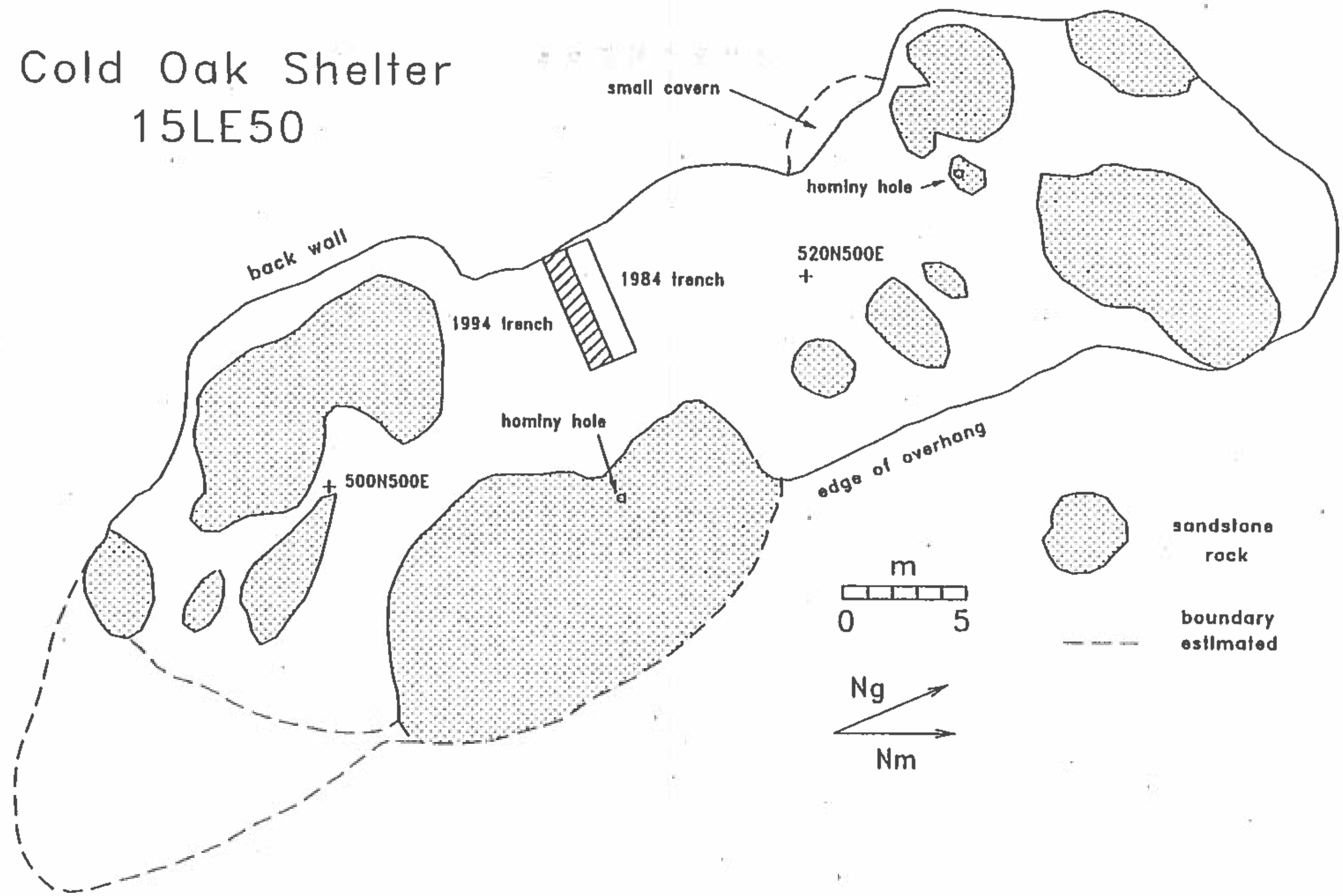

Figure 1. Planview of Cold Oak Shelter Showing the Location of 1984 and 1994 Excavations.

tight arbitrary vertical controls while at the same time avoiding mixing of materials that might be significantly different in age. The end result was a proliferation of bags and a somewhat exasperating jumble of unit-specific zones. However, it was possible using field notes, drawings, chronometric dates, and photographs to work out correlations between new and old profiles and excavated sediments and to assign each deposit to one of several major cultural/stratigraphic zones. Although time consuming, this excavation technique paid off when features or disturbances unrecognized as such during excavation proved to have been labeled as separate zones: materials recovered from them could thus be kept analytically separate from those of the surrounding matrix.

The major zones identified in the 1984 excavations were represented to a greater or lesser degree in the 1994 trench (Figure 2). The first of these, Zone I, overlies the prehistoric deposits. It consists of unconsolidated, sandy, grayish brown sediments with considerable ash and is rich in charcoal, bones, and artifacts. Where Zone I interfaces with intact sediments, there is variation in color and degree of compactness. Limestone tempered, cordmarked pottery and a Madison-like point from Zone I suggest that traces of Late Woodland activity have been thoroughly churned and homogenized by later disturbance. Presence of other diagnostic artifacts of earlier Woodland and Archaic age indicate an admixture of looters' backdirt. Zone Ia is a discontinuous lens of matted plant material probably associated with Historic use of the site as a stable for oxen (O'Steen et al. 1991); it is restricted to the two easternmost units. Zone Ib was recognized in profiles as being stratigraphically continuous with Zone IIc (see below), but is disturbed.

Zone II was originally described in 1984 as a layer of dry, compact, pale yellow sandy loam with numerous ash lenses (O'Steen et al. 1991). Zone II was retained as an analytical unit, but was subdivided to recognize internal variation. The subunits, some differing in color and/or texture from descriptions based on earlier excavation, are included with Zone II, based primarily on stratigraphic continuity and chronometric dates. Zone IIa is restricted to two central units where backfill was mounded over prehistoric deposits. The fill is medium to dark brown, and charcoal and bone are usually present in dense concentrations. Some portions of this stratum are probably disturbed, and in some cases were included with material from Zone I during excavation. One feature originating in this zone produced a date of 1910 ± 50 B.P. (A.D. 40) (uncalibrated midpoint; see Table 1). Zone IIb is extremely ashy, and ranges in texture from loose to compact; its color and sometimes less consolidated character distinguish it from earlier descriptions of Zone II. One feature originating in Zone IIb produced a radiocarbon date of 2060 ± 60 B.P. (110 B.C.). Zone IIc corresponds most closely to previous descriptions of Zone II and usually appears stratigraphically below Zone IIb. It is interrupted by looters' holes and by prehistoric features within the excavated trench. Zone IIc contains numerous features, including several apparent storage pits (some with a lining or cap of grass fibers and/or leaves), burned areas, and shallow basins. Dates from Zone IIc range from 2190 ± 80 B.P. to 2590 ± 90 B.P. (240-640 B.C.).

Zone III underlay Zone II throughout most of the trench; exceptions occurred where Woodland features had interrupted it. The sandy sediments of this zone ranged in color from medium to dark brown and, like Zone II, it contained numerous ash charcoal lenses. Uncharred plant material was also encountered where low moisture had inhibited decay (it was especially dense in Zone IIIa, identified during 1984 investigations). Features originating within Zone III consisted primarily of shallow basins, postmolds, and hearths. Dates from Zone III range from 2710 ± 60 B.P. to 2900 ± 100 B.P. (760- 950 B.C.). (With several exceptions, which are discussed below).

Zone IV was first identified during 1984 excavations as a layer of unconsolidated grayish-brown sand with ash lenses and decaying sandstone rocks. It was only noted at one end of the 1995 trench.

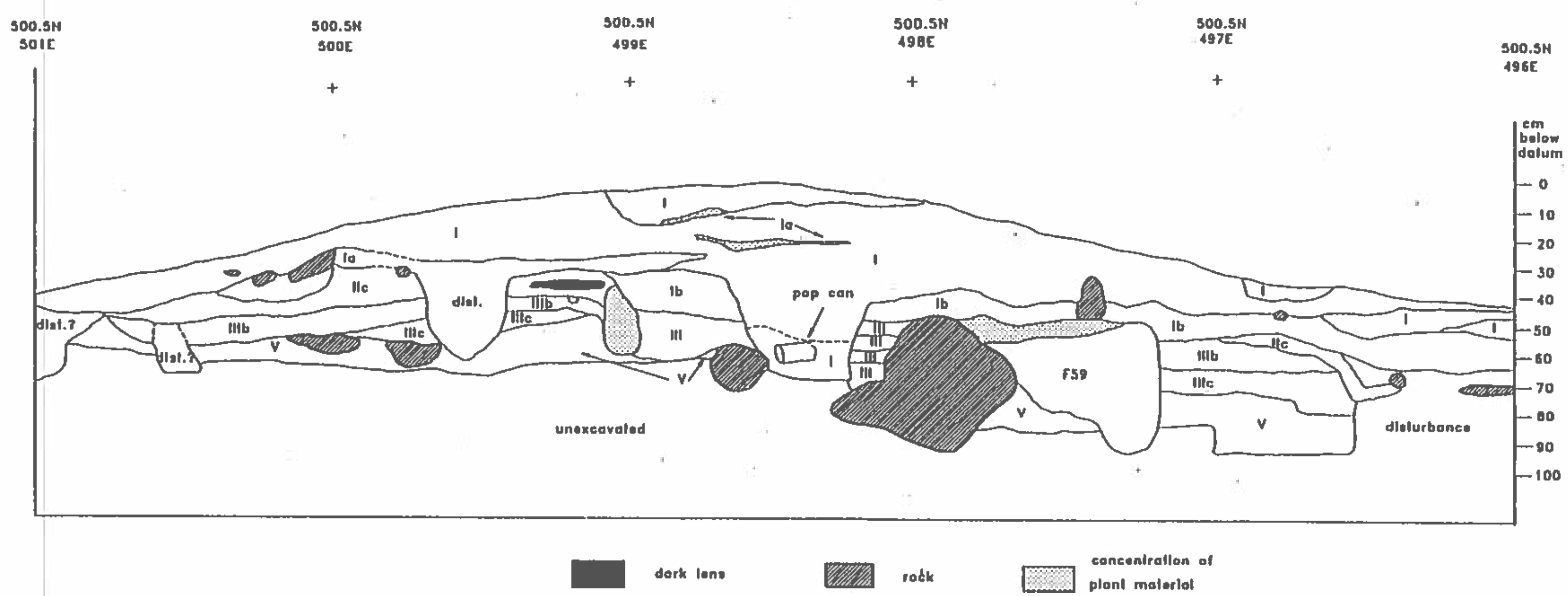

Figure 2. South Profile of 1994 Trench. Roman numerals indicate probable correlations with cultural zones (see text for explanation).

Table 1. Radiocarbon Dates from Cold Oak Shelter.

Sample Number	Context	Radiocarbon Years B.P.	Calibrated Two-Sigma Range (95.4% Confidence Interval)	Comments
Beta-22515	Zone III	2930 +/- 70	n/a	wood; not corrected for isotopic fractionation
Beta-58051; CAMS-4573	Zone III	2900 +/- 100	1400-800 B.C.	AMS date; *Cucurbita* rind
Beta-76310	Zone III, 50 cm b.d.	2840 +/- 70	1210-820 B.C.	wood
Beta-10445	Zone III	2830 +/- 60	n/a	wood; not corrected for isotopic fractionation
Beta-84750		2760 +/- 60	1030-800 B.C.	AMS date; textile from profile (depth unknown)
Beta-76311	Zone III, 85 cm b.d.	2710 +/- 60	990-790 B.C.	wood
Beta-38435 ETH-6764	Feature 2 (Zone II)	2590 +/- 90	900-410 B.C.	AMS date; *Chenopodium* seeds
Beta-84751	Zone II, 40-45 cm b.d.	2490 +/- 70	790-410 B.C.	nutshell
Beta-55370	Feature 8 (Zone II)	2470 +/- 90	n/a	wood; not corrected for isotopic fractionation
Beta-22518	Feature 22 (Zone II)	2470 +/- 60	n/a	wood; not corrected for isotopic fractionation
Beta-84753	Zone III, 60-65 cm b.d.	2420 +/- 60	770-390 B.C.	nutshell
Beta-84754	Feature 45 (Zone III)	2230 +/- 60	400-120 B.C.	AMS date; *Lagenaria* rind

Table 1. Radiocarbon Dates from Cold Oak Shelter (continued).

Sample Number	Context	Radiocarbon Years B.P.	Calibrated Two-Sigma Range (95.4% Confidence Interval)	Comments
Beta-22519	Feature 2 (Zone II)	2210 +/- 60	n/a	wood; not corrected for isotopic fractionation
Beta-76309	Feature 57 (Zone II); 49 cm b.d.	2190 +/- 80	400-40 B.C.	wood
Beta-84752	Feature 37 (Zone II); 55-60 cm b.d.	2170 +/- 70	380-40 B.C.	wood
Beta-76307	Zone III; 62 cm b.d.	2060 +/- 70	350-310 B.C. 210 B.C.-120 A.D.	wood
Beta-76308	Zone II; 52 cm b.d.	2060 +/- 60	200 B.C.-80 A.D.	wood
Beta-76306	Zone II; 26 cm b.d.	1910 +/- 50	1 A.D.-240 A.D.	wood

Calibrations were made using OxCal version 2.18 (Bronk Ramsey 1994, 1995; Stuiver et al. 1993).

where it appeared to underlie Zone III. Several small pits are associated with Zone IV. No radiocarbon dates were obtained from Zone IV, but material recovered during 1984 excavations suggest a Terminal Archaic placement.

Zone V is found throughout the excavated area and consists of almost pure yellow sand with much decaying sandstone and only a small admixture of cultural material. Several small pits were excavated into Zone V. No dates have been obtained from this zone.

RADIOCARBON DATES

A sequence of 18 radiocarbon dates has been obtained from Cold Oak that spans a 2,000-year period (Table 1). Most of the dates proved to be consistent with expectations based on temporally diagnostic artifact attributes and stratigraphic relationships. The sequence of calibrated dates can be used to make an argument against uncritical use of the "component" as an analytical unit (Figure 3). Calibrated age ranges were obtained using OxCal version 2.18. Only dates corrected for isotopic fractionation were used.

Three samples associated with Zone III produced anomalous dates (Beta-84753, Beta-84754, and Beta-76311), probably due to intrusion of more recent material from Woodland features. The two-sigma ranges associated with Zone III form a cluster spanning approximately 600 years. Note, however, that the Terminal Archaic range of dates straddles the conventional boundary between the Archaic and Woodland periods. It is hardly surprising, especially given what we now know about the antiquity of such quintessentially "Woodland" traits as pottery and agriculture, that the Zone III dates support the validity of the stadial constructs "Terminal Archaic," "Transitional Period" (Yerkes 1988) or "Late Holocene Regional Florescence" (Smith 1986).

The other major zone, Zone II, produced dates covering a much longer time span. The most recent were drawn from Zones IIa and IIb and by culture historical convention belong in the "Middle Woodland" period. However, the Early-Middle Woodland boundary does not seem to correspond with any major interruption in use of the shelter, at least judging by the overlap with subsequent "Early Woodland" dates. The only break in the chronometric sequence (and it is not much of one) occurs between samples that come from within Zone IIc. In other words, if there was such a break, it does not seem to coincide with any major change in the way people used the shelter.

The question of a hiatus in occupation between deposition of Zones III and II is an intriguing one, since the stratigraphic break is so easily observed. Chronometric dates are generally congruent with this distinction between the two zones. Patterns of deposition changed significantly after about 800 cal B.C. Whether or not this shift was accompanied by any interruption in use of the shelter is less clear. The latest Zone III and earliest Zone II dates do overlap at the two-sigma level. The latter date (Beta-38435) is potentially problematic: obtained directly on cultigen *Chenopodium* from a grass-lined storage pit excavated in 1984, it is several hundred years earlier than a conventional date on charcoal from the same pit (Beta 22519). Which one of the two dates is more accurate, or whether intrusive charcoal is involved, has not been determined. In any case, the overlap between Archaic and Woodland is reduced considerably if the chenopod date is eliminated from consideration. The radiocarbon data are compatible with a number of scenarios of intermittent use of Cold Oak. However, overlap between calibrated two-sigma ranges indicates that the shelter was visited several times (at least). No absences of substantial duration can be established, though some may have occurred.

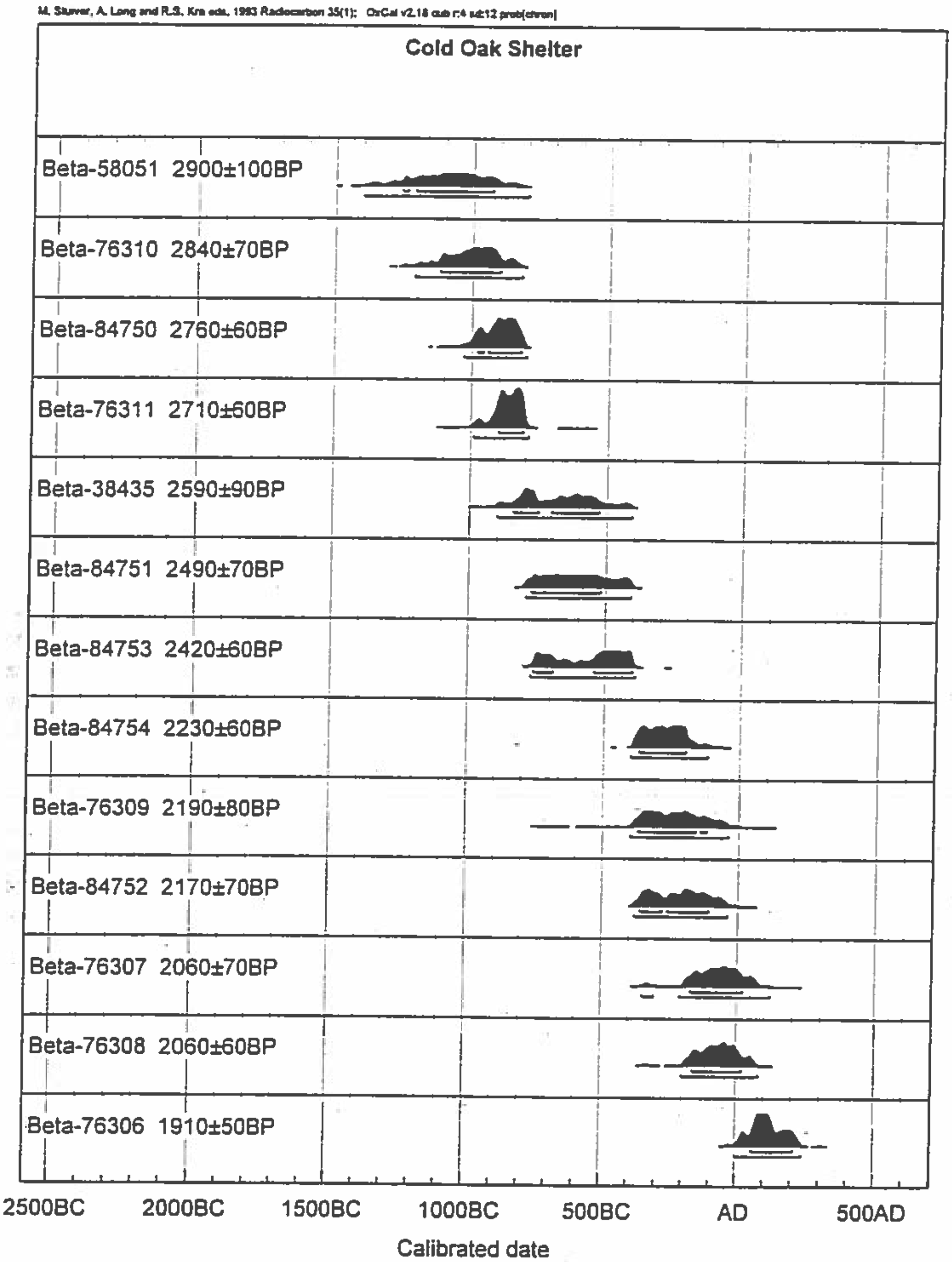

Figure 3. Probability Distributions and Standards Error Ranges for Calibrated Dates from Cold Oak. Calibrations were made using OxCal version 2.18 (Bronk Ramsey 1994, 1995; Stuiver et al. 1993) (see Table 1). Shaded areas denote probability distributions; horizontal lines denote one-sigma and two-sigma ranges.

ASSESSING POSTOCCUPATIONAL DISTURBANCE

Although post occupational disturbance of prehistoric deposits at Cold Oak has been extensive, both chronometric and artifactual evidence provide grounds for optimism about the potential of the site for documenting change. First, the majority of radiocarbon determinations are consistent with observed stratigraphic relationships. This fact implies that assessments of relative age of seemingly intact deposits can be made with some confidence. Disturbed deposits are often, although not always, identifiable on the basis of degree of compactness and/or obviously recent inclusions (such as bovid dung). The one anomalous date may well have been the result of the mixing of Archaic- and later Woodland-aged charcoal. Despite the precautions taken in the field to guard against it, such an occurrence is possible given the frequency with which material became detached from slumping profiles.

A second indication that much of the site's stratigraphic integrity has been preserved despite looting is the distribution of pottery with different surface treatments (Figure 4). Limestone tempered, cordmarked pottery is limited to samples representing a mixture of deposits (such as profile cleanings) and the disturbed upper layer, Zone I. Pottery is restricted to the upper (Woodland and later) zones. Burnished pottery is also found in disturbed zones, but is best represented in Zone II (the Early-Middle Woodland zone). This distribution is compatible with the regional record of temporal variation in surface treatment types. In general, in the uplands of eastern Kentucky and adjacent parts of West Virginia, cord-marked sherds are more likely to dominate Late Woodland than earlier Woodland assemblages, and burnishing is more likely to be common in Early Woodland than in Late Woodland assemblages (Ahler 1988; Haag 1942; Ledbetter and O'Steen 1991; Niquette and Boedy 1986; Niquette and Hughes 1991). The fact that the vertical distribution of surface treatment types at Cold Oak mirrors regional stylistic trends suggests that intact deposits are being correctly recognized as such and have not been invaded by intrusive artifacts of more recent age. Furthermore, the accumulation of artifacts from a broad time span in Zone I and the general absence of mixing in lower deposits suggests that artifacts are more likely to be moved upward than downward as a result of disturbance (most of the sherds from "mixed" contexts come from the surface or profiles rather than from deep intrusions). Thus, vertical distribution of different surface treatments is generally predictable on the basis of stratigraphic relationships.

SUMMARY AND SYNTHESIS

The history of human use of the Cold Oak Shelter can be summed up (admittedly with broad brush-strokes) in the following way. Sometime prior to 3000 B.P., people began modifying the sandy substrate of the sandstone overhang. Over the next 800 years, repeated use (on a seasonal basis, but probably not every year) resulted in accumulation of refuse, including organic material, that mixed with eroding sand to form a dense anthropogenic deposit into which small pits and hearths were dug. Crop gardens were cleared and planted on a small scale, either on hillsides adjacent to the site or on the small terraces of Cold Oak Hollow.

After 800 cal B.C., deposition patterns changed. More features, including storage pits, were excavated; the earlier of these intruded upon pre-800 B.C. deposits. Excavators of these pits contributed ash, charcoal, and other habitation refuse to the accumulating sediments. By this time, crops had become a more significant part of the diet and their storage was a key strategy for offsetting seasonal food shortages. Little is known about the prehistoric use of Cold Oak after about 200 cal B.C.; however, artifactual evidence indicates that some activity took place at least until ca. A.D. 1000.

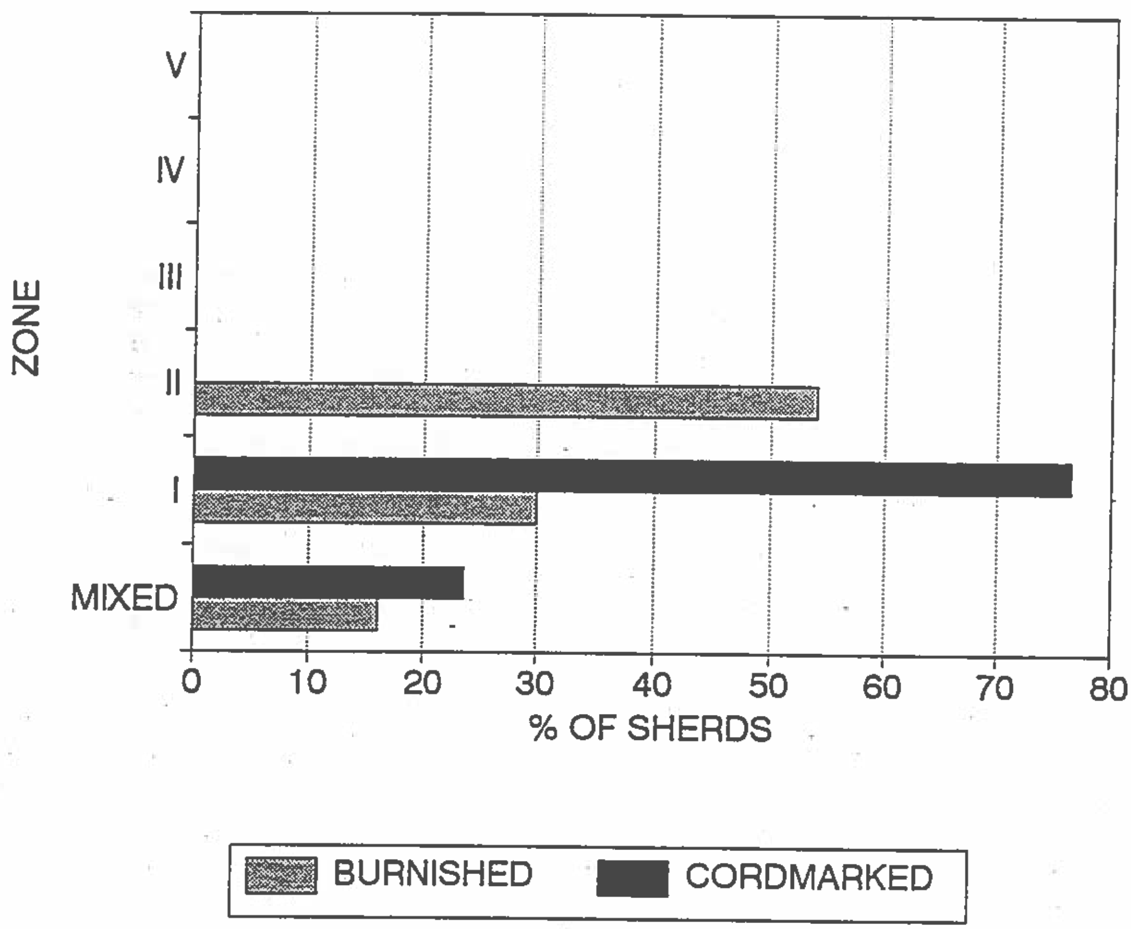

Figure 4. Distribution of Sherds with Different Surface Treatments Among Cultural Zones, Expressed as Percentage of Sherds > 4 cm in size.

Beginning around 200 B.P., Euro-American settlement became a major factor in the local landscape, eventually resulting in extensive forest clearance. Loggers brought their oxen to Cold Oak, as dung from these beasts amply attests. The trampling that resulted from this activity and from niter mining thoroughly churned the upper prehistoric deposits. In still more recent times, relic collectors have systematically probed prehistoric deposits, moving materials both laterally and vertically (but primarily upward rather than downward). They have selectively removed artifacts as well as disrupting the spatial relationships originally formed between artifacts and deposits in prehistory.

Finally, in 1984 and 1994, archaeologists excavated square holes in the shelter floor, further disturbing the upper layers of the site, size-sorting inclusions within its sediments (primarily carrying off the larger items and leaving behind thin layers of the finely-sifted matrix). Of course, the story is not over; vandals have been at the site since the 1994 excavations. With luck, it will be possible to salvage more information from this important site before its prehistoric deposits are completely destroyed.

CONCLUSIONS

This preliminary account of the occupational history of the Cold Oak Shelter offers several methodological lessons that can inform future research. First, it illustrates the point that disturbed sites contain valuable information for the archaeologist and should not be ignored (Knudsen 1985). The vast majority of dry shelters in the drainages of the Red, Kentucky, and Licking rivers have been disturbed, whether intentional or unwitting (Pollack and Ison 1983; Snedeker and Harmon 1990). If we are to tap their great potential for contributing to documentation of subsistence change, we must learn to deal with the disturbance of the archaeological record contained in these sites. In order to do so, it is extremely important to excavate in a way that maximizes the chances of distinguishing disturbed from intact prehistoric deposits in the field and (even if this attempt fails) of being able to separate their contents later.

Second, this analysis suggests that the concepts of "component" and "cultural period" may not be appropriate analytic units for documenting change at the level of the individual site. Division of materials from Cold Oak into "Middle Woodland", "Early Woodland," and "Terminal Archaic" categories for purposes of analysis may obscure some of the variation that we want to explain.

There is much work to be done at this site and others like it in the future. One of the primary objectives of the most recent phase of investigations at Cold Oak has been to reconstruct changes in the importance of food production and how it is correlated with changes in foraging patterns and land use. It is hoped that, building on the solid foundation of previous work at this site, that it will be possible to advance toward achieving this goal.

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THE RESEARCH POTENTIAL OF SURFACE-COLLECTED LITHIC ASSEMBLAGES: THE RHONDLE LEE COLLECTION, POWELL COUNTY, KENTUCKY

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ABSTRACT

Prehistoric lithic assemblages obtained through unsystematic surface collection can be problematic because detailed spatial attributes and contextual information are not usually recorded at the time of collection. Despite this limitation there are several lines of research that may be addressed using surface collected lithic assemblages, especially chipped-stone biface collections. Such collections can be used to document variability in chert types, and in the metric and nonmetric attributes of hafted biface stylistic types, to develop hypotheses about temporal patterns of raw material use, to detect diachronic patterns of tool reworking, and to evaluate hypotheses about evolutionary change in technology and in hafted biface attributes.

This paper describes these general propositions in more detail and illustrates them using a case study from the multicomponent Rhondle Lee Site (15Po302) in Powell County, Kentucky. The results of this application indicate that cherts in the Rhondle Lee collection have unique color values, that several dimensions of hafted biface types in the collection differ from those of specimens from other parts of the Eastern Woodlands, that the use of immediately available chert resources peaked during the Early Archaic and Late Archaic-Early Woodland periods, that the use of Paoli chert was pronounced during the Late Archaic-Early Woodland periods, that the use of exotic cherts was somewhat higher during the Archaic and may reflect a mobile lifestyle or sedentism with stockpiling, that bow and arrow technology may have been adopted as early as the Late Archaic-Early Woodland period in eastern Kentucky, and that some hafted biface attributes may have stylistic rather than functional significance.

INTRODUCTION

Prehistoric lithic assemblages obtained through unsystematic surface collection are common throughout most of the eastern United States because of a century-long tradition of artifact acquisition by collectors and avocational archaeologists. Though ubiquitous, these assemblages are problematic to professional archaeologists because detailed spatial attributes and contextual information are not usually recorded at the time of collection. Such data are essential for a variety of synchronic studies, for instance the nature of site structure for a given time period, as well as for diachronic studies, such as changes in land use over time. Despite these limitations, however, lithic assemblages obtained through unsystematic surface collection need not be neglected in archaeological research.

There are several lines of research that can be addressed using surface-collected lithic assemblages, especially chipped-stone biface collections. Such assemblages can be used to document variation in chert properties and in hafted biface morphology. Hypotheses about diachronic changes in raw material use, tool reworking, and evolutionary change can be advanced or evaluated using surface-collected lithic biface assemblages. This paper describes these general propositions in more detail and illustrates them with a collection from Powell County, Kentucky.

One limitation is that the hypothesis testing endeavor can only be accomplished with lithic collections containing chronologically diagnostic specimens. In the absence of stratigraphic control and reliable associations with dateable artifacts, stylistic typologies must be used for chronological control. Traditional stylistic typologies for lithic bifaces allow for "built-in" chronological control of surface-collected assemblages.

Several assumptions must be made when using surface-collected lithic assemblages in archaeological research. One assumption is that surface-collected lithic assemblages represent a random sample of the total lithic population of a site or a geographic area. It must also be assumed that a nonrandom distribution of a physical attribute of lithic tools, such as blade length, over time suggests the attribute had functional import and/or was under some selective pressure; a random distribution, on the other hand, indicates the attribute may be stylistic (cf. Dunnell 1978). The term "hafted bifaces" is purposely used throughout much of this paper instead of the term "projectile points" because the former does not imply functional labels that might be unwarranted without microwear or other analyses.

DOCUMENTING VARIABILITY

Since the utility of much archaeological research depends on the classification schemes used by archaeologists to partition artifact collections, we can benefit from research that addresses classification issues. Two common criteria used to classify lithic collections are raw material and morphological attributes. Classifying lithic artifacts by raw material is an important endeavor because it is requisite for addressing research questions related to technology, settlement, and land use. Morphological attributes are used to classify artifacts stylistically and functionally, and such typologies form the foundation of culture history and lifeways reconstruction research. Lithic collections obtained through unsystematic surface collection can be gainfully used to document variability in those properties commonly used to group artifacts with the goal of firming up the classification schemes upon which archaeological research is based.

CHERT PROPERTIES

Chipped-stone lithic assemblages obtained through unsystematic surface collection give archaeologists the opportunity to document variability in chert properties. One benefit of comprehensive and detailed documentation of chert variability is more secure identification of chert types. While physical chert properties are the focus of this research, mechanical and thermal properties can be investigated as well.

Color is perhaps the most commonly used physical criterion for identifying chert types. Unfortunately, color is also one of the most variable properties of most cherts. In the absence of microscopic examination of chert inclusions or sophisticated methods of color analysis such as instrumental colorimetry, archaeologists often must rely on visual examination of color as the primary means of chert identification. To this end, it would be useful to expand our documentation of color variability of different cherts, and lithic collections obtained through unsystematic surface collection are well suited to this task.

Use of a rock color chart distributed by the Geological Society of America (The Rock Color Chart Committee, 1984) would be useful in this enterprise. The rock color chart is similar to a Munsell soil color chart in that paint chips of common rock hues are arranged by value (lightness) and chroma (saturation). An example of a rock color is 10 YR 5/4, moderate yellowish brown, which is a hue bordering yellow-red with a value of five and a chroma of four.

One might correctly argue that characterization of chert colors in this manner is somewhat subjective, as color designations for the same specimen may vary from one observer to another or from day to day for a single observer. On the other hand, use of the rock color chart must surely be viewed as vastly superior to verbal descriptions of chert colors, such as "blue-green," "tan," or "dark brown," which are not tied to measurement tools allowing some degree of replicability. The rock color chart provides a means of quickly and inexpensively categorizing chert colors. Another advantage of expressing chert colors in such terms is that the numerical format of the system is amenable to statistical manipulations such as cluster analysis.

BIFACE MORPHOLOGY

Certain lithic collections lacking precise provenience data also can be used to document variability in biface morphology. Expanded documentation of physical properties may enhance our ability to efficiently and accurately distinguish tool functional types and stylistic types. Stylistic types are addressed in this study.

Justification for using surface-collected assemblages to document variability in biface morphology, especially those traits used in constructing or applying stylistic typologies, comes when one considers the present nature of the database in print. Some summaries of traditional biface stylistic typologies, which are used by archaeologists as guidelines for identifying stylistic types, are based on small samples or samples from limited contexts. For example, the metric attributes of Raccoon Notched bifaces as reported by Justice (1986:255) are based on sample sizes of one and two specimens. In the same publication (Justice 1986:253), metric measurements for Adena Stemmed bifaces are based on specimens obtained from a burial mound. How well would these bifaces represent the properties of bifaces recovered from other contexts like midden deposits or domiciles? Biface collections lacking precise spatial information can be used to fill in gaps in the present database used to classify bifaces by style.

In addition to concerns about sample sizes and sample context, other issues related to biface morphology can be addressed using collections obtained through unsystematic surface collection. As time and resources permit, archaeologists can use these assemblages to record a wider range of metric and nonmetric attributes that are relevant for typological designations, functional classification, and hypothesis testing. It would be helpful to record attributes in addition to total lengths, widths, and thicknesses, which alone may be insufficient for addressing certain research questions. Because biface collections abound throughout the Eastern Woodlands, this resource might be used to accumulate more information on the physical variability of biface types in different geographic regions. We would likely benefit by using data about Kentucky collections, as opposed to collections from New York or another region, when addressing research questions about Kentucky prehistory. Archaeologists might also benefit from publication of descriptive statistics, such as standard deviations, in addition to averages of specific biface properties because such information better represents morphological variability in biface types.

DEVELOPING AND TESTING HYPOTHESES ABOUT TEMPORAL CHANGE

Besides documentation of artifact variability, hypotheses about diachronic changes in human behavior can be developed and/or tested using certain lithic assemblages obtained through unsystematic surface collection. Some current hypotheses about culture history can be tested using such collections, or the collections can be used to develop hypotheses to be explored further using systematically recovered assemblages. This paper considers hypotheses related to raw material use, tool reuse, and evolutionary change that can be addressed using surface-collected lithic assemblages.

RAW MATERIAL USE

There are several ways surface-collected lithic biface assemblages can be used to study diachronic patterns of raw material use. One issue considered in this study is temporal patterns in raw material use at a site or in a geographic region. Surface-collected lithic biface collections can be used to develop or test hypotheses about changes in raw material preferences over time. Such an analysis requires that the researcher divide the bifaces into groups based on raw material or chert type; these groups must be further subdivided according to time periods as determined by stylistic types. Plots of the proportion of each raw material type for the time periods may show patterns that might reflect raw material preferences. Hypotheses about the occurrence of patterns and the reasons for patterns of raw material use can then be developed and tested using systematically obtained collections.

Another research focus related to temporal patterns of raw material use addressed in this study is changes in settlement strategies over time. Yerkes (1989) discusses the relationship between settlement strategies and the relative use of local versus exotic raw materials for chipped-stone tool manufacture. Some archaeologists contend that, generally speaking and holding constant other factors influencing raw material utilization (such as preference, quality, and knapping properties), mobile societies are likely to use a greater proportion of exotic materials than sedentary groups. After partitioning a surface-collected lithic assemblage into samples representing different time periods, the proportions of local and exotic bifaces for each sample are calculated and plotted. Those samples abounding in bifaces made of exotic materials may indicate a predominantly mobile lifestyle during that period compared to samples with an abundance of bifaces made of locally available materials. In this way, surface-collected biface assemblages can be used to develop hypotheses about temporal changes in settlement strategies. These hypotheses can then be tested using systematically recovered assemblages containing bifaces and debitage, since debitage is needed to distinguish mobile groups from groups who were relatively sedentary but stockpiled exotic raw materials (Yerkes 1989).

TOOL REWORKING

Another issue that can be addressed using surface-collected lithic assemblages with adequate samples of stylistically dateable tools is reworking. Two types of reworking are considered. Reuse of broken tools refers to tool reworking that alters the functional capabilities of the tool and is indicated by loss of the original functional edge(s) of the tool. Refurbishing is tool reworking that maintains the original functional capabilities and edges of the tool. These definitions are not meant to imply that tools are monofunctional. A fundamental assumption is that reuse and refurbishing occurred during the time period indicated by the tool's stylistic classification, for example Late Archaic points were reworked during that period. This type of analysis might also involve some educated guesses about original tool function. To track diachronic patterns of reuse, the percent of reused and reworked tool is plotted per time period. If a modal pattern is indicated in the scatterplot, potential explanations for the temporal patterns may be advanced and tested.

The frequency and extent of tool reuse and refurbishing is influenced by a number of factors, including raw material availability, the nature of the breakage, and tool function. Another potential explanation, settlement strategies, is examined here. Yerkes (1989:186) argues that one might "expect to find a larger proportion of 'worn-out' tools in the lithic assemblages from sedentary sites, while most of the tools found at temporary sites would be lightly used." Assuming this argument is correct, one might posit that time periods during which tool reuse and/or refurbishing were frequent practices would indicate periods of sedentism at a site or in a geographic region, whereas time periods during which reuse and/or refurbishing were uncommon would suggest mobility. These hypotheses could then be tested using systematically obtained assemblages of lithics and other artifacts.

EVOLUTIONARY CHANGE

Studies of evolutionary change based on surface-collected lithic assemblages can take a variety of forms, two of which are considered here. First, one can investigate the issue of changes in prehistoric hunting technologies in prehistory, in this case the timing of the adoption of the bow and arrow. Using Thomas' (1978) scheme for distinguishing hafted bifaces as dart points or arrow points based on metric attributes, one classifies specimens of different ages to determine when technological changes occurred. A time period during which the percentage of bifaces classified by Thomas' equations as arrow points is significant may mark the onset of this technological change. This approach can be used to test the prevailing viewpoint that in Kentucky and most of the Eastern Woodlands, bow and arrow technology was adopted during the late prehistoric (Late Woodland-Mississippian) period.

Second, evolutionary change can be used to explain changes in the properties of weapons systems over time (Applegate and Dancey 1994). One must first determine which attributes of hafted biface specimens in a collection are functionally significant with respect to weapon performance. Initial functional designations might be based on experimental research. Then each functional attribute is recorded for the sample and plotted in a scatterplot against time. If the distribution shows a random pattern, as determined by Pearson's correlation coefficient, the attribute probably was not under the influence of evolutionary forces and may reflect stylistic influences instead of functionality. A nonrandom attribute distribution, on the other hand, suggests that the attribute had functional import and may have been influenced by evolutionary forces. In this case, two assemblages with nonrandom distributions for the attribute are compared in order to determine what evolutionary processes (i.e. selection, drift, flow) may have operated. Certain forces, drift for instance, lead to increased inter-assemblage variability but decreased intra-assemblage variability over time; other evolutionary forces, such as flow, result in decreased inter-assemblage variability but increased intra-assemblage variability. To illustrate, consider that experimental studies have shown that neck width has functional importance in the performance of projectile points (Van Buren 1974). If variability in neck width is nonrandom for two assemblages, decreases within assemblages over time, and increases between assemblages over time, then drift or directional selection may have been operating on that property.

APPLICATION: THE RHONDLE LEE SITE

SITE DESCRIPTION

The Rhondle Lee Site (15Po302) is located in southwestern Powell County, near the border with Estill and Clark counties. Artifacts are concentrated on a small, fairly level terrace spur that extends south-southwest into the narrow floodplain of Red River (Figure 1). To the north, the site is bounded by wooded, steeply sloping valley walls. Two artificial ponds are located to the immediate north of the artifact concentration. The local bedrock is Devonian-Mississippian, and a layer of Boyle chert from the former outcrops at the western border of the artifact concentration.

The area from which artifacts in the collection were obtained measures approximately 165 m from east to west and about 85 m north to south direction, giving an area of about 13,700 m^2. However, the owner of the collection indicates that the total surface expression of the site is larger, continuing north of the two ponds up the slope, and that artifacts were encountered during the course of pond excavation. In addition to pond excavation, recent disturbance of the site involved plowing as well as ground leveling to the south of the barn. The area is currently in pasture.

The Rhondle Lee collection was obtained by the land owner over several years of unsystematic surface collection of the site after plowing. After an initial examination of the collection, U.S. Forest Service archaeologists Johnny Faulkner and Cecil Ison conducted limited testing of the site in 1992. Three shovel tests revealed intact midden deposits below the plow zone. Charcoal deposits indicative of a hearth-like feature were encountered in the central shovel test.

LITHIC COLLECTION

The complete Rhondle Lee collection includes chipped-stone tools and tool fragments, ground-stone tools, a cannel coal gorget, and thousands of pieces of lithic debitage. A portion of this private collection, namely lithic tools and tool fragments, was studied in 1994. The debitage was not examined in this study.

Of the 986 specimens, analyzed, 603 (61 percent) are classified as hafted bifaces. One hundred-fifteen of the hafted bifaces are complete specimens while 488 specimens are broken. A considerable portion the collection consists of miscellaneous bifaces: these include preforms and finished tool fragments, with the 332 specimens comprising 34 percent of the collection. The remaining 51 (5 percent) lithics are 10 unifacial tools, 18 perforators, eight knapping and hammer stones, seven ground-stone tools, five polished bifaces, two chert cores, and one gorget.

Much of the analysis is based on the hafted biface sample, which provides a means of investigating diachronic questions because the specimens can be assigned to diagnostic stylistic types. Of the 603 complete and fragmented hafted bifaces, 468 (78 percent) could be assigned to chronologically significant types as defined by Justice (1986). Late Paleoindian through Mississippian periods are represented. Late Archaic-Early Woodland types numerically dominate in the Rhondle Lee collection: the 312 specimens account for 67 percent of the sample. The Early Archaic period is also well represented, with the 63 specimens comprising 13 percent of the sample. Sample sizes for the other periods are as follows: Paleoindian (n=3), Early-Middle Archaic (n=3), Middle Archaic (n=9), Middle-Late Archaic (n=12), Early-Middle Woodland (n=9), Middle Woodland (n=17), Middle-Late

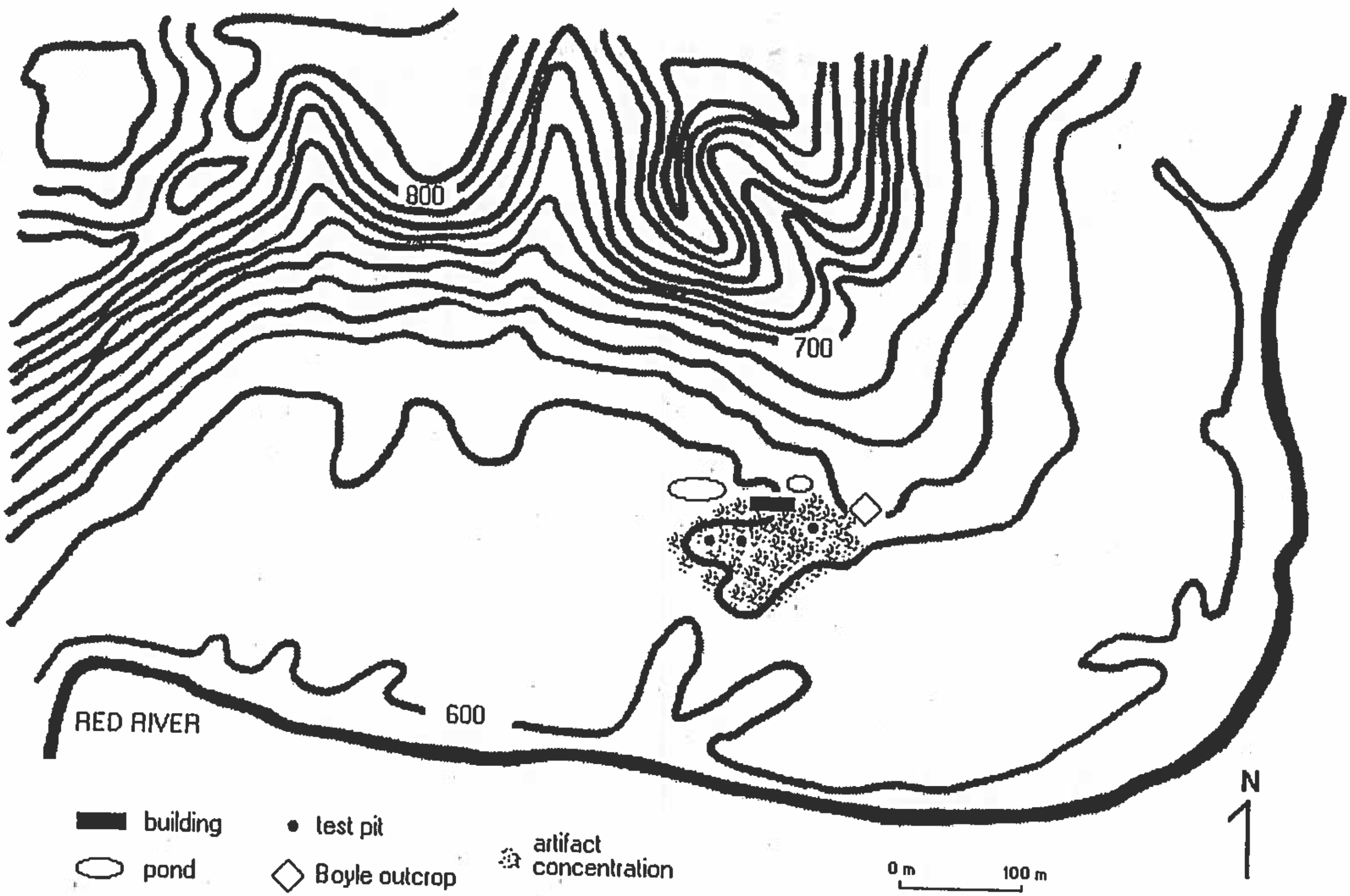

Figure 1. Map of the Rhondle Lee Site (15Po302) in Powell County, Kentucky.

Woodland (n=8), Late Woodland (n=5), Late Woodland-Mississippian (n=24), and Mississippian (n=3).

The Rhondle Lee collection is unusual among unsystematically collected surface assemblages. Unlike collections that are obtained throughout an entire county or region, the Rhondle Lee materials were collected from a circumscribed area. This aids in our ability to test propositions about prehistoric human activities in the area based on the collection.

RESEARCH RESULTS

To review, several issues were investigated using the Rhondle Lee lithic collection. One goal was to document variability in chert properties and hafted biface morphology. The second goal was to use the hafted bifaces to propose or assess hypotheses related to temporal patterns of raw material use and tool reworking as well as evolutionary change. The results of these analyses are presented below.

Chert Properties. Variation in the color of cherts in the Rhondle Lee collection was documented. This aspect of the research is based on the following samples of unheated lithics: hafted bifaces, perforators, polished bifaces, and miscellaneous bifaces. Color variations were recorded for eight chert types: Boyle, Paoli, Haney, St. Louis, Ste. Genevieve, Muldraugh, Breathitt, and Kanawha. Results are presented in Figure 2.

The following general trends in chert colors are noted. The greatest degree of color variation is documented for Boyle chert, although the most common hues are in the red and red-yellow range. All cherts except Ste. Genevieve and Kanawha exhibit red and yellow hues. The only chert type that occurs in shades of green is St. Louis; most St. Louis specimens fall in the 5GY category of greenish grays. Blue and purple hues are associated with Boyle, St. Louis, Ste. Genevieve, and Muldraugh. All chert types except Haney and St. Louis exhibit various shades of neutral gray. Neutral grays, brownish grays, and olive grays are the most common colors of Breathitt and Kanawha cherts in the Rhondle Lee collection.

Color patterns for each chert type are as follows. Hues represented in the Boyle sample are 5R, 10R, 5YR, 10YR, 5P, 5Y, and neutral. No Boyle specimens in the collection fall in the green range. Most Paoli specimens are of brown, yellow, and neutral hues: 5R, 10R, 5YR, 10YR, and neutral. None of the Paoli specimens register in the green, blue, or purple ranges. Hues of the Haney sample are 5R, 10R, 10YR, 5YR, and 5Y. Green, blue, and purple hues are not noted among the Haney specimens. St. Louis chert hues in the Rhondle Lee collection are 10YR, 5Y, 5GY, 5B, and neutral grays. Ste. Genevieve specimens fall in the 5PB, 5Y, and neutral hue ranges, and none of the Ste. Genevieve specimens registered in the brown, yellow, or green ranges. Muldraugh specimens of 5YR, 10YR, 5PB, 5Y, 5GY, and neutral hues are documented. None of the Muldraugh specimens fall in the green range. Hues of Breathitt are 10R, 5YR, and neutral, with no specimens falling in the green, blue, or purple ranges. Kanawha cherts fall in the neutral range only at 5Y and neutral.

Hafted Biface Attributes. The following metric attributes were recorded for the hafted bifaces in the Rhondle Lee collection: total length, blade length, stem length, blade thickness, stem thickness, neck thickness, blade width, stem width, base width, neck width, blade edge, and tip thickness. Several nonmetric attributes were also recorded: grinding, serration, beveling, cortex, striking platform, basal thinning, and presence of Hertzian cone notches. Nonmetric attributes related to morphology, such as

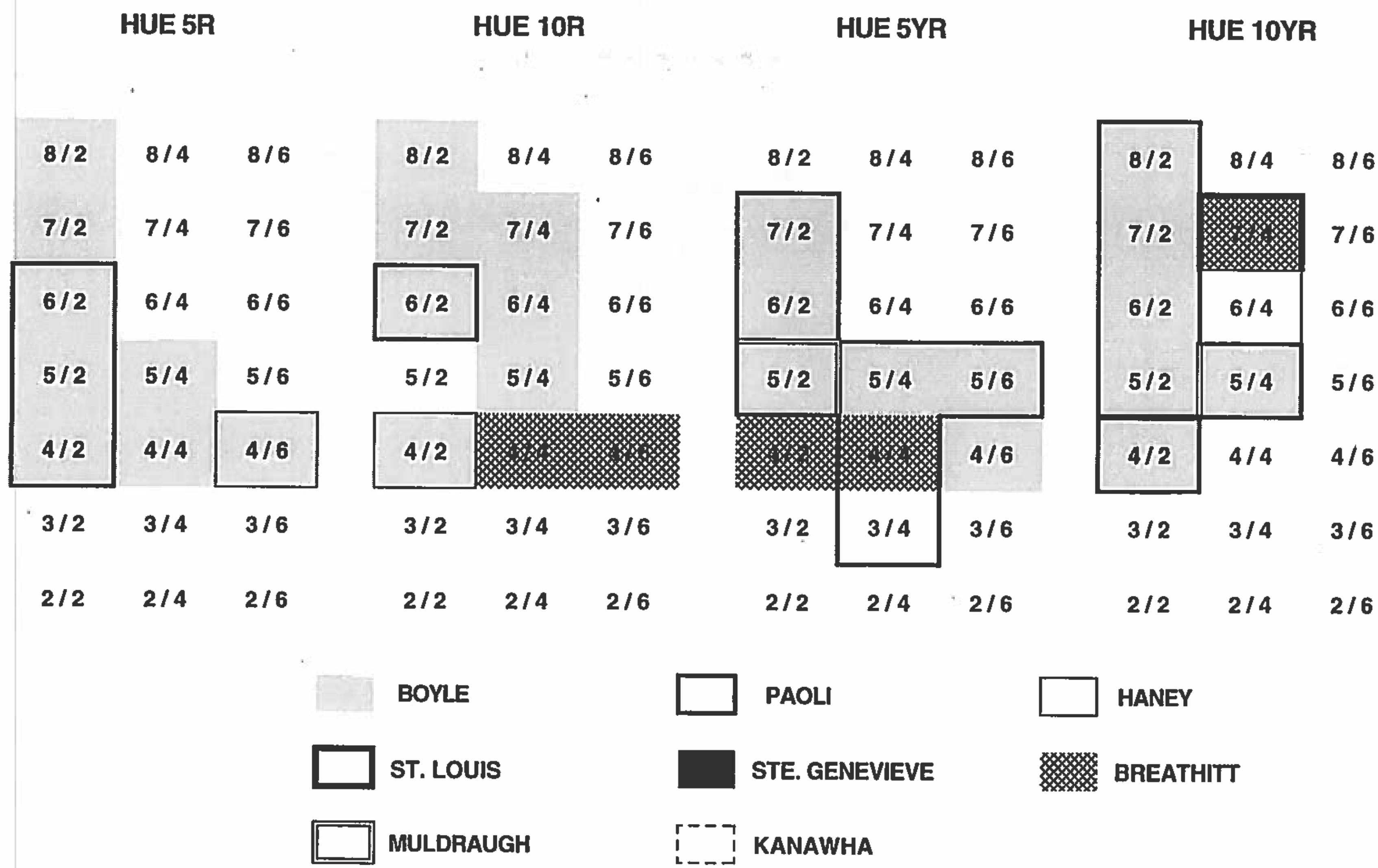

Figure 2A. Color Variations in Cherts Represented in the Rhondle Lee Site Collection: Brown and Yellow Hues.

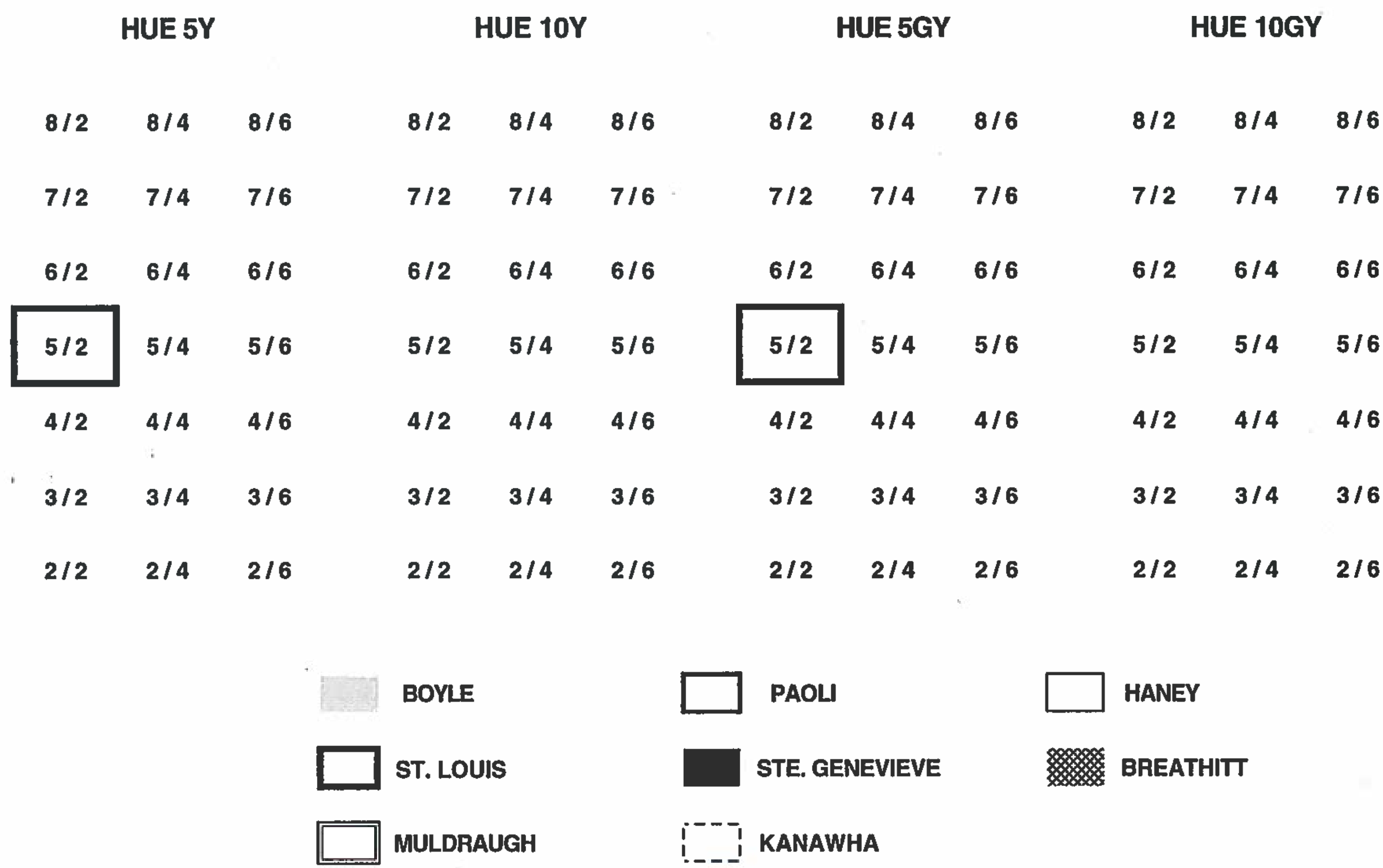

Figure 2B. Color Variations in Cherts Represented in the Rhondle Lee Site Collection: Green Hues.

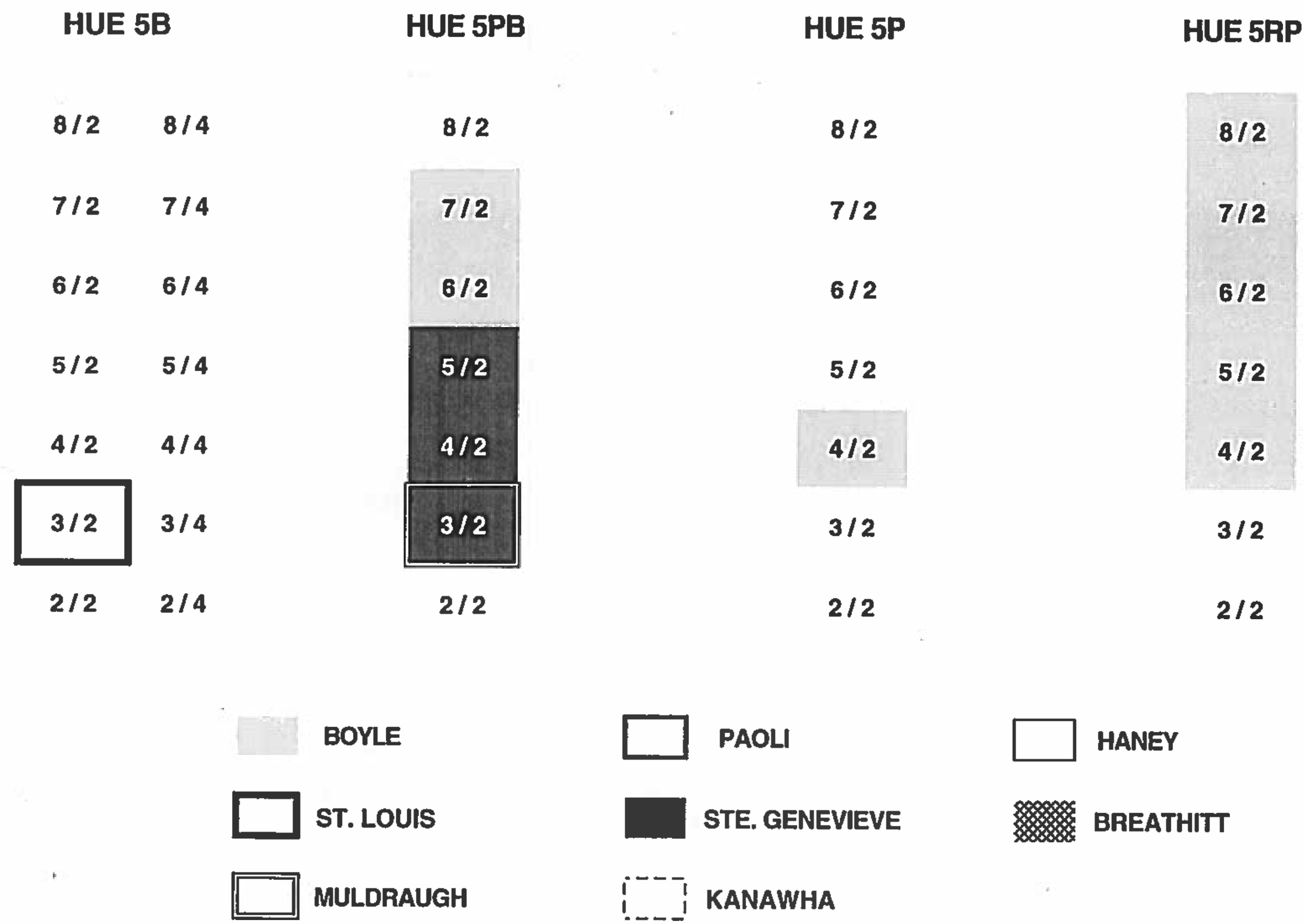

Figure 2C. Color Variations in Cherts Represented in the Rhondle Lee Site Collection: Blue and Purple Hues.

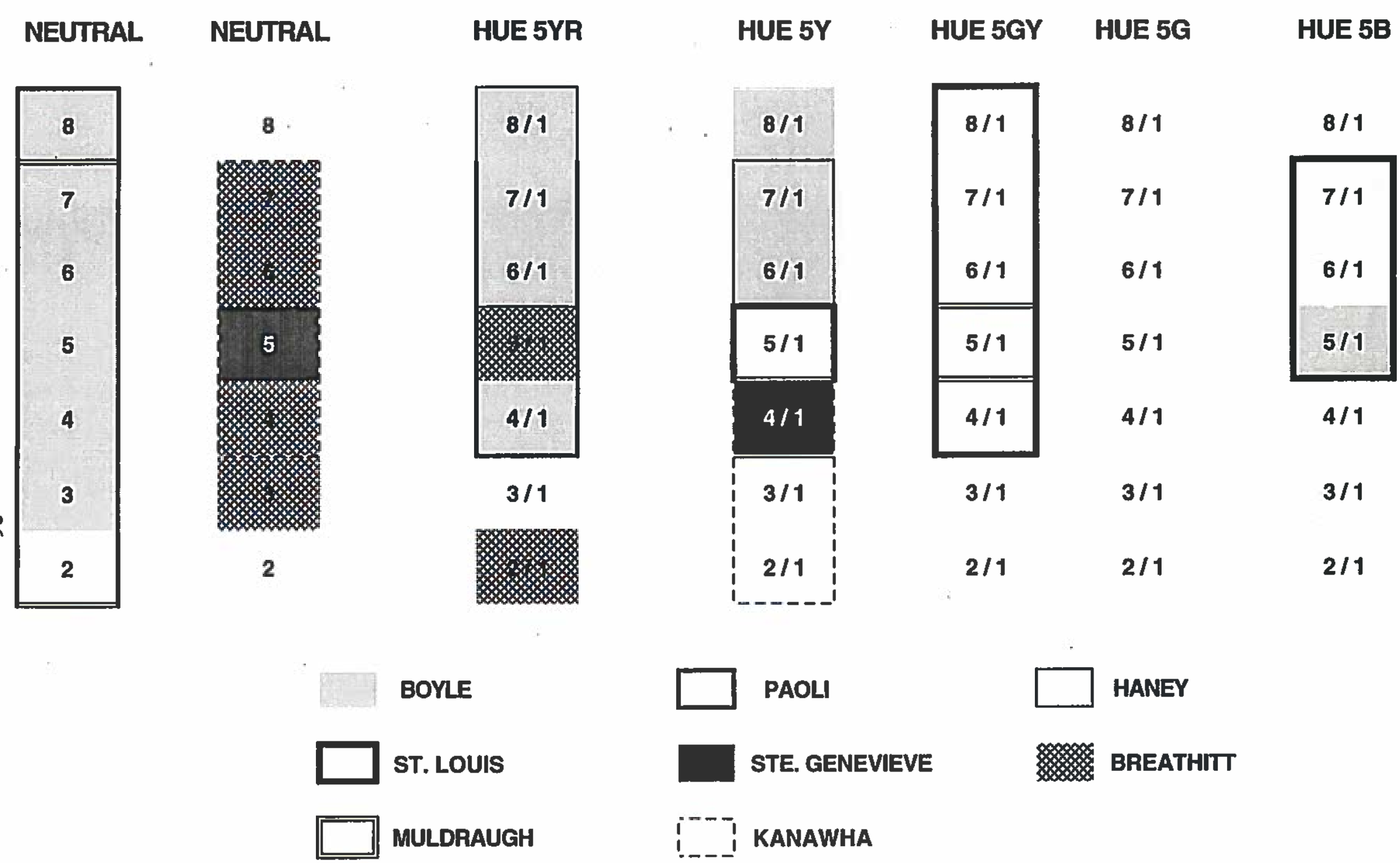

Figure 2D. Color Variations in Cherts Represented in the Rhondle Lee Site Collection: Gray Hues.

blade shape and cross sectional form, were recorded through line drawings. These properties were recorded as they may pertain to traditional typological classifications and functional designations.

A summary of the attributes recorded for each stylistic type in the Rhondle Lee collection is presented in Table 1. Statistically significant sample sizes are available for the following types: Adena Stemmed, Lamoka, and McWhinney. Other types have sample sizes ranging from 10 to 25: Karnak Stemmed, Kramer, Madison, Merom-Trimble, and Pine Tree. The sample sizes of the remaining types are less than 10. The attributes of only those types with sample sizes of 10 or more are discussed here.

In general, one can conclude from the data that the hafted bifaces of many types in the Rhondle Lee collection are smaller than those reported from other Eastern Woodland sites in Justice (1986). Adena Stemmed specimens in the Rhondle Lee collection, while falling in the reported range, are shorter on average than those reported from the Cresap Mound in West Virginia (Justice 1986:253). While falling in the observed range of variation at other sites, the Lamoka specimens in the Rhondle Lee collection are on average thicker than those reported from New York, thicker and wider than those reported from Michigan, and thicker than those from Wisconsin (Justice 1986:249). McWhinney specimens in the Rhondle Lee collection are comparable in metric attributes to those reported from Ohio, but the average widths are greater for the Rhondle Lee specimens (Justice 1986:249-250).

The average length of Karnak Stemmed specimens in the Rhondle Lee collection is considerably smaller than those from the Koster Site in Illinois and the Patoka Reservoir area of Indiana, although average widths and thicknesses are similar (Justice 1986:249). Compared with Kramer bifaces from the American Bottom in Illinois, Kramer specimens in the Rhondle Lee collection have shorter blades on average (but in the reported range), smaller average stem length (but in the reported range), and greater average thickness beyond the range reported in Justice (1986:253). Justice (1986:255-256) reports metric attributes for Madison bifaces from Alabama and New York, and the Rhondle Lee specimens are most like the former; however, the Rhondle Lee specimens have average length, width, and thickness slightly greater than those from Alabama, with some measures falling outside the reported ranges. The Madison bifaces from Kentucky are considerably longer and narrower than those from New York. Average dimensions for Merom-Trimble specimens in the Rhondle Lee collection are similar to those reported from the Wabash Valley in Indiana (Justice 1986:249). Compared with Pine Tree Corner Notched bifaces from Alabama, specimens in the Rhondle Lee collection average shorter stem length and narrower in stem width, and the averages are outside the reported ranges (Justice 1986:245). The Rhondle Lee specimens are also shorter on average, but fall within the range for the Alabama specimens.

Raw Material Use. The issue of raw material use patterns over time is based on the hafted bifaces that could be assigned to stylistic types. Raw material types were identified for 385 of these hafted bifaces and include Boyle, Paoli, Haney, St. Louis, Breathitt, Kanawha, Muldraugh, and iron ore (probably siderite). Only two chert types, Boyle (n=252) and Paoli (n=102), had large enough sample sizes to warrant analysis.

Figure 3 shows the percentage of Boyle and Paoli bifaces by culture period. The highest percentage of Boyle bifaces is associated with Early Archaic and Late Archaic-Early Woodland periods, suggesting that this immediately available chert resource was used predominantly during those periods. Early Archaic, Late Archaic, and Early Woodland stylistic types together account for about 90 percent of the Boyle specimens. The distribution of Paoli bifaces over time is more unimodal with a peak during the Late Archaic and Early Woodland periods. Paoli chert was used more during these periods than in

Table 1. Metric Attributes of Typed Hafted Bifaces in the Rhondle Lee Site Collection (continued).

	TL	BL	SL	BT	ST	NT	BLW	SW	BAW	NW	WT	BE	TT
ADENA STEM													
N	10	20	46	45	48	47	41	45	7	45	15	18	19
Average	54.07	32.74	19.51	8.97	6.90	8.02	26.89	18.85	17.49	19.24	12.54	75.06	4.44
Std Dev	7.84	8.27	3.04	1.44	0.95	1.03	3.84	2.08	2.20	1.89	3.90	15.63	0.87
BAKERS CREEK													
N	4	4	5	6	6	5	6		4	6		2	4
Average	41.29	28.16	13.40	7.86	5.14	6.94	24.12		21.95	17.29		60.33	3.67
Std Dev	9.52	8.31	2.32	1.25	0.72	0.90	2.61		3.78	1.90		15.26	0.21
BIG SANDY													
N	6	6	9	9	9	9	9		6	9		2	3
Average	38.60	23.66	9.59	7.26	4.38	6.37	24.16		24.68	18.00		53.08	3.77
Std Dev	10.28	8.21	1.96	0.90	0.55	0.56	4.95		5.41	2.53		31.25	0.87
BOTTLENECK													
N	1	1	2	2	2	2	2	1	2	2	1	1	1
Average	30.56	18.50	11.10	6.42	4.58	5.92	22.25	13.30	12.72	12.44	3.81	41.16	2.84
Std Dev			1.16	0.29	0.40	0.24	1.91		3.39	0.78			
BREWERTON EN													
N			3	3	3	3	3	1	2	3			
Average			8.32	7.60	4.90	6.21	24.26	21.84	23.22	19.18			
Std Dev			1.73	1.10	1.04	1.47	3.87		0.62	1.62			
BREWERTON SN													
N			4	4	4	4	4	2	3	4			
Average			8.84	7.68	4.38	6.09	23.33	17.00	17.36	14.39			
Std Dev			1.58	1.59	0.78	1.01	3.68	0.72	3.76	2.45			
BUCK CREEK													
N	2	2	9	9	9	9	5	8	6	9	1	1	2
Average	44.13	30.99	10.82	6.90	4.51	5.74	27.17	13.50	12.76	13.32	3.29	61.98	3.85
Std Dev	9.75	3.83	2.82	1.40	1.28	1.47	5.97	3.24	2.50	3.09			1.20
CHARLESTON													
N			1	1	1	1			1	1			
Average			8.36	5.11	2.22	3.26			20.32	15.60			
Std Dev													
CHESSER													
N			1	1	1	1	1	1		1			
Average			9.84	6.56	5.28	6.62	19.49	21.06		14.75			
Std Dev													
COPENA TRI													
N	2			6	5		5	3	4		2	2	2
Average	35.72			6.70	5.14		21.13	24.63	22.89		5.66	56.14	4.06
Std Dev	0.85			1.63	1.35		2.46	2.63	2.00		0.18	18.33	1.36
CRESAP													
N	1	2	1	2	2	2	2	2		2	1	2	2
Average	53.36	45.25	11.68	11.02	7.66	8.01	27.43	17.16		19.22	14.12	96.15	5.35
Std Dev		8.53		4.00	1.38	0.33	1.62	1.10		1.46		15.63	1.00
CYPRESS													
N			1	1	1	1	1	1		1			
Average			17.78	12.92	6.88	10.28	21.89	13.09		12.53			
Std Dev													
DECATUR													
N			1	1	1	1			1	1			
Average			5.43	5.51	3.39	4.03			18.04	14.96			
Std Dev													
DELHI-WADE													
N	4	5	6	7	7	7	5	6	1	7	2	4	6
Average	45.46	33.89	12.15	8.26	5.43	6.79	27.27	13.07	13.99	12.99	7.55	68.71	4.40
Std Dev	8.36	5.77	2.59	1.39	1.21	1.61	2.02	1.39		1.67	0.12	10.02	0.79

Table 1. Metric Attributes of Typed Hafted Bifaces in the Rhondle Lee Site Collection (continued).

	TL	BL	SL	BT	ST	NT	BLW	SW	BAW	NW	WT	BE	TT
<u>FORT ANCIENT</u>													
N				3					3				
Average				5.14					11.20				
Std Dev				4.21					9.83				
<u>FULTON</u>													
N	2	2	5	5	5	5	4	3	1	4	2	2	2
Average	65.38	50.21	9.56	8.24	4.30	5.97	30.50	14.27	17.86	15.47	16.26	108.59	4.39
Std Dev	10.39	4.40	0.98	1.24	0.69	1.11	2.73	2.57		1.39	6.22	9.89	0.32
<u>FULTON (Preform?)</u>													
N	3	3	5	5	5	5	4	5		5	1	2	3
Average	59.61	45.75	12.21	13.75	6.38	8.80	25.63	13.36		12.45	26.84	106.30	6.85
Std Dev	8.75	6.35	1.34	3.44	1.51	1.86	2.01	2.41		2.27		16.33	1.18
<u>GARY/COGSWELL</u>													
N	1	1	6	7	7	7	7	7	2	7	1	1	1
Average	43.68	19.82	15.18	9.63	6.58	8.00	26.74	14.49	15.31	17.27	7.64	47.51	4.36
Std Dev			4.84	1.57	1.23	1.47	2.80	2.69	1.26	2.27			
<u>GREENBRIER</u>													
N	1	1	2	2	2	2	2		1	2		1	1
Average	43.34	33.99	7.72	9.31	3.70	5.90	23.58		24.76	21.67		70.11	4.47
Std Dev			0.40	0.81	0.19	0.66	1.17			1.77			
<u>JACKS REEF CN</u>													
N			5	5	5	6	4	1	3	5			
Average			8.66	5.30	3.18	4.48	20.57	20.92	19.04	12.67			
Std Dev			2.09	1.11	0.80	1.39	3.73		2.45	1.29			
<u>JACKS REEF PENT</u>													
N	2			2					2		1	1	2
Average	33.03			5.22					22.34		4.10	51.30	3.69
Std Dev	1.81			0.05					2.61				0.47
<u>KANAWHA</u>													
N			1	1	1	1	1			1			
Average			7.20	5.75	3.49	4.96	25.26			11.27			
Std Dev													
<u>KARNAK STEM</u>													
N	4	3	10	11	10	10	10	8	8	10	3	4	4
Average	48.48	33.56	11.10	10.26	6.40	8.25	21.27	14.75	15.67	14.64	9.69	76.52	4.09
Std Dev	4.03	3.44	4.66	1.69	2.15	2.52	2.93	2.59	2.24	1.61	4.21	15.89	1.13
<u>KARNAK UNSTEM</u>													
N	5	5	6	9	8	7	9	6	4	8	5	6	6
Average	46.20	32.54	10.90	9.33	5.37	6.80	20.59	13.80	10.89	15.77	8.55	76.37	4.12
Std Dev	7.59	8.11	4.71	0.86	1.08	1.03	2.86	2.95	1.67	2.34	2.17	24.53	0.53
<u>KIRK CN</u>													
N			2	2	2	2	2		1	2			
Average			8.06	7.01	3.54	5.27	26.48		24.66	17.19			
Std Dev			2.11	0.54	0.11	0.77	3.31			2.74			
<u>KIRK STEM/SERR</u>													
N			6	7	6	7	4	4	3	7			
Average			8.97	8.00	4.95	5.96	25.53	18.53	13.22	17.02			
Std Dev			2.00	1.54	1.12	1.63	0.91	2.60	1.12	2.42			
<u>KRAMER</u>													
N	14	14	20	21	21	21	21	20	7	21	11	14	14
Average	51.93	31.36	15.12	10.41	7.06	8.60	25.34	17.02	12.89	16.54	10.79	71.23	5.11
Std Dev	7.09	3.09	3.55	1.68	1.51	1.65	3.21	1.60	1.10	1.72	1.67	8.43	1.56
<u>LAKE ERIE</u>													
N	1	1	1	2	2	2	2	1		2		1	1
Average	31.50	27.24	8.29	5.49	3.22	4.42	22.04	10.76		11.68		57.40	3.65
Std Dev				0.74	0.34	0.28	0.93			0.66			0.00

Table 1. Metric Attributes of Typed Hafted Bifaces in the Rhondle Lee Site Collection (continued).

	TL	BL	SL	BT	ST	NT	BLW	SW	BAW	NW	WT	BE	TT
<u>LAMOKA</u>													
N	18	19	23	25	25	25	23	13	12	25	14	14	15
Average	41.14	28.38	11.13	10.33	6.31	8.15	22.49	16.02	16.12	15.09	8.77	64.84	5.11
Std Dev	5.45	4.61	2.04	1.49	1.47	1.44	2.16	2.36	3.31	1.97	2.84	9.59	1.43
<u>LEDBETTER</u>													
N	2	3	2	3	3	3	3	2	1	3	1	3	3
Average	43.42	32.07	14.20	9.11	6.02	7.54	25.81	14.30	11.29	16.65	9.94	73.75	3.41
Std Dev	4.97	9.80	0.37	1.75	0.11	2.04	4.10	0.62		2.38		18.18	0.50
<u>LEVANNA</u>													
N				5	1		2	1	3		1	1	1
Average				4.70	3.14		16.60	18.71	21.75		2.99	78.74	2.15
Std Dev				0.44	0.00		1.42		1.27				
<u>LITTLE BEAR</u>													
N			1	1	1	1	1	1		1			
Average			17.08	12.23	7.82	9.93	28.40	16.30		18.45			
Std Dev													
<u>LOWE FLARED</u>													
N			2	2	2	2	2		1	2			
Average			8.59	6.55	5.03	5.95	20.09		17.08	13.61			
Std Dev			0.83	0.13	1.10	0.76	3.22			2.79			
<u>MACCORKLE</u>													
N	1	1	5	5	5	5	1	4		5	1	1	1
Average	40.56	23.38	13.52	6.63	4.87	6.25	28.56	25.57		21.29	7.39	52.59	3.00
Std Dev			1.71	0.81	0.62	0.56		2.05		1.65			
<u>MADISON</u>													
N	8			12	6		7	5	8		7	8	8
Average	34.78			6.02	4.92		18.98	18.83	17.55		4.12	56.07	3.46
Std Dev	5.79			1.47	0.58		2.16	3.58	1.70		1.64	7.62	0.70
<u>MATANZAS</u>													
N	1	2	3	4	4	4	4	2	1	4	1	2	2
Average	25.12	24.45	9.25	7.12	4.83	6.53	18.91	21.89	16.80	16.11	2.68	53.99	2.54
Std Dev		15.27	2.65	2.00	1.04	1.57	1.72	3.90		1.82		24.25	0.85
<u>MCWHINNEY</u>													
N	11	12	48	49	51	50	47	42	17	50	11	12	12
Average	55.78	42.12	10.68	10.71	6.25	8.15	27.30	15.14	14.15	15.54	16.99	95.42	5.34
Std Dev	7.49	6.80	2.62	2.28	1.29	1.73	3.32	2.69	4.40	2.11	6.74	14.49	1.35
<u>MEROM-TRIMBLE</u>													
N	1	1	14	15	15	15	14	5	6	15	1	1	1
Average	29.14	21.13	6.61	5.89	3.35	4.67	16.68	15.00	15.60	11.11	2.80	48.27	3.11
Std Dev			0.72	1.06	0.98	0.79	1.74	2.11	1.82	1.53			
<u>MORROW MTN I</u>													
N			3	3	3	3	2	2	1	3			
Average			6.61	8.24	3.88	5.50	21.52	8.21	10.80	13.50			
Std Dev			0.75	1.59	0.52	1.16	7.98	0.64		4.95			
<u>MORROW MTN II</u>													
N	1	1	2	2	2	2	2	2	1	2	1	1	1
Average	33.66	17.33	10.06	8.06	6.16	7.46	22.01	12.81	8.77	13.77	4.18	39.63	4.12
Std Dev			1.72	1.22	0.78	0.98	1.81	1.05		0.58			
<u>MOTLEY</u>													
N			3	3	3	3	2			2			
Average			9.94	7.69	5.05	6.81	23.30			12.23			
Std Dev			1.90	1.54	0.64	0.95	0.35			1.56			
<u>NODENA BANKS</u>													
N	1			2	1		2		2		1	1	1
Average	34.04			4.31	3.42		13.41		12.82		1.75	43.68	2.14
Std Dev				0.57			1.76		0.71				

Table 1. Metric Attributes of Typed Hafted Bifaces in the Rhondle Lee Site Collection (continued).

	TL	BL	SL	BT	ST	NT	BLW	SW	BAW	NW	WT	BE	TT
NODENA ELLIPTICAL													
N	1			1			1				1	1	1
Average	39.25			3.64			14.36				2.12	69.34	2.20
Std Dev													
PERKIOMEN													
N			1	2	2	2	1	2		2			
Average			9.86	8.52	5.93	7.66	12.02	16.55		15.68			
Std Dev				1.40	0.69	0.01		1.00		3.27			
PICKWICK													
N	3	3	2	3	3	3	2	2	1	3	2	2	3
Average	56.53	47.52	9.17	10.35	6.32	8.61	29.18	16.51	10.93	16.41	13.59	88.02	3.54
Std Dev	12.61	12.04	3.28	2.48	2.85	3.55	2.94	0.81		1.56	10.07	21.02	0.73
PINE TREE													
N	4	4	12	12	12	12	4	5	5	12	3	4	4
Average	45.72	34.83	9.27	7.52	4.48	6.13	26.78	21.19	22.29	17.01	6.63	74.24	2.97
Std Dev	3.44	2.57	2.39	1.38	1.03	1.25	7.64	2.97	4.26	1.98	1.28	9.44	0.62
PLAINVIEW													
N			1	0	1	1		1	1	1			
Average			13.00	0	5.00	5.89		23.41	25.59	23.29			
Std Dev													
RACCOON													
N			1	1	1	1	1	1		1			
Average			8.96	7.51	4.55	5.94	18.83	19.08		14.90			
Std Dev													
RADDATZ													
N	4	4	8	8	8	8	7	3	1	8	1	4	4
Average	54.16	42.35	9.89	8.12	4.69	6.42	23.08	20.43	28.19	16.77	10.96	89.73	3.65
Std Dev	6.98	7.38	3.05	1.47	0.89	1.12	3.53	3.21		1.96		13.00	0.58
ROBBINS													
N	1	1	6	7	8	7	6	6	4	6	1	1	1
Average	51.43	35.67	17.85	9.24	7.31	8.03	34.54	17.22	16.95	17.59	16.93	82.29	5.35
Std Dev			2.68	1.36	1.15	0.60	2.74	2.48	3.43	1.77			
SARATOGA //													
N	1	3	1	4	4	4	4	4	1	4	1	3	3
Average	40.39	23.68	13.52	10.13	5.91	7.49	27.49	16.84	18.19	17.48	8.80	54.02	4.16
Std Dev		5.41		2.01	1.31	1.50	1.69	2.52		3.23		6.63	0.80
SARATOGA BROAD													
N			1		1	1		1	1	1	1		
Average			13.66		7.27	8.11		18.69	19.51	18.38	7.52		
Std Dev													
SARATOGA EXP													
N	3	5	3	5	5	5	4	4	4	5	2	4	5
Average	37.07	27.77	11.37	10.02	6.00	7.84	28.27	18.75	19.96	19.79	9.22	70.88	4.93
Std Dev	4.68	5.46	1.06	3.69	3.19	2.66	3.94	1.47	2.79	2.09	1.58	6.92	0.45
SYNDER													
N	1	1	1	1	1	1	1		1	1	1	1	1
Average	46.25	28.94	13.72	12.38	8.61	10.68	36.20		21.64	18.23	18.10	75.69	5.15
Std Dev													
ST ALBANS													
N	1	1	4	4	4	4	1	2	3	4			1
Average	32.28	22.93	9.19	6.14	3.89	5.22	24.77	17.10	16.91	15.13			4.77
Std Dev			1.45	0.53	0.78	0.46		4.06	3.22	2.13			
ST CHARLES													
N	1	1-	2	2	2	2	1	2		2		1	1
Average	49.92	39.68	11.19	8.32	4.66	7.57	20.11	24.80		18.33		75.95	4.08
Std Dev			2.55	0.45	1.18	0.04		0.52		1.03			

Table 1. Metric Attributes of Typed Hafted Bifaces in the Rhondle Lee Site Collection (continued).

	TL	BL	SL	BT	ST	NT	BLW	SW	BAW	NW	WT	BE	TT
<u>STANLEY</u>													
N	1	1	2	2	2	2			2	2			1
Average	39.38	28.47	8.26	6.25	3.76	4.95			15.65	13.54			3.25
Std Dev			0.30	0.42	0.08	0.13			1.56	1.55			
<u>STEUBEN</u>													
N	3	3	8	7	8	8	5	1	7	7	2	2	3
Average	45.71	32.49	12.31	7.72	5.06	6.58	28.45	17.18	20.48	15.77	8.85	70.49	3.83
Std Dev	9.28	6.08	2.42	1.21	1.13	0.86	2.62		3.29	2.52	4.86	17.06	1.09
<u>STILWELL</u>													
N	1	1	3	3	3	3	2			3		1	1
Average	50.85	39.02	12.10	8.13	5.09	7.03	33.76			17.77		86.11	3.13
Std Dev			3.62	1.82	0.87	1.42	8.87			5.39			
<u>SUSQUEHANNA</u>													
N			2	2	2	2			2	2			
Average			11.07	6.16	4.58	5.56			16.99	13.39			
Std Dev			0.85	1.30	0.08	0.41			4.72	2.33			
<u>SYKES</u>													
N	1	1	4	3	4	4	3	2	3	4			1
Average	49.64	38.44	11.03	9.35	6.49	8.71	29.88	19.85	18.35	19.15			2.79
Std Dev			1.82	2.47	1.76	1.87	3.48	0.54	3.66	1.60			
<u>TABLE ROCK</u>													
N			5	6	6	6	4	4	4	6			
Average			12.95	10.04	6.03	7.89	27.60	14.04	15.60	12.88			
Std Dev			2.55	1.32	1.10	0.80	3.38	0.88	2.45	1.48			
<u>WHITE SPRINGS</u>													
N	1	1	2	2	2	2	1	1		1		1	1
Average	35.96	29.89	6.58	6.27	3.39	4.73	23.60	13.16		14.98		63.50	2.55
Std Dev			1.95	0.30	1.43	2.14							

Note: TL=total length, BL=blade length, SL=stem length, BT=blade thickness, ST=stem thickenss, BT=base thickness, BLW=blade width, SW=stem width, BAW=base width, NW=neck width, WT=weight, BE=blade edge, TT=tip thickness.

other periods for hafted biface manufacture: about 75 percent of all Paoli bifaces are Late Archaic and Early Woodland stylistic types. The Paoli distribution for the Rhondle Lee collections supports Ison's (1988) proposition that Cogswell Phase groups in the Cumberland Plateau preferentially used Paoli chert over others. The next step might be to develop and test hypotheses to explain these patterns of chert use.

The second issue related to raw material use focused on the relationship between it and settlement strategies. Testing propositions about settlement strategies based on raw material use at the Rhondle Lee Site is complicated by the fact that a source of chert (Boyle) is located adjacent to the site. To account for this, the category of immediately available is added to the local versus exotic dichotomy to describe distances to chert sources. Cherts available locally in outcrops or alluvium are Paoli, Haney, St. Louis, Ste. Genevieve, Breathitt, and iron oxide. Exotic cherts are Kanawha and Muldraugh (Applegate 1993).

Figure 4 shows the distribution of exotic, local, and immediately available chert types over time. The percentages of exotic, local, and immediately available cherts were calculated and plotted for each culture period. Although exotics never make up more than 12 percent of a given temporal sample, there is some indication that the use of exotic cherts was more common during the Archaic, suggesting a mobile lifestyle or sedentism with stockpiling. The greatest percentages of unidentifiable cherts also date to the earlier time periods, and the cherts might belong to exotic types with which the author is not familiar. The percentage of specimens made of immediately available Boyle chert is lower in the Archaic period than in most later periods. Later time periods are dominated by the use of locally and immediately available cherts, which may indicate a more sedentary settlement strategy. To determine whether Archaic-period use of exotics represents mobility or sedentism with stockpiling of exotic raw materials, one must examine systematically collected biface and debitage assemblages.

Tool Reworking. Testing the proposition about tool reworking and settlement strategies using the Rhondle Lee collection is complicated by the fact that a source of chert is available immediately adjacent to the site. Readily obtainable raw material could discourage people from reworking broken tools unless time, energy expenditure, or other constraints were operating. Regardless, and holding these considerations constant for now, one can examine the frequency of tool refurbishing and reuse over time as they relate to habitation permanence at the site.

Figures 5, 6, and 7 are based on the sample of typed hafted bifaces. Figure 5 illustrates the percentage of the total hafted biface sample exhibiting reuse, which in this case involved reworking into hafted scrapers. Considering first those time periods for which significant sample sizes of hafted bifaces are available, the incidence of reuse is highest during the Late Archaic period, with 16 percent of the 158 specimens exhibiting evidence of reuse. About nine percent of the Late Archaic-Early Woodland specimens were reused, followed by five percent of the Early Archaic specimens, two percent of the Early Woodland hafted bifaces, and four percent of the Late Woodland-Mississippian specimens. If reuse reflects settlement permanence, one might conclude that Late Archaic occupations of the Rhondle Lee Site were more sedentary than earlier and later occupations. This conclusion supports Railey's (1991) view of settlement strategies in the Cumberland Plateau area. Railey (1991:97) argued that Late Archaic habitations in the Red, Licking, and Little Sandy river drainages involved aggregated base camps, such as Bluestone, Seldon Skidmore, Zilpo, and Grayson, located in riverine settings. This hypothesis might be further evaluated in the future using systematically collected lithic assemblages, other artifactual remains, and cultural features from the site.

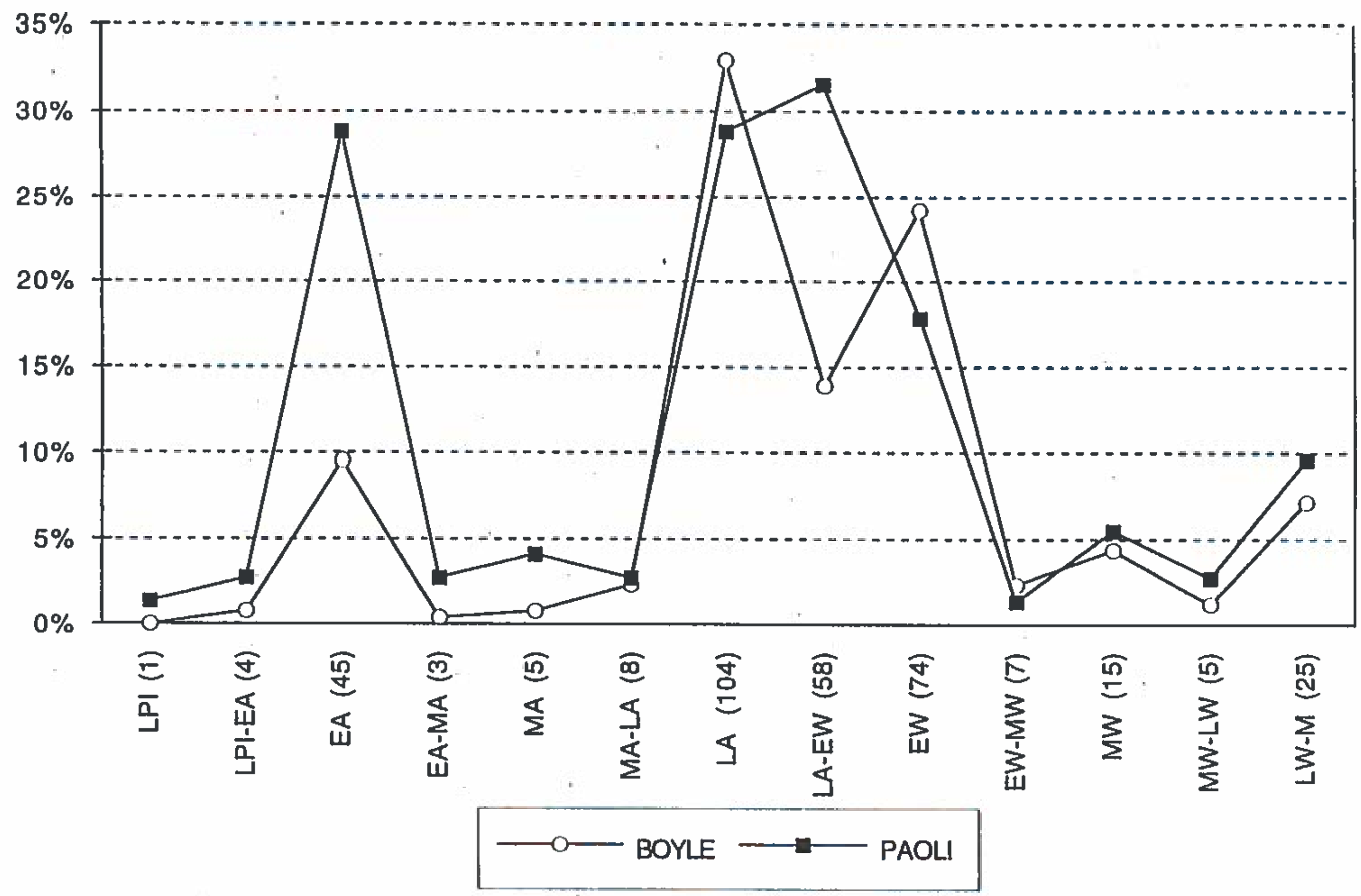

Figure 3. Percentages of Boyle (n=252) and Paoli (n=102) Hafted Bifaces Over Time for the Rhondle Lee Site Collection.

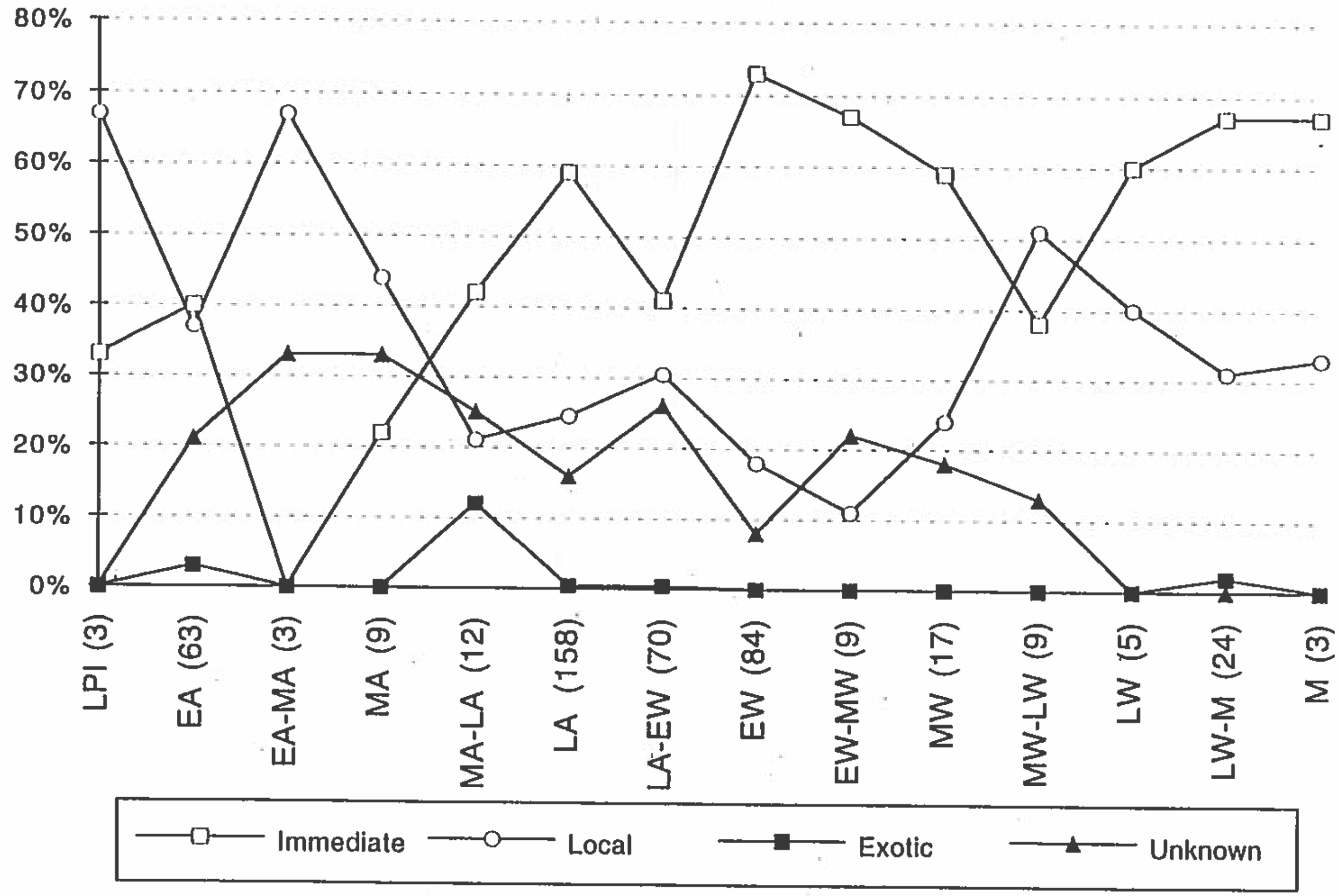

Figure 4. Percentages of Immediately Available, Local, Exotic, and Unknown Cherts Per Time Period for the Rhondle Lee Site Collection. Sample size for each period are listed along the x-axis; total sample size is 468.

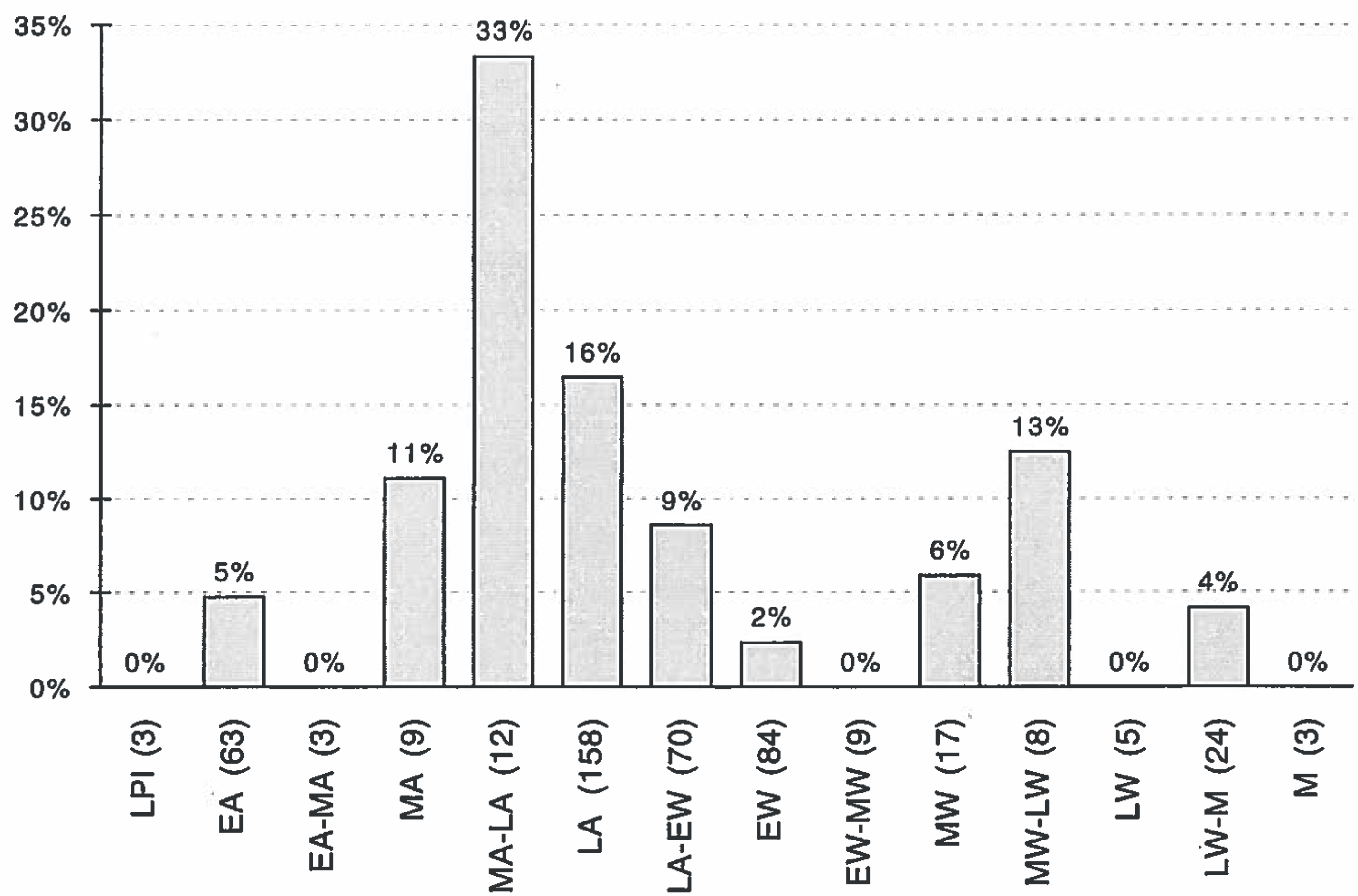

Figure 5. Percentage of Reused Hafted Bifaces Per Time Period for the Rhondle Lee Site Collection. Sample sizes for each period are listed along the x-axis; total sample size is 468.

Considering all samples regardless of sample sizes. the highest incidence of reuse occurs in the Archaic period, particularly the Middle and Late Archaic periods (Figure 5). Thirty-three percent of the twelve Middle-Late Archaic specimens were reused, along with 16 percent of the Late Archaic hafted bifaces and 11 percent of the nine Middle Archaic specimens. Taken together. 17 percent of the 179 Middle and Late Archaic specimens show evidence of reuse. A second but smaller peak is noted with the eight Middle-Late Woodland specimens. 13 percent of which were reused. These data suggest that Middle-Late Archaic and perhaps Middle-Late Woodland occupations at the Rhondle Lee Site were relatively more sedentary than occupations during other periods. Again, this hypothesis might be investigated in the future using different data sets.

Figure 6 illustrates the percentage of hafted biface specimens exhibiting refurbishing. usually by blade resharpening, per period. Looking at periods with samples of about 25 or more specimens. there is a markedly high percentage (38 percent) of refurbished bifaces in the Early Archaic sample. The next highest percentage. 17 percent. is associated with the Early Woodland sample. These data suggest that Early Archaic and Early Woodland occupations at the Rhondle Lee Site may have been more sedentary than occupations during other periods. a hypothesis that can be tested using other data sets. It is interesting that the Late Archaic sample. which had the highest percentage of reused bifaces among the samples with about 25 or more specimens, has a relatively low percentage of refurbished specimens.

When examining the percentages of refurbished hafted bifaces for all periods regardless of sample size, three peaks are evident (Figure 6). two of which were also noted when considering only those periods with large sample sizes. The highest percentages are again associated with the Early Archaic and Early-Middle Archaic periods: about 38 percent of these combined samples (n=66) are refurbished. About 20 percent of the five Late Woodland specimens contain evidence of refurbishing. followed by 17 percent of the 84 Early Woodland specimens.

Figure 7 illustrates the percentages of reused plus refurbished specimens per period. Considering first those periods with sample sizes of about 25 or more. about 43 percent of the 63 Early Archaic specimens were reworked. which is double the percentages for the Late Archaic and Early Woodland periods and about three times the percentage for the Late Woodland-Mississippian sample. On the basis of tool reworking, one might conclude that Early Archaic occupations at the Rhondle Lee Site were more sedentary than other occupations. Reworking peaks during the Early Archaic and Late Archaic-Early Woodland periods correspond to times when use of Boyle chert. which crops out adjacent to the Rhondle Lee Site, was used most extensively for tool manufacture. Perhaps the increased use of this immediately available chert supports the conclusion that site use was more sedentary during those times: occupants continued to rework tools while exploiting relatively heavily the locally available chert resource. It is difficult to draw conclusions about site use based on all samples regardless of size (Figure 7). but it can be argued that earlier occupations were more sedentary than later ones at the Rhondle Lee Site.

In the future. other explanations for temporal patterns in tool reworking could be examined. Chert quality and knapping properties may affect the practice of tool reworking. Biface reuse and refurbishing may also be influenced by the nature of tool breakage. i.e. the location of the break and the type of damage. Hafted biface attributes. especially thickness at the location of the break. should also be considered. It may be that larger bifaces, which are more common during certain culture periods. are more likely to be reused or refurbished than smaller ones because the former have more material with which to work.

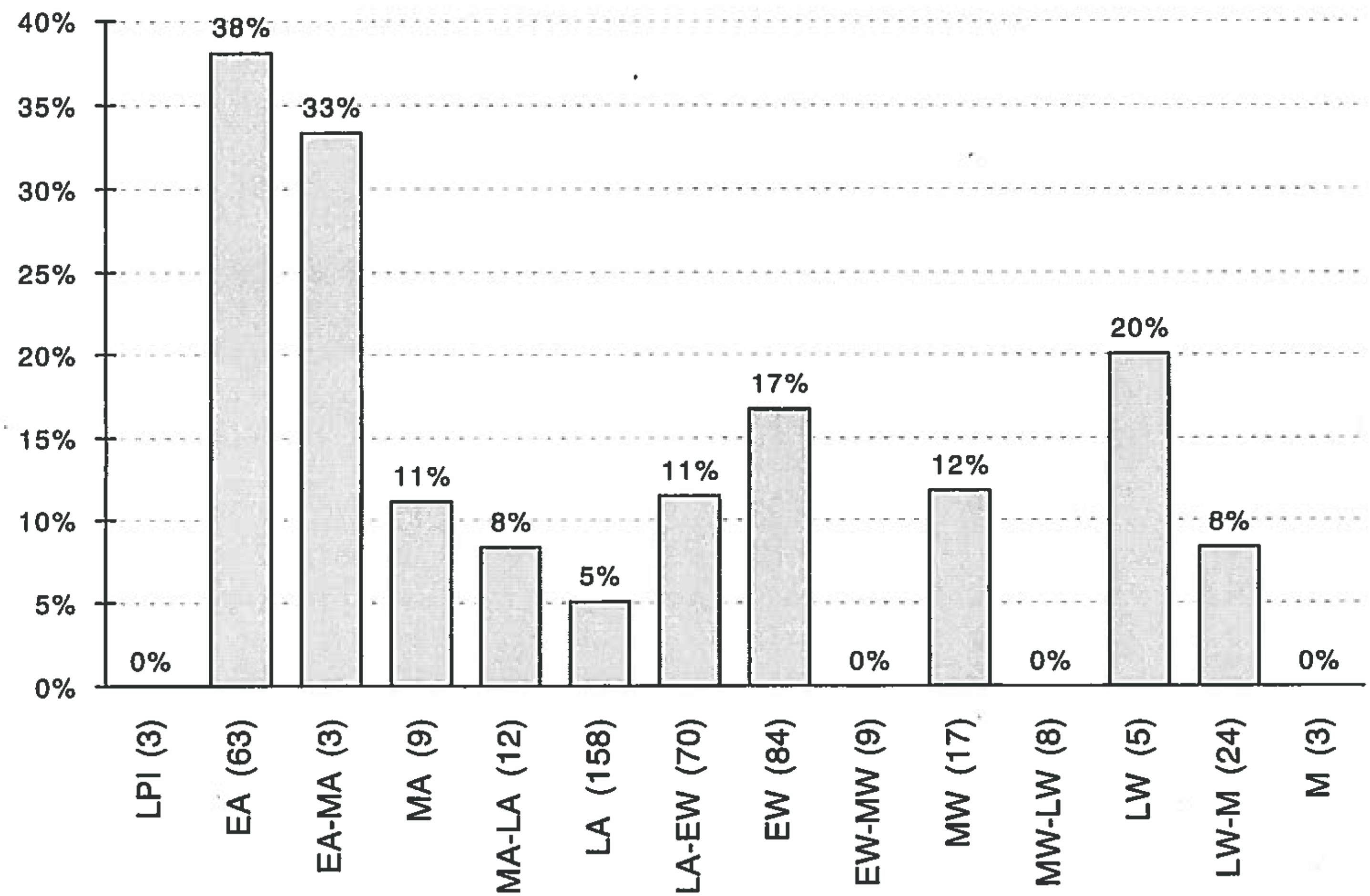

Figure 6. Percentage of Refurbished Hafted Bifaces Per Time Period for the Rhondle Lee Site Collection. Sample sizes for each period are listed along the x-axis; total sample size is 468.

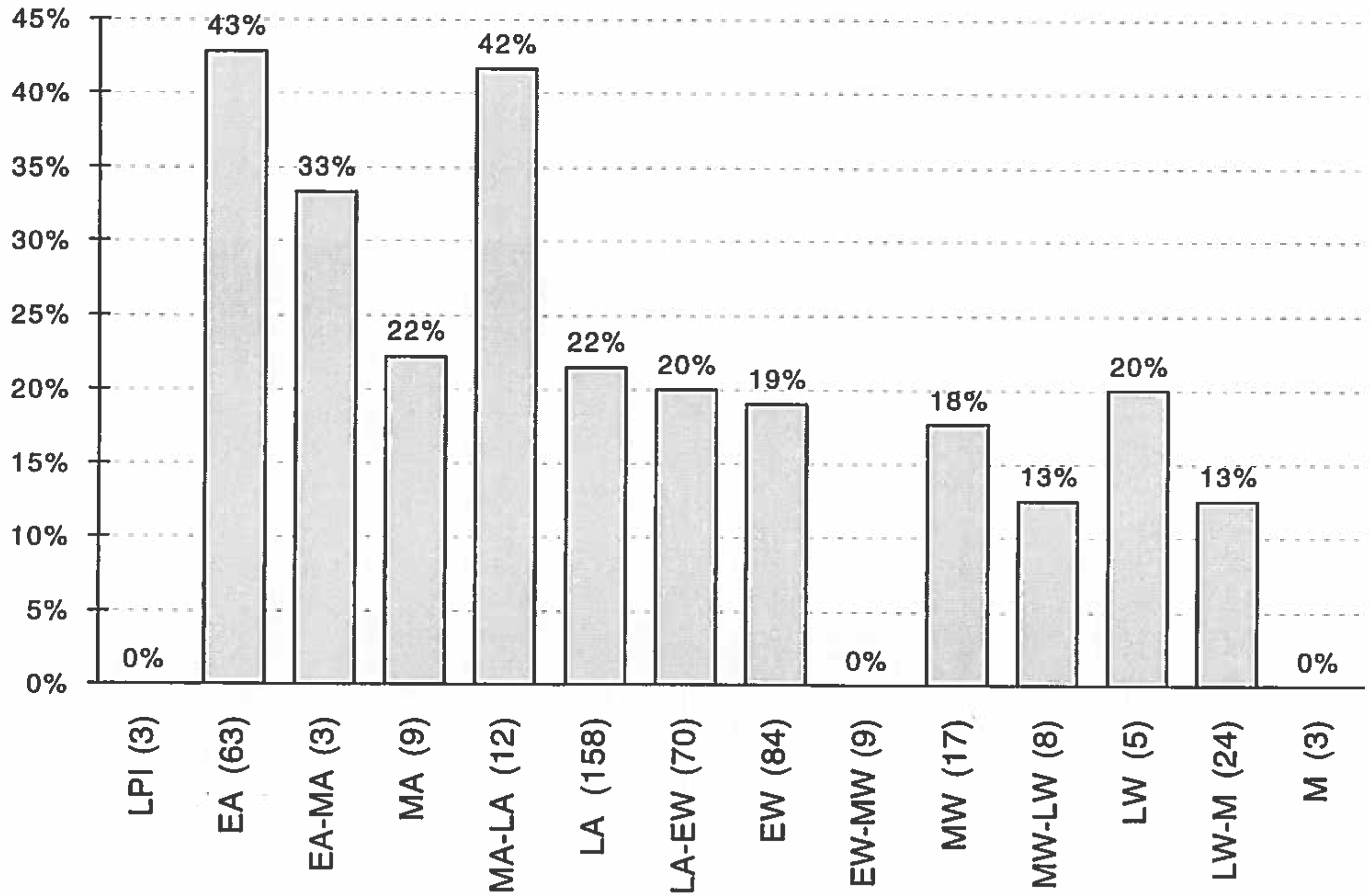

Figure 7. Percentage of Reworked (Reused Plus Refurbished) Hafted Bifaces Per Time Period for the Rhondle Lee Site Collection. Sample sizes for each period are listed along the x-axis; total sample size is 468.

Evolutionary Change. Consideration of the timing of technological change as indicated by the Rhondle Lee collection is based on the complete and unreworked hafted biface specimens that could be assigned to temporally diagnostic types (n=87). Based on Thomas' (1978) equations, specimens were classified as dart points or arrow points (Table 2). The percentages of darts and arrows for each time period were calculated and plotted. Unfortunately, some periods are represented by small sample sizes.

Only the Late Archaic and Early Woodland periods had significant sample sizes of complete typeable specimens. It is very interesting to note, however, that for these two samples, a considerable percentage of the specimens are classified as arrow points according to Thomas' (1978) equations. Half of the 46 Late Archaic hafted bifaces are so classified and almost 40 percent of the 29 Early Woodland specimens are categorized as arrow points. These data indicate that adoption of the bow and arrow may have occurred earlier than is generally accepted in eastern Kentucky and that additional research concerned with the timing of this technological change is warranted. Future research might use additional collections and/or methods other than Thomas' (1978), which is based on artifact morphology and ethnographic analogy, such as experimental or microscopic use wear studies.

It is interesting to note that all five Mississippian specimens are classified as arrow points using Thomas' (1978) equations. This lends some credibility to the equations and the results for the Late Archaic and Early Woodland periods because most archaeologists agree that bow and arrow technology was used during the Mississippian period. One hundred percent of the Paleoindian and Early Archaic bifaces are classified as arrow points, but there are only a small number of specimens (Paleoindian, n=1; Early Archaic, n=2).

The analysis also suggests that dart points were used throughout much of the time the Rhondle Lee Site was occupied, from the Early Archaic through Late Woodland periods. Few archaeologists would argue with this observation. The one Early-Middle Archaic biface was classified as a dart point as were the one Middle Woodland and one Late Woodland specimens. There are no complete Middle Archaic specimens in the collection.

With respect to the issue of evolutionary change in functional attributes of hafted bifaces, the distribution of hafted biface neck thickness was examined for the Rhondle Lee collection. This attribute was selected for analysis because experimental work by Van Buren (1974) suggested that neck thickness had functional significance in the performance of bifaces as hunting weapons (Van Buren 1974). Neck thicknesses for over 400 specimens were plotted against time (Figure 8). The temporal dimension, years before present, is the X-axis; these values were determined by finding the average of the two endpoints of the temporal range for the stylistic type as reported by Justice (1986). For example, Justice (1986) reports that Adena Stemmed bifaces in the Ohio Valley and surrounding states have been dated between 800 and 200 B.C.; Adena Stemmed points were assigned an x-value of the average of these two dates, 500 B.C. While this method of quantifying time is not desirable, it is necessary to allow us to reduce time to one number based on unsystematically collected lithic assemblages.

A visual examination of Figure 8 indicates some changes in neck thickness over time: (1) a decreasing trend from the Paleoindian to Middle Archaic, such that neck thickness of Late Paleoindian types tends to be greater than that of Early and Middle Archaic types, (2) an increasing trend from Middle Archaic to Early Woodland, and (3) a decreasing trend from Early Woodland to Late Woodland. The Mississippian period is not represented because the triangular shape hafted biface types from this period lack necks. Despite the apparent existence of changing trends in neck thickness in the scatterplot,

Table 2. Attribute Summary for Unbroken Specimens Identified as Dart or Arrow Points According to Thomas' (1978) Equations.

SPEC	TYPE	PERIOD	DATES	TL	BT	BLW	NW	REWORK	DART	ARROW	THOMAS
11	Adena Stem	EW	800-300 BC	49.50	9.98	26.44	20.78	blade?	22.89	22.92	ARROW
18	Adena Stem	EW	800-300 BC	45.84	8.73	22.87	18.11	no	18.01	19.20	ARROW
58	Adena Stem	EW	800-300 BC	42.57	9.11	25.57	21.81	blade	19.97	21.23	ARROW
60	Adena Stem	EW	800-300 BC	37.36	8.19	22.84	19.36	blade	15.89	18.07	ARROW
66	Adena Stem	EW	800-300 BC	54.85	10.00	22.58	17.31	blade	20.03	20.96	ARROW
67	Adena Stem	EW	800-300 BC	55.05	9.89	22.65	19.59	no	19.60	21.41	ARROW
94	Adena Stem	EW	800-300 BC	41.52	10.22	21.33	16.87	no	16.20	19.03	ARROW
4	Adena Stem	EW	800-300 BC	62.59	8.35	27.17	17.43	no	26.34	22.55	DART
6	Adena Stem	EW	800-300 BC	64.93	9.55	27.01	21.09	no	26.24	24.55	DART
19	Adena Stem	EW	800-300 BC	52.97	8.39	23.78	17.70	no	20.40	20.01	DART
25	Adena Stem	EW	800-300 BC	57.20	9.75	27.02	17.98	no	25.57	23.23	DART
28	Adena Stem	EW	800-300 BC	62.45	12.78	29.03	18.50	no	30.05	27.47	DART
46	Adena Stem	EW	800-300 BC	60.23	12.34	29.62	18.60	no	30.15	27.15	DART
64	Adena Stem	EW	800-300 BC	56.88	11.20	27.83	20.07	no	28.59	25.27	DART
80	Adena Stem	EW	800-300 BC	51.81	7.03	24.15	20.35	blade	19.51	19.45	DART
306	Big Sandy	EA	8000-6000 BC	28.06	6.50	19.07	16.35	blade	9.60	13.19	ARROW
371	Bottleneck	LA	3770-3000 BC	30.56	6.62	23.60	12.99	blade	16.33	14.97	DART
304	Brew-Matanzas	LA	3700-1723 BC	31.68	9.79	19.88	17.79	no	12.23	17.11	ARROW
350	Brew-Matanzas	LA	3700-1723 BC	37.83	8.00	20.07	18.84	no	13.13	18.11	ARROW
354	Brew-Matanzas	LA	3700-1723 BC	29.50	6.52	18.46	16.05	no	9.21	13.01	ARROW
221	Buck Creek	LA-EW	1500-600 BC	37.23	5.62	21.12	10.33	no	14.80	13.09	DART
439	Cresap Stem	EW	1000-500 BC	53.36	13.85	26.28	18.18	no	25.52	26.05	ARROW
118	Dalton Cluster	LPI-EA	8500-7700 BC	40.55	8.63	22.45	16.92	no	16.73	18.09	ARROW
249	Delhi-Wade	LA-EW	1300-200 BC	37.14	9.11	24.75	15.13	blade	19.45	18.83	DART
497	Dickson Cluster	LA-EW	1500 BC-AD 100	31.97	6.15	21.05	14.83	blade	13.71	15.64	ARROW
528	EA-MA	EA-MA	8000-4000 BC	36.05	6.42	23.30	12.35	no	17.06	15.11	DART
361	Fulton Turkeytail	LA-EW	1500-500 BC	72.73	9.57	33.64	16.91	no	36.64	27.63	DART
395	Fulton Turkeytail	LA-EW	1500-500 BC	58.03	6.52	27.74	16.25	no	25.72	20.49	DART
447	Fulton Turkeytail	LA-EW	1500-500 BC	69.49	15.68	27.16	12.33	no	31.64	28.53	DART
16	Gary/Cogswell	LA-EW	1500 BC-AD 100	43.68	8.22	28.57	19.30	blade	24.01	21.48	DART
397	Kamak Stem	LA	3700-3000 BC	46.13	8.30	16.51	13.01	no	11.37	14.78	ARROW
517	Kamak Unstemmed	LA	3700-3000 BC	48.85	9.96	23.12	16.89	no	19.63	20.44	ARROW
549	Kamak Unstemmed	LA	3700-3000 BC	36.51	10.22	17.74	14.03	no	11.57	16.19	ARROW
313	Kamak Unstemmed	LA	3700-3000 BC	40.08	8.28	15.82	17.29	no	8.44	14.70	ARROW
601	Kamak Unstemmed	LA	3700-3000 BC	51.11	8.76	24.68	15.76	no	21.69	20.13	DART
10	Kramer	EW	500 BC	44.53	9.82	23.21	17.09	tip/blade	18.83	19.94	ARROW
45	Kramer	EW	500 BC	54.87	12.34	27.34	20.76	no	25.92	25.98	ARROW
8	Kramer	EW	500 BC	64.41	8.77	27.05	18.52	no	26.46	23.29	DART
24	Kramer	EW	500 BC	50.63	9.93	28.44	18.41	blade	26.02	23.43	DART
27	Kramer	EW	500 BC	61.44	10.90	25.89	18.51	no	25.34	24.28	DART
70	Kramer	EW	500 BC	53.44	11.48	28.37	17.34	blade	24.90	23.87	DART
120	Kramer	EW	500 BC	41.80	8.44	29.03	17.65	blade?	24.66	21.31	DART
158	Kramer	EW	500 BC	41.05	11.59	25.34	13.27	no	22.28	21.27	DART
531	Kramer	EW	500 BC	48.88	7.77	23.31	15.25	no	19.00	18.07	DART
72	Kramer	EW	500 BC	49.93	10.27	25.80	18.84	blade?	22.51	22.41	DART
403	LA Stem	LA-EW	4000-500 BC	49.25	16.52	23.93	16.98	no	23.24	26.55	ARROW
470	LA Stem	LA-EW	4000-500 BC	50.57	13.48	25.89	19.39	no	23.87	25.41	ARROW
532	LA Stem	LA-EW	4000-500 BC	57.02	11.77	21.69	15.57	no	20.45	21.93	ARROW
136	LA Stem	LA-EW	4000-500 BC	45.04	10.79	28.44	19.67	no	25.03	23.64	DART
184	LA Stem	LA-EW	4000-500 BC	38.87	8.35	23.72	15.18	no	18.23	17.89	DART
453	LA-EW	LA-EW	4000-200 BC	65.85	16.28	28.23	18.05	no	29.19	28.98	DART
89	Lamoka	LA	3500-1800 BC	41.99	12.06	22.97	13.88	no	19.65	20.80	ARROW
100	Lamoka	LA	3500-1800 BC	38.67	10.28	21.55	12.92	no	16.83	18.01	ARROW
167	Lamoka	LA	3500-1800 BC	41.42	11.01	23.59	15.25	no	19.58	20.41	ARROW
168	Lamoka	LA	3500-1800 BC	37.84	9.99	22.74	17.46	no	18.99	19.22	ARROW
346	Lamoka	LA	3500-1800 BC	41.78	9.81	20.23	15.59	no	15.05	17.91	ARROW
473	Lamoka	LA	3500-1800 BC	46.25	10.23	21.36	15.31	no	17.48	19.23	ARROW
479	Lamoka	LA	3500-1800 BC	40.58	11.29	22.07	14.32	no	17.90	19.85	ARROW
483	Lamoka	LA	3500-1800 BC	41.12	8.22	21.31	15.31	no	15.87	16.91	ARROW
505	Lamoka	LA	3500-1800 BC	37.19	12.86	22.96	13.19	no	19.13	20.65	ARROW
525	Lamoka	LA	3500-1800 BC	37.16	9.47	20.51	19.82	no	13.44	18.15	ARROW
414	Lamoka	LA	3500-1800 BC	49.59	12.61	27.27	16.80	no	25.83	24.74	DART
516	Lamoka	LA	3500-1800 BC	44.06	9.95	24.61	14.32	no	21.09	20.06	DART
324	Madison	LW-M	AD 800-Historic	40.48	7.63	19.93	18.73	no	12.89	16.42	ARROW
336	Madison	LW-M	AD 800-Historic	40.19	6.50	19.25	13.27	no	12.79	13.92	ARROW
334	Madison	LW-M	AD 800-Historic	36.90	8.06	20.28	22.65	no	11.94	17.42	ARROW
338	Madison	LW-M	AD 800-Historic	37.88	6.93	16.53	17.14	no	8.38	13.59	ARROW
493	Matanzas	LA	3700-2000 BC	25.12	4.65	17.85	17.06	blade?	6.78	11.02	ARROW
477	McWhinney	LA	4000-1000 BC	48.59	13.47	24.10	16.17	no	22.30	23.75	ARROW
92	McWhinney	LA	4000-1000 BC	63.16	15.73	33.71	18.16	no	37.08	32.22	DART
116	McWhinney	LA	4000-1000 BC	43.48	9.91	24.18	13.78	no	20.58	19.85	DART
463	McWhinney	LA	4000-1000 BC	59.80	12.42	28.84	14.42	no	30.08	25.89	DART
415	McWhinney	LA	4000-1000 BC	58.22	11.23	29.43	17.09	no	29.45	25.56	DART
105	McWhinney	LA	4000-1000 BC	67.09	12.21	33.38	18.87	no	38.31	29.17	DART
389	McWhinney	LA	4000-1000 BC	55.32	11.77	22.74	12.07	no	22.17	21.49	DART
422	McWhinney	LA	4000-1000 BC	46.20	12.16	27.33	16.91	no	25.06	24.04	DART
226	Merom-Trimble	LA-EW	2000-715 BC	29.14	5.94	16.07	12.44	no	9.26	11.51	ARROW
319	Nodena Banks	LM-Proto	AD 1400-1700	34.04	3.91	12.16	12.31	no	2.29	7.48	ARROW
263	Pickwick	LA	2500-1000 BC	41.97	8.81	27.10	14.73	no	23.08	19.94	DART
457	Pickwick	LA	2500-1000 BC	83.50	13.19	31.26	18.68	no	33.51	26.59	DART
419	Pine Tree	EA	7500-6900 BC	41.66	7.03	17.31	15.64	blade	10.45	14.16	ARROW
87	Robbins	EW-MW	500 BC-AD 200	51.43	12.03	32.85	17.19	no	32.58	27.14	DART
124	Saratoga	LA-EW	2000-650 BC	38.83	8.01	34.04	23.26	no	26.72	24.17	DART
537	Saratoga	LA-EW	2000-650 BC	40.61	8.17	27.48	18.84	no	22.20	20.47	DART
468	Saratoga	LA-EW	2000-650 BC	40.39	9.34	27.22	20.58	no	21.91	21.71	DART
150	Snyder	MW	200 BC-AD 200	46.25	12.38	36.20	18.23	no	35.55	28.88	DART
394	Steuben	MW-LW	AD 100-800	55.51	8.91	28.67	18.21	no	28.86	23.14	DART

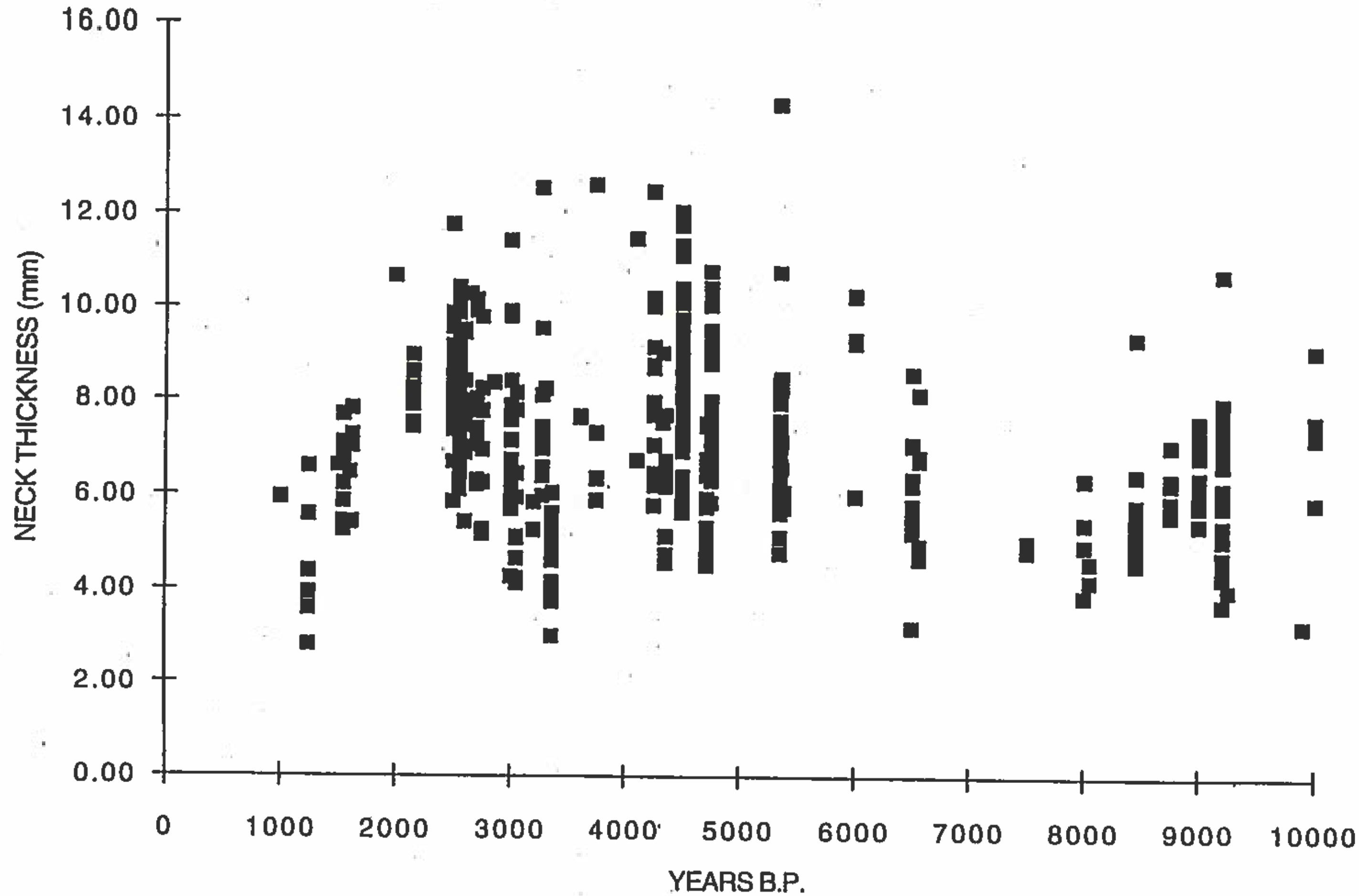

Figure 8. Temporal Changes in Neck Thickness for Typed Hafted Bifaces in the Rhondle Lee Site Collection (n+434).

Pearson's correlation coefficients for the three segments of the regression line are relatively low (0.31 for the Paleoindian-Middle Archaic segment, -0.22 for the Middle Archaic-Early Woodland segment, and -0.03 for the Early to Late Woodland segment) and suggest a weak relationship between neck thickness and chronology. Although this might not be an ideal statistic to use in this case, it can be argued that for the Rhondle Lee sample, this physical attribute of hafted bifaces has a random distribution over time and, therefore, was not likely under the influence of evolutionary forces or the result of functional change. By extension, changes in the attribute may reflect stylistic or some other change instead; differences in neck thickness might be used to define stylistic types.

Had it been determined that the attribute was nonrandomly distributed over time, we might conclude that the attribute was under the influence of evolutionary forces. When compared with other assemblages it may be possible to use measures of between-group and within-group variation over time to identify which evolutionary processes influenced this property of hafted bifaces. Further research involving improved statistical manipulation is needed, and it might be wise to confirm through microwear and other analysis the specific functions of the individual hafted bifaces.

CONCLUSIONS

In summary, this paper attempted to illustrate the research potential of unsystematically collected lithic assemblages with respect to description and hypotheses testing. It is argued that archaeologists can use surface-collected assemblages more productively. Although we cannot use them to delineate activity areas, surface-collected assemblages can be useful in documenting variability in chert types and biface stylistic types, and in explaining temporal patterns of raw material utilization, tool reworking, and the evolution of weapon systems.

This study of a lithic collection obtained through unsystematic surface collection yielded some interesting results. Many stylistic types of hafted bifaces in the Rhondle Lee collection differ in several dimensions in comparison with samples from other parts of the Eastern Woodlands. Occupants of the Rhondle Lee Site likely used some cherts differentially over time in the manufacture of chipped-stone tools. The incidence of tool reworking changes over time at the site and may represent more sedentary occupations during the Early Archaic, Late Archaic, and Early Woodland periods. Classification of a high percentage of Late Archaic and Early Woodland hafted bifaces as arrow points warrants further investigation into the timing of the adoption of the bow and arrow.

Additional avenues of investigation not examined here are possible using surface-collected lithic assemblages. For example, one might conduct microwear analyses of such collections as it relates to tool function, settlement permanence, and range of activities at prehistoric occupations (Yerkes 1989). It might also be possible to use surface-collected lithic assemblages to test propositions derived from evolutionary ecology models. Such models might be useful in examining the roles of specific constraints on tool reuse and raw material utilization. It seems there is fertile ground for making the most of this ubiquitous form of artifact assemblage.

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Ryan J. Weller of Applied Archaeological Services in Columbus, Ohio assisted in typological identifications. The author thanks Mr. Bill Scott for access to visit the site. Photographs, line drawings, and attribute summaries for the collection are on file at the Office of the State Archaeologist in Lexington, Kentucky. Responsibility for the information included in this paper lies with the author alone.

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NOT QUITE NEWT KASH: THREE SMALL ROCKSHELTERS IN LAUREL COUNTY

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ABSTRACT

The results of 1994 test excavations at three small rockshelter sites in Laurel County are described. These sites are interpreted as consisting of seasonal, short term occupations that occurred intermittently and over long periods of time. These sites are placed within the broader framework of settlement studies for eastern Kentucky.

INTRODUCTION

This paper considers the prehistoric use of rockshelters in Eastern Kentucky. We believe that there is ample evidence to suggest use of many rockshelters on a temporary, short term basis, with visits perhaps spanning thousands of years. This paper investigates the nature of those temporary, short term occupations. What more can the archaeological record tell us about the inhabitants of these rockshelters? Can the archaeological record reveal how the inhabitants interacted -- or perhaps didn't interact -- with the broader settlement systems of the region?

We use as the empirical basis for this investigation, three small rockshelter sites excavated in the spring of 1994 in Laurel County, Kentucky (Carmean 1994). These excavations were conducted by Eastern Kentucky University for the U.S. Forest Service to determine the eligibility of the rockshelters for inclusion in the National Register of Historic Places. In this paper we describe the rockshelters and the results of the excavations we conducted. The paper concludes with a discussion of subsistence and mobility strategies, and considers how the Laurel County sites can contribute to our understanding of Eastern Mountain adaptations.

The three rockshelters are located in northern Laurel County about 2 km south of the Rockcastle River, just east of I-75, and immediately south of State Highway 909 (Boedy and Sharp 1992). The shelters are all located in a low broken cliff line near the head of an unnamed hollow that drains into Wollum Branch (Figure 1). Sandstone outcrops occur just below the crest of the ridge. Access to the ridge top from any of the shelters is good. A seep at the base of a rock outcrop located midway between

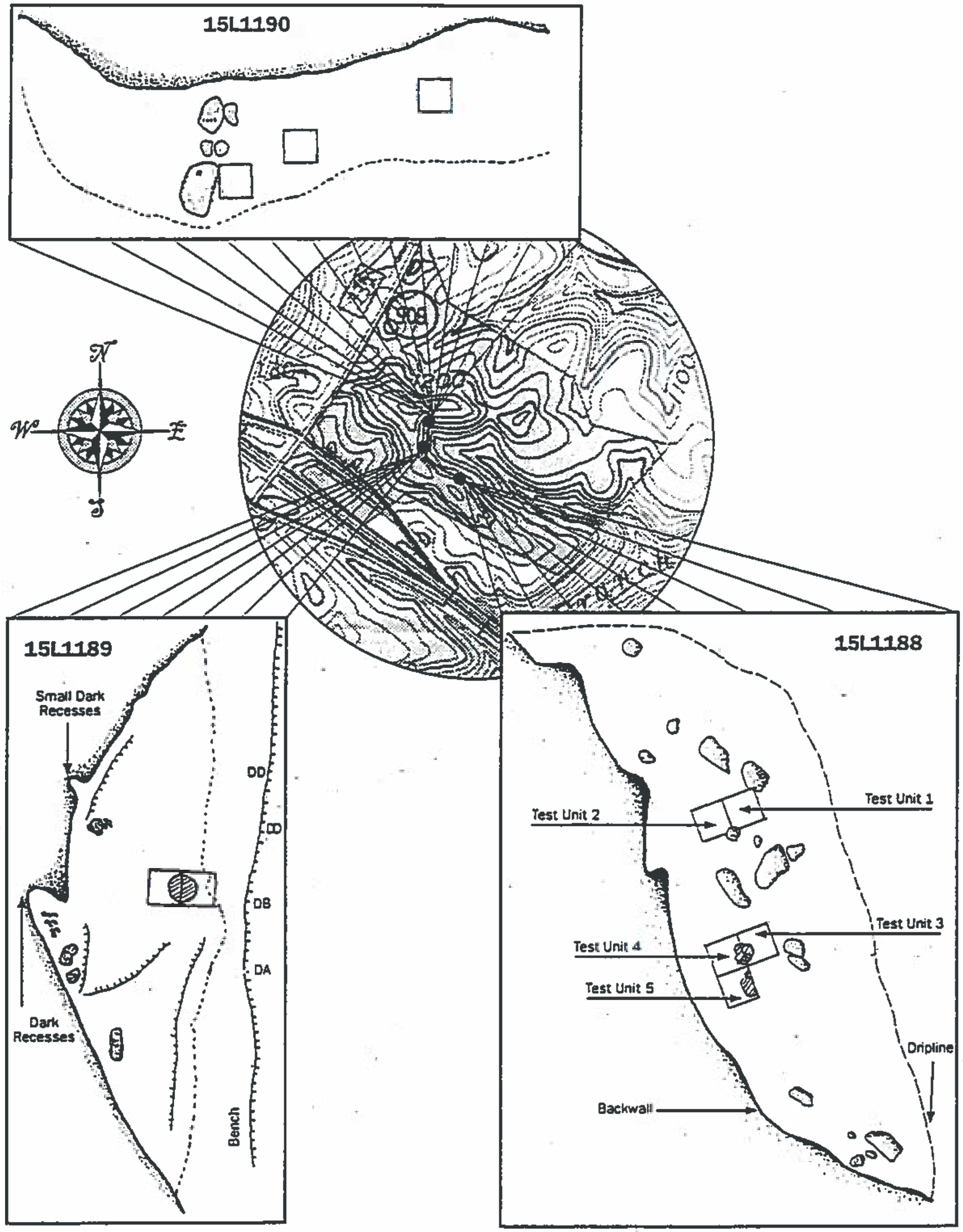

Figure 1. Wollum Branch Hollow Showing Locations and Orientations of Three Rockshelters. Test units (1 x 1 m) show rockshelter scale.

sites 15LI188 and 15LI189 provides a reliable source of water. The sides of the hollow are steep and the drain is incised, although the elevational change from the ridge crest to the drain is only about 40 m.

GROOVEY SHELTER

The "Groovey Shelter" (15LI190) is a south facing overhang, 16 m long with a maximum depth of 2.5 m. At the dripline, the ceiling is 3.5 m high, and forms a continuous arc to the floor which does not restrict usable space. The floor is level and free of rock, except for several boulders at the west end of the shelter. The largest sandstone rock exhibits two parallel abrading grooves, hence the name of this shelter. Although the shelter is open at both ends and is really more of an overhang than a shelter, it provides adequate protection from rain.

Excavation of 3 m^2 of the floor area revealed shallow deposits consisting of an upper, dark gray, sandy loam, humus layer (0-5 cm) overlaying a reddish-yellow sand and small rock (5-20 cm). Very little disturbance was noted in this shelter except for a small area along the backwall. No features were identified during the excavations.

A total of 200 artifacts were recovered, which include chipped stone tools (n=5), debitage (n=191), ceramics (n=2), and faunal remains (n=2). Tools include one Chesser Notched projectile point, diagnostic of the early Late Woodland Period (Justice 1987), one complete triangular biface, two biface fragments, one of which may be the hafting element of a stemmed point, and a broken hafted scraper (see Figure 2 for diagnostics, see Carmean 1994 for metrics). Both ceramics are small body sherds with unknown temper, plain exterior surfaces. One of the sherds exhibits a small lug or podal appendage. The ceramics are characteristic of Woodland pottery and could be from the same vessel. All of the recovered debitage is from the later stages of lithic reduction. Faunal remains consist of small unidentified, burned fragments.

Evidence from the Groovey Shelter indicates use during the Woodland Period. Limited floor space probably restricted the size of the group using the overhang. Low artifact density suggests a short period or periods of occupation.

RISING SUN SHELTER

Site 15LI189 faces due east, hence the name: "Rising Sun Shelter." The shelter is 16 m long, with a maximum depth of 4.5 m. At the center of the dripline, the ceiling has a height of 2.2 m, however, most of the ceiling is much less than 2 m high and along the backwall it is only about 1 m high. The floor of the shelter is composed entirely of sand. The floor slopes toward the center and is slightly damp.

Two square meters were excavated in the Rising Sun Shelter. Excavation revealed diffuse cultural deposits in yellow brown sand that changed to reddish brown sand at about 15 cm below the surface. Although excavation was continued to a depth of 50 cm, artifacts were restricted primarily to the upper 40 cm. The deposits became damper and more compact with depth.

Feature 4 (Figure 3) was an irregularly shaped, dark brown stain with a few reddish oxidized areas near the margins. The feature measured 70 cm across and was identified at 15 cm below the surface. It contained charcoal, sandstone rock, faunal remains, and artifacts. Although it continued to a depth of 40 cm, the feature is interpreted as a surface hearth which leached into the underlying loose sandy matrix. Most of the artifacts recovered from the Rising Sun Shelter came from this feature.

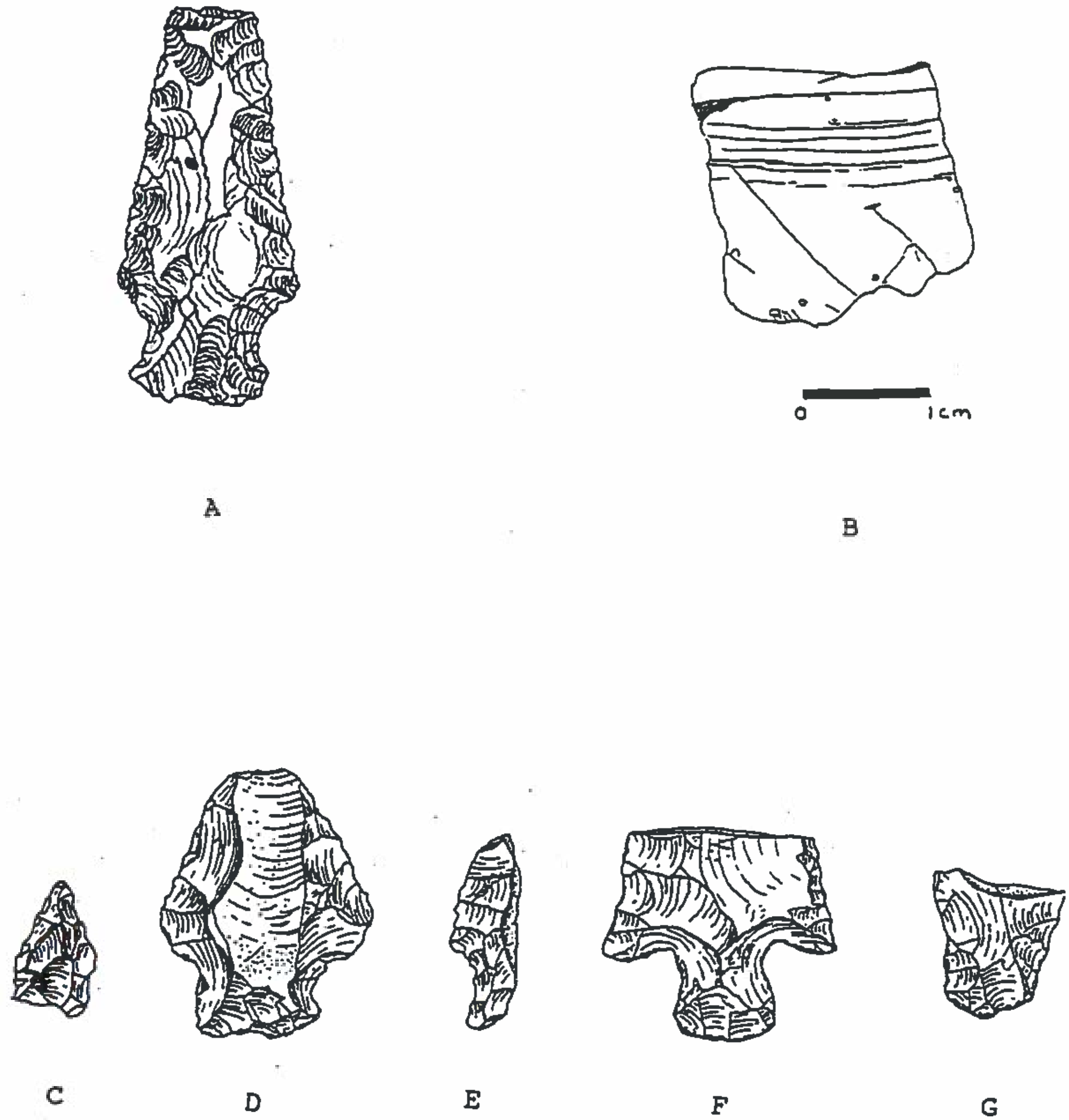

Figure 2. Diagnostic Artifacts From Wollum Branch Rockshelters: 15Ll190, (a) Chesser Notched; 15Ll189, (b) Middle Woodland limestone tempered rim sherd (note the shallow oblique and horizontal incising); 15Ll188, (c) Triangular, (d) Chesser Notched, (e) Chesser Notched, (f) Wade, (g) Adena Stemmed. All projectile points are drawn to scale. The rim sherd illustration is enlarged and contains its own scale.

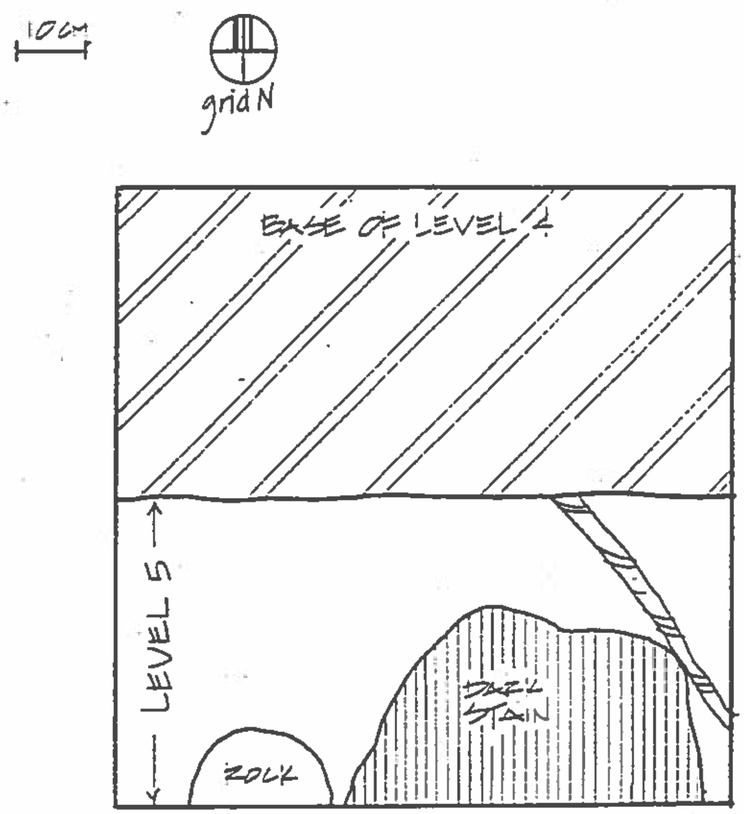

Figure 3. Feature 4 at the Rising Sun Shelter (15LI189).

Charred hickory nut shell yielded an uncorrected date of A.D. 260 $\pm$ 70 (Beta-76836) for Feature 4. Just south of the feature, four crude bifaces were recovered in close proximity to one another. These may represent a cache associated with the hearth.

In addition to floral and faunal remains, a total of 95 artifacts, including flaked stone tools, debitage, and ceramics were recovered. The tools include one biface fragment and four complete, thick bifaces, mentioned above, manufactured from Boyle chert. Each of the thick bifaces retain portions of brown water-worn cortex, suggesting all four may have been made from a single piece of chert.

The debitage consists of 71 flakes and shatter. Four flakes retain cortex on the dorsal surface, but most appear to be the result of later stages of reduction. A single core, exhibiting random flake removal, was also recovered.

Eighteen sherds were recovered from the feature, consisting of 14 very small or split specimens, four body sherds, and one rim sherd. Although none could be refitted, they are probably all from the same vessel. The assemblage is tempered with limestone. Body sherds exhibit plain exterior surfaces and have an average maximum thickness of 10.6 mm. The rim is slightly recurved and has a flat lip with rounded corners. Four faint horizontal lines are located in the constricted area 5 mm below the lip. Two shallow incised lines are located below the band of horizontal lines and run obliquely to the lip (Figure 2). Rim curvature suggests a small vessel with an orifice diameter of about 15 cm.

The ceramics from Rising Sun Shelter are clearly different from sherds recovered from the other two shelters. Attributes such as limestone temper, plain exterior surface treatment, and vessel thickness, suggest Rising Sun Shelter pottery dates to the Middle Woodland Period. This assessment is supported by the radiocarbon date from the feature.

Floral remains recovered from Feature 4 include both unidentified wood and pine charcoal as well as hickory and black walnut nutshells. A substantial number (n=444) of faunal remains were recovered from Feature 4, however, these consisted primarily of unidentified bone fragments (n=409). In addition, non-poisonous snake (n=1), pit viper snake (n=1), unidentified large bird (n=2), medium/large mammal (n=29), turkey (cf. *Meleagris gallapavo*, n=1), and white-tailed deer (*Odocoileus virginianus*, n=1) elements were present in the feature.

The Rising Sun Shelter is the smallest of the three shelters investigated and had the least number of artifacts. The radiocarbon date and the pottery indicate the shelter was used during the Middle Woodland Period. The integrity of the feature and the low density of artifacts suggest a short period of use.

BIG SHELTER

Site 15Ll188 -- the Big Shelter -- is a northeasterly facing shelter measuring 18 m long and 5 m wide. The ceiling has a maximum height of 2.5 m at the dripline and ranges from a little over 2 m to less than 1.5 m in the interior. The center of the shelter has the greatest amount of headroom. The floor in the central part of the shelter is level but slopes up at either end. During periods of heavy rain, there is a tendency for the floor in the central part of the shelter to become wet. Scattered boulders are present on the floor. Since this was the largest shelter we investigated, it was named the "Big Shelter."

While the shelter contains a total of 87 m^2 of floor area, surface collections revealed that only 50-60 m^2 in the central and northern part of the shelter were used prehistorically, either because of low ceiling height or sloping floor. Much of this area had been disturbed by prior digging. The two northern test units were dug in the most disturbed area to check the depth of the disturbance and to determine whether any intact deposits remained. Both 1 x 1 m test units revealed the disturbance was shallow (10 to 15 cm deep) and that there were no intact cultural zones below the disturbance.

Deposits in the three test units in the southern half of the shelter were not disturbed. The stratigraphy consisted of an upper zone of brown sandy loam that varied in depth from 3 to 10 cm. This zone was underlain by light brown sandy clay loam that was excavated to a depth of 20 cm below the surface. Although a few flakes were recovered from the interface of the upper and lower zones, the lower zone appears to be the base of cultural deposits, however, two prehistoric features were identified that intruded into the lower zone.

Both features are interpreted as hearths (Figure 4). Feature 1 was defined 10 cm below the surface and consisted of an elliptical shaped, dark brown stain 1.5 m north-south by 85 cm east-west with faint oxidation around the edges. It contained charcoal, sandstone rock, and debitage. Maximum depth was 16 cm. Charcoal from Feature 1 yielded an uncorrected date of 1479 $\pm$ 60 B.C. (Beta 72793), while charcoal from Feature 3 yielded an uncorrected date of 460 $\pm$ 60 B.C. (Beta 72794).

Feature 3 was only partially excavated since it extended into an adjoining unit. It consisted of a well defined band of reddish oxidized soil surrounding a very dark brown stain measuring 73 cm east-west by 43 cm north-south. Maximum depth was 24 cm below the surface and the feature contained charcoal, sandstone rock, and debitage.

A total of 756 artifacts were recovered from Big Shelter, and included artifacts from the surface and disturbed areas as well as artifacts from the test units. The assemblage consisted of nine projectile points or point fragments, six bifaces or biface fragments, two scrapers, one spokeshave, four flake tools, one core, 683 flakes (unmodified, shatter, or broken flakes), one pitted stone, 49 ceramic sherds, faunal and floral remains.

Identifiable projectile point types recovered from the shelter (Figure 2) include the proximal end of a Wade, an Adena Stemmed base, two Chesser Notched points, and a triangular point (Justice 1987). The Wade, one of the Chesser Notched points, and several untyped point fragments, came from the level above Feature 1, and two point fragments came from the level above Feature 3. Other specimens were recovered from the surface or were from disturbed contexts. In addition to the points recovered during the current investigations, a complete Chesser Notched point and a triangular point fragment were collected from disturbed contexts during reconnaissance survey (Boedy and Sharp 1992).

Wade points are considered diagnostic of the Terminal Archaic Period (Justice 1987:180). Adena Stemmed points are usually associated with the Early Woodland Period (Justice 1987:191), while Chesser Notched points are diagnostic of the Late Woodland Period (Justice 1987:213). Normally, the triangular point style is associated with the Late Prehistoric Period (Justice 1987:224-229). Based on diagnostic projectile points, the shelter could have been used from the Late Archaic Period, until perhaps as late as the Late Prehistoric Period. The infrequency of any particular point style and the radiocarbon dates suggest sporadic use of the shelter from 1500 B.C. to as late as A.D. 1600, while the ceramics suggest pre- A.D. 1200 use.

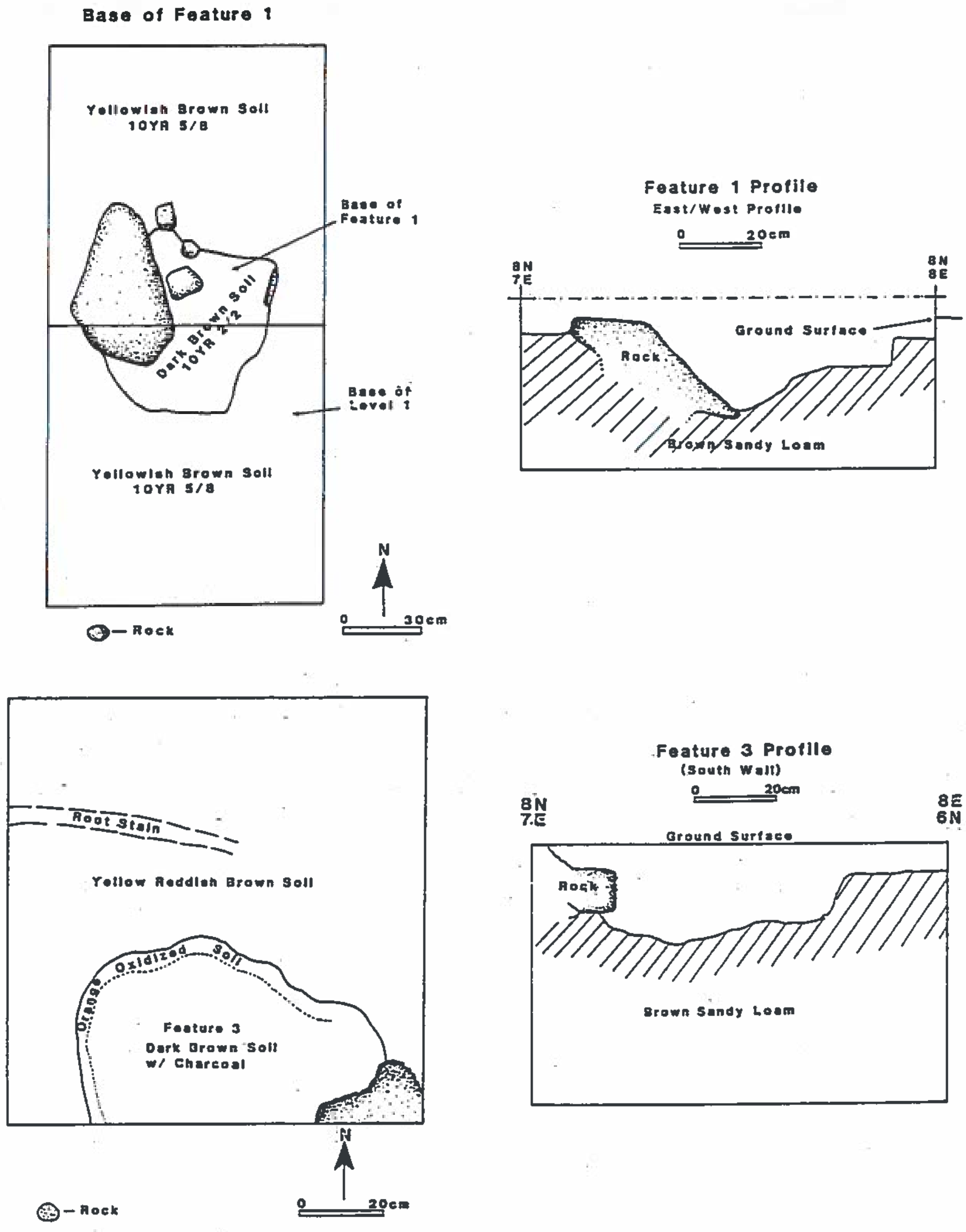

Figure 4. Features 1 and 3 at the Big Shelter (15Ll188).

Other flaked stone tools include several nearly complete bifaces that appear to be late stage projectile point preforms that were broken, one due to natural fractures in the chert and the other by knapping error. The scrapers consist of one small end scraper and a larger side scraper. The spokeshave was manufactured from a secondary reduction flake and exhibits a concave notch on a lateral edge with unifacial flaking. Although more early stage reduction flakes were recovered from 15Ll188 than from the other shelters, most of the 683 flakes or shatter, are small and are probably the result of later stages of tool manufacture and maintenance. A single core was also recovered.

The only ground stone tool recovered was a fist size chunk of sandstone with a nutting pit on the broadest surface. The pit measures 33 mm x 30 mm with a depth of 5 mm. The specimen was recovered from the surface.

A total of 49 sherds were recovered from the shelter. Seventeen were tempered with limestone and 32 were tempered with siltstone. All except one have plain exterior surfaces. The exception is a siltstone tempered cordmarked sherd. The average thickness of both groups is 5.5 mm. Recovered rims (n=2) were very small. Based on temper, surface treatment, and paste characteristics a minimum of at least three different vessels are represented in the collection. None of the sherds are associated with features identified at the site and almost all are from disturbed contexts. The general morphology of the assemblage suggests the ceramics date no earlier than A.D. 100, and the absence of shell tempering suggests they predate A.D. 1200.

Charred botanical remains recovered from Feature 1 consist of unidentifiable wood charcoal and hickory nutshell. Wood charcoal that included, white oak, hickory, and pine species, was recovered from Feature 3. In addition, floral remains from Feature 3 flotation included, black walnut nutshell, one squash rind (*Cucurbita* sp.), and nine unidentified fleshy fruit (plum? paw-paw?) seed fragments.

Faunal remains from the shelter consisted of seven burned or calcined unidentified mammal bone fragments. The poor preservation of faunal remains is probably related to the shallow deposits and the moisture.

Big Shelter was the most complex site investigated and produced the most artifacts. The shelter produced evidence for low intensity, intermittent use from the Late Archaic through the Late Prehistoric Period. Diagnostic projectile points recovered include Wade, Adena Stemmed, Chesser Notched, and triangular styles. The ceramics are characteristic of Late Woodland pottery. Radiocarbon dates substantiate use during the Late Archaic and Early Woodland Periods.

INTERPRETATIONS

Diagnostic artifacts and radiocarbon dates from the three shelters indicate use over a long period of time. Late Archaic period occupation is indicated by a radiocarbon date and perhaps the Wade style projectile point, while the presence of triangular points suggests shelter use may have continued at least into the Late Woodland and perhaps into the Late Prehistoric Period. However, two radiocarbon dates, the ceramic assemblages, and the majority of the diagnostic projectile points recovered, indicate the shelters were more frequently used during the Woodland Period.

All three sites clearly represent temporary, short-term use. The cultural deposits are shallow, limited numbers of artifacts were recovered, and the only features encountered were surface hearths. The length of any single occupation is unknown. However, the presence of a number of different animal species associated with the hearth in 15Ll189, coupled with the assumption that the hearth represents one occupational episode, an occupation of several weeks is suggested.

While both 15Ll188 and 15Ll190 contain Late Woodland ceramics, the paste characteristics of ceramics from the two shelters are somewhat different and provide reasonable doubt that these two sites may have been occupied concurrently. Finally, there is little information to help establish any particular season of occupation in any of the shelters.

The artifacts recovered suggest a range of normal domestic activities, including: hunting, butchering, hide preparation, food processing, lithic tool manufacture and maintenance, and fabrication of wood items. In addition, the abrading grooves on the boulder in 15Ll190 suggest bone tool manufacture.

The use of chert resources is fairly consistent in all three of the shelters. Table 1 below, presents percentages of chert types represented in the flaked stone tool and debitage categories recovered from the three shelters.

Table 1. Chert Types by Rockshelter in the Study Area.

Chert Type	15Ll188 (%)	15Ll189 (%)	15Ll190 (%)
St. Genevieve	42	41	41
Haney	23	6	8
Boyle	12	19	23
Muldraugh	4	1	5
Paoli	1	1	4
Breathitt	2	0	0
Unidentified	16	37	19

The most common chert type in all of the shelters is St. Genevieve followed by Haney and Boyle. St. Genevieve and Haney outcrop in adjacent Rockcastle and Jackson counties, and may even have been available as stream cobbles from the Rockcastle River. Boyle, on the other hand, is only available from Silurian formations located on the edge of the Outer Bluegrass to the north and west and is not locally available. Muldraugh, Paoli, and Breathitt chert, representing less than 10 percent of the assemblage from any one site, are also unavailable locally.

Chert types represented in the recovered assemblages suggest a heavy reliance on local resources. Less abundant chert types, from the north and west, indicate that even though the sites are located within the southern draining Rockcastle-Cumberland River watershed, shelter occupants had access to resources from more distant areas. The non-local chert types represented in the assemblages indicate either direct procurement of these materials as part of seasonal rounds, or trade.

In summary, use of all three of the shelters appears to represent a number of short periods of habitation by small groups of people, with occupations occurring primarily throughout the Woodland Period.

DISCUSSION AND CONCLUSIONS

Although the three Laurel County rockshelters discussed here are rather insignificant individually, they are representative of many rockshelter sites in Eastern Kentucky. Surveys conducted for ten timber sales on the London Ranger District over the past year, resulted in the documentation of 62 prehistoric rockshelter sites. Only nine of those shelters (15 percent) had deposits that contained black greasy soil, abundant charcoal, artifacts, and faunal remains indicative of cultural midden, which suggests intensive prehistoric occupation. The deposits in the vast majority of the recorded shelters were similar to the deposits described above for the Laurel County shelters.

It is tempting to interpret these temporary use rockshelter sites as hunting camps, however, they are not all special purpose field camps in the strict sense of Binford's (1980) collector model. Archaeologists often have a tendency to interpret Eastern Kentucky rockshelter sites from the perspective of the Woodland/Late Prehistoric sedentary village developments that were occurring in some areas. From this perspective, rockshelter sites like those described here would be considered ancillary, seasonal, special purpose, temporary residences, that are supportive to large settlements elsewhere. This perspective is especially true for the Late Woodland Period.

An alternative explanation -- and the one we favor -- is that in some areas Woodland people simply retained a higher degree of residential mobility at all times of the year. Clearly, there was interaction between groups over broad areas as the overall similarities in material culture (e.g. pottery and points) indicate, but perhaps changes in lifestyles (e.g. from nomadic to sedentary) were differentially accepted or never accepted in some areas. In addition, mobile lifestyles do not necessarily preclude limited horticultural activities (Gorecki 1991:243-247), although it may have inhibited the acceptance of plants requiring more intensive care (e.g. tropical cultigens). Finally, a mobile Woodland settlement system, such as the one we describe, is implicit in Dunnell's (1972) interpretation of Woodland Period developments of the Fishtrap Reservoir, also located in Eastern Kentucky.

In summary, we suggest that it is entirely possible that there were groups of nomadic peoples living in the eastern mountains that largely did not participate in the Woodland/Late Prehistoric developments nearby. The mobile eastern Kentuckians were certainly not unaware of village developments in the region. Rather, their mobility may have been a more efficient mechanism for exploiting their local environment. Thus two environmental adaptations -- mobile and sedentary -- may well have co-existed in a relatively small region, represented by distinct groups of people. Based on the occurrence of a generalized domestic artifact assemblage recovered from the three Laurel County rockshelters examined here, we suggest that these shelters reflect independent, autonomous groups that traveled the eastern mountains not directly associated with their more sedentary neighbors.

ACKNOWLEDGMENTS

We thank Cecil Ison, Forest Archaeologist, for initially offering the opportunity to integrate this project into an Eastern Kentucky University course as a hands-on learning experience. Johnny Faulkner identified the lithic artifacts and Gwynn Henderson identified the ceramics. The students who took the "Archaeology and the Law" course (Jonathan Dean, Johnny Faulkner, William Hill, Valarie Hines, Stuart Jones, Janet Quigg, and Jeff Rogers), performed field, laboratory and write-up tasks in a competent

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DEGENERATIVE JOINT DISEASE OF THE CHIGGERVILLE SITE (15OH1) AS AN INDICATOR OF BIOMECHANICAL STRESS

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ABSTRACT

This study is a partial re-evaluation of the skeletal sample from the Chiggerville shell mound (15Oh1) along the Green River in Ohio County. Kentucky. Included in this analysis are new age determinations. as well as the study of degenerative joint disease of the major appendicular joints. an indicator of biomechanical stress. Overall. arthritis is highest at the elbow, shoulder. and hip. and lower at the wrist. knee. and ankle. Males tended to have more arthritis in the upper arm. exhibiting in high frequencies in the shoulder and elbow. Females exhibited more arthritis of the elbow and wrist. Males did not show marked asymmetry of the upper arm. thus exhibiting no osteological evidence for use of the atlatl. Albeit a small sample, these data support a preliminary model for hunter-gatherers biomechanical stress among prehistoric Green River inhabitants.

INTRODUCTION

The recognition and study of stress-related (or activity based) pathologies and their implications for interpreting past life ways have recently become of major interest to bioarchaeologists. Different living conditions and subsistence patterns. such as hunting and gathering or agriculture. involve specific activity patterns. Presumably. these activities. such as atlatl throwing or corn grinding put joints of the body under different forms of mechanical stress. These stresses are then manifested in lesions on the bone. including degenerative joint disease or osteoarthritis. In its primary form. osteoarthritis is the result of repeated "wear and tear" on joints of the body (Hough and Sokoloff 1989).

Many scholars in the last few decades have tried to link degenerative lesions of the joints to specific activities (Angel 1966: Bridges 1991: Jurmain 1990: Merbs 1983: Pickering 1984). Hunting activities in males, specifically the use of the spear thrower. or atlatl. in males has been of particular interest. The early assumption was that repeated use of the atlatl in hunting. which creates stress on one side of the body. would result in asymmetrical arthritis of the elbow. After the development of the bow and arrow. which creates stress on both arms. arthritis should become more symmetrical in the elbow.

Angel (1966) observed a high predominance of asymmetrical arthritis of the elbow in a small number of males from the Tranquility Site. a California hunter-gatherer settlement. At this time he coined the term "atlatl elbow." Since that time. however. it has been debatable whether the use of the atlatl can actually be seen in the osteological record.

Pickering (1984) compared skeletal samples between Middle Woodland. Late Woodland. and Mississippian populations in the Lower Illinois River Valley. The pattern of asymmetrical arthritis in the elbow shifting to symmetrical was not seen. however. Bridges. in comparing hunter gatherer and agricultural populations from the Pickwick Basin in Alabama, also did not find that pattern (Bridges 1991). Actually, in the Pickwick Basin, arthritis became slightly more asymmetrical among the agriculturalists.

One of the more frequent and popular comparisons that are made among skeletal populations is between hunter-gatherer and agriculturalists. In regards to arthritis, there are peculiar conflicting results. Lallo (1973) and Goodman et al. (1984) compared degenerative pathologies in sequential populations from Dickson Mounds, Illinois: Late Woodland horticulturalists, and Mississippian agriculturalists. Arthritis increased greatly, from 43 to 76 percent in males, and 41 to 67 percent in females from the preagricultural to agricultural populations. Goodman et al.(1984:295) conclude that "degenerative pathologies significantly increase through time and affect males more frequently than females." They cite no specific activities that could be associated with these increases, however.

Larsen, however, in comparing hunter-gatherers and agriculturalists in coastal Georgia, found a different pattern of arthritis frequencies (Larsen 1984). Arthritis in both males and females decreased overall with the transition to agriculture. Among the appendicular joints the elbows and knees, the two most affected joints in both groups, exhibited the most differences between populations. Though Larsen noted the agricultural group adults were younger overall, age distributions of individuals affected did not differ significantly.

These differences are somewhat puzzling. There could be different levels of stressful activities in these different regions. Environmental factors could partly explain these results, as perhaps one region leads to more physically demanding agricultural practices than others. Genetic predispositions for arthritis cannot be ignored either. It is entirely possible that increased arthritis in some of these populations could partly be the result of genetic factors.

Unfortunately, this issue is complicated by the fact that the etiology and pathogenesis of arthritis is still poorly understood (Hough and Sokoloff 1989). Medical studies on living populations have produced conflicting results. Some studies have shown no distinct differences in the amounts of arthritis in runner's knees (Panush et al. 1986; Panush and Brown 1987), while others have shown increased arthritis in soccer player's knees (Klunder et al. 1980). Besides "wear and tear" on joints, several other factors can be involved in the onset of osteoarthritis, such as age (Jurmain 1977), sex (Cobb 1971; Radin et al. 1971), metabolic and endocrine disorders (Hough and Sokoloff 1989), and genetic predisposition (Stecher 1959; Hough and Sokoloff 1989).

Presented here is a study of osteoarthritis in the adult skeletal population from the Chiggerville Site, a Late Archaic shell mound. Arthritis differences in age and sex are discussed and correlated with assumed activity patterns, such as the use of the atlatl in males. Comparisons' with other skeletal samples also are made, along with some populational comparisons from other regions of the Southeast and Midwest.

THE CHIGGERVILLE SITE

The Chiggerville Site (15Oh1) is located along the Green River in Ohio County, Kentucky. Within a few miles to the east and west are numerous Late Archaic shell mound sites, including Indian Knoll and Carlston Annis. Though the Chiggerville Site was first described in the literature by Moore (1916), it was excavated by the University of Kentucky Museum of Anthropology under the auspices of the Works Progress Administration in 1938. One year later, Webb and Haag (1939) published the site report, the first detailed report on a Green River shell mound. Webb and Haag (1939) recorded a total of 53 features from the site, the vast majority being hearths which suggest habitational occurring at the site. A strong mortuary component was also present, as 114 burials were excavated. Though no radiocarbon dates have ever been obtained from the Chiggerville Site, its strong similarities to other well-dated Green River shell mound sites indicate placement in the Late Archaic period.

The Chiggerville human skeletal collection is currently curated at the University of Kentucky Museum of Anthropology. Since its excavation, few osteological analyses have been performed on the collection. As part of the Webb and Haag (1939) site report, Ivar Skarland, a physical anthropologist at the University of Kentucky, performed some preliminary demographic analysis on the collection, but he admitted his age determinations and sex estimates were "at best ... arbitrary and relative" (Webb and Haag 1939:29). Most of his analysis consisted of cranial measurements as at that time in anthropology cranial morphology and its correlates to race were of prime importance.

The skeletal collection lay dormant until the mid-1970s when two Western Michigan graduate students, Sullivan (1977) and Wyckoff (1978), performed paleopathological and paleodemographical analyses as part of their Master's theses. Wyckoff examined biological relationships and growth at Chiggerville. Sullivan examined the skeletal pathologies, including osteoarthritis. He reassessed age criteria and deduced the sex of the population.

Unfortunately, the adult age estimates by Sullivan (1977) were taken from unreliable markers, such as dental attrition and cranial sutures. Dental attrition is especially difficult in Archaic skeletons, because extreme wear on teeth, even in young individuals, is common. Though the pubic symphysis is regarded as one of the best age estimators, their preservation in archaeological samples is often very poor. This collection is no exception, which includes only nine symphyses among 61 adults. Before the re-analysis of arthritis in this study was performed, the adults were re-aged with a more recently developed technique, the morphological changes of the auricular surface of the sacro-iliac joint in the pelvis (Lovejoy et al. 1985).

METHODS

A total of 61 adults (33 males and 28 females) was macroscopically examined for the presence or absence of arthritis in the major appendicular joints of the body namely the shoulder, elbow, wrist, hip, knee, and ankle. Arthritis was recorded with respect to age, sex, and side of each individual. With respect to side, arthritis can be characterized as either symmetrical (affecting both sides of the body equally) or asymmetrical (affecting predominately one side of the body).

When neither morphological changes of the auricular surface of the sacro-iliac joint (Lovejoy et al. 1985) or changes in the pubic symphysis (Gilbert and McKern 1973; Katz and Suchey 1986) of these two elements was preserved, cranial sutures and amounts of osteoporosis were used to place adults in broader age categories. Sex was determined using the morphology of the pubic bone (Phenice 1969) as well as skeletal robusticity. Arthritis manifests on bone in three distinct kinds of lesions: porosity, lipping, and eburnation. These were recorded in degrees of severity: trace, slight, moderate, and severe. For the purposes of this paper, trace and slight scores were combined and recorded as absence of arthritis, while moderate and severe scores were combined and recorded as presence of arthritis. When possible, arthritis also was noted when it seemed to be of a secondary origin, such as a fracture. In other words, instead of the arthritis resulting from "wear and tear" on the joint, it may have been because of a fracture in the bone, which results in the malalignment of the joint and subsequent arthritis. Other factors also can be involved in the etiology of osteoarthritis. which will be discussed later.

RESULTS

With respect to age. the results followed an expected pattern. Arthritis frequencies become greater with increasing age in both males and females. When arthritis is compared in males aged between 20 and 40 years with those aged 40 and over. a clear increase is seen in all the joints (Figure 1). In females. the same increasing pattern can be seen in all except the ankle (Figure 2). This is not surprising. as arthritis is a degenerative condition with age. meaning more years of "wear and tear" on joints translates to more arthritis.

When arthritis is compared between males and females. some interesting results are found. Males tend to have an earlier onset of arthritis than females. In the 20-40 year age range. males had greater frequencies than females. especially in the elbow and shoulder. and a little more in the knee (Figure 3). This. however. could be due in some part to a fewer number of females in this age range. When frequencies of arthritis of all age groups are examined. males still have greater frequencies of arthritis in the shoulder and slightly greater numbers in the elbow and hip (Figure 4). Females show greater numbers in the wrist while the knees and ankle are much the same.

When the right and left sides are compared in males and females. there are no glaring differences (Figure 5). Males have somewhat more arthritis in the right shoulder than the left. This could represent mere handedness or possibly an activity putting one side of the arm under more stress. Females have somewhat more arthritis in the right wrist and hip than the left (Figure 6). Again. like the males. this either represents handedness or is the result of a specific activity.

Overall. 70 percent of males and 54 percent of females had at least one joint exhibiting arthritis. despite the higher average age of females in the population. When all the joints are tallied. though. males exhibit arthritis in 20 percent of their joints. while females exhibit 17 percent.

DISCUSSION

Even with the small sample size at Chiggerville. some preliminary conclusions can be made about sex differences. In particular. males have more arthritis of the shoulders. and females have more arthritis of the wrist. This could very well be due to different activity patterns between males and females. Males were probably involved in activities resulting in stress in the upper arm. Females. on the other hand. with more wrist arthritis. were probably involved in activities resulting in stress in the lower arm.

It is difficult to pinpoint any specific activities that could lead to these results. It is far too simplistic to explain these arthritis patterns as hunting stresses in men and gathering stresses in women. It appears that males may have engaged in more physically stressful activities at a younger age. This is very speculative. however. because females under the age of 40 are much under-represented in the population when compared to males in that age range.

This study looked for lesions to determine whether any asymmetrical pattern among the Chiggerville males could be found in the elbow and shoulder. Only those individuals where both sides were preserved enough to accurately score were used. In all. 78 percent of the males with arthritis of the shoulder exhibited arthritis of both shoulders. Likewise. 75 percent of the males with arthritis of the

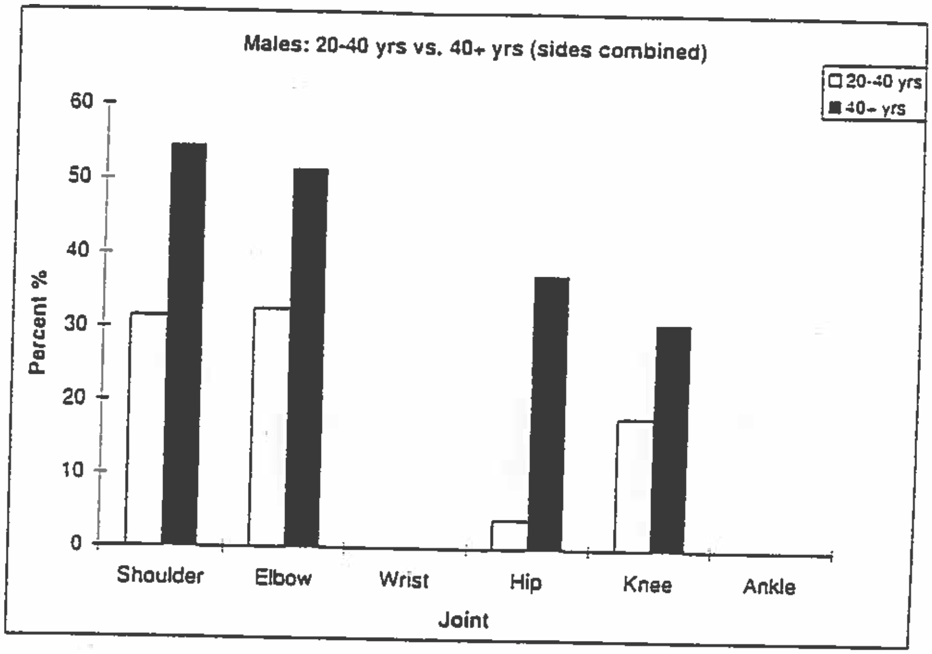

Figure 1. Comparison of Arthritis Frequencies in Males 20-40 Years and Males 40 Years and Over.

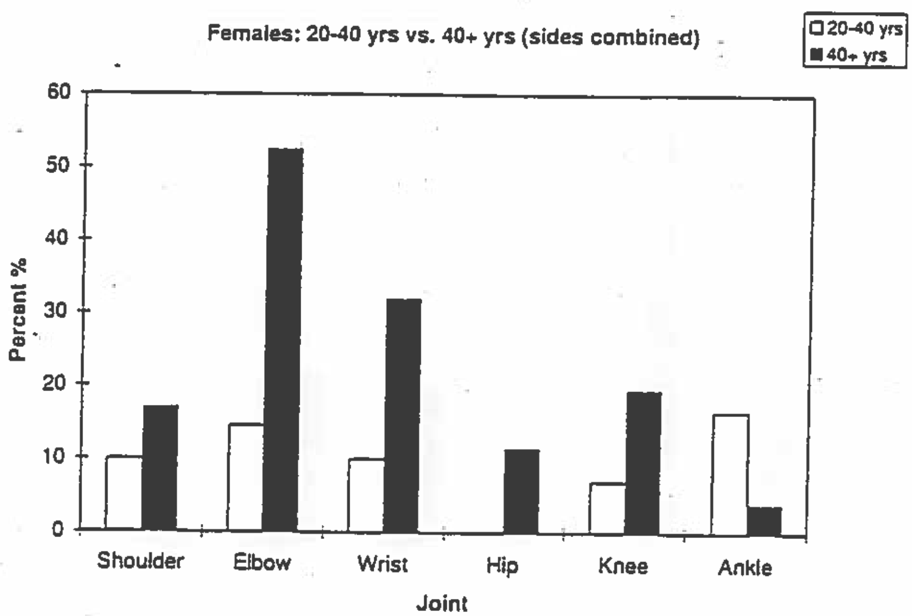

Figure 2. Comparison of Arthritis Frequencies in Females 20-40 Years and Females 40 Years and Over.

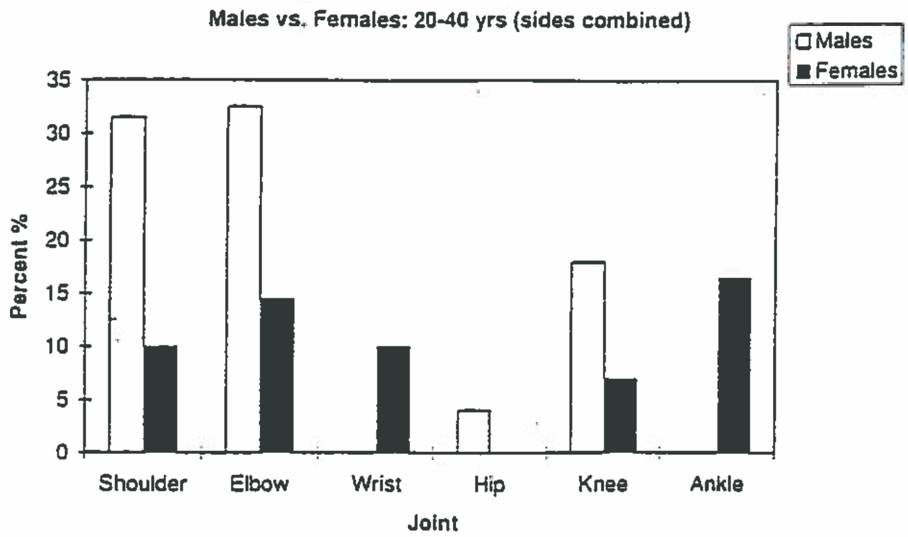

Figure 3. Comparison of Arthritis Frequencies in Males Versus Females 20-40 Years.

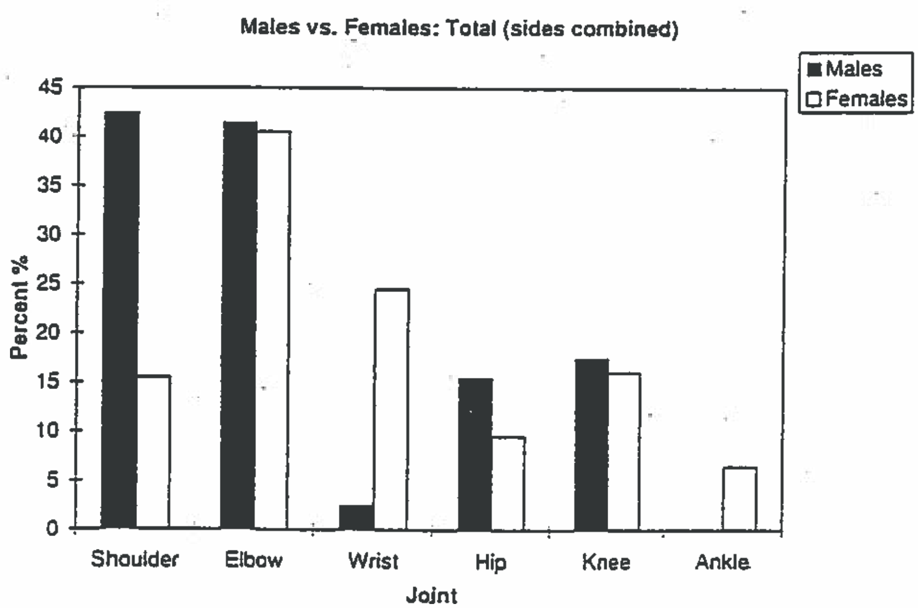

Figure 4. Comparison of Arthritis Frequencies in Males Versus Females.

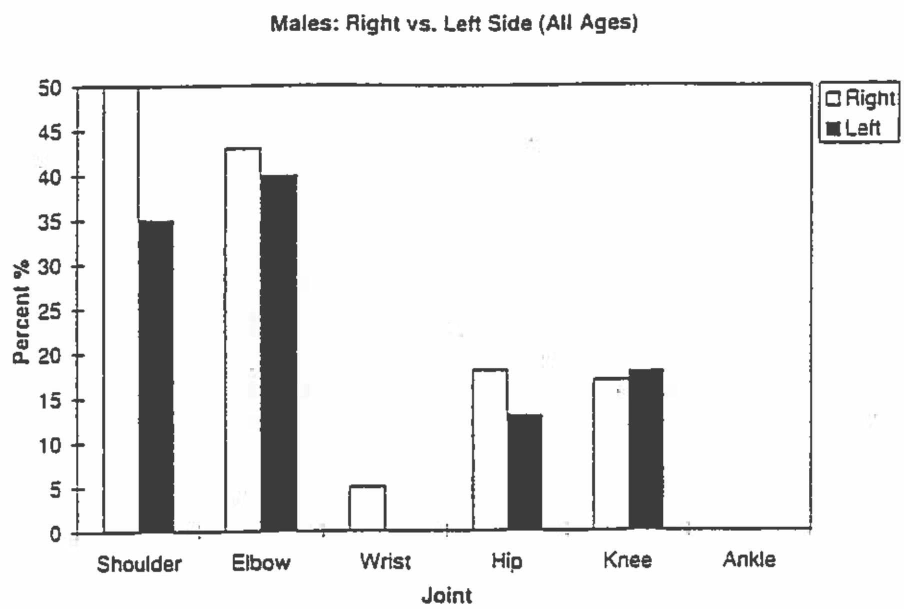

Figure 5. Comparison of Arthritis Frequencies in Right Side Versus Left Side in Males (All Ages combined).

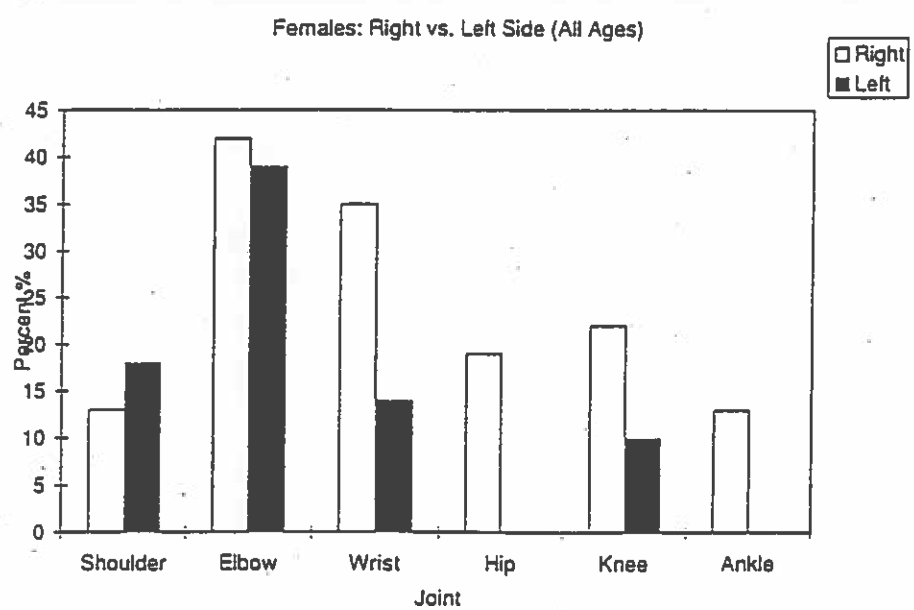

Figure 6. Comparison of Arthritis Frequencies in Right Side Versus Left Side in Females (All Ages combined).

elbow exhibited arthritis of both elbows. This is not the asymmetrical pattern expected to be seen from the use of an atlatl.

The overall arthritis patterns from the Chiggerville Site are compared here with Bridges' (1991) findings in her Pickwick Basin Archaic sample (Figure 7). Overall they are very similar, especially in the shoulder, elbow, and wrist. They also are similar in that neither shows marked asymmetry of the elbow and shoulder. These similarities may be due partly to comparable subsistence strategies in the two groups. Both are located near rich riverine resources, which could have meant the need for hunting large game. Thus, the use of the atlatl, may not have been as prominent as is often assume. As Bridges (1991) suggested for the Pickwick Basin Archaic sample, gathering of plants, river resources, and the hunting of small animals may have an equally or more prominent role in the Green River subsistence strategy. Bridges' (1991) results were in contrast to her earlier study in which she found increased bone dimensions and cross-sectional structure among the agriculturalists, especially among women (Bridges 1989). She suggested that among agriculturalists repetitive forces on the bone could have acted more on increasing bone density and dimensions than cause arthritis. This also is in contrast to other groups, such as the Inuit Eskimos, where hunting with harpoons is prominent. This created more constant physical stress on the arms of males, and Inuit skeletal samples have shown asymmetrical arthritis of the arms in males.

CONCLUSIONS

It will be interesting to see how this Chiggerville data compare with later agricultural skeletal populations in Kentucky. Will future research reveal that arthritis increased with agriculture as in the Illinois sample, decreasing arthritis as in the Georgia coast, or will it follow the Northern Alabama model, where the frequencies are not significantly different between the two? To help answer this question, it is necessary to place the Kentucky data into broad regional comparisons.

To summarize briefly the results of arthritis frequencies among the Chiggerville sample:

1. Males exhibit more arthritis of the upper arm represented in the shoulder, where females exhibit arthritis more of the lower arm (wrist).

2. Males did not exhibit marked asymmetry of the shoulder and elbow, thus revealing no osteological evidence for the physical stresses involved in the use of the atlatl. This may be the result of heavy reliance on a gathering subsistence strategy for many months of the year.

3. Arthritis frequencies closely resemble those of Pickwick Basin hunter gatherers (Bridges 1989).

Only larger data sets can yield a clearer picture of prehistoric arthritis in Kentucky and how it relates to specific activity patterns. The Chiggerville sample was small with poor preservation, none the less some interesting questions can still be asked of these data for the future.

1. Ultimately, of course, what do these patterns of arthritis really represent? How well does the osteological evidence relate to actual patterns of physical work loads and stress among hunter-gatherer and agricultural populations?

2. Will future work on Green River Archaic skeletons exhibit evidence of symmetrical arthritis

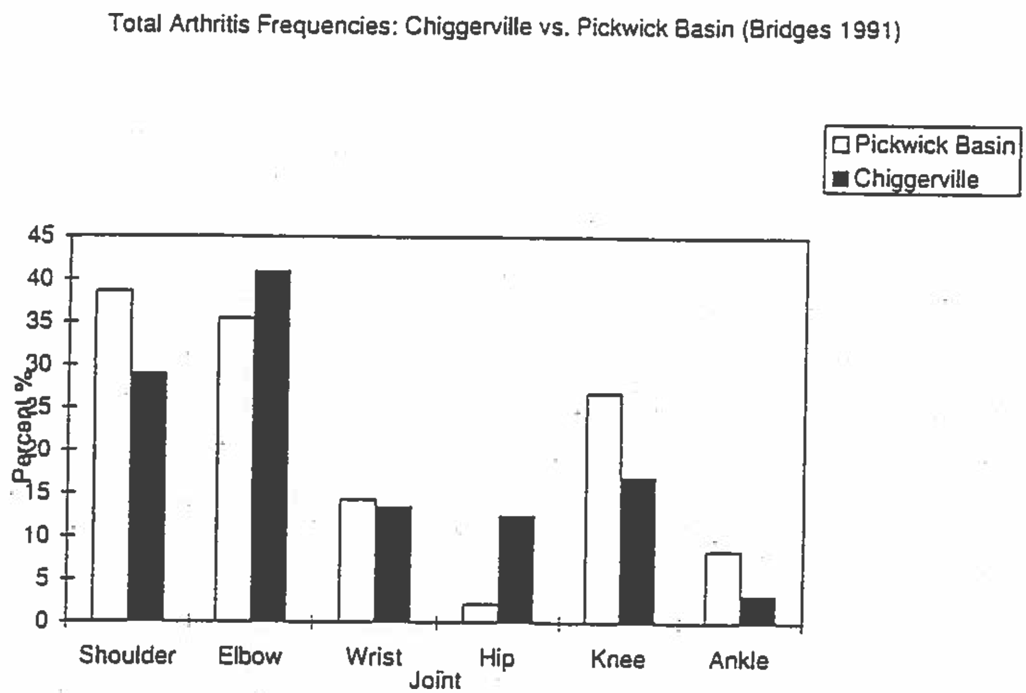

Figure 7. Comparison of Arthritis Frequencies in Chiggerville Versus Pickwick Basin (Bridges 1991).

in the elbow and shoulder in males, thus supporting the atlatl elbow hypothesis, or will it follow the model presented here?

It is hoped that this research can help in answer these questions, thus providing a foundation for broader comparative studies.

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MOTHERS' WORK LOADS AND THE ORIGIN OF SEX ROLES IN THE MIDWEST-MIDSOUTH REGIONS

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ABSTRACT

This paper reviews the prospective work of women in the Archaic. Woodland. and Mississippian periods. relying on the skeletal evidence. to argue that women's and mothers' work loads were progressively more taxing as production for ceremonies and horticulture and agriculture were added to their tasks. Evidence indicates that mothers coped with these labor and time demands by weaning children earlier and it is proposed here. by pressing older children into childcare responsibilities. and camp and field labor. A review of the skeletal evidence of child nutrition and health lends support to these proposals. It was in the search for weaning foods that maize was adopted in these two regions.

INTRODUCTION

Most attempts to look for gender in archaeological site and settlement pattern data have addressed sexed work roles and changes in those roles. This paper reviews the bioarchaeological literature concerned with sex roles for the precontact period Midwest (Illinois. central Mississippi. Ohio rivers) and Midsouth (Tennessee River) regions to assay the evidence for sexed worked roles and life experiences. The conditions under which strongly sexed work roles occurred in the prehistory of the regions are examined by referring first to the anthropological literature and then the bioarchaeological literature about children in these two regions. The influence of maize in these changes will be discussed. This paper proposes that the impact of mothers' increasing work loads was to wean children earlier and to require that older children become caretakers for younger children as well as be responsible in other ways.

While it is tempting to talk about gender in this review. the argument presented here is based on sexed skeletons. Gender in these societies was probably based not on soft tissue as it is in our society. but on behavior and dress. neither of which is recovered from these burials. The terms "male" and "female" are used here to denote the skeletal/biological category. but not to imply the genders man and woman. nor to limit the number of genders to two. A crucial aspect of my discussion of mothers is the use of nursing to feed infants so that "mothers" in this paper are always females (see Bolen 1992 for a discussion of mothering that liberates females as the exclusive mothers.)

FEMALE WORK IN THE MIDSOUTH--MIDWEST REGIONS

THE ARCHAIC PERIOD

The transition to the Holocene environment of this region is accompanied by increases in quantities of artifacts of particular types, increases in sites, and increased evidence of plant processing. All three observations could be indicating not only an increased number of people but also social groupings much smaller than those characteristic in the Pleistocene environment. The work loads of both females and males in the Midwest--Midsouth regions probably increased significantly with the establishment of the Holocene environment, not only because an increased food variety increased search time (greater geographical diversity of foodstuffs, frequent harvesting due to storage limitations) and food preparation time (due to an increased variety of ways to process the diverse foods) but also because tool manufacture and maintenance time increased. Where large social groups offer opportunities to share equipment and even specialize in activities, small social groups must be fully equipped and members prepared to perform a range of activities. Greater numbers of social groups create more sites and more artifacts than do fewer social groups, even when population is held constant. The Early Archaic period may have had a social organization of small social groups year round.

The Middle Archaic to Late Archaic transition saw many groups in the Midwest--Midsouth regions adopt a logistical pattern meaning that large aggregates of people are a common feature of the region again at least seasonally. Some of these aggregation loci were at shell mounds where some of the dead were interred by large groups in rituals led by female and male shamans, gatherers and hunters (Claassen 1992). In the lower Illinois Valley probable aggregation points were the bluff top cemeteries where young and middle-aged adults were buried. The ceremonial life of these aggregate groups surely required significant investments of time by both females and males who prepared foodstuffs, trade/gift items, and prepared for and enacted their roles in ceremonies.

The bioarchaeological literature contains the best evidence of workloads for females. Perzigian (cited in Cook 1984) uncovered greater sexual dimorphism in the Archaic Indian Knoll population than in the Middle Woodland Klunk series, which could be the result of different activities. Cassidy (1984:326) suggests that the higher rates of wear-related stress beginning earlier in life in a subsample of Indian Knoll skeletons might mean that males were more physically active than females.

THE WOODLAND PERIOD

During the Early and Middle Woodland periods females' work loads came to incorporate the new activities of at least clay quarrying, pottery manufacture; new food procuring techniques, most notably planting and weeding; storing, food preparation, and cooking techniques; greater time requirements for burial ceremonialism--mound building, tomb construction, body preparation, grave goods production, time in ceremony (given the tremendous increase in the number of mounds and the number of burials), and more children as birth rates increased.

Adena burial practices favored the placement of males in mounds and females and children in rock shelters (Snow in Cassidy 1984:327). From the latter point Webb and colleagues concluded that rockshelters were the domain of women (Cassidy 1984:327). I think it highly likely that the Early and Middle Woodland rockshelters with cached cultigens were storage facilities and harvest season camps for women.

Watson and Kennedy (1991) assert that women were the ones causing the genetic changes in the cultigens, as well as causing the habitat changes. Women must consciously have developed races and varieties of cultigens and domesticates by conducting breeding experiments, observing the progeny, selecting seed stock that was hardier, in short, consciously manipulating the gene pool of target plants. By Middle Woodland times, the native cultigens required clearance of riverbanks and floodplains, planting, tending, harvesting, parching of seeds, preparation of storage containers and pits, and innovations in pottery technology for cooking seeds (Braun 1985).

In the Lower Illinois Valley skeletal populations, there were different status-based diets in the Middle Woodland population and in Late Woodland populations, they were based on sex. Taller males had more goods than did shorter males indicating dietary differences (Buikstra 1984) while higher and lower status females did not appear to differ in stature. Females from the Ledders Site had elevated levels of strontium compared to males. The interpretation is that women had less access to animal protein than did men (Lambert et al. 1977) probably indicating that women and men consumed more of the products of their own labor than they shared those products. I take this dietary trace element difference to be indicating further that women were the horticulturists. Diets may be more democratic somewhat later in time. Individual consumption of maize varied widely in the Late Woodland and Emergent Mississippian periods (Bender et al. 1981, Buikstra et al. 1986:530). Sex differences in isotopic values were noted by van der Merwe and Vogel (1978). Both male and female status groups differed in stress-related dental defects (Cook 1984:242).

Hamilton (cited in Cook 1984:243), in examining Illinois skeletal samples, found that the early Late Woodland burial sample showed decreased sexual dimorphism from that characteristic of Middle Woodland populations, because of increased female size. Greater robusticity was particularly evident in the female upper arm. In general, the decreased sexual dimorphism indicates that women's work was requiring strength from the same muscle groups as those delivering strength in males. In Late Woodland times, female size decreased increasing sexual dimorphism. Data from southwestern Ohio sites show that sexual dimorphism was least among the Late Archaic and most among Middle Woodland peoples (Perzigian et al. 1984:350).

Degenerative pathologies--osteoarthritis, osteophytosis, and degeneration of the vertebral centrum-- increase through time significantly in Dickson Mounds affecting males more frequently than females and are related to work habitually performed (Goodman et al. 1984:295). Unfortunately, Goodman et al. do not provide information on the loci of degeneration, which would allow for a discussion of the prospective work differences.

THE MISSISSIPPIAN PERIOD

Bridges (1989, 1994) examined Archaic and Mississippian populations from the Perry Site on the Tennessee River in north Alabama to gather data on habitual activities. Mississippian males had greater changes in legs, females in arms and legs--changes that increased their strength. The use of mortar and pestle is the activity most obviously different for women while the use of bow is evident in men. The introduction of maize agriculture seems to have brought little difference to the type of work men did but greatly changed the type of work women did (Bridges 1989: 392).

Hamilton's examination of Mississippian skeletons from Illinois sites found that sexual dimorphism again declined as women became more robust in the upper arms. Tasks associated with agriculture are thought to be responsible for the increased size of women--tasks like weeding and pounding seeds in a mortar. In the lower Illinois Valley, females evidenced more arthritis in their left arms and spines than in earlier periods and the arms of males become more symmetrical in size. Lessened sexual dimorphism was observed in the Fort Ancient lifestyle (Perzigian et al. 1984:350). The femoral midshaft index further indicated a somewhat less physically demanding way of life for the Fort Ancient peoples than the Hopewellians experienced. In the Middle Mississippi valley, both osteophytosis and osteoarthritis rates rise late in the Mississippian period suggesting "a decline in mechanical stress with increased reliance on agriculture" (Rose et al. 1984:412). Femoral heads increased in size among males and decreased in size among females during the period influencing the view of increased sexual dimorphism late in the Mississippian (Rose et al. 1984).

Adult males from Dickson Mounds had more traumatic lesions in their postcranial skeletons with fractures most common on humerus, clavicle, ulna, and radius. While these data may indicate that male work stress had increased while female had not, it is just as likely that interpersonal male strife/competition has increased in this era (Goodman et al. 1984).

THE DEVELOPMENT OF SEXED WORK ROLES

The development of sexed work roles within native societies (e.g. female horticulturists, potters, cooks, child care workers; male hunters, gamblers, travelers, fighters) appears to have at least one cause in mother's work loads and expectations of children's labor. Children in hunting/gathering societies may gather food (Hadza children gather up to 50% of their food needs) or they may do little to nothing related to the food quest (!Kung). It has been argued that the !Kung children are not productive because the population density of the Kalahari is so low, the plants and animals so well known, and water too heavy for children to carry (Draper 1975). They do not participate in child care because there are enough adults in camp. Although the Hadza camps rarely have adults in them, parents leave children nonetheless but take infants. Children are not used as care givers in either situation. With the adoption of agriculture or other labor intensive activities that subtract the mother regularly from camp, however, even infants are left behind. In that situation, infants' diets are supplemented, they are weaned earlier, and they are cared for by children.

Draper (1975) could find no work expectations of !Kung girls or boys, no "cultural pressures," in the bush that determined the sex roles or personality traits so commonly associated with men and women of the world. Yet girls stayed closer to camp or in camp, had more interaction with adults, particularly women, and had less interaction with girl peers than did boys. Play groups were, however, rarely sex-segregated and girls were more often engaged in rough play than were boys before eight years old. Instead, Draper spoke in terms of proclivities on the part of girls to stay close to adults and that this proclivity came to be exploited by sedentary !Kung. The new types of work for sedentary !Kung women and children are food storage, more involved processing of new foods (corn and sorghum), keeping domesticated animals out of harm or from harming. Greatly busied mothers in sedentary villages call upon girl children to run errands, and tend children because girls are more often at hand.

When production is centered in the household, when women's work takes them away from home several hours daily, or when women's subsistence work is demanding, children are expected to be responsible and obedient (Draper and Cashdan 1988:341). Responsibility involves child care, field labor, water fetching, food processing, cooking, storage, animal tending, and errand running. Sexed roles are formed in this situation. Several authors have noted that obedient and responsible children are stressed less by adults among foragers, simple horticulturists, and in industrialized cultures and most by agriculturists.

The implications for sex role development in the social history of the Midwest-Midsouth region are profound--strong sex role formation would not have been present from the beginning of human occupation in the region but was triggered by work loads so demanding that mothers had to leave infants in the care of children. Work loads, while increasing during the Archaic, should not have required women to leave infants behind. The need for obedient, responsible children probably occurred with the move to greater reliance on local domesticates during the Middle Woodland. It could be that the (1) horticultural intensification evident in increased seed numbers, decreased natural floodplain woods, and seed to nutshell ratios, (2) production of durables and consumables for gift/trade, and (3) ceremonial activities of Adena and Hopewell culture, combined to produce work loads that took mothers away from home daily, situated some production activities at the home, and taxed mothers' energy. To cope with these demands on their time, they required older children to take on responsibilities-- caring for younger children, crop work, food processing, etc. Sexed roles would have formed during this period and intensified with the adoption of maize agriculture--earlier in the Fort Ancient area, later in the Mississippi Valley. As maize agriculture faded in some areas with the decline of Mississippian cultural influences a relaxation of sexed roles should have occurred. In fact, there is little indication of working children in the ethnohistoric literature (Alice Kehoe, personal communication, 1996).

BIOARCHAEOLOGY OF CHILDREN OF THE MIDWEST-MIDSOUTH

If mothers work loads were such that they left nursing infants behind with older children the bioarchaeological data should reveal evidence of earlier weaning, and possibly evidence of increased work by children. However, the failure to study infant and children's skeletons in general in collections of the Eastern United States makes it impossible to assess several aspects of this proposal at this time. Do children's skeletons show their incorporation into horticultural activities? What tasks are children performing in Mississippian times? Are infants fed carbohydrate substitutes earlier than the Middle Woodland? When does maize replace the native crops in weaning diets? What are the nutritional consequences and differences of a weaning diet of the native starchy seed crops or of maize?

WEANING

Weaning studies have been conducted utilizing dental information (Cook and Buikstra 1979), the ratio of Sr to Ca in juvenile bones (Sillen and Smith 1983), δ 13C (Katzenberg et al. 1993), and δ15N (Fogel et al. 1989; Katzenberg and Pfeiffer 1995; Katzenberg et al. 1993). In the two regions under study here, weaning diets have largely been addressed using dental information.

Few dental abscesses were observed in sub-adults of Early Woodland Adena populations (Cassidy 1984:327). Dental health was quite good in a sample of 14 children from Salts Cave (Cassidy 1984:329). Cook and Buikstra (1979) argue that increased child dental problems in the Middle Woodland period (after 1500 years ago) of the Eastern U.S. are indicative of the use of the native starchy seeds as weaning food at this time. Such an observation suggests that either earlier mothers did not wean children with the native starchy seeds or that their use has been greatly intensified to become more visible archaeologically. Mothers further increased weaning efforts in Late Woodland times (Cook and Buikstra 1979).

Investigators of the Dickson Mounds population found that growth indicators (long bone length and circumference, Wilson bands and enamel hypoplasias) showed a decrease in growth rate and an increase in growth disruption in Mississippian infants around the ages of 2-4 years. They believed that the data indicated an increased use of maize in the weaning diet (Goodman et al. 1984:297). The Fort

Ancient Hardin Village skeletal population clearly evidences the transition to a high carbohydrate weaning diet. Caries were "common to rampant at all ages after infancy" (Cassidy 1984:329).

Cook (1984:248) reports that in a comparison of Harris lines on Middle Woodland, Late Woodland, and Mississippian children's skeletal elements, the introduction of maize was marked by fewer Harris lines. Lowered levels of acute stress appear at age two in the Late Woodland sample "when children are being weaned onto a high-carbohydrate maize diet with resulting growth failure," while the Mississippian sample shows low numbers of Harris lines throughout infancy and childhood. Body composition, P/Ca ratio, secondary hypoparathyroidism, *activity levels*, and other complicating causes can be invoked to explain the appearance of less stress in the maize reliant population.

In children older than six months Cribra orbitalia, an anemia, is associated with other indicators of nutritional stress supporting "the interpretation of weaning age protein-calorie malnutrition that is most pronounced in the late Late Woodland" (Cook 1984:258).

CHILDREN'S WORK

Within a subsample of skeletons from Indian Knoll (Archaic), Cassidy (1984:324-325) found evidence that growth arrests "in utero or in the first few months of life were unusual, growth arrest in the later months and early childhood was frequent but short-lived, and growth arrest in mid-childhood was infrequent and mild." Mild arthritis in Adena subadults has been noted (Cassidy 1984:327). These findings are in keeping with a notion that Archaic sub-adults were not pressed into much work.

Bone fractures were highest at Dickson mounds in subadults of the Middle Woodland period and decreased through time thereafter. While frequent bone fractures are considered to indicate work stress, and could therefore indicate that children were doing less work in Mississippian times, it could be also that for children less play and less exploration or more work around the camp resulted in fewer fractures.

Buikstra et al. (1986:538) observed that juvenile mortality decreased from Middle Woodland through Mississippian times in the lower Illinois Valley. It could be that as these societies came to value children for their labor potential conditions for children attracted more attention, which enhanced their survivorship.

SUMMARY AND CONCLUSIONS

This paper has advanced the hypothesis that mother's work loads increased to the point of needing to employ children as baby-sitters during the Middle Woodland period and thereafter. Use of children for child care and other field and home labor gave rise to the sexed adult work roles recorded in historic documents. The bioarchaeological evidence for female work and for children's weaning and work has been examined.

The evidence for Archaic period work loads seems to indicate that all women may have performed more subsistence and food preparation work in the Middle and Late Archaic than had earlier women. Men were under more stress than were women and women did lighter work than what they performed later in prehistory in the two regions. Late Archaic women may have performed more production and ritual work than did earlier women.

Both strength and time requirements for work increased with the new Woodland activities. A possible new female site type emerges--the rockshelter storage site. Diets are differentiated by sex in Late Woodland times. In addition to the increased time and strength requirements for Woodland Period work, mothers probably bore a greater number of children. In a review of life during the Late Woodland/Mississippian period in the lower Illinois Valley, Buikstra et al. (1986:531) write, "it is clear that female work-related pathology changed significantly (Pickering 1984) in a way that would be consistent with a model of increased labor for women with the acquisition of maize agriculture." particularly in food preparation and food transport.

Work performed by Mississippian females habitually involved grain processing, hoeing, and weeding, as well as other activities that increased strength requirements. Males experienced increased social strife. In Ohio, the Fort Ancient lifestyle was less physically demanding than had been that of the Hopewellian era; such was not the case in the Lower Illinois Valley or the Tennessee Valley.

When demands exceeded time available, it seems that there were several options open to pre-contact peoples to manage time. Task specialization would exempt most people from doing a particular task. Substituting tasks would keep the number of tasks constant. Increasing the number of workers would help, perhaps drawing upon idle children or elderly individuals. What indications are there that time management was practiced in this region and when do these signs appear? The change from shell mounding to dirt mounding at the juncture of the Late Archaic and Early Woodland periods may be such a labor and time saving decision. The adoption of pottery for direct heat cooking may be another (Sassaman 1993). That both of these changes occur in the Early Woodland period further suggests that time management may be a new concern in the Woodland period. Furthermore, mothers used carbohydrate rich seeds to wean children at a younger age in the Middle Woodland and increased these efforts in Late Woodland times (Buikstra et al. 1986). Weaning children earlier would allow infants to be left behind and mother to work more energetically both because she is unencumbered and undistracted and also because the heavy energy demands of lactation will cease sooner. The increased workload and economic responsibility of women late in prehistory may well have earned them higher status (Cohen 1987).

Buikstra et al. (1986) argue that the population increase of the Midwest during the Woodland period was due to an increase in fertility. They demonstrate that the most likely cause of the increase in fertility was the dietary improvement in weaning foods, which allowed for earlier weaning and thus shortened periods of postpartum amenorrhea and shortened birth intervals (see Holland 1989 for explanation of cause and effect). More specifically "the nutritional mechanism for shortened birth intervals accompanying sedentism lies in access to soft foods appropriate for weaning diets (Buikstra et al. 1986:540). They view the crucial step in the weaning process to be not the wide scale planting of carbohydrate-rich seeds of goosefoot and knotweed but the innovations in cooking technology (thinner vessel walls) which made it possible to boil these seeds and render both greater carbohydrate returns, and a gruel.

Why there would be an interest in better weaning foods is not explored by Buikstra and her co-authors nor is the question of why more children would be tolerated. One strong possibility for greater weaning effort is that mothers' work loads increased after Early Woodland times necessitating that they expend more energy than previously at work and be absent from home regularly and quite possibly that some production activities be located in the home. Mothers' work loads necessitated the use of baby-sitters who needed a supplemental food for the infants in their care.

It seems that the work load level for mothers that necessitated these changes in child labor and weaning practices was present in Middle Woodland societies of the Midwest rather than the Late Woodland as proposed by Buikstra et al. (1986:540). The evidence consists of the thinning of vessel walls which occurs in the fifth century A.D., the population increase which begins in the Middle Woodland, the visible use of starchy weaning food, and the energy requirements necessary to establish and maintain the social network of Hopewell societies. The procurement of raw materials and the working of those materials, the construction of mortuary facilities, the time spent in ceremony and in building extra-familial social ties were great. Braun (1985) used changes in the diversification of pottery decoration and style to claim greater interaction and cooperation among Middle Woodland groups. Widespread incorporation of distinctive Hopewell decorative motifs into domestic pottery at dozens of localities throughout Midwest after A.D. 200 may reflect a rising importance in domestic orientation. At the same time, pottery styles show greater consistency between different localities as if economic and social ties between neighboring communities became increasingly long-term (Braun cited in Fagan 1991:384). What are the specific types of interactions between women envisioned or implicated by these observations?

It is also during the Middle Woodland that maize first appears in the Midwest region. Bone chemistry studies have failed to find any evidence of Middle Woodland use of maize but floral analyses contradict this impression. It may be that maize was adopted in the Middle Mississippi River Valley area first as an infant food supplement superior to the local domesticates available, but that the practice of excluding infant and children's skeletons from isotopic studies is obscuring this use (e.g. Bender et al. 1981; van der Merwe and Vogel 1978).

At least one strategy for coping with the time management crisis for late pre-contact period females, especially mothers, was to wean children earlier and to endow older children with new responsibilities. Changing mothers work loads during the Middle Woodland brought about changes in cooking, vessel technology, juvenile survivorship, fertility, and the social construction of mothering and childhood. The increased number of children resulting from increased fertility would seem to cancel out any energy gained by a society whose mothers weaned children earlier but the use of children as infant caregivers and children's labor in the field and at home resulted in a net energy gain for first the horticultural and later the agricultural societies of the Midwest and Midsouth. The economic cost of children began to decline in the Middle Woodland, which may have fueled the increased birth rate in a more meaningful way than did simply a shortened period of amenorrhea, answering Holland's critique of Buikstra et al. (1986). While mothers' work loads increased significantly with the adoption of cultigens and domesticates the greatest gain in energy and labor for late Woodland and early Mississippian groups may well have come from the incorporation of children into the labor pool.

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MIDDLE WOODLAND OCCUPATION AT THE MARTIN JUSTICE SITE (15Pi92), PIKE COUNTY, KENTUCKY

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ABSTRACT

The Martin Justice Site (15Pi92) is a multi-component prehistoric and historic site located along the upper reaches of Island Creek, an intermittent tributary of Levisa Fork in east-central Pike County, Kentucky. Temporally diagnostic prehistoric artifacts recovered from the site suggest that it was occupied from the Middle Archaic to the Late Woodland periods. This paper focuses on two identified Middle Woodland occupations at the site that were largely the result of residential base activities. The two Middle Woodland occupations are interpreted to have been long-term residential camps, lasting several months. The earlier occupation contains evidence of a habitation structure with interior features and outside activity or work areas. The more recent occupation consists of remains associated with what could best be described as family hearths or households. It is composed of multiple features representing more than one functional type, drop and toss zones, site furniture, and a possible structure. The limited artifact assemblage and the relative density of plant foods suggest that daily, rather than intensive high bulk, procurement and processing activities were undertaken at the site.

INTRODUCTION

The Martin Justice Site (15Pi92) is a multi-component site located in the Cumberland Plateau area of the Eastern Kentucky Coalfields Physiographic Region, Pike County, Kentucky (Kerr and Creasman 1995). It is situated near the headwaters of Island Creek, a minor tributary of the Levisa Fork of the Big Sandy River, at an elevation of 366 m AMSL approximately 12 m above Island Creek. Island Creek flows in a southwesterly direction for some 3.38 km before emptying into Levisa Fork (the upper reaches of Fishtrap Lake). In the general area of the site, the landscape is dissected with narrow ridgetops, steep sideslopes and narrow V-shaped valleys. The site occupies a sloping terrace or bench at the mouth of a relatively large hollow perched about midway in elevation between local bottoms and ridgetops. This landform is covered with a thin mantle of colluvium.

Vegetation within the site area consists of a thick growth of weeds, briars, and a few scattered saplings. The site is situated on Hayter loam, 15 to 30 percent slopes, which constitutes a minor component of the Marrowbone-Fedscreek-Kimper-Dekalb soil association (Kelley 1990). This soil series is deep, moderately steep to steep, and well drained. It occurs on colluvial foot slopes and alluvial fans. Areas with Hayter loam soils are long, narrow or fan-shaped delineations at the base of hillsides or at the mouth of coves. Soil characteristics within the site area are highly varied, but deposition is primarily colluvial. The area has been severely modified by the historic occupations at the site and by subsequent plowing, timbering, and mining activities. Topsoil ranges from 0 to 30 cm in depth and is a dark grayish brown (10YR4/2) to dark brown (10YR4/3) sandy loam. It contrasts with the underlying subsoil, which is a very rocky, dark yellowish brown (10YR4/6) to yellowish brown (10YR5/6) sandy clay loam.

The site was identified when a projectile point cache was observed eroding from the bed of a bulldozed road through the site. Remarkably, no other prehistoric remains were identified in the roadbed or other exposed, disturbed areas, nor in a series of 11 screened shovel probes excavated at the site during the initial investigations. Further inspection of the area where the cache was found revealed that it was associated with a pit feature (Feature 1). Another pit feature was identified in the road (Feature 2) and two additional pits (Features 3 and 4) were identified in an area approximately eight m to the east of the first feature when a frontloader was used to gently scrape disturbed plowzone deposits from three relatively small areas of level ground in the area.

Phase II testing and phase III mitigation efforts identified 29 additional features, 15 postmolds, and a thin midden pocket (Figure 1). Thirty of the features were completely excavated, and three were sampled (50 percent of the feature was excavated). All postmolds were excavated. The majority of the postmolds defined a roughly rectangular structure (Structure 1) located near the northern end of the site. The midden pocket at the southern end of the site was sampled by a 6 x 7 m block (Block A) and then excavating this block in 1 x 1 m units. The excavations at the Martin Justice Site documented occupation debris dating to the Middle and Late Archaic and Early through Late Woodland.

The focus of this paper concerns the Middle Woodland occupations of the Martin Justice Site. The Middle Woodland assemblages are described first, then we investigate the spatial distribution and relationship of site facilities (features and postmolds) to determine the function of the site with reference to site structure and assemblage composition. Finally, employing data from other sites in the area, we explore patterns of general site distribution across the landscape and variations in site function to place Martin Justice in a broader perspective.

THE MIDDLE WOODLAND ASSEMBLAGE AND AGE

This section describes intact subsurface facilities discovered at the site. It also describes and analyzes the material remains recovered from the site. Lithic, ceramic, botanical, and faunal remains are included in the assemblage. The remains provide information on the relative periods of occupation or use of the site. Finally, several radiocarbon dates were assayed for charcoal samples recovered from the site to absolutely date the occupations present.

FEATURES

Of the 33 pit features documented, 13 pit features are attributed to Middle Woodland occupations (Table 1). The largest group of pit features are categorized as hearths (n=7) which comprise 53.8 percent of the Middle Woodland pit feature assemblage. The classification of features as hearths is based on the presence of oxidized soil. Hearths are typically ovoid in planview, basin-

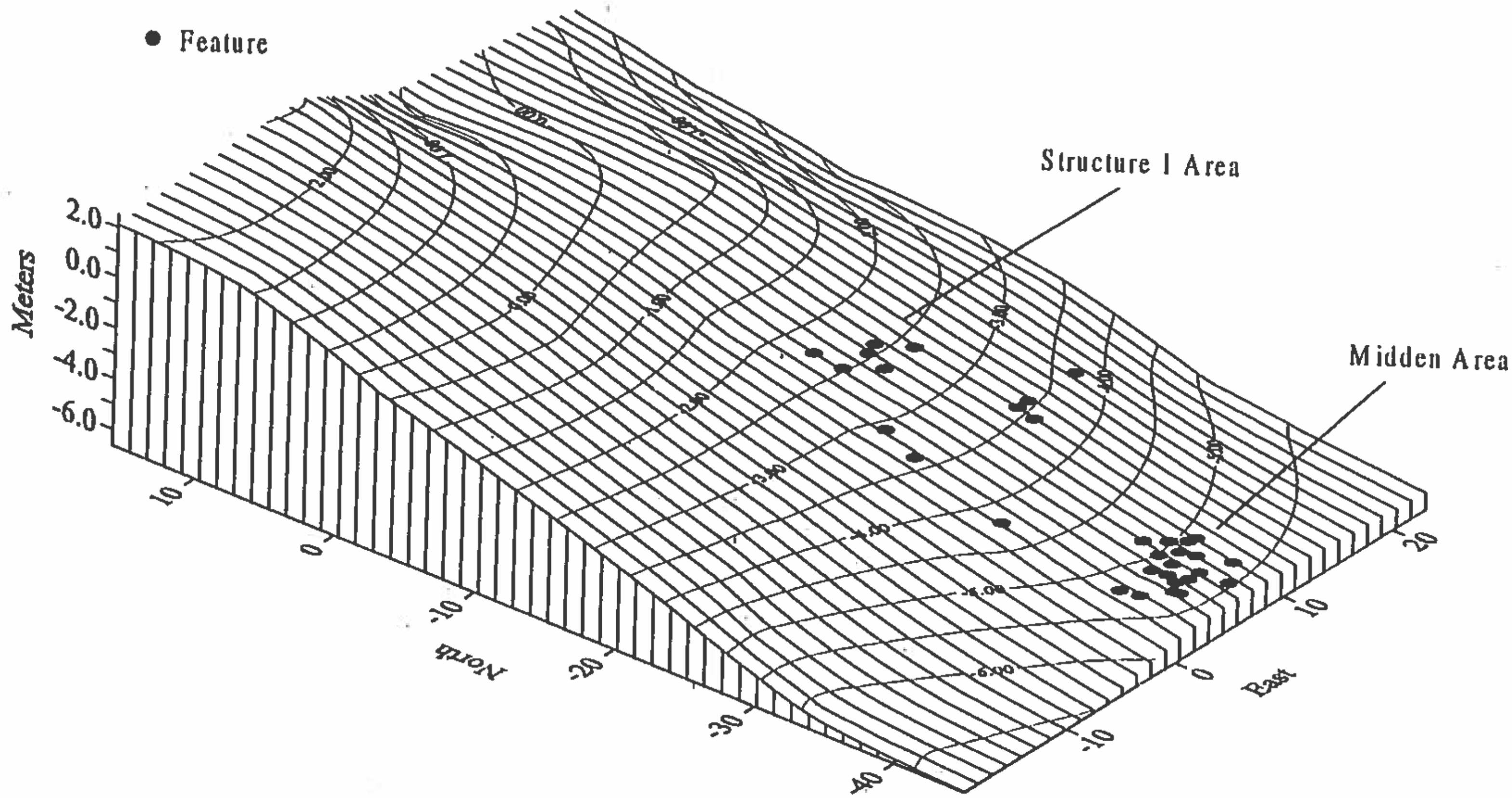

Figure 1. Surface Map Showing the General Distribution of Features at the Martin Justice Site.

Table 1. Amounts and Densities of Debitage, Formed Flaked Lithics Artifacts, Ceramics, and Rock in Middle Woodland Pit Features From Flotation Samples and Excavations.

Feature Number	Feature Type	Volume[a] liters	Debitage n	Formed Artifacts n	Ceramics n	Rough Rock kg	Debitage Density n/l	Formed Artifact Density n/l	Ceramic Density n/l	Rock Density kg/l
1	burial pit?	135.95	11	12	-	33.2	.08	.09	-	.24
3	earth oven	294.74	5	4	94	150	.02	.01	.32	.51
7	earth oven	154.95	31	1	5	149	.20	.01	.03	.96
4	hearth	79.30	3	-	-	21	.04	-	-	.26
5	hearth	105.77	32	1	-	29	.30	.01	-	.27
6	hearth	84.48	27	2	1	33.5	.32	.02	.01	.40
9	hearth	307.20	68	6	25	62	.22	.02	.08	.20
18	hearth	15.16	2	-	-	17.6	.13	-	-	1.16
20	hearth	62.19	7	-	1	28	.11	-	.02	.45
33A	hearth	142.71	33	-	1	3	.23	-	.01	.02
16	shallow basin	11.78	2	-	-	11.5	.17	-	-	.98
19	shallow basin	65.06	7	-	1	26	.11	-	.02	.40
30	shallow basin	48.88	30	2	2	19	.61	.04	.04	.39

[a]Calculated volume.

shaped in profile, large (averaging 94 cm in diameter) and contain several kilograms of rock. The second largest group of features (n=3, 23.1 percent) are classified as shallow basins, primarily due to the absence of associated oxidized soils. However, the density of rock and charcoal within the fill is very similar to hearths, which suggests they may have served a similar function. Earth ovens comprise 15 percent (n=2) of the pit feature assemblage. This class is segregated from hearths based on their large size (depth greater than 35 cm and surface diameter about 100 cm), large volume of rock and the presence of stratified fill. The final pit feature is a possible burial pit containing a cache of Middle Woodland stemmed dart points. Although the cache is of Middle Woodland age, the pit feature in which it was found may not have been. Nut charcoal recovered from the feature was radiocarbon dated to the Late Archaic (4190 ± 80 B.P.; Beta-79596: charred nutshell) and which may indicate that the dart point cache (found at the top of the feature) was intrusive.

In addition to the pit features noted above, 15 postmolds are present. Postmolds represent 31 percent of the total number of features recorded at Martin Justice. Table 2 summarizes the remains recovered from the postmolds. Postmolds, like pit features, are disturbed to varying degrees by historic plowing, prehistoric feature construction (Postmolds 21, 22, and 23), and bioturbation. Postmolds documented at the site are generally ovoid in plan view. The diameter of the postmolds range from 17 to 24 cm, averaging 21 cm. The depths of postmolds show a greater variation, ranging from 6 to 28 cm. The average depth is 14 cm. The variation in depth probably reflects differential degrees of impacts from prehistoric and historic activities.

LITHIC ASSEMBLAGE

The purpose of the lithic analysis is to describe the assemblage and to characterize the manufacturing technologies represented by the assemblage (Pecora 1995). The Middle Woodland lithic artifacts are difficult to separate from the materials associated with other occupations at the site. This section describes artifactual material recovered from the site in general and, where possible, the Middle Woodland materials specifically.

The technological analysis of all the chipping debris identified 1,360 pieces of technologically diagnostic debris (49.9 percent) and 1,363 pieces of technologically non-diagnostic debris (50.1 percent). The majority (n=866, 63.7 percent) of the technologically diagnostic debris is considered to be diagnostic of biface reduction, followed by biface platform preparation (n=430, 31.6 percent) and non-biface (core?) reduction (n=64, 4.7 percent). Biface reduction debris includes early percussion thinning flakes (n=131, 9.6 percent), late biface thinning flakes (n=239, 17.6 percent), early pressure thinning flakes (n=217, 16.0 percent), and late pressure thinning flakes (n=279, 20.5 percent). Non-diagnostic debris includes shatter and unidentifiable flake fragments.

Seventy-seven formed chipped stone artifacts were recovered from the site. The majority consist of tools (n=52, 68 percent) and are dominated by a variety of dart points and dart point fragments (n=38, 73 percent). The remaining tools include seven triangular arrow points (14 percent), four lanceolate shaped projectile points (7.7 percent), a small drill fragment (1.9 percent), and two unifacially modified flakes (3.8 percent). Two of the dart points are recycled into endscrapers. Most of the projectile points are exhausted or fragmented, indicating that they were discarded as waste products. However, 11 apparently unused, large stemmed dart points from a cache of 21 fragments were recovered from Feature 1. These artifacts appear to have been purposely cached at the site (as opposed to discarded), and did not appear to have been used and rejuvenated.

Table 2. Amounts of Debitage, Ceramics, and Rocks in Postmold Features From Excavations.

Postmold Number	Debitage n	Ceramics n	Rough Rock g	Charcoal/ Charred Nutshell g	Cinders/ Coal g
2	2	-	1562.8	-	1.0
3	-	-	109.2	-	.1
6	-	-	408.2	-	.2
8	-	-	842.3	-	5.8
13	-	-	583.8	<.1	.2
14	-	-	959.8	-	.2
16	-	-	1733.4	<.1	.1
17	1	-	1652.9	.4	.1
19	1	-	1771.9	-	.4
20	-	-	163.8	<.1	-
21	1	-	590.0	-	-
22	-	-	166.4	.3	-
23	1	-	103.2	.2	-
24	3	2	65.9	.1	.2
25	2	-	17.5	-	-

Twenty-five non-tool formed artifacts (32 percent), consisting of three biface blank fragments (12 percent), five flake cores (20 percent) and 17 undiagnostic biface fragments (68 percent) also were recovered. The biface blank fragments and non-diagnostic biface fragments are considered products of biface manufacturing failures. The five flake cores are very small, and four specimens appear to have been reduced using a bipolar technique. Finally, 22 sandstone nutting stones (pitted stones) and one sandstone cobble hammerstone were recovered. Nine pitted stones were recovered from Middle Woodland feature contexts (Feature 1, n=1; Feature 3, n=3; Feature 9, n=3; and Feature 30, n=2). The other pitted stones and the hammerstone could not be directly related to a specific occupation. The pitted stones generally are characterized by multiple U-shaped depressions measuring only a few centimeters in diameter. These artifacts were possibly used to process nut resources.

The lithic analysis indicates lithic reduction activities were focused on the final stages of biface tool manufacture and rejuvenation. The presence of early percussion thinning (10 percent) and late biface thinning (18 percent) flakes, coupled with the low percentage of non-biface reduction debris (5 percent) and high percentages of early (16 percent) and late (20 percent) pressure thinning flakes indicate that the bulk of the lithic material was introduced to the site in a biface form. Such bifaces may have included biface blanks, preforms, and finished bifacial tools (projectile points). The low quantities and small size of the non-bifacial reduction debris (core) and few cores suggest that very little core reduction occurred. The small size of the cores, the use of bipolar reduction technique, and the small size of the associated core reduction debris, indicates a great deal of effort was placed on maximizing the utility of the stone tool. Another economizing measure might be reflected by the general lack of tool variability, despite the apparent heavy prehistoric use of the site evident by the feature distribution and evidence for the structure. The majority of the tools consist of projectile points and projectile point fragments (n=49, two of which are unifacially reworked), followed by two unifacially modified flakes and one small drill fragment. It is likely that most of the useable tools brought to and manufactured at the site were removed for use elsewhere. Such economizing measures may be expected considering the distances from the site to viable chert sources.

Two groups of projectile points are associated with the Middle Woodland occupation. One group consists of dart points characterized by a long or elongated, narrow stem form. This group is subdivided into three subgroups based on the stem, shoulder, and base shapes and the overall size of the points. The point cache comprises the first two subgroups, consisting of 11 whole or fragmented points (Figure 2a-d). The third subgroup consists of a point found in Feature 3 (Figure 2e). The second group is represented by a recurvate triangular or lanceolate form (Figure 2f). This point was recovered from Unit 10 of Block A.

The assignment of the first group of projectile points to a specific named type is problematic. Selected attributes of these artifacts are similar to attributes found on a number of projectile points found during the Terminal Archaic through Middle Woodland periods in the region. Regardless, these points are assigned to the Early-Middle Woodland period with a suggested date range of ca. 2950 – 1850 B.P. This date range is supported by radiocarbon dates obtained from the site. Feature 3, with one of these points, returned a date of 2250 ± 60 B.P. (Beta-79597; wood charcoal). Feature 17 gave a date of 2590 ± 110 B.P. (Beta-79599; wood charcoal and charred nutshell) and Feature 5 produced a date of 1870 ± 70 B.P. (Beta-80889; wood charcoal).

The recurvate triangular or lanceolate point is morphologically similar to Nolichucky points first described by Kneberg (1957) for forms occurring on the Camp Creek Site in Tennessee. These points are often included, along with Greenville and Candy Creek types, in the Middle Woodland

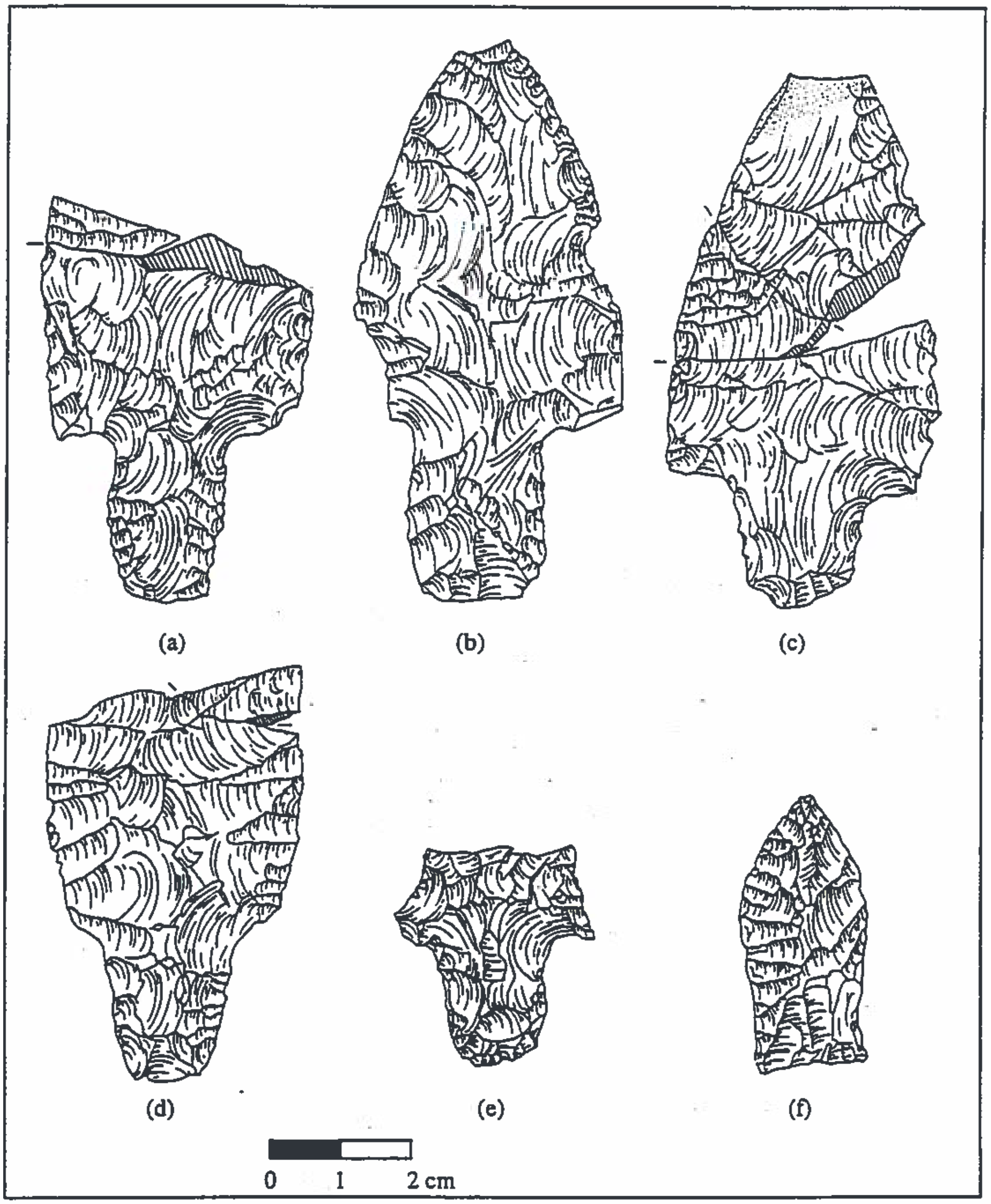

Figure 2. Examples of Middle Woodland Projectile Points: (a-d) representative points from Feature 1; (e)point from Feature 3; (f) point from Unit 10.

Copena Cluster (Faulkner and McCollough 1973; Justice 1987), because of their similar form and co-occurrence. This point also is similar to many Middle Woodland triangular points (Copena, Connestee) identified by Keel (1976) in the Appalachian Summit region. The temporal span for these points is ca. 1800-1450 B.P. The radiocarbon date for Feature 5 of 1870 ± 70 B.P. potentially dates this point and Middle Woodland component at Martin Justice to which it is associated.

CERAMIC ASSEMBLAGE

The purpose of the ceramic analysis is to describe the assemblage and to compare it to existing defined types (Kerr 1995). The ceramics associated with the Middle Woodland period occupations consist of two types: Adena Plain var. Inez and Johnson Plain var. Unspecified. Forty-five body sherds, four rim sherds and one neck sherd are typed as Adena Plain var. Inez. All of the sherds were found in Feature 3, representing one vessel. Temper consists of a moderate amount of medium sized crushed siltstone. Exterior surfaces are well smoothed and almost burnished. Few siltstone particles are exposed on the sherd surfaces. The interior surfaces are similar to the exterior although less burnished. The rim is thickened and flared outwards emphasizing the constricted neck of the vessel (Figure 3). The shoulder and base shapes are unknown, but the body is probably globular and medium sized, and is a typical Early to Middle Woodland vessel type found in eastern Kentucky.

Forty-five body sherds, two rim sherds and two neck sherds are typed as Johnson Plain var. Unspecified. They were recovered from 10 of the units and one postmold in Block A and from eight pit features. The sherds are tempered with a moderate amount of medium-sized crushed siltstone (n=49) or sandstone (n=9). With the exception of the sherds in Feature 3, they are gritty to the touch from micaceous sand present in their paste. The exterior surfaces of the pottery in Feature 3 are well smoothed. They exhibit a somewhat dull burnished appearance. Few temper particles are exposed on the surface of these sherds. In contrast, the sherds of this type in the other proveniences, in general, are poorly smoothed and many temper particles are exposed on surface. The interior surfaces are smoothed. Unlike the exterior surface, many temper particles are exposed on the interior surfaces of all the sherds. One small rim sherd from Feature 3 is straight or direct and exhibits the thickened rim form of Johnson Plain ceramics (Figure 3). The shapes of the shoulder, body and base are unknown. This is an Early to Middle Woodland ceramic type found in eastern Kentucky.

Both types of ceramics described above are associated with Middle Woodland occupations. The Adena Plain var. Inez and some of the Johnson Plain var. Unspecified ceramics are most likely associated with the group of dart points characterized by a long or elongated, narrow stem form. All the Adena Plain var. Inez and most of the Johnson Plain var. Unspecified ceramics were recovered from Feature 3, along with one of these points. They represent the earliest of the Middle Woodland ceramics at the site. Feature 3 is radiocarbon dated to 2250 ± 60 B.P. Feature 17 also contained Johnson Plain var. Unspecified pottery and is radiocarbon dated to 2590 ± 110 B.P. Some of the Johnson Plain var. Unspecified ceramics are possibly associated with more recent Middle Woodland occupation and a radiocarbon date of 1870 ± 70 B.P. for Feature 5 possibly dates these ceramics.

BOTANICAL REMAINS

Botanical remains recovered from Middle Woodland features consist of nutshell, seeds, fruits, and wood charcoal (Crites 1995). *Carya sp.* nutshell (hickory) is the most abundant nutshell identified, both in density and ubiquity, followed by *Juglans sp.* shell (walnut) and *Juglandaceae*

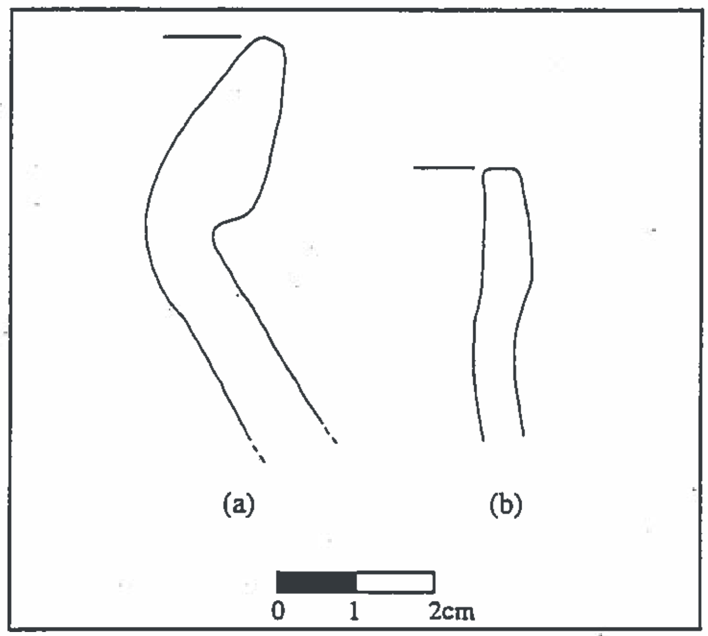

Figure 3. Rim Sherd Profiles: (a) Adena Plain var. Inez rim; (b) Johnson Plain var. Unspecified rim.

shell (hickory or walnut) (Tables 3 and 4). Two of the features (Features 1 and 9) display high nutshell densities, suggesting that the fill in these features resulted from more intensive nut processing and discard. These higher nutshell densities, however, do not indicate bulk processing (see discussion in Creasman [1995]).

Seeds constitute a minor portion of the ethnobotanical assemblage (Tables 4 and 5). *Chenopodium berlandieri* seeds (chenopod) were recovered from Feature 3 (n=2). They do not appear (on the surface) to represent a domesticated population. Numerous *Phalaris caroliniana* seeds (maygrass) also were recovered from Feature 3 (n=27). *Phalaris caroliniana* generally is considered a protected or cultivated taxon in the region during prehistory. A single *Euphorbia cf. maculata* fragment (spurge) recovered from Feature 7 would suggest the presence of open areas in the site area. A *Cucurbita* rind fragment, also from Feature 7, is very small, and a thickness measurement is not obtainable. It could have represented a domesticated population, but with only the one specimen, this designation would be dubious.

The identified wood charcoal species is dominated by *Carya sp.* (hickory) (Table 6). It is followed in percentage by *Quercus* (oak, all species combined), *Pinus sp.* (pine) and *Acer sp.* (maple). Several of the features exhibit wood charcoal densities by weight that indicates the fill resulted from "thermal" activities. They include Features 3, 9 and 30. Of the identified wood charcoals, 14 percent represent secondary growth species (*Pinus*, *Liriodendron tulipifera* [tulip poplar] and *Gleditsia triancanthos* [honey locust]). The percentage of successional woody taxa suggests the presence of open areas in the site vicinity.

FAUNAL REMAINS

Very small fragments of calcined bone were recovered from a number of Middle Woodland features (Feature 9, n=31; Feature 30, n=1; Feature 32, n=14). In addition to bone, one very small fragment of mussel shell was recovered from the site (Feature 9, n=1). None of the bone or shell could be typed as to species. Most of the bone appears to be small mammal or bird elements; although, their fragmentary nature made this assessment tentative at best.

ANALYSIS OF SITE STRUCTURE AND FUNCTION

Archeological sites, such as the Martin Justice Site, which contain evidence of several occupation episodes, actually represent only a small segment of a rather complex cultural system, even at the seemingly simple hunting and gathering level of adaptation. The remains left at any given site primarily inform the archaeologist about the use of that particular site and its surrounding environment (generally for only a small portion of the year). To be able to reconstruct the dynamic adaptive system the archaeologist has to identify the function(s) of each site comprising the system and fit the parts (sites and their locations) together (Binford 1983:132-133). Defining the character of prehistoric site types and settlement systems in the Upper Big Sandy River drainage, or any other area of Kentucky, is probably one of the most basic and fundamental steps in the study of prehistoric life ways (Jefferies 1990).

Collectively, general models of the prehistoric cultural-developmental sequence in the Southeast suggest that the general mode of subsistence prior to the Mississippian period was dominated by hunting and gathering of native resources (see discussion in Davis [1990:8-18]). On a worldwide scale, hunter-gatherer societies exhibit a continuum between highly mobile foragers and

Table 3. Plant Remains from the Middle Woodland Features at the Martin Justice Site.

Feature Number	Flotation Volume liters	Carya spp. Nutshell n	Carya spp. Nutshell g	Juglans nigra Nutshell n	Juglans nigra Nutshell g	Juglans spp. Nutshell n	Juglans spp. Nutshell g	Juglandaceae Nutshell n	Juglandaceae Nutshell g	Total g
1	42	514	11.91	2	.53	-	-	-	-	12.44
3	20	-	-	-	-	13	.86	-	-	.86
4	20	-	-	-	-	-	-	-	-	-
5	19	77	1.15	-	-	-	-	28	.28	1.43
6	20	153	1.77	-	-	8	.26	55	.45	2.48
7	15	97	1.32	-	-	2	.02	38	.19	1.53
9	20	232	3.31	-	-	-	-	-	-	3.31
17	22	39	.62	-	-	-	-	-	-	.62
20	20	-	-	-	-	-	-	-	-	-
30	16	84	1.26	-	-	-	-	-	-	1.46
33A	11	37	.65	-	-	3	.07	14	.1	.82
Total	225	1233	21.99	2	.53	26	1.33	135	1.02	208.75

Table 4. Botanical Material Density and Ubiquity Values for the Middle Woodland Features at the Martin Justice Site.

Material	Raw Data n	Raw Data g	Density[a] n/l	Density[a] g/l	Ubiquity[b] %
Carya spp. Nutshell	1233	21.99	5.48	.098	73
Juglans Nutshell	28	1.86	.124	.008	45
Juglandaceae Nutshell	135	1.02	.60	.004	36
Seeds/Fruits	31	.02	.138	Trace	18
Wood Charcoal	6445	101.36	28.64	.45	100.0

[a]Count or weight divided by total liters of processed fill (225 liters).
[b]Percent of features containing particular material (11 total features)

Table 5. Seeds and Fruit Remains from the Middle Woodland Features at the Martin Justice Site.

Feature Number	Chenopodium berlandieri n	Chenopodium berlandieri %	Phalaris caroliniana n	Phalaris caroliniana %	Euphorbia cf. maculata n	Euphorbia cf. maculata %	Cucurbita n	Cucurbita %	Total n
3	2	6.9	27	93.1	-	-	-	-	29
7	-	-	-	-	1	50	1	50	2
Total	2	6.45	27	87.10	1	3.22	1	3.22	31

Table 6. Identified Wood Charcoals from the Middle Woodland Features at the Martin Justice Site.

Feature Number	*Carya* spp. n	%	*Quercus rubra* n	%	*Quercus alba* n	%	*Quercus* spp. n	%	*Gleditsia triancanthos* n	%	*Fraxinus* spp. n	%	*Ulmus* spp. n	%	*Acer* spp. n	%	*Liriodendron tulipifera* n	%	*Pinus* spp. n	%	Total n
1	26	52	-	-	3	6	5	10	4	8	-	-	-	-	12	24	-	-	-	-	50
3	46	46	46	46	-	-	1	1	-	-	3	3	-	-	-	-	-	-	4	4	100
4	4	8	4	8	-	-	6	12	-	-	-	-	-	-	36	72	-	-	-	-	50
5	22	73.3	5	16.7	-	-	3	10	-	-	-	-	-	-	-	-	-	-	-	-	30
6	6	27.3	-	-	-	-	4	18.2	3	13.6	-	-	2	9.1	-	-	-	-	7	31.8	22
7	30	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
9	21	70	3	10	-	-	5	16.7	-	-	-	-	-	-	-	-	1	3.3	-	-	30
17	13	43.3	5	16.7	-	-	4	13.3	3	10	-	-	-	-	-	-	-	-	5	16.7	30
20	4	13.3	-	-	4	13.3	6	20	7	23.3	-	-	-	-	7	23.3	-	-	2	6.7	30
30	7	23.3	-	-	-	-	-	-	8	26.7	-	-	-	-	10	33.3	-	-	18	60	30
33A	16	53	-	-	-	-	3	10	-	-	-	-	-	-	1	3.3	-	-	10	33	30
Total	195	45.1	63	14.6	7	1.6	34	7.9	25	5.8	3	.7	2	.5	65	15.0	1	.2	36	8.3	432

fully sedentary collectors (Binford 1980; Forde 1963; Lee 1979; Yellen 1977). Binford (1980) has developed a general model of hunter-gatherer organizational variability that incorporates variables such as residential and logistical mobility, storage, length of growing season, effective temperature, and temporal and spatial incongruity of resources. In its simplest form, the general model of hunter-gatherer adaptation is one where groups employ either a foraging strategy or a collector strategy in response to local conditions. In this simple dichotomy, foragers practicing a "mapping on" strategy generate two types of sites: residential bases and locations. In contrast, collectors tend to rely more on a logistical strategy and create additional types of archaeological sites: field camps, stations, and caches. Table 7 provides an outline of expected types of sites for foragers and collectors modeled after Binford (1980).

Foragers are characterized by a high degree of residential mobility, i.e., the residential base is frequently relocated. Foragers relocate the base camp when resources in the foraging area have been depleted or at least are no longer economical to harvest. Collectors, on the other hand, have lower residential mobility opting to increase the resource base using logistical camps operated from the residential base. It is unlikely that many hunter-gatherers fit neatly into a forager/collector dichotomy but rather fall along a forager/collector continuum. This mixing of organizational alternatives provides the basis for an array of settlement strategies and archaeological patterning (intrasite and intersite structure). Variability in the hunter-gatherer subsistence strategies derives from differences in the magnitude of residential mobility and environmental differences conditioning subsistence activities within a seasonal cycle. Hofman (1984:132) has suggested that "groups living in markedly seasonal environments such as the mid-Holocene Southeast might be expected to exhibit some combination of foraging and collecting strategies which are variously employed in different settings and seasons." Such mixing of forager and collector strategies has been documented for hunter-gatherers in the American West both ethnohistorically (Downs 1966) and prehistorically (Creasman and Thompson 1988, 1997).

The following discussion summarizes the characteristics of residential camps, field camps, and locations that would have been created by hunter-gatherers and groups practicing mixed gardening and hunting-gathering (Table 7). Residential camps (or residential bases) are the loci out of which foraging parties originate and where most processing, manufacturing and maintenance activities occur (Binford 1980). The residential camp is the only habitation site created by foragers and the primary habitation site created by logistical collectors (and part-time farmers). The artifact assemblage at the residential camp reflects the broad range of activities conducted there. The assemblage also may contain non-portable site furniture such as grinding stones and ceramic vessels that may be cached at the site for future use. Habitation structures at the residential site, if present, may reflect the season and duration of occupation. The duration of occupation also will influence the pattern of refuse disposal and arrangement of activities within the site. The character of the residential camp is expected to be highly variable. Because foragers are characterized by high mobility, low-bulk and daily food procurement, the contents of residential camps will be rather homogeneous with variation reflecting differences in seasonal scheduling and different duration of occupations. Collectors on the other hand are characterized by food storage for at least part of the year and logistically organized food-procurement parties. The character of residential bases of collectors will tend to be less homogeneous due to differences in duration and season of occupation. It also will reflect high-bulk input, storage, and logistical procurement and processing. Residential sites, because of their diversity and intensity of activities, will have high archaeological visibility.

The field camp is a temporary operation center for a task group and is created only by

Table 7. Expected Settlement Types for Foragers and Collector Settlement Systems.

System Type	Residential Camp	Settlement Type Field Camp (Logistical Residence)	Location (Activity-Specific)
Forager	Present	None	Kill Locus
			Plant Harvesting Locus
			Lithic Extraction Locus
Collector	Present	Hunting Camp	Kill Locus
		Fishing Camp	Butchering Locus
		Plant Processing Camp	Plant Harvesting Locus
			Lithic Extraction Locus
			Station
			Cache

Note: Data from Binford (1980) and Davis (1990).

logistically organized collectors (Binford 1980). The field camp is the place the group sleeps, eats and maintains itself while away from the residential camp. Field camps are associated with the procurement of specific resources and can be differentiated from residential camps based on evidence of a limited range of maintenance, manufacturing, and processing activities (Fisher 1993). Moreover, the contents of field camps will reflect the procurement and processing activities relating to the targeted resource. The field camp generally will have a lower artifact and feature density and diversity than residential sites. The arrangement of dwellings and disposal of refuse will be unstructured when compared to residential sites (Fisher 1993). Recognition of a field camp function for sites in the archaeological record can be complicated by the nature of logistical organizational patterns. The rather low density of artifacts that characterize field camps can become a location of rather dense artifact concentration through redundant use of the location. The limited spectrum of activities characterizing field camps can be altered by reoccupation of the location for a dissimilar function (Binford 1982). This type of reuse tends to obscure any internal structure of the material remains.

The places where extractive tasks are carried out are termed locations (Binford 1980). Among foragers, locations are generally low-bulk procurement sites that are occupied for a very short period. The rather low intensity of procurement and processing generally leaves little evidence of the activity and, therefore, has little archaeological visibility. One forager location that would have a higher visibility would be the site for the procurement of lithic raw material. Collectors also procure and/or process raw materials at locations. Unlike foragers, collectors seek resources for a far larger group. This may result in high-bulk procurement and processing events (e.g., bison kill sites). High-bulk locations may have a higher degree of archaeological visibility and such sites will be characterized by a single resource type (e.g., fish) and a very restricted artifact assemblage.

Everyone would agree that sites are composed of different arrangements of facilities, surfaces, and items (artifacts and food waste). The distribution of the facilities (fixed features such as hearths and house) and portable items within a site reflect planning and the organization of space and not merely a haphazard accumulation of remains. Ethnoarchaeological studies have shown that sites are organized by components or modules (Binford 1983). Depending on the length of occupation, season of use, and types of manufacturing and production activities, modules may be homogeneous or reflect differing kinds of activities or uses. Ethnoarchaeological research has revealed that within residential sites activities are consistently associated with facilities, hearths and/or structures (Bartram et al. 1991; Binford 1983; Jones 1993; Yellen 1977). The constellations of facilities and related debris have been referred to as the family hearth (Jones 1993), family area (Yellen 1977) or household cluster (Bartram et al. 1991). Bartram et al. (1991:91-92) describe the household cluster as:

> an elemental unit of virtually all camps that is composed of the associated sets of facilities and structures belonging to an individual household. Kua camps variably comprised a household cluster or one or more household groups that were formed by an aggregation of two to as many as seven or more household clusters.

Because most archaeological excavations focus their attention on sites with features, or the portion of the site with features, these efforts result primarily in the documentation of household areas (residential sites). The presence of hearths alone, or even temporary habitation structures, is not sufficient evidence to infer residential function: field camps also contain hearths, and at times habitation structures (Fisher and Strickland 1991; Griffin 1984, 1985). As noted in the discussion above, distinguishing characteristics for residential bases would primarily be the greater diversity of manufacturing, maintenance and processing activities, as expressed by diverse facilities and artifact assemblages, and greater diversity of subsistence resources. The distributions of these activities and patterns of refuse disposal also would serve to distinguish between residential camps and field camps as well as variability within residential camps (see Creasman [1995] for a discussion).

THE MARTIN JUSTICE SITE

The location of the Martin Justice Site (15Pi92) is unique for prehistoric sites in the mountains of Kentucky. It is situated near the head of Island Creek, 600 m downstream of, and 180 m lower in elevation than the ridge divide. The site occupies a narrow, moderately sloping point formed by two hollow drainages, and set 12 m higher in elevation than the channel of Island Creek. The position of the site is, therefore, above the narrow valley bottom on a south-facing slope. The cultural remains documented at the site are situated along the crest of the sloping point (Figure 1). The southern limit of the site is located about 45 m north of the creek where the point leveled from a 15 to 20 percent slope to about a five percent slope.

The southern portion of the site contains a thin midden deposit (5 to 10 cm thick) and a dense concentration of 20 pit features and four postmolds (Figure 4). North of the midden, the slope of the ground increases to 8 to 10 percent. A second concentration of features is situated 16 to 22 m north of the midden. This concentration consists of six pit features and 11 postmolds (Structure 1), and generally defines the northern limits of the site. Seven additional pit features are identified between Structure 1 and the midden to the south. Three of these form a very distinct cluster. All of the features north of the midden are located at the base of a stony plowzone that varies between 15 to 30 cm in depth. The midden deposit also is found at the base of the plowzone.

The majority of the features exposed and recorded during site investigations can not be assigned to any specific period and many of the features with temporally diagnostic artifacts contain mixed assemblages. In the following discussion we will attempt to model the occupation events representing the Middle Woodland assemblage summarized above.

Figure 4 is a plan map of the site showing the distribution of features possibly of Middle Woodland age based on radiocarbon determinations and/or diagnostic projectile point forms and ceramic sherds. Features containing Middle Woodland artifacts, or with Middle Woodland radiocarbon ages, are located in both the midden area (n=7) and the northern portion of the site (n=4). These include hearths (F5, F6, F9, F17, F20, and F33A), earth ovens (F3 and F7), a shallow basin (F30), a possible burial pit with a projectile point cache (F1), and a postmold (PM24) next to F33A. A number of other features are considered Middle Woodland in age based on spatial associations. These include Feature 4 (a hearth) situated next to Features 3 and 20; Feature 16 (a shallow basin) located next to Feature 17; Feature 18 (a hearth) located near Feature 17; and the postmolds in the northern portion of the site and those in Block A. Feature 19, located just to the east of Features 3 and 20, also may have been associated with the Middle Woodland occupations at the site. The Middle Woodland remains located in the northern portion of the site will be discussed first.

The remains in the northern portion of the site represent two possibly related activity areas. A group of eleven postmolds is present around Features 16, 17, 18, and 44. The postmolds are considered to represent the remains of a structure (Structure 1) that enclose the four features (Figure 5). Feature 14, just outside the postmold pattern, also probably is associated with the structure, but Feature 13 is not because of its age (Middle to Late Woodland). The postmolds occur singularly and in pairs. Two sets of pairs are situated on the east side of the pit features. A third pair is located to

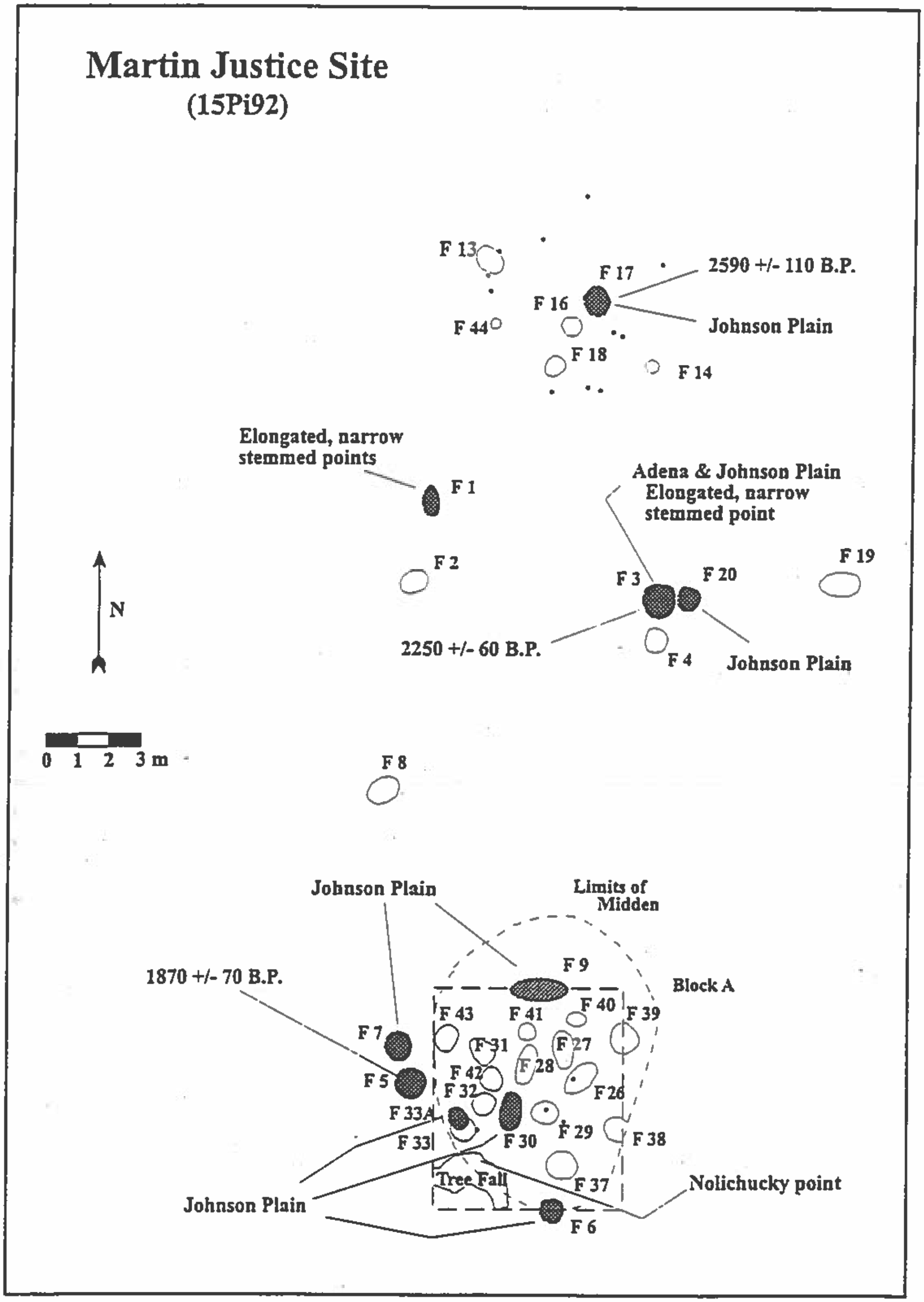

Figure 4. Schematic Plan Map of the Martin Justice Site (15Pi92) Showing the Distribution of all Features and those Containing Middle Woodland Diagnostic Artifacts or Radiocarbon Dated to the Period.

the west of the features. It is conjectured that the structure is roughly rectangular in planview. If so, the structure measures about 5.5 m by 3.5 m in size. The paired postmolds east of the pit features may have been for a partition, an entryway or roof supports. The four features within the structure (F16, F17, F18, and F44) are positioned in the southern to eastern portion of the structure floor. Enthnoarchaeological studies have noted that interior features are often placed near the doorway to take advantage of light and to free floor space for other uses (Bartram et al. 1991; Binford 1983; O'Connell et al. 1991).

Historic plowing and subsequent erosion have destroyed any evidence of a floor that may have been associated with the structure. The pit features in the structure contain a small assemblage of artifacts and economic remains. The fill from Feature 16, a shallow basin, was not analyzed for macro-floral remains, but it contained two small pieces of debitage. Feature 17, a hearth, held six small flakes, 17 small ceramic sherds and sherdlets, and 39 charred nutshells. The fill from Feature 18 also was not analyzed for macro-floral remains, but it contained two small flakes. The remains for the features suggest that a variety of tasks were performed around them. The artifacts and economic remains are characterized by very small items (primarily less than 1.0 cm^2) and they occur in low densities. These attributes suggested that the structure was occasionally cleaned and the refuse was discarded elsewhere (Binford 1983; Metcalf and Heath 1990; Simms and Heath 1990).

A cluster of three closely spaced features (F3, F4, and F20) is located about 6.0 m to the south of Structure 1 (Figure 4). This feature cluster consists of an earth oven (F3) and two hearths (F4 and F20). Feature 3 is radiocarbon dated to 2250 ± 60 B.P. and Feature 17, in Structure 1, is radiocarbon dated at 2590 ± 110 B.P. The date ranges for the two samples overlap at two standard deviations, which indicates that the features are possibly contemporaneous. Both of the features contain sherds of Johnson Plain var. Unspecified, and Feature 3 contains Adena Plain var. Inez sherds. The Johnson Plain var. Unspecified sherds from the two features are possibly from the same vessel. Again, ethnoarchaeological studies have observed that a site inhabited by a single family is generally comprised of a structure and associated outside activity areas represented by features (Bartram et al. 1991; Binford 1983; O'Connell et al. 1991; Yellen 1977).

Binford (1983) has observed that manufacturing and processing activities take place typically around outside hearths even during cold weather. Only during inclement weather do activities move indoors. Remains associated with this feature cluster are generally more varied, of larger size and occur in greater density than remains from features within the structure. Feature 3 contains an elongated, narrow stemmed Middle Woodland dart point, five flakes, three pitted stones, 73 ceramic sherds and 21 sherdlets, 13 charred nutshells, and 29 charred seeds. The remains in Feature 4 consist of three flakes. Six flakes and a single ceramic sherd as present in Feature 6. The fill from Feature 4 and Feature 20 were analyzed for macro-floral specimens, but neither contained economic remains. The character of remains suggests that the feature cluster is a location for generalized activities. The variable size of the material indicates the accumulation of primary refuse, and in the case of Feature 3 it was possibly used for secondary refuse disposal after it served its primary function.

The nearby Features 1 and 19 possibly represent additional outside activity areas. Feature 1 consists of a large elliptical pit located about 5.0 m southwest of Structure 1. A cache of 11 large, elongated, narrow stemmed Middle Woodland dart points was found at the top of the feature. None of the points display any evidence of use or reworking. The feature has one of the highest densities of charred nut remains (n=516) and contains a pitted stone. Charcoal and nutshell from the feature dates to 4190 ± 80 B.P. With the present data, it can not be determined whether the feature is a Middle Woodland burial or if the point cache is intrusive to a Late Archaic feature. The point cache from the feature, however, is probably associated with the occupation of the Middle Woodland structure. A smaller, used and reworked elongated, narrow stemmed Middle Woodland Stemmed dart point was recovered from Feature 3. The proximity of Feature 19 (shallow basin) to Structure 1, and located a few meters east of the Feature 3 cluster, suggests that it too may be related to this family use area. The feature contained seven pieces of debitage, a dart point fragment, and a ceramic sherdlet. The fill was not analyzed for macro-floral remains.

The Middle Woodland remains in the northern portion of the site comprised a household (family) use area. The use area consists of a structure and outside activity loci. The cluster of features formed by an earth oven and two hearths probably represents what could be considered a kitchen area. The presence of a substantial habitation structure, organization of space into differentiated activity or use loci, and maintenance of the house (cleaning) strongly indicates a long period of occupation, probably several months or more (Binford 1983; Kent 1992; O'Connell 1987; Simms 1987). The assemblage of artifacts and economic remains indicates that a variety of manufacturing, maintenance and processing tasks were carried out. Plant food remains are dominated by nutshell (*Juglans sp.* in F3 and *Carya sp.* in F17). Additional plant foods consist of *Chenopodium* berlandieri and *Phalaris caroliniana* seeds recovered from Feature 3. The *Chenopodium berlandieri* seeds do not appear to represent domesticated species. The *Phalaris caroliniana*, on the other hand, probably represents a protected plant; however, intensive cultivation of this taxon is not indicated because of the small number of seeds recovered. The occurrence of both taxa could represent the consumption of stored foods carried into the site. Alternatively, the presence of the seeds also may indicate they were procured from local stands created through natural or human disturbance, or even of low intensity gardening. If the *Phalaris caroliniana* and *Chenopodium berlandieri* seeds were harvested during the site occupation it would have occurred during the late fall (Munson 1984). The nutshell remains indicate that the occupation also possibly occurred in the late fall to early winter.

Features located in the southern portion of the site (Block A) that contained Middle Woodland diagnostic artifacts consisted of hearths (F6, F9, and F33A), an earth oven (F7) and a shallow basin (F30). Feature 5 did not contain Middle Woodland diagnostics but a wood charcoal sample from it was radiocarbon dated to 1870 ± 70 B.P. Several of these features contained temporally diagnostic artifacts of other periods. Feature 5 not only dated to 1870 ± 70 B.P., but it also produced a Savannah River-like dart point. Feature 6 held a Johnson Plain var. Unspecified sherd and a Merom-Trimble dart point. Feature 9 contained Early Woodland Thick and Johnson Plain var. Unspecified pottery and a Brewerton dart point. Consequently, Features 6 and 9 will not be included in the discussion of this area of the site. Four postmolds (PM 22-25) also were identified in Block A, and they may be of Middle Woodland age. Postmold 24, which contained a Johnson Plain var. Unspecified sherd, is the only postmold with a diagnostic artifact.

The distribution of the features and postmolds in Block A is shown in Figures 4 and 6. The following discussion will concentrate on the feature cluster (F5, F7, F30, and F33A) on the western side of Block A. The locale may represent the main area of Middle Woodland use in this portion of the site. Features 5 and 7 (hearth and earth oven, respectively) are located less than 50 cm apart, just outside of Block A. Feature 33A is situated about 1.0 m southeast of Feature 5, and Feature 30 is located about 1.0 m east of Feature 33A. The distribution of the features forms a shallow arc with Features 5 and 7 grouped on the western side. The closely spaced nature of the features suggests that

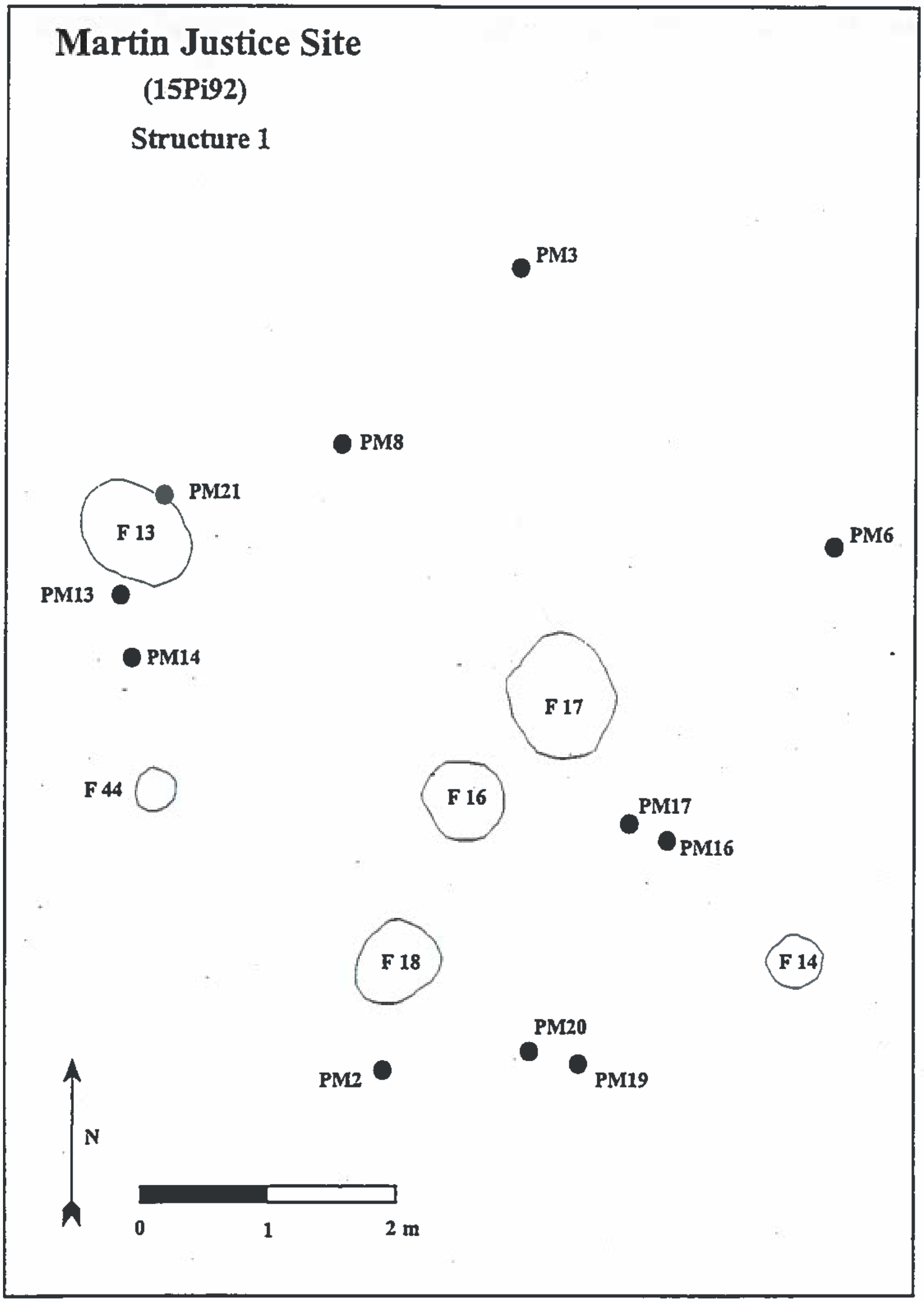

Figure 5. Schematic Plan Map of Structure 1 at the Martin Justice Site.

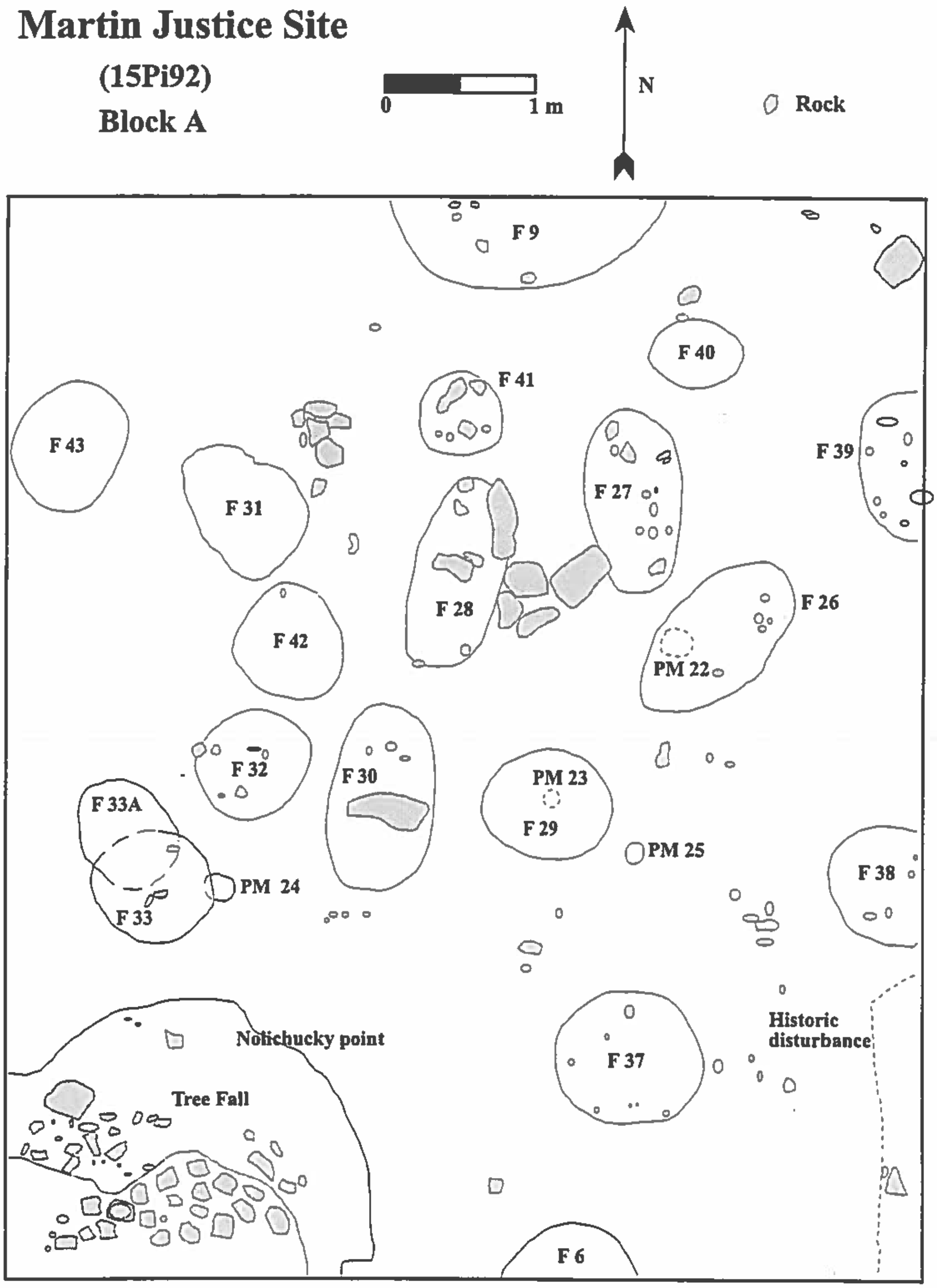

Figure 6. Schematic Plan Map of Block A at the Martin Justice Site Showing the Distribution of Features and Locations of Disturbed Areas.

they comprised a single, multi-feature activity or use area (Creasman 1995). Ethnoarchaeological studies have shown that contemporaneous household use areas are spaced some distance apart (several meters or more) to provide adequate space for tasks around and near the features (Binford 1983; Yellen 1977). If the features represent more than one household activity area, we would expect greater spatial separation between them. Although the features are components of à single use area, they are probably not constructed or used at the same time. Multi-feature activity areas are created as result of specific needs (roasting, baking, or heating) or serviceability of the feature (construction of a new feature when the old became too messy or not usable) (Binford 1983).

The postmolds identified in the block are located near this feature cluster (Figures 4 and 6). Postmold 24, containing the Johnson Plain sherd, is situated near Feature 33A. Postmolds 23 and 25 are located about 1.0 m east of Feature 30, with Postmold 22 situated about 1.5 m to the northeast. The postmolds do not form a definite pattern, but indicate the possible presence of a small structure (ramada or lean-to) or perhaps meat drying racks in the eastern part of the feature cluster.

Cultural materials recovered from the excavation of Block A reveal that the areas to the south and east of this concentration of features contains rather low to moderate densities of lithic debitage and ceramics (Figure 7a-b). Much of the lithic debitage may have been associated with other occupations. This suggests this is a primary work area (drop zone) that was kept clean of large (greater than 2 to 3 cm^2) debris (Binford 1983). The distribution of Johnson Plain var. Unspecified ceramics indicates several distinct concentrations of sherds primarily associated with these features (Figure 7b). The greatest concentration of Johnson Plain var. Unspecified sherds is located about 1.0 to 1.5 m north of Feature 33A and extends northwest toward Feature 7. A second, lower density peak is located north of Feature 30 and west of Postmold 22. A third concentration of ceramic sherds is located to the south of Feature 33A. This area also contains the recurvate triangular or lanceolate Middle Woodland Nolichucky projectile point. Both the debitage and ceramic sherd distributions near Features 5, 7, 30, and 33A indicate that activity around the features created drop and toss zones (Binford 1983). The concentrations of remains 1.0 to 1.5 m from the hearths, the toss zone, were probably created by tossing debris away from the feature location.

The features are the location(s) of rather generalized activities. Each of the features contains 20 to 30 pieces of debitage. Features 7, 30, and 33A each contain a few sherds of Johnson Plain var. Unspecified pottery. Lithic tools recovered from the features consist of two pitted stones (F30), an intrusive Savannah River-like dart point (F5), and a bipolar core (F7). Each of the features contains charred nutshell, dominated by *Carya* spp., ranging for 54 to 137 fragments per feature. Other plant foods are represented by a *Euphorbia cf. maculata* seed and a *Cucurbita* rind fragment from Feature 7. Feature 30 also contains a single fragment of burnt bone. The relatively low density of nutshell, as well as other economic remains, suggests low bulk processing of food resources, a pattern reflective of processing to fill daily needs. The composition of the assemblage demonstrates that the activity area served a residential function. The presence of 1) multiple features representing more than one functional type, 2) drop and toss zones, and 3) site furniture and a possible structure suggests that the occupation was of relatively long duration, potentially several months (Creasman 1995). The economic remains suggest that the occupation occurred during the fall to early winter.

In summary, the Middle Woodland remains in the northern and southern portions of the site comprise two distinct occupation episodes. Those in the northern area date to ca. 350-450 B.C. Diagnostic artifacts consist of elongated, narrow stemmed Middle Woodland dart points and Johnson Plain var. Unspecified (siltstone tempered) and Adena Plain var. Inez ceramics. The Middle

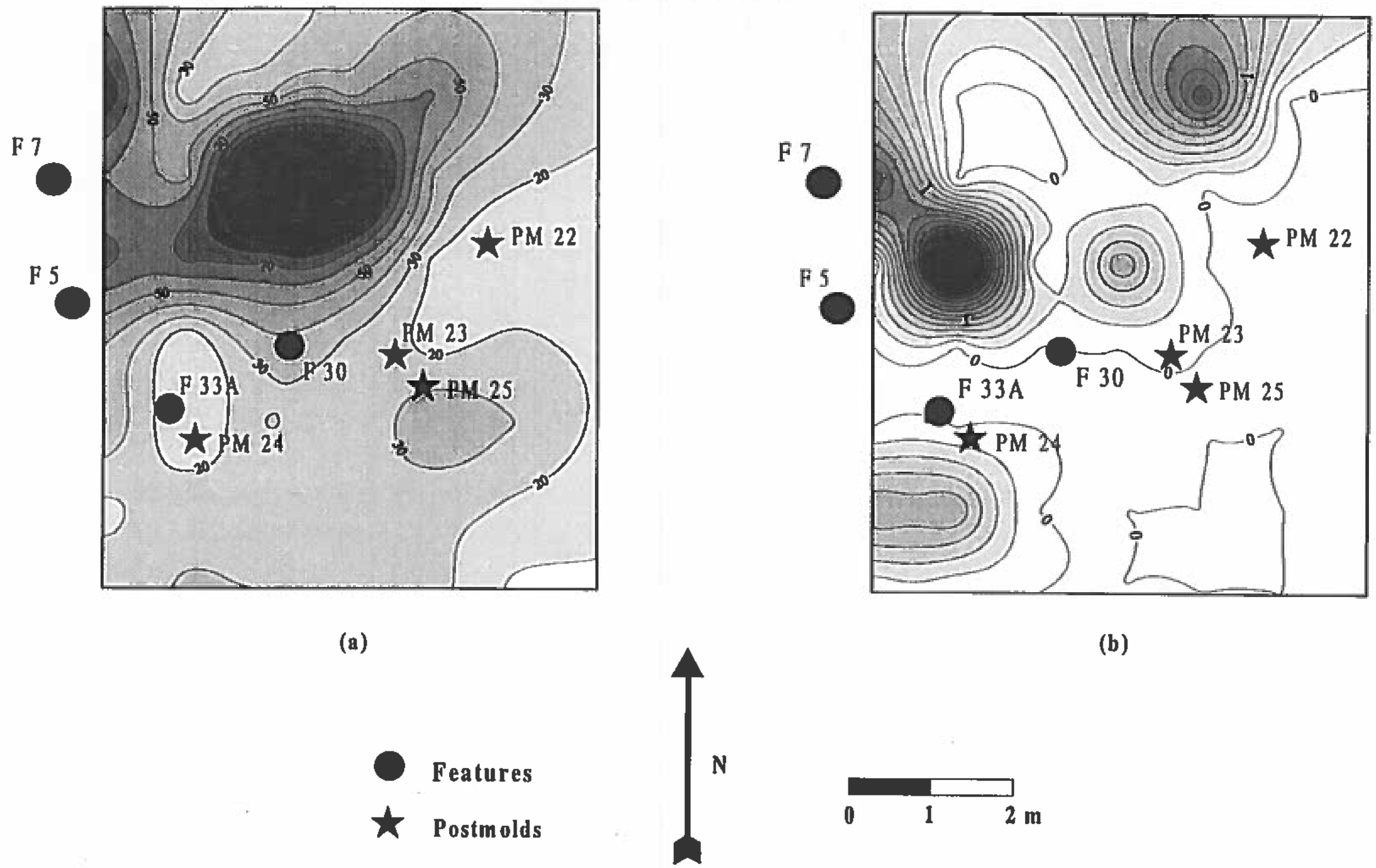

Figure 7. Maps of Block A Showing the Density of (a) Lithic Debitage and (b) Johnson Plain var. Unspecified ceramics.

Woodland occupation in the southern portion of the site (the midden area) probably dates later in time (ca. A.D. 100). Associated ceramics consist exclusively of Johnson Plain var. Unspecified, but include both sandstone and siltstone tempered varieties. A recurvate triangular or lanceolate Middle Woodland Nolichucky projectile point, recovered from the block 1.0 to 1.5 m south of Feature 33A, is probably associated with this occupation.

INTERSITE SETTLEMENT PATTERNS

The study of prehistoric settlement patterns or systems in the Upper Big Sandy region, which includes Floyd and Pike Counties, Kentucky and Mingo County, West Virginia, is limited or constrained by the available data. Information on site distributions and densities within the three county area is of uneven coverage and quality. What is known about the vast majority of these sites is based on data collected from inventory only (amateur reporting, opportunistic reconnaissance and surveys completed for development projects). Furthermore, of the ca. 240 sites that are recorded in Floyd, Pike, and Mingo counties only about 25 percent contain temporally diagnostic prehistoric artifacts. Coupled with the poor survey data, excavation data that provide the opportunity to assess the number and function of individual occupations, subsistence activities, duration of use and season of occupation are even more meager. Because of these limitations, the study adopted rather simple objectives: to detect trends in the variation of site distributions on the landscape and in the locations of functional classes of sites (Creasman 1995:7-36). The following describes the apparent Middle Woodland settlement patterns in the region.

Twenty-six sites containing cultural material dating to the Middle Woodland period are present in the Upper Big Sandy study area (Figure 8). Typically, these sites contain Middle Woodland pottery (Johnson Plain or similar ceramics) and projectile points that span the Early to Middle Woodland periods. Figure 8 plots the distribution of sites in the Upper Big Sandy region that can be assigned to this period, as well as other sites mentioned in this discussion. Twenty-one (81 percent) of the sites are located within floodplain situations and five sites (19 percent), including Martin Justice, are not located within a floodplain setting. Sixty-two percent of the sites situated on the floodplains (n=13) are located on the Levisa Fork and one (5 percent) is located on the Tug Fork. The remaining seven floodplain sites (27 percent) are located on moderate-sized creeks feeding into the Levisa Fork.

Variation in the distribution of sites with respect to physiographic setting or location, in part, will reflect the placement of the site in terms of the acquisition of, or access to, subsistence (food) and other resources (drinking water; wood for fuel, artifact manufacture or house building; lithic materials) (Binford 1982; Jochim 1976, 1981; Yellen 1977). Furthermore, hunter-gatherer studies (Binford 1982; Jochim 1981; Lee 1979; Yellen 1977) indicate that residential sites are surrounded by a foraging zone (the area that can effectively be exploited by females). The typical foraging area covers a 9.0 km radius of the residential camp (although in rugged terrain the radius may be smaller). The procurement of resources in areas outside the foraging zone is accomplished by the establishment of a new residential site (foraging strategy) or through the establishment and use of field camps (collector strategy).

In the study area, the majority of the Middle Woodland sites or components (58 percent) are located on the Levisa Fork (n=13) or Tug Fork (n=1) floodplain or within 2.0 km (n=2) of the Levisa Fork floodplain, suggesting a bias in site placement towards this resource zone. Of the ten sites located at a greater distant from the river, five are 4.0 to 5.0 km away and the five are more than 8.0

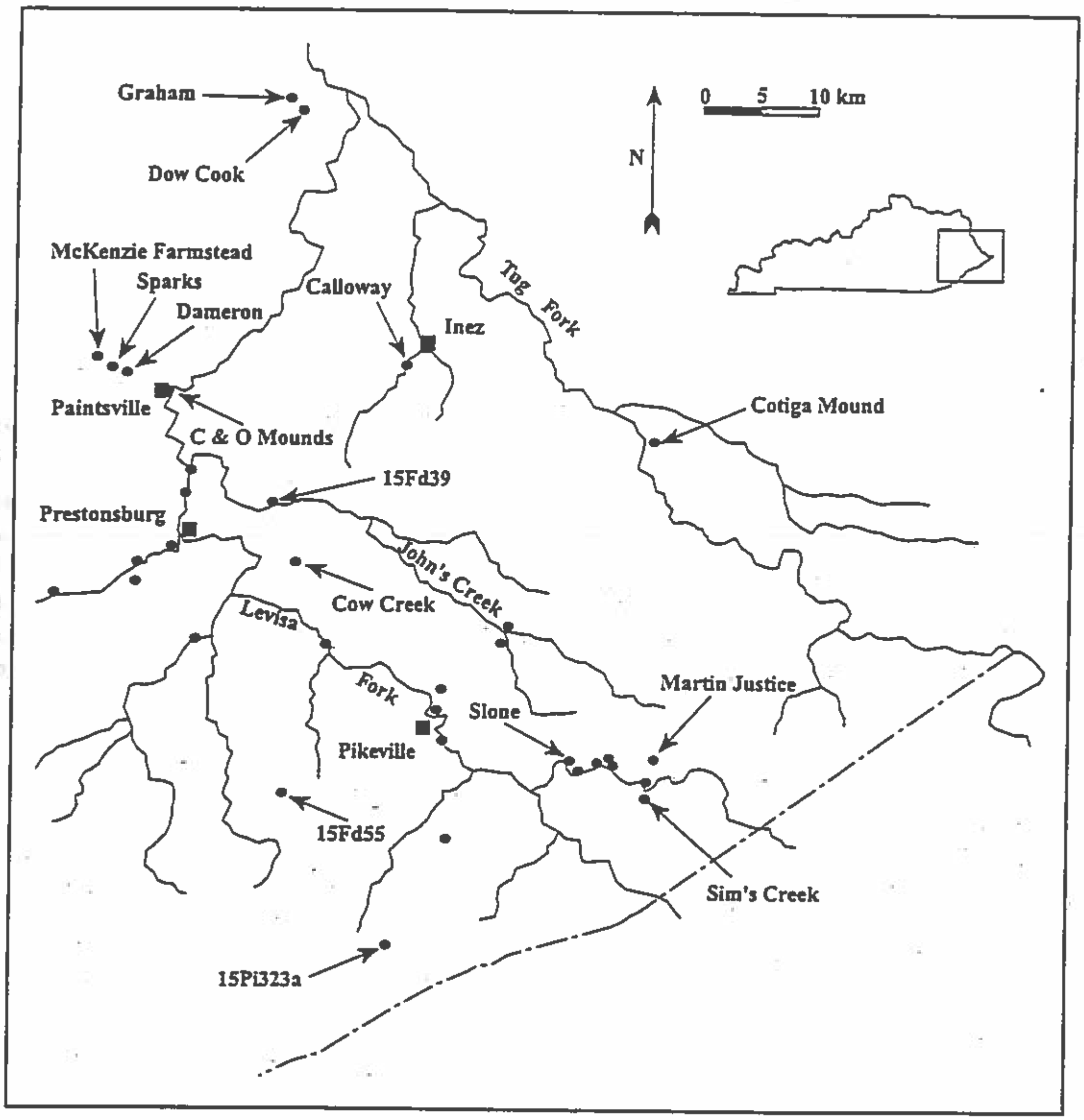

Figure 8. Distribution of Middle Woodland Sites in the Upper Big Sandy Region.

km away. Six of these 10 sites are located along moderate-sized creeks. The function of the vast majority of the sites in the sample could not be determined with the extant data. Just considering that the sites are locatable demonstrates that they had high archaeological visibility, a property of residential camps and field stations.

The patterns of site distribution (dispersion and density) in the Levisa Fork drainage appear, in part, to reflect a combination of two things, sampling problems and physiographic constraints of the area. First, historic land use has had a profound impact on the landscape of eastern Kentucky and the archaeological sites within this area. Intensive timbering and agricultural activity in the uplands (above valley bottoms) has resulted in the loss (erosion) of much of the topsoil of the region effectively limiting the locales where archaeological sites are likely to have survived (primarily within alluvial deposits and rockshelters). The intensity of archaeological survey coverage also has varied (casual inspection, pedestrian survey, shovel testing). Second, the physiography of the area has played a role in the patterns of site location; however, the placement of sites with respect to physiographic conditions primarily reflects prehistoric cultural processes. The study area is characterized by steep rugged terrain. Level ground attractive for the placement of settlements comprises only a small percentage of the land area and tends to be concentrated along major stream bottoms and ridgetops. The limited area for suitable camp locations would have created a pattern of site packing and increased site visibility, because of redundant use of specific limited landscapes. If some of those landscapes subsequently have been destroyed (as is potentially the case with much of the ridgetops) the sample may have become extremely biased.

The general patterns of site density and distribution during the Middle Woodland (and other times) in the Upper Big Sandy, therefore, does not necessarily reflect cultural patterns or processes, but may reflect biases in sampling, preservation, and site visibility. In other words, the seemingly high density of sites on the Levisa Fork floodplain and low density of sites on upland ridgetops may not reflect differences in settlement intensity, mobility strategy or differential use of these landscapes. At a gross level, data suggest that Middle Woodland sites are dispersed over the landscape, i.e., Middle Woodland sites occur on the floodplain of at least the one major drainage (Levisa Fork) and in the hinterlands away from it.

To get past this very generalist and simplistic settlement pattern model, an attempt was made to differentiate the sites based on their functional characteristics. The extant data for each site, however, severely limit the ability to do this for the vast majority of the sites. Within the study area, sufficient data (primarily excavation data) to determine site function exist for only Martin Justice, Slone (15Pi11), Sim's Creek (15Pi7), Cow Creek (15Fd63), 15Fd55, 15Pi323A, and Cotiga Mound (46Mo1). Seven sites are a poor sample with which to develop meaningful settlement models. To add robustness to the sample several sites in the immediate vicinity (the same drainage basin) are incorporated in the study. These sites include Graham (15La222), Dow Cook (15La4), Calloway (15Mt8), McKenzie Farmstead (15Jo67), Sparks (15Jo19), Dameron (15Jo23a), 15Fd39, and the C. and O. Mounds (15Jo2 and 15Jo9). These sites are discussed below.

A wide range and moderate density of material and economic remains were recovered from the Middle Woodland components at Graham (Niquette 1989), Dow Cook (Niquette and Kerr 1989), Calloway (Niquette and Boedy 1986) and two sites, Slone and Sim's Creek (Zone B remains), in the Fishtrap Reservoir (Dunnell 1966). These sites also contain a small number, but wide variety of subsurface facilities displaying that an array of activities were undertaken at the sites. This evidence suggests that the sites functioned as short- to medium-term residential bases.

Although 15Pi323A was not excavated, the types of materials identified at the site (lithic debitage, projectile points, bifaces, scrapers, drills, and ground stone) suggest that this site is a residential base (Schock et al. 1976). A significant number of Middle Woodland sites were identified during the Paintsville Reservoir investigations. The types of sites include eight rockshelters and three open air sites. Two of the rockshelter sites, Dameron and Sparks, were extensively excavated, but none of the features identified are attributed to the Middle Woodland occupations (Adovasio 1982). The presence of pottery at the sites may suggest they were residential but probably used for only short periods.

Another Middle Woodland component at Sim's Creek is an example of a long-term residential site. Dunnell (1966:123) delineates several different components associated with the Zone A and plowzone strata. One of these, Component 3, is represented by Johnson Plain pottery, lithic debitage, pitted stones and a flake point. The component is roughly 20 m by 15 m in area. Numerous features, including at least one earth oven (Feature 52) and one ground or pitted stone cache pit (Feature 39), are attributed to this component. The remnants of one structure also are associated with this component. It is a small (3.6 m by 2.8 m) rectangular structure built of single posts driven into the ground (Dunnell 1966:Figure 46). No features are present inside the structure, but two earth ovens are located nearby. This Middle Woodland component at Sim's Creek is clearly residential and of a long-term duration.

Another probable long-term Middle Woodland residential base is identified by McBride (1994). While excavating the McKenzie Farmstead Site, she identifies the remnants of a Middle Woodland structure and associated subsurface facilities. Few lithic tools are recovered from the site, but numerous plain surfaced sandstone and limestone tempered pottery fragments are identified. Moreover, abundant charred nutshell, fruit remains, and seeds are identified in the botanical assemblages from the features. Their presence indicates that some gardening may have taken place at the site. Furthermore, Scarry (1994) suggests that the site was occupied at least from late spring through fall. As a whole, this Middle Woodland habitation site is residential in nature and occupied for several months (long-term duration).

The Middle Woodland components at the Cow Creek (Deiss 1987) and 15Fd55 (Turnbow and Allen 1977, Stallings and Ross-Stallings 1991) rockshelters can not be definitely described as residential; therefore, locations or field camps are probably included in the settlement-subsistence system of this time period. The two professionally excavated and documented mound sites (C. and O., and Cotiga) in the Upper Big Sandy region demonstrate that mortuary behavior in this region rivaled that of the Middle Ohio Valley but probably on a smaller scale. The C. and O. mounds are located on Paint Creek, in Paintsville, Johnson County, Kentucky (Webb 1942). Cotiga Mound is located on the Tug Fork, Mingo County, West Virginia (Frankenberg and Henning 1994). The one mound at Paintsville (15Jo2) was constructed in a single episode overlying a single log tomb and numerous large, circular paired-postmold patterns. The other mound (15Jo9) contained several log tombs in its base that were covered first by a truncated pyramidal-shaped mound and then by two additional layers. Cotiga Mound, built in several episodes, contained numerous cremation burials. One paired-post structure is identified under the mound. The relationship of these mounds to Martin Justice and the other Middle Woodland sites documented in the region is difficult to determine given the available data. It is probable that the sites where mounds are now located were used by a number of Middle Woodland groups in the region. They may have been used first as mortuary camps, upon which elaborate burial mounds are later built.

Ten additional possible mound or mound complex sites have been recorded in the Upper Big Sandy study area, but none has been investigated. Some are described as earthen mounds, others are stone mounds and still others are stone and earthen mounds. Only one of these (15Fd39) could be attributed to the Middle Woodland period based on accounts that within it looters found mica and skeletal remains. This site is located on a low toe slope or 'hogback' overlooking Johns Creek about 8.0 km east-northeast of Prestonsburg. Furthermore, some of the mound sites are located on habitation sites (15Fd9, 15Fd14 and 15Fd24), but the relationship of the mounds to the habitation debris is unknown. It is clear that these sites need to be investigated in order to reveal the full range of settlement variability in the region.

Functional classes represented by sites or components in the sample consist primarily of residential camps (n=11). Data from eight residential camp components suggest that they were occupied for several weeks to possibly several months. The occupation duration of three residential components was long-term, greater than three months. It appears that the size of the group that occupied residential sites was small (a single to several family units). For example, the data from Martin Justice, a long-term residential site, indicate that the site was occupied by a single family or residence unit. Furthermore, the distribution of sites suggests that Middle Woodland residential occupations in the Big Sandy region are positioned in both lowland and upland ecotones. They primarily are situated on the valley floor of the Levisa Fork and valley floors of tributary streams. This latter group tends to be positioned at a distance of 2 to 5 km from the Levisa Fork. The location of the Calloway Site, on the Middle Fork of Rockcastle Creek over 9 km from the Tug Fork, indicates that residential sites situated on the valley floor of tributary streams did occur far from the major drainages. Similarly, upland residential sites can be near or far from the major drainages. Martin Justice is located in a small hollow 2 to 3 km from the Levisa Fork and 15Pi323A is situated on a ridgetop 17 km from the Levisa Fork.

The second functional class of Middle Woodland sites consists of field camps and is represented by 15Fd55 and Cow Creek. The sites share similar attributes, they both are located in rockshelters in upland terrain, and they appear to have functioned as hunting camps. The sites are located over 5 km (Cow Creek) and 12 km (15Fd55) from the Levisa Fork. Some of the residential sites also could, at times, have served as field camps. Binford (1982) has observed that within a logistical system the same position on the landscape may be occupied at different times for different purposes. For example, a location used as a hunting camp later can be used as a residential site. The reuse of specific landscapes for differential purposes would tend to obscure functional differences.

The final functional class of sites in the sample includes mounds (15Fd39, C. and O., and Cotiga). These sites are landscape positions reserved for the interment of the dead, rather than being associated with the procurement and/or processing of subsistence resources, and probably serve a unique function in the cultural system. The larger mounds (C. and O., and Cotiga) are located on the floodplains of Levisa and Tug Forks, respectively. Site 15Fd39, a small stone and earth mound, is located on a ridgetop adjacent to and overlooking Johns Creek. As argued by Seeman (1986) and Clay (1991), these ritual or mortuary centers probably act as the only means of social interaction between dispersed groups. They further suggest that the centers are located at the conjoined edges of multiple, small, and relatively independent social group territories. The mortuary centers are, in effect, the glue that holds together dispersed, and possibly related, groups. The evidence for the existence of small (group size), dispersed residential sites discussed above conforms to the observations of Seeman (1986) and Clay (1991). It would appear that mortuary centers are one mechanism used to maintain cohesive cultural or social units.

The documentation of Middle Woodland sites representing different functional classes, not surprisingly, demonstrates the existence of a logistically organized collector subsistence strategy, however, nuances of the system remain allusive. Residential camps are positioned on divergent points of the landscape (on larger rivers, on smaller tributary streams and in uplands away from the former) and they vary in their duration of occupation, between relatively short- to long-term. Nevertheless, there are insufficient data to determine the forces driving site placement and occupation duration. We suspect that seasonal variation in the location, availability and density of subsistence resources may have been prime factors. Adding to the complexity in residential camp characteristics are the effects of gardening to supplement naturally occurring resources. Interestingly, the Martin Justice Site is positioned in a prime location to support Ison's (1991) model about prehistoric upland farming in Eastern Kentucky. His model suggests that farming on slopes was probably the preferred method of gardening at the end of the Late Archaic period. If the preferred method of gardening involves preparing the area using slash-and-burn methods, he argues that burning-off slopes is more efficient than clearing valley bottoms. In addition, the higher slopes are exposed to more sunlight than the valley bottom, which also traps cold air. Both of these phenomena demonstrate that the upland slopes provide a longer growing season compared to the valley bottoms. We argue that upland slope farming continued into the Middle Woodland period. The type of Middle Woodland occupation at Martin Justice, long-term residential base, and its position on the landscape, moderate south-facing slope, illustrates Ison's argument to that effect.

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THE SHELBY LAKE SITE: A LATE WOODLAND UPLAND CAMP IN SHELBY COUNTY, KENTUCKY

By

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ABSTRACT

During 1992, ten pit features were excavated at the Shelby Lake Site (15Sh17) near Shelbyville in Shelby County, Kentucky. Cultural remains and radiocarbon dates indicate that these features date to the early Late Woodland period. Minor Early Archaic and early Fort Ancient components are represented by projectile points from the surface of the site. Floral and faunal remains recovered suggest that the site may have been a late winter/early spring hunting camp or part of a local dispersed early Late Woodland period settlement system. This paper describes the features and cultural remains recovered from the site. The Shelby Lake Site also is compared to other Late Woodland sites in the Commonwealth.

INTRODUCTION

During July and September, 1992, the Kentucky Heritage Council conducted excavations at the Shelby Lake Site (15Sh17) near Shelbyville, Kentucky (Figure 1). KHC staff archaeologists, with the assistance of several volunteers, excavated ten Late Woodland features exposed by bulldozing for an amphitheater in Clear Creek Park. The excavation of these features and analysis of the recovered materials has provided new information about Late Woodland development in the Inner Bluegrass Region of Kentucky. Minor Early Archaic and early Fort Ancient components also were represented by projectile points from the surface of the site.

The Shelby Lake Site is located in central Shelby County, north of Shelbyville, Kentucky. The site is situated on an upland ridge crest (231 m or 770 feet above M.S.L.) that is oriented east-west. Clear Creek (now Shelby Lake), is located about 150 m north of the site. This stream is a tributary of Brashears Creek, which flows into Salt River. The site extends over an area approximately 156 m east-west and 100 m north-south (1.56 ha). The excavations were restricted to the western end of the site, where the plowzone had been removed by construction activities.

The site was initially recorded by Charles D. Hockensmith on July 12, 1977 during an archaeological survey of Clear Creek Park for the Office of State Archaeology at the University of Kentucky. At that time, the site was thought to date to the early Fort Ancient period on the basis of a

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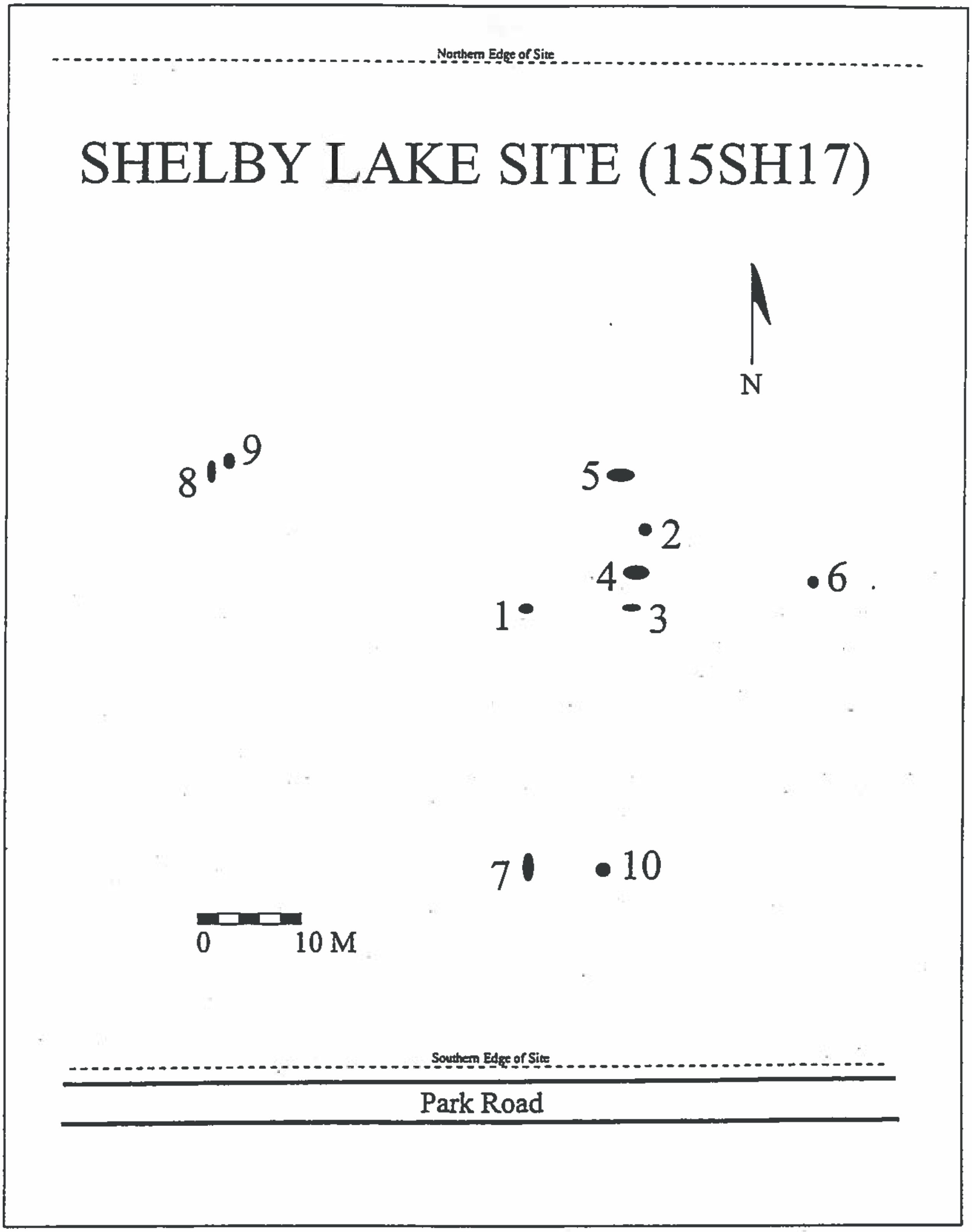

Figure 1. Map of the Shelby Lake Site Showing the Distribution of the Features.

triangular projectile point and grit-tempered ceramic sherds. During June 1980, Robert L. Brooks prepared a report describing six prehistoric sites within the park recorded by R. Berle Clay and Hockensmith. Brooks thought that 15Sh17 was a Late Woodland/Fort Ancient occupation based on the 1977 surface collection, which included one triangular projectile point, three grit tempered ceramic sherds, two biface fragments, eight marginally modified flakes, 84 unmodified flakes, eight chert chunks, and one fragment of fired clay (Brooks 1980:21).

This paper describes the Shelby Lake Site and the cultural remains recovered. The first three sections describe the methodology, features, and radiocarbon dates. Next, the ceramic and lithic artifacts are discussed. The botanical and faunal analyses are then presented. Finally, the summary and conclusions discuss the placement of the Shelby Lake Site within the Late Woodland settlement system of central Kentucky.

METHODOLOGY

Extensive disturbance restricted archaeological investigations to the excavation of truncated pit features. All features were troweled to define their boundaries and were then photographed. To determine whether features contained stratified deposits, one half of each pit was removed. Each feature was profiled and photographed again. The second half was then excavated. After excavation, final photographs were taken and a plan view drawing was prepared. Ten liter flotation samples were taken from each feature to recover botanical remains and small faunal remains. The remaining soil was carefully screened through 6.4 mm wire mesh. Finally, samples for radiocarbon dating were taken when sufficient quantities of charcoal were present.

FEATURES

During the course of the 1992 investigations, ten pit features were excavated in an area measuring 40 m north-south and 60 m east-west. The documented features fall within two general groups: shallow pits (ranging in depth 4-23 cm, but most were 4-9 cm deep), oval in plan view, and ranging in diameter between 28 and 50 cm; deep pits (19 to 50 cm), also oval, ranging in width from 1.1 to 1.5 m and in length from 1.6 to 1.8 m. The largest feature, Feature 7 (Figure 2), which measured 1.5 by 3 m in size appeared to be two large, overlapping pits. Feature contents included chert flakes, sherds, bone fragments, burned clay, burned limestone, and charcoal. A few features also yielded projectile points and other chert tools.

Several of the features probably functioned as cooking pits (Figure 3), based on the presence of burned limestone fragments, burned clay, burned animal bones, and charcoal in the feature fill. Other pits may have functioned as storage pits. Some of the pits were probably filled with trash after their initial use.

CHRONOLOGICAL PLACEMENT

The two radiocarbon dates obtained for Shelby Lake have calibrated mid-points of A.D. 610 and 640 (Table 1). At two standard deviations, these dates overlap between A.D. 540 and 670. These dates were extremely similar to the date from the Old Bear Site, which yielded a calibrated mid-point of A. D. 621 (Brooks 1985:114). The radiocarbon dates obtained from these sites supports the suggestions based on the material culture that Shelby Lake and Old Bear date to the early Late Woodland period.

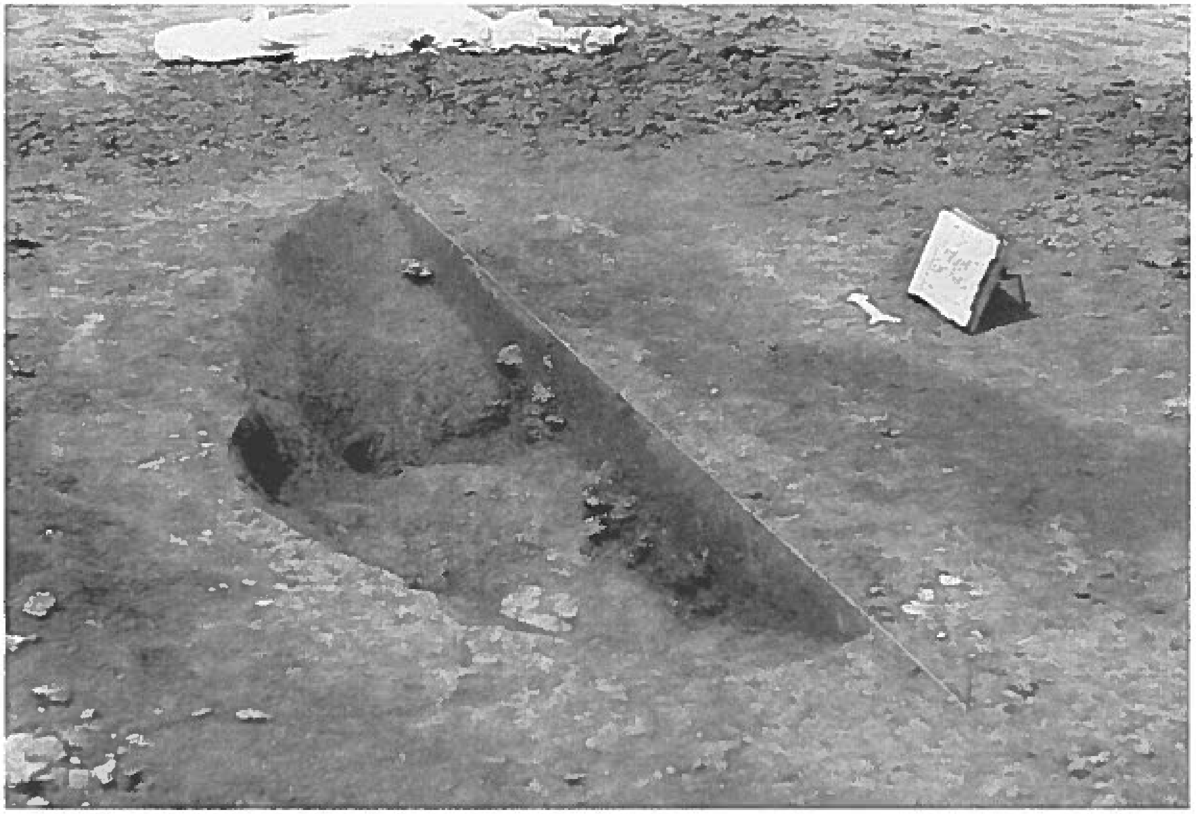

Figure 2. Photograph of Feature 7 Showing the Two Overlapping Pits and the East Profile.

Figure 3. Photograph of Feature 4 Showing the Concentration of Limestone in the East Profile.

Table 1. Shelby Lake and Old Bear Radiocarbon Dates.

Laboratory Number	BP	Uncalibrated Date	Calibrated Date at Two Standard Deviations
Shebly Lake			
Beta-73162	1430±60	520±60	540(640)690
Beta-73163	1480±60	470±60	440(610)670
Old Bear			
Uga-3706	1440±100	510±100	410(621)780

CULTURAL REMAINS

Several categories of cultural remains were recovered during the investigations. The general artifact classes include ceramics and chipped stone.

CERAMICS

Of the 727 sherds recovered from the Shelby Lake Site, 72 were larger than 4 cm^2 and 655 were smaller than 4 cm^2. Exterior surface treatment was recorded for all body sherds greater than 4 cm (n=62). Those sherds smaller than 4 cm^2 (n=649) were simply lotted by provenience and counted. More detailed information was collected for rims (n=9), necks (n=5), bases (n=1), and angular shoulders (n=1), regardless of size. This resulted in 78 sherds being subjected to detailed analysis (72 greater than 4 cm^2 and six less than 4 cm^2).

Exterior surface color ranged from reddish brown to dark brown, while interior surface color ranged from reddish brown to black. More than 90 percent of the specimens were tempered with limestone (n=71), while the remaining sherds (n=7) were tempered with other types of crushed rock. Most of the sherds were cordmarked (n=58), with S-Twist cord, but some (n=13) exhibited smoothed-over cord impressions, and others had plain (n=4) exterior surfaces. The plain sherds were highly burnished as were many of the smoothed-over cordmarked specimens.

In general, cordmarked sherds (Figure 4) tended to be thinner (mean=5.0 mm) than smoothed-over cordmarked (mean=6.9) or plain (mean=5.7) sherds. The smoothed-over cordmarked sherds (Figure 5) included an angular shoulder, which exhibited slight thickening at the shoulder, and a basal sherd. These specimens had thicknesses of 7.8 mm and 10.8 mm, respectively. When only the body sherds were considered, the mean thickness of the smoothed-over cordmarked sherds was reduced to 6.5 mm. Although it was possible that many of the thicker specimens were from the lower or basal portion of elongated jars, it also was possible that early Late Woodland people used both thin-walled and thick-walled vessels.

Figure 4. Cordmarked Ceramics from the Shelby Lake Site.

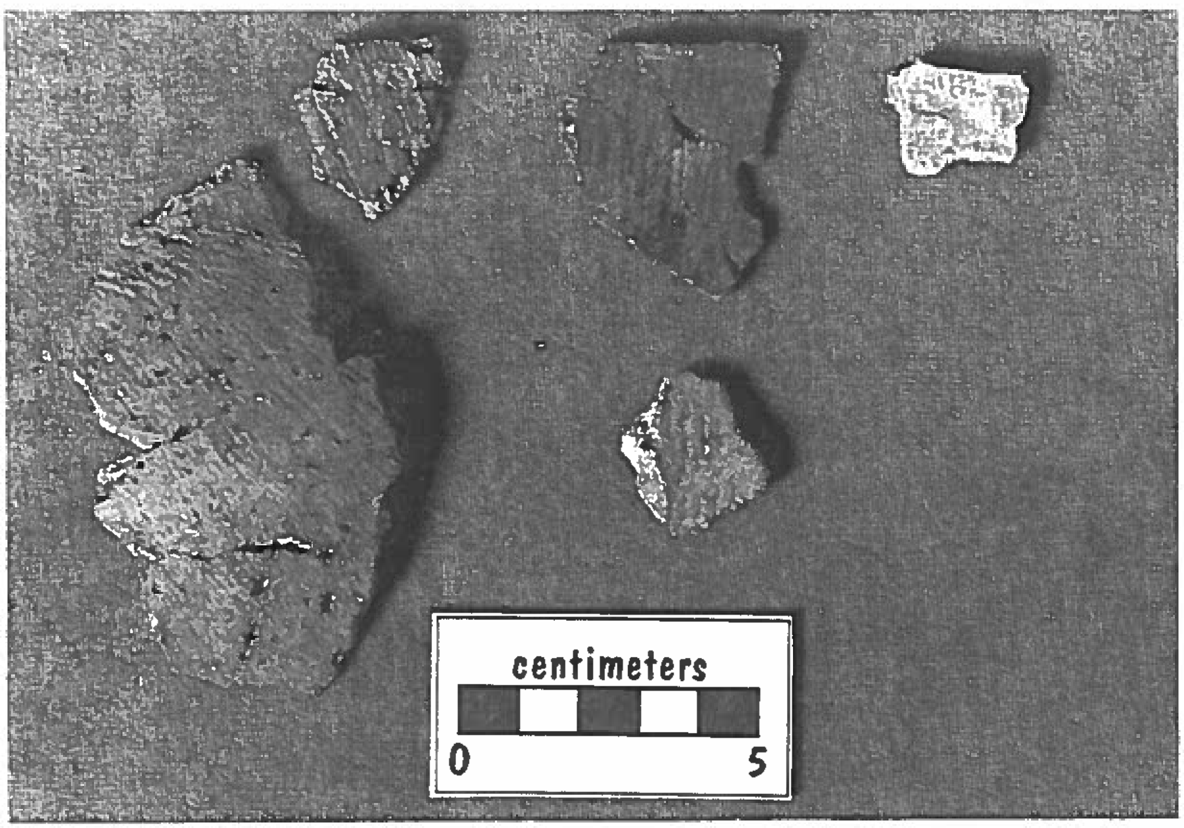

Figure 5. Smoothed-Over Cordmarked Ceramics from the Shelby Lake Site.

Rims were direct or recurved in profile and had flat lips, most of which were cordmarked. Vessel lips tended to be slightly thicker (ca. 1 mm) than the neck of the vessel, due to the flattening of the lip. One rim appeared to be part of a vessel that had a castellated rim. Vessel orifices ranged in diameter from 10 to 14 cm with a mean of 12 cm.

The Late Woodland ceramic collection from Shelby Lake was similar to the nearby Old Bear Site (Brooks 1985) (Figure 6). These two collections have mean sherd thicknesses of 5.4 and 5.5 mm, respectively, and both collections were dominated by cordmarked sherds, with minor amounts of smoothed-over cordmarked and plain specimens. Other similarities include direct or recurved rims with cordmarked lips and castellated rims (Figure 7). The primary difference between the two collections was the presence of lip notching within the larger Old Bear collection. The absence of this decorative rim treatment within the Shelby Lake collection can be attributed to the smaller sample of sherds recovered from this site.

Except for the presence of castellated rims, the Shelby Lake and Old Bear ceramic collections were very similar to other early Late Woodland ceramic assemblages from the middle Ohio Valley (Figure 8), including Hansen (Henderson 1988) and Bentley (Henderson and Pollack 1985) in Greenup County, Rogers in Boone County (Kreinbrink 1992), SARA in Jefferson County (Mocas 1995), Dreaming Creek in Madison County (Fenton and Lonzy 1995), Pyles in Mason County (Railey 1984), 15Ne55 in Nelson County, Leonard Haag in Indiana (Reidhead 1974), and Childers in West Virginia (O'Malley 1990). In general these collections were characterized by thin-walled elongated jars, most of which have cordmarked exterior surfaces. Jars tend to have direct, recurved, or slightly out flaring rims and some vessels have angular shoulders.

The presence of castellated and carinated (lip notching) rims and the absence of angular shoulders at the Old Bear Site, led Railey (1990:289, 1991:70) to suggest that this site dated to the terminal Late Woodland (A.D. 800-1000), rather than the early Late Woodland (A.D. 500-800) as suggested by Brooks (1985) and an uncalibrated radiocarbon date of A.D. 510 ± 100. Although the presence of castellated vessels distinguishes both the Shelby Lake and Old Bear ceramics from most early Late Woodland assemblages, a similar rim was recovered from the Newtown component at the Leonard Haag Site (Reidhead 1981; Reidhead and Limp 1974:11). Lip notching has been identified at several other early Late Woodland sites, including Rogers (Kreinbrink 1992), Hansen (Henderson 1988:329), and Dreaming Creek (Fenton and Lozny 1995).

CHIPPED STONE

A variety of chipped stone artifacts were recovered from the Shelby Lake Site. Included in this category were bifaces, a chert celt, cores, and flakes.

Bifaces

The 17 bifaces recovered from the site were sorted into one of three categories (initial reduction, primary trimming, and secondary trimming) that represent different stages in the manufacturing process. During initial reduction, the first stage of stone tool manufacture, artifacts were " . . . formed by the removal of at least a portion of the natural exterior surfaces of raw material, or 'decortication' as it was commonly called. This process may continue without a shift in flaking strategy until the raw material piece was exhausted" (Fenwick and Collins 1975:4). During the second stage, primary trimming, bifaces receive " . . . their general outline and sectional form (Fenwick and Collins 1975:7). Secondary trimming

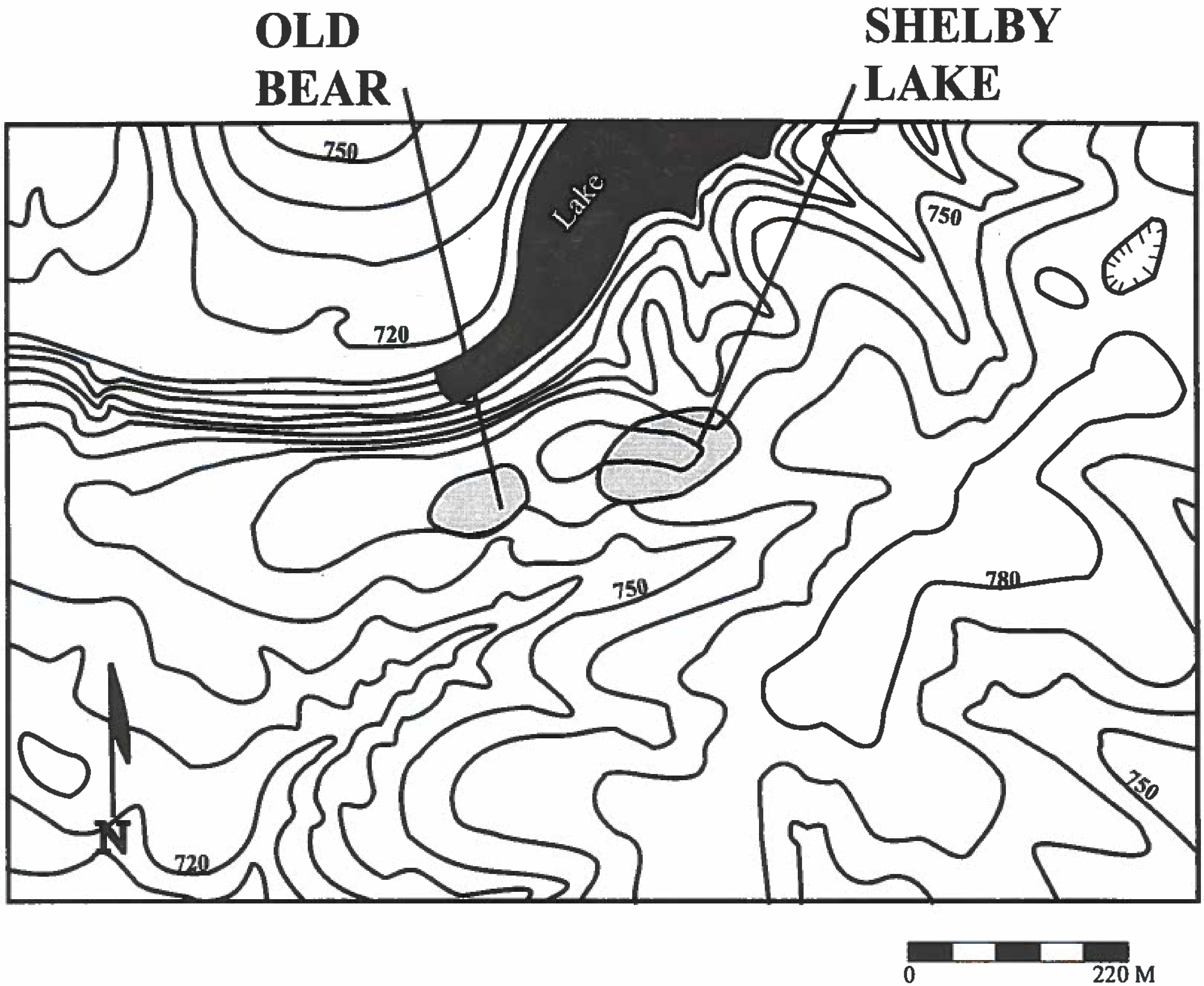

Figure 6. Contour Map Showing the Spatial Relationship Between the Shelby Lake and Old Bear Sites.

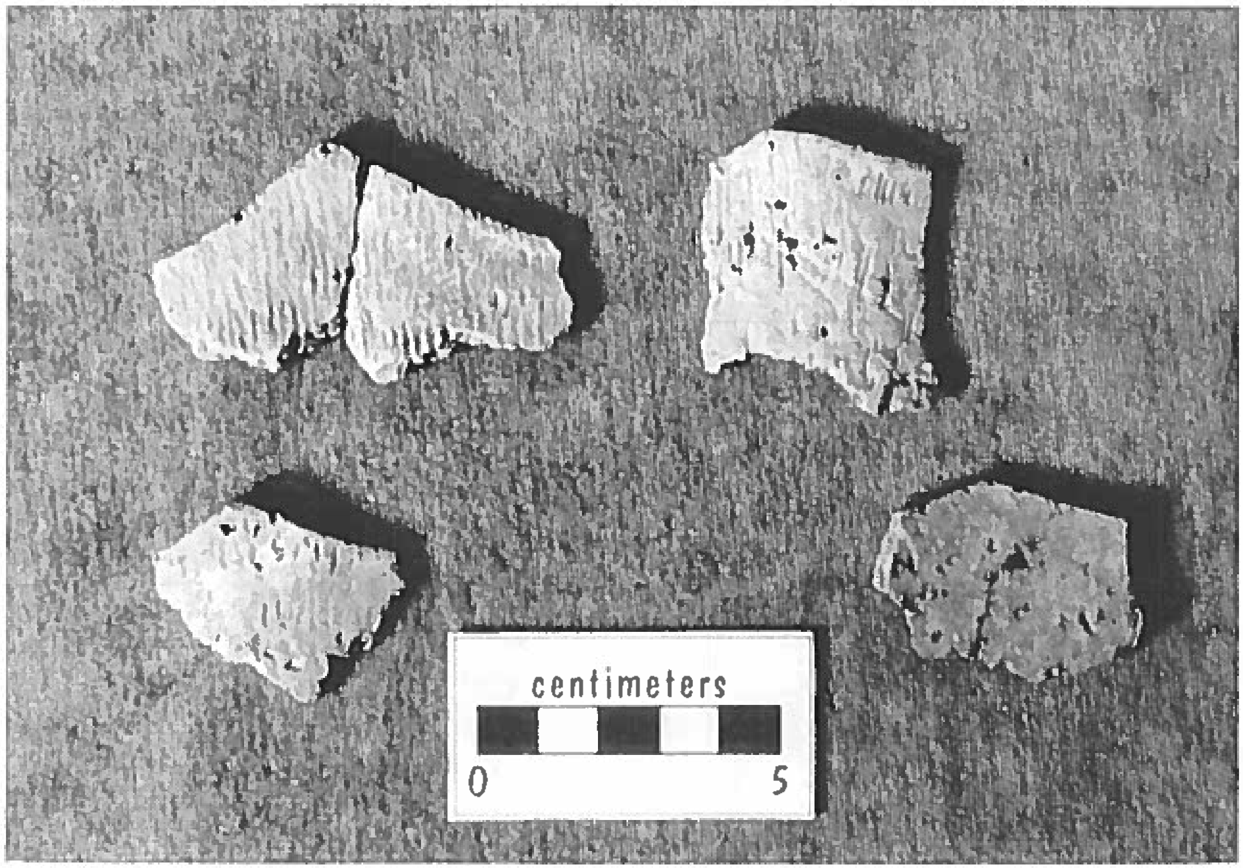

Figure 7. Rim Sherds from the Old Bear Site.

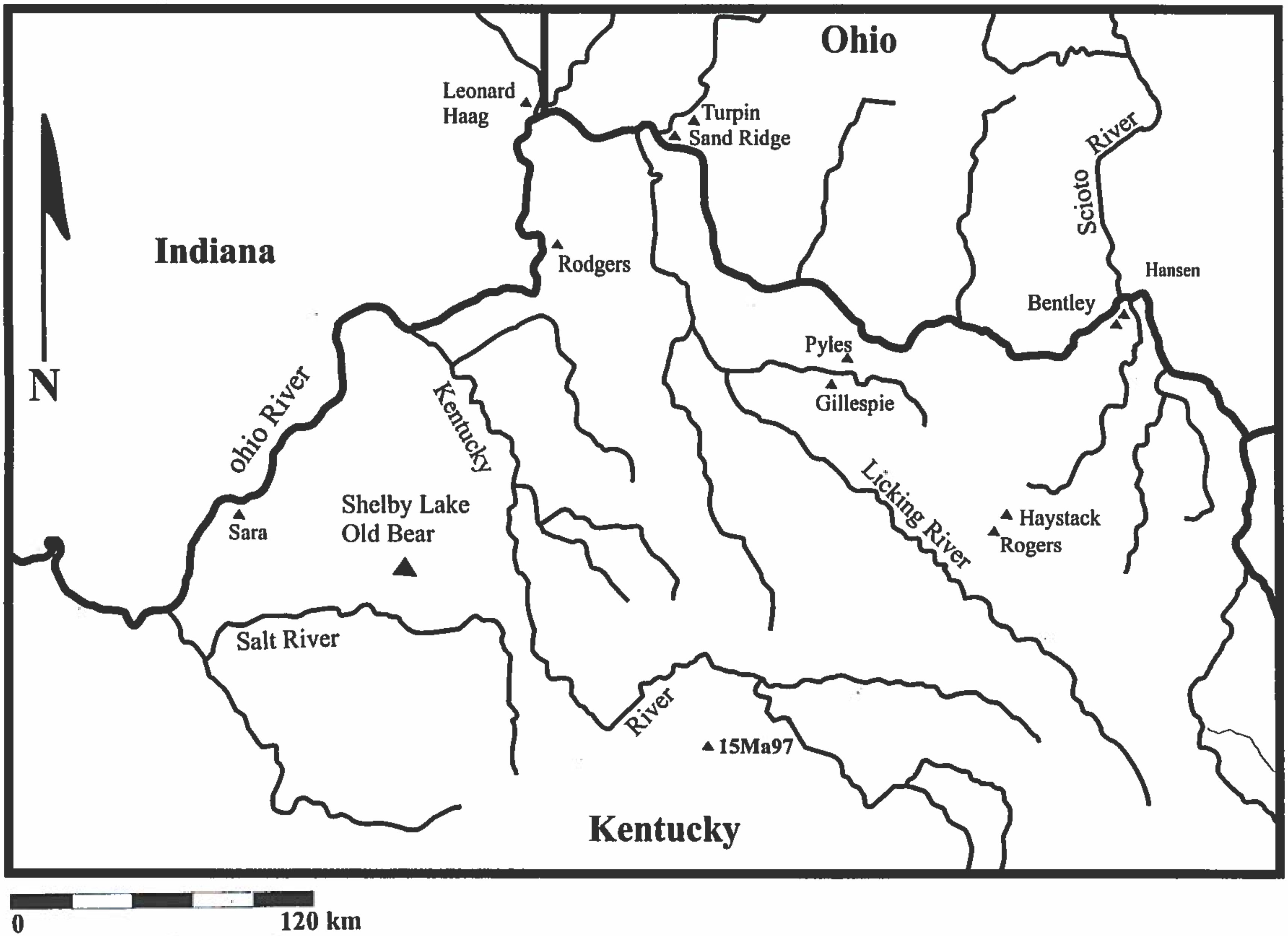

Figure 8. Map of the Middle Ohio Valley Showing the Location of Significant Late Woodland Sites.

was the final stage of manufacture where "...the final edge qualities and shape attributes were imparted to the biface (Fenwick and Collins 1975:7).

Only one initial reduction biface and two primary trimming bifaces were recovered from the site (Table 2). The single initial reduction biface was recovered from Feature 8. One of the primary trimming bifaces was a complete specimen with an ovate shape. Wear along one lateral edge and one end suggests that this specimen may have been used as a knife. The second specimen appears to be the proximal portion of a projectile point preform that snapped during the manufacturing process.

Sixteen specimens were classified as secondary trimming bifaces (Table 2). These include eight projectile points, two hafted end scrapers, one drill, and five fragmentary specimens. The fragmentary specimens include four distal ends (three from Feature 8 and one from Feature 7), one edge fragment (Feature 8), and one mid-section (from the general surface). Three of the distal ends were thin, well-made fragments that were probably from projectile points. The fourth distal end exhibits heavy wear on one side of the blade and the distal end, suggesting that it was used as a knife. The edge fragment and mid-section were probably projectile point fragments.

Projectile Points

The eight projectile points recovered include two expanded stem, two side notched, one corner notched, one possible corner notched, one straight stem, and one triangular specimen (Table 2). The first expanding stem point (Figure 9c) was a proximal portion. It had an excurvate base, and inversely tapered shoulders. This point resembles a Chesser Notched style (Justice 1987:213-214). The second expanding stem specimen (Figure 9g) was a nearly complete point. The proximal end was slightly damaged, but the specimen appears to be an expanding stem style or shallow side notch. This point also resembles a Chesser Notched style (Justice 1987:213-214).

Two specimens were classified as side notched projectile points but they may be expanded stem styles. The first specimen (Figure 9a) was a small complete point which is similar to the Matanzas Side Notched type, which dates to the Late Archaic period (Justice 1987:119-120). However, given its that it was recovered from a Late Woodland feature, it is probably a Chesser Notched point (Justice 1987:213-214) whose blade that has been repeatedly resharpened. The small remaining blade gives the specimen the appearance of side notching. The second specimen (Figure 9b) was the proximal portion of a shallow side notched or an expanding stem point. It is similar to the Steuben Expanded Stemmed or Bakers Creek type (Justice 1987: 208-212).

One corner notched point and one possible corner notched point were recovered from the surface. The first specimen (Figure 9e) was a complete St. Charles point (Justice 1987: 57-58). This specimen has a shallow basal notch, heavy basal grinding, alternate beveling of the blade edges, blade serrations, and expanding barbs. The second specimen was a proximal fragment with a rounded base, heavy basal grinding, and alternate beveling of the blade. It characteristics indicate an Early Archaic affiliation.

One specimen with a short straight stem (Figure 9d). It appears that extensive heat damage caused the blade to snap. Since the stem was extremely short, it may have been reworked.

The final projectile point (Figure 9h) was a complete triangular specimen with an expanding excurvate base found on the surface. This point conforms to Railey's (1992: 156-158) Type 2 Fine

Table 2. Measurements of Projectile Points and Other Bifacial Lithic Tools.

Type	Context	ML	MW	T	BAW	SL	SW	BLW	BL	NW	ND
Chesser Notched	S	---	23	8	21	13	21	23	---	---	---
Chesser Notched	S	42	21	7	21	---	---	21	33	5	3
Mantanzas	F8	25	17	6	16	8	---	17	17	4	2
Steuben Expanded	S	---	26	8	---	14	23	26	17	5	3
St. Charles	S	63	31	10	28	---	---	31	51	5	5
Stemmed	F7	---	26	6	---	6	21	26	---	---	---
Triangular	S	47	21	6	21	---	---	---	---	---	---
Hafted Scraper	S	29	19	8	19	10	19	23	15	---	---
Hafted Scraper	S	49	37	8	23	11	23	31	37	---	---
Drill	F7	26	23	5	---	---	---	---	---	---	---
Initial Reduction Biface	S	41	29	19	---	---	---	---	---	---	---
Primary Trimming Biface	S	66	43	8	---	---	---	---	---	---	---
Primary Trimming Biface	S	31	31	9	---	---	---	---	---	---	---
Celt	F8	96	47	23	---	---	---	---	---	---	---

Key: S=Surface, F=Feature, ML=Maximum Length, MW=Maximum Width, T=Thickness, BAW=Basal Width, BL=Blade Length, SL=Stem Length, SW=Stem Width, BLW=Blade Width, NW=Notch Width, and ND=Notch Depth. All measurements are in millimeters.

Figure 9. Projectile Points from the Shelby Lake Site: a, Mantanzas or resharpened Chesser Notched; b, Steuben Expanded Stemmed; c, Chesser Notched; d, short stemmed specimen; e, St. Charles; f, Bakers Creek hafted scraper; g, Chesser Notched; h, Type 2 Fine Triangular: Flare Base.

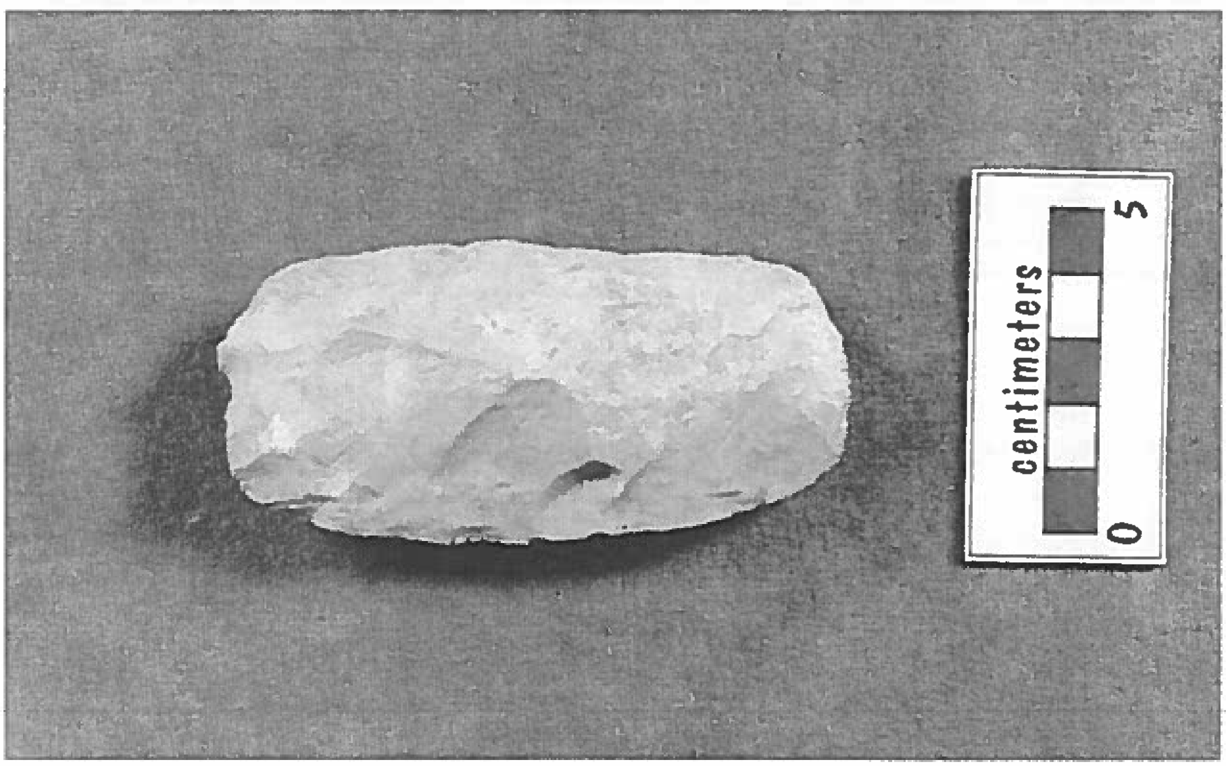

Figure 10. Chert Celt from Feature 8.

Triangular: Flared Base point which dates to the early Fort Ancient period (A.D. 1000-1200). This was a common projectile style at the Johnson Site in Scott County (Hockensmith 1984:95) and at the Muir Site (15Js86) in Jessamine County (Sharp 1988:193).

The projectile points from the Shelby Lake Site cluster into three periods: Early Archaic, Middle to Late Woodland, and Fort Ancient. The side notched and expanding stem styles were similar to Justice's (1987:208-214) Lowe Cluster, and closely resemble Chesser Notched, Steuben Expanded Stemmed, and Bakers Creek. The Chesser Notched style occurs initially during the Middle Woodland but was most popular during the Late Woodland period with a date range of A.D. 300 to 700 (Justice 1987:214). Steuben Expanded Stemmed points are also characteristic of terminal Middle Woodland and early Late Woodland with a range of A.D. 100 to 800 (Justice 1987:208-211). The Bakers Creek point is a middle and terminal Middle Woodland style that appears about A.D. 150 and continues to A.D. 600 (Justice 1987:211-212).

The remaining specimens were surface finds that predate or post date the features. The St. Charles point is an Early Archaic style with a suggested date range of 8000 to 6000 B.C. (Justice 1987:57). The triangular point with a flared base is an early Fort Ancient style with a date range of A.D. 1000 to 1200 (Railey 1992:165).

Hafted End Scrapers

Two hafted end scrapers were recovered from the site (Table 2). One specimen (Figure 9f) has an expanding stem and appears to be a reworked Bakers Creek or Chesser Notched projectile point (Justice 1987:211-214). The working edge was 21 mm long with a steep working angle. As previously noted, Baker Creek or Chesser Notched points date to the Late Woodland period (Justice 1987:211-214).

The second specimen has a slightly expanded stem with an incurvate base. This scraper resembles a Hi-Lo Cluster point style (Justice 1987: 44-46). It has a working edge length of 26 mm. This style could date to the Late Paleo Indian or Early Archaic period (Justice 1987: 44-46). Justice (1987:46) notes that Hi-Lo Cluster points were resharpened into hafted end scrapers and other tools.

Drill

A single drill was recovered (Table 2). This specimen has a damaged base and broken bit. It appears to have a triangular base with a bit that was oval in cross section. Some use wear was evident on the incomplete bit.

Chert Celt

A chert celt (Figure 10) was recovered from the site (Table 2). This specimen was manufactured from a gray, white and brown mottled chert. Heavy use wear was present on both lateral edges of the celt. It appears to have been used for scraping.

Cores

Eight cores were found at the site (Table 3). They have the following size ranges: length: 22-83 mm; width: 11-43 mm; and thickness: 18-44 mm. The cores exhibit random flake removal patterns. Two specimens have limestone adhering to one surface indicating that the raw material was recovered from tabular chert deposits. One specimen contains a yellowish brown cortex which reveals that it was a pebble chert derived from a stream bed.

Table 3. Cores Recovered From the Shelby Lake Site.

Context	Length	Width	Thickness
Feature 4	35 mm	14 mm	21 mm
Feature 4	26 mm	12 mm	28 mm
Feature 7	22 mm	21 mm	18 mm
Feature 8	24 mm	18 mm	19 mm
Feature 8	26 mm	11 mm	28 mm
Feature 10	42 mm	31 mm	30 mm
Feature 10	30 mm	18 mm	24 mm
Surface	83 mm	43 mm	44 mm

Flakes

The investigations at the Shelby Lake Site yielded 3,002 chert flakes. Most of these flakes (n=2,943) were recovered from features (Table 4) and the remainder (n=59) were collected from the surface (Table 5). The flakes were classified into 15 categories that reflect the amount of cortex present and edge condition. These flakes were initially divided into five categories: cortex (retains cortex on most of one surface), semi-cortex (retains cortex on about one half of the exterior), edge cortex (cortex on the edge or striking platform), bifacial thinning (no cortex present), and shattered (flake fragments lacking a bulb of percussion). These categories were further subdivided on the basis of edge condition: unmodified (no edge damage), modified (random damage of unknown source), and retouched (exhibiting a regular pattern of small flake scars). Because of their surface context, the remainder of this section will focus on the flakes from features.

Analysis of the chert debitage recovered from features suggested that chipped stone tool production and maintenance were important activities at the Shelby Lake Site. The analysis results are presented in Table 4. The range of flakes present indicates that all phases of biface reduction occurred at the Shelby Lake Site. The presence of large numbers of very small bifacial reduction flakes (n=899) suggests that blade resharpening and tool maintenance were common activities at the site. Both hard hammer and soft hammer techniques were used in tool manufacture.

Edge analysis indicates that only one percent of the chert flakes (n=32) were utilized by the site inhabitants. These flakes functioned as small cutting or scraping tools. Another 1.5 percent of the flakes (n=42) exhibited randomly modified edges, which could have resulted from either prehistoric use or accidental damage. A factor that undoubtedly limiting flake utilization was size. Many of the specimens were very tiny pressure flakes that were too small to permit their use as tools.

Table 4. Quantities and Types of Chert Flakes From Features at the Shelby Lake Site.

Flake Types	Unmodified	Modified	Retouched	Totals	Percent of Total
Cortex	23	0	0	23	.8 %
Semi-Cortex	41	2	3	46	1.6 %
Edge Cortex	156	7	2	165	5.6 %
Bifacial Thinning	864	19	16	899	30.5 %
Shattered	1785	14	11	1810	61.5 %
Totals	2869	42	32	2943	100.0 %

Table 5. Quantities and Types of Chert Flakes From General Surface at the Shelby Lake Site.

Flake Types	Unmodified	Modified	Retouched	Totals	Percent of Total
Cortex	2	1	0	3	5.1 %
Semi-Cortex	2	1	0	3	5.1 %
Edge Cortex	12	1	2	15	25.4 %
Bifacial Thinning	11	2	3	16	27.1 %
Shattered	19	1	2	22	37.3 %
Totals	46	6	7	59	100.0 %

Several flakes appear to be blades. The best examples (n=5) were recovered from Features 5 and 8. They range in length from 29 to 37 mm. in width from 7 to 10 mm. and in thickness 2 to 3 mm. Another seven specimens were considered possible blades (wider). They were recovered from Features 7, 8, and 10. They range in length from 25 to 37 mm. width from 12 to 17 mm. and thickness 2.5 to 8 mm. Some of the blades have blade-like flake scars on their exterior surfaces suggesting that a series of blades were removed from a prepared core. These Late Woodland blades were shorter and narrower than Middle Woodland blades, which were at least 50 mm long and 12 mm wide (Yerkes 1994:111). A microwear analysis of the Middle Woodland bladelets from the Murphy Site in Ohio (Yerkes 1994:118) revealed that these were used for a variety of cutting, scraping, and piercing tasks on meat, hides, bone or antler, wood, stone, and plant materials. The blades from Shelby Lake may have been used for similar purposes. Excavations at the Froman Site (15CL51) in Carroll County yielded 29 bladelets and six blade cores (Stallings and Stallings 1996:123). These bladelets were similar to those recovered from Shelby Lake. Several blades and blade cores were recovered from the excavations at the Late Woodland Hansen Site (15Gp14) in Greenup County (Ahler and Henderson 1988:194 and 248). Recent excavations at site 15Ne55 produced blades from features dating to the early Late Woodland period (Davis et al. 1997:169).

Lithic Discussion

Several Late Woodland sites have been investigated in Kentucky. The closest and most pertinent comparative sample was from the Old Bear Site (15Sh18). The excavation of two pit features at the Old Bear Site yielded 758 chert artifacts. The three projectile points from the Old Bear Site were similar to Chesser Notched or Bakers Creek styles, which were also present in the assemblage from Shelby Lake (Brooks 1985:114). Other similarities include the presence the blade preforms, cores, and flakes representing all stages of lithic manufacture (Brooks 1985:116). Missing from the Old Bear Site assemblage were hafted scrapers, drills, and chert celts.

Projectile point styles from Shelby Lake are also comparable to those recovered from other Late Woodland sites in Kentucky. At the Froman Site, Chesser Notched, Steuben Expanded Stem, and Baker Creek were marginally represented in the sample while Lowe Cluster, Lowe Flared Base, and Large Triangular Cluster were the dominant point types (Stallings and Stallings 1996:145). The most common styles at the Pyles Site (15Ms28) in Mason County included Lowe Flared Base, Steuben Expanded Stem, and Bakers Creek (Railey 1984:52). The largest group of projectile points from the Hansen Site in Greenup County fell within the Lowe/Steuben/Chesser cluster with a number of other styles including Large and Small Triangular clusters (Ahler 1997, 1992; Ahler and Henderson 1988:224). At site 15Ne55, 23 Late Woodland points were recovered including 16 Lowe Flared Base, four Steuben Expanded Stem, and three Chesser Notched (Davis et al. 1997:74-76).

Hafted scrapers and drills have also been found at other Late Woodland sites in Kentucky. At site 15Ne55, four hafted scrapers and three drills were recovered (Davis et al. 1997:78-79). Both hafted scrapers and drills were recovered from Pyles Site (Railey 1984:55-56). A few scrapers and drills were also recovered from the Hansen Site (Ahler 1988:218).

BOTANICAL REMAINS

Twenty archaeobotanical samples from nine features, totaling 167 liters of soil, were processed and analyzed. Recovered archaeobotanical remains included a variety of nutshell dominated by hickory, along with squash and gourd rind, native cultigens (maygrass and possibly cultivated chenopod), and fleshy fruits. The wood charcoal profile reflects the presence of a mixed hardwood oak-hickory forest during the Late Woodland period. The absence of carbonized spring seeds, such as pokeweed and purslane within the Shelby Lake Site botanical collection coupled with the predominance of storable plant food remains, such as nutshell, suggest a late autumn site occupation.

METHODS

Botanical remains were recovered using water flotation. After drying, the materials caught in the fine screen were passed through a 2 mm geological sieve, before sorting charcoal from uncarbonized contaminants such as roots. In open prehistoric sites like the Shelby Lake Site, only carbonized plant remains were considered to be part of the archaeological record. Carbonized material such as wood and nutshell from the larger than 2 mm sample was then identified, counted, and weighed, while materials smaller than 2 mm were scanned carefully for seeds. This procedure was followed because fragments of wood and nutshell smaller than 2 mm are difficult to reliably identify and because charcoal specimens larger than 2 mm have been found to be representative of smaller specimens, with the possible exceptions of acorn and squash rind (Asch and Asch 1975). Sieving of archaeobotanical samples also saves laboratory sorting time without a loss of information.

The samples were examined under a light microscope at magnifications of 10 to 30x. Identification of materials was aided by a comparative collection of both archaeological and modern specimens, along with standard catalogs (Martin and Barkley 1973). When applicable, specimens were sorted by species, counted, and weighed to the nearest tenth of a gram. Macroscopic wood characteristics were observed from specimen cross-sections. Changes in the visibility of macroscopic characteristics that occur during carbonization were also accounted for, to ensure maximum accuracy of identification (Rossen and Olson 1985). Very small wood specimens, or specimens that were badly deformed during the carbonization process, were classified as "unidentified." Similarly, badly deformed non-wood specimens were classified as "unidentified-general" and deformed or fragmented seeds were classified as "unidentified-seeds."

PRESERVATION

Archaeobotanical preservation varies greatly between sites for reasons that are only partially understood. Two factors that influence preservation are soil drainage and chemical composition of midden and feature deposits (e.g., soil pH and ash content). The circumstances surrounding plant carbonization, including firing temperature and the amount of oxygen reduction, also influence preservation. Soil particle size and inclusions affect whether or not carbonized plant remains are eroded or destroyed by mechanically grinding.

In the case of the Shelby Lake Site, preservation varied substantially between and even within individual samples. Small seeds, such as maygrass, were recovered in excellent, poor, and heavily eroded conditions. Nutshell also was recovered in a variety of states of preservation. The preservation of botanical remains was, however, adequate to allow for the identification of a variety of plant species.

WOOD CHARCOAL

Wood charcoal (n=6,363) was the most common component of this assemblage. Ten species were identified (Table 6). White oak group and hickory dominate the wood charcoal, together comprising 56 percent of specimens by frequency. Other wood species identified include white ash,

Table 6. Shelby Lake Site Archaeobotanical Collection.

Species	*Frequency*	*Percent*	*Gram Wt*	*Percent*	*Ubiquity*
Wood Charcoal					
white oak group (*Quercus* sp.)	2385	37.5	24.9	39.5	55.6
hickory (*Carya* sp.)	1112	17.5	11.4	18.1	55.6
white ash (*Fraxinus americana*)	1082	17.0	9.8	15.6	11.1
American chestnut (*Castanea dentata*)	838	13.2	7.1	11.3	11.1
American holly? (*Ilex opaca*?)	265	4.2	2.4	3.8	11.1
black walnut (*Juglans nigra*)	226	3.6	1.8	2.9	22.2
sycamore (*Platanus occidentalis*)	192	3.0	2.3	3.7	11.1
hackberry (*Celtis* sp.)	124	1.9	1.2	1.9	22.2
yellow poplar (*Liriodendron tulipifera*)	98	1.5	1.7	2.7	22.2
honey locust (*Gleditsia triacanthos*)	41	0.6	0.4	0.6	22.2
Total identified wood charcoal	6363	100.0	63.0	100.0	
unidentified wood charcoal	1481		13.0		
Total wood charcoal	7844		76.0		
Nutshell					
hickory (*Carya* sp.)	2738		44.9		66.7
black walnut (*Juglans nigra*)	63		1.1		55.6
hazelnut (*Corylus* sp.)	14		0.1		11.1
acorn (*Quercus* sp.)	7		0.0		22.2
butternut (*Juglans cinerea*)	3		0.1		11.1
Total	2825		46.2		

Table 6. Shelby Lake Site Archaeobotanical Collection (continued).

Species	*Frequency*	*Percent*	*Gram Wt*	*Percent*	*Ubiquity*
Cultigens					
squash rind (*Cucurbita* sp.)	29		0.0		22.2
gourd rind (*Lagenaria* sp.)	1		0.0		11.1
Total	30				
Seeds (native cultigens)					
maygrass (*Phalaris caroliniana*)	27		---		44.4
chenopod (*Chenopodium* sp.)	6		---		22.2
Total	33				
Seeds (fleshy fruits)					
nightshade (*Solanum americanum*)	35		---		22.2
sumac (*Rhus* sp.)	6		---		22.2
blackberry (*Rubus* sp.)	3		---		33.3
persimmon (*Diospyros virginiana*)	1		---		11.1
Total	45				

American chestnut. American holly. black walnut. sycamore. hackberry. yellow poplar. and honey locust. With the possible exception of American chestnut and American holly. these species are important secondary forest components. Because American chestnut succumbed to a blight during the early and middle portions of this century. it is difficult to assess its overall contribution to the composition of the prehistoric and early historic forests of central Kentucky remains. American holly is rarely found in the regional archaeological record. and may have been only a tertiary species.

Although wood charcoal assemblages may reflect the construction and firewood preferences of the site's past occupants. wood preferences have probably not affected this collection because: 1) no posts or house logs were encountered during the excavations. 2) all botanical remains were recovered from pit features. 3) most wood samples contained multiple species mixed together. and 4) the wood collection was similar to other regional archaeological collections (Rossen 1991) in depicting a mixed oak-hickory forest. In contrast. architectural features such as posts or roof timbers and botanical samples dominated by a single wood species (all absent from the Shelby Lake Site) would be more likely to produce a wood charcoal collection biased by wood selection preferences. It thus appears that this wood collection is a reasonably accurate representation of important local forest species in the vicinity of the Shelby Lake Site.

PLANT FOOD REMAINS

Plant food remains recovered from the Shelby Lake Site include nutshell. squash. and gourd rind. seeds of at least one and maybe two native starchy seed cultigens (maygrass and possibly. chenopod). and fleshy fruit seeds.

Nutshell

Nutshell was dominated by thick-shelled hickory (*Carya* sp.). Hickory accounts for 96.9 percent of the nutshell by frequency (97.2 percent by weight) (Table 6). Throughout much of the Archaic and Woodland periods in Kentucky. hickory was a "focal" plant resource. Hickory nuts were collected and processed for their high protein and fat content. and ease of collection. preparation. and storage. Swanton (1946) reviewed at length the ethnographic data on hickory nut use by southeastern Native Americans. The most common use he found was as a "hickory nut soup." which was prepared by cracking the nuts and placing them into a pot of boiling water. where the nutshell would settle to the bottom leaving an oily white broth that was considered a delicacy.

Four other nut species (black walnut. hazelnut. acorn. and butternut) were recovered in small amounts and do not appear to have been as important to the diet as hickory. Black walnuts (*Juglans nigra*) contain over three times the nutmeat (Styles 1981:82) and approximately ten percent the protein and fat of hickory (Lopinot 1982:858-859). Walnuts are. however. much more difficult to process and prepare in bulk. and unlike hickory. walnut trees do not grow in solid stands. As with walnuts. hazelnuts (either *Corylus americana*. the American hazelnut or *Corylus cornuta*. the beaked hazelnut) also are high in protein and are be easily stored (Krochmal and Krochmal 1982:6-8).

Acorn (*Quercus* sp.) was probably the most abundant and reliable southeastern United States nut. because it produces consistent annual masts while other species vary more in annual production. However. acorns require special processing to remove the astringent tannic acid of the nutmeat. Furthermore. acorns are nutritionally inferior to other nuts. with only half the protein. and one-third the fat of hickory nuts. Despite this. acorns may be simpler to collect than other types of nuts. and nutmeat yields are high, so the net energy potential of acorn may be similar to that of other nuts (Lopinot 1982:726). Because the acorn nutshell is fragile, this species is probably under-represented in the archaeological record (Asch and Asch 1975).

Butternut (*Juglans cinerea*) is widespread in the eastern United States' archaeological record but in small amounts. Its nutritional content, processing and use was very similar to that of black walnut. Butternut trees, however, only produce good harvests every two or three years. Consequently, butternuts may not have fit into a seasonal collection strategy as well as other nut-bearing species that produce more consistent harvests (U.S. Department of Agriculture 1948:110, 202).

Squash and Gourd Rind

Squash rind (*Cucurbita* sp., n=29) was found in two features. Prehistoric squashes in the southeastern United States were hard-shelled and probably used primarily for their edible seeds. Squash appears very early in the archaeological record, having been found in several Archaic period contexts (Cowan et al. 1981; Kay et al. 1980; Marquardt and Watson 1983). There is ongoing debate concerning whether these early specimens represent domesticated or wild species, and whether or not squash had native North American origins (see Fritz 1988; Heiser 1989; Smith 1987; Watson 1989 on this debate). It is not known whether squash was cultivated during Archaic times, but by the Late Woodland period it was certainly a garden plant.

Gourd (*Lagenaria* sp.) is a plant of probable South American origin (Stone 1984). Gourds were used as containers, and their use probably diminished with the adoption and increasing use of pottery during the Woodland period. Because squash and gourd rind do not preserve easily, they are likely to be under represented in the archaeological record (Asch and Asch 1975). The presence of 29 squash rind specimens in the small collection from the Shelby Lake Site suggests a substantial Late Woodland economic use of this plant.

Native Cultigen Seeds

The remains of one (maygrass) and, possibly, a second (chenopod) starchy-seed plant were recovered. Maygrass (*Phalaris caroliniana*, n=27 seeds) seeds contain more protein and fat than domesticated grains such as corn, wheat, and barley (Cowan 1978:269-270). However, its trait of indeterminate inflorescence, or sequential seed ripening, would have complicated its systematic cultivation and harvest. Maygrass was cultivated throughout the southeastern United States by Late Woodland times (Johannessen 1984; Lopinot 1988; Rossen 1985; Wymer 1990).

Chenopod (*Chenopodium* sp., n=6 seeds), also known as goosefoot or lambsquarters, was used for both its greens and its abundant, starchy seeds. A domesticated variety (*Chenopodium berlandieri*) was widely used in the southeastern United States during Woodland times (Smith 1987; Watson 1989). The domesticated chenopod is distinguished from wild populations by its distinctive "truncate-margin" profile (as opposed to a simpler biconvex profile in wild seeds) and a thinner or absent seedcoat. The six specimens from the Shelby Lake Site were all popped and heavily deformed, without seedcoats. It was thus not possible to determine whether or not they represent the domesticated variety.

Fleshy Fruit Seeds

Seeds of four fleshy fruits (nightshade, sumac, blackberry, and persimmon) were recovered. The small-seeded nightshade (*Solanum americanum*) produces edible berries, and the seeds occasionally occur in small amounts at other Kentucky Late Woodland sites such as Hansen (Lopinot 1988:613). There is no ethnographic evidence for its historic use in the southeastern United States. Sumac (*Rhus* sp.) is a bush that produces edible berries that were easily stored. The plant is best-known for its historic use in a tea that is high in Vitamin C, although it is a high energy food source and medicinal plant (Gilmore 1931:47-48; Vogel 1982:378). The berries were often dried for storage (Swanton 1946:606). Sumac also may have been used as a flavoring for nut soups such as the hickory nut soup previously described (Cowan 1979:9). Sumac has been found in many sites in southeastern United States Woodland period sites in low to moderate frequencies (Lopinot 1982, 1988; Rossen n.d.; Wymer 1990). In central Kentucky, the use of sumac appears to have reached its peak usage during the Fort Ancient period (Rossen 1992:196-199).

Blackberry (*Rubus* sp., n=3) and persimmon (*Diospyros virginiana*, n=1) are edible fleshy fruits. Blackberry seeds are often recovered in low frequency from southeastern United States sites, and were probably a marginal food source (Yarnell 1969). Persimmon seeds are also present in Midwestern archaeological sites, but never in great frequency, during the Woodland period (Lopinot 1988:762). Persimmons are notable for their high sugar content and there is abundant ethnographic data for their use by historic southeastern Native Americans (Swanton 1946:293).

DISTRIBUTIONAL OBSERVATIONS

The large majority of plant remains in this collection were recovered from four (Features 7-10) of the nine pits excavated at the Shelby Lake Site. The broad similarity of the remains in these four features is remarkable (Table 7). All contain large amounts of hickory nutshell, along with small amounts of maygrass. Three contain squash rind, black walnut, acorn, and blackberry, and two contain chenopod, sumac, and nightshade. Despite the small number of pits and volume (110 liters) examined, the replication of plant remains in these different features implies that there was little sample bias in the collection. Of the remaining features, Features 1 and 2 are totally devoid of charcoal and Features 4, 5, and 6 contain only wood charcoal along with traces of nutshell.

BOTANICAL SEASONALITY

Estimating the seasonality of a site from an archaeobotanical assemblage is difficult at best. Factors such as sampling, preservation, and food storage can be misleading. In the case of the Shelby Lake Site, the combination of the presence and absence of certain plant species and the consistency of plant remains in the various features allows a tentative estimate of seasonality. Other data from faunal remains, site organization, and features may corroborate or contradict the impression given by the botanical remains.

The Shelby Lake Site contains storable species such as hickory and sumac that would have been collected in October. The earlier maturing hazelnut (July to August) was present in trace amounts. Hard-shelled squash and gourd were also late autumn maturing species. These plant species may have been brought to the site and stored there, or may have been processed at the site for later use.

Spring and summer Late Woodland period occupation sites usually produce large frequencies of native cultigens, fleshy fruits, and a long list of seeds of weedy annuals in low frequency. The Hansen Site in Greenup County and the Watson Site in Boone County are good examples of large Late Woodland period botanical assemblages associated with spring-summer-early autumn occupations

Table 7. Plant Food Remains from Features at the Shelby Lake Site.

Feature Number	Feature 7		Feature 8		Feature 9		Feature 10	
Species	freq	gm wt	fre	gm wt	freq	gm wt	freq	gm wt
hickory (*Carya* sp.)	56	0.6	1006	44.9	1108	16.1	524	7.6
black walnut (*Juglans nigra*)	2	0.0	35	0.5	15	0.3		
hazelnut (*Corylus* sp.)			14	0.1				
butternut (*Juglans cinerea*)			3	0.1				
acorn (*Quercus* sp.)	3	0.0	3	0.0	1	0.0		
squash rind (*Cucurbita* sp.)			14	0.0	2	0.0	13	0.0
gourd rind (*Lagenaria* sp.)	1	0.0						
maygrass (*Phalaris caroliniana*)	2	---	2	---	3	---	20	---
chenopod (*Chenopodium* sp.)			1	---			5	---
sumac (*Rhus* sp.)	1	---	5	---				
blackberry (*Rubus* sp.)	1	---			1	---	1	---
nightshade (*Solanum americanum*)					1	---	34	---
persimmon (*Diospyros virginiana*)					1	---		
unidentified-general	3	0.0	15	0.1	4	0.0	5	5
unidentified-seeds	4	---	4	---	9	---	6	---
Liters	52		28		20		10	

Note: No archaeobotanical remains were recovered from Features 1 (3 liters) and Feature 2 (3 liters). Hickory (*Carya sp.*) was the only plant food remains from Feature 3 (10 liters: freq=2, gm wt=.0), black walnut (*Juglans nigra*) was the only plant food remains from Feature 6 (16 liters: freq=8, gm wt=0.3) and both were recovered from Features 4 (25 liters: freq=37, gm wt=0.5 and freq=3, gm wt=0.0, respectively.

(Lopinot 1988; Rossen n.d.). Farther afield, in West Virginia, there are several examples of spring-summer-early autumn site occupations, including the Childers, Woods, and Green Sulphur Springs sites (Rossen 1985; Wymer 1990). These sites contain seeds, such as purslane (*Portulacca* sp.), pokeweed (*Phytolacca* sp.), bulrush (*Scirpus* sp.), burclover (*Medicago* sp.) and goosegrass (*Eleucine indica*), that are often fortuitously carbonized during summer-early autumn seed dispersal and rain episodes (for similar data from central Ohio, see Wymer 1987). In comparison, the Shelby Lake Site collection contained few native cultigen and fleshy fruit seeds and no seeds of the many weedy annuals that usually occur in Late Woodland sites. Its remains were heavily dominated by storable nuts, a pattern generally reminiscent of the plant remains from the Goolman Site, a Fort Ancient winter camp in Clark County, Kentucky (Wymer 1983). The Goolman Site was located inside a steep ravine that afforded protection from the wind (Turnbow and Jobe 1984), which was unlike the open and exposed Shelby Lake Site. It therefore seems possible that the Shelby Lake Site was a late autumn seasonal occupation.

BOTANICAL SUMMARY

Most of the Shelby Lake archaeobotanical collection was derived from four pit features. The plant food remains were dominated by hickory nutshell, but small amounts of other types of nutshell and seeds of native cultigens and fleshy fruits were also present. However, weedy annuals that reflect summer and autumn seed rain and food use were absent. The collection indicates a strong focus on potentially storable plant foods, especially hickory nuts. A late autumn seasonality for this collection is postulated, depending on other corroborating lines of seasonality evidence. If corroborated by other site data, this plant collection would indicate a short-term seasonal encampment during the late autumn period of winter preparation or during winter itself. This collection suggests that, during that time of year, the usually large inventory of wild and cultivated plant resources became heavily focused on hickory nuts and a few other storable foods.

VERTEBRATE FAUNAL REMAINS

A total of 4,844 faunal elements were examined. All elements were identified by direct comparison with modern specimens in the Osteology Collections of the University of Kentucky Museum of Anthropology, Lexington, and the University of Tennessee, Knoxville. Identifications were also supported by standard catalogs (e.g., Brown and Gustafson 1989; Gilbert 1980; Gilbert et al. 1985; Hillson 1986; Olsen 1964, 1968a, 1968b). Data were sorted using standard techniques (Davis 1987, Hesse and Wapnish 1985), and numerically coded following the format presented by Shaffer and Baker (1992), and were manipulated using dBase III+ Faunal Analysis Coding System (FACS) support programs. Taxonomy has been derived from several sources: amphibian and reptile, from Dixon (1987) and Stebbins (1985); avian, from Robbins et al. (1983); and mammalian, from Hall (1981). Fish remains and invertebrates were essentially not present. Weights are given as aggregates, in grams, for the amount of bone present within each feature (Table 8).

Faunal remains were derived from dry screening through 6.4 mm mesh, and from heavy and light fraction flotation samples. Elements were coded for a number of attributes. These include provenience information, taxon, element, portion of element, side, age, age criteria, burning, cut marks, and medical disorders/trauma. Taxa were identified to genus and species, whenever possible; extremely fragmented elements were identified only to order, class, or family.

The minimum number of individuals (MNI) was calculated as the most frequently occurring sided element by age class for each species (Grayson 1984). The number of individual specimens

Table 8. Shelby Lake Site Fauna Feature Recovery (weight in grams).

FEATURE RECOVERY									
TOTAL WEIGHT (in grams)									
Feature No.	1	3	4	5	7	8	9	10	TOTAL
Screened (6.4 mm)	16.3	6.3	696.0	199.8	1169.2	1113.2	120.0	494.5	3815.3
HF (6.4 mm)			12.1		103.6	0.5	71.1	81.4	268.7
TOTAL	16.3	6.3	708.1	199.8	1272.8	1113.7	191.1	575.9	4084.0

present (NISP) was also recorded. While the NISP values are given for the site as a whole, and for each separate provenience (surface and features), the MNI values (Table 9) were determined for the site as a unit due to the probable contemporaneity of the features. For the purposes of this study, elements that compare favorably ("cf.") to a taxon are included with that taxon in the calculations of NISP and MNI.

PRESERVATION

The vertebrate faunal remains from Shelby Lake were remarkably well-preserved. A number of whole (n=73) or partially complete elements were recovered including a nearly complete black bear cranium, along with most of its teeth. However, a high percentage of the large mammal (most likely white-tailed deer, as well as elk and bear) long bone shaft fragments were shattered, perhaps as the result of fracturing for marrow extraction. Most small animals, such as fish, birds, micro mammals (e.g., mice), and many reptiles and amphibians were under-represented when compared to other sites. Since all flotation samples (both heavy and light fractions) were analyzed, the under-representation of small animals does not appear to be attributable to sampling error. Most of the elements recovered from flotation represent fragments assignable to order, class, or higher in the taxonomic classification scheme.

RESULTS

The fauna remains recovered from the Shelby Lake Site (4,844 elements) do not reflect the wide range of species found at Late Woodland sites in the lower Illinois River valley such as Newbridge, Carlin, Weitzer, and Apple Creek (Styles 1981), or the Middle Woodland sites such as Napoleon Hollow (Styles and Purdue 1986). The analysis resulted in the identification of 7.8 percent of the elements to the level of order, family, genus, or species. The most numerous taxa were mammals (NISP=4,202), followed by birds (NISP=566) and by herptiles (NISP=37). At least 11 different species were identified. The most common were deer (NISP=168), followed by black bear (NISP=115), various turtles (NISP=33), and raccoon (NISP=31). By far, the elements most ubiquitous (Table 10) in the assemblage were medium/large mammal long bone shaft fragments (NISP=1,763).

Table 9. Shelby Lake Site Fauna Remains. [NISP=Number of Individual Specimens Present]

TAXON	S	F 1	F 3	F 4	F 5	F 7	F 8	F 9	F 10	TOTAL NISP
Vertebrata (vertebrates)				20			12	1		33
Small/med vertebrate, class ind.						1	4			5
Osteichthyes (med bony fish)							1			1
Testudinata (turtles)				2	2	9	10	2	1	26
Terrapene carolina (eastern box turtle)						1				1
Trionyx spiniferus (spiny softshell turtle)				6						6
Serpentes (snakes)						1				1
Colubridae (colubrid snakes)							1		1	2
Viperidae (pit viper snakes)							1			1
Aves (med/large birds)									5	5
Aves (large birds)		5		242	9	93	106	4	92	551
Meleagris gallapavo (turkey)				6	1	1	2			10
Mammalia (small/med mammals)				5		3	2	1	5	16
Mammalia (med/large mammals)	17	51	14	292	99	870	1456	280	369	3448
Mammalia (large/v large mammals)					1		11			12
Mammalia				1		24	20	295	55	395
Rodentia (med rodent)						1		1		2
Aplodontia rufa (mountain beaver)							1			1
Carnivora (carnivores)				2			1			3
Ursus Americanus (black bear)			1	21	2	78	9	1	3	115
Procyon lotor (raccoons)					3	20	5	11	2	31

Table 9. Shelby Lake Fauna Remains (continued). [NISP=Number of Individual Specimens Present]

TAXON	S	F 1	F 3	F 4	F 5	F 7	F 8	F 9	F 10	TOTAL NISP
Felis concolor (cougar)				1						
Cervus elephus (elk or wapiti)				4		4			2	10
Odocoileus virginianus (white-tailed deer)				13	18	61	50		26	168
TOTAL	17	56	15	615	135	1167	1692	586	561	4844

Aquatic Fauna

Only one bony fish element, a complete vertebra from Feature 8, was recovered from the Shelby Lake Site. The paucity of fish elements cannot be wholly attributed to poor preservation and/or small sample bias. Although the site's location near streams would suggest that fish might have been used, this does not appear to have been the case. Likewise, no fish remains were reported by Brooks (1985) for the Old Bear Site.

Aves

Bird bones comprise 11.7 percent (N=566) of the assemblage. Avian elements were mostly long bone shaft fragments attributable to medium/large birds that could not be differentiated (NISP=433). At least one wild turkey was included in the assemblage, and most of the additional avian material was probably turkeys or large water fowl.

Terrestrial Fauna

Large forest/forest edge species (deer and black bear) comprised the highest percentage of the faunal assemblage at Shelby Lake. These animals have high meat yields, and rate high for nonfood uses (Styles 1981:85). White-tailed deer dominate the terrestrial fauna. A minimum of seven deer were present: two young (one fetal/infant and one subadult each) and five mature animals. In addition to the identified complete and fragmented elements, a large amount of the long bone shaft fragments assigned to the medium/large mammals category were most probably from deer. Black bear remains were also present in the assemblage; in addition to the cranium and teeth mentioned above, vertebrae, ribs, long bones, and metapodials (metacarpals and metatarsals), were recovered. At least two bears, one larger and one smaller, were represented. In addition to the deer and bear, at least one elk, or wapiti, represented by a rib from Feature 2, tibia fragments in Feature 4, and rib, scapula, humerus, and sesamoid elements in Feature 7, was present. A singe ulna from a cougar was recovered from Feature 4.

Medium-sized mammals, such as raccoons and at least one mountain beaver, were present. Styles (1981:88) has noted that among these species, turkey and raccoon offer the best combinations of abundance and meat yield. Unidentified small/medium mammals contribute to the assemblage, but in much fewer numbers. It was interesting to note that small animals such as rabbits, opossum, skunks, squirrels, and so on that were easily trapped were completely missing from the identifiable assemblage. Small- and micro-sized mammals likewise were virtually absent.

Table 10. Shelby Lake Site Fauna: Total Taxa Not Identified to Order or Below (NISP, MNI*).

TAXON	Total Not ID'd to Order NISP	% of Not ID'd to Order	% of Total	MNI
Vertebrata	33	0.74	0.68	
Small vertebrate, class indeterminate	3	0.07	0.06	
Medium vertebrate, class indeterminate	2	0.04	0.04	
Osteichthyes (Medium)	1	0.02	0.02	1
Aves (Medium/large)	5	0.11	0.1	
Aves (Large)	551	12.34	11.37	
Mammalia (Small)	9	0.20	0.19	
Mammalia (Small/medium)	7	0.16	0.14	
Mammalia (Medium)	12	0.27	0.25	
Mammalia (Medium/large)	3436	76.94	70.93	
Mammalia (Large/very large)	12	0.27	0.25	
Mammalia	395	8.15	8.15	
TOTAL	**4466****	**100**	**92.20**	**1**

**NISP* (Number of Individual Specimens Present; *MNI* (Minimum Number of Individuals)
**Total NISP for site: 4844

Reptiles and amphibians were scarce in the collection. The remains of at least one spiny softshell turtle and an eastern box turtle were identified included among the few shell, long bone, and phalange fragments. Snakes also were represented in very small numbers; two colubrid, and one unidentifiable, procelous vertebrae were included with one vertebra from a pitvier.

Modification

The faunal material from Shelby Lake was examined for various types of modification. Gnawing by rodents and carnivores was essentially absent. Evidence of weathering, in the form of surface erosion, cracking, and so on was also not observed. In general, the bone was in excellent condition. Just over a quarter percent (n=1,253) of all elements exhibit at least some degree of burning; very few of these, however, show evidence of extended or high heat burning (i.e., calcined). Cut marks, indicative of butchering and food processing activities, were low (n=57).

Five bone tools were identified including two awl fragments and a scraper (Table 11). One of the awls was made from a long bone from a large bird (Feature 4) and the other was made from a burned mammal long bone fragment (Feature 9). A mammal rib (Feature 3) appears to have been used as a scraper. Another mammal bone (Feature 4) exhibited polish. The fifth specimen was a mammal bone (Feature 7) had been drilled.

Table 11. Culturally Modified Bone Tools from the Shelby Lake Site.

Provenience	Taxon	Element	Comment
Feature 3	Mammalia (M/L)	Rib fragment	Rib scraper
Feature 4	Aves (Large)	Long bone diaphyseal fragment	Pointed implement ("awl")
Feature 4	Mammalia (M/L)	Indeterminate	Modified; polished fragment
Feature 7	Mammalia (M/L)	Indeterminate	Drilled
Feature 9	Mammalia (M/L)	Long bone diaphyseal fragment	Modified "awl" tip, very burned

Finally, over three quarters of the faunal assemblage (n=3,715) exhibit no sign of pathological lesions or signs of trauma. The types of pathology that were observed include some evidence of osteoarthritis, and periosteal lesions, the latter of which indicate a form of non-specific stress. This suggests that healthy and young, rather than sick or debilitated, animals were procured by the Shelby Lake Site occupants.

FAUNAL SEASONALITY

The paucity of elements from fish, small mammal, and rodent taxa argues against Shelby Lake as a long-term habitation site. Fish and mussels would be readily available during the summer months, yet do not appear to have provided a large percentage of the subsistence base. Rather, the fauna suggest that Shelby Lake was used as an intermittent late winter/early spring occupation. Deer remains provide important clues to argue for a late fall/winter occupation. In particular, a deer cranium was recovered whose pedicle had just begun to grow. This indicates that this animal was killed some time between February and early May. Likewise, the presence of fetal/infant deer elements supports a late winter/early

spring occupation. Deer were more active in the late fall than during other seasons: turkeys were also easier to exploit in the winter when flocks were formed. Based on his examination of the faunal remains from the Old Bear Site, Brooks (1985) also argued for a late winter/early spring occupation.

FAUNAL DISCUSSION

The Shelby Lake fauna appear to reflect a bias towards forest edge resources, and against aquatic species. The relative number of specimens present versus the minimum number of individuals suggests that the animals procured at the site were extremely fragmented, perhaps to facilitate marrow extraction from long bones. The MNI and NISP values from Shelby Lake support a conclusion that although the MNI counts were low and suggest a small number of species utilized, the NISP counts indicate that the actual number of taxa were more abundant, and were highly fragmented. Marshall and Pilgram (1993) argue that MNI and NISP were affected differently by increasing fragmentation. Based on their investigations of the level of fragmentation found in cattle specimens from Ngamuriak, NISP was preferable to MNI as a less-biased measure of body-part representation (Marshall and Pilgram 1993:267). Although a higher NISP ratio would cause one to suspect a greater degree of fragmentation, Marshall and Pilgram (1993:267) state that if the assemblage was highly fragmented, the number of identifiable specimens will decrease.

Very little is known about early Late Woodland faunal assemblages from Kentucky. Few sites from this period have been systematically excavated and analyzed. The Hanson Site fauna (Breitburg 1988), while similar to Shelby Lake in numbers (n=3,755), contained poorly preserved materials. Only 42 specimens were identified to the species level (Breitburg 1988:626). Breitburg reports that 95 percent of the observed material consisted of indeterminate mammal remains. He did conclude, however, that elk, deer, passenger pigeon, and drumfish, among other species, were used by the Hanson inhabitants. In addition, small mammals, fish, birds, and molluscs were used. This is markedly different from the pattern observed at Shelby Lake. At the Pyles Site, the elements recovered were extremely fragmented, allowing for only 11 percent of the total random sample (n=1,053) to be identified. The majority of the identifiable specimens consisted of deer (n=104, 93.7 percent). Trace percentages of bear, groundhog, turkey, and box turtle were also present. Most of the fauna from Pyles was recovered from midden contexts, rather than features (Railey 1984:81).

The lack of systematically excavated Late Woodland sites in Kentucky, with large samples of flora and fauna, restricts our understanding of subsistence use during this cultural period. More data are needed to gain a more complete picture of seasonality and site functions. The Shelby Lake fauna suggest a late winter/early spring exploitation of first line food sources, perhaps at a short term or special purpose camp rather than a village site.

SUMMARY AND CONCLUSIONS

Similar types of cultural materials were recovered from the Shelby Lake and Old Bear sites. While more features were identified at Shelby Lake than at Old Bear, at both sites basin-shaped pits tend to be found in clusters of two to four pits. Unfortunately, both sites were investigated under less than optimal conditions. Both sites were damaged by earth moving and other construction activities prior to the archaeological investigations. These activities exposed subplowzone early Late Woodland pit features. It is possible that additional features (more shallow) and posts molds were once present but were completely destroyed prior to the archaeological investigations. Also, because the plowzone had been removed, we know little about the overall nature and spatial distribution of cultural materials at these sites. However, examination of backdirt piles indicates that both sites had a low density of cultural materials.

Although the wide range of projectile points recovered from disturbed contexts at Shelby Lake and Old Bear suggest that these sites contain more than one component, all of the features excavated appear to be associated with early Late Woodland use of this locality. This observation was based on attributes of the ceramics recovered from the excavated features and the radiocarbon dates (see Table 1) obtained from both sites. The low densities of materials observed and recovered from these two sites and the spatial clustering of the documented pit features indicate that they were occupied by small groups for short periods of time.

In the middle Ohio Valley, the early Late Woodland period is marked by increased population nucleation and an intensification of the plant subsistence strategies of the preceding Middle Woodland period (Wymer 1992). Late Woodland villages cover ca. 1.5 to 2.0 ha, with some, such as Pyles (Railey 1984) and Gillespie (Railey 1990:306), consisting of a midden ring encompassing a central plaza. Others such as Rogers contain well-developed middens (Kreinbrink 1992). These larger sites appear to represent the coalescing of dispersed Middle Woodland households. This settlement shift has been well-documented by Dancey (1992), based on his work at Murphy and Water Plant, in the Scioto River Valley.

Early Late Woodland archaeobotanical collections reflect an increase in both the density and diversity of plant remains from the Middle Woodland period (Wymer 1992). This is reflected in high nut shell and seed densities, and the variety of fruit and berry seeds recovered from early Late Woodland sites. In general, early Late Woodland archaeobotanical assemblages reflect an intensification of horticultural activities (i.e., greater production of starchy-oily seed plants) coupled with a diversification in the types of plants collected (Wymer 1992:67).

The Shelby Lake and Old Bear sites are small settlements lacking well-developed middens. They may have been occupied by only one or two households. These sites have more in common with earlier Middle Woodland settlements with respect to size (Dancey 1988, 1992). It is possible that the early Late Woodland was characterized by increased nucleation in some areas but not in others. Alternatively, villages and smaller settlements may have been part of the same settlement system, one that involved nucleation during the warmer months and dispersal to widely scattered camps during the winter. As such, open sites like Shelby Lake and Old Bear and early Late Woodland rockshelter sites such as Rogers, Haystack, and Rock Bridge (Cowan 1979; Gremillion 1996) may have served similar functions within the early Late Woodland settlement system.

There is some botanical and structural evidence to suggest that the larger village sites may have been occupied during the warmer months (Ahler 1988:642; Lopinot 1988). Analysis of the Hansen Site archaeobotanical remains led Lopinot to suggest that this village was primarily occupied during the spring and summer. In support of this suggestion. Ahler (1988) argued that the wide spacing of structure posts was not conducive to a winter occupation and that the Hansen Site was located in an area that was susceptible to flooding during the winter months. If early Late Woodland families did relocate to smaller settlements during the late fall and winter, then Shelby Lake and Old Bear would represent this component of the early Late Woodland settlement system.

The archaeobotanical remains point to a focus on fall plants, while the faunal remains from the Shelby Lake Site are suggestive of a late fall/winter occupation. Most of the archaeobotanical plant food remains represent plants that were harvested in the fall. In particular, the Shelby Lake archaeobotanical collection lacks many of the fleshy fruits and spring/summer plant remains found at larger early Late Woodland sites. The Shelby Lake assemblage also lacks seeds of annual plants and weeds that were often accidentally deposited in the archaeological record during the summer/early fall months.

The faunal collection provides some of the best evidence for a late winter/early spring occupation. In particular, the collection contains a deer skull whose peticles had begun to grow. This indicates that this animal was killed some time between February and early May. Based on his examination of the faunal remains from the Old Bear Site, Brooks (1985) also argued for a late fall/winter occupation. While the faunal evidence can be used to argue for use of this locality during a particular time of the year, it cannot be used to argue for the absence of a spring, fall or summer occupation.

An alternative to the winter camp hypothesis is that Shelby Lake and Old Bear represent dispersed settlements that could have been occupied year-round as were the larger villages. As noted earlier, this may indicate that within the middle Ohio Valley the early Late Woodland was characterized by nucleation in some areas but not in others. Settlements such as Shelby Lake and Old Bear may have been part of dispersed communities or may represent the fissioning of a Late Woodland village. Clearly, more work is needed to determine the relationships and functions of both large and small early Late Woodland settlements. In particular, data are needed on the distribution and nature of early Late Woodland sites in the central Kentucky, where few sites dating to this time period have been investigated.

In summary archaeological investigation of the Shelby Lake Site resulted in the documentation of several large basin-shaped early Late Woodland features, that were similar to those from the nearby Old Bear Site. Analysis of the ceramics recovered from the Shelby Lake Site indicates that they were similar to Newtown ceramics of the middle Ohio Valley and the recovery of castellated rims points to a relationship with the Leonard Haag Site located in southwestern Indiana. Projectile points are primarily expanded base varieties such as Chesser Notched, Steuben Expanded Stemmed, and Bakers Creek. The presence of blades indicate the continuation of this technology into the Late Woodland period. Based on the archaeobotanical and faunal remains recovered from Shelby Lake and Old Bear, it is suggested that these two sites were either early Late Woodland fall and/or late winter/early spring camps. In either case, these sites were occupied for a short period of time.

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CABORN-WELBORN CERAMICS: INTERSITE COMPARISONS AND EXTRAREGIONAL INTERACTION

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ABSTRACT

The Caborn-Welborn phase (A.D. 1400-1700) of the lower Ohio Valley spans the period of time from the collapse of the Angel chiefdom to the arrival of Euro-Americans into this region. The collapse of the Angel chiefdom led to a reorganization of the Mississippian population on the landscape and to a restructuring of social and political relationships both internally and externally. To gain a better understanding of these changes, a study was initiated in 1992 that focused on three Caborn-Welborn phase communities: Slack Farm in Kentucky, and Hovey Lake and Caborn in Indiana. This paper presents an overview of the salient aspects of Caborn-Welborn ceramics and identifies intersite differences in the composition of the Slack Farm, Caborn, and Hovey Lake ceramic collections. In addition, aspects of Caborn-Welborn ceramics that reflect extra-regional interaction with Mississippian groups to the south of the Ohio Valley and Oneota groups to the north are identified.

INTRODUCTION

The Caborn-Welborn phase (Green 1977; Green and Munson 1978; Munson and Green 1973) of the lower Ohio Valley dates from A.D. 1400-1700 and as such brackets the period of time from the collapse of the Angel chiefdom (Black 1967) to the arrival of Euro-Americans in this region. The collapse of the Angel chiefdom led to the abandonment of the Angel Site and a reorganization of the regional population within a smaller territory centered near the mouth of the Wabash River (Figure 1). A restructuring of social and political relationships accompanied this collapse.

By the middle of the fifteenth century, if not earlier, there is little or no evidence of Mississippian occupation throughout the lower Ohio, lower Tennessee-Cumberland (Butler 1991; Lewis 1990; Muller 1986), middle Cumberland (Smith 1990), Green (Lewis 1990), and upper central Mississippi river valleys (Milner 1990; Williams 1990; Woods and Holley 1991). Williams (1990) has characterized the area encompassed by these former Mississippian chiefdoms as the Vacant Quarter. In most of these regions, the collapse of a Mississippian chiefdom appears to have led to the abandonment of local centers as well as associated villages, hamlets, and farmsteads (Hall 1991; Morse and Morse 1983; Muller 1986). Following the collapse of these regional chiefdoms, local populations may have dispersed to widely scattered and smaller settlements or they may have emigrated to other

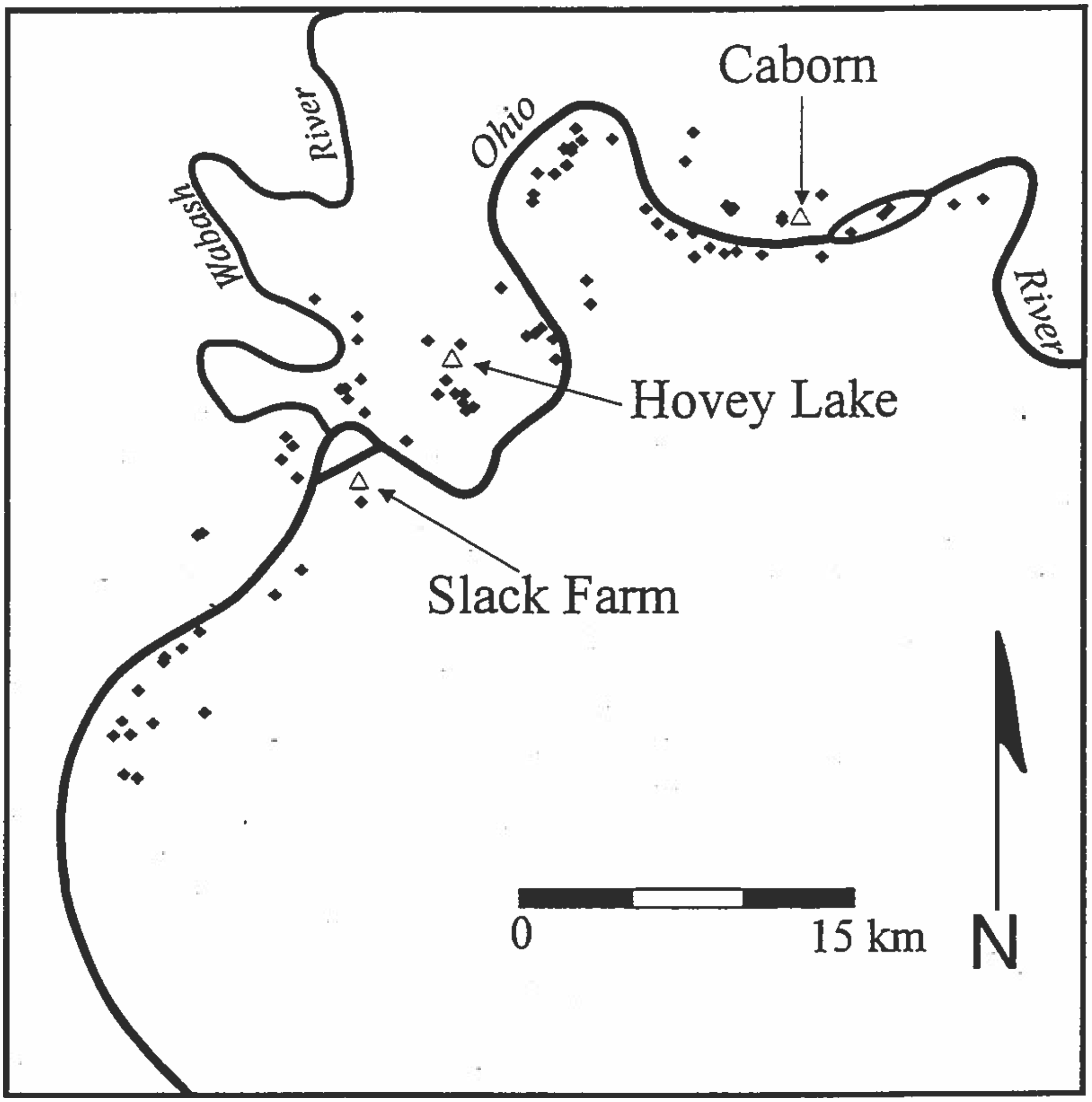

Figure 1. Location of Slack Farm, Caborn, and Hovey Lake Sites.

regions. In these areas, the fifteenth century is thus marked by a decline in population density, intra- and extraregional interaction, and sociopolitical complexity (cf., Tainter 1988:193). Researchers account for the collapse of these Mississippian chiefdoms by citing such factors as changes in climate patterns, environmental degradation, resource depletion, the introduction of new varieties of corn and beans that reduced subsistence risk and allowed greater household autonomy, and the decentralizing tendencies of chiefly authority (Green and Munson 1978; Hall 1991; Muller 1986; Pauketat 1992; Rindos and Johannessen 1991; Williams 1990).

While the contemporary Angel to Caborn-Welborn transition is similarly marked by a reorganization of people on the natural and cultural landscapes, some aspects of this transition are different (Green and Munson 1978; Muller 1986; Pollack 1998; Williams 1990). In particular, the collapse of the Angel chiefdom did not result in a decline in population density or in extraregional interaction. Rather, the population shifted downstream slightly. Settlements were centered around the mouth of the Wabash River rather than the mouth of the Green River and were distributed within a somewhat smaller area (ca 60 km) than has been documented for the preceding Angel phase (ca 110 km) (Green and Munson 1978). Within this area, more than 80 sites with Caborn-Welborn phase components have been identified. These sites range from small settlements of less than 0.5 ha in size to large villages encompassing more than 14 ha.

In order to gain a better understanding of the late Mississippian period in the lower Ohio Valley, the authors initiated a project in 1992 aimed at characterizing Caborn-Welborn phase material culture, settlement patterns, community organization, subsistence strategies, sociopolitical organization, and bioanthropology. The focus of this research was the materials and records from three sites: Slack Farm (15Un28) in Union County, Kentucky, and Caborn (12Po32) and Hovey Lake (12Po10) in Indiana (Pollack and Munson 1989, 1991) (Figure 1). Slack Farm and Hovey Lake are located near the center of the Caborn-Welborn region, and Caborn is located along the eastern edge of the distribution of Caborn-Welborn sites. While the primary goal of the Caborn-Welborn Archaeological Project is to describe all aspects of Caborn-Welborn material culture, the focus of this paper is the ceramic collections recovered from Slack Farm, Caborn, and Hovey Lake.

In the following section a brief description of each site and the nature of the archaeological investigations conducted at Slack Farm, Caborn, and Hovey Lake is presented. This is followed by an overview of the salient aspects of Caborn-Welborn ceramics and an intersite comparison of ceramic types and traits among the three sites. Finally, ceramic types and attributes that reflect extraregional interaction with Mississippian groups to the south of the Ohio Valley and Oneota groups to the north are identified.

SITE DESCRIPTIONS

Of the three site collections reported on in this paper, the Slack Farm (15Un28) ceramic collection is substantially larger than the Caborn and Hovey Lake collections. Covering more than 14 ha, the Slack Farm Site is the largest Caborn-Welborn phase village identified to date. The site is located at the base of bluffs overlooking the Ohio River, and extends from the first terrace onto the floodplain. Sibley Creek forms the site's northeastern border, and the Ohio River is located less than 300 m from the northwestern edge of the site.

Caborn (12Po32) is located on a floodplain ridge about 300 m from the Ohio River and is bordered on both sides by former sloughs. Many Caborn-Welborn phase sites are located in similar environments, where they tend to be associated with loamy floodplain soils (Munson 1995). These characteristics suggest that Caborn-Welborn settlements were situated in localities that had fertile, easily worked soils, and also provided access to animal and plant resources that could have been exploited from nearby sloughs, backwater lakes, and the Ohio River. The Caborn Site is much smaller than Slack Farm and Hovey Lake, encompassing an area of about 2.2 ha.

Although the Hovey Lake Site (12Po10) encompasses more than 11 ha (Munson 1997), Caborn-Welborn materials are primarily concentrated within a ca 3.2 ha area. The site consists of a 2.2 ha residential area surrounding a central plaza. At least five cemeteries are located along the margins of the village area. Though not as large as Slack Farm, Hovey Lake is nonetheless one of the larger Carbon-Welborn villages identified to date. As the name Hovey Lake implies, the site is located near a large cypress swamp and backwater lake; these wetlands were formed as a result of the migration of the Ohio River channel. The Hovey Lake Site is situated on a terrace, about 3.6 km from the Ohio River.

The focus of the Slack Farm archaeological investigations was the more than 450 holes dug by ten looters over a two month period in 1987 (Arden 1989; Fagan 1988; Munson et al. 1988). Investigation of the area disturbed by these individuals resulted in the recovery of a large artifact collection, including more than 350,000 Caborn-Welborn sherds. Although most of these materials were recovered from disturbed contexts in looter holes and dirt piles, artifact samples were obtained from intact portions of several features and house basins. Documentation of these features included plan and profile mapping, the collection of radiocarbon and flotation samples, and the excavation of the basal portions of several large pits. Examination of the spatial distribution of partially intact features, houses, and burials indicates that they tend to occur as discrete clusters surrounding a relatively open area (Pollack 1998). Each cluster consists of domestic structures and underground storage facilities that are situated adjacent to or near a cemetery. Within a ca. 2 ha area on the first terrace, five large and one small residential/mortuary clusters organized around a central plaza or courtyard were identified. To the southwest of these six residential/mortuary clusters and across a ravine where a small spring-fed stream transverses the site, is another large cemetery and associated residential area. Additional residential areas, some with small associated cemeteries, are located throughout this site, with many being situated on the floodplain.

In comparison to Slack Farm, the Caborn and Hovey Lake investigations, are more traditional studies and, as such, the ceramic collections from these two sites are significantly smaller than the Slack Farm collection. A controlled surface collection of the Caborn Site resulted in the identification of several artifact concentrations, house- and pit-size surface features, and plow-disturbed burials (Munson et al. 1987). Limited investigation of some of these areas resulted in the excavation of several pit features, wall trenches, and numerous post holes. In addition, buried, shallow midden deposits were sampled (Munson et al. 1989; Munson and Jones 1991). The work at Hovey Lake involved the mapping of house-size surface stains, plow-disturbed burials and artifact concentrations, the complete excavation of a burned house, the partial excavation of an adjacent smaller structure, and the sampling of midden deposits. Excavation of the burned house revealed that its construction involved the placement of wall trenches within a deep basin, and that it had been rebuilt a least once. Several individuals and numerous infants had been interred along the interior house walls, in a mortuary program involving removal of juveniles and adults and their reinterment outside the house (Cook and Munson 1990; Munson 1997).

RADIOCARBON DATES

Radiocarbon dates (Table 1) have been derived from charcoal samples from Slack Farm, Caborn, and Hovey Lake. Although some of the Slack Farm and Caborn radiocarbon dates have standard deviations that extend into the seventeenth century, the bulk of the midpoints cluster in the late fourteenth and fifteenth centuries. The radiocarbon dates from Slack Farm were obtained from several of the residential areas documented at the site. These dates as well as the fluoride dating (Roach 1995) of a sample of the Slack Farm burials from each residential area suggests that they were all being used at the same time. While the Slack Farm dates are consistent with a community that was established following the collapse of the Angel chiefdom, a greater range of dates had been expected, given the presence of historic trade goods, such as European copper or brass tubes, bracelets and beads, as well as glass beads.

As with the Slack Farm Site, radiocarbon dates from Caborn (Table 1) have midpoints that cluster in the late fourteenth and fifteenth centuries. In contrast to Slack Farm and Caborn, the radiocarbon dates (Table 1) from Hovey Lake point to long-term use of this locality. However, as discussed in this paper, the ceramics from Hovey Lake reflect continuity from the earlier Angel phase and are indicative of an early Caborn-Welborn occupation. The ceramic data from Hovey Lake point to a shorter period of use than is reflected by the three radiocarbon dates from this site: A. D. 1290 (1405) 1460, A. D. 1310 (1410) 1450, and A. D. 1490 (1657) 1950. That the two recent dates obtained from the site, which have been corrected for the effects of C12/C13, have midpoints that fall in the late fourteenth/early fifteenth centuries suggests that they may be more reliable than the very late date. At present there is no evidence to suggest that Hovey Lake continued to be occupied into the sixteenth or seventeenth centuries.

CABORN-WELBORN CERAMICS

Introduction

In this section, the ceramic collections from Slack Farm, Caborn, and Hovey Lake are used to characterize various aspects of Caborn-Welborn ceramics. While the tables included in this paper provide a breakdown of types and attributes by site, in this section this information is presented for the region as a whole. This is not meant to imply that all of the types described or all of the attributes discussed should be found at every Caborn-Welborn site, but rather that these types and attributes are present at some Caborn-Welborn sites. Excluded from this discussion are nonvessel ceramic objects such as pestles, disks, and ear plugs.

The focus of the Slack Farm, Caborn, and Hovey Lake ceramic analysis was the decorated body sherds and rims, appendages, and fabric impressed and cordmarked vessel rims greater than 4 cm^2 (Table 2). Information also was collected on several whole or reconstructible vessels from Slack Farm and Hovey Lake, and a detailed analysis of the structure of fabric impressed and cordmarked sherds from all three sites was undertaken. Table 2 presents a breakdown of the analyzed sample by site, and Table 3 provides an overview of the entire ceramic collection recovered from each site.

It should be noted that because plain and fabric impressed rims and body sherds less than 4 cm^2, and plain body sherds greater than 4 cm^2 were not analyzed, the frequencies presented in Table 3 for Mississippi/Bell Plain, Kimmswick Fabric Impressed, and the less than 4 cm^2 body sherds represent estimates of the total number of sherds recovered from each site. The estimates derived for

Table 1. Radiocarbon dates from Caborn-Welborn Sites.

Site	Context	Sample No.	Age BP	Calibrated date	Material
Slack Farm					
	F. 298	BETA-62695	600+/-50	1290(1328,1333,1395)1430	Wood
	F. 24	BETA-62689	630+/-60	1280(1310,1353,1385)1430	Wood
	F. 93	ISGS-2849	640+/-70	1270(1307,1360,1379)1430	Corn
	F. 68	ISGS-2851	570+/-70	1290(1403)1450	Corn
	F. 68	BETA-62689	570+/-50	1300(1403)1440	Corn
	F. 92	BETA-62690	550+/-50	1300(1408)1440	Corn
	F. 215	ISGS-2850	470+/-70	1320(1438)1630	Corn
	F. 319	BETA-62694	420+/-50	1420(1454)1640	Corn
	F. 319	ISGS-2853	390+/-70	1410(1478)1650	Corn
Hovey Lake					
	F. 39	ISGS-2852	560+/-70	1290(1405)1460	Corn
	F. 36	DIC-2360	250+/-60*	1490(1657)1950	Wood
	T.U. A	Beta 102580	540+/-50	1310(1410)1450	Wood
Caborn					
	Midden	BETA-39278	580+/-40	1310(1330,1347,1393)1411	Nut
	F. 17	BETA-38381	570+/-50	1300(1403)1440	Wood
	F. 17	ISGS-2851	400+/-70	1410(1473)1650	Grass
	F. 18	BETA-38382	380+/-50	1440(1483)1650	Wood
Leonard					
		RL-82	460+/-125*	1290(1441)1950	Wood?
		RL-83	345+/-190*	1287(1518,1580,1624)1955	Wood?

* Not corrected for isotopic fractionation C-12/C-13.
Calibrated for 2 Sigma from CALIB computer program following Stuiver and Pearson 1993.

Table 2. Analyzed Ceramics.

Ceramic Type	Hovey Lake		Slack Farm		Caborn	
Mississippi Plain	456	43.9%	4,870	32.2%	330	25.2%
Bell Plain	280	27.0%	2,948	19.5%	169	12.9%
Kimmswick Plain	91	8.8%	669	4.4%	97	7.4%
Kimmswick Fabric Impressed	106	0	869	0	4	0
Kimmswick Net Impressed	3	0	7	0	0	0
Cordmarked	8	0	22	0	0	0
Caborn-Welborn Decorated	71	0	4,797	0	701	1
Parkin	1	0	31	0	0	0
Manly Punctate	3	0	203	0	4	0
Matthews Incised	0	0	44	0	0	0
Old Town Red	11	0	92	0	1	0
Angel Negative Painted	0	0	5	0	0	0
Walls Engraved	0	0	29	0	0	0
O'Byam Incised	3	0	9	0	0	0
Oneota-Like	2	0	199	0	1	0
Fortune Noded	0	0	1	0	0	0
Beckwith	1	0	16	0	3	0
Misc. Incised/Trailed	0	0	52	0	0	0
Kent Incised-Like	2	0	54	0	0	0
Mound Place Incised	0	0	4	0	0	0
Campbell Punctate	0	0	43	0	0	0
Campbell Applique	0	0	13	0	0	0
Campbell Incised	0	0	8	0	0	0
Unassigned Detached lugs	0	0	156	0	1	0
Total	1,038	1	15,141	1	1,311	1

Table 3. Site Ceramic Collections.

Ceramic Type	Hovey Lake		Slack Farm		Caborn	
Kimmswick Plain	143	1.9%	1,934	2.7%	179	3.6%
Kimmswick Fabric Impressed*	518	6.8%	5,320	7.3%	29	0.6%
Tolu Fabric Impressed	3	0.0%	36	0.0%	0	0.0%
Kimmswick Net Impressed	17	0.2%	51	0.1%	1	0.0%
Cordmarked	245	3.2%	291	0.4%	16	0.3%
Bell/Mississippi Plain**	6,619	86.6%	59,564	81.8%	4,029	81.2%
Parkin Punctate	1	0.0%	31	0.0%	0	0.0%
Caborn-Welborn Decorated	71	0.9%	4,797	6.6%	701	14.1%
Manly Punctate	3	0.0%	203	0.3%	4	0.1%
Matthews Incised	0	0.0%	44	0.1%	0	0.0%
Old Town Red	11	0.1%	92	0.1%	1	0.0%
Angel Negative Painted	0	0.0%	5	0.0%	0	0.0%
Walls Engraved	0	0.0%	29	0.0%	0	0.0%
O'Byam Incised	3	0.0%	9	0.0%	0	0.0%
Oneota-Like	2	0.0%	199	0.3%	1	0.0%
Fortune Noded	0	0.0%	1	0.0%	0	0.0%
Beckwith	1	0.0%	16	0.0%	3	0.1%
Misc. Incised/Trailed	0	0.0%	52	0.1%	0	0.0%
Kent Incised-Like	2	0.0%	54	0.1%	0	0.0%
Mound Place Incised	0	0.0%	4	0.0%	0	0.0%
Campbell Punctate	0	0.0%	43	0.1%	0	0.0%
Campbell Appliqué	0	0.0%	13	0.0%	0	0.0%
Campbell Incised	0	0.0%	8	0.0%	0	0.0%
Totals	7,639	100.0%	72,796	100.0%	4,964	100.0%
Less than 4 cm^2***	20,431		269,700		11,988	
Grand Total	28,070		342,496		16,952	

* Kimmswick totals include an estimate of the less than 4 cm^2 pan rims in each site collection.
** Bell/Mississippi Plain totals include an estimate of the less than 4 cm^2 plain rims and body sherds larger than 4 cm^2 in each site collection.
*** The Less than 4 cm^2 totals represent an estimate of the small body sherds in each site collection

Mississippi/Bell Plain include all of the analyzed rims and appendages as well as an estimate of the number of body sherds greater than 4 cm^2 and rims less than 4 cm^2. The Slack Farm estimates were derived from a preliminary analysis (Tune 1991) of a 5 percent sample of this collection. This sample was used to obtain an estimate of the total number of unanalyzed Mississippi/Bell Plain body sherds greater than 4 cm^2, plain and fabric impressed rims less than 4 cm^2, and undecorated body sherds less than 4 cm^2. The ratio of analyzed plain to fabric impressed rims was then used to estimate the number of Mississippi/Bell Plain and Kimmswick Fabric Impressed rims sherds less than 4 cm^2 present in the Slack Farm collection. A similar procedure was used to derive these estimates for Caborn and Hovey Lake.

As with most Mississippian site ceramic collections, Caborn-Welborn assemblages contain a variety of vessel forms, including jars, bowls, pans, bottles, plates, and funnels (Table 4). Most of these vessels have plain exterior surfaces. The exceptions being fabric impressed, net impressed, cordmarked, slipped, or decorated specimens. Plain jars tend to have paste and temper characteristics that are consistent with Mississippi Plain (Phillips 1970), while most plain bowls, bottles, and plates are similar to Bell Plain (Phillips 1970). Pans with fabric impressed exterior surfaces were classified as Kimmswick Fabric Impressed, those with net impressed exterior surfaces as Kimmswick Net Impressed, and pans with plain exterior surfaces as Kimmswick Plain (Phillips 1970). In contrast to fabric impressed pans, bowls with fabric impressed interior surfaces were classified as Tolu Fabric Impressed (Webb 1931). Other jars, bowls, and bottles were decorated with incised, trailed, engraved, or punctated designs or slips usually on their exterior surface, but occasionally on the interior surface. Whenever possible these decorative attributes were used to assign these specimens to previously defined types. Cordmarked pans and jars were not assigned to a specific type.

Table 4. Number of Rims for Each Vessel Form.

Vessel Form	Site					
	Hovey Lake		Slack Farm		Caborn	
Pan	209	25.7%	1,546	18.7%	101	19.1%
Bottle	21	2.6%	225	2.7%	13	2.5%
Jar	320	39.3%	3,897	47.2%	269	50.9%
Bowl	253	31.1%	2,541	30.8%	140	26.5%
Plate	3	0.4%	11	0.1%	1	0.2%
Conch Shell Bowl	3	0.4%	9	0.1%	2	0.4%
Pinch Pot Bowl	2	0.2%	2	0.0%	0	0.0%
Pinch Pot Jar	0	0.0%	10	0.1%	0	0.0%
Funnel	3	0.4%	16	0.2%	2	0.4%
Total	814	100.0 %	8,257	100.0 %	528	100.0 %

Undecorated Ceramic Types

Mississippi and Bell Plain. Jars, bowls, and bottles are associated with both Mississippi Plain and Bell Plain at Caborn-Welborn sites, but all of the funnels had paste characteristics that are consistent with Mississippi Plain and all of the plates had Bell Plain pastes. Mississippi and Bell Plain jars have globular to subglobular bodies and usually have a rounded rim/neck juncture and direct to slightly outcurving rims. About 10 percent of the plain jar rims have inslanting or recurved rims, and 15 percent exhibit a sharp angle at the rim/neck juncture. Jar handles are primarily wide, thin, parallel-sided or triangular straps attached to the rim at the lip and extending to below the base of the neck. Thick straps and intermediate loop/strap handles are also present. Most jars have at least one pair of handles, but some have four or more handles, which usually occur in even numbers.

A variety of decorative attributes are associated with jar rims (Table 5). Lugs tend to be attached to the rim at the lip and include single, bifurcated, and notched examples (Figure 2). Most are oval. They tend to be found on the rim below the lip and often occur as groups of two or three nodes. Vessels often exhibit opposing sets of lugs or nodes and handles. Notched or beaded horizontal applied strips on jars are sometimes present and tend to occur below the lip. Most jar lips are plain, but a few are punctated and exterior lip notching is sometimes present above strap handles.

Mississippi and Bell Plain bowls include both simple hemispheres and shallow open vessels with outslanting walls and flat bottoms (also known as deep rim plates [Hilgeman 1992]) (Table 6). Many of the shallow bowls have scalloped rims. Decoration (Figure 3) on hemispherical bowls consists of punctations and notches on vessel lips, notched or beaded horizontal rim strips, lugs, nodes, modeling of walls into animal effigies, and effigy rim riders. Lugs are usually flat and oval and are attached to the rim at the lip. Most are plain but some are incised, engraved, or notched. As with jars, nodes tend to be found below the lip and occur in groups of two or three.

Table 6. Bowl Rim Form.

Rim Form	Site					
	Hovey Lake		Slack Farm		Caborn	
Direct	356	56.1%	3,521	62.8%	278	72.0%
Incurved	67	10.6%	319	5.7%	28	7.3%
Outslanting	115	18.1%	844	15.0%	63	16.3%
Outslanting Scalloped	97	15.3%	925	16.5%	17	4.4%
Totals	635	100.0%	5,609	100.0%	386	100.0%

Effigy bowls and jars also have been recovered from Caborn-Welborn sites. Some have a modeled head and sometimes a tail was attached to the rim (e.g., ducks, humans, unknown animals). Others (e.g, fish, opossums, humans in supine positions) were shaped by modeling the vessel wall to depict a head and other major features such as legs or a tail, and by adding small lugs to indicate minor features such as ventral fins. Conch shell or gourd-shaped effigy bowls in Caborn-Welborn collections are rounded on one side and taper to a point on the opposite side of the vessel. The rounded side often has a cluster of three to five nodes just below the rim.

A variety of bottles are present in Caborn-Welborn collections including long-necked, hooded, wide-mouthed, and neckless specimens. Long-necked and hooded bottles tend to have narrower openings and to be smaller than wide-mouth bottles. Most of the wide-mouth bottles have rounded necks, but some have a sharply angled rim/neck juncture, while others have a slight thickening or flange

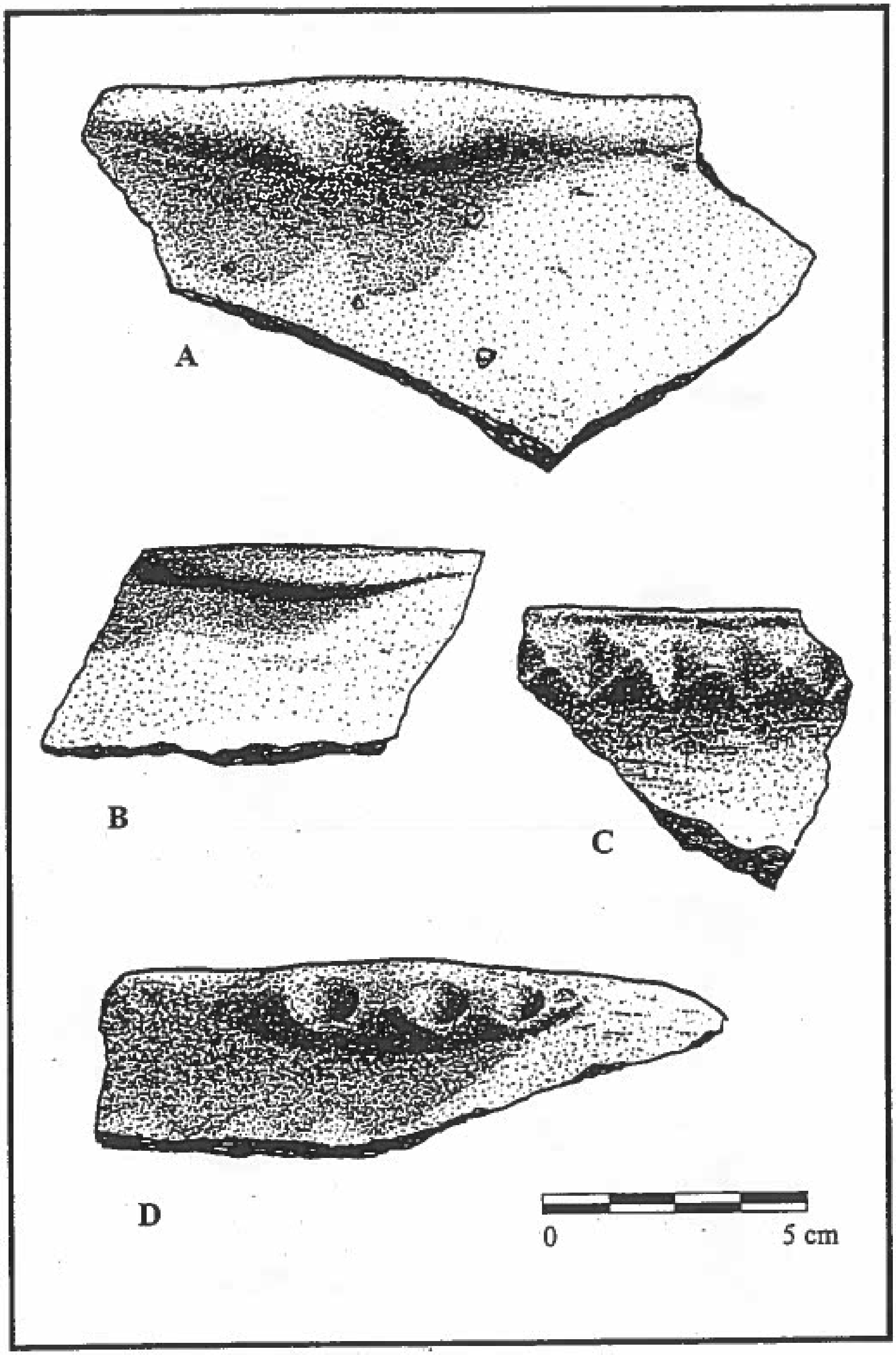

Figure 2. Jars: a, Bifurcated Lug; b, Single Lug; c, Notched Applied Horizontal Strip; d, Notched Lug.

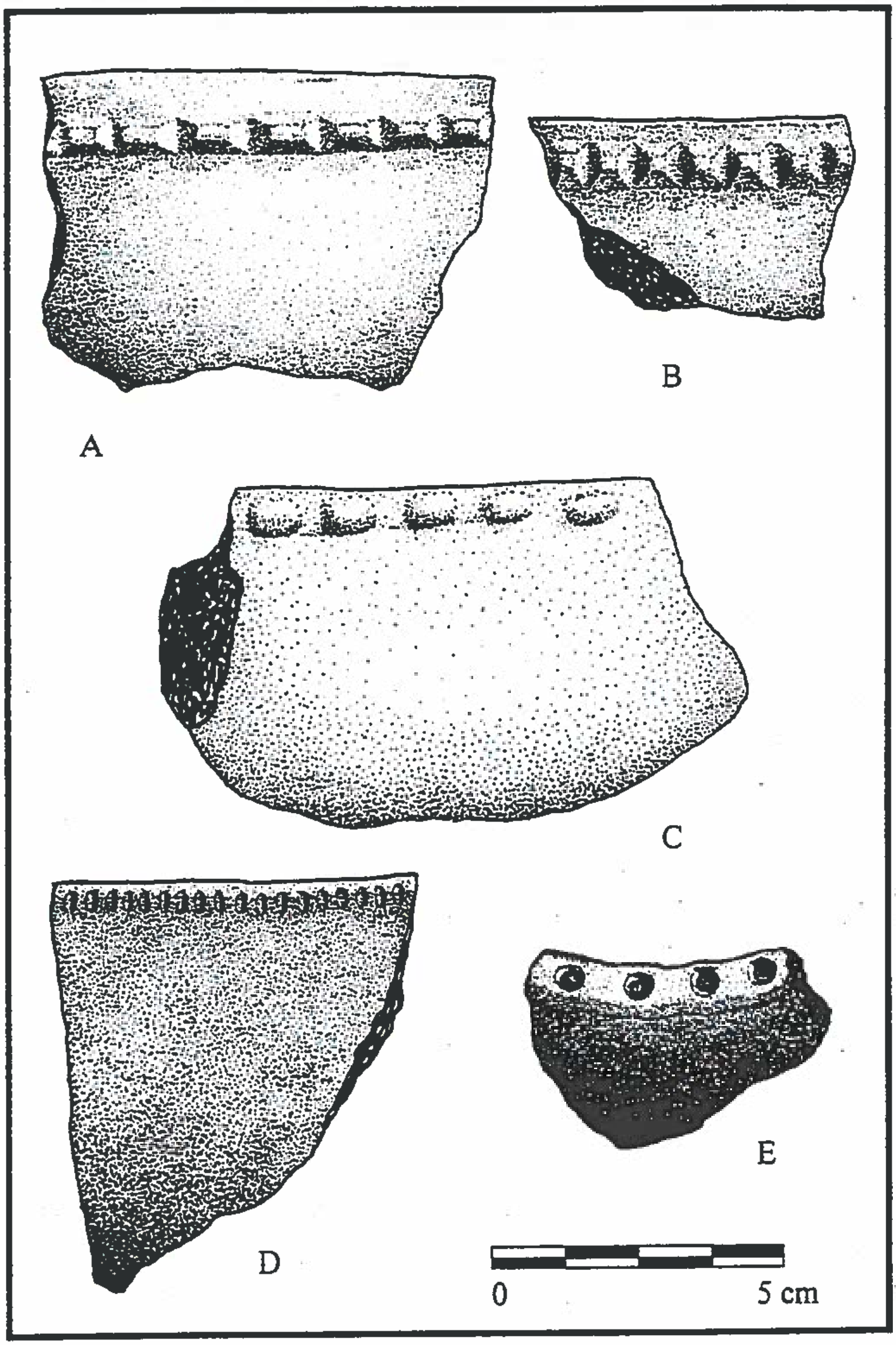

Figure 3. Bowls: a, b, Notched Horizontal Strips; c, Nodes; d, Exterior Lip Notches; e, Punctated Lip.

on the interior of the rim/neck juncture. Appendages associated with bottles are limited to a few wide, thin strap handles. Only a few plates are present in Caborn-Welborn site collections.

Funnels are thick-walled vessels having direct rims at the upper orifice and sides that taper to a smaller opening at the bottom of the vessel. Pinch pot jars and bowls are small, crudely made hand modeled vessels distinct from the smallest vessels manufactured by coiling.

Kimmswick Fabric Impressed, Net Impressed, and Plain. Pans usually have plain or fabric impressed exterior surfaces, but a few have net impressed exterior surfaces. Kimmswick Fabric Impressed and Kimmswick Net Impressed pans tend to have thickened rolled lips, while most Kimmswick Plain pans do not thicken toward the rim. Most of the fabrics from Caborn-Welborn sites, like those examined from other Mississippian sites (Drooker 1992), were manufactured by twining, though a few net fabrics are present (Turner and Henderson n.d.; Turner et al. 1996). These twined

Table 5. Jar and Bowl Nonhandle Appendages.

Nonhandle Appendages	Site					
	Hovey Lake		Slack Farm		Caborn	
Jars						
Node	3	7.5%	136	19.6%	7	14.0%
Multiple Nodes	1	2.5%	35	5.0%	0	0.0%
Notched Horizontal Strip	0	0.0%	15	2.2%	11	22.0%
Plain Horizontal Strip	0	0.0&	5	0.7%	0	0.0%
Plain Lug	24	60.0%	304	43.8%	5	10.0%
Bifurcated Lug	9	22.5%	101	14.6%	1	2.0%
Multiple Lug	3	7.5%	28	4.0%	0	0.0%
Incised Lug	0	0.0%	3	0.4%	1	2.0%
Notched Lug	0	0.0%	28	4.0%	22	44.0%
Effigy	0	0.0%	5	0.7%	0	0.0%
Notched Vertical Strip	0	0.0%	11	1.6%	2	4.0%
Plain Vertical Strip	0	0.0%	23	3.3%	1	2.0%
Totals	40	100.0%	694	100.0%	50	100.0%
Bowls						
Node	6	26.1%	129	19.1%	4	4.0%
Multiple Nodes	4	17.4%	59	8.7%	2	2.0%
Notched Horizontal Strip	5	21.7%	250	36.9%	79	79.8%
Plain Horizontal Strip	0	0.0%	32	4.7%	0	0.0%
Plain Lug	3	13.0%	106	15.7%	6	6.1%
Bifurcated Lug	0	0.0%	5	0.7%	1	1.0%
Multiple Lug	0	0.0%	2	0.3%	0	0.0%
Incised Lug	0	0.0%	12	1.8%	2	2.0%
Notched Lug	1	4.3%	22	3.2%	3	3.0%
Effigy	4	17.4%	60	8.9%	2	2.0%
Totals	23	100.0%	677	100.0%	99	100.0%

fabrics were made predominately by plain twining. Other major types of twined fabrics include alternate paired twining and plain twining with transposed interlinked warps. The latter, along with groups of weft rows in pairs or triplets and crossing warps, often were used to create geometric patterns in these fabrics. Slightly more than 25 percent of the fabrics exhibit some form of decoration.

Cordmarked. Most of the cordmarked sherds are from jars that had cordmarked bodies and plain necks. Cordmarked jars are similar in size and shape to plain vessels. The only appendages associated with cordmarked rims are a triangular lug and a pair of nodes. A few rims are from pans that had thickened rolled lips.

Tolu Fabric Impressed. Sherds that had plain exterior surfaces, but fabric impressed interior surfaces were classified as Tolu Fabric Impressed. Unlike Kimmswick Fabric Impressed, which is associated with pans, interior fabric impressions are usually associated with hemispherical bowls.

Decorated Ceramic Types

Caborn-Welborn Decorated. Caborn-Welborn Decorated (Munson 1984) vessels are distinguished by trailed (mean width of 2.9 mm), incised (mean width of 1.4 mm) (Tables 7 and 8), and/or punctated designs located on globular jars between the neck and shoulder. In terms of basic vessel shape, these jars differ little from those classified as Mississippi Plain. As with plain jars, Caborn-Welborn Decorated vessels can have notched or punctated lips.

Handles on Caborn-Welborn Decorated vessels are similar to those documented for Mississippi Plain jars. Most are plain, but some have trailed, incised, and/or punctated decorations. Other types of appendages associated with Caborn-Welborn Decorated jars are single, bifurcated or notched lugs, notched strips, and nodes. Sometimes appendages, such as notched vertical strips, lugs, and plain or punctated nodes, are incorporated within Caborn-Welborn designs (Figure 4z-dd).

Designs on Caborn-Welborn Decorated jars are located below the neck and extend to and sometimes below the shoulder. They consist primarily of triangular areas demarcated by incised or trailed lines (Table 9; Figures 4 and 5); one descending from the neck and the other rising from the shoulder. From one to 17 lines were used to layout the design, with most having from two to four lines. Alternating rows of lines and punctations or just punctations also were used to layout the triangular areas (Figure 4e). Often a line that encircled the jar was used to form an upper border for the design (Figure 4a, b, d-g), and sometimes a line was placed directly below the design to create a lower border (Figure 4b). In addition to incising, trailing, or punctations, the exterior or interior surface of a few Caborn-Welborn Decorated jars also have a red slip.

Descending triangular areas were usually filled with parallel incised or trailed lines (Figure 5a) or with a series of punctations (Figure 5b). However, sometimes they were left plain (Figures 4f and 5c). In some instances the rising triangles also were filled with lines or punctations (Figure 4d, g), but these areas were usually left plain (Figure 4a, c, f, h). In several respects, Caborn-Welborn Decorated designs are similar to those described for Barton Incised (O'Brien and Fox 1994; Phillips 1970; Phillips et al. 1951): both are characterized by triangular areas filled with parallel lines. However, on Barton Incised vessels such designs are usually restricted to the area between the rim and neck, while on Caborn-Welborn Decorated jars they are always located below the neck. The use of multiple lines to layout the design also serves to distinguish Caborn-Welborn Decorated from Barton Incised designs and in

Table 7. Caborn-Welborn Shoulder Decoration.

Shoulder Decoration	Site					
	Hovey Lake		Slack Farm		Caborn	
Trailing	28	62.2%	1,465	57.8%	170	32.4%
Trailing and Punctation	5	11.1%	321	12.7%	126	24.0%
Incising	10	22.2%	423	16.7%	133	25.3%
Incised and Punctation	0	0.0%	75	3.0%	31	5.9%
Punctation	2	4.4%	250	9.9%	65	12.4%
Totals	45	100.0%	2534	100.0%	525	100.0%

Table 8. Caborn-Welborn Decorated Line Width.

Site	Mean	Standard Deviation	Cases
Hovey Lake			
Trailed	2.8	1.3	28
Trailed and Punctated	2.1	0.7	5
Incised	1.9	1.9	10
Total	2.5	1.4	43
Slack Farm			
Trailed	3.1	1.2	1,441
Trailed and Punctated	2.7	1.2	314
Incised	1.4	0.6	418
Incised and Punctated	1.7	0.8	73
Total	2.7	1.3	2,246
Caborn			
Trailed	2.3	0.9	166
Trailed and Punctated	2.1	0.9	114
Incised	1.4	0.6	132
Incised and Punctated	1.5	0.7	31
Total	1.9	0.9	443

Table 9. Caborn-Welborn Shoulder Motifs (lower case letters refer to illustrations Figure 4).

Decorative Motifs on Vessel Shoulders	Site					
	Hovey Lake		Slack Farm		Caborn	
Lines Border/Lines Fill (a, b)	10	22.7%	524	20.7%	62	11.8%
Lines Border/No Fill (f)	3	6.8%	83	3.3%	19	3.6%
Parallel Angled, Horizontal, or Curved Lines	4	9.1%	45	1.8%	8	1.5%
Line Border/Punctation Fill (c, d)	2	4.5%	167	6.6%	71	13.5%
Line Border/Line & Punctation Fill (g)	0	0.0%	2	0.1%	0	0.0%
Punctation Border/No Fill (h)	1	2.3%	1	0.0%	2	0.4%
Punctation Border/Punctation Fill (I)	0	0.0%	6	0.2%	0	0.0%
Punctation Bordering Line	0	0.0%	19	0.7%	7	1.3%
Punctation Border Horizontal Lines & Line Border/Line Fill (o)	0	0.0%	10	0.4%	2	0.4%
Punctation Interior Border (r)	0	0.0%	8	0.3%	1	0.2%
Rising Chevron (j, k)	0	0.0%	11	0.4%	3	0.6%
Descending Chevron/Line Border	0	0.0%	12	0.5%	4	0.8%
Descending Chevron/Line Border/Punctation Fill	0	0.0%	2	0.1%	1	0.2%
Descending Chevron/Punctation Border or Descending Chevron/Punctation Fill & Line Border/Line Fill (m, n)	0	0.0%	3	0.1%	0	0.0%
Descending Chevron/Punctation Border/Line Border (q)	0	0.0%	24	0.9%	16	3.0%
Descending Chevron & Horizontal Lines/ /Punctation Border & Vertical Line Border (p)	0	0.0%	1	0.0%	0	0.0%
Alternating Lines/Punctation Border & Punctation Fill (e)	0	0.0%	4	0.2%	5	1.0%
Alternative Rows Line & Punctation (l)	1	2.3%	31	1.2%	13	2.5%
Other Line	20	45.5%	1,208	47.7%	206	39.2%
Other line & Punctation	2	4.5%	127	5.0%	42	8.0%
Other Punctation	1	2.3%	246	9.7%	63	12.0%
Totals	44	100.0%	2,534	100.0%	525	100.0%

particular Barton Incised var. *Arcola*, which, like Caborn-Welborn Decorated, is characterized by line-filled triangular designs located below jar necks.

While the rising triangular area was usually left plain, sometimes three to four horizontal lines or descending chevrons (Figure 4m-q) were used to fill part of this space. Most of the groups of horizontal lines and descending chevrons were bordered by a row of punctations. These designs are similar to the thunderbird or hawk motif noted on Oneota ceramics (Benn 1989; Hall 1991). Nested rising chevrons, which rarely are bordered by punctation, also were used to fill triangular areas (Figure 4j- k). In addition to being used to fill triangular areas and as an outer border, punctations were used to fill areas between alternating diagonal or vertical lines (Figure 5l) and as an inner border (Figure 4r).

Punctation on vessel shoulders is about four times more likely to be associated with trailed than incised lines (Table 7). About 80 percent of the time, punctation occurs as fill. Approximately 50 percent of the punctations are oblong in shape, 20 percent are circular (most appear to have been made with a pointed object but some were made with a hollow reed), and 12 percent are triangular. The remaining punctation shapes consist of crescents, or resemble more of a dash than a punctation.

The most common design (line or punctation filled triangular areas) associated with Caborn-Welborn Decorated jars has a regional antecedent in Angel Negative Painted designs. The primary differences being that on the former it was incised or trailed and placed on jars and on the latter this design was painted and is associated with plates (Hilgeman 1992: Table 5.1). On Angel Negative Painted ceramics this design has been interpreted as representing a sun symbol with the center of the sun corresponding to the well of the plate and the encircling band of line-filled triangles its rays (Curry 1950; Hilgeman 1991). Based on the similarity in design layout exhibited by Angel Negative Painted plates and Caborn-Welborn Decorated jars, it is quite likely that the rising and descending triangular areas found on Caborn-Welborn Decorated vessels also depict the rays of a sun symbol, with the center of the sun corresponding to the orifice of the jar. Thus, while the technique used to depict the sun may have differed (painted vs incised/trailed) similar messages may have been conveyed by the designs.

Angel Negative Painted. Negative painted ceramics resembling Angel Negative Painted (Hilgeman 1992) are present in Caborn-Welborn collections. However, they are not as common as red-filmed specimens.

Old Town Red. Most of the red filmed specimens in the Slack Farm, Caborn, and Hovey Lake collections were classified as Old Town Red (Phillips et al. 1951:129-132). Within these collections red filming occurs on the exterior surfaces of Bell Plain bottles and on both the exterior and interior surfaces of Bell Plain or Mississippi Plain bowls. Occasionally an Old Town Red specimen was engraved.

Manly Punctate. Manly Punctate (Phillips 1970) is characterized by undulating rows of punctations, which often parallel an incised or trailed line. The undulations form a series of arches around the neck of jars. Unlike Caborn-Welborn Decorated specimens, which are characterized primarily by oblong punctations, on Manly Punctate vessels they are almost always circular, with 16 percent having been made with a reed. When lines are associated with the punctations, they have an equal chance of being incised (mean width of 1.4 mm) or trailed (mean width of 2.5 mm). Some of the Manly jars have been slightly modeled to form large bosses underneath the arches.

The Manly Punctate design is characterized by a great deal of variability with respect to the composition and number of rows of punctations and incised/trailed lines (Figure 4w-x). For instance,

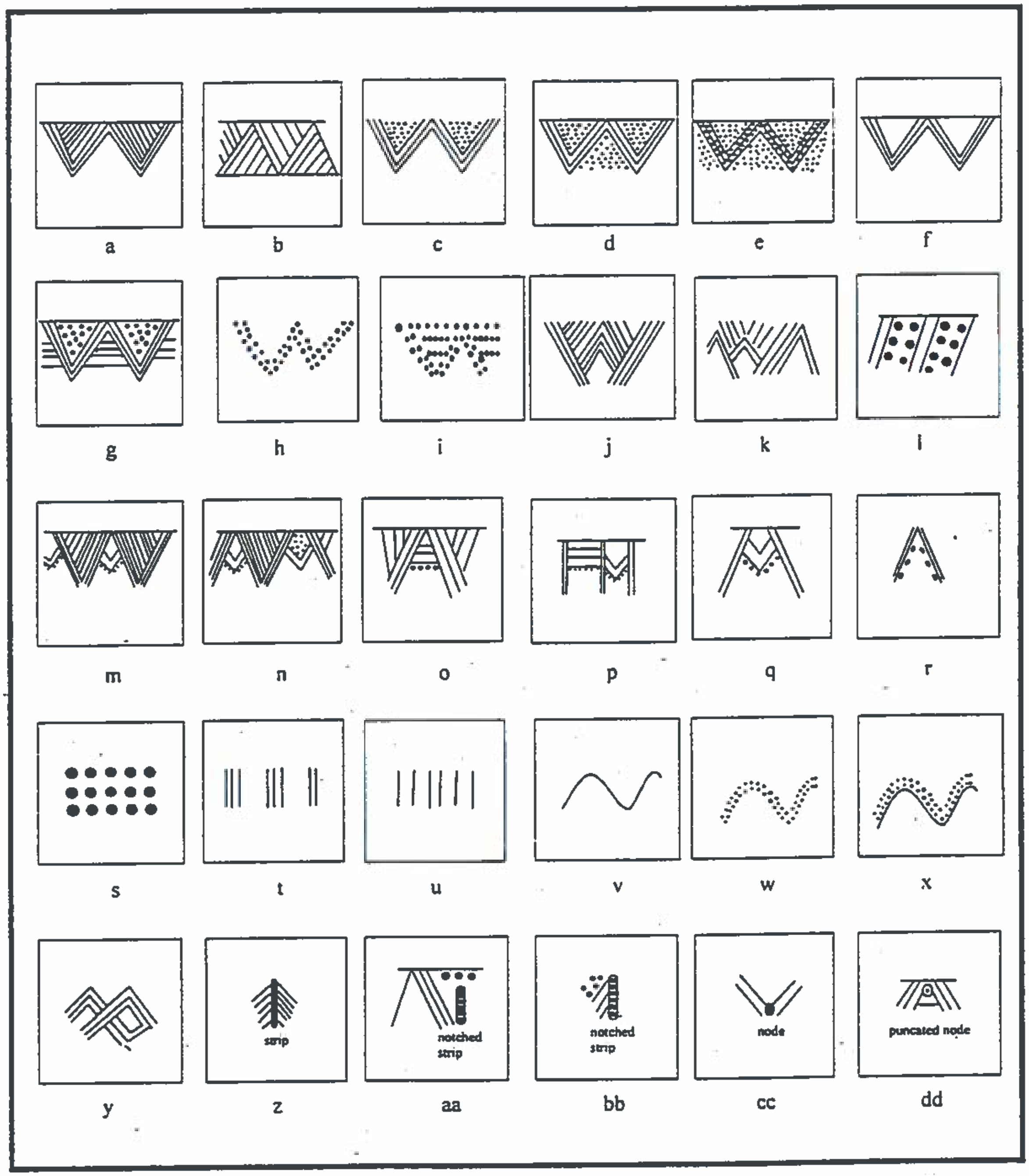

Figure 4. Ceramic Designs: a-r, z-dd, Caborn-Welborn Decorated; s, Campbell Punctate; t, u, Campbell Incised (neck and shoulder) or Kent Incised (shoulder); a, b, f, o, r, q, u, "Oneota-Like" v, Matthews Incised; w, x, Manly Punctate; y, Beckwith Incised.

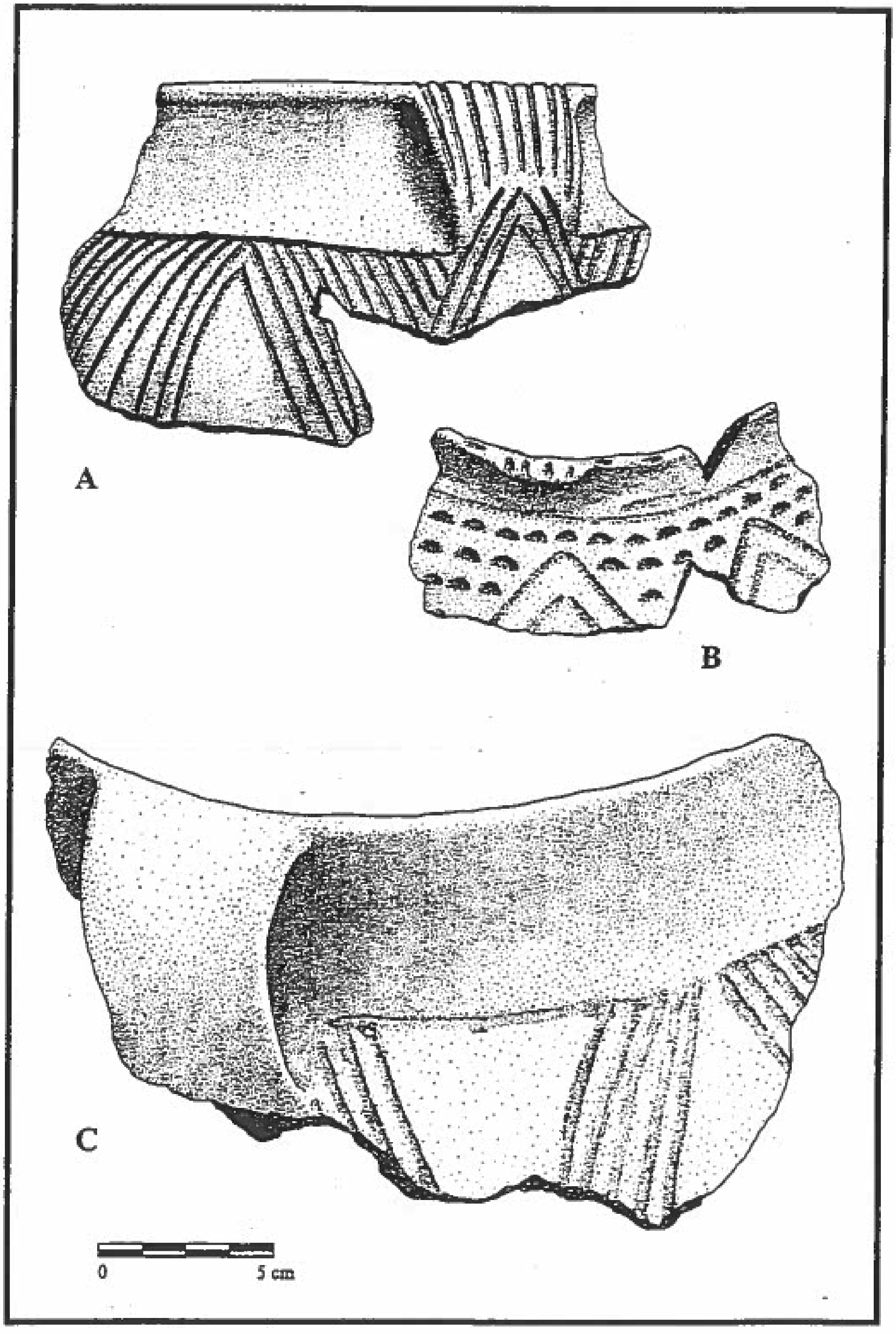

Figure 5. Caborn-Welborn Decorated.

when an incised or trailed line is present, it may be located below, above, or between rows of punctations. Unlike Parkin Punctate or Campbell Punctate vessels which often have more than four thick or thin strap handles and punctated lips, Manly Punctate vessels have only two opposing strap handles and occasionally opposing bifurcated lugs. The lips of Manly vessels are rarely punctated.

Matthews Incised. Sherds that exhibit one or more parallel curved lines that form a design similar to that of Manly Punctate were classified as Matthews Incised (Phillips 1970). Within Caborn-Welborn collections, this design is usually represented by a single trailed (mean width of 3.0 mm) or incised (mean width of 1.2 mm) line (Figure 4v).

Beckwith Incised. Some jar sherds exhibit an incised (mean width 0.8 mm) rectilinear guilloche that extends from just below the rim to slightly below the neck. These sherds were classified as Beckwith Incised (Phillips 1970). It should be noted that O'Brien and Fox (1994:162) assign a similar design to Barton Incised. In this study the name Barton Incised was reserved for sherds that have line filled triangular areas that are located between the lip and the neck.

O'Byam Incised/Engraved. Several sherds exhibit incised or engraved line-filled triangles on the interior surfaces of shallow bowls with outslanting walls. These specimens are similar to O'Byam Incised/Engraved (Clay 1963; Lewis 1986; Pollack and Railey 1987). This type is common in the lower Tennessee-Cumberland (Clay 1963; Pollack and Railey 1987) and Jackson Purchase (Lewis 1986, 1990) regions of Kentucky.

Mound Place Incised. Designs associated with Mound Place Incised (Phillips et al. 1951:127-129) consist of two or more parallel lines placed horizontally just below the lip of Mississippi or Bell Plain bowls. Sometimes the lines dip down below an effigy rim rider. All of the Mound Place Incised sherds in Caborn-Welborn collections have paste characteristics that are consistent with Bell Plain.

"Oneota-Like." One group of ceramics was distinguished from the other sherds recovered from Slack Farm, Caborn, and Hovey Lake, by the co-occurrence of several attributes: rim form, appendage form, and decoration type and location. These ceramics were assigned to the "Oneota-like" type. In general these specimens exhibit a sharply angled rim/neck juncture in contrast to the more rounded necks of Mississippi Plain and Caborn-Welborn Decorated jars. Handles associated with these rims tend to be either loops or intermediate loop/straps that are rectangular in cross-section. Many of these handles are notched and were attached to the rim below the lip, extending to just below the rim/neck juncture (Figure 6a, b). These jars are also distinguished from Mississippi Plain and Caborn-Welborn Decorated vessels by the presence of interior lip decoration consisting of shallow notches, dashes, and trailed chevrons (Figure 6a, c, d). Sometimes the top of the lip is punctated or notched (Figure 6d).

All rims with interior lip modification and all notched loop handles were assigned to the Oneota-like group. However, plain rims with a sharply angled rim/neck juncture, but lacking interior rim decoration or notched handles were not placed within this group, but instead were classified as Mississippi Plain.

"Oneota-like" vessels include jars with plain and decorated exterior surfaces. Trailing tends to be wider and shallower (Figure 6f) than on Caborn-Welborn Decorated vessels (average widths of 4.0 mm compared with 2.6 mm, respectively). Few "Oneota-like" vessels are decorated with incised lines

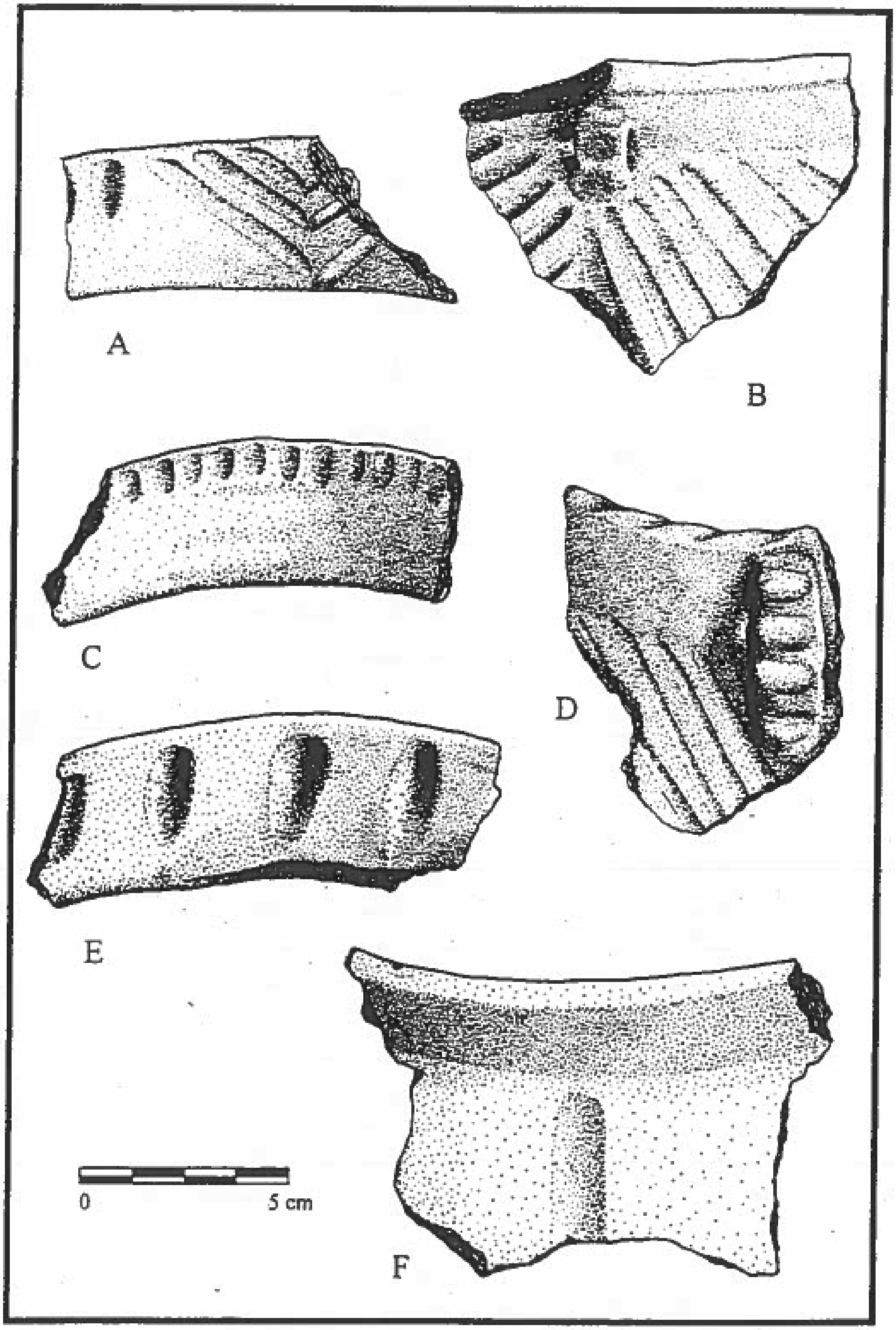

Figure 6. "Oneota-Like" Ceramics: a, Interior Trailed Chevron and Dashes; b, Rectangular Notched Loop Handle, and Trailed Design (a is the interior view of b); c, Interior Notches; d, Notched lip, Rectangular Notched Loop Handle, and Trailed Design; e, Interior Dashes; f, Wide Shallow Trailed Lines (e is the interior view of f).

or punctations. When present. punctation is primarily used as an exterior (Figure 4o) or interior (Figure 4r) border to embellish trailed designs.

One trailed design that is common on the "Oneota-like" vessels, but is not found on Caborn-Welborn Decorated jars, consists of wide, shallow, parallel vertical or diagonal lines that do not enclose or fill triangular areas (Table 10: Figures 4u and 6f). Similar designs have been observed on Huber Trailed ceramics in northern Illinois and Indiana (Bluhm and Fenner 1961: Bluhm and Liss 1961: Faulkner 1972: Herold et al. 1990:42: Michalik and Brown 1990:203), and Koshkong Bold vessels in Wisconsin (Bozhardt 1994: Hall 1962). This design also is a defining characteristic of Kent Incised (O'Brien and Fox 1994:37: Phillips 1970), a central Mississippi Valley ceramic type. To distinguish the "Oneota-like" ceramics from Kent-Incised, when this design was associated with rims that exhibit interior lip modification and a sharply angled rim/neck juncture or extremely wide trailed lines, it was assigned to the "Oneota-like" group, but rim and body sherds of globular jars with rounded necks and incised or narrow trailed lines were assigned to the type "Kent Incised-like" (see below). Other trailed designs (Table 10) identified on "Oneota-like" vessels include triangular areas demarcated by trailed lines and filled with diagonal trailed lines or left plain, and descending chevrons (Figure 4 q)

Table 10. Oneota-Like Shoulder Motifs (lower case letters refer to illustrations Figure 4).

Decorative Motifs on Vessel Shoulders	Site			
	Hovey Lake		Slack Farm	
Line Border/Line Fill (a, b)	1	100.0%	12	20.0%
Line Border	0	0.0%	3	5.0%
Line Border/No Fill (f)	0	0.0%	5	8.3%
Parallel Vertical/Angled Lines (u)	0	0.0%	10	16.7%
Parallel Horizontal Lines	0	0.0%	1	1.7%
Punctation Bordering Line	0	0.0%	1	1.7%
Punctation Border Horizontal Lines & Line Border/Line Fill (o)	0	0.0%	1	1.7%
Punctation Interior Border (r)	0	0.0%	1	1.7%
Descending Chevron/Line Border	0	0.0%	2	3.3%
Descending Chevron/Line Border/Punctation Fill	0	0.0%	1	1.7%
Other Line	0	0.0%	21	35.0%
Other Punctation	0	0.0%	2	3.3%
Totals	1	100.0%	60	100.0%

Barton Incised. As noted above decoration on these specimens is located in a zone between the lip and neck of jars. Exterior designs on Barton Incised rims consist primarily of line-filled triangular areas. Some designs are similar to those observed on Caborn-Welborn Decorated, but usually only one was used to layout rising and descending triangles.

Parkin Punctate. Sherds that appear to have been derived from jars that were punctated from the neck to the bottom of the vessel were classified as Parkin Punctate (Phillips 1970). Some Parkin Punctate vessels also have punctated lips. Punctations with a crescent or U-shape, as well as punctations with an adjacent rise (a small elevated ridge of clay next to the hole) are the most common forms of punctations observed on Parkin vessels recovered from Caborn-Welborn sites. As many as eight handles occur on some Parkin Punctate jars.

Campbell Punctate. In contrast to Parkin Punctate, punctation on Campbell Punctate vessels is characterized by distinct rows of punctations (Figure 4s). In the central Mississippi Valley, this type is primarily associated with wide-mouth bottles (Chapman and Anderson 1955; House 1993; O'Brien and Fox 1994:40), but it is also associated with jars (O'Brien and Fox 1994:219). In the Caborn-Welborn area, this design is primarily restricted to jars (Figure 7). From one to five rows of primarily oblong punctations are found on these vessels. Occasionally there is a single incised or trailed line above the punctated area.

Some Campbell Punctate jars also have punctated lips and a few have as many as 16 handles (Figure 7). Although no Campbell Punctate bottle rims were recovered from Slack Farm, Caborn, or Hovey Lake one is present in the collection from the Moore Site (Pollack 1998). This sherd has an interior beveled lip that is similar to what House (1991, 1993:27) has referred to as the "Memphis Rim made".

"Kent Incised-Like." As was previously noted, jars that have rounded necks and whose shoulders were decorated with a series of vertical or diagonal lines (Figure 4t, u) that do not enclose or fill triangular areas were classified as "Kent Incised-like" (Phillips 1970). Lines on "Kent Incised-Like" can cover the entire shoulder area, or they can occur as clusters of three to four lines with plain areas between them. One of the Kent Incised-like vessels has eight thin strap handles and oblong punctations on its lip, and another has a series of small lugs extending from its lip. A slight majority of Kent Incised-like sherds are truly incised (mean width of 1.4 mm), while the remaining sherds have trailed lines (mean width of 2.3 mm).

Campbell Incised. Several sherds exhibit incised (mean width of 1.0 mm) lines that extend from the lip or just below the lip to below the shoulder. These specimens were classified as Campbell Incised (Chapman and Anderson 1955; O'Brien and Fox 1994).

Walls Engraved. Several sherds with Bell pastes have engraved exterior or interior surfaces. (Figure 8). These specimens appear to be similar to Walls Engraved, which is a common late Mississippian type in the Memphis area of western Tennessee (Phillips et al. 1951; Smith 1990). One of the engraved designs suggests the form of a duck with teeth (Figure 8), and another a portion of bird that has crude talons (Figure 8) that are similar to those on an engraved bottle from Owl Cave in the western Ozarks and Craig C bird-man from Spiro (J. Brown 1989:191, 200; Lawton 1964, cited in J. Brown 1989:200). Others appear to be abstract representations of animals, but most are too fragmentary to interpret.

Campbell Appliqué. Several rims have a series of applied vertical strips that are located on the rim between the lip and the neck. These specimens were assigned to the type Campbell Appliqué (O'Brien and Fox 1994; Phillips 1970).

Fortune Noded. One sherd exhibited a series of nodes on the vessel's exterior's surface. This is the diagnostic characteristic of the type Fortune Noded (Phillips 1970).

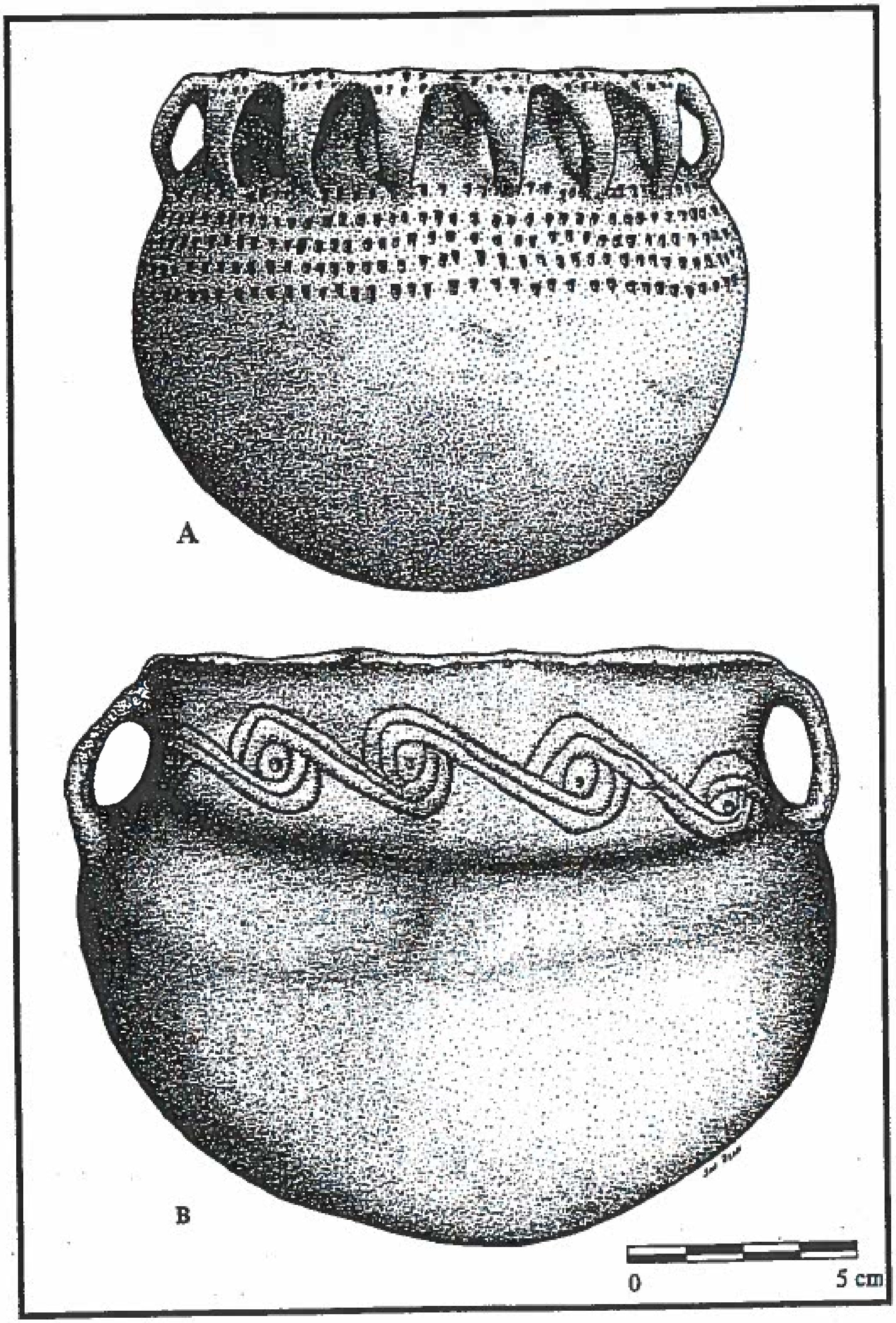

Figure 7. Campbell Punctate (top) and Miscellaneous Incised (bottom).

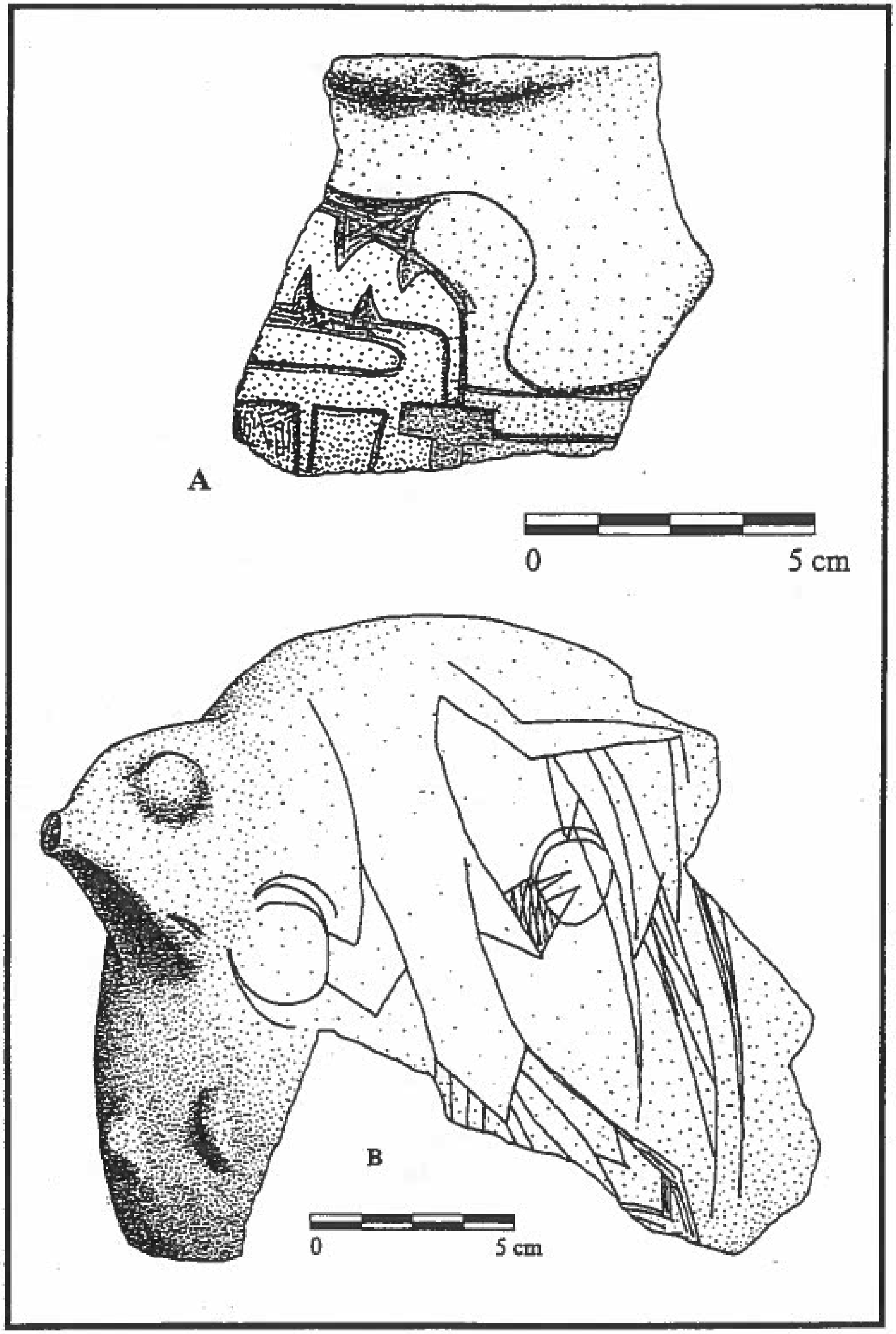

Figure 8. Walls Engraved.

Miscellaneous Incised/Trailed. This group included sherds with Mississippi or Bell Plain pastes that could not be assigned to previously defined types with any degree of confidence. Some of the small rim sherds exhibit incised or trailed lines between the neck and rim. Unfortunately, the small size of most of these specimens precluded their assignment to an existing ceramic type. Other sherds assigned to this group exhibit curved lines that form semi-circles or complete circles.

A complete jar also was assigned to this group. It had opposing thin strap handles and a punctated lip. An incised scroll design had been placed on its neck (Figure 7), with a single punctation associated with the center of each scroll link. It is similar to scroll designs on bowls from Alabama (Walthall 1980:262).

INTERSITE COMPARISONS

Intersite comparisons of ceramic types and attributes found at Slack Farm, Caborn, and Hovey Lake suggest the presence of intraregional ceramics differences within the Caborn-Welborn area. At this time, however, it is still not clear whether these differences are related to the types of contexts sampled (e.g., house floors vs. pits), site function, social differences within Caborn-Welborn society, or diachronic changes. Of the three sites included in this study, the Slack Farm collection contains the greatest variety of ceramic types, some of which (e.g., Campbell Appliqué or Campbell Incised) have not been found at either Hovey Lake or Caborn (Table 2). Other types, such as Tolu Fabric Impressed, O'Byam Incised, and Parkin Punctate, were recovered from Hovey Lake and Slack Farm but not Caborn, while types such as Beckwith and Manly were recovered from all three sites. Undoubtedly some of the observed differences in ceramic assemblage composition can be attributed to sample size and length of occupation, since the Slack Farm collection is substantially larger and the site appears to have been occupied for a longer period time than the other two sites.

Additional insights into the Caborn-Welborn phase can be gained through intersite comparisons of decorative traits, vessel forms, and appendages. Although Caborn-Welborn Decorated ceramics were recovered from all three sites, this type accounts for only 1.0 percent (Table 3) of the Hovey Lake collection (7.0 percent [Table 2] of the Hovey Lake analyzed sample of rims, decorated body sherds, and appendages), but 6.7 percent of the Slack Farm collection (31.7 percent of the analyzed sample) and 14.1 percent of the Caborn collection (53.5 percent of the analyzed sample). While fewer incised, trailed, or punctated sherds were recovered from Hovey Lake than Caborn, a greater variety of decorated types and surface treatments is represented in the Hovey Lake collection.

Not only does Caborn have a higher percentage of decorated jars than Hovey Lake and Slack Farm, it has a higher percentage of incised Caborn-Welborn Decorated sherds (35.7 percent compared to 23.3 and 21.8, respectively) relative to trailed specimens. Furthermore, at Caborn, lines associated with Caborn-Welborn Decorated designs are somewhat narrower than at the other two sites. Caborn's incised or trailed vessels have a combined mean line width of 1.9 mm compared to 2.5 mm for Hovey Lake and 2.6 mm for Slack Farm (Table 8).

There are also intersite differences in the use of punctation as a decorative treatment. Punctation combined with trailed or incised lines is much more common at Caborn than it is at either Hovey Lake or Slack Farm (Table 7). However, the use of only punctation as a decorative treatment below the rim is present at all three sites, where it is represented by types such as Campbell Punctate, Parkin Punctate, and some Manly Punctate and Caborn-Welborn Decorated jars (where punctations were used to create triangular areas that were usually filled with punctations).

Although incised or trailed decoration is more common at Caborn than at Hovey Lake, Kimmswick Fabric Impressed pans are much more common at Hovey Lake and Slack Farm than at Caborn. Of the 183 pan rims recovered from the Caborn site, only four have fabric impressed exterior surfaces (Table 2). In addition, shallow bowls with outslanting walls and scalloped rims, which account for about 40 percent of the Hovey Lake and Slack Farm bowl rims, comprise only 7.6 percent of the Caborn sample (Table 5). The Hovey Lake and Slack Farm collections also contain more Old Town Red bowls and bottles than Caborn (Table 2). Angel Negative Painted ceramics were recovered only from Slack Farm.

"Oneota-like" ceramics were primarily recovered from Slack Farm (Table 2). Two jars rims from Hovey Lake and one jar rim/handle from Caborn were assigned to this type based on the presence of interior lip notching. One of the Hovey Lake rims has a rounded neck; the neck of the other could not be determined. The former also has a handle scar located below the rim. The Caborn specimen consists of the upper portion of a jar with an interior notched lip and a thick strap handle. While these specimens do not exhibit all of the characteristics described previously for "Oneota-like" specimens, they were included in this group based on the presence of interior lip notching. If these rims are not included within the "Oneota-like" group, then sherds assignable to this type would be limited to Slack Farm.

Intersite differences also were noted in the types of nonhandle appendages associated with bowls and jars (Table 5). In particular, notched applied horizontal strips account for 79.8 percent of bowl appendages at Caborn, but only 21.7 and 36.9 percent of the bowl appendages at Hovey Lake and Slack Farm, respectively (Table 5). However, nodes and single oval or triangular lugs are much more common at Hovey Lake and Slack Farm than at Caborn (Table 5). In addition, plain horizontal strips and effigy vessels are more common at Slack Farm than at either Hovey Lake or Caborn.

Other intersite differences are evident in bowl lip decoration. Bowls with punctations on the top of the lip are present in the Hovey Lake and Slack Farm collections, but are absent in the Caborn collection. Exterior lip notching is more common at Caborn and Slack Farm than it is at Hovey Lake and interior lip notching was observed only on a few of the Slack Farm bowl rims.

Differences in jar nonhandle appendages (Table 5) include a greater preference for bowls with horizontal notched applied strips or notched oval lugs at Caborn than at Slack Farm or Hovey Lake. However, bifurcated lugs and nodes are much more common in the Hovey Lake and Slack Farm ceramic collections than they are in the Caborn ceramic collection.

Intersite comparisons of ceramic types and attributes has resulted in the identification of several traits that serve to distinguish the Hovey Lake and Caborn collections from each other, with Slack Farm usually sharing a particular trait with one or the other site. One interpretation of the observed patterns is that the paucity of Caborn-Welborn Decorated sherds and bowls with notched or beaded applied horizontal strips, and the high percentage of Kimmswick Fabric Impressed pans and shallow bowls with outslanting walls and castellated rims at Hovey Lake is representative of an early Caborn-Welborn component. One that reflects ceramic continuity from the earlier Angel phase. If this is the case then the establishment of the Hovey Lake community would predate Caborn, which is characterized by a high percentage of Caborn-Welborn Decorated jars and bowls with notched or beaded applied horizontal strips, and a low percentage of Kimmswick Fabric Impressed pans and shallow bowls with outslanting walls and castellated rims. Although the initial occupation of Caborn may have overlapped with Hovey Lake, this site would have continued to have been occupied after Hovey Lake had been abandoned.

Because Slack Farm shares attributes with both Hovey Lake and Caborn, the Caborn-Welborn occupation of Slack Farm probably overlaps the occupations at these sites.

This temporal arrangement is supported by chronological trends identified at Oneota sites in both the Chicago area (Brown and O'Brien 1990) and the LaCrosse region (Boszhardt 1994:209). A decrease in incised/trailed line width and a greater use of punctation as fill through time has been documented in these regions. If this pattern is applicable to the Caborn-Welborn region then the notably thinner line width documented for Caborn and the greater use of punctations as fill also indicates that Caborn postdates Hovey Lake (Table 8). While the same reasoning could be used to argue that Caborn postdates Slack Farm, the overall greater line width at Slack Farm probably reflects its longer settlement history and the presence of Oneota-like decorated sherds within the Slack Farm collection.

While variation in the percentage that Caborn-Welborn Decorated constitutes of site ceramic collections appears to be related to temporal trends, differences in the use of punctations and lines to fill descending triangular areas may reflect cultural differences within the Caborn-Welborn region. Caborn, which is located along the eastern edge of the distribution of Caborn-Welborn sites, is characterized by a high percentage of jar shoulder designs that use lines to layout triangular areas that were filled with punctations (Table 9). This differs from the pattern at the more centrally located Slack Farm and Hovey Lake sites where these triangular areas were primarily filled with lines. If other sites within the Caborn-Welborn region are found to confirm the observed variation in the spatial distribution of line- and punctation-filled pendants, then this pattern may reflect the presence of two or more distinct cultural groups or factions within the Caborn-Welborn region.

The wider range of ceramic types identified within the Slack Farm assemblage is in part attributable to sample size, but it also may reflect the importance of this community within the Caborn-Welborn region. Slack Farm is not only one of the largest Caborn-Welborn settlements, but is the only community to have been occupied throughout the Caborn-Welborn phase. Because it is located across from the mouth of the Wabash River and is centrally located within the distribution of Caborn-Welborn settlements, it is possible that Slack Farm may have been a central node within the Caborn-Welborn settlement system. Though it lacks the corporate architecture, in the form of platform mounds and stockades, that typified earlier Mississippian regional centers in the lower Ohio River Valley, it may have been an important meeting place for intra- and extra-regional interaction within the Caborn-Welborn region.

EXTRAREGIONAL INTERACTION

Comparison of the Caborn-Welborn phase ceramics from Slack Farm, Caborn, and Hovey Lake with those from other regions (Figure 9) indicates that some decorative treatments and designs present within these collections are a product of extraregional interaction with Mississippian groups to the south of the Ohio Valley as well as Oneota groups to the north. To date, there is little or no ceramic or other lines of evidence to suggest that Caborn-Welborn people interacted with Fort Ancient groups located further up the Ohio River. Interaction with Mississippian groups to the southwest (including southeastern Missouri, northeastern Arkansas, and western Tennessee) is reflected in the presence of ceramic types such as Parkin Punctate, Campbell Punctate, Campbell Incised, "Kent Incised-like", Campbell Appliqué (a post-A.D. 1500 central Mississippi Valley ceramic type [Mainfort 1996]), and Walls Engraved (Table 5.1). Jars with arcaded handles also are diagnostic of post-A.D. 1500 components in the central Mississippi Valley.

Caborn-Welborn and its Nearest Neighbors A.D. 1500

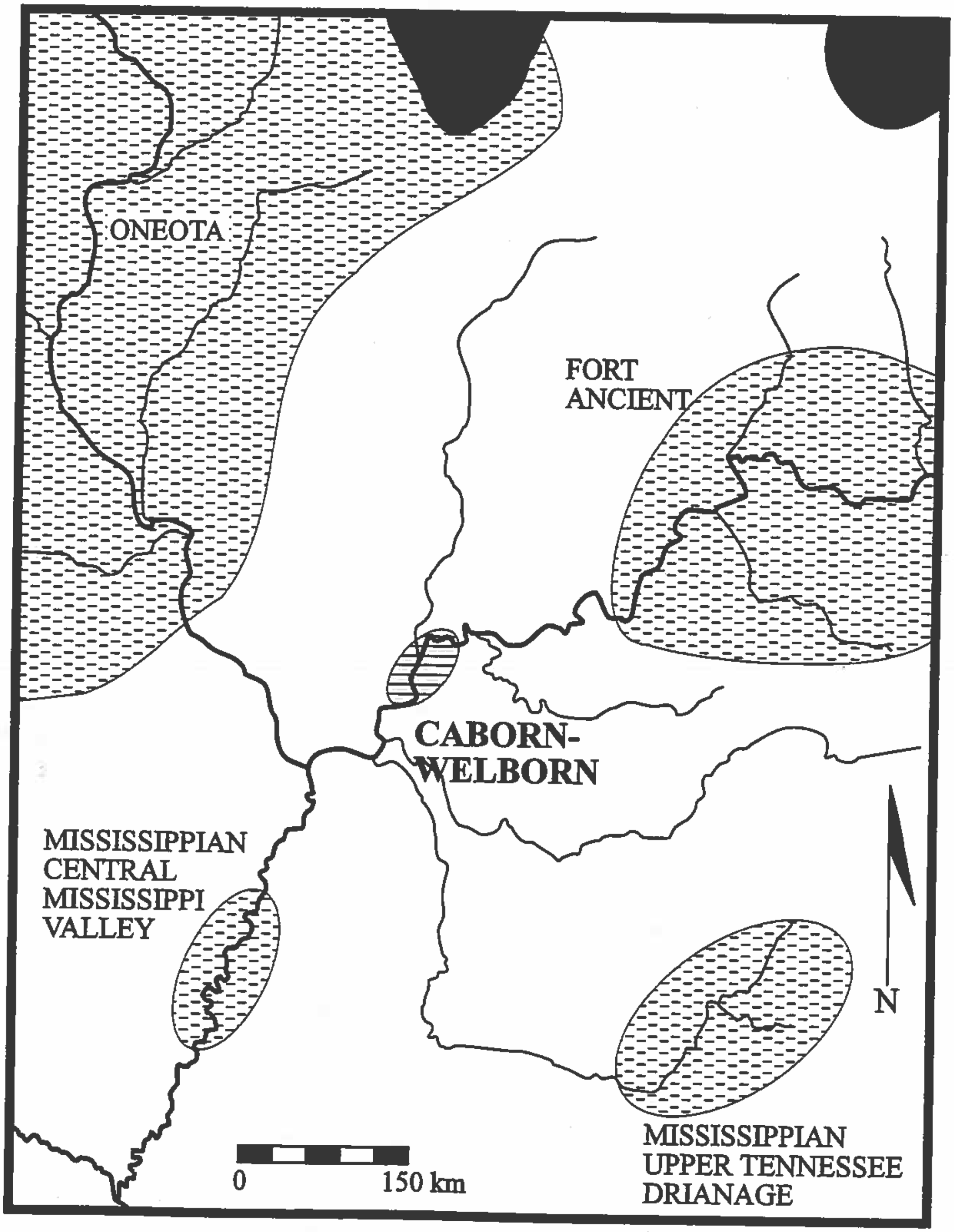

Figure 9. Caborn-Welborn and its Nearest Neighbors ca. A.D. 1500.

In contrast to decorated ceramic types that reflect extraregional interaction, decorated types, such as Angel Negative Painted, Old Town Red, Mound Place Incised, Beckwith Incised, Matthews Incised, and Manly Punctate, reflect continuity with earlier lower Ohio River Valley Mississippian groups. These types are well known from Mississippian sites (Clay 1963; Cole et al. 1951; Hilgeman 1992; Pollack and Railey 1987) in the lower Ohio Valley that predate the Caborn-Welborn phase.

Ceramic attributes that may reflect interaction with Mississippian groups to the southeast of the Ohio Valley are more difficult to identify, but may include bowls and jars with notched or beaded rim strips, and jars with notched lugs. Incised and punctated designs below jar necks and incised strap handles from late Mississippian sites in southeastern Tennessee (Lewis and Hendrick 1995:110-115) also could be a product of interaction with the Caborn-Welborn region. While many of these traits are found over a broad area to the south of the Ohio Valley, they nonetheless reflect some level of interaction and communication with Mississippian groups outside the Ohio Valley. It is worth noting that among the three sites examined as part of this study, these traits are most common at Caborn, which is located on the eastern edge of the Caborn-Welborn area. The greater frequency of these traits at Caborn may point to more interaction between Caborn-Welborn settlements located upstream from Slack Farm with Mississippian groups to the southeast of the lower Ohio Valley than those located downstream from the mouth of the Wabash.

Extraregional interaction with Oneota groups to the north of the Ohio Valley (including northern Illinois, southwestern Wisconsin, and northeastern Iowa) is reflected by the jars that exhibit a sharply angled rim/neck juncture, notched loop handles, interior rim notches and trailed chevrons, and wide trailed lines on vessel shoulders (Boszhardt 1994; Brown and O'Brien 1990; Hall 1962; Henning 1970; Santure et al. 1990; Tiffany 1988; Wedel 1959). Prior to the Slack Farm investigations the presence of "Oneota-like" ceramic elements was recognized in some Caborn-Welborn ceramic collections, but only on one or two sherds, which tended to obscure their significance. The very large ceramic sample from Slack Farm, however, allowed for the identification of a suite of attributes that are more similar to Oneota decorated vessels than they are to Caborn-Welborn Decorated jars. "Oneota-like" sherds account for approximately 1.3 percent of the analyzed Slack Farm ceramic sample (0.3 percent of all sherds), but the actual number of "Oneota-like" specimens in this assemblage is probably under represented, because plain unmodified rims that exhibit a sharp inflection at the rim/neck juncture and lack notched handles were classified as Mississippi Plain. Likewise, because decorated body sherds from Oneota-like vessels cannot be reliably distinguished from Caborn-Welborn decorated specimens, most were classified as Caborn-Welborn Decorated.

Based on an examination of vessel attributes and the context of recovery of the central Mississippi Valley and "Oneota-like" ceramics, some tentative suggestions can be offered concerning the manufacturing of these vessels and the nature of Caborn-Welborn interaction with other groups. Within Caborn-Welborn site collections, central Mississippi Valley decorated ceramic types as well as Mississippi Plain and Caborn-Welborn Decorated are associated with similar jar and rim forms. Similar types of handles, lugs, and nodes also are present on these jars. Given the overall similarity of the shape of these jars and the types of appendages associated with them, there is little evidence at hand to suggest that the central Mississippi Valley decorated ceramic types in the Slack Farm and Hovey Lake collections represent trade items or were manufactured by nonlocal potters. Rather they appear to have been manufactured locally by Caborn-Welborn potters.

In contrast to the central Mississippi Valley types, the distinctiveness of the "Oneota-like" jars, with their sharply angled rim/neck juncture, notched rectangular loop handles, and interior lip notches, dashes, and chevrons, clearly distinguished them from Caborn-Welborn Decorated jars. Since the manufacture of ceramic vessels often requires acquisition of motor habits that are usually learned during childhood (Arnold 1985, 1989), it is quite likely that many of the Oneota-like jars recovered from Slack Farm, and probably other Caborn-Welborn sites, were manufactured by Oneota potters. If this is the case, then these ceramics represent either trade vessels or pots manufactured by Oneota potters residing within Caborn-Welborn communities.

Along with ceramic vessels manufactured by Oneota potters, Oneota-derived decorative designs, such as the thunderbird/hawk motif (Figure 4m-q), have been found on Caborn-Welborn Decorated vessels. In addition, to Campbell Appliqué, applied vertical strips were sometimes incorporated within Caborn-Welborn Decorated designs. The presence of Oneota and central Mississippi Valley design elements on Caborn-Welborn Decorated jars points to the diffusion of ceramic decorative styles and their reinterpretation within a regional ceramic tradition.

Unlike Oneota-like jars, which are primarily known from nonmortuary contexts at Caborn-Welborn sites, central Mississippi Valley derived ceramics types such as Parkin Punctate, Campbell Punctate, Campbell Incised, and "Kent Incised-Like" as well as lower Ohio Valley decorated types, such as Manly Punctate, were often interred with the dead. This suggests that ceramic types that reflect extra-regional interaction, may have been used for different purposes within Caborn-Welborn communities. One interpretation is that the contextual association of central Mississippi Valley derived types with mortuary contexts reflects continued participation of Caborn-Welborn people in Mississippian religious and ceremonial life.

On the other hand, the contextual association of Oneota-like jars with nonmortuary contexts suggests that use of these vessels by Caborn-Welborn people involved a different set of activities from those of the central Mississippi Valley derived types. Perhaps economic concerns may have played a greater role in the Caborn-Welborn use of "Oneota-like" jars. Exchange relationships with Oneota groups would have provided Caborn-Welborn people with access to catlinite pipes, copper, and perhaps other goods, while Caborn-Welborn people could have provided Oneota groups with marine shell gorgets and beads acquired through exchange relationships with other Mississippian groups. These economic relationships could have been cemented and maintained by establishing a presence within a trading partner's community, through the relocation of households, marriages, or the adoption of other types of kinship relationships. Once partnerships were established, other mechanisms such as the Calumet ceremony, which had spread south and east and had reached the central Mississippi Valley by the period of early European contact (Blakeslee 1981; I. Brown 1989; Hall 1991), may have been used to sustain these economic relationships.

In addition to ceramics, the forms of pipes, ornaments, and engraved stone objects further show Caborn-Welborn external connections. Disk pipes (cf. Murphy Site, Moorehead 1906: Figure 22; Adams 1949: Plate X) comparable to Oneota forms are the most common pipe form, with both catlinite and local limestone being used in their manufacture. Catlinite or a similar redstone was also used to make pendants, marine shell was used to make beads, gorgets and ear plugs, and native copper, European copper and brass was used to make beads, tubes, spirals, bracelets, and tinkling cones. Engravings on catlinite disks and tablets of coal and slate include both the weeping eye motif and the hawk or eagle dancer.

Taken together, the identification of nonlocal ceramic attributes within Caborn-Welborn ceramic assemblages and the recovery of objects manufactured from nonlocal materials suggests that some sort of social interaction took place between people living in the vicinity of the mouth of the Wabash and groups living far beyond the borders of the Caborn-Welborn homeland. They also indicate that some members of Caborn-Welborn society participated in Oneota and Mississippian long distance exchange networks and interaction spheres (Brown et al. 1990: Hall 1991: Welch 1991). The impetus for and the political motivation behind this interaction has yet to be determined.

SUMMARY

The ceramic collections recovered from Slack Farm, Caborn, and Hovey Lake, as with most Mississippian collections, are dominated by Mississippi Plain and Bell Plain jars and bowls. Other types identified within these three Caborn-Welborn ceramic assemblages include Kimmswick Fabric Impressed, Kimmswick Plain, Kimmswick Net Impressed, Caborn-Welborn Decorated, "Oneota-like," Parkin Punctate, Manly Punctate, Matthews Incised, Beckwith Incised, Campbell Incised, Campbell Punctate, Campbell Appliqué, "Kent Incised-like," Walls Engraved, O'Byam Incised/Engraved, Fortune Noded, Angel Negative Painted, Mound Place Incised, Barton Incised, and Old Town Red. Their frequency of occurrence points to variation in the distribution of these types within the Caborn-Welborn region. All of the types identified within the region are present at Slack Farm. Some of the minor decorated types, such as Parkin Punctate, O'Byam Incised/Engraved, and "Kent Incised-like," also were found at Hovey Lake, but were not recovered from Caborn. However, while Caborn-Welborn Decorated accounts for almost half of the analyzed sherds from Caborn, this type accounts for less than 7.0 percent of the Hovey Lake collection. On the other hand Kimmswick Fabric Impressed sherds comprise slightly more than 10.0 percent of the Hovey Lake collection, but less than 1.0 percent of the Caborn ceramic collection.

Intraregional differences also have been identified with respect to the intersite distribution of ceramic attributes. Again differences were noted primarily between Caborn and Hovey Lake. Differences that were identified include a paucity of scalloped rim bowls and bifurcated jar lugs at Caborn, and the infrequent use of horizontal applied strips on bowls and notched jar lugs at Hovey Lake. Also, incised and trailed lines at Caborn tend to be much narrower than those from Hovey Lake. Based on these comparisons it has been suggested that Hovey Lake predates Caborn, and the Caborn-Welborn component at Slack Farm spans both the Hovey Lake and Caborn components. However, more work is needed to determine if the intersite distribution of ceramic types and attributes discussed in this paper reflect temporal trends, intraregional linkages, or site function.

Participation in extraregional exchange is reflected in ceramic types, attributes, and designs that are characteristic of other regions. The presence of "Oneota-like" jars within some Caborn-Welborn ceramic collections points to interaction with groups to the north of the Ohio Valley. While these jars could represent vessels that were used to transport nonlocal goods to the Ohio Valley, it is quite possible that they were manufactured by Oneota potters residing within Caborn-Welborn communities. The presence of ceramic types such as Parkin Punctate, Campbell Applique, and Walls Engraved within Caborn-Welborn ceramic collections points to interaction with Mississippian polities to the south of the Ohio River Valley. That some of the central Mississippi Valley types occur as grave offerings can be seen as continued participation by Caborn-Welborn populations in Mississippian religious and ceremonial life.

The geographic location of the Caborn-Welborn homeland may have been a factor in the Caborn-Welborn involvement in late Mississippian exchange networks. Their communities were situated along the Ohio River around the mouth of the Wabash River, and within a day's canoe trip to the east or west of the Ohio's confluence with the Green and Tradewater rivers. Therefore, Caborn-Welborn people were in an ideal position to play an important role in extraregional exchange, influencing not only the east-west flow of goods along the Ohio River, but perhaps more importantly the north-south riverine movement of materials along the Wabash, Tennessee-Cumberland, Tradewater, and Green rivers. It is possible that the leaders of Caborn-Welborn society functioned as middlemen in the long-distance movement of goods between Mississippian polities in the south and Oneota tribal groups to the north. Exchange in this manner may have been mediated through fictive kinship relations and the Calumet Ceremony.

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RECONSTRUCTING THE 1932-1939 KING EXCAVATIONS AT WICKLIFFE MOUNDS

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ABSTRACT

One of the excavation goals at Wickliffe Mounds since 1984 has been to reconstruct and re-evaluate the Fain W. King project of 1932-1939. King dug in six mounds, A through F. Approximately 85,000 artifacts, but little documentation beyond anecdotal publications, now are available to represent the King project. Murray State University and Middle Mississippi Survey studies since 1984 have investigated five of King's mounds (and failed to find the sixth). As the current excavation project enters its final phase, it is time to evaluate whether the goal of reconstructing the King project, and analyzing its results, can be fulfilled.

INTRODUCTION

The Wickliffe Mounds Site (15Ba4) was first mapped by Robert Loughridge (1888), who sketched this small Mississippian village site (Figure 1) and provided some approximate measurements of the mounds. The site was apparently surface collected during the early part of this century, and was brought to the attention of William S. Webb and William D. Funkhouser in the late 1920s by Fain King of Paducah, who had a collection from the site (U.K.: King to Funkhouser, November 14, 1927). In 1930, construction of U.S. Highway 51 from Wickliffe to Cairo, Illinois, disturbed the southern tip of the site. King bought the land in 1932, and in October of that year, began excavations (Wesler 1988).

King excavated the site from late 1932 until at least 1939, operating it as a tourist attraction at the same time. He conveyed the property, probably without some of the finest artifacts, over to Western Baptist Hospital of Paducah in 1946, which in turn donated it to Murray State University in 1983. Since 1983, the Wickliffe Mounds Research Center (WMRC) has established a program of revising the exhibits and renewing research on the site. The primary goal in the beginning of the project was to reevaluate the King excavation, with the objective of putting the artifact collection into an analyzable context. WMRC researchers have, in the process, refined the chronology for the site's occupation, between ca. A.D. 1100 and 1350, and have made progress analyzing spatial and functional patterns within the site. After 11 seasons of work, WMRC projects have tested almost all of the major areas of the site, and are beginning to conclude the field work, with only a few tests remaining to study the southern site area. It seems to be a good time, then, to consider how well analysis can approach the original goal: to understand better the King project of the 1930s.

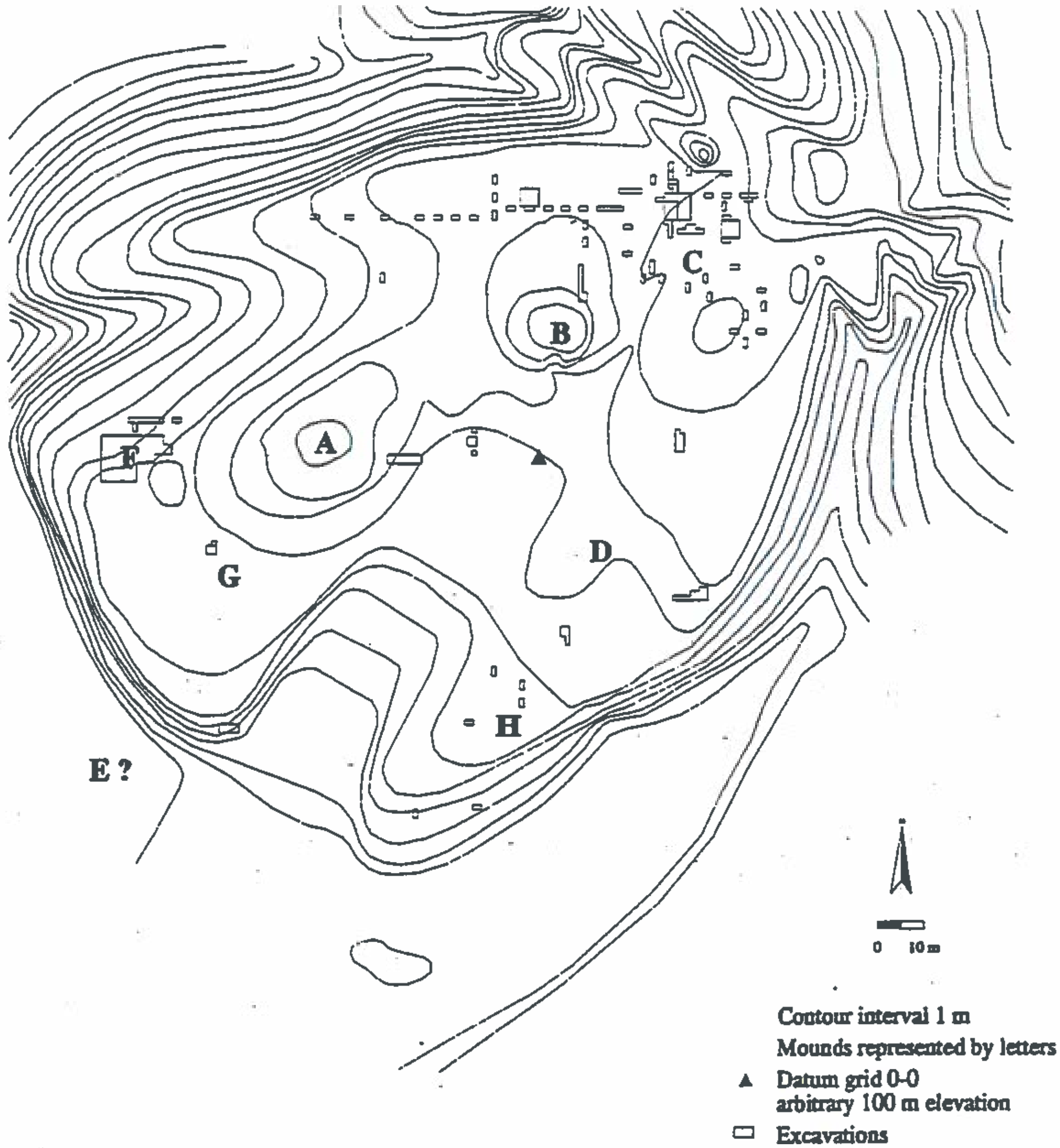

Figure 1. The Wickliffe Mounds Site. Topographic map drawn by Charles Stout. Used by permission of the Western Kentucky Project, University of Illinois at Urbana-Champaign. Digitized and modified by Kristin Brown.

MOUND A

King's crews completed excavations in the two platform mounds and exposed the first 40 burials in the first month of the project (Wesler 1988). Although he kept some records of his excavations, repeated searches have not been able to find them. King began his investigations with the larger platform mound, Mound A, a double-tiered mound to the west of the presumed plaza. His workers removed approximately 87 m^3 from the center of the mound, reaching a depth of approximately 2.2 meters. So far, WMRC researchers have located no more than a score of artifacts that were catalogued from the Mound A excavations. Ethnobotanical materials--charred corn, thatch, and wood--are more abundant, but have not yet been analyzed.

Published discussions provide very little information. Blanche Busey King (1939), King's wife, published a book called *Under Your Feet*, in which an occasional tidbit of useful information can be found. Two short articles, one by Thomas M. N. Lewis (1934) and the second by F. King (1936), provide essentially the same description of Mound A. They describe two buried mound surfaces, one at 1.5 m (5 ft) below the surface and the second about 3 m below surface (5 ft deeper). Both surfaces showed posthole patterns and charred timbers from burned buildings. The upper buried mound surface was described as having three rectangular clay "altars" and a line of postholes interpreted as a prayer rail. F. King's (1936) article claimed that the mound fill was nearly sterile.

Luckily, there is a bit more than the published information. Walter B. Jones consulted with King on the initial testing, bringing a crew of students from the University of Alabama under the field direction of David L. DeJarnette. The involvement of the Alabama workers was very brief, but Jones or DeJarnette made a sketchy record of work in progress in the first months of the excavation. These notes are on file at the University of Alabama, in the Library Archives and at Mound State Monument (hereafter cited as U.A. and M.S.M., respectively).

The Mound A excavations began in September of 1932 with two test units at the crest of the mound. The two units eventually expanded into each other, becoming a single block excavation. The notes provide a very brief description of the upper strata of the mound fill, down to the first defined older surface. Evidently, these soils consisted of an upper, dark-colored plowzone and topsoil over a thicker yellowish mound fill. Both zones contained charcoal, burnt brick (probably daub), and shell tempered sherds, of which only a few apparently were saved. At the base of the yellow mound fill was a heavy charcoal stratum, underlain by a surface with a line of postholes, interpreted as a burned structure on a former mound crest.

A few black and white photographs, provided by personnel of M.S.M., are keyed to descriptions in the notes. The following paragraphs are direct quotations from the notes:

> A-10. Photograph from surface of mound on south side-- overlooking the fire baked clay altars--with double row of post holes to the east--Part of North profile in background--A-11. Photograph from west bank overlooking entire pit with E profile in background--Showing bottom structure with superimposed structure. Also portion of charred thatch roof in foreground at base of pit--Profile shows two distinct charcoal, occupational stratum--Shows also part of three fire baked clay altars.
>
> A-12, A-13. Photograph of charred section of roof showing charred timbers in place and interwoven with smaller material probably cane or similar material.

A-14. Photograph from west at profile above post holes-- showing the edge of roof [of] charred structure to end at outer edge of the post hole row--This charred material end[s] rather abruptly dipping down at this point.

A-15. Close up of center altar from east side--lower structure in back ground. The altars are made of very hard burned clay--in some spots the clay has a red color but on most of the surface and extending into the burned clay it has a very black color being discolored by continuous fires. The thickness of the burned clay is approximately 1-1/2" as an average for all three of the altars--The row of holes on the east side of the three altars are about 2-1/2' deep and all appear to lean so that the post that occupied the hole would necessarily lean toward the altars. A charred material as found on the lower structure was encountered on top of the altars.

There is no indication that the soils were screened during the excavation. The notes describe only meager artifactual finds, including shell-tempered ceramics, a large pottery trowel, a hammer stone, two bone awls, and a chipped stone drill. The pottery trowel and a few ceramic sherds are stored at the Mound State Monument. Only a handful of specimens in the Wickliffe Mounds collection bear Mound A labels.

The Mound A excavation was still open in 1983, but was in very poor shape. The floor and walls were crumbling and very dry, and the south wall had collapsed. In 1983, a University of Illinois project under the general direction of R. Barry Lewis obtained charcoal samples from the two major burned strata. These samples yielded radiocarbon dates of A.D. 1120±77 (ISGS-1143), from the lower stratum, and A.D. 1185±76 (ISGS-1156) from the upper stratum (Lewis 1986). Deposits both above and below the dated levels remained to be dated.

WMRC excavations in 1984 placed a 2 x 8 m trench in the eastern side of Mound A (Wesler 1985). The crew identified at least six mound construction zones, and also an underlying midden, which King's excavations had not reached. The excavators found no sign of middens associated with earlier mound crests. Aside from architectural remains associated with the mound platforms, artifacts in the mound are accidental inclusions in the mound fill, which evidently were too fragmentary to interest King's crews. The WMRC excavations in Mound A, then, resulted in two main additions to King's work: a more thorough understanding of the full stratigraphy of the mound, and a three-part ceramic sequence tied to radiocarbon dates (Wesler 1985, 1991a).

MOUND B

Mound B is the only one of the 1930s King excavations of which a stratigraphic drawing survives (U.A.). It shows a recognizable platform mound stratigraphy, with several mound construction zones separated by charcoal zones. By analogy with Mound A, it could be assumed that the charcoal zones were the remains of burned buildings at early summits of the platform mound. Published accounts of the 1930s King excavations have very little to say about Mound B. B. King's (1939) book, and her and F. King's several articles (B. King 1937; F. King 1934, 1936), repeat the same data. They called it the Council House Mound, to distinguish it from the Temple Mound, Mound A. Most of their discussions of Mound B focus on the feature pattern at the subsoil, a large, roughly square posthole pattern with a number of internal postholes and several features interpreted as fire pits. At this base level, the 1930s excavators found a bone "turkey caller," some charred maize cobs, two ceramic discs, a cannel coal ring, a worked piece of fluorspar, and several ceramic vessels, including one that sounds like Bell Plain and others with red-filmed interiors. Aside from the pots, WMRC researchers have identified fewer than half a dozen artifacts from the Mound B excavation, and it seems that the Kings recovered or kept essentially nothing other than what they enumerated in this list.

King dismissed the mound deposit above the basal zone by saying, "Very few artifacts were found elsewhere," and in another article referred to the mound fill as "almost sterile" (F. King 1934, 1936). The M.S.M. notes are wordier, but presage the published accounts by concentrating on the floor pattern. The WMRC conducted excavations in Mound B in the summer of 1990 (Wesler 1990b, 1991b), placing a long trench on the north side of the mound. The excavators found that the 1932 drawing was accurate, but simplified: the stratigraphy is much more complex than the older drawing indicated. The general stratigraphy is much like that of Mound A, with an underlying midden capped by successive platform mound stages. There are two major differences from Mound A. First, the midden under Mound B grows considerably deeper away from the center of the mound. The Mound B trench is on the north side of Mound B, away from the plaza, and village deposits lapped against the slope of the mound each time the mound was expanded. In Mound A, by contrast, the crew excavated the plaza side, and no additional deposition took place once the mound defined the edge of the plaza.

The second difference is that the dark zones on the mound crests in Mound B, labeled as charcoal in the 1932 drawing, are actually middens, which spread down the mound slopes. Mound B was a residential mound. As a working hypothesis, analysis is treating Mound B as an elite residence, an idea that could not be gleaned from the King project.

MOUND C

King designated the third mound he excavated as Mound C, an area that turned out to be the cemetery. The earliest published discussion of the cemetery is by Lewis (1934). Lewis described the mound as "not a prominent one." He noted extended, bundle, and cremation burials among the 153 exposed, and said that only one individual, a woman, would have been more than 70 years old at death. Lewis discussed several burial associations, and more generally noted a high frequency of effigy vessels, mica, hematite, fluorite, lead, copper, cannel coal, marine shells, and bone and stone tools among the findings. It is very difficult, at this point, to assess the true associations of these materials, and most of them cannot be identified among the collections.

More interesting, in light of recent work, was Lewis's (1934) comment that burial pits could not be defined. Lewis thought that the bodies were placed on the ground and dirt heaped over them, which would have created the mound. "Layers of charcoal are to be seen under the burials" (Lewis 1934).

Subsequent discussion by the Kings added little to Lewis's information. F. King (1934) referred to more than 140 burials, and added that "This mound is about one-tenth excavated... Tests made elsewhere indicate there should be a total of eight hundred to one thousand burials in this mound." There is no extant information about these alleged tests.

WMRC excavations in 1991-1994 focused on reevaluating the cemetery and Mound C. The deposition is very complex (Wesler 1992; Wesler and Mattemes 1991). The basal zone was a midden. Mound C proper is one in a complex of three small mounds (Wesler 1993). The mounds are covered by a late midden zone. The burials are contained for the most part in the late midden, occasionally penetrating deeper. Like Lewis and King, WMRC excavators could not trace burial pits in the midden soil, but did find several pits that penetrated lower deposits. Because there are pits, and because this is a well-defined, very densely occupied cemetery, the current view is that the cemetery is intrusive, post-dating the abandonment of the Wickliffe village. This interpretation will have to be verified by direct dates (see Clay 1997; Wesler 1997 for further details and implications).

WMRC researchers cannot confirm the number and variety of grave goods that King and Lewis reported. One burial peripheral to the main group had three vessels, which comprised half the ceramics found in situ in the 1990s.

WMRC excavators confirmed the presence of extended and bundle burials, and one cremation. It is not clear whether the cremation belongs to the cemetery or to the underlying mound. New excavations confirmed the presence of charcoal lenses associated with some burials, which appear to be charred boxes. Analysts now can estimate the full extent of the cemetery. Matternes's (1994) most recent estimate of a burial population of 800 to 900 is consistent with King's estimate.

In addition, WMRC excavators identified an area of conglomerate rock slabs on the northwest side of the mound. It resembles robbed limestone-slab graves of the surrounding Mississippian regions, expressed in locally available material. There is no indication that the disturbance was historic, however.

Analysis of the cemetery is continuing. The WMRC project has added considerably to any interpretation that could have been gained from the King project, and has called into question several assumptions that would have been made without additional data.

MOUND D

B. King's (1937:83, 1939:47) published accounts describe Mound D as rectangular in shape, and measuring 32 x 16.75 m (105 by 55 ft) , with a maximum height of 1.8 m (6 ft). F. King (1936) earlier described it as having a height of 2.1 m (7 ft) and a length of 51.8 m (170 ft), but Loughridge (1888) drew it as two small, rounded mounds. King tested Mound D at the beginning of his project, with a single square unit placed arbitrarily at the north end of the mound (M.S.M.). This test was recorded only with a sketch of its general location, and was apparently backfilled with the same unscreened soil removed from it.

The excavation in Mound D was resumed in 1935, this time on a grid. An F. King letter includes a sketch of the mound, locating a benchmark pin in relation to the grid baseline (U.C.: King to J. C. Harrington, October 28, 1935). The benchmark is also marked on a topographic map prepared by James DeJarnette in 1932 (U.A.), and appears to be in the same horizontal location as a large iron pin now in the floor of the Mound D excavation exhibit. The iron pin will provide a potential point for helping relocate the King Mound D grid. The provenience labels on Mound D sherds in the King collection fit well with the Kings' published descriptions of 1.5 x 1.5 m (5 x 5 ft) squares and 30 cm (1 ft) levels (B. King 1939).

The Kings' reports of the mound excavations and contents are anecdotal at best. They reported 63 infant burials and six structure patterns at the base of the mound. Most of the structures were rectangular, but one was circular, 6.7 m (22 ft) in diameter (B. King 1937:83, 1939:44ff). Posthole patterns representing the circular structure and several straight wall trenches are still visible in the Mound D excavation exhibit. The Kings described the mound fill as a "great accumulation of kitchen midden," rich in artifacts, yielding several fire pits, a charred fabric bag containing corn, and a large fluorspar pendant (B. King 1939:50, 70, 81, 84).

More intriguing is their laconic report of adult burials apparently within the mound. F. King (1936) first mentioned only that there were four adults "at higher levels." B. King (1939:50) expanded the description: "In the middle of the structural outlines, three feet from the base of the mound, two adult extended burials were found completely covered with cypress and other bark. We also found a burial pit, the bottom covered by stones and six bundle burials."

Numerous artifacts and features are still on display in the Mound D excavation (human remains have been removed from the sites of infant burials). Most of the features apparently remain as excavated, especially those that intrude the subsoil (e.g. excavated postholes within unexcavated wall trenches) are evidently genuine. The artifacts, however, cannot be taken to be in situ without intensive further study.

The 1987 WMRC field school was planned to study Mound D as an approach to questions of context and artifact patterning (Wesler 1989). A small remnant of the mound is visible at the north end, outside the exhibit building, and the project began with a section of the remnant, hoping to find evidence of the mound structure. Excavators tested outside the south end of the building for the same reasons. To the east of the exhibit building, there is a large surface depression, bounded by a low ridge on the bluff line at the east edge of the site. The ridge was tested by R. Barry Lewis's crew in 1983 (Lewis 1986). From the grid labels on the extant collection and the U.I. tests, it seemed that the depression was King's excavation and the ridge the remnant ground surface. The 1987 field school also placed an interrupted trench eastward from the building to sample the depressed area and to section the ridge.

To summarize briefly, the northern remnant is a later mound over a thin early village midden with features. The south end of the test penetrated disturbed deposits, which appear to be the backfill of the 1932 test. Tests at the south end of the building found backfilled deposits down to subsoil, with truncated features remaining in the subsoil. Evidently King's excavation reached south of both the building and the WMRC trench, to an unknown distance.

The ridge at the east side is indeed a remnant midden, while the low area is old excavation, not backfilled (Wesler 1989). The WMRC collections have about 20,000 grid-provenienced sherds from King's Mound D excavations, not all of which have been analyzed. There is also a collection at the University of Michigan, where King sent some 11,000 sherds in the 1930s (Wesler 1989). With three-dimensional plotting of the artifacts, it will be possible to make a tentative reconstruction of the complexity--or lack thereof--of the original mound, to supplement the tiny 1987 sample from the north edge.

Distribution patterns in other artifact classes already have proved interesting. A few clusters of artifacts were confined to single levels and squares. Without detailed context notes, it is uncertain whether these were features, but provisionally, the clusters may be interpreted as caches. Three projectile point caches, one cache of bone tools, and one of gaming pieces, are unique in any deposit investigated so far on the site. Also, three-fourths of the provenienced conch shell effigy fragments identified came from Mound D. Coupled with the note of adult burials in the mound, it may be suggested that, if there was an elite burial mound at Wickliffe, it was Mound D (Wesler 1990a). Unfortunately, given the nature of the data, this interpretation remains speculative. Still, distributional data plus WMRC excavations should provide a clearer picture of Mound D than would otherwise have been the case.

MOUND E

Mound E is the least documented of the Kings' mound excavations. Published references are terse. Only two of B. King's publications even mention Mound E. In an end-note to an article, she stated that since May 1937 they had found two caches of corn with split cane containers (B. King 1937:90). In her book, she mentions a large cache of corn and cobs in Mound E, "which really was a village site" (B. King 1939:40).

The M.S.M. field notes provide a few more hints. A sketch map places three Mound E tests in the northwest corner of the site. The notes are as follows:

> "E1--on East side of Mound `A' and north of Mound `B'--pit 4' x 8'.
> "E2
> "1st Level--Black soil [.] number of sherds [.] indication of garbage pit-- "2nd soil lighter in color, texture change from loam to yellow clay-- "E2a1 Bone neddles [sic] found in cache very fine neddles [sic]."

No text at all discusses the third Mound E test. A list of a few artifacts recovered from the Mound E tests is appended to the M.S.M. notes, but does not help locate the area. From the sketch map, the three pits are north of Mound A and west of Mound C, northwest of Mound B; as in Mound D, the Kings' base line was somewhat off magnetic north (Wesler 1989:73-74). The three Mound E tests form the points of a triangle, E3 farthest east, E2 farthest west, and E1 midway between but somewhat to the south. From provenience labels on the ceramic collection, the Kings excavated a large block when they returned to Mound E. Most intriguing, on the grid north side, the excavation reached three levels deep, implying a three-foot profile. Since no such profile is visible on the site today, it seems that the excavation area was backfilled. One would think that the backfill area should be identifiable by archaeological tests in the correct area.

Excavations in 1988 and 1989 placed a line of tests across the northwest sector of the site, with a couple of perpendicular tangents (Wesler 1991c). One unit probably intersected King's test E3, and the soil profiles in the tests farthest west match the description of E2 in the Alabama notes. But it was painfully obvious that the crews did not find the Mound E block excavation. Returning to the Alabama notes, the only extant guide, an observer will find that both the artifact inventory and the narrative notes mention a test E5. (There is no discussion anywhere of a test E4, yet another puzzle. There are, however, three sherds marked E4 L1 at M.S.M.) Referring to E5, the notes mention "E5--north of camp... In digging a trench to drain depression north of camp..." they ran into burials. The narrative goes on to describe the excavation of two burials, but has nothing more to say about the location (M.S.M.). However, in a letter to Fay-Cooper Cole in 1938 (U.C.), F. King also refers to "Mound E, across road."

There are a couple of ditch-like depressions to the north and west of Mound C. Photographs (M.S.M.) show that the camp was to the east or slightly southeast of Mound C. F. King cut a road in 1932, later graveled. These hints, coupled with the finds of burials, place test E5 near the cemetery. Excavations in 1992-1993 identified a large historic disturbance in this area, but it is not nearly big enough to be the gridded Mound E block.

It is still not clear where Mound E was. King's final note, "across road" (U.C.: King to Cole, November 10, 1938) written in 1938 and thus apparently after the excavation, may mean across the highway, but the disturbed conditions there today make locating it extremely unlikely.

MOUND F

Mound F evidently was the Kings' final excavation. Published discussions provide very little information. Articles by Lewis (1934), Butler (1935), F. King (1936), and B. King (1937) were written before Mound F was excavated. B. King (1939) described Mound F as 24.4 x 12.2 m (80 by 40 ft), with a "small, cone-shaped emplacement on an elongated mound." Artifacts and features are merely mentioned, including house patterns, hearths, infant burials, a charred basket, fish bones, and a fluorspar pendant, with no useful information about context (B. King 1939:57-58, 81).

Unfortunately no field notes of the Mound F excavation have been found. Mound F at one time had a frame exhibit building covering it, but this building burned in the 1940s or 1950s. No photographs of the excavation, the building, or any exhibits in the building are available.

The WMRC field school cleared much of the floor of the King's Mound F excavation in 1985 and 1986, and also tested just north. The excavation floor was at subsoil level, with remnant truncated features that provided data on feature patterning as well as a small artifact sample. The excavators also identified a remnant mound fill and underlying midden in the northwest corner. Analysis cannot confirm the reported layers of charcoal, and so cannot assess the Kings' interpretation of Mound F as a "signal mound." Most if not all of the mound and midden belong to the Late Wickliffe period (A.D. 1250-1350) (Wesler and Neusius 1987).

The WMRC collections have some 10,000 grid-provenienced sherds from King's Mound F. There are also sets of sherds marked MF-38 4L and MF-39 4L. These may have come from the last two years of King's excavation, when he abandoned the grid and finished Mound F in two blocks. His letter of 1938 (U.C.: King to Cole, 10 November 1938) has an artifact inventory for "Season 1938, Mound F... Area excavated 30' x 40' [9 x 12 m] to subsoil," with no indication of any grid used.

As with Mound D, three-dimensional mapping of the artifacts, especially the ceramics, coupled with the chronology and contexts visible from new excavations, will tell something about the structure of Mound F. Whether these data will indicate the mound's function is yet unknown.

CONCLUSIONS

WMRC excavations since 1983 have illuminated considerably the King project, and have created a much better basis for analysis of the artifacts he left behind. The Kings excavated two platform mounds, one ceremonial, one residential. They exposed perhaps 15 percent of a cemetery, which was a far more complex structure than they were able to recognize. They conducted gridded excavations on three mounds, one of which cannot be found, but two of which are much better known now than would have been the case without new data.

When F. King conducted gridded excavations in cooperation with the University of Chicago, his methodology was close to 1930s standards, and the collections are systematic enough to be useful today. It may or may not be his fault that field notes are not available to go with them. When F. King opened the two platform mounds and the first forty burials in the first month of the project in 1932, he was working with a University of Alabama crew, doing to the Wickliffe Mounds what they had done to other mounds up to that point. F. King's last two years, when he abandoned the grid in Mound F and he failed to cooperate with professionals toward analysis and systematic curation, are perhaps his greatest failings. The WMRC will continue to analyze his work along with its own as its excavators wrap up the Wickliffe excavations for this generation. WMRC researchers will, however, bequeath to the next generation a much more systematically documented set of data.

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DEATH AND DISEASE IN THE LOWER CUMBERLAND RIVER VALLEY: BIOARCHAEOLOGICAL EVIDENCE FROM THE LATE PREHISTORIC TINSLEY HILL SITE

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ABSTRACT

This study examines the human skeletal evidence for health and disease in the Late Prehistoric Tinsley Hill population (A.D. 1241 - A.D. 1541) (Clay 1963a), Lyon County, Kentucky. It addresses unresolved questions concerning associations between levels of nutritional and environmental stress and cultural terminations of Late Prehistoric (A.D. 800 - A.D. 1700), "Middle Cumberland" Mississippian occupations in the Cumberland River Valley. Observations of dental and skeletal pathologies in the Tinsley Hill population indicates that malnutrition, traumatic injuries, and disease were not as prevalent in populations from the lower Cumberland River Valley as populations occupying contemporaneous sites, such as Averbuch in the Nashville Basin. This suggests that biological and environmental stresses were not an immediate factor in Middle Cumberland Mississippian cultural terminations in the lower Cumberland River Valley.

INTRODUCTION

In the Cumberland River Valley of eastern North America (Figure 1) Mississippian societies appear to have been "culturally stable throughout most of their existence, and population growth appears to have been one response to the sedentary, permanent nature of the Mississippian occupation" during the Late Prehistoric period, A.D. 800 - A.D. 1700 (Eisenberg 1986:1). However, by the end of the Late Prehistoric period "Middle Cumberland" Mississippian societies are no longer visible in the archaeological record of the Cumberland River Valley, possibly as a result of depopulation (Autry 1983; Lewis and Kneberg 1955; Williams 1990). Biological stresses (disease, malnutrition and trauma) have been suggested as factors in the possible depopulation and the demise of "Middle Cumberland" Mississippian societies in the Cumberland River Valley (Buikstra et al. 1988; Eisenberg 1991a, 1991b, 1986).

Bioarchaeological studies of the human skeletal series from the Averbuch site (40Dv60), a Middle Cumberland village in the uplands of the Nashville Basin of central Tennessee, have shown evidence of increased biological stress during the latter part of the Late Prehistoric period (A.D. 1300-1700) (Berryman 1981, 1984a, 1984b; Eisenberg 1986, 1991a, 1991b). These studies indicate that biological stresses, associated with, and potentially caused by, physical and cultural environmental stresses (overcrowding, poor sanitation, competition, and conflict), were important factors in the depopulation of the Cumberland River Valley by Middle Cumberland societies (Buikstra et al. 1988; Eisenberg 1986, 1991a, 1991b). This hypothesis was tested with a bioarchaeological analysis of the Middle Cumberland Tinsley Hill skeletal sample (Lane 1993).

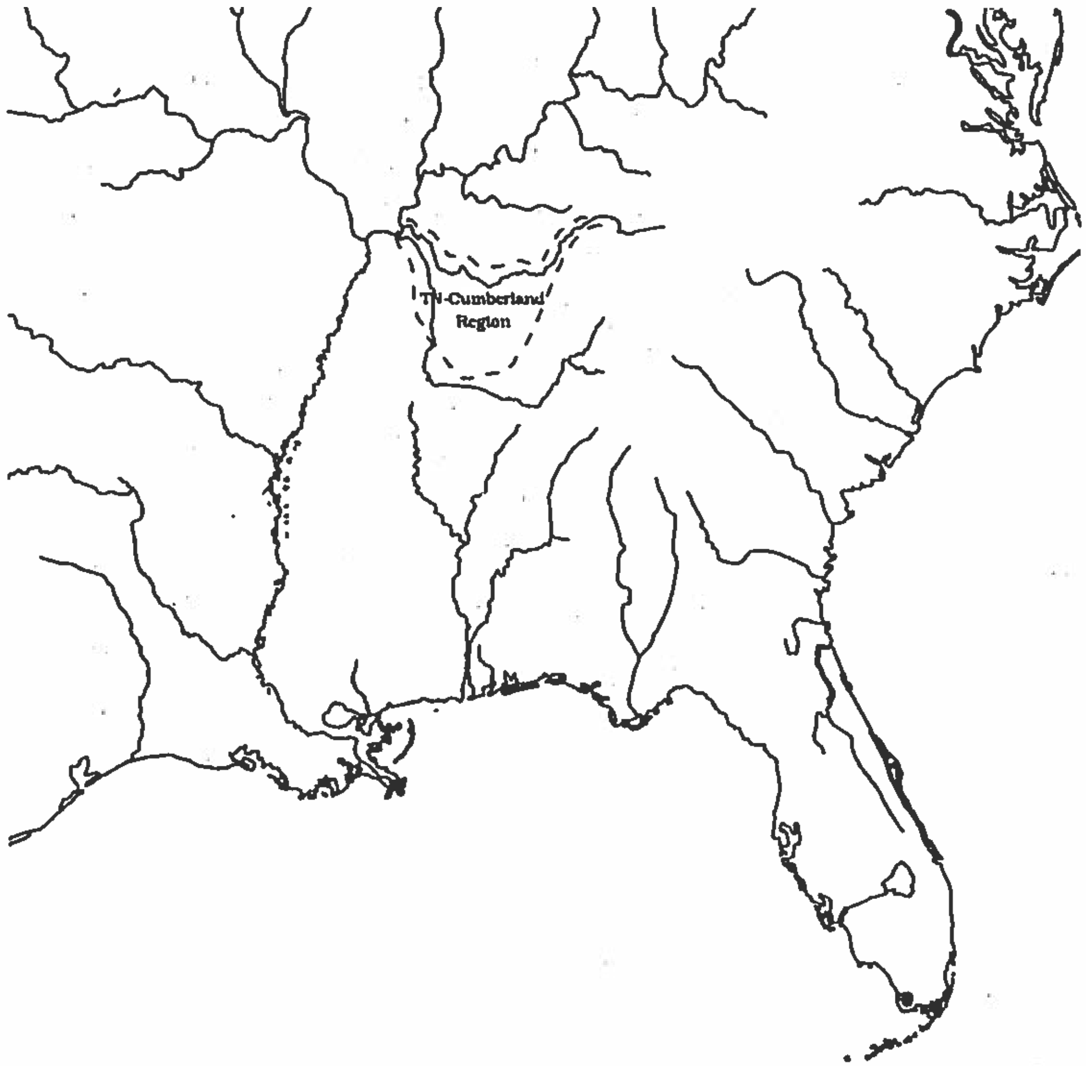

Figure 1. Location of the Tennessee - Cumberland River Valleys.

STUDY POPULATION

The Tinsley Hill Site (15Ly18A-D) is located on the east bank of the Cumberland River (Figure 2) in Lyon County, Kentucky, 2.9 km southeast of Eddyville (Clay 1963a, 1961; Schwartz 1961; Schwartz and Sloan 1959). It was first documented in 1958 by Sloan, and was reported by Schwartz and Sloan (1959) the following year. The site consists of a village area (15Ly18A), cemetery (15Ly18B), an area of unspecified cultural remains on the bluff to the north (15Ly18C), and a mound structure (15Ly18D) (Clay 1961; Schwartz and Sloan 1959). The cemetery was selected in 1959 for partial excavation resulting in the recovery of 54 graves. The results of these excavations were reported by Schwartz (1961). Subsequent investigations, reported by Clay (1961, 1963a, 1963b, 1976, 1979), of the mound and village, resulted in the recovery of six subadults. In addition to the original report by Schwartz (1961), Llewellyn (1964) re-examined the demographic characteristics of the skeletal population and Lane (1993) completely analyzed patterns of health and disease in the skeletal materials as part of their M.A. theses at the University of Kentucky.

Tinsley Hill occupies a broad alluvial plain approximately 7 ha in size, ideally located to take advantage of networks of trade and communication, and local subsistence and non-subsistence resources (Clay 1976). Two Middle Cumberland occupations have been documented at Tinsley Hill. A Jonathan Creek phase (A.D. 1000 - A.D. 1200) occupation consisted of a small hamlet. After a brief period of abandonment the site was reoccupied as a mound and village complex during the Tinsley Hill phase (A.D. 1300 - A.D. 1600) (Clay 1963b, 1976, 1979). The cemetery was used by the local population during the Tinsley Hill phase, and is therefore roughly contemporaneous, though smaller in size, than the Averbuch skeletal sample.

METHODS

Demographic analysis of the Tinsley Hill skeletal collection was undertaken to determine whether the sample was representative of all age and sex classes and to determine mortality distributions as an indicator of biological stress (Lane 1993, 1994). Age at death was determined for subadults primarily on the basis of dental development, though degree of epiphyseal fusion and long bone lengths were considered also. For adults, developmental and degenerative changes of the auricular surface of the ilium (Lovejoy, et. al. 1985) and pubic symphysis (McKern and Stewart 1957; Todd 1920, 1921) were considered to be the most reliable indicators for determining age at death. Degree of cranial suture closure (Krogman 1973) and dental wear also were used to determine adult age, if no other skeletal indicators were available, despite the limited reliability of these features (McKern and Stewart 1957; Ubelaker 1989).

Sex determinations were made for adults and older subadults using pelvic and cranial traits and degree of skeletal robusticity (Acsadi and Nemeskeri 1970; Bass 1979; Krogman 1973; Steele and Bramblett 1988; Ubelaker 1989). Sex determinations were not attempted for subadults under the age of fifteen.

A maximum number of 136 individuals was initially determined to be present in the Tinsley Hill skeletal cemetery population. However, a number of these individuals were represented by only a few fragments of skeletal material. These fragmentary individuals were compared with individuals from surrounding graves on the basis of anatomical representation, age, and sex to determine the possibility that taphonomic processes had resulted in the scattering of an individual into adjacent graves (Lane 1993:33). Based on the results of these comparisons and the addition of the six subadults from the

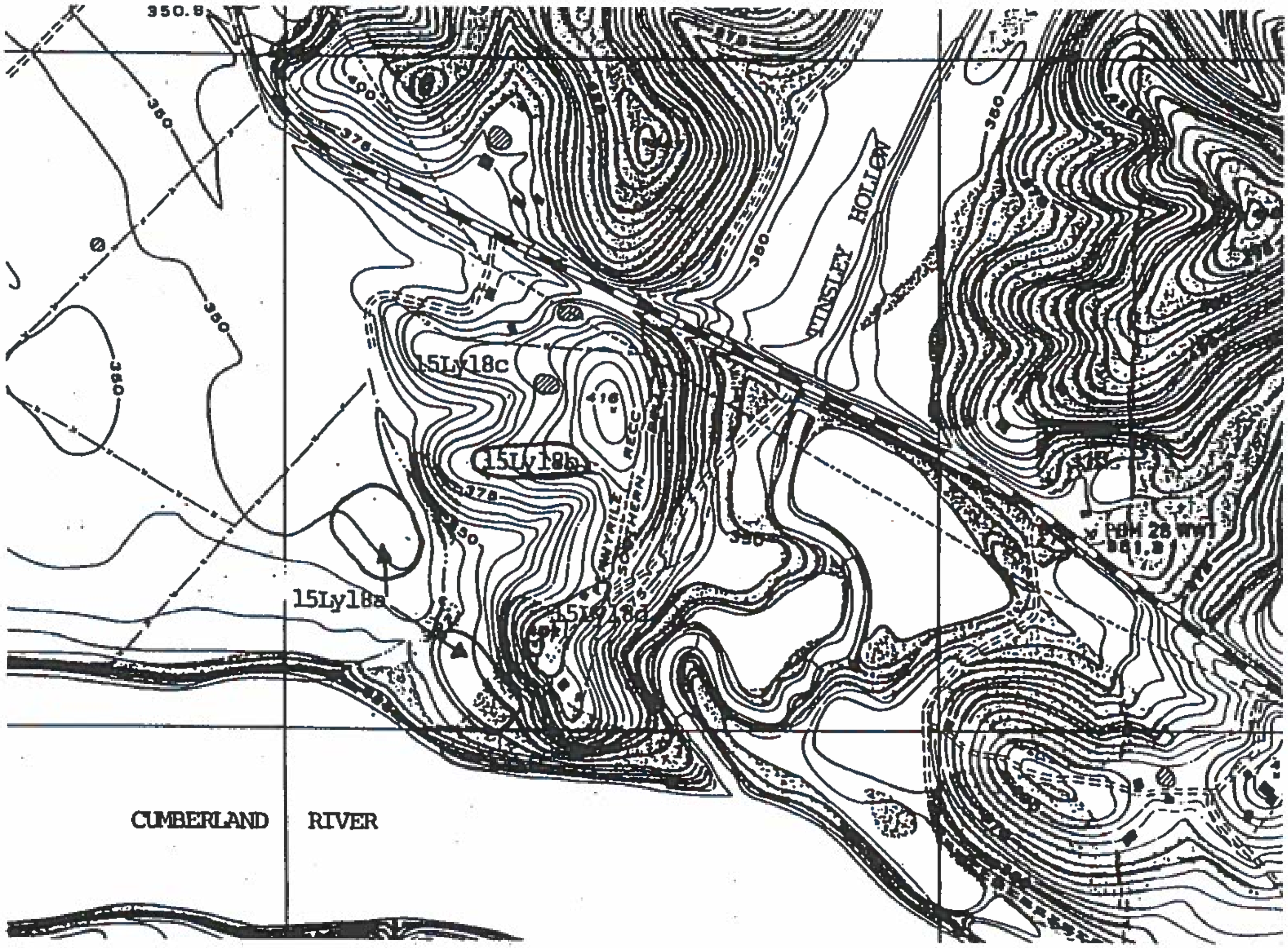

Figure 2. Location of the Tinsley Hill Site.

village, it was determined that the maximum number of individuals in the sample was 130 individuals. A more conservative estimate of the minimum number of individuals present was 99. It was decided to use the minimum number of individuals of 99 for further analyses of mortality distribution and levels of biological stress (Lane 1993, 1994).

Two macroscopic categories of dental observations, dental wear and caries, were used to quantify the consequences of certain diets and food processing technologies to dental health, which may have severe consequences, both localized and systemic, for the general physical health of an individual. To assess dental wear in the Tinsley Hill skeletal population Scott's (1979) system was used to score dental wear of deciduous and permanent molars. The prevalence of dental caries in the Tinsley Hill population was assessed using the methods developed by Moore and Corbett (1971).

Four categories of skeletal pathology were selected for observation: traumatic injuries, metabolic disorders with a dietary component (iron-deficiency anemia), non-specific indicators of infectious disease (osteolytic and osteoblastic lesions), and specific indicators of endemic treponematosis and tuberculosis. These and other pathological conditions have been shown to have considerable variation in prevalence within populations based on age, sex, and socio-economic status classes (Buikstra 1981; Buikstra and Cook 1981; Cook 1976; Ortner and Putschar 1981; Steinbock 1976; among others). These variations in prevalence depend upon both cultural and biological factors.

Each skeletal element, whether partial, whole or fragmentary, was observed macroscopically for pathology. Each element was then scored using a five digit coding system developed by Mary Powell (1988). The coded information was then analyzed to assess both specific and non-specific levels of biological stresses to which the Tinsley Hill population was subjected.

DEMOGRAPHIC CHARACTERISTICS

Demographic analysis of the 99 individuals used in this study indicated that 55 were adults and 44 were subadults under the age of 20. Of the 55 adults in the Tinsley Hill sample, sex determinations were possible for 43. Eighteen adult individuals were classified as male, 25 as female, and the remaining 12 were indeterminate. In addition, sex determinations were possible for six of the eight late adolescents (15-19.9 years): two males, four females and two indeterminate (Lane 1993:53, 1994).

The mean age at death calculated for all individuals in the Tinsley Hill skeletal sample was 29.6 years. Mortality in the Tinsley Hill skeletal sample peaked during the 1-2 year age range, the 15-19.9 year age range and again in the 30-34.9 year age range (Lane 1993:54,59, 1994). This approximates the mortality pattern suggested by Clarke (1977) for pre-industrial agricultural populations. The rise in mortality during the 15-19.9 year age range is primarily a result of high female mortality, possibly associated with child birth (Lane 1993:94-95, 1994).

DENTAL AND SKELETAL PATHOLOGY

The Tinsley Hill sample exhibits the expected pattern of dental eruption and attrition associated with Mississippian agricultural populations (Larsen 1981; Milner 1982; Powell 1985). There does not appear to be any clear association between biological sex and dental attrition (Lane 1993:68, 1994). The incidence of carious lesions and antemortem tooth loss was moderate to high (Figure 3), involving primarily the posterior teeth. This pattern also is consistent with that reported for other Mississippian

Figure 3. Burial 7A at the Tinsley Hill Site Showing Broken Ribs.

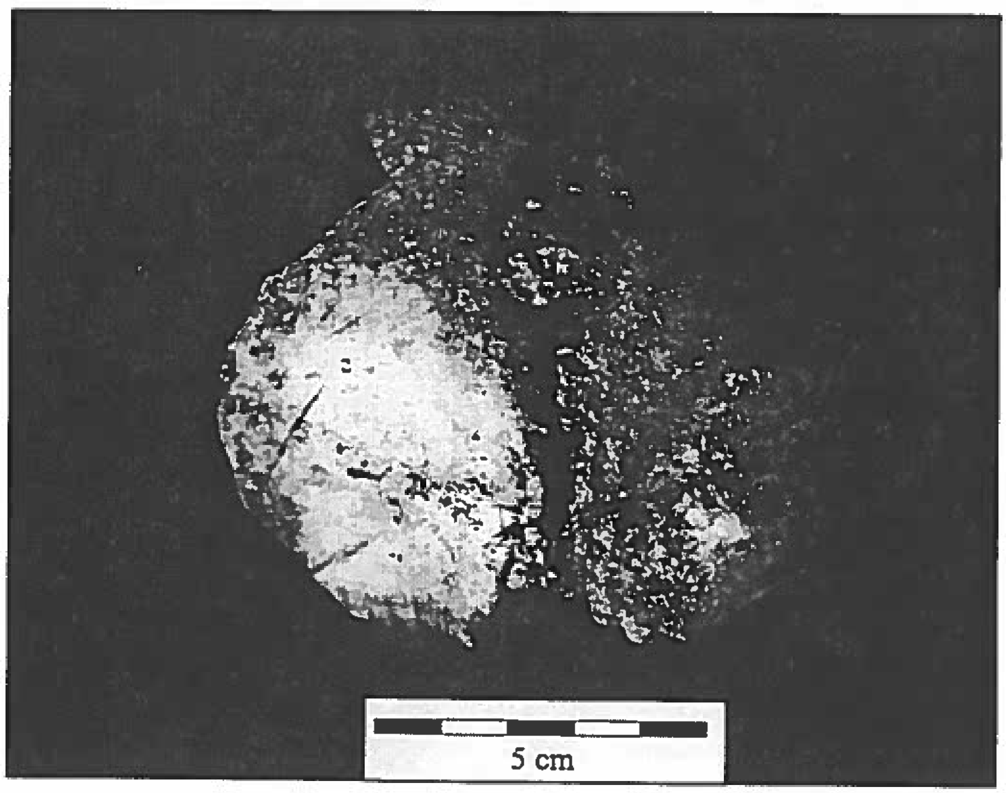

Figure 4. Burial 17 at the Tinsley Hill Site Showing Possible Scalping Marks.

agricultural populations (Larsen 1981; Milner 1982; Powell 1985) and does not suggest severe biological stress associated with dental pathology. However, females show the greatest incidence of dental caries and antemortem tooth loss, possibly indicating greater biological stress for females (Lane 1993:95, 1994).

Traumatic injuries were classified as fractures, cutting or piercing wounds, or other injuries. Of the 99 individuals in the Tinsley Hill sample, three (3.0 percent) exhibited signs of traumatic injury. Burial 7a (Figure 3), an adult male of undetermined age, displays fractures on fragments from the right fourth through eighth ribs. These five ribs were broken anterior to the rib angles and are healed with callus formation at the fracture sites, though they were rebroken post-depositionally. The location and appearance of the fractures suggests simple fractures produced by a bending force (Ortner and Putschar 1981) resulting from either a fall or in response to a blow (Lane 1993:79, 1994).

Burial 17 (Figure 4), a late adolescent female age 17-18 years, exhibited unremodeled cutting wounds or deep scratches in the left occipital and parietal. These wounds consists of a series of laterally directed shallow parallel cuts into the outer table of the calvarium. One set of cuts on the occipital are located slightly inferior to the occipital protuberance. The nature of these wounds are highly suggestive of cuts associated with scalping (Lane 1993:79, 1994).

Burial 36b, an adult male aged 45-50 years, exhibited signs of subperiostital apposition on the diaphyses of the left tibia and fibula. Associated with this was slight osteophytosis of the left tibial joint surface. The appearance of and the lack of bilateral asymmetry of these conditions suggests that mechanical stress was placed on the left knee joint as a result of traumatic injury (Lane 1994, 1993:79-80).

The Tinsley Hill cranial material was examined macroscopically for focal resorptive lesions of the cranial vault and the orbits indicative of porotic hyperostosis and cribra orbitalia. Lane (1994, 1993) reported that two adult individuals displayed evidence of iron-deficiency anemia, however, reanalysis of these individuals suggests other possibilities. The pin-prick like lesions (Figure 5) observed on the parietals and superior occipital of Burial 11c, an adult female 35-40 years of age are more likely a result of age associated changes in the outer calvarium. Additionally, the lesions observed on the (Figure 6) orbits, and the parietals and superior occipital (Figure 7) of Burial 24a, an adult male 40-45 years of age, probably are the result of a scalp infection. Therefore, there is no clear evidence for the presence of iron-deficiency anemia as an indicator of nutritional stress in the Tinsley Hill skeletal population.

All skeletal elements from the Tinsley Hill sample were examined macroscopically for evidence of osteolytic and osteoblastic lesions indicating the presence of nonspecific and specific infectious disease. No osteolytic lesions were noted. Osteoblastic lesions consisted of either pitting and/or striations of the cortex, or periostitis. While these lesions sometimes result from traumatic injury without subsequent infection, they alert the bioarchaeologist to the likely presence of infectious disease in the skeletal sample.

Osteoblastic lesions were observed in 17 of the 99 individuals (17.2 percent) and of these, 13 (13.2 percent) displayed periostitis. Periostitis was observed in five of the 44 subadults (11.4 percent of subadults or 5.1 percent of the total skeletal sample) and 11 of the 55 adults (20 percent of adults or 11.1 percent of the total skeletal sample). Osteoblastic lesions were primarily confined to the postcranial skeleton in both the adult and subadult population. Five of the ten adults who displayed distinct areas

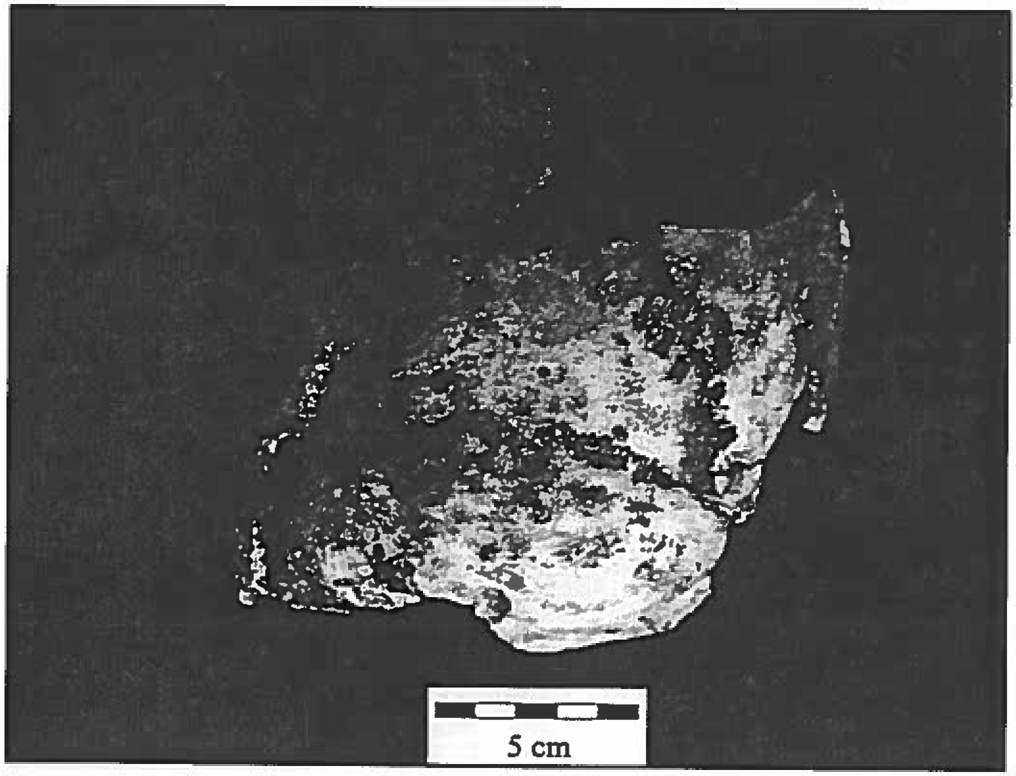

Figure 5. Burial 11C at the Tinsley Hill Site Showing Cranial Lesions.

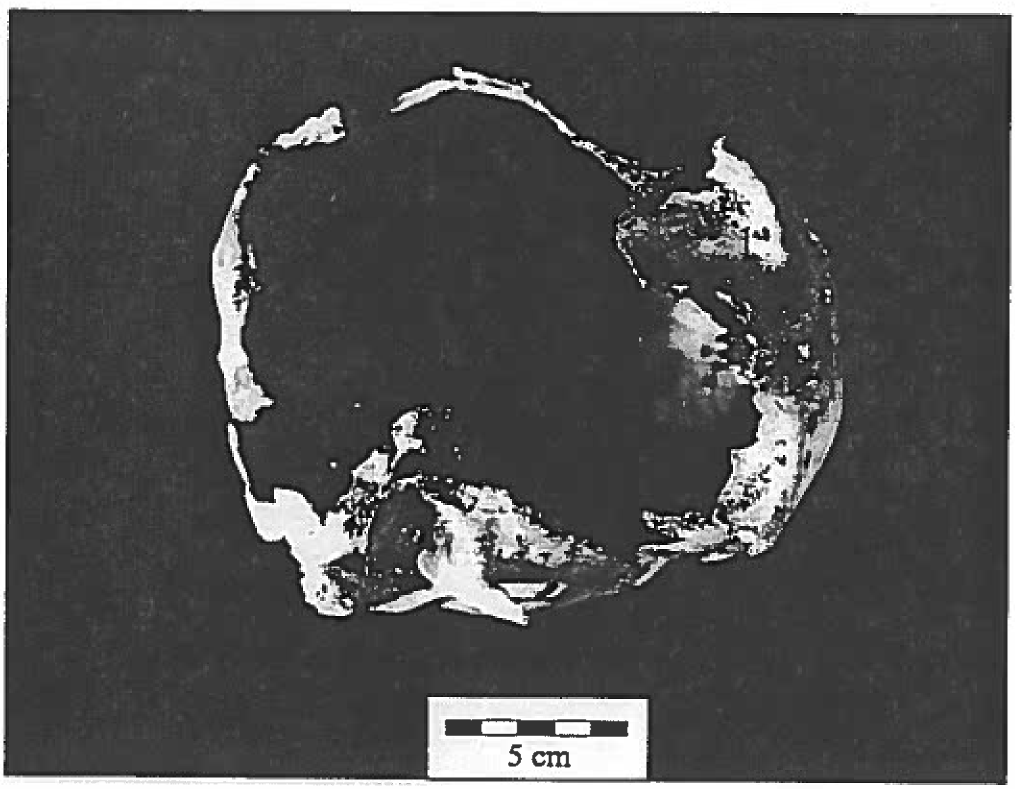

Figure 6. Burial 24A at the Tinsley Hill Site Showing Lesions on the Orbits.

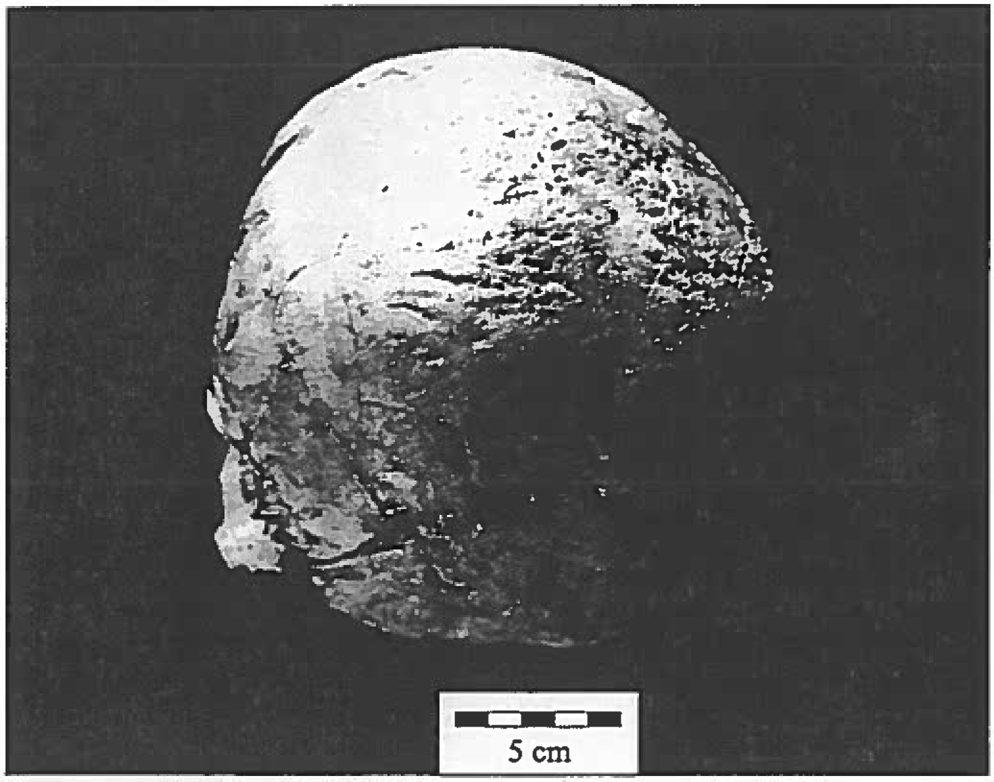

Figure 7. Burial 24A at the Tinsley Hill Site Showing Cranial Lesions.

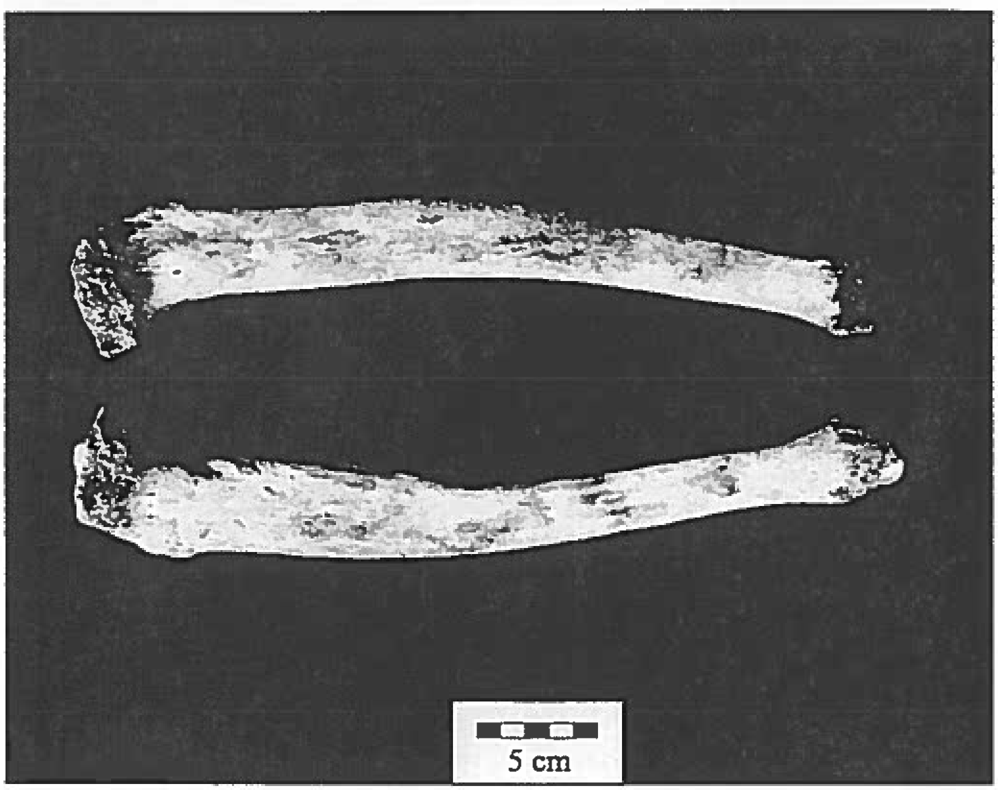

Figure 8. Burial 45B at the Tinsley Hill Site Showing Sabre Shins.

of subperiostital deposition also displayed striations and/or pitting of the cortex of other bones indicating some lesser degree of subperiosteal circulatory disturbance. Striations and/or pitting of the cortex only was observed in four adults (7.3 percent of adults or 4.0 percent of the total skeletal sample). Overall periostitis was observed more frequently in females than in males (Lane 1993:82,88, 1994).

Only one individual displayed skeletal evidence distinctive of treponematosis. Burial 45b, an adult of undetermined gender 30-35 years of age, displayed extensive deposition of well remodeled periostitis on the central third of both tibia (Figure 8). These lesions are similar in appearance to the "classic" lesions of the tibia known as "sabre shins" due to the curved appearance they produce (Hackett 1951; Ortner and Putschar 1981; Steinbock 1976). In addition to tibial lesions, the individual exhibits extensive remodeled periostitis on the diaphysis of the right clavicle and remodeled striations on the distal diaphyses of both femora. The frequency of skeletal lesions distinctive of treponematosis in the Tinsley Hill sample is lower then expected if endemic treponematosis existed in the population. However, some of the cases of nonspecific periostitis may represent very mild responses to treponemal infection. It also could be interpreted that Burial 45b represents an individual who entered the Tinsley Hill community already infected with the disease but no longer contagious and therefore, the Tinsley Hill population itself did not suffer from endemic treponematosis (Lane 1993:92, 1994).

None of the characteristic skeletal lesions of the vertebrae, cranium, hip, or knee indicative of tuberculosis were observed in the Tinsley Hill skeletal sample.

DISCUSSION

Comparisons (Table 1) of the Tinsley Hill analysis with analyses of other Middle Cumberland skeletal samples from central Tennessee: Arnold - 40Wm5 (Ferguson 1972; Ward 1972; Widmer and Perzigian 1981), Averbuch - 40Dv60 (Berryman 1981; Eisenberg 1986), Brown - 40Mu260 (Boyd et. al. 1983), Ganier - 40Dv15 (Broster 1972; Ward 1972), Mound Bottom - 40Ch8 (Autry 1983; Buikstra et. al. 1988), and West - 40Dv12 (Dowd 1972; Wright et al. 1973); and western Kentucky: Williams - 15Ch2 (Webb and Funkhouser 1929), is difficult because of the different levels and types of analyses conducted, and the methods of reporting. Therefore, only the most general comparisons can be made between the Tinsley Hill skeletal population and other Middle Cumberland skeletal samples. Subadult mortality clustered at approximately 45 percent in the majority of these samples, which is within the expected pattern for pre-antibiotic agricultural populations (Clarke 1977; Mensforth 1986), except at the West site where subadult mortality (67 percent) exceeds the expected upper limit. Subadult mortality is relatively low at Brown, Mound Bottom, and Williams. Comparisons of mean age at death and adult mortality peaks indicates that biological stress was highest among members of the Arnold, Averbuch, and Ganier skeletal populations. Additionally, mortality at Averbuch was high in early adulthood and may have had severe consequences on reproduction (Eisenberg 1986, 1991a, 1991b). Mortality at Mound Bottom and Tinsley Hill, however, does not suggest that biological stress was as high or that young adults were severely impacted.

Overall incidence of reported skeletal pathology was high at Averbuch and Brown, and was reported to be low at Mound Bottom, Tinsley Hill, and West. Skeletal evidence of traumatic injuries was reported at two sites: Averbuch and Tinsley Hill. Evidence of inter-personal violence was reported at both sites, though the incidence was slightly lower for Tinsley Hill (Lane 1993, 1994) than for the Averbuch sample (Eisenberg 1986, 1991a, 1991b), where scalping, parry fractures and piercing wounds were reported. Evidence of iron-deficiency anemia, likely associated with malnutrition, was reported at Averbuch and Brown. At Averbuch the evidence of cribra orbitalia or porotic hyperostosis occurred

Table 1. Comparison of Indicators of Biological Stress.

SITE	DATE A.D.	GRAVES	# IND.	% SUB-ADULT	% ADULTS	MEAN AGE	MORT. PEAKS	CARIES	PATH-OLOGY	NOTES
Arnold	1200	151	171	45	55	27	0-10 *	-	-	1
Averbuch	1200-1400	645	888	47	52	-	3.4-4 20-30	-	High	1,2,3,4
Brown	1200-1600	33	47	26	74	-	-	High	High	3
Ganier	1200-1450	102	68	46	54	21	1.5-3 20-30**	-	-	
Mound Bottom	860-1300	164	142	27	74	-	0-2 25-35	-	Low***	
Tinsley Hill	1241-1541	54	99	44	56	30	1-5 30-35	High	Low	2,4
West	1275-1495	50	55	67	33	-	-	High	Low	
Williams	1200-1600	17	20	16	84	-	-	-	-	

Notes: 1: Tuberculosis
2: Treponematosis
3: Iron-deficiency Anemia
4: Trauma

* Adult mortality peaks not reported.
** Reflects adult male mortality only.
*** Only 23 of the 142 individuals were examined for pathology.
Adapted from Lane 1993.

in over 45.7 percent and 32.2 percent respectively of the total skeletal population. Evidence of cribra orbitalia and porotic hyperostosis did not occur in the Mound Bottom, Tinsley Hill, or West populations.

Indicators of nonspecific infectious disease were observed to occur frequently in the skeletal populations from Averbuch and Brown. At Averbuch 62.4 percent of the skeletal population exhibited some evidence of infectious disease. In contrast evidence of non-specific infectious disease was reported in 17.1 percent of the skeletal sample from Tinsley Hill and was not observed in the skeletal populations from Mound Bottom, and West. Evidence of specific infectious disease occurred at Arnold, Averbuch, Tinsley Hill. At Arnold, Widmer and Perzigan (1981) reported evidence of lesions indicative of tuberculosis in a single individual, while lesions indicative of treponematosis occurred in a single individual at Tinsley Hill (Lane 1993, 1994). Evidence of tuberculosis, blastomycosis and endemic treponematosis were observed in a number of individuals from the Averbuch skeletal sample (Eisenberg 1986, 1991a, 1991b).

While statistical comparisons between these skeletal samples is not possible given the lack of uniform analytical methods and reporting, some general observations are possible. There is a potential trend toward moderate to low levels of nutritional and environmental stress in populations occurring temporally earlier such as Mound Bottom. Lower levels of biological stress also are reported for those populations residing near major river corridors, especially outside of central Tennessee such as Tinsley Hill. Additional analyses are necessary to determine the validity of these observations (Lane 1993:105, Lane 1994).

Recent research by Schurr (1994) determined mean stable carbon isotope ratios for skeletal samples from Tinsley Hill, Buckner, Capitol View, and Larkin (Table 2) provided information on Late Prehistoric subsistence among Fort Ancient and Mississippian groups in Kentucky. Previously, Buikstra et al. (1988) conducted analysis of skeletal populations from Illinois and Tennessee, including individuals from Arnold, Averbuch, and Mound Bottom, to determine the relative changes in stable carbon isotopes through time as a dietary indicator of increased consumption of C4 bearing plants, primarily maize. Comparison of these studies suggests that Mississippian populations occurring temporally later in central Tennessee had the highest consumption of C4 bearing plants. This has been interpreted as an indicator of potential dietary stress among Middle Cumberland Mississippian inhabitants (Buikstra et al. 1988). The values from Tinsley Hill (Schurr 1994) were higher than expected given the low frequency of skeletal pathology but still were not as high as reported for Arnold and Averbuch (Buikstra et al 1988). This evidence, coupled with a lack of evidence of iron-deficiency anemia, possibly suggests less dietary stress at Tinsley Hill than at Arnold or Averbuch.

CONCLUSIONS

Mortality profiles, and dental and skeletal pathologies do not suggest severe levels of biological stress at Tinsley Hill (Lane 1993, 1994) Stable carbon isotope ratios and dental wear suggests that the Tinsley Hill population had a subsistence base focused primarily on maize agriculture (Lane 1993:95). Evidence of nutrition, health, and disease suggest that biological stress was at the expected level for prehistoric, pre-antibiotic populations. The one case of possible scalping does indicate that inter-personal conflict was not unknown, but was probably not prevalent in the lower Cumberland River Valley. There is a high correlation between greater incidence of dental and skeletal pathologies in females suggesting they were potentially more biologically stressed than males at Tinsley Hill, however (Lane 1993, 1994).

Table 2. Mean Stable Carbon Isotope Values for Illinois, Kentucky, and Tennessee.

SITE	PERIOD\CULTURE	MEAN VALUE
Koster, Il.	Archaic	-21.7
Gibson, Il.	Middle Woodland	-20.9
Koster, Il.	Early Late Woodland	-20.9
Ledders, Il.	Late Late Woodland	-17.4
Helton 47, Il.	Early Emergent Mississippian	-18.3
Helton 47, Il.	Middle Emergent Mississippian	-18.8
Helton 47, Il.	Late Emergent Mississippian	-15.3
Schild Knoll B, Il.	Mississippian	-12.3
Long (Cemetery), Ky.*	Archaic	-24.1
Buckner, Ky.	Fort Ancient	-9.4
Capitol View, Ky.	Fort Ancient	-11.1
Larkin, Ky.	Fort Ancient	-10.0
Tinsley Hill, Ky.	Late Mississippian	-8.7
Penitentiary Branch, Tn.	Terminal Archaic	-21.2
Mansker Creek, Tn.	Middle\ Late Woodland	-20.7
Mound Bottom, Tn.	Early Mississippian	-9.3
Goodletsville, Tn.	Late Mississippian	-7.8
Arnold, Tn.	Terminal Mississippian	-7.8
Averbuch, Tn.	Terminal Mississippian	-8.0

Adapted from Buikstra et al. 1988 and Schurr 1994. * Lane 1991.

The relatively low to moderate levels of skeletal pathologies distinctive of iron-deficiency anemia, trauma, and nonspecific and specific infectious disease observed in the Tinsley Hill skeletal series does not invalidate the hypothesis presented by Eisenberg (1986, 1991a, 1991b) and Buikstra et al. (1988) proposing that nutritional and environmental stresses contributed to the cultural terminations of Middle Cumberland societies. It does suggest, however, that these stresses were severest, and therefore, had a potentially greater impact, within the immediate vicinity of the Nashville Basin, especially for groups located in the uplands. As suggested by Eisenberg (1986, 1991a), in areas where population density was lower, such as the lower Cumberland River Valley of western Kentucky, this stress would have been less severe and would have not contributed significantly to the local termination of Middle Cumberland society (Lane 1993). Further, comparable skeletal analyses of Middle Cumberland populations need to be undertaken to further test the validity of these hypotheses.

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ASSESSING THE MAIZE CONSUMPTION OF FORT ANCIENT AND MIDDLE MISSISSIPPIAN POPULATIONS OF THE OHIO VALLEY: NEW STABLE ISOTOPE EVIDENCE

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ABSTRACT

It is well known that the Late Prehistoric Fort Ancient and Middle Mississippian populations of the Ohio Valley were supported by subsistence economies based on the cultivation of corn or maize (Zea mays). It has been suggested that some Fort Ancient populations consumed more maize than contemporary Middle Mississippians, a conclusion which seems counter-intuitive based on the greater complexity of the Mississippian societies. Newly obtained stable carbon-isotope ratios from Fort Ancient and Middle Mississippian sites in the Ohio Valley demonstrate that Fort Ancient societies were actually less dependent on maize compared to Middle Mississippians.

INTRODUCTION

The Late Prehistoric (after A.D. 1000) Fort Ancient and Middle Mississippian populations of Kentucky and adjacent areas of Ohio, Indiana, and Illinois were supported by subsistence economies based on the cultivation of corn or maize (*Zea mays*). The importance of maize to Fort Ancient subsistence is indicated both by botanical evidence from preserved plant remains (Rossen 1992; Rossen and Edging 1987; Wagner 1987) and by stable carbon-isotope ratios obtained for several Fort Ancient sites in Kentucky and Ohio (Broida 1984; Conard 1988; van der Merwe and Vogel 1978) showing that maize provided the bulk of dietary calories. However, existing stable carbon-isotope ratios show substantial variation between the sites analyzed to date, ranging from average $\delta^{13}C$ values of -11.8 per mil at the Turpin Site in Ohio (van der Merwe and Vogel 1978) to an average of -9.6 per mil at the Slone Site in Kentucky (Broida 1984) (the unit "per mil" is analogous to "percent" and is commonly used to describe stable carbon-isotope ratios as defined below). This variation is much greater than the typical analytical error of .1 per mil, and suggests that Fort Ancient subsistence practices were variable enough that different populations consumed significantly different diets throughout their lifetimes. These variations could represent regional differences in Fort Ancient subsistence, or changes in subsistence practices over time, but because of the relatively small isotopic data base, the causes of this variation are now unclear.

It has also been suggested (Rossen 1992; Rossen and Edging 1987; Wagner 1987) that eastern Kentucky Fort Ancient subsistence economies can be distinguished from western Kentucky Middle Mississippian ones because the Fort Ancient populations in the east consumed more maize than the contemporary Middle Mississippians in the west. This model is based on the analysis of botanical remains from a number of Fort Ancient and Middle Mississippian sites and a very limited sample of stable carbon-isotope ratios from a few Middle Mississippian and Fort Ancient sites. While the model of higher maize consumption was perfectly reasonable based on isotope ratios that were then available, it is now contradicted by isotope ratios recently obtained for samples from the Middle Mississippian sites of Angel in Indiana (Schurr 1989, 1992) and Wickliffe in Kentucky (Schurr and Schoeninger 1995). The stable carbon isotope ratios from these Middle Mississippian sites average around -9.0 per mil, suggesting that these Middle Mississippians consumed more maize than most Fort Ancient populations analyzed to date. This lack of correspondence between the isotopic data base and the botanical data base is subject to several interpretations. For example, subsurface storage pits are more common at Fort Ancient sites, so maize may be more likely to be preserved at Fort Ancient sites; or perhaps stable isotope ratios do not accurately reflect human diets if different varieties of maize are consumed (Wagner 1987). It is also important to note that only a very small number of Fort Ancient and Middle Mississippian sites in Kentucky have provided stable carbon-isotope ratios, so generalizations about Late Prehistoric subsistence practices in Kentucky based on isotope ratios may be misleading.

The significance of previously reported stable carbon-isotope ratios in regard to Middle Mississippian and Fort Ancient subsistence is difficult to evaluate because the isotope ratios come from sites that are geographically and chronologically dispersed. In order to more critically evaluate differences in maize consumption between Fort Ancient and Middle Mississippian populations, it is necessary to compare samples that are roughly contemporary with each other and that come from sites in relatively close geographic proximity to each other. For this study, stable carbon-isotope ratios of prehistoric bone collagen were obtained from the Middle Mississippian site of Tinsley Hill (located on the Lower Cumberland in western Kentucky) and from three Fort Ancient sites (Buckner, Larkin, and Capitol View) located in the Central Bluegrass Region of Kentucky (Figure 1). The four sites were all occupied during the period known as the Madisonville Horizon (Henderson, et al. 1992), or very close to its beginning at approximately A.D. 1400, and are thus contemporary or very nearly so.

THE SITES

THE MIDDLE MISSISSIPPIAN TINSLEY HILL SITE

The Tinsley Hill Site (15Ly18) is a late Middle Mississippian site located in the Cumberland Valley. The excavations were initially designed to investigate a stone-lined grave cemetery at the site (Schwartz 1961) and these investigations were expanded in later seasons to examine the village occupation and a mound. The site covered approximately 6 ha or 7 ha (Lane 1993; Lewis 1990), and consisted of a village occupation on the Cumberland floodplain along with the cemetery and a mound, each of which is located on a bluff overlooking the village area. Based on the site map of Lane (1993, Figure 2), the occupation area of the site covered about 3.6 ha in two separate areas, the cemetery covered approximately 1 ha, and the mound area approximately 0.6 ha.

Test excavations in the village area at the base of the bluff identified two stratified Mississippian components, with the earlier one dating to the Jonathan Creek phase (approximately A.D. 1000-1100) and the later dating to the Tinsley Hill phase (A.D. 1300-1450), which represents the bulk of the occupation at the site. The cemetery is presumed to be coeval with the Tinsley Hill phase occupation of the village. The dating of the Tinsley Hill phase is somewhat uncertain. The original excavators (Schwartz 1961) thought the site was occupied between A.D. 1500-1780 based on the presence of historic artifacts recovered from disturbed contexts within the cemetery area. These dates are now

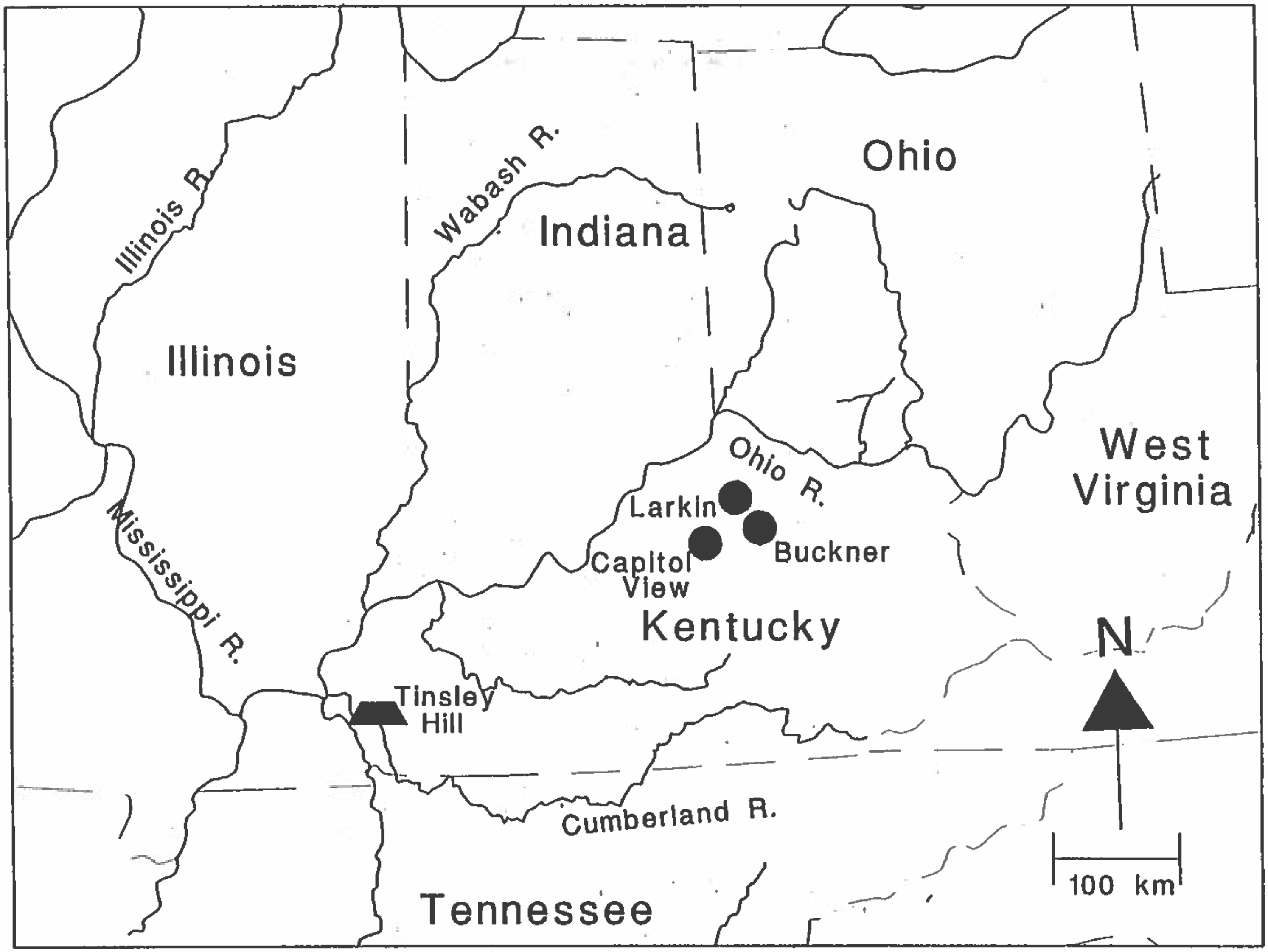

Figure 1. The Sites and their Locations.

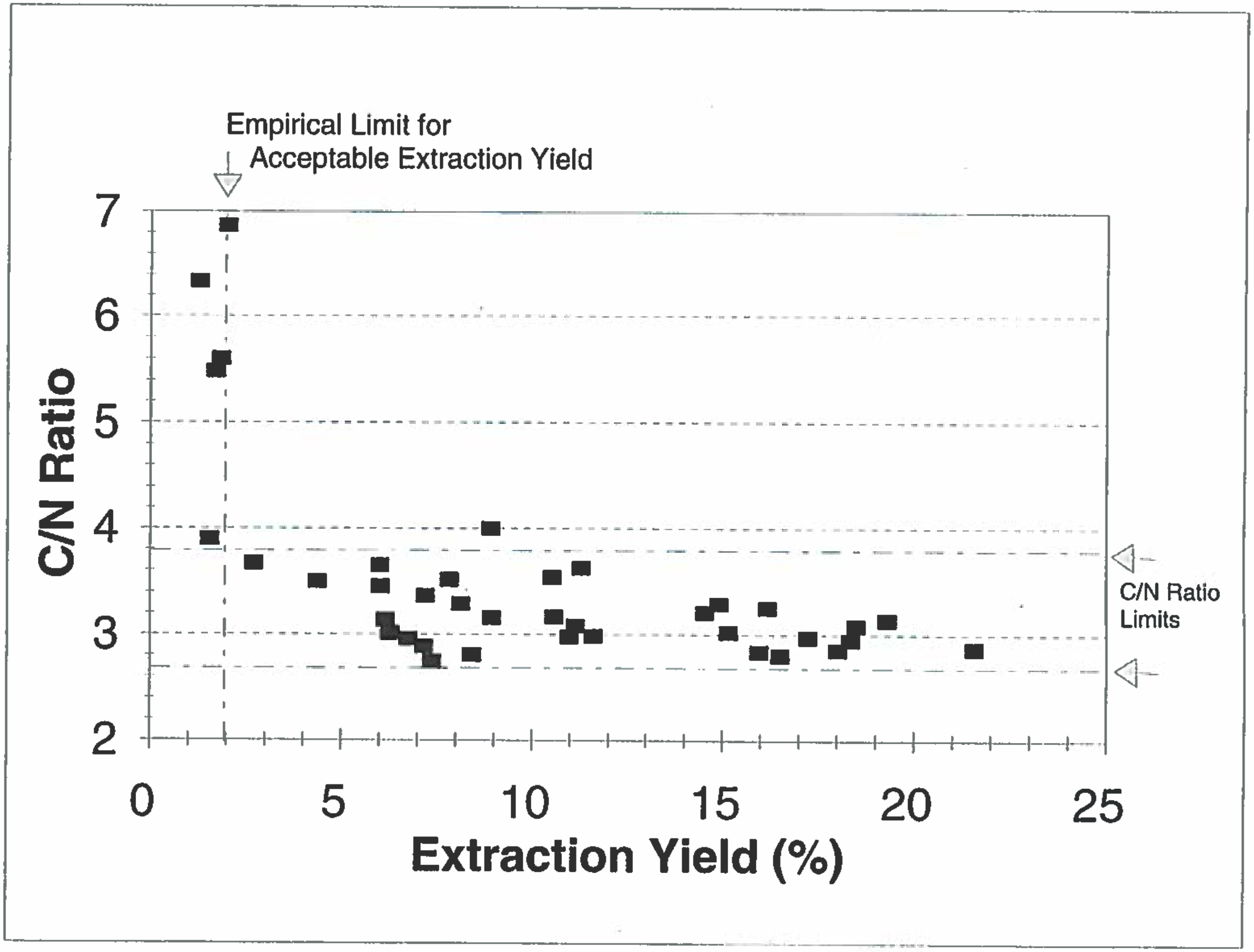

Figure 2. C/N Ratio versus Extraction Yield.

considered to be much too late, and dates between A.D. 1300-1450 (based on radiocarbon dates from the village occupation) would now be considered more acceptable for the Tinsley Hill phase (Butler 1991; Hilgeman 1992).

The stone-lined grave cemetery at the site produced the remains of at least 99 individuals from 52 graves. An excellent study of the bioarchaeology of the site has recently been completed by Lane (1993, also see Lane this volume). The mortuary treatments at Tinsley Hill range from fully extended burials in stone-lined graves to secondary burials (Schwartz 1961). There is some evidence for reuse of graves at the site, perhaps indicating a mortuary program with several stages. No formal analysis of the burial program has been conducted, but in general, the mortuary treatments at Tinsley Hill are very similar to those at Angel (Schurr 1989), with the exception that at Angel, stone-lined graves are rare and were reserved primarily for disarticulated burials (probably because suitable stone was not available nearby). The overall appearance of the mortuary program is one representing an unranked or weakly ranked society, without elaborate or marked variations in wealth or status evidenced with grave goods. If status differences are present, they were symbolized by burial position or mortuary rituals that were not preserved archaeologically. There is no evidence of an elite stratum within the Tinsley Hill cemetery, and the cemetery population appears to represent the remains of a non-elite stratum within a weakly ranked society, a pattern repeated at Angel (Schurr 1989) and at other Cumberland Mississippian sites (Autry 1983). Stable carbon- and nitrogen-isotope ratios were obtained from 15 burials to provide a sample of adults with a male:female sex ratio of 1:2 from a variety of mortuary treatments present at the site.

FORT ANCIENT SITES

The Fort Ancient sites used in this study are located in the Central Bluegrass region, one of the most intensively investigated portions of the state (Sharp 1990:479). The Fort Ancient chronology of the region and corresponding changes in material culture and settlement patterns are relatively well known (Henderson et al. 1992; Turnbow 1988). Fort Ancient occupations of the region begin around A.D. 1000 and last until the historic period. The sites used in this study represent the later end of the sequence, beginning with the Buckner Site (probably dating to just before or near the start of the late Fort Ancient Madisonville Horizon around A.D. 1400), and ending with the late Madisonville Larkin Site (occupied around A.D. 1600). The sample from the Capitol View Site represents a relatively brief occupation that probably dates to the early Madisonville horizon (chronologically between Buckner and Larkin).

The Buckner Site

The Buckner Site (15Bb12) was originally included by Griffin (1966) in the Madisonville Focus. The site consists of two circular village middens covering a total of about 8 ha (Sharp 1990). The larger village midden (170 m in diameter, 2.3 ha) is thought to date to the late Middle Fort Ancient period (during the two centuries just prior to A.D. 1400). The smaller village midden (110 m in diameter, 1.0 ha) probably dates to the early Madisonville horizon (at or shortly after A.D. 1400). Little is known about the mortuary treatments at this site compared to Larkin and Capitol View. Burials were abundant in the habitation area at the site and in a nearby bluff-top cemetery (Collins 1847, cited by Griffin 1966:181-182). Three small mounds were also present at the site, but it is not known whether they dated to one of the Fort Ancient occupations or to earlier Adena or Middle Woodland components known to have been present (Griffin 1966:183). If the mounds are Fort Ancient, they probably date to the Middle Fort Ancient period because similar mounds are known from Middle Fort Ancient sites along the Ohio River and in southern Ohio (Henderson et al. 1992). A small sample of burials from the site was obtained by the University of Kentucky in 1939, but little published information about them is available, except that they were located on one side of two structures investigated at that time, indicating that the community was internally organized (Sharp 1990:483). The burials excavated in 1939 are thought to have come from the early Madisonville Horizon village area. Eight burials with a male:female sex ratio of 1:4 were analyzed.

The Capitol View Site

The Capitol View Site (15Fr101) is an early Madisonville horizon (ca. A.D. 1400) settlement approximately 115 m in diameter (covering an area of about 1 ha) (Henderson 1992a). The site was organized as a loose semicircle with habitation areas grouped around a central plaza. It appears to represent a relatively short term occupation of perhaps as little as 10 years by a population no larger than 70 individuals. The site was completely excavated in stages over a period of two years, and all previously undisturbed features at the site were documented by the excavations. Ten burials with poor to moderate bone preservation were identified. The burials were located in a zone between the plaza and the habitation area, a pattern documented for other circular Fort Ancient sites (Heilman and Hoefer 1980; Henderson et al. 1992). All burials represent adults or adolescents, all were articulated, and most were semi-flexed except for one fully extended male. Grave goods were absent except for a single individual who was buried with a cannel coal "palette" of unknown function. Four of the ten burials (two males and two females) were analyzed.

The Larkin Site

The Larkin Site (15Bb13) also was included in Griffin's (1966) original formulation of the Madisonville focus. The site was occupied later than either Buckner or Capitol View and is a late Madisonville horizon site dating to the period of initial contact with Europeans. The site was organized differently than the earlier Fort Ancient sites. It lacked the circular village organization, and instead consisted of several small middens scattered over an area of 7.7 ha (Sharp 1990:484). Ten individuals in three separate clusters of graves were recovered from the site during excavations conducted prior to the construction of a gas pipeline across the site (Pollack et al. 1987). The burial clusters may represent family groups. All but one of the burials were articulated and one adult male (Burial 5) had been scalped. In most cases, bones (crania or major skeletal elements on the left side of the body) had been removed from the burials some period of time after interment, presumably as part of a systematic mortuary ritual. Carbonized plant remains (especially beans and maize) were also incorporated into the grave fill as part of the mortuary ritual after the skeletal elements were removed. Six specimens (three male and three female) were analyzed.

In summary, the sites of Buckner, Capitol View, and Larkin provide samples of burials from a very restricted geographic area spanning less than two centuries from the beginning of the Madisonville Horizon around A.D. 1400, until the start of the Protohistoric period (just before the period of initial contact with Europeans). The earlier Fort Ancient sites (Buckner and Capitol View) are roughly contemporary with the latest occupations at Tinsley Hill and Angel. The sites provide an excellent sample for evaluating differences in maize consumption between Middle Mississippian and Fort Ancient peoples in the Ohio Valley. In addition, stable carbon-isotope ratios from the three Fort Ancient sites can potentially identify changes in maize consumption in the Central Bluegrass region during the Madisonville Horizon.

PROCEDURES USED FOR THE ISOTOPE ANALYSIS

Stable carbon-isotope ratios of human burials from the midcontinental United States measure prehistoric maize consumption (DeNiro and Epstein 1978; van der Merwe and Vogel 1978). Stable nitrogen-isotope ratios give generalized measures of the trophic level of the prehistoric diet (DeNiro and Epstein 1981; Schoeninger 1985; Schoeninger and DeNiro 1984) and indicate which ecosystems provided dietary protein. Stable carbon- and nitrogen-isotope ratios of prehistoric human bone collagen were obtained from the 32 burials listed in Table 1.

The specimens were analyzed using procedures that were previously used to analyze specimens from the Angel Site (12Vg1) in Indiana (Schurr 1989, 1992), the Wickliffe Site (15Ba4) in Kentucky (Schurr and Schoeninger 1995), and several Fort Ancient sites in Ohio (Schurr and Schoeninger 1995) Bone fragments weighing several grams were cleaned and processed to obtain purified proteins for analysis. The purified proteins were then converted to gas, the carbon dioxide and nitrogen were separated and purified by cryogenic distillation under vacuum, and the stable isotope ratios of the purified proteins were measured using a mass spectrometer. Isotopic compositions are reported using the "delta" (δ) notation in units of "per mil" where:

$$\delta = (R_{sample} - R_{standard})/R_{standard} \times 1,000 \text{ per mil}$$

For $\delta^{13}C$ values, $R = {}^{13}C/{}^{12}C$ and the PeeDeeBelemnite (PDB) is used as the standard. For $\delta^{15}N$ values, $R = {}^{15}N/{}^{14}N$ and the standard is atmospheric nitrogen (AIR). The overall precision (extraction and analysis) of the isotope analysis was $\pm$ 0.1 per mil. The extraction yields (yields of purified protein) and carbon to nitrogen ratios (C/N ratios) of the extracted proteins were measured during the sample preparation to assess the reliability of the isotope ratios (the precision of the C/N ratio determination was $\pm$ 0.2).

RESULTS

The extraction yields, C/N ratios, and stable isotope ratios obtained for each specimen are shown in Table 1. The extraction yields and C/N ratios are used to evaluate the reliability of the stable isotope ratios. Once the reliable stable isotope ratios are identified, they are used to compare prehistoric diets at the sites.

EXTRACTION YIELDS

The extraction yield (reported as the percent by weight of protein obtained from the bone) indicates how much protein is produced when the bone is soaked in acid to remove the bone mineral. Extraction yields ranged from 21.6 percent (characteristic of modern bone or very well preserved prehistoric samples) to 1.6 percent (indicating extremely poor preservation). It has been shown (Ambrose 1990; Schoeninger et al. 1989) that specimens with extraction yields below two percent are so degraded that they frequently give unreliable stable isotope ratios and dietary reconstructions based on such specimens could be unreliable. Three burials (Burials 4 and 9 from Larkin and Burial 25a from Capitol View) produced extraction yields below two percent. These specimens were not used in the subsequent discussions of stable isotope ratios and diet. In general, the burials from Larkin and Capitol View were less well preserved than those from Buckner and Tinsley Hill. This indicates that the burials at the sites were interred in more acidic soils and may indicate less midden development at these sites (which may indicate less intensive or shorter term occupations).

Table 1. **Burials, Extraction Yields, C/N Ratios, and Stable Isotope Ratios.**

Burial	Extraction Yield (%)	C/N Ratio	$\delta^{13}C$ (per mil)	$\delta^{15}N$ (per mil)	Sex
Capitol View (15Fr101)					
15 Fr 101-02	6.03	3.45	-12.7	7.5	F
15 Fr 101-05	2.01	6.87	-14.4	n.d.	M
15 Fr 101-07	6.15	3.14	-9.5	8.2	F
15 Fr 101-25a	1.85	5.60	-15.9	n.d.	M
Buckner (15Bb12)					
Bb12-01	6.29	3.01	-10.7	7.3	F
Bb12-02	11.14	3.08	-10.4	8.4	F
Bb12-05	7.38	2.74	-9.0	7.6	F?
Bb12-07a	18.01	2.85	-8.4	8.0	F
Bb12-08a	8.43	2.81	-9.7	8.5	F
Bb12-08b	6.25	3.01	-9.5	8.4	M
Bb12-09	16.51	2.80	-8.4	8.0	F
Bb12-15	7.83	3.52	-9.2	8.7	M
Larkin (15Bb13)					
Bb13-03a	4.37	3.50	-10.5	7.8	F
Bb13-04	1.56	3.89	-11.6	8.8	M
Bb13-05	2.71	3.67	n.d.	7.9	M
Bb13-06	21.56	2.86	-9.6	7.5	F
Bb13-07	8.14	3.29	-9.8	8.2	F
Bb13-09	1.71	5.48	-13.0	10.9	M
Tinsley Hill (15Ly18)					
Ly18-02	17.24	2.97	-8.4	8.8	F
Ly18-06	14.91	3.29	-8.8	7.7	F
Ly18-08	11.29	3.63	-10.1	9.1	M
Ly18-14	19.31	3.14	-8.6	8.2	F

Table 1. Burials, Extraction Yields, C/N Ratios, and Stable Isotope Ratios (continued).

Ly18-24	8.95	3.16	-7.9	8.9	M
Ly18-26	15.97	2.84	-7.6	8.2	F
Ly18-28	15.16	3.02	-8.1	8.7	F
Ly18-30	10.53	3.54	-8.7	8.2	F
Ly18-33	11.61	2.98	-9.2	7.9	F
Ly18-36	18.49	3.08	-8.7	8.3	M
Ly18-41	16.17	3.25	-9.0	8.4	F
Ly18-42	6.00	3.65	-8.8	8.8	F
Ly18-44	18.35	2.95	-8.1	9.3	M
Ly18-47	7.21	3.37	-10.1	8.9	F
Ly18-50b	10.57	3.17	-8.1	10.1	M

CARBON TO NITROGEN (C/N) RATIOS

The carbon to nitrogen ratio (C/N ratio) is the ratio of carbon gas to nitrogen gas produced when the samples are converted into purified gases for analysis on the mass spectrometer. It has been empirically shown (DeNiro 1985) that samples producing C/N ratios ranging between 2.9 and 3.6 produce reliable stable isotope ratios and that samples with C/N ratios outside this range are not to be trusted. The C/N ratios of the specimens analyzed here ranged from 2.74 to 6.87. Four specimens produced C/N ratios below 2.9, but they were within the experimental error of the analysis and their stable carbon- and nitrogen-isotope ratios were not significantly different from the isotope ratios of specimens with C/N ratios solidly in the acceptable range, so the isotope ratios of these borderline samples were included in the dietary discussions. Four specimens produced C/N ratios higher than 3.8 (higher than the upper limit of 3.6 plus the precision of 0.2). Three of the specimens with high C/N ratios also had unacceptably low extraction yields (see above). The remaining specimen (Capitol View Burial 5) had a high C/N ratio (6.87) and a borderline extraction yield (of 2.01 percent). The stable isotope ratios of this sample also were excluded from the dietary discussion.

A graph of C/N ratio as a function of extraction yield (Figure 2) clearly indicates that specimens with extraction yields below two percent were most likely to produce high C/N ratios, suggesting the protein extracts were contaminated with some non-proteinaceous carbon source. There also seems to be a slight trend of increasing C/N ratio with increasing yield, but a linear regression found that the relationship was not significant ($r^2 = 0.2599$).

STABLE ISOTOPE RATIOS

Based on the extraction yields and C/N ratios, four of the 32 specimens were considered unreliable. The $\delta^{13}C$ and $\delta^{15}N$ values for the remaining 28 specimens that produced reliable isotope ratios are given in Table 1 and summary statistics for the reliable isotope ratios from each site are shown in Table 2.

The Capitol View sample produced the lowest average $\delta^{13}C$ value (-11.1 per mil) but the sample size was very small (only two specimens produced usable data). The Capitol View sample also had a very high standard deviation (2.24) compared with the other sites (the other standard deviations ranged from 0.45 to 0.76). Previously known sites producing standard deviations greater than about 0.8 are either sites which may span a relatively long period of time when significant dietary change occurred or are Middle Mississippian sites where different segments of the population may have consumed different diets because of status-related dietary differences (Schurr 1992). The high standard deviation of the Capitol View sample is surprising because the site was occupied for a relatively short period of time (it is thought to represent the briefest occupation of the four sites). There is no reason to believe that the population of Capitol View was undergoing an episode of extremely rapid dietary change or to suspect that there were dramatic dietary differences within the Capitol View population. It thus appears that the Capitol View sample may simply be unreliable in spite of the attempts to eliminate unreliable specimens by rejecting those that produced unacceptable extraction yields and C/N ratios.

Of the remaining three sites (Tinsley Hill, Buckner, and Larkin), the Tinsley Hill sample had the most positive mean $\delta^{13}C$ value (-8.7 ± 0.72, expressed as the sample mean ± one standard deviation). The mean values for Buckner (-9.3 ± 0.76) and Larkin (-10.0 ± 0.45) were similar to each other and both were slightly less positive than the mean for Tinsley Hill. There is a significant difference in mean $\delta^{13}C$ value between these sites according to a one-way analysis of variance ($F = 5.0350$; $df = 2, 22$; $p =$

.0156). A least-significant difference test between the mean values of Tinsley Hill, Buckner, and Larkin indicates there is a significant difference between the mean value of the Middle Mississippian Tinsley Hill site compared to the mean values of Buckner and Larkin at the 0.05 confidence level, but no significant difference between the average $\delta^{13}C$ values for the two Fort Ancient sites.

Because of low extraction yields and the relatively low abundance of nitrogen compared to carbon in collagen, two of the samples from Capitol View (Burials 5 and 25a) did not produce enough nitrogen gas for mass spectrometry. The $\delta^{15}N$ values are similar to the $\delta^{13}C$ values, with the Tinsley Hill site having a significantly higher average $\delta^{15}N$ value (8.6 ± 0.60) compared to the values for the three Fort Ancient sites, with mean values ranging from 7.8 to 8.1. In this case, both the mean $\delta^{15}N$ value for the two "reliable" Capitol View burials and the variation of the Capitol View sample are very similar to those of the other sites. This indicates that the unreliable Capitol View specimens are contaminated with extraneous carbon sources but that diagenesis has not altered the ^{15}N content of the samples. Once again, a comparison of the mean values for the three sites with the most reliable data (Tinsley Hill, Buckner, and Larkin) indicates that the mean value for Tinsley Hill is significantly higher than the means for Buckner and Larkin, but there is no significant difference between the two Fort Ancient sites (according to a one-way analysis of variance, ($F = 4.3739$; $df = 2, 22$; $p = 0.0246$).

DISCUSSION

The average stable carbon-isotope ratios for each site (Table 2 and Figure 3) do not support the hypothesis that Madisonville Horizon Fort Ancient populations of the Central Bluegrass consumed more maize than the Middle Mississippian inhabitants of Tinsley Hill. The opposite appears to be true, and the mean $\delta^{13}C$ value for the Tinsley Hill site (-8.7 per mil) is less negative than the mean values for the three Fort Ancient sites (which range from a minimum of -11.1‰ for Capitol View to a maximum of -9.4‰ for Buckner). The sample from Tinsley Hill indicates that diets at the Middle Mississippian site contained more ^{13}C, and hence more maize, than the diets at the three Fort Ancient sites.

It has been suggested that different varieties of maize may have different stable carbon-isotope ratios (Wagner 1987). If this were true, it would be necessary to know the stable carbon-isotope composition of maize from each site before the human $\delta^{13}C$ values could be interpreted (Schoeninger and Schurr 1994). For example, if the inhabitants of Tinsley Hill grew and consumed maize with higher ^{13}C contents than the maize grown by Fort Ancient populations, the human values at Tinsley Hill would be higher than the Fort Ancient ones even if both groups consumed the same amount of maize. The existing evidence now indicates that different varieties of maize do not have different isotopic compositions. Stable carbon-isotope analysis of many varieties of modern maize and of prehistoric maize from sites in North America (Tieszen and Fagre 1993), and of prehistoric maize from six sites (two Middle Mississippian and four Fort Ancient) in the Ohio Valley (Schurr and Schoeninger 1995), have identified no significant differences in the stable carbon-isotope ratios of different varieties of maize. At this time, it appears that differences in human stable carbon-isotope ratios reflect real differences in maize consumption. Thus, the higher mean $\delta^{13}C$ value for Tinsley Hill probably reflects a higher level of maize consumption at this site compared to Fort Ancient sites of the Central Bluegrass region.

The average $\delta^{13}C$ value for Buckner is slightly higher than the average for Larkin, which may indicate some decrease in maize consumption over time between the two sites. However, the difference between the mean values is slight and does not appear to be significant according to the analysis of variance cited above. The low average for the Capitol View sample is mainly determined by Burial 2

Table 2. Summary Statistics for the Reliable Stable Isotope Ratios.

Site	$\delta^{13}C$ (per mil) mean ± 1 sigma	$\delta^{15}N$ (per mil) mean ± 1 sigma
Tinsley Hill (15Ly18) (n = 15)	-8.7 ± .1	8.6 ± .6
Males only (n = 5)	-8.6 ± .9	9.2 ± .7
Females only (n = 10)	-8.7 ± .7	8.4 ± .4
Buckner (15Bb12) (n = 7)	-9.4 ± .8	8.2 ± .5
Males only (n = 2)	-9.4 ± .9	8.6 ± .2
Females only (n = 6)	-9.3 ± .2	8.0 ± .5
Capitol View (15Fr101) (n = 2, both female)	-11.1 ± 2.24	7.8 ± .4
Larkin (15Bb13)	-10.0 ± .4 (n = 3)	7.8 ± .3 (n = 4)
Males only	-11.6 (n = 1)	8.3 ± .4 (n = 2)
Females only	-10.0 ± .4 (n = 2)	7.8 ± .4 (n = 3)

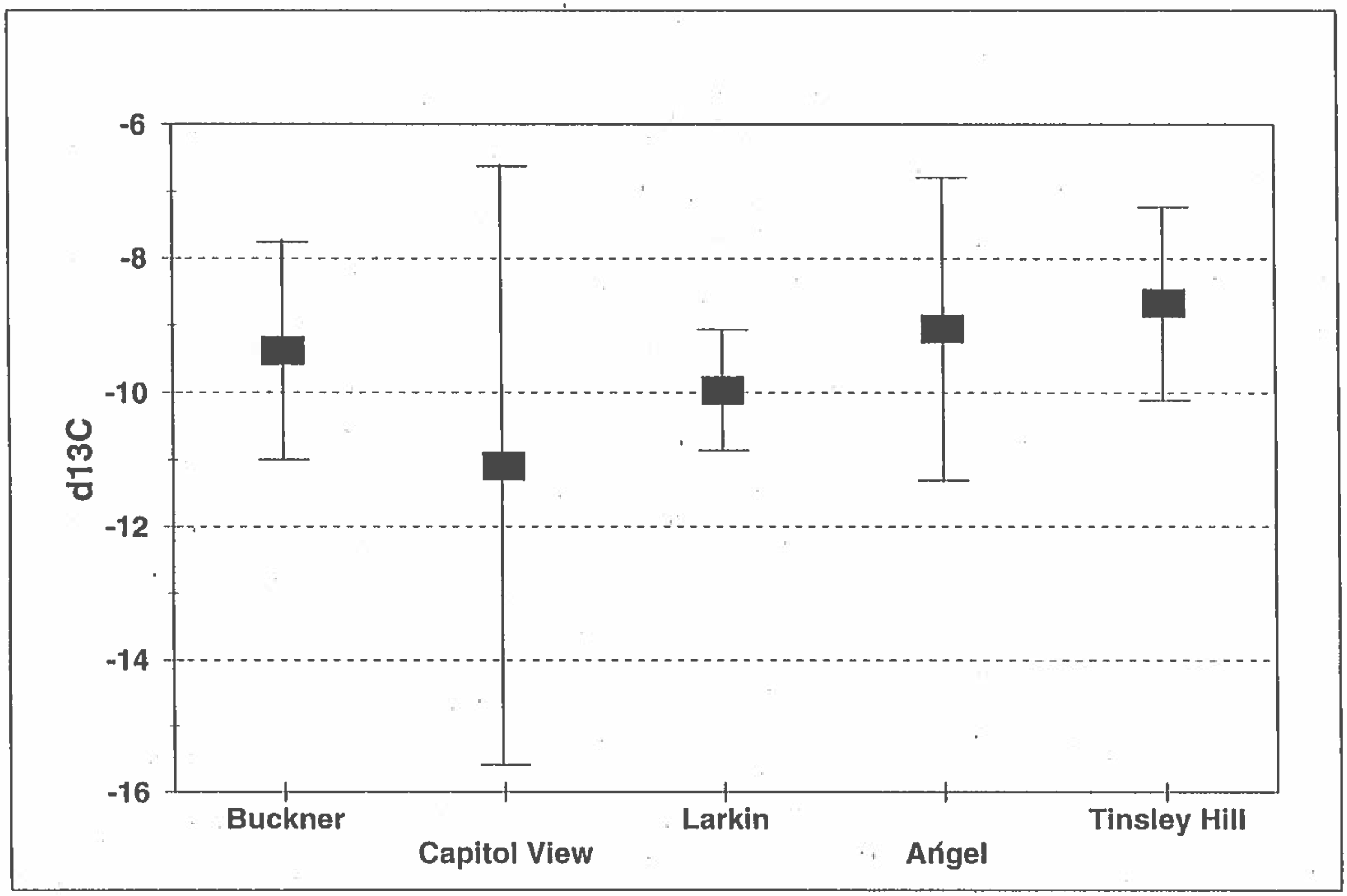

Figure 3. Mean Stable Carbon-Isotope Ratios from Buckner, Capitol View, Larkin, and Tinsley Hill(error bars indicate ± 2 sigma limits).

($\delta^{13}C$ = -12.7‰) which had the lowest $\delta^{13}C$ value of any burial with satisfactory extraction yields and C/N ratios. Given that the two Capitol View burials with unacceptable yields and C/N ratios also had very low $\delta^{13}C$ values (δ^{3} C = -14.4‰ for Burial 5 and -15.9‰ for Burial 25a), the Capitol View specimens seem very susceptible to contamination by C3 carbon sources such as humates or rootlets. The low value of Burial 2 from Capitol View may also reflect contamination despite its satisfactory yield and C/N ratio. If the carbon isotope ratio for Burial 2 is rejected, the $\delta^{13}C$ value for the sole remaining burial from Capitol View (-9.5‰ for Burial 7) is virtually identical to the means for Buckner and Larkin. Thus, the Fort Ancient data provide no evidence for changes in subsistence in the Central Bluegrass between approximately A.D. 1400 to A.D. 1600 for the three sites tested, a conclusion which must be considered tentative given the small number of sites sampled.

COMPARISONS WITH PREVIOUSLY REPORTED STABLE CARBON-ISOTOPE RATIOS

A regional perspective provides additional evidence that Middle Mississippian populations of the Lower Ohio and Tennessee-Cumberland consumed more maize than their Fort Ancient counterparts. Stable carbon-isotope ratios have been reported for human burials from several lower Ohio drainage Middle Mississippian sites (Figure 4). The Middle Cumberland sites of Arnold, Averbuch, and Goodlettesville have produced the highest average stable carbon-isotope ratios from eastern North America (Buikstra et al. 1988), with the slightly earlier Mound Bottom Site from the same region having a slightly lower average. Stable carbon-isotope ratios from the Angel site (Schurr 1989, 1992) also were relatively high. The unusually high $\delta^{13}C$ values from the region indicates that various cultures shared a common subsistence pattern along with a common material culture, a subsistence pattern that was distinguished by an unusually high dependence on maize (Schurr and Schoeninger 1991). This model of Middle Mississippian subsistence in the lower Ohio Valley and in the Tennessee/Cumberland region is further reinforced by the new data from Tinsley Hill.

Stable carbon-isotope ratios also have been reported from several Fort Ancient sites (Figure 4) including the Sun Watch Village (Incinerator Site) (Conard 1988), Turpin (van der Merwe and Vogel 1978), the Woodside component of the Slone Site, and Hardin Village (Broida 1983). In addition to these previously reported sites, $\delta^{13}C$ values are now available from the Baum, Gartner, and Feurt sites in Ohio (Schurr and Schoeninger 1995) to supplement the data from Capitol View, Buckner, and Larkin reported here.

The average $\delta^{13}C$ values of the Middle Mississippian sites of the lower Ohio range from -7.8‰ to -9.6‰. These values are consistently higher than those for the Fort Ancient sites, with means ranging from -9.4‰ to -11.5‰ (Figure 4). The intra-site variability of the Middle Mississippian sample (with a total range of 1.8‰) is slightly less than that of the Fort Ancient sample (with a range of 2.4‰). The Middle Mississippian data available to date appear to indicate that maize dependence increased until about A.D. 1150 and then declined. However, only seven sites have been sampled, and different periods are dominated by sites from different regions. The sites dated before A.D. 1300 are all located in the Middle Cumberland, while those dated around A.D. 1400 are located along the Ohio or the Lower Cumberland. It is thus unclear whether we are seeing temporal or regional trends in the data, or some combination of both. Later samples are clearly needed from the Middle Cumberland, and earlier samples are needed from the Ohio Valley proper.

Regional and temporal studies of Fort Ancient subsistence have generally concluded that there was little variation in Fort Ancient subsistence over space or time (Henderson et al. 1992; Rossen 1992; Rossen and Edging 1987; Wagner 1987). These conclusions, however, are contradicted by the

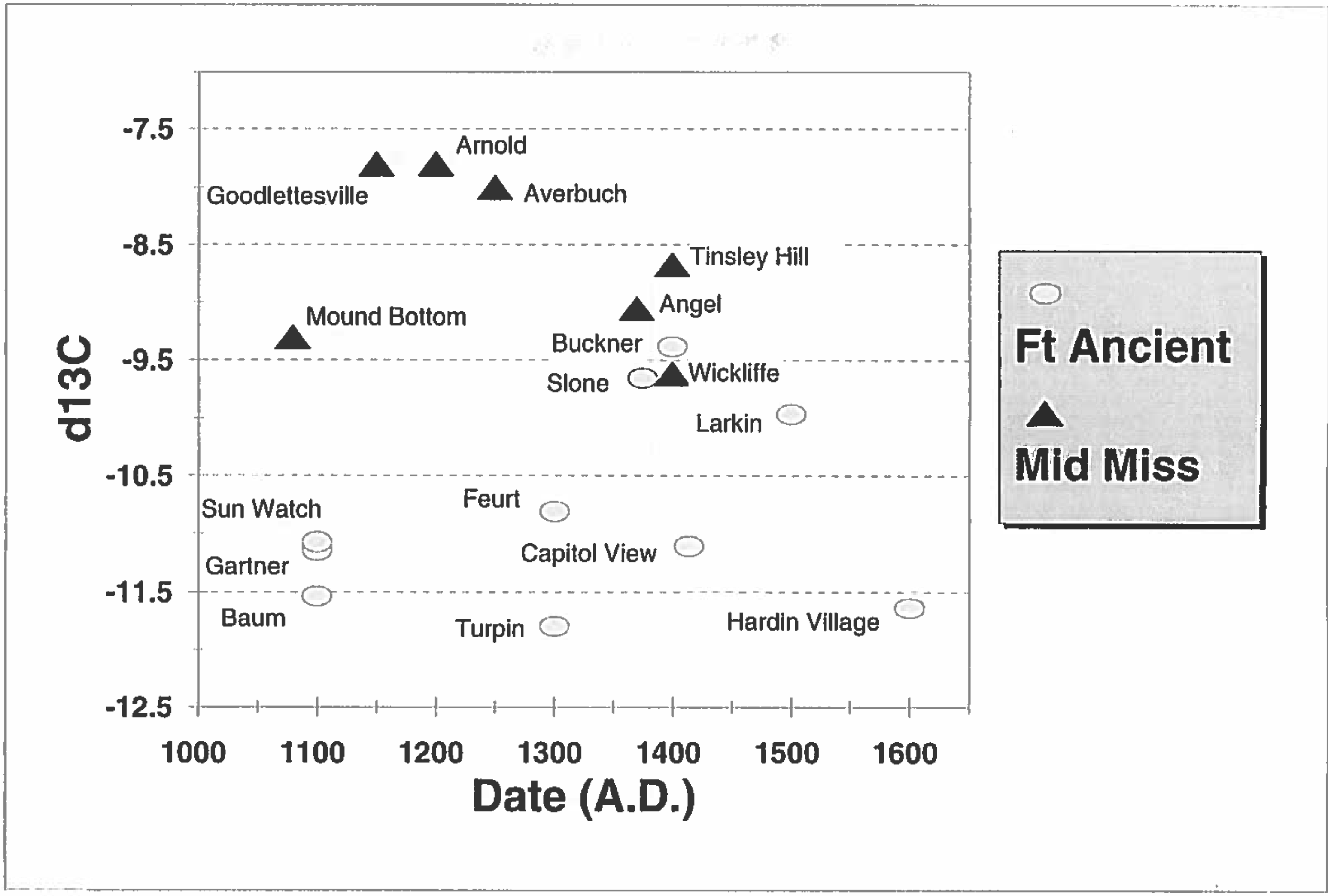

Figure 4. Previously Reported Mean Stable Carbon-Isotope Ratios from the Ohio Valley Region.

variability of the limited isotopic sample available to date. The variability within the existing Fort Ancient sample is larger than that of the Middle Mississippian sample, suggesting that Fort Ancient maize consumption varied significantly. The extant Fort Ancient sample suffers from the same problems of uneven temporal and regional sampling exhibited by the Middle Mississippian one. Although the apparently sudden increase in maize consumption around A.D. 1400 (at the start of the Madisonville Horizon) is intriguing, the isotope ratios from the Hardin Village Site (Broida 1983) indicate that the Madisonville Horizon cannot be uniformly characterized by high maize consumption. A contour map (Figure 5) of isotope ratios for all the sites shown in Figure 4 indicates a general regional trend of decreasing maize consumption with increasing latitude, and suggests that Fort Ancient sites in the interior of Kentucky (the three Central Bluegrass sites and Slone) are more similar to Middle Mississippian sites in their maize consumption than they are to Fort Ancient sites to the north. This pattern may reflect a complex pattern of differential maize use determined by local population density and environmental productivity, climatic limits on maize cultivation, or some combination of these and other unidentified factors.

It also is apparent that two very different patterns of prehistoric subsistence have been inferred by the two methods of botanical analysis and stable carbon-isotope analysis. Botanical evidence has been interpreted to indicate that the Middle Mississippian populations of the Ohio Valley consumed less maize than the Fort Ancient ones (Rossen 1992; Rossen and Edging 1987). These interpretations of the botanical evidence were consistent with the stable carbon-isotope ratios available at that time, but currently available stable carbon-isotope ratios give exactly the opposite picture - a very troubling situation. As both archaeobotanical data and stable isotope ratios are widely used to reconstruct prehistoric diet, differences in the results produced by these two methods must be reconciled. Either one of the two methods for measuring maize consumption contains serious errors, or the data are being interpreted incorrectly.

One likely source of the divergence between the isotopic and botanical data is that these two data sets are complementary measures (Hastorf 1990). Stable carbon-isotope ratios reflect the isotopic composition of maize and the amount of maize consumed. Botanical remains reflect the production, processing, consumption, and discard of plant foods but do not provide direct measures of consumption. Others have noted the importance of considering depositional contexts in the interpretation of botanical remains. For example, Rossen and Edging (1987) specifically excluded Larkin from their analysis because the botanical remains came from unusual mortuary contexts where maize remains were incorporated into burial features as part of mortuary rituals that might not correlate well with typical patterns of maize consumption at the site (Pollack et al. 1987). In a similar manner, the low abundance and ubiquity of the maize remains in botanical samples from Capitol View are thought to reflect the contexts producing the remains, which were mainly house floor contexts, as opposed to midden and pit feature contexts that provide the bulk of botanical remains at Fort Ancient sites (Henderson et al. 1992:213). It is therefore necessary to carefully assess the depositional contexts of Fort Ancient and Middle Mississippian botanical data to determine their relationships to the isotopic data.

STABLE NITROGEN-ISOTOPE RATIOS

The difference in the $\delta^{15}N$ values between the sites indicate that the inhabitants of Tinsley Hill ate diets that contained more ^{15}N than was the case for diets of the Central Bluegrass Fort Ancient sample. Little comparative data on stable nitrogen-isotope ratios are now available from the Ohio Valley region or from the entire eastern portion of North America. Prehistoric human stable nitrogen-isotope ratios from southern Ontario average above 10 per mil from the Archaic through the Historic period.

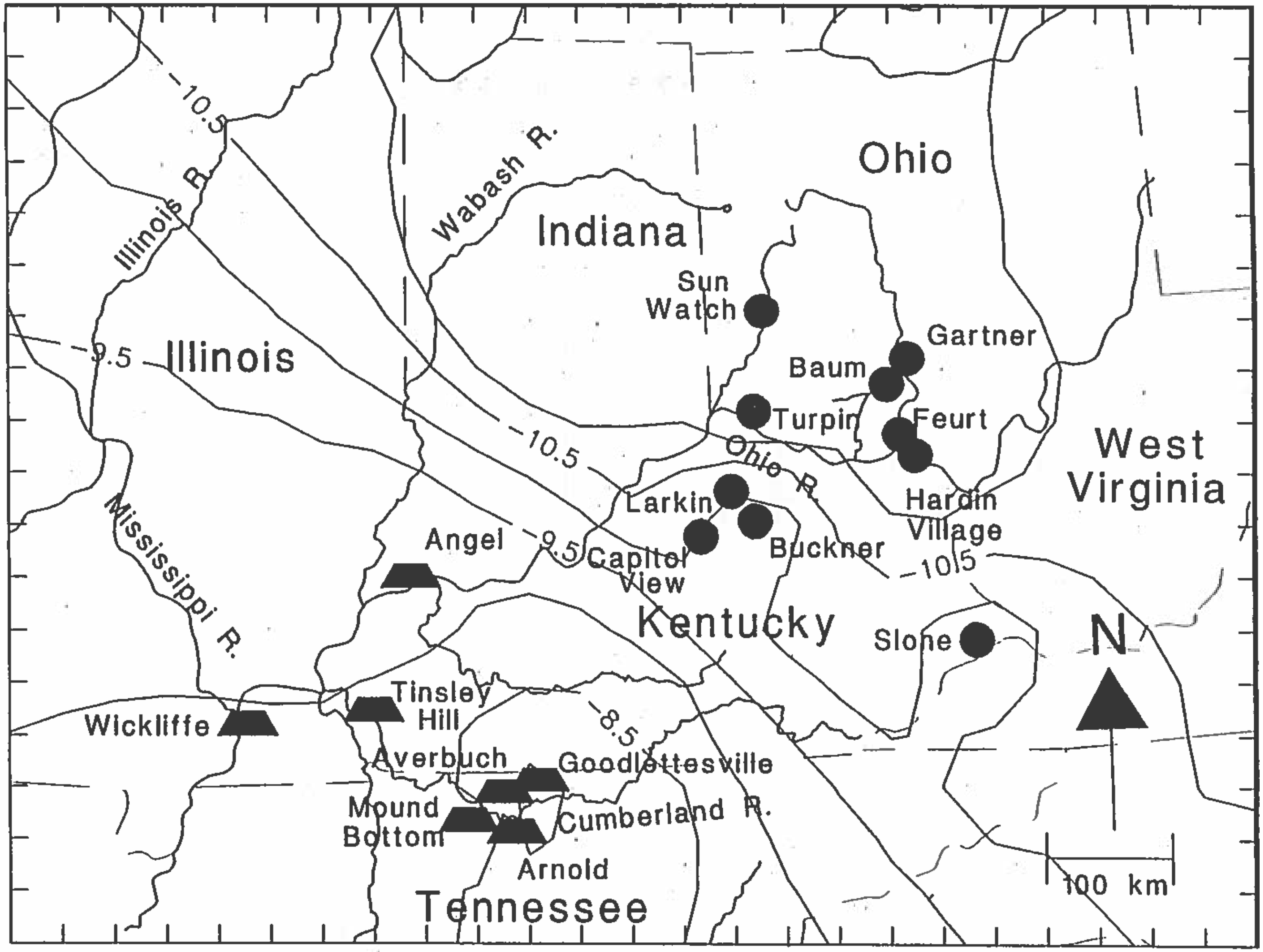

Figure 5. Contour Map of Stable Carbon-Isotope Ratios from the Ohio Valley Region.

Similar $\delta^{15}N$ values also have been reported for the Late Woodland Gard Island 2 site in the Western Basin region of Lake Erie (Schurr and Redmond 1991). Relatively high values reflect the importance of fish from the Great Lakes as a major source of dietary protein for the inhabitants of the region (Katzenberg 1989) and are thus not very relevant to the interpretation of the Ohio Valley data. Only two other sites have produced stable nitrogen-isotope ratios for comparison with the sites of this study. These are the Middle Mississippian Angel site in Indiana (Schurr 1989, 1992) and the Sun Watch (Incinerator) site in Ohio (Conard 1988). The $\delta^{15}N$ values reported for these sites are consistent with the results of this study. For Angel, the mean $\delta^{15}N$ value was 8.9‰ for a sample of 40 burials, and the mean value 7.7 per mil for a sample of 26 adult burials from Sun Watch (Conard 1988). Both the Angel $\delta^{15}N$ and $\delta^{13}C$ values are very similar to those obtained for Tinsley Hill, indicating that diets of very similar isotopic composition were consumed at both Middle Mississippian sites. This of course suggests that the inhabitants of both sites ate very similar quantities of the same types of foods. The Sun Watch $\delta^{15}N$ value is very similar to those of the Central Bluegrass Fort Ancient sites, but the $\delta^{15}C$ value is significantly lower (-11.2 ± 0.6 [Conard 1988]). The similarities in the Fort Ancient nitrogen-isotope ratios indicate that similar ecosystems were exploited and that similar sources of protein were consumed at the Central Bluegrass sites and at Sun Watch, but the more negative $\delta^{13}C$ value for Sun Watch indicates less maize was consumed at that site.

The observed difference in $\delta^{15}N$ values could have several explanations. First, the results may indicate that the diets at Tinsley Hill and Angel were at a higher trophic level than those at the Fort Ancient sites. For example, the inhabitants of Tinsley Hill and Angel may have consumed relatively more meat (Schoeninger 1985). The results also could indicate heavier exploitation of aquatic resources which generally have higher ^{15}N contents than terrestrial ones (Katzenberg 1989; Schoeninger and Schurr 1993). The higher $\delta^{15}N$ values for the Middle Mississippian sites may reflect a greater abundance of aquatic resources in the vicinity of Tinsley Hill and Angel compared to the Central Bluegrass sites, a conclusion consistent with the relative settings of Middle Mississippian and Fort Ancient sites in the Ohio Valley region. Finally, legumes generally have lower $\delta^{15}N$ values than other plants because they obtain most of their nitrogen through a symbiosis with nitrogen-fixing bacteria (DeNiro and Epstein 1981). Thus, a diet which contained a high proportion of legumes would have a lower $\delta^{15}N$ value than one which contained little or no legumes. Beans were the most important legume available to the occupants of these sites, and archaeobotanical data seem to suggest that beans are much more abundant in Fort Ancient botanical assemblages compared to Middle Mississippian counterparts (Wagner 1987). It has been estimated that beans must provide about 17 per cent of the diet before they produce a clearly recognizable isotopic signature with a difference in $\delta^{15}N$ values of about two per mil (Schwarcz et al. 1985). The differences in $\delta^{15}N$ values between the Middle Mississippian and Fort Ancient sites is in the range of 0.4 to 1.2‰, so the stable nitrogen-isotope ratios are ambiguous and may or may not indicate increased bean consumption by Fort Ancient populations. Given the problems associated with interpretations of the archaeobotanical record that were identified above for maize remains, along with the other possible explanations for higher $\delta^{15}N$ values in the Middle Mississippian populations, further work must be done before the $\delta^{15}N$ values can be confidently interpreted. Because of the many different possible sources of dietary nitrogen, studies of human stable nitrogen-isotope ratios must be accompanied by complementary studies of $\delta^{15}N$ values in prehistoric flora and fauna (Katzenberg 1989; Schoeninger and Schurr 1993) before the human $\delta^{15}N$ values can be fully understood.

CONCLUSIONS

It is now apparent that Middle Mississippian populations of the Lower Ohio generally consumed more maize than their Fort Ancient counterparts of the Middle Ohio, and that the regional patterns of maize consumption are too complex to be explained by a simple dichotomy between Middle Mississippian and Fort Ancient. The Middle Mississippian stable carbon-isotope ratios now available from the region clearly indicate that Middle Mississippians consumed more maize than most Fort Ancient populations analyzed to date. The Central Bluegrass $\delta^{13}C$ values indicate relatively high levels of maize consumption compared to all other Fort Ancient sites reported to date except for the Slone Site. The Fort Ancient sites with the highest maize consumption are the southern-most sites located furthest from major river valleys. This may be an indication that the interior Fort Ancient communities coped with more limited resources of an interior setting by increasing maize consumption (Broida 1984).

The archaeobotanical data indicate that maize was the most important plant food for both Middle Mississippian and Fort Ancient cultures, and also have shown that plants other than maize differed in importance at Middle Mississippian and Fort Ancient sites. Although there is evidence that chenopodium (*Chenopodium berlandieri*) was used at the Madisonville Site (Dunaven 1993) and is present in small amounts from several Kentucky Fort Ancient sites (Rossen 1992), evidence for the use of small-seeded oily or starchy annuals such as chenopodium and maygrass (*Phalaris caroliniana*) is more common at Middle Mississippian sites than at Fort Ancient ones (Rossen 1992; Rossen and Edging 1987; Wagner 1987). According to the hierarchy of plant utilization defined by Rossen and Edging (1987), nuts and native cultigens (small-seeded starchy and oily annuals) were second in importance for Middle Mississippians but were least important at Fort Ancient sites where beans were second in importance to maize. At this time, the pattern of $\delta^{13}C$ and $\delta^{15}N$ values at Middle Mississippian and Fort Ancient sites is generally consistent with the relative hierarchies of plant utilization defined by Rossen and Edging (1987). Maize is indeed the single most important food for both cultural traditions. The more positive $\delta^{15}N$ values at Middle Mississippian sites could indicate that fewer beans were consumed at these sites. However, the more positive $\delta^{13}C$ values for Middle Mississippian sites, compared to most Fort Ancient sites, indicates that the hierarchies of plant use start at different levels. In combination, the isotopic and archaeobotanical data provide evidence for a generally higher intensity of plant utilization by the Middle Mississippians.

Levels of maize consumption in the Ohio Valley region appear to have been conditioned by three factors. The first is social organization, with the hierarchically ranked chiefdoms having generally higher maize consumption than the tribal Fort Ancient societies (Schurr and Schoeninger 1995). This is undoubtedly related in part to higher population densities at the Middle Mississippian communities, but may also reflect higher intensities of inter- and intra-group economic competition within the Middle Mississippian societies as lineages vied for prestige. The second appears to be the overall productivity of the local environment, with more productive environments located closer to the main river channel requiring less maize production to maintain a given level of sociopolitical organization than do less productive environments located in upland regions. Fort Ancient and Middle Mississippian communities located along interior drainages consumed more maize than their counterparts located along the lower reaches of the Ohio, the Tennessee, and the Cumberland. This reflects more intensive use of maize as an alternative to wild foods when wild foods are less abundant. Finally, the length of the growing season may have placed an upper limit on maize consumption in the region, as there is an overall north-south cline in the human $\delta^{13}C$ values (Figure 5). The overall pattern of maize consumption in the region during the late prehistoric period are clearly a product of interactions between social and environmental variables. Although the outlines of some of these variables are now becoming clear, the specifics remain to be defined. For example, there is now no way to compare site catchment productivity on a regional basis. It thus remains difficult to evaluate the relations between environmental productivity and maize consumption in any but the most general terms.

The presumed pattern of more intensive use of maize by Middle Mississippian populations compared to Fort Ancient correlates well with current theories about population density in the region. In the Nashville Basin, the consequences of maintaining an unusually high population density are reflected in extremely positive $\delta^{13}C$ values and in skeletal evidence of relatively poor health relative to other Middle Mississippian populations (Eisenberg 1991; Lane 1993). It would be extremely interesting to evaluate the health of Fort Ancient populations in order to further explore the interactions between health, population density, and maize consumption.

The variability in the Fort Ancient $\delta^{13}C$ values indicates that different Fort Ancient populations consumed measurably different amounts of maize. The evidence of variable maize consumption contrasts markedly with current models of Fort Ancient subsistence which usually stress similarities among Fort Ancient sites (Henderson et al. 1992; Rossen and Edging 1987; Wagner 1987). Given that Fort Ancient and Middle Mississippian subsistence systems both relied on a mix of domesticated and wild foods, changes in maize production and consumption must have been associated with corresponding changes in the uses of wild plants and animals. A closer look at the existing archaeobotanical database may reveal regional and temporal variations in plant and animal use within the overall Fort Ancient pattern, as is the case at the Madisonville Site, where botanical data seem to reflect changes in plant utilization over time (Dunaven 1993). Past botanical studies of Fort Ancient sites have successfully demonstrated that Fort Ancient populations used a relatively consistent set of resources. Further studies are now needed to better define regional and temporal variations in the exploitation of specific resources. Such studies are especially necessary because of the complementary nature of archaeobotanical and isotopic data. The isotopic data provide information on maize consumption but cannot identify variations in the consumption of wild plant species or C3 domesticates. Stable carbon-isotope ratios thus give a one-dimensional picture of subsistence which must be expanded by archaeobotanical studies.

Regional and temporal variations in Middle Mississippian subsistence patterns are poorly understood primarily because archaeobotanical and archaeofaunal data are not available. Many of the largest sites (such as Tinsley Hill and Angel) were excavated prior to the invention of flotation recovery. Further excavations designed to collect subsistence data at these sites are needed to supplement the isotopic data because it would be desirable to compare human $\delta^{13}C$ values and other archaeological measures of subsistence from the same sites. This is especially important for hierarchically organized Middle Mississippian communities because different patterns of resource use may have existed at each level of the settlement hierarchy.

It is clear that each successive model of Fort Ancient and Middle Mississippian subsistence is contingent on the information and theoretical perspectives available at that time. Like all other studies, this one is also contingent, and with luck, these conclusions will be modified in time as well. The efforts of many researchers have defined the overall outlines of Middle Mississippian and Fort Ancient subsistence in the Ohio region. The many different perspectives about late prehistoric cultures of the Ohio region now extant promise to further clarify our understanding of these unique, vanished cultures.

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AN ANALYSIS OF MEDICINES USED ON THE LATE EIGHTEENTH CENTURY FRONTIER IN KENTUCKY AND ILLINOIS

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ABSTRACT

Eighteenth century medicine, especially as practiced on the western frontier, is a subject with few extant primary sources from which to draw for serious research. The ledgers kept by Francis Connard, a frontier physician and surgeon, lend valuable insight into the manner in which the art of medicine was practiced on the frontier. As Connard was also a military surgeon, the ledgers give a glimpse into the daily professional life of a regimental surgeon of George Rogers Clark's Illinois Battalion.

INTRODUCTION

Bleedings, noxious mixtures of sulfur, fantastic herbal decoctions and non-anesthetic amputations are all part of eighteenth century medicine. Were physicians of this period merely stumbling along in blind ignorance, blithely unaware of the harm and pain they were causing their patients? Or were they just beginning to realize the real possibilities which the medical profession could and would realize in the years to come? Francis Connard was a frontier physician of the late eighteenth century in Kentucky and the Illinois country. He was engaged by General George Rogers Clark's Illinois Battalion as Surgeon, from 1779 to 1781 (Draper 1779-1781: Ms. 60J265). This paper examines late eighteenth century medical practice based upon Francis Connard's medical accounts ledger, a list of medical applications and surgical procedures contained within the collection of unpublished George Rogers Clark Papers in the Virginia State Library Archives.

The guiding principle of eighteenth century medicine was that of balance (Wilbur 1980:8). The body and all of its constituents must be in proper harmony in order for good health to be maintained. The Greek medical concept of "humors" as the central component of the body's chemistry was still the accepted standard of physiological science in the eighteenth century. These humors included the body fluids of blood, phlegm, black bile, and yellow bile (Barker 1929:9). The proper balance of these humors was considered essential to healthy existence. Therefore, the practices of eighteenth century medicine were designed to keep humors in balance.

Eighteenth century medical practice was far removed from its modern counterpart. Medical schools were not the primary route to becoming a physician. By far the most popular route taken to become a physician was that of apprenticeship. During a three to six year period (Wilbur 1980:1), the apprentice was given "on-the-job" training by his mentor. After successfully completing his apprenticeship, the apprentice was awarded a certificate of proficiency, which at the time, carried the same credence as a medical school degree (Wilbur 1980:1).

Only larger cities had the facilities suited to formal medical instruction. The first recorded anatomy lecture in the Colonies, with dissection, occurred in 1750 in New York. Using the corpse of an executed murderer, Hermanus Carroll, students were exposed to the internal structures of the human body, much to the distress of the general public. The windows of the dissection rooms were often destroyed by angry mobs (Wilbur 1980:2-3).

The only statutory requirement for medical practice was the possession of a certificate of proficiency from an apprenticeship or a degree from a medical school. However, the enforcement of these requirements was haphazard at best. Often a person could engage in the practice of medicine with no formal training whatsoever, and no questions would be asked regarding his qualifications.

The etiological environment of the eighteenth century was one that was extremely challenging to the practitioners of "physik" as medicine was termed in the eighteenth century (Dewhurst 1974:v). The lack of understanding of the modern area of bacteriology and virology made for a morass of theory and practice, aimed at defeating the diseases that were so misunderstood.

The most common ailments of the eighteenth century included gout, hydrops (or dropsy), the tympany, diabetes mellitus, consumption, asthma, jaundice, nephritis (or kidney stones), palsey, hemiplexia, St. Vitus' Dance, apoplexy, scrofila, epilepsy, leprosy, pruritis, plague, the pox, and the ague (or malaria) (Dewhurst 1974). Sanitary conditions, horrendous by modern standards, were prime producers of outbreaks of diseases such as cholera, typhus, and plague. The lack of a standardized vaccination process also led to outbreaks of diseases such as smallpox.

Some attention should be given to the contrasting roles of the apothecary and the physician. The apothecary's position was primarily that of mixing and dispensing the medicines, which were prescribed by the physician, who was the primary diagnostician (Wilbur 1980:21). One may draw parallels to modern pharmacists based upon this, however these comparisons are not entirely valid. The apothecary, although not the primary diagnostician, did at times practice the art. Often, a physician's order was countermanded by the apothecary, sometimes at the patient's request, at others because the apothecary simply disagreed with the physician's diagnosis (Wilbur 1980:21).

The apothecary's arsenal, although lacking in modern antibiotics and pain killing drugs, nonetheless had no fewer than ten different classifications of drug treatments. Each of these treatments had its own place in the natural pharmacopoeia of the eighteenth century. Anodynes, such as opium and laudanum, were used to relieve pain; however, they were not useful for relieving other symptoms. Antiarthritics, such as epsom salts and Peruvian (Jesuit's) Bark, which contains quinine, were used to treat the ague (or malaria). Antidysentary treatments included pulverized Brazil root and paragoric. Antipyretics or febrifuges, were used to treat fevers (Wilbur 1980:11-12).

Emetics formed a fifth group of treatments. Emetics, including tartar and ipecac, produced immediate vomiting and were popular treatments with physicians, although their popularity among patients is debatable. Muscular antispasmodics, such as hard liquor and oil of amber were used to relax muscles. Purgatives and cathartives, or laxatives, such as rhubarb, castor oil, and epsom salts were used to induce diarrhetic evacuation of the bowels. Salivation inducing medicines, such as oil of mercury, were used to stimulate the production of saliva, as well as act as an intestinal counter irritant. Diaphoretics, such as camphor and rhubarb, were used to induce sweating, especially after intestinal symptoms had been resolved. Diuretics of all kinds were employed to increase the flow of urine, especially in cases of dropsy (or edema), thereby ridding the body of excess fluids (Wilbur 1980:11-12).

The above medications were prepared and administered in several different ways. The preferred manner of administering medications was orally. Another popular method was 'clysters' (Wilbur 1980:11), which were rectal infusions of medication, similar to an enema. Blisters and cataplasms (or poultices, were often applied directly to the skin in order to counteract some irritation. One of the more popular blisters was cantheride, known today as "Spanish Fly" (Wilbur 1980:11).

With regard to traumatic injuries, it is necessary to first observe the world of civilian trauma, and then compare it to military injuries. Civilian trauma tended to be of the more common variety, such as sprains, strains, fractures, the occasional gunshot wound, and other traumatic injury to soft tissue. In this regard, eighteenth century medical practice is little different from today.

The military, however, faced drastic trauma. Gun and cannon shot wounds were common, as were injuries from sword and bayonet (Wilbur 1980:34). Treatment priorities also differed between civilian and military situations. In the military, less emphasis was placed on saving a damaged limb. The surgeon near the battlefield was more interested in stopping bleeding first through the use of a tourniquet usually followed by amputation. This course of action was simply more expeditious given the large number of wounded that had to be tended (Wilbur 1980:27).

Surgeons of the eighteenth century were not the esteemed group of professionals that they have become today. Once again, the medical world followed the lead of the ancient Greeks to whom the distinction between a physician, who practiced medicinal cures, and a surgeon, who enacted physical repair, was nonexistent (Barker 1929). The role of the military surgeon and surgeon's mate were mandated by law (Hening 1969:18). Every military regiment was to have a surgeon, as well as a surgeon's mate, whose task it was to assist the physician in the completion of his duties. Often this entailed holding patients immobile for procedures such as amputations and bullet extractions.

Surgical procedures were carried out without benefit of anesthesia. Often the wounded soldier was given a musket ball to bite to aid in enduring the pain of the procedure, thus giving rise to the modern expression, "bite the bullet" (Wilbur 1980:38). Surgeons were also limited in the scope of what could be accomplished by surgery. Compound fractures, deeply imbedded bullets and gangrene were often cases for the amputation knife.

Medical practice on the frontier was different from the practice of medicine in the cities. Of course, medicines were difficult to come by. Because of this, frontier practitioners were forced to rely more heavily upon native medicines than upon imported ones. For example, Belladonna (or Deadly Nightshade), was a common plant in use by eighteenth century physicians. Atropine, which could be extracted from the leaves and roots of Belladonna, was a most useful antispasmodic drug. Also, Hellebore, a plant from American swamps and meadows, produced a root which could be decocted into a diuretic, cathartic, and a circulatory stimulant (Wilbur 1980:23). Different types of trauma were also present on the frontier. Perhaps the most widely known was that of scalping. Scalping was not pursued by Native Americans alone, many European-Americans practiced this activity with great enthusiasm. The only treatment was to dress the wound and allow the scalp to regenerate itself. Often this would work, although the scalp would be totally devoid of hair in the affected region (Wilbur 1980:39-40).

CONNARD'S LEDGERS

The medical ledgers kept by Francis Connard, as a running account of his expenditures, are a fascinating record of frontier medicine in the latter half of the eighteenth century. They describe in detail medicines and treatments prescribed for the members of General George Rogers Clark's Illinois Battalion while they were under Connard's care. For example, the ledgers show that from June 27, 1779 to May 16, 1780, Connard prescribed 72 purgative decoctions. This is in keeping with the practice of the day, that of using laxatives to remove intestinal irritation (Wilbur 1980:12). Therefore, one may see that in this particular arena, Connard followed typical eighteenth century protocols.

Rum was used in medicines quite often. From July 10, 1779 to April 13, 1780, a total of 21 gallons and 29 bottles of unknown capacity were distributed to the men of the Illinois Battalion. It was a standard practice in the army to issue no more than one half pint of rum per soldier per day (Wilbur 1980:55). Rum was usually considered to be detrimental to the soldiers health and well-being, however, when mixed with camphor, it was considered useful for treating a variety of illnesses, including malaria (Wilbur 1980:15). Also in this vein, Connard issued 38 doses of astringent cordial potion. This is another example of the use of liquor as an agent for the administration of medicines.

Connard also issued 165 bottles of sudorific decoction. Sudorifics were used to instigate perspiration and were one way to rid the body of fluids detrimental to good health, and keep the body in balance (Wilbur 1980:12). Also issued were four doses of an unspecified diuretic decoction and sixteen doses of emetic, two additional methods of removing fluids from the body.

Mercury, or quicksilver (a poison), was also prescribed as a medicine. Connard issued seventy-six doses of mercurial pills to the Illinois Battalion. Mercury was thought to be useful in the treatment of smallpox (as a purgative) (Wilbur 1980:14), and in the treatment of "the itch" (or syphilis) (Leake 1975:96), and is present in surprising quantities. A total of 125 ounces of mercurial ointment were issued to the men of the Illinois Battalion, an interesting commentary on their off-duty activities.

Poultices were common to Connard's practice, and the available literature tends to indicate that poultices were fairly common in eighteenth century medical practice at large (Wilbur 1980). Plasters were also fairly common in the ledger. Plasters were used as an irritant or a blister to produce an irritation that would counter irritation elsewhere in the body (Wilbur 1980:11). Connard issued 44 plasters.

Surgical procedures comprise a surprisingly small portion of Connard's ledger entries. This is surprising given that Connard was a military surgeon. It is possible that combat related procedures went unremunerated, while non-combat pharmacological distributions were reimbursed. There is precedent for this assumption, as evidenced by the Continental Army policy charging officers and men alike for treatment of any venereal disease they contracted (Wilbur 1980:16).

Of the surgical procedures listed, bleeding comprises the greatest frequency, with eleven entries.

Bleeding, through the use of a lancet, was a popular procedure, as it was generally considered the premier method for the removal of impure blood from the body (Wilbur 1980:10). Contrary to popular belief, there are very few references to leeches in the military medical literature of the eighteenth century. Perhaps this is due to the slowness with which a leech removes blood from the body.

Next in order of frequency was the extraction of teeth. Connard performed a total of seven tooth extractions. The drawing of teeth was likely to be a source of mixed emotion for the soldier. To be sure, application of the wrench-like tooth extractor was painful, however the relief of the pain of the diseased tooth may have mitigated the pain of the extraction (Wilbur 1980:40).

Last in the field of surgical procedures were the setting of fractures and the excision of tumors. Fracture reductions occurred three times. The excision of tumors, of which two are listed, is simply the surgical removal of growths, whether benign or malignant.

Upon examination of Connard's ledger, one sees no extraordinary illnesses attributed to the Illinois Battalion, with the possible exception of a small outbreak of either smallpox or consumption, and syphilis, as evidenced by the presence of medicinal mercury. The large distribution of rum represented may have resulted from a laxness in discipline which may have occurred as a result of extended service on the frontier.

Most curious was what was not mentioned in the ledger. Of primary significance is the absence of Peruvian (Jesuit's) Bark, which was used to combat malaria (Wilbur 1980:34). This drug played a very significant role on the Kentucky/Illinois frontier, and was issued to officers at Clark's 1780-81 Fort Jefferson (Carstens 1990a, 1990b, 1990c). However, it must be remembered that just because an item is not listed in the ledger, does not mean that the men did not have access to it.

CONCLUSIONS

We would conclude that Francis Connard was a competent practitioner of medicine, given the state of the art in the late eighteenth century. His medical documentation reveals a frontier physician operating within a medical establishment. He dealt with diseases and injuries common to the less developed parts of the continent. There is no conclusive evidence of epidemic or widespread disease, other than the presence of smallpox, consumption and syphilis, all of which are implied from the type of pharmacopoeia issued. Otherwise, Clark's Illinois-Battalion appears to have been quite healthy.

The health of a population is frequently the domain of medical and physical anthropologists. Archaeologists need to be aware of the medical practices used in historic settings. The natural pharmacopoeia of the eighteenth century may not survive in its entirety in the archaeological record, however, often a trace may remain. Archaeologists need especially to be cognizant of the technology associated with medical practice, this often being the only evidence of medical activity that will survive in its entirety in the archaeological record.

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ARCHAEOLOGICAL INVESTIGATIONS AT THE 1795 ELIJAH FOLEY HOUSE, FAYETTE COUNTY, KENTUCKY

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ABSTRACT

In this paper, the results of salvage excavations at the Elijah Foley House (15Fa231) near Lexington, Kentucky are presented. Foley, an early gunpowder manufacturer, built a two story brick residence on his property about 1795. The diverse artifact assemblage at this site was representative of the entire occupational span of the house. Although the site had been disturbed by construction activities for a new subdivision, it still provided an excellent assemblage of an early rural farmstead.

INTRODUCTION

During the summer of 1994, the Kentucky Heritage Council learned that the Elijah Foley House in southern Fayette County, Kentucky was being demolished to make way for a new subdivision. The Foley House was constructed about 1795 by gunpowder manufacturer Elijah Foley. Since this was one of the few surviving early houses in rural Fayette County, the Kentucky Heritage Council felt the need to conduct excavations at the Foley House. Mr. Steve Haydon, owner and developer, was contacted and he graciously gave us permission to conduct archaeological investigations at the site. Between April 21 and June 2, 1994 (12 field days), salvage excavations were conducted under the supervision of Kentucky Heritage Council staff archeologist Charles D. Hockensmith.

The Elijah Foley House is located within the Inner Bluegrass region. The site is situated on a ridge top about 380 m east of Clays Mill Road in southern Fayette County and approximately 8 km south of downtown Lexington. The Jessamine-Fayette County line is 450 m south of the house. Archaeological remains associated with the house extended over an area 53 m north-south and 62 m east-west. The area surrounding the house had been bulldozed extensively in connection with a proposed subdivision called Foley's Landing.

This report has been divided into several major sections. Initially, the Elijah Foley House and its setting are described in a section about architecture. The next section discusses the Foley family and their role in gunpowder manufacturing industry. Subsequent sections discuss the archaeological

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[1] With contributions by Gary A. O'Dell, Nancy Foley Johnson, and Valerie A. Haskins.

investigations and cultural deposits at the site. The bulk of the report deals with the artifacts recovered from our excavations. A section about faunal remains follows. The subsequent sections deal with functional group patterning and integrity of the archaeological deposits. The final section presents the conclusions of the study.

ARCHITECTURE

The original Elijah Foley House was a two and a half story Federal style structure with three bays (Figure 1 a-d). Flemish bond brickwork was used on the front, back, and east sides. One course of a decorative molded brick was used on the front and rear walls of the house. The structure had a gabled roof and two outside end chimneys with corbeled caps. It was built on a cut limestone foundation. A small basement with cut limestone walls was located under the northwest wing of the house. The windows were nine over six on the first floor and six over six on the second floor. Brick coussoirs were over pegged windows.

Later in time the Foley House was modified and enlarged. A Greek Revival two-panel door with a four paned transom and shouldered architrace was added to the main entrance. Also, a delicate fretwork band was added at the lower edge of the cornice. A one story, three bay east wing with a hip roof probably functioned as a separate kitchen at one time. A breezeway or dogtrot originally separated the house and kitchen. The breezeway was later closed in using a common bond brick pattern. The wide mortar joints in the breezeway sharply contrasted with the narrow (pencilled) mortar joints of the original structure.

During the mid-nineteenth century, a rear two story addition with two bays was added. It had an inside end chimney, mitered window frames, and common bond brickwork. A porch supported with square brick columns was covered with a shed roof. The porch was later enclosed with horizontal wood siding (Figure 1d).

A one story brick garage is located 21 m east of the Foley House. It measures 6.1 by 12.25 m (20 by 40 feet) with a north-south long axis. The garage was constructed with used brick (some with paint on them) and built on a limestone foundation. Portland cement was used in the wide mortar joints. A hip roof with shingles covers the structure. The north end of the structure had a thin concrete floor and was used for parking a vehicle. The southern two-thirds of the structure was subdivided into two compartments with a north-south wall. The western compartment has coal on the floor and may have functioned as a coal shed. The eastern compartment was filled with recent trash and served an unknown function. Architectural historian William Macintire (personal communication 1994) thinks that the garage was built no earlier than 1900.

A small frame building was located in the east side yard. At the time of the fieldwork, it had been pulled down and the roof was on the ground to the west. The structure was a small shed (3.05 by 3.75 m) with a wooden floor and tin roof. The wire nails used in the structure indicate that it probably dates to the twentieth century.

A natural spring is located about 150 m northwest of the house. The water flows from under a large limestone outcrop located at the base of the hill. This is a very reliable spring with a very strong and constant stream of water. There was no evidence for a spring house. However, fill dirt for the proposed subdivision had been dumped to the edge of the spring. The only evidence of human activity

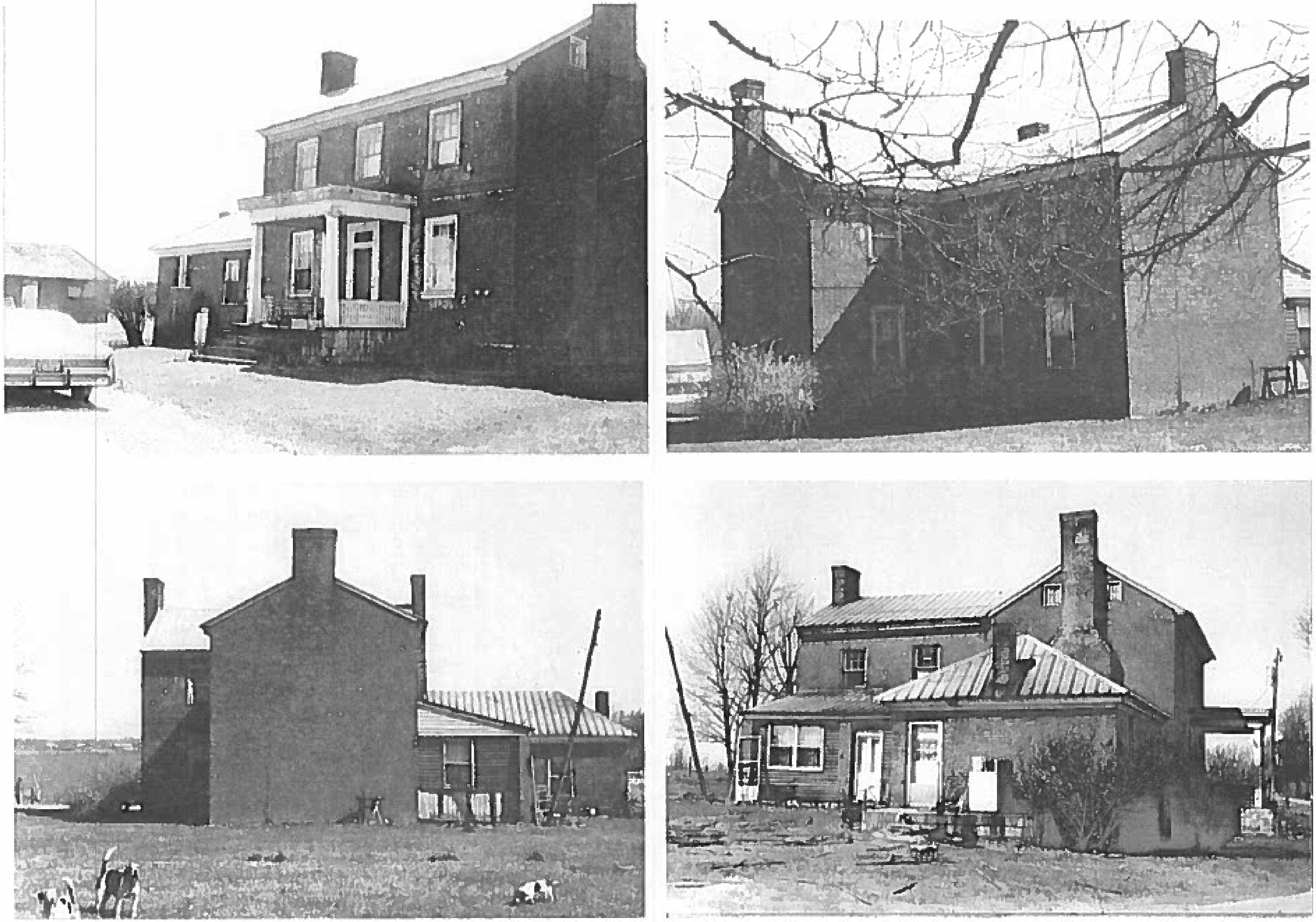

Figure 1. Photographs of the Elijah Foley House Taken During the 1960s: a, front elevation; b, west and rear elevations; c, rear elevation; d, east elevation. Courtesy of the Office of Historic Preservation in Lexington.

was a flattened bucket and a recent earthen embankment below the spring to impounded the water into a shallow pond.

THE FOLEY FAMILY AND THEIR ROLE IN GUNPOWDER MANUFACTURE

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During the period from about 1795-1815, gunpowder was one of the most important export commodities in the developing economy of Kentucky. Not only was it valuable, it was a necessary article for local use. In an era marked by conflict with the British and their Indian allies, gunpowder was sufficiently compact that it could be profitably transported to neighboring states and territories. The Bluegrass region was centrally located to the largest known natural repositories of saltpeter (calcium or potassium nitrate) in North America, the primary ingredient needed to make gunpowder. Consequently, in Kentucky, the Bluegrass region became the trade center for saltpeter and the manufacturing center for gunpowder. The largest cluster of gunpowder factories was located in Fayette and Jessamine counties in the vicinity of South Elkhorn Creek. The industry here, and for the state, was pioneered by the Foley family.

The Foleys were among the earliest settlers in Kentucky. Richard Foley and family set out from Frederick County, Virginia for the western frontier in late autumn of 1779. Foley was accompanied by his wife Margaret (Wilson), and their six children ranging in age from ten years to eight months. By mid-December of that year, they had reached their intended destination, the fertile Bluegrass uplands between the Kentucky River and the heads of the Salt and Green rivers (present Mercer County). They may have been the first European arrivals at the site of an intended settlement, and helped to establish Bowman's Station. The Foleys, with several other families, spent a hard first winter at the station.

Decades later, Elijah Foley was interviewed by the Reverend John D. Shane. As Elijah recalled:

> My mother was the first white woman that was there for some time; and our coming was the first settling of the station. There was nothing but a camp there, till some time in March, because it was to cold to work. As soon as we had gotten a good camp, Colonel [Abraham] Bowman brought his family from Harrodsburg, and by spring we had twenty families that had camped in the snow and remained during that winter (Beckner 1937:255).

There are some alternative versions of the first camp at the station that winter of 1779. Regardless of whether or not the Foleys were actually first on the spot, they certainly were among the founders of the station (Wayland 1943:103-105).

The Foleys left Bowman's Station in 1787, and came to live in Fayette County near Lexington at about that time. Richard Foley's name first appears on the Fayette tax lists in 1789. In June 1791, Richard purchased 61.6 ha (154 acres) on South Elkhorn Creek, a few miles south of town, from Elijah Craig for "fifty pounds lawful money of Virginia" (Fayette County 1791). By this time, the Foley family had been increased by the addition of three more children. Richard built a house on the hill overlooking the Elkhorn. This site is bounded by the Higbee Mill Road to the north and the Clays Mill Road to the west.

The community of South Elkhorn takes its name from South Elkhorn Creek. Here in 1783 Lewis Craig established the first Baptist church and first worship assembly in Kentucky (Collins 1847:108). John Higbee was another of the early settlers in this neighborhood, who built a grist mill and operated several other enterprises including an inn and a tavern.

Soon after settling at South Elkhorn, Richard began making gunpowder by hand with mortar and pestle, according to family tradition. Many of the early settlers in Kentucky were well acquainted with the art of gunpowder manufacture. During the Revolutionary War, gunpowder had been a scarce and vital commodity in the colonies and instructions for its manufacture had been published in many newspapers. While the elements of powder making were common knowledge, making good gunpowder was not. The art of producing high quality black gunpowder lay in determining the best proportion of ingredients for the mixture and in the subsequent processing.

The manufacturing technology had remained virtually unchanged since gunpowder had first been made by the Chinese nearly a thousand years before the American Revolution. In all its aspects, gunpowder making was a highly dangerous trade. Because of the risk of explosion from even the slightest spark, all equipment was wooden. The basic items were a mortar and pestle, in which the moistened ingredients were ground and mixed. With a single mortar and pestle one man could produce small quantities of gunpowder for personal use; commercial operations used a series of these hooked to a camshaft and driven by water or animal power. The moist gunpowder mass was then pressed through a screen to produce grains of the desired size, and then dried. Finally the gunpowder was polished in a tumbler and packed into containers for use or sale.

Richard Foley must have been well acquainted with the techniques of gunpowder making, for he soon erected a powder mill on his property along the waters of South Elkhorn Creek. The mill most likely consisted of several buildings. The usual practice in powder manufacture was to conduct each step of the process in a separate building to minimize both the magnitude of an explosion and the loss of equipment. By spring of 1793 Richard had made sufficient quantities to advertise in the *Kentucky Gazette* (1793), available at his "powder mill on South Elkhorn," gunpowder of "superior quality, by the large or small quantity, at 3 [shillings] 9 [pence] per lb. with an allowance to those who purchase a large quantity." Based on available documentation, Richard Foley is believed to be the first person in Kentucky to produce gunpowder in commercial quantities.

In 1793, of the ten Foley children, only Elijah (22) and John (14), two of the five males, began to help their father in the powdermill. It was fortunate that they learned the trade, because Richard, 49 years old, died of measles the following year and the welfare of the family now depended on these two elder sons.

By the terms of Richard's will, probated in Fayette County in January 1795, his widow Margaret received 100 of the original 154 acres (40 of 61.6 ha), containing the "house and plantation" and presumably the powder mill operation (Fayette County 1795). Elijah received 54 acres (21.6 ha) from the southern end of the property, "laid off in such a manner as to include the big spring and the branch...". The other children in the family were to receive various sums as they reached age 21 (Fayette County 1795).

Elijah had his own family by this time, having married Rachel Miller prior to 1793, when their son Richard was born. On his 54-acre (21.6 ha) inheritance, he built a sturdy and spacious brick house in the Federal style, two and a half stories with a gable roof and full basement. Immediately after his father's death, Elijah assumed primary responsibility for running the powder mill, as indicated by an advertisement for gunpowder under his name in the 24 June 1797 *Kentucky Gazette*. A similar advertisement ran in 1799 (*Kentucky Gazette* 1799). However, Elijah was soon forced to turn the powder mill over to his brother John. Richard's widow, Margaret, died in 1801, and by the terms of her late husband's will, John was to assume possession of the "house and plantation," property which included the powder mill.

In 1803 John, now 24 years old, advertised in the *Kentucky Gazette* that he "has on hand, and keeps a constant supply of the first quality of gunpowder," at the South Elkhorn mill. This powder, which was also available at the store of Lewis Saunders in Lexington, was priced at two shillings per pound to "any person buying 25 pounds [11.25 kg], or more" (*Kentucky Gazette* 1803). The same advertisement was repeated on 21 February 1804.

As the years of the first decade of the nineteenth century passed, many other South Elkhorn families followed the lead of the Foleys and established mills to manufacture gunpowder. While there were many other mills in the neighborhood that produced ground corn, whiskey, and lumber, there came to be a greater concentration of gunpowder establishments at South Elkhorn than anywhere else in the state. While many of these local mills were small, in aggregate they constituted a significant portion of all gunpowder production for Kentucky.

According to the 11 May 1801 *Kentucky Gazette*, 3,042 pounds (1,368.9 kg) of gunpowder were shipped from the port of Louisville during the preceding six-month period. Although this was export shipment only from a single port, during the first years of the new century total gunpowder production in the state was only a fraction of what would be made in the years immediately preceding the War of 1812. The 1810 census of Kentucky manufacturers, a period when the threat of impending war with Britain had considerably boosted speculative production of black powder, reported the total for that year as slightly over 115,000 pounds [51, 750 kg] (Coxe 1814:125-126). This figure included local use as well as that for exports.

By comparison, the reported sales of South Elkhorn gunpowder by the largest wholesale/retail firm in Kentucky, that of Samuel and George Trotter in Lexington, amounted to 49,416 pounds (22,237.2 kg) of gunpowder from April 1806 to July 1812. This is equivalent to over 8,200 pounds (3,690 kg) of gunpowder produced per year by the mills of South Elkhorn. This powder was reported to have been resold to "regular customers residing in the state of Kentucky, Ohio, and Pennsylvania, and designed for home consumption" (Trotter and Trotter 1812).

The Trotter firm stated that they had purchased, for resale, gunpowder made in the mills of Daniel Bryant, John B. Miller, William Roman, Nathaniel Pettitt, and the three Foley brothers Elijah, John and William. This statement indicates that Richard Foley's third son William, who was 25 years old in 1806, had joined with his brothers to run the family business. All the other men named, Bryant, Roman, Miller, and Pettitt, were residents of the South Elkhorn area and near neighbors of the Foleys.

John Foley sold an adjoining 10.75 acres (4.3 ha) of the south end of his property to Elijah in 1802. With a similar purchase from another neighbor, Elijah increased his holdings to a little over 80 acres (32 ha). In 1804 William purchased 82.75 acres (33.1 ha) adjoining the east boundary of Elijah's land. Over the next few years the three brothers engaged in various land transactions until, by July 1811, John remained in possession of 40 acres (16 ha) of the original 100 (40 ha) left him in his father's will, including the house and powder mill; Elijah owned 76 acres (30.4) adjoining John; and William had divested himself of the property next to Elijah.

From February 1804 to November 1811, little is known of the Foley powder mill operation. No advertisements for Foley gunpowder appear in regional newspapers. On 12 November 1811 an advertisement appears in the *Kentucky Gazette*, under Elijah's name, that implies the mill may have been out of operation for several years beforehand. Elijah stated:

> Having put my powder mill in complete order, I am ready to manufacture powder....Merchants or others who wish to deal in that article will find it their interest to apply to the subscriber, living about six miles from Lexington... (*Kentucky Gazette* 1811).

Alternatively, this ad might also indicate a change in management. The mill was still on John's property, but the brothers may have made an agreement whereby Elijah managed or even purchased the powder mill. The use of the phrase "my powder mill" in the ad seems to imply ownership.

Additional light on the fortunes of the Foley powder mill in the years immediately preceding the War of 1812 is shed by a series of broadsheets published in July 1812. According to one of these sheets, the firm of S & G Trotter had in 1809 stopped purchasing any gunpowder from the Foley mill (Trotter and Trotter 1812). This would had been a severe blow to the Foleys, and might well have forced the mill to shut down its operations. Having lost a guaranteed outlet for the output of the Foley mill, the advertisement for gunpowder placed in the 11 November 1811 *Kentucky Gazette* by Elijah was likely an attempt to regain a market share. However, by that time many persons, anticipating the outbreak of war, had constructed powder mills in the Bluegrass. Among these were the Trotter brothers, who with ample funds built powder mills on the Old Frankfort road that soon became the largest such establishment in the state. The Trotters used their political connections to help land huge military contracts for gunpowder from the U.S. government (O'Dell 1990).

Under these circumstances, Elijah became embittered and let his resentment overpower his discretion. In late summer 1811, Elijah accompanied by several neighbors, was riding through the South Elkhorn neighborhood, returning from a trip to Lexington. Elijah, John Keller, Jacob Keller (John's son; the Kellers were South Elkhorn landowners who shared a boundary with the Foleys), William Pollard, Elijah Pollard, and John B. Miller (Jessamine County powderman, near neighbor to the Foleys) were en route to the Republican Meeting House on the Higbee Mill Road (a non-denominational place of worship, established 1801, located directly across the stream from the Foley property) (Ward 1933). Along the way John Keller remarked "I wonder where all the powder went that was made for Trotter's in this neighborhood?" Allegedly, Elijah Foley replied, "They sent it to Canada, for his brand was seen there." According to a deposition by one of his companions, Elijah implied that the Trotters were supplying the British with gunpowder and thus were traitors to their country (Trotter 1812).

Emotions were high in those months before the outbreak of war, and this incendiary rumor spread through the Bluegrass with various elaborations. The indignant Trotters responded in July 1812 with a broadsheet to which were appended various depositions of their good character and proofs of the destinations of their gunpowder. The Trotters referred to Elijah as "a man, who, from habitual intoxication has become considerably deranged in his intellects" (Trotter and Trotter 1812).

Elijah immediately printed up a somewhat incoherent handbill of his own, in which he denied having spread any such rumor. Purportedly sworn statements were attached, but in reading, these seem to do more damage than if they had been omitted. One such statement, used inexplicably as exoneration for Elijah, read thusly:

> WILLIAM POLLARD says, before witnesses, that he never heard Foley say that the said Trotters had sent powder to Canada but once, and then Capt. Foley was in a state of intoxication, and knew not what he was saying (Trotter 1812).

George Trotter Jr. printed still another handbill on 31 July, in which he reproduced Elijah's own sheet and asked the readers to draw their own conclusions.

There was no time left to pursue the handbill war further. War with Great Britain had been declared on 18 June 1812, and volunteers were mustering to fight the British and their Indian allies in the Northwest. George Trotter, Jr., a colonel in the Fayette militia, left Lexington to become personal aide to General William Henry Harrison. Samuel Trotter stayed in Lexington and made gunpowder for the army (O'Dell 1990). Elijah, who had been active in the local militia (42nd regiment, Fayette County) since 1800 (Clift 1957:78) and was known to his neighbors as "Capt. Foley" (Trotter 1812), enlisted in the mounted volunteer militia as a private soldier in the company of Captain James Williams, commanded by Lt. Colonel James Allen (Kentucky Adjutant General's Office 1891:254). Elijah served his 30-day term in Harrison's army and spent the rest of the war at home.

After the war, the gunpowder manufacturing industry in Kentucky was ruined as Great Britain flooded American markets with high quality gunpowder at very low prices. Very few of the mills were able to survive. Apparently the Foley gunpowder mill was among the casualties of the depressed postwar economy, for it was never heard from again.

Over the next few years Elijah's fortunes sank still further. From the evidence in the Trotter broadsheets, Elijah was an alcoholic. In the 17 April 1815 edition of the *Kentucky Gazette* appeared the following notice: "The trustees for Elijah Foley (insane) Thos. Roberts, John & Jacob Keller, caution the public not to deal with Foley due to his insanity." In July 1816 John and Jane Foley sold their land, including the powder mill, to Jane's father Thomas Roberts. Three months later, a deed in the Fayette books under the date of 3 October 1816 granted provisional title to Elijah's house and 32 acres (12.8 ha) of land to Roberts and James Craig.

The circumstances were rare for that period. According to the deed:

> Whereas the said Elijah Foley & Rachel Foley from some unfortunate circumstances are unable longer to live together as man and wife and they have immediately agreed to separate and the said Elijah by these

presents, releases and relinquishes all right and claim in the said Rachel as his wife and covenants from henceforth to withdraw from and never more to molest the said Rachel. And the said Rachel hereby releases and relinquishes all claims in the said Elijah Foley for future support and covenants henceforth to withdraw from the said Elijah Foley (Fayette County 1816).

Roberts and Craig, as trustees of the Foley estate, were to offer the property for sale to the highest bidder. One-third of the proceeds were to go to Rachel for support of herself and her children, and the remainder to Elijah.

The record is not clear as to exactly what happened at this point. The Fayette tax lists show Elijah in possession of 33 acres (13.2 ha) in 1817 and for many years afterward, increasing to 40 acres (16 ha) by 1839. Apparently a reconciliation came about between Elijah and Rachel, as the property was not sold and Rachel is listed as wife to Elijah in the 1840 census for Fayette County. The 40-acre (16 ha) tract is shown under Rachel's name on the tax lists in 1844, a year after Elijah's death in 1843. Rachel's name did not appear on the tax list for 1845, but her son James is shown in possession of 35 acres (14 ha) beginning at that time. Evidently Rachel died in 1844. The 1861 and 1877 maps of Fayette County show Thomas Foley in residence at the Elijah Foley home place (Beers and Lanagan 1877; Smith, Gallup & Co. 1861); Thomas was grandson to Elijah through Elijah's youngest son Richard. Thomas died in 1892.

The old house passed out of the hands of the Foley family, and in the 1970s was occupied as a tenant residence and later became vacant. In 1992 vandals set fire to the interior and gutted the structure, collapsing the roof (Edwards 1994). Attempts by the Blue Grass Trust for Historic Preservation to find a buyer who would restore the house, an expensive undertaking, were unsuccessful. In 1994, the remains of the structure were dismantled, the brick salvaged for its resale value, and the site graded over to make way for housing in a new subdivision development.

The Foleys were important early pioneers in Kentucky, and have left numerous descendants now scattered across the country as well as in the Bluegrass. Richard Foley certainly deserves a footnote in history as the man who first began commercial production of gunpowder in Kentucky, nor is his colorful if erratic son, Elijah, likely to be forgotten soon. Careful reconstruction of the past, by means including archaeological excavations and also deeds, letters, and contemporary accounts, serve to recreate historical events and help bring to life personalities. In learning about our antecedents, we also learn about ourselves.

ARCHAEOLOGICAL INVESTIGATIONS

During the initial visit to the Foley House, it was observed that much of the site had been affected by recent construction activities. The eastern half of the house had been demolished and the resulting brick rubble piled in the rear yard. A sewer manhole had been installed near the former northwest corner of the house and the small basement was partially filled with rubble. The western yard had been bulldozed to subsoil, trees and undergrowth had been bulldozed from the rear of the structure, and a strip had been bulldozed across the back yard. A layer of fill had been deposited between the house and garage and across the narrow front yard. These activities severely restricted our sample of the Foley House midden and the locations where we could place excavation units.

The archaeological investigations at the Foley House (15Fa231) used a combination of hand excavation units and shovel probes (Figure 2). A total of 20 square meters were excavated. Sixteen of the units were 1 x 1 m in size and one unit was 2 x 2 m in size. The 1 x 1 m units were used to sample the north (front) yard, the southeast yard, and the southwest corner of the garage. Nine of the units formed a 3 x 3 m block in the southeast portion of the yard. A final unit (2 x 2 m) was excavated within the eastern wing (kitchen) of the house after demolition to sample a midden. All units were excavated in arbitrary 10 cm levels and the soil was screened through 13 mm hardware cloth. Artifacts were bagged and provienced by unit and level. The 39 shovel probes were excavated on a four meter grid to sample the rear (south) yard and to obtain information from areas between units. They also were excavated in 10 cm levels and screened through 13 mm hardware cloth. The artifacts and records are curated by the Museum of Anthropology at the University of Kentucky.

CULTURAL DEPOSITS AND FEATURES

The cultural deposits at the Foley House have experienced varying degrees of disturbance throughout the history of the site. The soil profiles exhibit only minor stratigraphic differences. In general, the cultural deposits are confined to the upper 30 cm of soil usually containing two zones. A sterile clay subsoil extends below 30 cm in most instances. In areas disturbed by historic pipe lines, cultural remains extend to a greater depth within backfilled trenches. Because of the simplicity of the cultural deposits, comments will focus on different areas. These areas include the front of the house, the area near the southeastern rear yard, the 3 x 3 m excavation block, and the southwestern corner of the garage. Two units excavated in front of the house were placed adjacent to the house foundation. The soil in this area turned out to be disturbed by drainage and gas pipe lines. In these units the midden (10-30 cm thick) was a medium brown clay loam underlain by a reddish brown clay subsoil.

The soils in the 3 x 3 m excavation block, southern yard, and area at the southwest corner of the garage had slightly different profiles. In the 3 x 3 m block, three soil horizons were noted: a medium brown clay loam (10-14 cm thick) overlying a light brown clay loam (15-22 cm thick) which terminated on an orange brown clay (unknown thickness). The soils in the back (south) yard also consisted of three horizons: a medium brown clay loam (13-17 cm thick) overlying a light brown clay loam (12-18 cm thick) which terminated on a light yellowish brown clay (unknown thickness). The area adjacent to the garage contains a dark brown loam (12-20 cm thick) overlying an orange/brown clay (unknown thickness). A dense layer of gravel was present in front of the garage just beneath the grass.

Two features were recorded during the investigations. Feature 1 was located at the base of level 1 (10 cm deep) in Unit 6. This crescent-shaped area measured 83 cm north-south and 34 cm east-west and appeared to extend to the east. Excavation revealed that it was a shallow (less than 10 cm) lense of dark brown clay loam containing charcoal, coal cinders, wire nails, and burned glass. This feature probably represents the contents of a stove or fireplace that was dumped in the yard. Feature 2 is a large post mold located at the southwest corner of the garage in Units 12 and 16. It measures 40 cm north-south, 53 cm east-west, and 70 cm deep. The mottled fill (dark brown clay loam/orange clay) of Feature 2 yielded brick fragments, limestone fragments, wire, and a few twentieth century artifacts.

Pipes were encountered in three units. In Unit 1, a ceramic sewer or drain pipe was uncovered at the base of level 1 (10 cm deep). The pipe extended from the center of the south wall to the northwest corner of the unit. Since Unit 1 is adjacent to the kitchen of the Foley House, the ceramic pipe may have

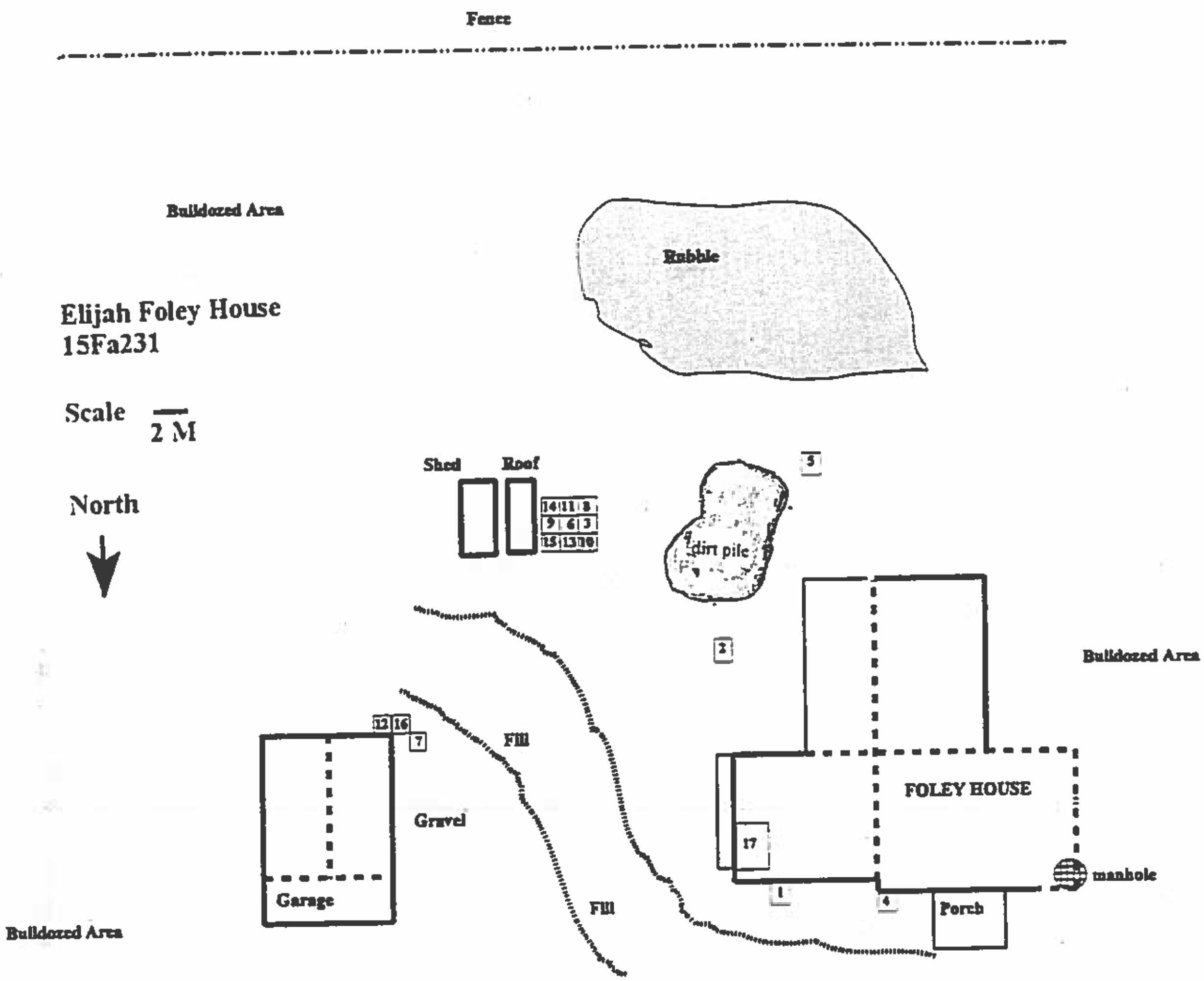

Figure 2. Map of the Elijah Foley Site Showing the Structures, Disturbances, Excavation Units, and Shovel Probes.

served as a drain for the kitchen sink. Two parallel pipelines were unearthed in Unit 4. These pipes extend northward across the center of the unit. They may have been water or gas lines. Finally, a pipe trench was encountered along the west wall of Unit 17 under the former kitchen after demolition. The trench was excavated to a depth of 25 cm below the unit floor and was still going down. We suspect that it is a modern water or sewer line running to the bathroom.

Other possible features were noted during the investigations. In the northeastern (Units 13 and 15) and the southeastern (Unit 14) corners of the 3 x 3 m excavation block, some evidence of a former outbuilding was uncovered. In Unit 15 and the adjacent edge of Unit 13, several small limestone slabs and a few brick fragments were in an L-shaped configuration (possible corner). Two meters to the south in Unit 14, some additional limestone slabs, brick fragments, and a concentration of mortar were encountered in a linear configuration. The limestone, bricks, and mortar may be foundation remanents from a former outbuilding. The high density of animal bones in the excavation block indicates that this may have been the smoke house. A circular stone ring was exposed north of the garage and ash beds were noted along the fence row between the house and garage. Unfortunately, this area was bulldozed before it could be studied.

It was planned that the plowzone from the backyard of the Foley House be stripped off before the area was bulldozed. It was felt that this area potentially contained privy pits and other features dating to the late 1700s and early 1800s. During the final grading for the subdivision, the developer decided to place fill over the backyard, and it was not possible to have top soil removed to look for features.

ARTIFACT ANALYSIS

The Elijah Foley assemblage consists of 6,657 artifacts. The majority of these artifacts (n=6,012) were historic, as expected. However, a large assemblage of prehistoric artifacts also were recovered. Most of the prehistoric artifacts are associated with a Late Prehistoric Fort Ancient component. A separate paper will focus on the Fort Ancient component while this report will be restricted to the historic component.

Functional Groups

During analysis, artifacts were first classified by material type categories including ceramics, flat glass, other glass, metal, bone/shell, and other materials. Subsequent analysis focused on attributes with chronological and stylistic implications such as manufacturing types, decoration styles, functional class, and form types. Finally, the artifacts were assigned to general functional groups based on South's classification (South 1977), in order to determine historic artifact patterning.

A total of 11 general functional groups were used in this classification, representing an expansion of South's (1977) original eight functional categories. However, many historical archaeologists frequently modify the groups and group contents to account for temporal and regional variations. For this study, it was necessary to breakdown groups into more specific additional groups. This was done to enable a more in-depth investigation of particular activities. This modification of groups permits a more complete interpretation of the site. The 12 functional groups used in this analysis include kitchen, architecture, clothing, activities, arms, personal, furniture, entertainment, transportation, faunal, and miscellaneous groups. The Foley artifact assemblage will be discussed within this framework of these functional groups (Ball 1984; South 1977; Young et al. 1990).

The Elijah Foley artifact assemblage is comprised predominately of artifacts from the kitchen and architecture groups. The remaining groups were moderately represented. The faunal assemblage comprised a large part of the artifact assemblage. The distribution of artifacts within the functional group framework can be seen in Table 1.

Table 1. Functional Groups at the Foley House.

Functional Groups	Number	Percentage
Kitchen	1,730	28.7%
Architecture	2,246	37.5%
Furniture	195	3.2%
Entertainment	27	0 .5%
Clothing	75	1.2%
Activities	198	3.3%
Arms	21	0 .4%
Transportation	18	0 .3%
Miscellaneous	90	1.4%
Faunal	1,381	23.0%
Personal	31	0 .5%
Total	**6,012**	**100%**

Kitchen Group

The kitchen group artifacts include items that would be associated with kitchen related activities, such as food preparation, service, and storage. This group also includes items that were not necessarily related to foodways, but may also have been stored and used in the kitchen, such as pharmaceuticals, cleaners, and other household chemicals. The majority of the kitchen group consists of ceramic and glass artifacts, accounting for 29 percent of the group totals (Table 1). The remaining kitchen group artifacts were metal.

Ceramics. There were 642 sherds recovered that were in the kitchen group. The sherds were classified by attributes into ceramic type, decoration type, decoration color, vessel part, and vessel form. Eleven different types of ceramics were present which included: whiteware, white granite, pearlware, porcelain, yelloware, redware, buff stoneware, grey stoneware, creamware, and fixture porcelain. Most of these types are well known to historical archaeologists, however, several of these types require some definition. For this analysis, fixture porcelain refers to a thick rough porcelain like ceramic often used in the twentieth century for lighting fixtures and bathroom fixtures. The term whiteware refers to a very porous refined earthenware with a white body and a white paste. White granite represents a non or slightly porous refined earthenware that has a white body and white paste, and is commonly called "Ironstone" (Miller 1991). There were many trade names that were used to describe white granite during the nineteenth century. The distinction between porous and non-porous whiteware may have chronological implications since American potters were trying to emulate fine non-porous porcelain (Majewski and O'Brien 1987). Although some English ceramics, using the name "Ironstone," were produced as early as 1805, wide spread manufacture of white granite ceramics did not begin until 1845 (Miller 1991; Noel

Hume 1969). Thus, as manufacturing techniques improved over time, the non-porous aspect of ceramics increased suggesting that non porous whitewares would become more frequent through time. This trend can be substantiated with marked English and American ceramic pieces that reveal trade names like ironstone, semi-porcelain, graniteware, stone china, and semi-vitreous, which typically exhibit late nineteenth century dates (DeBolt 1994; Godden 1964). Although porosity can be relative to a particular analyst, consistency was ensured for the Foley House assemblage by having the same person analyze all the ceramics.

The distribution of these ceramic types throughout the Elijah Foley Site are illustrated in Table 2. The most frequently encountered ceramic types were whiteware and white granite, which accounted for 29 and 25 percent of the ceramic assemblage, respectively. A substantial amount of redware (Figure 3c-e) also was recovered from the Foley Site, constituting 14 percent of the ceramic assemblage. Frequencies of pearlware, porcelain, yelloware (Figure 3a-b), and stoneware (Figure 3f-g) also were significant, while remaining ceramic types represented less than two percent of the ceramic assemblage.

Table 2. Ceramic Types at the Foley House.

Ceramic Type	Number	Percentage
Whiteware	232	29.0%
White granite	202	25.3%
Pearlware	78	9.7%
Porcelain	61	7.6%
Yelloware	36	4.5%
Redware	113	14.2%
Stoneware	46	5.7%
Creamware	8	0.9%
Fixture porcelain	5	0.6%
Sewer pipe	10	1.2%
White clay	3	0.4%
Unidentified	7	0.9%
Total	**801**	**100%**

Ceramic types result from a particular mode of manufacture. A chronology of ceramic types can be constructed using manufacturing attributes. Although date ranges are very broad for ceramic types, it is possible to place an assemblage within certain decades or show popular transitions of ceramic types. Creamware, pearlware, redware, and yelloware are the best indicators of temporal affiliation. Creamware has a general manufacturing period from 1762 to 1820, pearlware 1780 to 1830, redware 1750 to 1870, and yelloware 1830 to 1930 (Ketchum 1983; South 1977). Whiteware also can be useful in designating the ceramic transition between the late nineteenth century and early twentieth century. In this case, whiteware has been given a general date of 1830 to 1890 (Smith 1983) and white granite a general date of 1845 to the present, which will be represented by 1950 (Miller 1991). It is most probable that white granite sherds recovered from the Elijah Foley Site were produced prior to the mid-twentieth century.

The next attribute taken into account for the ceramic assemblage was that of decoration type.

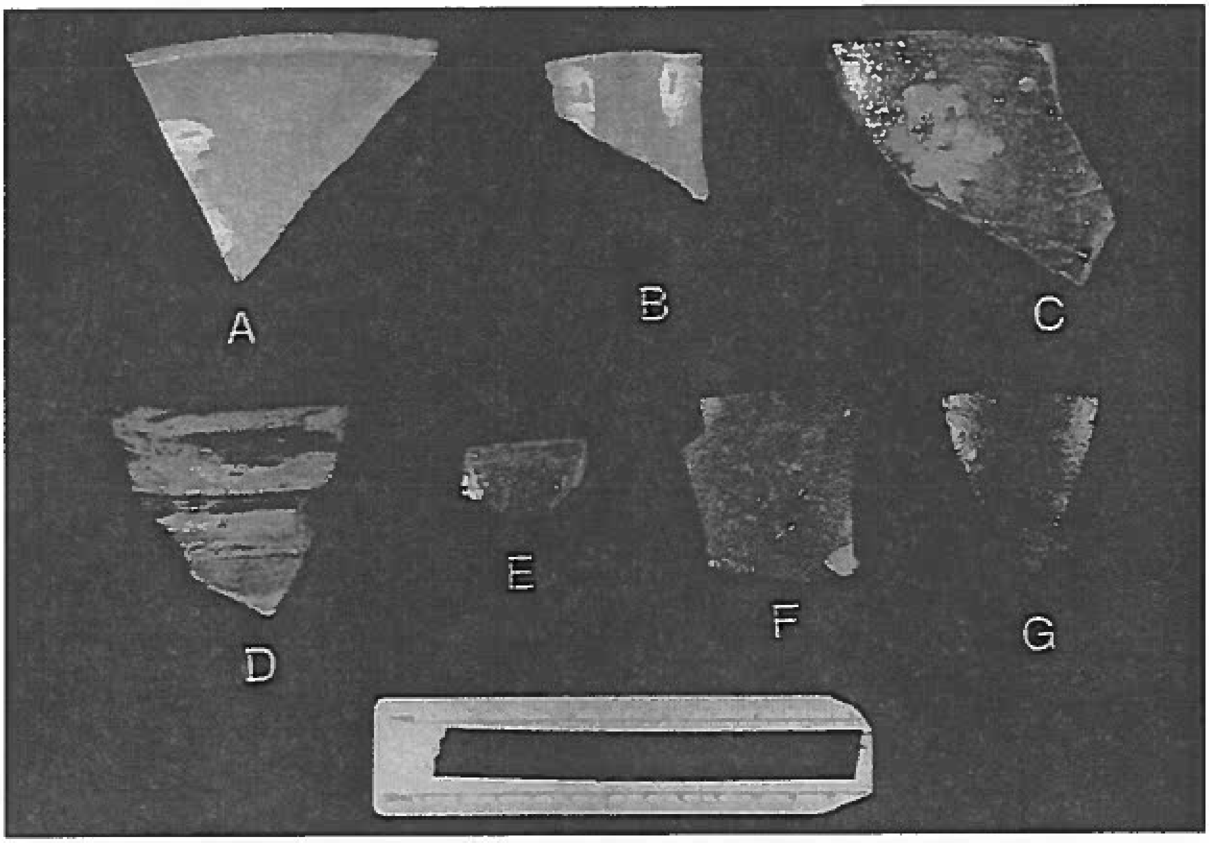

Figure 3. Ceramics From the Foley Site: a-b, yelloware; c-e, redware; f-g, salt glazed ware.

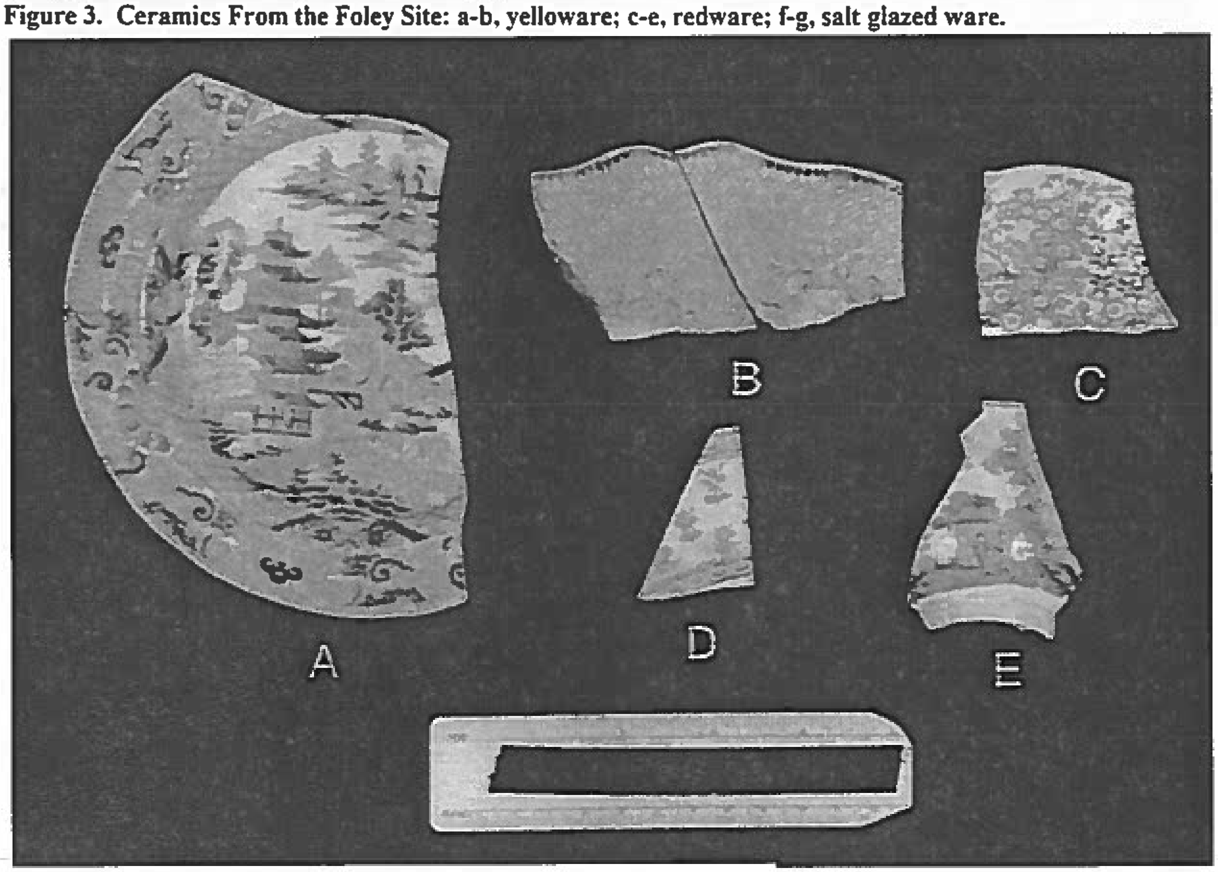

Figure 4. Transfer Printed Ceramics From Unit 17 at the Foley Site.

Decoration styles can have both chronological and stylistic implications. Fifteen different types of decoration were present in the ceramic assemblage. The decoration types included plain, decal, transfer printed (Figure 4), edge, mocha, Rockingham, flow, colored glaze, relief, shell edge, hand painted (Figure 5), banded, sponge, luster, and salt glaze. The majority (46 percent) of the ceramics were plain while relief decoration (15 percent) was the second most common type. Transfer printed, salt glazed, clear glaze, slip glaze, and shell edged decorations were well represented in the assemblage. The remaining decoration types were represented by less than two percent each of the assemblage.

Some decoration types have general periods of manufacture, depending on which ceramic type they appear, refining their chronological placement. The best dating indicator found at the Elijah Foley Site is transfer printed ceramics. This type of decoration on pearlware has a general date range of 1795 to 1830 (South 1977). Transfer printing that occurs on whiteware has a general date range of 1830 to 1860 (Price 1979). While other decoration types have general date ranges, these date ranges are just as broad as those for ceramic types.

Some other non-chronological trends can be observed from the distribution of decoration types at the Elijah Foley Site. The refined earthenwares exhibited differing patterns of decoration. Whiteware, pearlware, and white granite were more likely to be decorated than porcelain, yelloware, and creamware. Pearlware was the most likely to be decorated with a transfer print, shell edge, or flow, which is a type of transfer print. Whiteware was mostly decorated with transfer print, flow, shell edge, and colored glaze. However, the majority of these two ceramic types were plain. The majority of white granite was decorated in relief and transfer print, with relief occurring more often than plain decoration. The remaining refined earthenwares were typically plain isolated examples of other decoration (Table 3).

General date ranges for ceramic types and decoration types can be combined and computed to produce a mean ceramic date for the site (South 1977). The mean ceramic dating formula for the Elijah Foley Site produced a date of 1857 (Table 4).

Based on the ceramic attributes examined, the bulk of the assemblage is representative of the late nineteenth century. However, substantial amounts of earlier ceramics were present in the assemblage. The historic documentation suggests an occupation at this site since the 1790's, which is also reflected in the ceramic assemblage. The use of ceramic attributes as temporal indicators can be problematic, because the date indicated for a particular attribute only reflects the date of manufacture and is not indicative of the date of archaeological deposition. Also, ceramics were often objects that were considered heirlooms and passed from generation to generation. However, accidental breakage or stylistic taste often interrupted this tradition. South (1977) suggested an average of 20 years lag to account for these instances. Caution must be taken when using distribution of sherd frequencies, particularly for the mid nineteenth century to early twentieth century, when mass production of inexpensive ceramic goods made it feasible for people to purchase higher qualities of ceramics. Such may bias the distributional relationships of ceramic types.

The ceramic assemblage also was analyzed for vessel parts and vessel forms. By analyzing vessel part frequencies, it is possible to produce minimum vessel counts. However, this analysis has more implications for determining site integrity. The most prevalent vessel part is the body sherd which accounts for 57 percent of the ceramic assemblage. Rim sherds were the next abundant vessel part with only 20 percent of the ceramic assemblage. Remaining vessel parts, include bases, attachments, other, and whole, were modestly represented. The condition of these sherds were very poor, with most sherds being less than two centimeters in size (Table 5).

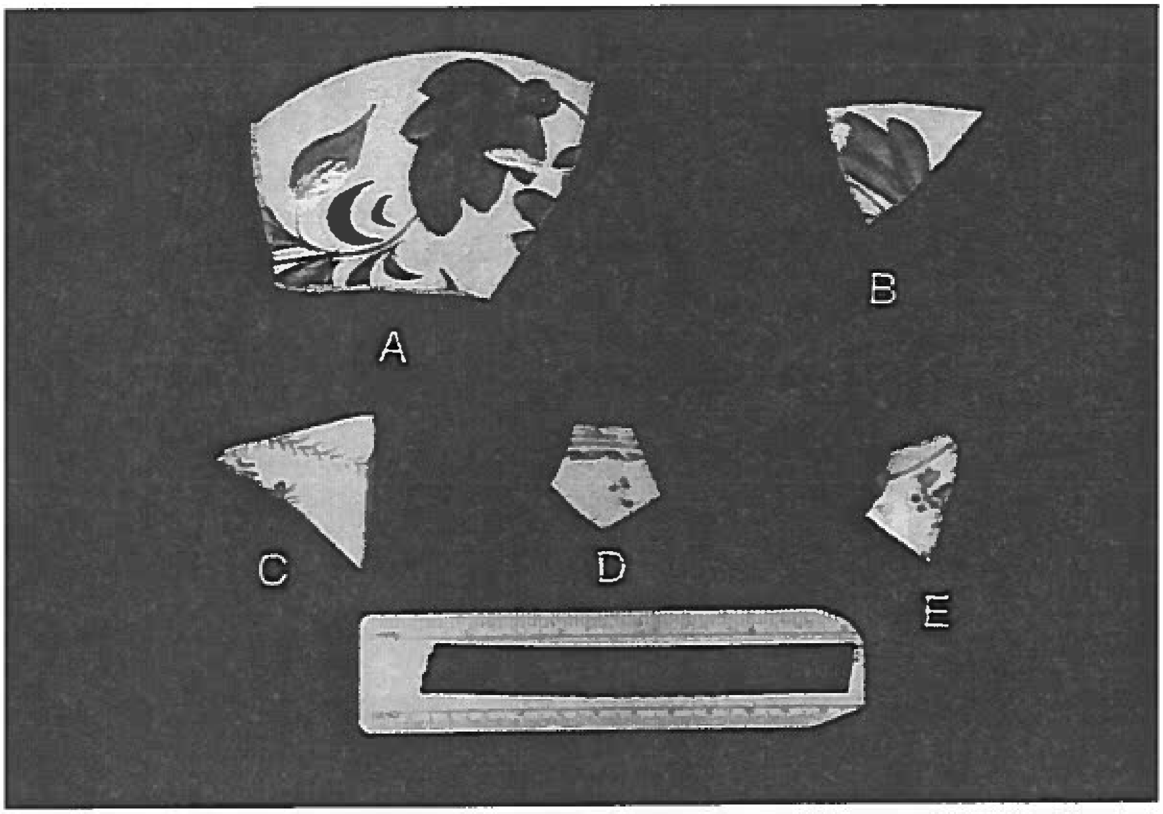

Figure 5. Hand Painted Ceramics From Unit 17 at the Foley Site.

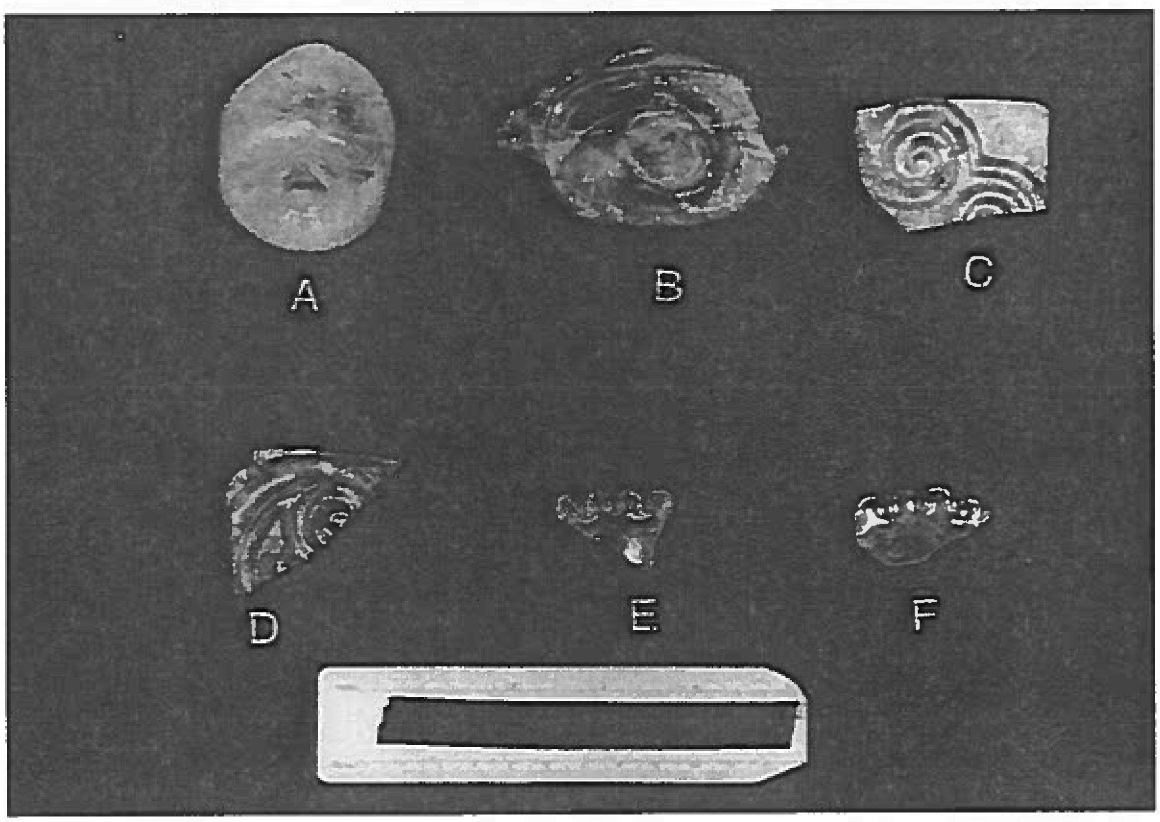

Figure 6. Glass From the Foley Site: a-b, bases of bottles with pontil scars; c-d, body sherds with relief designs; e-f, lamp globe crowns.

Table 3. Ceramic Decoration Types at the Foley House.

Type	W. ware	W. granite	P. ware	Porc.	Y. ware	C. ware	R. ware	S. ware	Total	%
Undecorated	142	74	35	41	31	7	27	1	358	46.1
Decal	2	7	0	3	0	0	0	0	12	1.5
Transfer printed	40	0	19,	5	0	0	0	0	64	8.2
Edge	3	0	3	1	0	0	0	0	7	1
Mocha	2	0	0	0	1	0	0	0	3	0.4
Rockingham	1	0	0	0	3	0	0	0	4	0.5
Flow	12	0	4	0	0	0	0	0	16	2.1
Slip	10	4	0	1	0	0	6	20	41	5.3
Relief	1	109	1	2	0	0	1	1	115	14.8
Shell edged	16	1	9	1	0	0	0	0	27	3.5
Trans. printed & shell edge	1	0	0	0	0	0	0	0	1	0.1
Hand painted	2	0	4	4	0	1	0	0	11	1.4
Banded	0	5	2	0	1	0	0	0	8	1
Decal, lustre, & relief	0	2	0	1	0	0	0	0	3	0.4
Sponge	0	0	1	0	0	0	0	0	1	0.1
Clear/lead glaze	0	0	0	0	0	0	73	0	73	9.4
Salt glaze	0	0	0	0	0	0	6	24	30	3.9
Swirl	0	0	0	2	0	0	0	0	2	0.3
Total	**232**	**202**	**78**	**61**	**36**	**8**	**113**	**46**	**776**	**100**

Table 4. Mean Ceramic Date at the Foley House.

Ceramic Type	Decoration Type	Number	Mean	Reference
Whiteware	Undecorated	142	1860	Smith 1983
	Decal	2	1925	Adams 1980
	Transfer print	40	1850.5	Price 1979
	Edge decorated	15	1845	Price 1979
	Mocha	2	1850	Smith 1983
	Flow blue	12	1862.5	Price 1979
	Trans. print & edge	1	1845	Price 1979
	Hand painted	2	1850	Price 1979
Pearlware	Undecorated	35	1805	South 1977
	Transfer print	19	1812.5	Smith 1983
	Edge decorated	12	1810	South 1977
	Hand painted	4	1812.5	Smith 1983
	Banded	2	1810	Smith 1983
Creamware	Undecorated	7	1791	South 1977
Redware	All	113	1810	Ketchum 1983
Yelloware	Undecorated	31	1880	Ketchum 1983
	Mocha	1	1880	Ketchum 1983
	Banded	1	1880	Ketchum 1983
	Rockingham	3	1870	Barret 1964
White granite	Undecorated	195	1897.5*	Miller 1991
	Decal	7	1925.5*	Adams 1980
	Total	**647**	**1857**	

*Based on date ranges of 1845-present (1950) and 1901-present (1950).

Table 5. Ceramic Vessel Parts at the Foley House.

Vessel Part	Number	Percentage
Body	435	56.6%
Rim	157	20.4%
Base	47	6.1%
Attachment	3	0.4%
Other	85	11.2%
Whole	41	5.3%
Total	**768**	**100%**

Nearly three-fourths (73 percent) of the ceramic sherds could not be identified by vessel form. This difficulty occurred because of the high frequency of very small body sherds. Of the identifiable vessel forms, plates were the most abundant followed by bowls and cups (Table 6). Other vessel forms included saucers, crocks, platters, teapots, and a bottle.

Glass. Glass artifacts comprised the majority (n=986) of the kitchen group. The glass artifact assemblage was analyzed for vessel portion, which categorized each shard as lip, base, body, rim, whole, or other. When lip and base shards were discovered, they were analyzed for their specific type of manufacture. These two aspects of container glass are the most diagnostic for dating. Only 21 glass container lips were identified from the assemblage. The majority of the lips (n=19) were machine made while the remainder consisted of two applied lips and one unknown lip. Machine made lips date from the early twentieth century to the present. The applied lip process was generally used from the eighteenth century to the late nineteenth century (Diess 1981; Jones and Sullivan 1989).

Thirty-one basal portions were identified in the glass assemblage. Most (n=17) of the base portions exhibited Owens scars while five basal portions had pontil marks (Figure 6a-b), two were plate bottom molded, and seven were unknown. The Owens scar is indicative of the automatic bottle making process developed by Michael J. Owens in 1903; the process is still used today (Diess 1981; Jones and Sullivan 1989). The pontil marks are caused by breaking the pontil from the base of a vessel. The pontil was used to hold the glass vessel during tooling and final shaping of a vessel. This process was prominent from the eighteenth century to the late nineteenth century (Diess 1981; Jones and Sullivan 1989). The plate bottom molded base is representative of a late nineteenth century date (Diess 1981).

Lip or rim sherds were analyzed for the type of seal that would have been used. There were 33 identifiable examples of glass container seals from the assemblage. Screw caps were the most prevalent (n=16) while the stopper seal type was next in frequency (n=10). Other seal types were minimally represented and include the crown cap, lock top, and open vessel. Screw caps and crown caps began during the late nineteenth century and are still used today (Newman 1970; Diess 1981).

The glass assemblage was analyzed by color. Most glass color types are either undiagnostic or their period of manufacture is very broad. However, some color types such as amethyst and amber colored glass can provide limited temporal information. These glass colors are much more diagnostic because of their shorter period of manufacture. Amethyst glass, was formed by adding manganese to the glass mixture, in an attempt to make glass clear. This attempt was successful, however, the glass became an amethyst color when exposed to ultraviolet light. The period of manufacture for this type of glass occurred between 1880 to 1914 (Kendrick 1966). Different chemicals were used to produce amber glass. It has a date range of 1914 to 1930 (Kendrick 1966). The Elijah Foley glass assemblage produced 11 sherds of amethyst glass and two sherds of amber glass. The most abundant glass color was clear, which dates from 1875 to the present (Fike 1987). Earlier glass colors include green tinted, blue tinted, olive, and black. These colors have continue to be produced today. Although glass color does not provide much information for identifying nineteenth century context, it can be useful for determining early twentieth century contexts.

Table 6. Kitchen Ceramic Vessel Forms (number of sherds) at the Foley House.

Form/Type	Whiteware	White granite	Pearlware	Porcelain	Yelloware	Redware	Stoneware	Total	Percentage
Unidentified	179	150	34	19	32	95	28	537	72.9%
Plate	20	41	30	3	0	0	0	94	12.7%
Bowl	6	14	8	4	3	2	0	37	5 %
Saucer	1	0	2	2	0	0	0	5	0.7%
Cup	8	14	1	8	1	0	0	32	4.3%
Crock	0	1	0	0	0	3	15	19	2.7%
Platter	0	10	1	0	0	0	0	11	1.5%
Teapot	0	0	1	0	0	0	0	1	0.1%
Bottle	0	0	0	0	0	0	1	1	0.1%
Total	**214**	**230**	**77**	**36**	**36**	**100**	**44**	**737**	**100%**

Container glass decoration was analyzed. Most of the sherds were plain or exhibited no decoration. Twenty-five of the sherds were embossed, however, they were generally too small to yield diagnostic information. Other types of decoration exhibited were pressed, cut, relief (Figure 6 c-d), and screen printed designs. Screen printed designs are the only diagnostic decorations represented in the later group, and dates to the mid twentieth century (Diess 1981).

The functional class of sherds was determined when possible. Unfortunately, most of the sherds were undiagnostic for identifying functional class. Of the discernable functional class types, beverage bottles were the most common class of kitchen sherds. A detailed listing of glass functional classes recovered from the Elijah Foley House is illustrated in Table 7.

The remainder of the kitchen group artifacts consists of several examples of metal and bone items including forks, knives, spoons, pot handles, and caps for bottles.

Architecture Group

The architecture group consists of artifacts associated with structures, including building materials and decorative architectural attributes. The majority of the architecture group consists of metal artifacts (n=1,209) and window glass (n=1,020). The architecture group accounted for 37.5 percent of the Elijah Foley assemblage (Table 1).

Metal. This assemblage was primarily divided between nails and other metal artifacts. The nail assemblage consists of three types of nail manufacture, wrought, machine cut, and wire. Each of these nail types have chronological significance. Wrought nails were hand made and are indicative of the earliest type of nail manufacture, predominating before the nineteenth century. However, this type of manufacture was practiced

Table 7. Kitchen Glass Functions at the Foley House.

Function	Number	Percentage
Unidentified	931	96.0%
Canning jar	1	0.1%
Stopper	3	0.3%
Tumbler	3	0.3%
Lid liner	4	0.4%
Dropper	2	0.2%
Other medicine bottle	1	0.1%
Milk bottle	1	0.1%
Lid	1	0.1%
Beverage bottle	15	1.6%
Local medicine bottle	3	0.3%
National medicine bottle	2	0.2%
Pharmaceutical bottle	2	0.2%
Cosmetic container	1	0.1%
Total	**970**	**100%**

up until the mid nineteenth century. Machine cut nails, or square nails were the first mass produced nails cut from sheets of metal. This nail type dominated the early to late nineteenth century with production ending in the 1880s (Nelson 1968; Smith 1975). Wire nails or circular nails were developed in the 1860s and became most prevalent at the turn of the century. They are still the dominant nail type today (Nelson 1968; Smith 1975).

The Foley site nail assemblage exhibited all three types of nails. Each nail was examined to determine whether it was a whole specimen or a fragment. The total amount of whole nails from the assemblage was 365. Nail fragments accounted for 566 items of the total identifiable nail assemblage which totaled 931 artifacts. The fragmented nail assemblage was dominated by the machine cut type with 81 percent of the assemblage. Wire nail fragments comprised only 17 percent of the fragment assemblage, while the wrought fragments frequency was two percent. Fragmented nails have limited utility outside of chronology (Table 8).

Table 8. Nail Sizes at the Foley House.

Size/Type	Wire	Machine cut	Wrought	Total
Fragment	98	460	8	**566**
2d	6	17	0	**23**
3d	10	30	0	**40**
4d	18	20	0	**38**
5d	3	7	0	**10**
6d	19	3	0	**22**
7d	6	3	0	**9**
8d	56	18	0	**74**
9d	25	6	0	**31**
10d	43	12	0	**55**
12d	11	3	0	**14**
16d	7	2	0	**9**
20d	11	2	0	**13**
30d	3	1	0	**4**
40d	0	4	0	**4**
50d	1	1	0	**2**
Large head	16	0	0	**16**
Rose head	0	1	0	**1**
Total	**333**	**590**	**8**	**931**

Whole nails provide a wealth of information pertaining to the structures at the site. Of the 365 whole nails recovered, the majority (64 percent) were wire nails. The machine cut nails comprised 35 percent of the whole nail assemblage (Table 8).

The fact that a nail is whole allows its size to be determined. Nail size is an indicator of the type of construction that occurred. Different size nails were used for different aspects of construction. Small nail sizes were better for roofing, while larger nails were better for framing. Whole nails can be classified as pulled, clinched or unaltered (Young 1994). Pulled nails were removed after having been driven fully or partially into a surface. Clinched nails were driven into a surface and the protruding point was then bent over for stronger holding power. Unaltered nails were most likely lost or dropped during construction activities.

The whole nail assemblage was further analyzed by penny weight, a standard size designation currently used today by nail manufacturers. The Elijah Foley assemblage ranged from a 2d penny weight to a 50d penny weight. The majority of the wire nails ranged in size from 8d to 10d. Machine cut nails had the highest frequency of 3d and 4d sizes. The total distribution of nail sizes is illustrated in Table 8. The 8d to 10d pennyweight nails are associated with siding and flooring construction activities, while the smaller 3d to 4d pennyweights nails are associated with roofing. Nails with a penny weight over 10d were used for heavy framing while penny weights in the 6d range were used for light framing activities (Young 1994). The distribution of nail sizes indicate that the wire nails were used primarily for flooring and siding, while the machine cut nail assemblage indicates a high frequency of roofing construction (Table 8).

The analysis of nail condition indicates that 53 percent were unaltered specimens. Pulled nails had the next highest frequency (44 percent) while clinched nails were minimally represented with three percent (Table 8). Nail condition indicates that most of the whole nails were dropped or lost. However, there also was considerable dismantling of structures or nailing mistakes.

Since much of the Elijah Foley House complex was standing during the archaeological investigations, information about the types and styles of structures were present. However, the nail assemblage may indicate the presence of outbuildings that were no longer standing during excavation. It is probable that the nail assemblage represents continuous construction and remodeling activities. This pattern is particularly noticeable in the high frequencies of machine cut nail fragments as opposed to wire nail fragments.

A variety of other metal items complete the architecture group. These include hinges, a pintile, door knobs, nuts, bolts, screws, and lighting fixtures.

Flat Glass. The flat glass assemblage totaled 1,021 artifacts. All but one of these artifacts were sherds of window glass, while the one was probably furniture glass. The flat glass assemblage was analyzed for variation in color and thickness. Four different colors (green tint, blue tint, aqua tint, and clear) were present. A variety of thicknesses were recorded, measured to the nearest hundredth in millimeters, with 198 different measurement categories. A mean flat glass date was calculated with this assemblage using formulas by Moir (1983) and Ball (1983). The Ball formula produced a date of 1826 and the Moir formula produced a date of 1860. Given the long occupation of this site, both of these dates are realistic.

Flat glass dating formulas make the assumption that window glass became progressively thicker through time. For this assumption to be accurate in a statistical formula, there should be some continuity of window glass thickness on a site. Since depositional processes generally change the context of the sherds, a mixing of different types of windows glass from different time periods may occur. Occasionally, good archaeological context can isolate a particular window or time period. Unfortunately, there is much variation in thickness even within a single window pane. The wide range of window glass at the Elijah Foley House produced problematic mean flat glass dates.

Other architecture related artifacts included bricks, mortar, plaster, and asphalt roofing shingles. Of these, only bricks warrant a detailed description.

Bricks. An opportunity to examine numerous bricks occurred when the Foley House was being demolished during the fieldwork. Observations were made regarding how the bricks were used in the house before the last walls (13 inches thick) were removed. The bricks were all hand made and probably produced nearby on the Foley property. Three grades of common bricks were present. These grades were determined by the degree of firing. The best grade were those bricks closest to the fire in the kiln. They were a reddish brown color and were well fired. They range in length from 20 to 20.7 cm, in width from 10 to 10.3 cm. and in thickness from 5.3 to 5.8 cm. These bricks were used in the exterior walls of the house. Bricks from the top or outer edges of the kiln were under-fired and thus of an inferior grade. Since these light yellowish brown bricks were porus and could not withstand weathering, they were used on the interior walls. They range in length from 20.7 to 21 cm, in width from 10.2 to 10.4 cm, and in thickness from 5.8 to 6 cm. Their slightly larger size is probably because of less shrinkage since they received less heat during firing. The third grade included bricks that were over-fired and had a black glassy glaze on one or more surfaces. These bricks are about the same size as the first grade. Since the glazing detracted from their appearance, they were used on the rear of the structure or in the interior walls.

A second category of bricks were rounded decorative specimens. These dark reddish brown bricks were flat on the bottom surface and flat on a 5 cm wide strip across the top. They curve downward from the edge of the 5 cm strip to the bottom of the brick. They are similar in style to the "bullnose stretcher" illustrated by Gurcke (1987:121). The only difference between these bricks and the "bullnose stretcher" is the 5 cm wide flat surface on the top to receive mortar. These hand made bricks served both decorative and practical functions by spanning the gap where the wall was slightly inset and by creating an attractive architectural feature. Brick mason Charles P. Hockensmith (personal communication, 1994) noted that these bricks are commonly referred to as water table bricks. They range in length from 20.4 to 20.5 cm, are 10 cm wide, and range in thickness from 5.6 to 5.8 cm. These handmade bricks were produced in a wooden mold and struck on the bottom surface.

The final category consists of fire bricks. These specialized bricks had to be purchased from a commercial manufacturer since they were made from heat resistant clays not available in the Bluegrass region. Specimens were recovered from a rear first story fireplace (mid 1800s addition) which was later converted from burning wood to coal. These light yellowish brown bricks were marked with the brand name of "JUSTICE" in recessed letters. They range in length from 22 to 22.2 cm, in width from 10.6 to 11.3 cm. and in thickness from 6 to 6.4 cm. This "JUSTICE" brand name is not listed by Gurcke (1987). The International Brick Collectors Association was contacted to obtain information on the "JUSTICE" brand name. They were aware of this brand but had no information on its manufacturer or date of production (Jim Graves, personal communication 1995).

Some very general observations can be offered concerning the manufacture and firing of the hand made bricks. The bricks were formed in wooden molds which were struck by pulling a board or other straight object across the top of the mold to remove the excess clay. The struck surfaces frequently show lines and depressions where small pebbles were dragging during the striking process. Some specimens indicate that the bottom of the mold was smooth but slightly irregular. Other bricks with slightly uneven sides suggest that the clay was not always firmly pressed into the molds. Their sandy texture indicates that the molds were sprinkled with sand to prevent the clay from sticking.

The bricks also show some evidence of how they were fired. Specimens with narrow parallel strips of glazing on their sides indicate that the bricks were stacked in the kiln on their edges with air spaces between them to facilitate the circulation of the heat. The orientation of the bricks were alternated

90 degrees for each course as they were stacked in the kiln. The kilns were undoubtedly temporary field kilns with arches built into them as the bricks were stacked. These primitive kilns are not very efficient and consequently produce many underfired specimens. This type of kiln was very temporary and would leave very little in the way of archaeological evidence.

Arms Group

The arms group includes 16 brass cartridges for rifles or pistols, three brass bases for shotgun shells, and one possible stock plate. The most common cartridges are 0.22 caliber rim fire long (n=8) and short (n=5) cases. The long casings have three headstamps: C (n=6), F (n=1), and U (n=1). Four of the .22 caliber short casings have a U headstamp and one is blank. The C headstamp is by the Cascade Cartridge of Blount, Idaho while F may represent Federal and U may represent UMC or Remington. Barnes (1985:305) states that "the .22 Short is the oldest American, commercial self-contained, metallic cartridge. It was first introduced in 1857 for the Smith and Wesson First Model revolver and is still loaded and widely used all over the world." Barnes further notes that "Remington introduced noncorrosive (Kleanbore) priming for their rimfire line in 1927 and the first high velocity type in 1930" (Barnes 1985:305). The 0.22 caliber long and long rifle cartridges were first introduced in 1887 (Barnes 1985:305).

Three larger caliber brass cartridges were recovered. The smallest of these is a 0.25 caliber rimfire with no headstamp. Next, is a 0.32 caliber rimfire lacking a headstamp. Finally, a 6 mm centerfire with the headstamp "R-P 6 mm REM" was found. Barnes (1985:308) states that the 0.25 caliber Stevens Short was "introduced in 1902 as a shorter, cheaper and less powerful version of the .25 Steven... only smokeless powder was used when it was discontinued about 1912." The 0.32 caliber Extra Short cartridge was introduced about 1871 and remained in use until about 1920 (Barnes 1985:308). The 6 mm cartridge was a common military and later civilian type produced in recent years. It is manufactured by the Remington Arms Company.

Three brass shotgun shell bases were recovered. The most interesting specimen is a 12 gauge shell with the following headstamp "W.R.A. Co. STAR." Stadt (1984:6) states that "Star shells were offered from 1884 to 1894 in 10 and 12 gauges." The W.R.A. Co. stamp indicates that the shell was manufactured by the Winchester Repeating Arms Company of New Haven, Connecticut. The second specimen is also 12 gauge with a headstamp of "U.M.C. Co. CLUB." This shell dates to before 1912 when the Remington Arms Company officially merged with the Union Metallic Cartridge Company to form Remington Arms-U.M.C. (Fiegel 1991:189). The third specimen is a 410 gauge with the headstamp "REM UMC 410 NITRO." This shell dates to sometime after the 1912 merger of Remington Arms Company and Union Metallic Cartridge Company (Fiegel 1991:189: Hatch 1956:207-209).

Transportation Group

The transportation group consists mostly of auto parts including several spark plugs, which were probably deposited as a result of activities associated with the garage and dumping during the years of abandonment. The transportation group also consists of horseshoes, which are indicative of the primary mode of transportation during the nineteenth century and farm related activities.

Horse Shoes. Seven horseshoes were recovered. Four are actual horseshoes, one is a muleshoe, one is probably a ponyshoe, and one is a partially completed specimen. The horseshoes vary considerably. One early specimen is very thin (5-6 mm thick) and lacks both caulks and fullering. It measures 12.5 cm long and 12.6 cm wide with 17-20 cm wide branches. Three horseshoes have heel caulks (7 x 11 mm to 13 x 17 mm and 5-10 mm long) and two have distinct fullering grooves. They range from 8-10 mm thick with branches 17-23 mm wide. The larger shoe (14.2 cm long and 14 cm wide) appears to have been made for a large draft horse used for heavy pulling. The two smaller horseshoes (13 x 12.3 cm and 13.5 x 12 cm) were probably worn by quarter horses that were used for transportation. The ponyshoe measures 9.2 cm long, 10 cm wide, and 18 mm thick. The branches are 19 mm wide and lack caulks. A single mule shoe with flaring branches at the heel measured 14.4 cm long, 10 cm wide, with branches 17-20 mm wide, and 9-14 mm thick. It has heel caulks (14 x 15 cm and 5 mm long) and a toe clip. The final specimen is a half finished shoe with an unmodified bar stock on one end. This shoe has been hammered into shape (including a fullering groove) but developed a stress fracture when the blacksmith tried to bend it into shape.

The shoes recovered from the Foley House indicate that four types of animals were being used around the farm. Most common were horses used for riding or pulling buggies. Second, draft horses were used for heavy pulling tasks on the farm. Third, mules were used for plowing and other activities. Finally, a pony was probably used for children to ride.

Entertainment Group

The entertainment group consists primarily of marbles and doll parts. Modern plastic and metal toys complete the assemblage. However, the marbles were the most abundant and diverse of the entertainment group artifacts.

Marbles. Twenty-five marbles were recovered from the Foley House (Figure 7). Six of these are made from clay. Two earthenware marbles were imperfectly rounded. One is grayish brown (1.5 cm) and the other (Figure 7c) is a light tan (1.45 cm). A third specimen (1.7 cm) appears to be a banded stoneware marble. This marble had alternating bands of dark and light gray. Another stoneware marble is a Bennington type (Figure 7b). This irregular marble (1.6 to 1.8) has a mottled brown glaze with spots. The two remaining marbles are unglazed porcelain or china types. The first china is a white specimen (1.6 cm) lacking decoration. The second china (2.2 cm) specimen has two bull's eyes painted in black with a dashed line in red (Figure 7a).

Most clay marbles were produced in Europe and the United States during the late 1800s and the early twentieth century (Randall 1971:103). The cruder specimens were usually made and fired by children while machine molded clay marbles were produced by some potteries (Carskadden et al. 1985:88). Stoneware marbles such as Benningtons have a "...brown manganese glaze... quite similar in appearance to the mottled brown or tortoise shell glaze found on Rockingham pottery" (Carskadden et al. 1985:90). They were probably produced in Germany during the 1880s and 1890s (Carskadden et al. 1985:90). Porcelain marbles were manufactured from kaolin/feldspar clay in glazed and unglazed forms (Carskadden et al. 1985:90). Gartley and Carskadden's (1987:120) study of marbles from the Irish Channel Cistern in New Orleans suggest that the bull's-eye pattern dates between 1850 and World War I.

Nineteen marbles are various types of machine made glass specimens (Figure 7 d-I). Only one solid color specimen was recovered while most marbles (n=15) had two colors. The remaining specimens had three or four colors each (Figure 7 d-I). Predominate colors included white, blue, green, yellow, red, and orange. These specimens had different types of swirl patterns. Four specimens were transparent glass with swirl patterns on the inside. A single machine made agate with yellow swirls was

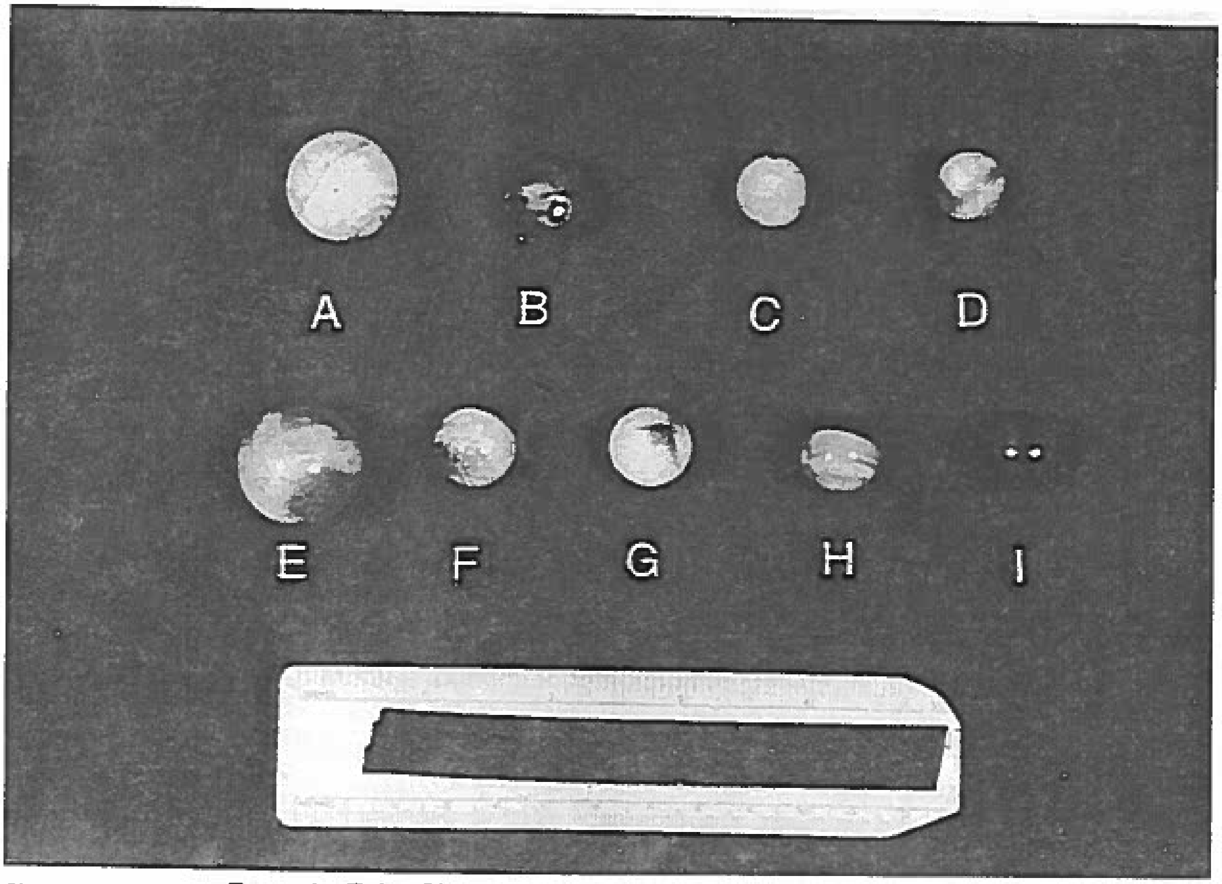

Figure 7. Marbles From the Foley Site.

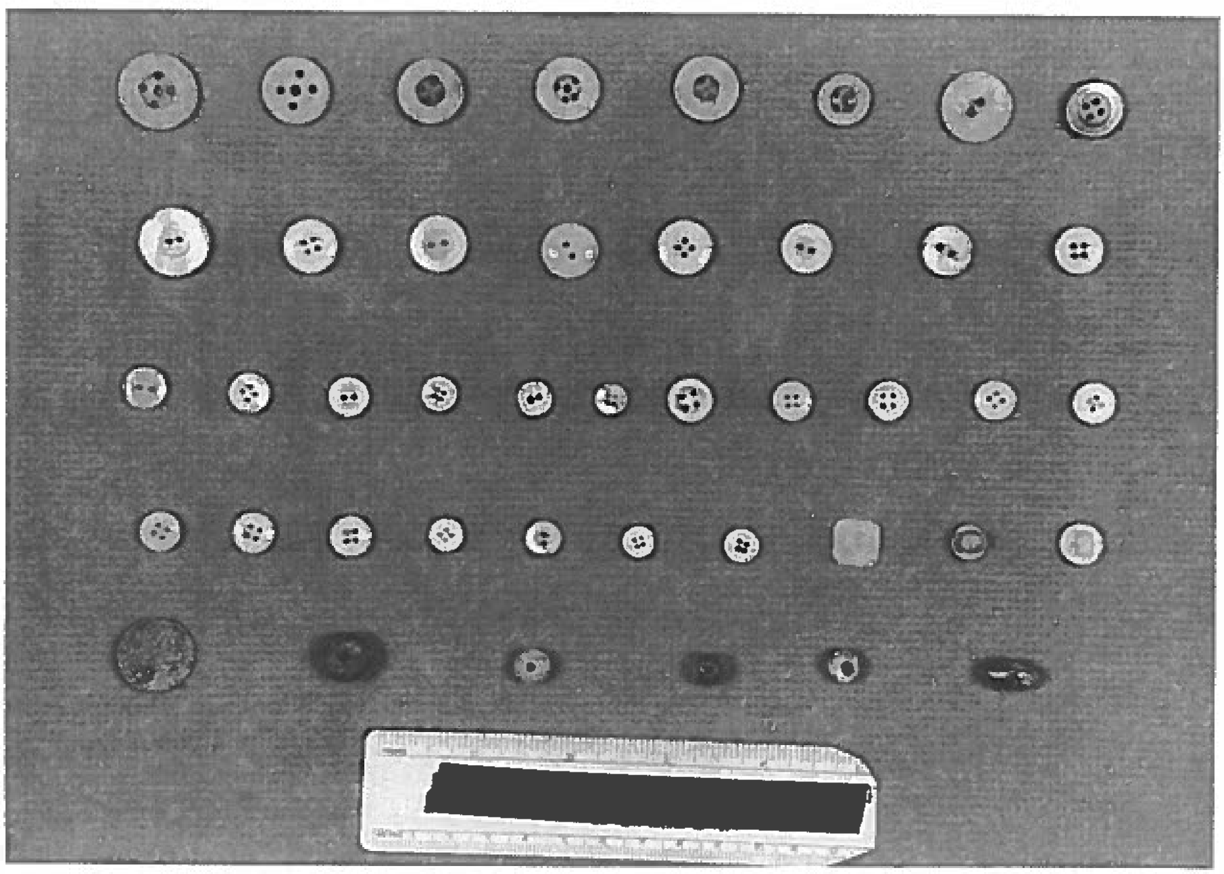

Figure 8. Buttons and Beads From the Foley Site.

in the sample. In terms of size, the glass marbles ranged from 1.2 to 2.45 cm in diameter with most specimens clustering between 1.4 and 1.7 cm. Many of the marbles exhibited damage from being used. The damage ranged from small nicks to occasional conoidal fractures to heavy battering.

Perfectly rounded machine made marbles were first produced sometime between 1901 and 1905 (Carskadden et al. 1985:93; Randall 1971:105). Machine-made "Akro Agates" were very abundant between 1914 and the 1930s (Carskadden et al. 1985:93). It was not possible to make marbles with three or four colors until 1926 when John Early invented a new machine (Randall 1986:163). These multi-colored marbles became very common by the 1930s and 1940s (Randall 1986:163).

Clothing Group

The clothing group artifacts consist mainly of buttons (85 percent). The remaining clothing group artifacts were buckles, eyelets, cuff links, and various small leather shoe parts.

Buttons. The Elijah Foley site produced 64 buttons (Figure 8), which varied in material, decoration, number of holes, and size. The majority of the buttons were made of porcelain and shell, with other material types including bone, plastic, metal, and glass. Fifty-four of the buttons exhibited holes that ranged from one to five holes per button. The remaining buttons exhibited shanks or other types of fastening. Two and four hole shell or porcelain buttons were the most prevalent, as well as, five hole bone buttons. Most of the button assemblage was plain and not decorated. However, several decorated buttons were recovered. Two porcelain buttons were decorated with a red transfer print in a geometric design and a red illegible hand painted design. One glass button was decorated with a molded geometric design. Also, two metal military buttons were recovered.

The buttons range in date from the mid-nineteenth century to present day. Most of the buttons are representative of the late nineteenth to early twentieth centuries. The four and five hole bone buttons typically date from 1800 to 1865 (South 1964). Ceramic buttons are more indicative of a late nineteenth and early twentieth century date, probably as a replacement for the more brittle bone buttons, as ceramic manufacturing techniques improved during this time. Between the early and mid-twentieth century, ceramic buttons were replaced with plastic buttons (Diess 1988). Shell buttons seem to have a much wider range of manufacture than other types. Although shell buttons had been produced since the eighteenth century, the ornate styles and sizes that are typical of the period are not reflected in the Elijah Foley assemblage. Plain two and four hole varieties were most representative of the Elijah Foley assemblage. This type was manufactured throughout the nineteenth century and into the early twentieth century. However, Kentucky was a large producer of freshwater shell buttons during the 1880's through the 1920's, which may have implications for the Elijah Foley shell button assemblage (Claassen 1994).

Two pre-Civil War U.S. infantry buttons were recovered. One button depicts an eagle with shield and contains the letter "I." The second metal military button also depicts an eagle and shield. These buttons actually may have belonged to Elijah Foley, who had served in the Fayette militia.

Furniture Group

The furniture group consisted of decorative ceramic items and lamp globe glass (Figure 6 e-f). The ceramic items were dominated by decorative sherds of unknown forms, but they probably represent vases or other furniture type room adornments. Also, six flower pot sherds were recovered. Glass items represented lamp globe glass, which consisted of mostly body sherds with a few distinguishable crowns.

Personal Group

The personal group represents a wide variety of items that are related to personal adornment or that are likely to be kept on one's person. The personal group artifacts recovered from the Elijah Foley site are predominately represented by smoking pipe fragments and coins. Other items include beads, bone handled pocket knives, a key, and jewelry. The jewelry consists of two rings, one of which had a small green stone and metal band of unknown type. The other ring was too badly deformed to identify. The knives were extremely rusted; several had simple etched bone handles. Only the coins and pipes warrant further discussion.

Coins. A total of nine coins representing a wide range of dates were recovered. Two coins from the nineteenth century include a 1859 penny and an 1865 penny. A 1908 nickel and a 1913 penny represent coins from the early twentieth century. The remaining coins, a 1937 penny, a 1948 quarter, a 1973 dime, and a 1975 penny were found during Elijah Foley excavations. One coin was so badly burnt that it was not legible.

Pipes. Four smoking pipe fragments were recovered. The most complete specimen is an "elbow" type with ribbed exterior decorations from Unit 11 (Level 2). It is made from a light brown unglazed clay. The pipe is 34 mm long, 33 mm high, and has a 6 mm diameter bore in the mouth piece. The base of the bowl is smooth. A second specimen, a bowl fragment, was recovered from Unit 3 (Level 2). It is made from a medium brown unglazed clay. The bottom of the bowl is smooth but a ribbed exterior decoration extends from the adjacent area toward the mouth piece. The third specimen is a small rim fragment from a bowl recovered from Unit 8 (Level 3). It is made from a light brown unglazed clay and has a vertical rib pattern. The final specimen recovered from Unit 13 (Level 1) is a mouth piece with a small portion of the bowl. The mouth piece has a raised rim and a series of "X"s around the stem. It is 37 mm long with a 7 mm diameter bore. Fay (1986:99) indicates that "elbow" style pipes were made during the late eighteenth and early nineteenth centuries.

Other Groups

Other functional groups were represented by the activities and the miscellaneous groups. The activities group consisted of artifacts that were related to activities not specifically related to any of the other functional groups. This group includes mostly fencing and unidentifiable items that were obviously related to activities associated with residential or farming activities. The miscellaneous group primarily includes very recent artifacts that were probably deposited during final dumping activities when the site was abandoned. The inclusion of these artifacts could bias the interpretation of specific functional groups.

FAUNAL REMAINS

By

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Adirondack, New York

Faunal remains from the Elijah Foley House excavations comprise a modest assemblage (N = 1,383). This total includes items such as bone and shell buttons, and bone knife and fork handles: these are discussed elsewhere in this report. Although vertebrate faunal remains were recovered from a number of contexts, detailed analyses were conducted only on those from one provenance, Unit 17, Level 1 (N = 201) (Table 9). Percentages offered in figures and text refer only to the vertebrate faunal remains from this unit. These materials are the primary subject of this report. General comments about the remainder of the assemblage also are offered. This section provides information about subsistence practices of the inhabitants of this late nineteenth century farmstead by examining taxonomic composition and butchering patterns. In addition, the taphonomy of the elements is considered.

In general, the condition of the faunal remains is quite good. Skeletal part representation appears to be excellent. However, because of a number of factors, not all faunal materials were recovered during the excavations: therefore, the assemblage must be considered a somewhat biased sample.

Methodology

The methodology employed in this analysis was to: 1) assign specimens to the most specific taxonomic category possible, 2) to determine NISP (number of identifiable specimens) and MNI (minimum number of individuals), as defined from skeletal part representation within size of the animal, age categories, symmetry (right/left), and portion (e.g., proximal, distal, midshaft, lateral, etc.) of the elements, and 3) to describe macroscopic morphological characteristics such as weathering, breakage, burning, cut/saw marks, evidence of trauma/pathology, and presence/absence and degree of carnivore/rodent gnawing that establish cultural and natural taphonomic factors affecting the specimens. Microscopic observations were made on specimens that exhibit cut or saw marks in order to establish whether the marks were made by machine or by hand. As only one provenance was examined in detail, NISP and MNI estimates are only for this unit. Each element was not individually weighed during analysis: total counts and weights of the faunal materials were provided by Jay Stottman.

Identification of the specimens was made by direct comparison to comparative collections held at the University of Kentucky Museum of Anthropology in Lexington, and at the University of Tennessee in Knoxville. Taxonomic nomenclature for mammals followed Hall (1981), while avian taxonomy was derived from Robbins, Bruun, and Zim (1983). Additional skeletal identification sources included Chaplin (1971): Davis (1987): Gilbert (1980): Gilbert, Martin, and Savage (1985): Hesse and Wapnich (1985): Hillson (1986): Olsen (1964, 1968a, 1968b, 1979a, 1979b): and Parmalee (1985).

Identifications and the attendant data were encoded into a database, using the vertebrate faunal analysis coding system (FACS) established by Shaffer and Baker (1992). The data were input into a Paradox database using a dBase structure, then were manipulated using FACS dBase support programs and procedures to check for illogical errors due to miscoding or erroneous data entry. File links are established to convert coded data back to text, and to give listings by scientific name as well as common name. These listings are provided below.

Taxonomic Representation

Pig elements (*Sus scrofa*) (N = 65) comprise the largest portion of the domestic assemblage from Unit 17 Level 1 (Table 9), followed by chicken (*Gallus gallus*) (N = 38). Cattle (*Bos taurus*) also are represented by a small sample (N = 13). Sheep/goat (*Ovis/Capra*) are represented by five elements, and a single horse (*Equus caballas*) bone also was recovered from this unit. Wild animals consist of turkey (*Meleagris gallapavo*) (N = 6), rabbit (*Sylvilagus floridanus*) (N = 9), and goose (*Branta* sp.) (N = 1). Taxa that were most likely included in the assemblage because of natural, rather than human, processes include at least two, and perhaps three, species of rats [*Neotoma floridana*, and *Rattus* sp. (Black and/or Norwegian)] (N = 6), frog (*Rana* sp.) (N = 1), and muskrat (*Ondatra zibethicus*) (N = 1). One modified marine shell fragment also was recovered from this unit; it is not included in any of the totals or percentages presented here.

Elements not assigned to a specific taxon also contributed to a total understanding of the nature of the assemblage. For example, a number of Aves elements were assigned to medium, medium/large, or large categories (N = 26); in all likelihood, most of these are elements from domestic chickens. Likewise, most of the small/medium mammal elements (N = 4) are probably rabbits, and the large/very large mammals (N = 23) are mostly pigs, and perhaps a small number of cattle elements. The micro/small mammal elements (N = 2) are both vertebrae, and are probably from small rodents such as rats.

A total of 146 elements (73 percent) from Unit 17, Level 1 could be assigned to taxa at the level of Order or below. Those not identified to Order or below were grouped according to general size categories of birds (medium-medium/large) and mammals (micro/small, small/medium, and large/very large). Both wild and domestic animals are represented in the assemblage, although, as expected from the context (under the kitchen extension of this late nineteenth century structure), domestic mammals and birds dominate the sample (Table 9). For the purpose of discussion, elements that compare favorably ("cf.") to a taxon are grouped and described with that taxon. Elements that could not be definitely assigned to a specific taxon were grouped according to Order, size and type. The size, texture, and context of these elements give clues as to the probable taxon to which they belong.

Mammals dominate the Unit 17 assemblage (NISP=129), accounting for 64 percent of the total. Of these, most (NISP=107, 53 percent) could be attributed to domestic mammals. Pigs and cattle make up the overwhelming majority of the domestic mammals (7 percent). Many of the elements could be classified to taxon only as "large mammal." This is particularly true for vertebral and rib elements. Given the cultural context, these are undoubtedly from pigs and cattle, however, specific morphological characteristics other than general size and texture were not sufficiently present to positively distinguish between the taxa. When these undifferentiated large mammals are totaled, 94 percent of the total domestic mammals are represented by swine and cattle.

Birds also constitute a large portion of the Unit 17 assemblage (NISP=71, 35 percent). Most of the elements represent domestic chickens (54 percent), while turkey (8 percent) and geese (1 percent) account for a small percentage of the total. Over a third of the avian elements only could be classified as medium/large birds (37 percent); most of these are undoubtedly chickens with a few turkey elements.

Other animals (NISP=23) make up the remaining 11 percent of the total assemblage from Unit 17. Most of these elements represent rabbits (39 percent), a frog, muskrat, and two species of rat. As mentioned previously, the small/medium mammals are probably rabbits, and the micro/small elements, both vertebrae, are probably from rats but could not be assigned to specific taxa. .

Modifications to Bone

Macroscopic signs of modification to bone such as gnaw marks, burning, and sawing, as well as bony responses from trauma or illness were noted. A small portion of the assemblage from this unit exhibited signs of modification. The most impressive morphological sign of modification is that by gnawing. The most common agent was most likely rodent gnawing, although some evidence of carnivore gnawing was seen.

Very little of the assemblage exhibits signs of having been burned black or calcined. Some materials exhibit possible slight charring from perhaps roasting.

Table 9. Faunal Remains from Unit 17 at the Foley House.

Taxon	Total NISP	% of NISP
Rana sp.	1	0.5%
Branta sp.	1	0.5%
Gallus gallus	29	
cf. Gallus gallus	9	18.9%
Meleagris gallapovo	6	3 %
Sylvilagus floridanus	9	4.5%
Neotoma floridana	2	1 %
Ondatra zibethicus	1	0.5%
Rattus sp.	4	2 %
Sus scrofa	57	
cf. Sus scrofa	8	32 %
Bos taurus	12	
cf. Bos taurus	1	6.5%
Ovis/Capra	4	
cf. Ovis/Capra	1	2.5%
Equus caballas	1	0.5%
Other		
Aves (Medium)	3	
Aves (Medium/large)	14	
Aves (Large)	9	12.9%
Mammalia (Micro-small)	2	1 %
Mammalia (Small)	1	
Mammalia (Small/medium)	3	2 %
Mammalia (Large)	19	
Mammalia (Large/very large)	4	11.4%
Total	**201**	**100%**

Cut marks were present on some of the faunal assemblage from Unit 17. A few elements were cut with a saw rather than by hand. In particular, ribs and some vertebrae from both pigs and cattle exhibit saw or axe marks. It is interesting to note that the marine shell exhibits evidence of sawing; the function of this item remains unknown.

Some of the elements show evidence of pathology. This natural modification is generally in the form of periosteal lesions, bony inflammatory responses to trauma or illness. Most of these lesions were noted on domestic mammals, such as swine or cattle. These lesions can usually be attributed to non-specific stress.

Body Part Representation

In general, the taxa and their body parts represented are typical for a nineteenth century farmstead in the Midwest or southeast. Not surprisingly, taxa consist primarily of pigs, chickens, and some cows, with small percentages of wild species included. The body parts represented indicate that the pigs, chickens, and turkeys were probably grown on the farm, and the entire carcass butchered and used.

Chicken and turkey elements such as the tibiotarsals are present, while most chickens sold in groceries today remove the heads and the ends of the limbs. No avian cranial parts were recovered, however. This may be because of the excavation strategies and recovery methods employed by the excavators, and because only one unit was subjected to detailed faunal analysis.

Likewise, pig body part representation suggests that the entire animal was butchered and used, rather than single cuts of meat. Many cranial portions, including dentaries, were noted from this unit and from the remainder of the assemblage as well. In addition, elements such as phalanges suggest that the entire animal was used. Hog butchery practices have been well documented, particularly from Appalachia and other small subsistence farmstead areas. Most of the animal was utilized, including organs such as the brain, liver, and lungs ("lights").

Very few cattle elements could be positively identified; however, many of the "large animal" ribs could likely be attributed to these animals. The sample size is too small to be able to discern whether the cows were locally butchered or specific cuts of meat purchased and brought to the farm.

Faunal Conclusions

The recovery of a large number of pig and chicken bones from an eighteenth/nineteenth century residence in the Bluegrass, even close to the Lexington area, is not surprising. These staples would be expected in farmsteads and urban residences of this era. Whole animals appear to have been used. It is interesting to note that wild fauna, such as turkey and rabbits, appear to be plentiful.

The paucity of riparian animal remains, particularly fish, can most likely be attributed to the recovery methods employed. The excavations at the Elijah Foley house were a salvage effort: traditional means of excavation and artifact processing were not always employed. For example, in Unit 17, many of the bones were picked up by the excavators, rather than recovered by screening. While Shaffer (1992) has found that the use of 6.25 mm (.25 inch) mesh hardware cloth biases a faunal sample toward the loss of elements from smaller animals, screening would normally contribute toward a consistent good sample of rabbit-sized animals or larger. In the absence of screening, fish elements undoubtedly would be lost.

The extensive rodent and carnivore gnawing also suggests that smaller elements may have simply been eaten, and thus not recovered. Many of the avian elements, in particular, were so heavily gnawed that they were nearly completely encircled by gnawing. The ends were almost always missing. It is very likely that these bones may have been tossed into the yard in an expedient disposal pattern, and were therefore at the mercy of dogs and/or rodents.

The assemblage from Unit 17 is enticing. A glimpse at the faunal remains from other contexts at the Elijah Foley house demonstrates that similar taxa are represented. What might be of interest would be to discern if body part representation, and taphonomy, would be expressed differently in other regions of the house/yard, and through time. It would also be of interest to see if percentages of types of taxa recovered would remain the same or differ from the pattern expressed in Unit 17. The additional fauna from the Elijah Foley excavations should be analyzed and compared to that recovered from Unit 17, and from other sites in the Bluegrass as well to contribute toward enhancing our picture of economic subsistence during this time.

FUNCTIONAL GROUP PATTERNING

The artifact assemblage was separated into functional groups in order to be related to artifact patterning models and to delineate activity areas within the yard. Overall, the artifact pattern is indicative of a typical domestic residence or farmstead. This is not unexpected given the abundance of architectural and documentary evidence that better illustrate this fact. This type of artifact patterning is on much too broad of a scale to lend any interpretive information to the understanding of this site. However, these functional groups also may be used to delineate particular activity areas within the farmstead complex. Percentages of particular functional groups, when viewed spatially, can aid in the identification of outbuildings or particular activity areas (Andrews 1992; Rotenizer 1992).

Functional group percentages were used to delineate the activities that took place in the area of the 3 x 3 meter block excavation. The block excavation was located in close proximity to the house and adjacent to the roof remains of a small outbuilding. The function of this outbuilding was unknown, despite the abundance of documentary evidence for the site. The kitchen, architecture, and the faunal groups represent the majority of the artifacts from this excavation block. The faunal group was the most abundant with 39 percent of the block assemblage (Table 9). The architecture and kitchen groups followed with 32 and 24 percent, respectfully. The remaining functional groups were minimally represented.

The high frequency of architecture related artifacts confirm the existence of an outbuilding in the location. This is substantiated by the high concentrations of mortar discovered within the block of units, as well as, the discovery of several pieces of limestone, which may have been associated with a foundation or chinking. The high frequency of faunal remains recovered from the block excavation may actually be the determinant of outbuilding function. The faunal assemblage consisted of an overwhelmingly high frequency of pig. The elements of the remains represent mostly teeth, jaws, and feet. This suggests that the area served as a place for pig slaughtering or a disposal area for unwanted pig parts. This high frequency of pig bones indicates that the outbuilding was probably the smokehouse. With this premise in mind a high concentration of coal/clinker and wood charcoal were recovered from the block excavation. However, a smokehouse was not always used for smoking meat since meat was often sugar cured or salt cured in these structures. Nevertheless, these structures still retained the name smokehouse (Karen Hudson, personal communication 1995). High concentrations of coal and clinkers were discovered at the Gibb's smokehouse in Knox County, Tennessee (Young 1994).

The functional group frequencies were compared to other excavations conducted in the region that included smokehouses. Excavations at Liberty Hall in Frankfort, Kentucky depicted a high concentration of faunal remains in units excavated behind a standing smokehouse (Fay 1986). Although kitchen refuse and building hardware were discovered in higher frequencies, the units behind the smokehouse produced a significant amount of faunal remains. Although the faunal assemblage was not identified by units, the majority of the faunal assemblage for the site was pig. Excavations at the Waveland Historic home in Lexington, Kentucky included a block excavation near a standing smokehouse (Pollack and Hockensmith 1985). These excavations revealed high concentrations of faunal remains in the assemblage. The architecture, kitchen, and faunal groups were the abundant groups represented in the block assemblage. The kitchen group had the highest frequency followed by the faunal, and architecture groups. Pig was the most abundant taxa identified in this assemblage and the elements recovered were consistent with the Elijah Foley faunal assemblage with a majority of teeth and foot bones.

Although these assemblages vary in the frequencies of kitchen and architecture groups, the high frequency of faunal remains exhibited in all the assemblages near the smokehouse is significant. While large concentrations of faunal material may also be discovered near kitchens, these sites suggest that smokehouse outbuildings will also accumulate a large proportion of faunal remains, particularly pig. The architecture group will depict discrepancies because of the difference between standing structures and no longer standing structures, which will produce a high frequency of architectural remains, as exhibited in the Elijah Foley site assemblage. The findings from the excavations of known smokehouses at other regional sites is consistent with the Elijah Foley faunal assemblage and functional group distributions. Thus, the assertion that the block excavation at the Elijah Foley site probably represents a smokehouse.

ARCHAEOLOGICAL INTEGRITY

Since only two minor features were discovered during the excavations, the interpretation of the site is primarily reliant on materials recovered from the sheet midden throughout the yard. Investigation of this midden has proven to be important to site interpretation, by using particular artifacts as temporal indicators to designate spatially significant middens (King and Miller 1987). The ability to distinguish between temporally different middens spatially has enabled interpretations to be made concerning ethnicity by relating this information to the yard depositional habits of particular ethnic groups.

In order to conduct an investigation of the Elijah Foley site midden, the integrity of the archaeological context must be assessed. As noted previously, recent disturbances greatly restricted the location of excavations. However, this site also has experienced a great deal of disturbance throughout its long occupation. This condition was exhibited in the site stratigraphy, distribution of artifactual temporal markers, and condition of the artifacts. The site stratigraphy was consistent throughout the site being comprised of a 20 to 25 cm mixed historic layer and a lighter subsoil that contained a light artifact density of historic and prehistoric artifacts in the transition area between the two zones.

The distribution of temporal indicators was mixed vertically throughout the site. Early and later artifacts were found equally within all arbitrarily designated levels. Prehistoric.materials were also mixed within the level, but they tended to be most concentrated in the deeper levels. It is probable that some residual prehistoric artifacts underlaid the mixed historic zone within the transitional area to subsoil. Finally, the condition of the artifacts suggests a considerable amount of disturbance or mixing. The majority of the artifacts were small fragments usually no larger than 2 or 3 cm. Most of the larger artifacts were recovered from a midden underneath the house or from surface collections. The surface finds were collected in the recently disturbed areas of the site, in which the artifacts were probably dredged up and spread out from destroyed subsurface features.

Midden studies have shown that middens that have destroyed vertical context tend to retain some horizontal integrity, which can provide beneficial data concerning the spatial patterns of particular artifact concentrations (King and Miller 1987). However, temporal designation of artifact concentrations is necessary for delineating differently deposited middens spatially. For earlier historic sites, there are several artifact classes which allows precise dating of middens without interference of an abundance of other artifact classes. However, with the influx of the numerous artifact types and the difficultly of dating many of the artifacts during the late nineteenth century, midden delineation becomes problematic. There is no way to accurately designate the date of particular artifact concentrations in enough detail to delineate these different midden deposition episodes. This is the case for the Elijah Foley site assemblage, which consists mainly of late nineteenth and early twentieth century artifacts. While sheet midden studies have proven informative on early historic sites, the sheer frequencies and difficulty of dating late nineteenth and early twentieth century artifacts in detail have limited the benefits of a midden analysis.

Another problem with the Elijah Foley Site sample was the restricted area of intact deposits that could excavated. Several activities were contributing factors that limited the scope of the investigations. These activities clearly limited the possibility for conducting accurate spatial research. Overall, the site appears to have been disturbed or mixed occasionally over its long history. This would not be unusual for a long term occupation, which would undoubtedly have several periods of demolition, construction, and different land uses. The matter is complicated with the influx of a tremendous amount of recent trash resulting from the site's use as a dump after its abandonment. Also, the recent earthmoving activities associated with the construction of the subdivision disturbed much of the site, particularly the subsurface features. The disturbances to the archaeological context greatly limited the interpretive potential of the site. Thus, much of the interpretive value is restricted to the level of artifact analysis.

Unit #17

Although most of the site had disturbed context, one unit exhibited some resemblance of good archaeological context. During the last two field days, demolition had begun on the remaining standing sections of the house. After demolition, a small area under the kitchen was left clear of rubble. In this area, the exposed soil contained several large sherds of early ceramics. On the last day of excavations, enough rubble was hand cleared to allow the excavation of a 2 x 2 m unit. The soil exposed was very dark, loose, and it obviously had been consistently dry. There were several large pieces of limestone encountered on the east side of the unit. These limestone fragments appeared to have been associated with a dry laid foundation wall and mortared bricks located at that end of the unit. A concrete porch and steps had been added to the east wall of the kitchen, in which some of the original foundation appeared to have been disturbed. Some of the limestone slabs were two or three courses high and may have been remanent of former piers used to support a floor. Other slabs were obviously out of context.

As excavation began, it was obvious that this area represented a trash midden and was comprised of one zone, with intermittent pockets of different soil textures, bricks, and rubble. The midden contained large ceramic sherds, bones, buttons, marbles, coins, metal, and some glass fragments. It appeared that this midden was completely intact. However, numerous recent items such as carpet, clothing, plastic wrappers, foam rubber, and even fresh grass occurred consistently throughout the unit. At first this occurrence was quite puzzling, however, when the floor of the unit collapsed into a rather large rodent burrow, the source of the disturbance was apparent. A ground hog had recently burrowed into the rich loose soil and carried carpet, plastic, foam rubber, clothing, and numerous other items to line his burrow.

As the excavations proceeded, other disturbances were discovered. A pipe trench was discovered along the west side of the unit. This pipe trench coincided with a pipe trench discovered in Unit #1 which was located adjacent to the outside north wall of the kitchen. Although these disturbances had contaminated the midden with recent artifacts, it appears that the original intact midden extended to a depth of 55 cm and represents a short term deposition. Thus, this unit provided the best archaeological context at the site. Although it was impossible to distinguish between the context of the midden and the context of the rodent burrow stratigraphically, the temporal difference in the artifacts is great enough to assume that the earlier artifacts are associated with the midden and the recent artifacts are intrusive with the burrow.

Having established the contextual integrity of the unit, we next focused on dating the midden assemblage. The earliest ceramics from the Elijah Foley Site were discovered in this midden, including pearlware and whiteware. A majority of these artifacts were highly decorated with hand painting and transfer prints. One datable maker's mark was discovered exhibiting a date of 1839. A mean ceramic date was calculated for the midden ceramic assemblage, producing date of 1855 (Table 10). Also, a mean flat glass date was calculated exclusively for this unit, producing the same dates of 1826 and 1860 that were produced by the total site assemblage. However the best temporal indicators were the three coins discovered in the midden. All three coins were pennies, which had dates of 1859, 1865, and 1913. The coin dates were factored into the mean ceramic date to produce another mean date for the unit, of 1856 (Table 10). Unit #17 also, produced the earliest glass artifacts found at the site, several of which exhibited pontil marks, indicative of the early to mid nineteenth century (Diess 1981; Jones and Sullivan 1989).

The midden artifact assemblage exhibits a date from the early to late nineteenth century. However, this represents the manufacture dates for these artifacts and not necessarily the deposition date. The time of deposition probably coincided with the major renovation of the kitchen, when it was connected to the main house. As mentioned before, this was completed by extending the kitchen across the breezeway or dog trot to the main house. It is possible that the entire kitchen may have been renovated at this time, including the installation of a new floor. This renovation probably occurred just after the turn of the century, considering the presence of the 1913 coin. The midden most likely was deposited during this renovation of the kitchen. However, the intrusive pipe would had to have been constructed while the floor had been removed. These circumstances present several possible scenarios for the formation of this midden. The most plausible is that the midden could have been deposited at the time of renovation and later the floor was replaced for a pipe or the pipe was added long after midden deposition during a kitchen renovation, that took place long after the kitchen, was connected to the house.

The Unit #17 faunal assemblage seems to also support a turn of the century deposit date. This assemblage indicates that many of the bones were machine sawed. Machine sawing suggests that these cuts of meat were probably purchased from a butcher and thus were representative of a later date, possibly turn of the century. The bones exhibit no evidence of having been brought into the midden by animals and were probably deposited purposefully in the midden.

This midden does contain the most concentrated assemblage of early to mid nineteenth century artifacts found at the Foley Site. Although these artifacts may have been deposited much later, it is still the most intact assemblage that dates to Elijah Foley's lifetime. The rest of the Elijah Foley Site assemblage seems to have been associated with Thomas Foley of the late nineteenth century and the non Foley occupants of the twentieth century. Unfortunately, the historical documentation has not been helpful for determining the temporal affiliations of construction episodes, which would provide a better context for the midden assemblage.

Table 10. Mean Ceramic and Coin Date Unit 17 at the Foley House.

Ceramic Type	Decoration Type	Number	Mean	Reference
Whiteware	Undecorated Hand painted Flow blue Shell edge Transfer printed	6 2 5 4 14	1860 1850 1862.5 1845 1850	Smith 1983 Price 1979 Price 1979 Price 1979 Price 1979
Pearlware	Undecorated Hand painted Edge decorated Transfer printed Banded	3 3 4 8 2	1805 1812.5 1805 1812.5 1810	South 1977 Smith 1983 South 1977 Smith 1983 Smith 1983
Redware	Undecorated	12	1810	Ketchum 1983
Yelloware	Undecorated	2	1880	Ketchum 1983
White granite	Undecorated Decal	34 1	1897* 1925*	Miller 1991 Adams 1980
Maker's Mark	Printed date	1	1839	
	Total	**101**	**1855**	

*Based on date ranges of 1845-present (1950) and 1901-present (1950).

Coins	Number	Date
Penny Penny Penny	1 1 1	1859 1865 1913
Total	**3**	**1879**

The ceramic assemblage from this unit exhibits a higher frequency of decorated wares than the entire site assemblage, particularly transfer prints. The distribution of decoration types is also, more evenly distributed than the entire site assemblage. Given the earlier date for this assemblage it seems that many of these highly decorative ceramics probably reflect the wealth of the Foley family during the early to mid nineteenth century. Unfortunately, the remaining site assemblage lacks the context to make temporal designations feasible for comparison. A trend observed within this ceramic assemblage indicates that the later white granite wares were plain or relief decorated as opposed to the earlier pearlware and whitewares, which were decorated with transfer prints, hand painted, flow, or edge decorated than plain or relief. This may indicate a decline in socio-economic status or may indicate stylistic changes between these time periods (Table 11).

CONCLUSIONS

The destruction of the Elijah Foley Site created an opportunity for archaeology, but it also created numerous obstacles. Without the cooperation of the developer and the diligence of the many volunteers, this unique site would have been long forgotten underneath suburbia. Although preservation is the primary goal in most cases, the salvage of information can preserve history and continue to benefit historical and archaeological research. The excavations at the Elijah Foley house produced over 6,000 artifacts representative of the early nineteenth century to the mid twentieth century.

Because much of the site had been disturbed by recent land grading, demolition of the structure, vandalism, fire, and historic renovating, the archaeological context for this vast artifact assemblage has limited integrity. This restricts the interpretive potential of the material culture recovered at this site. However, a previously unknown smokehouse was discovered. Although we were not able to isolate the date for the structure, it has been learned that the common practice of smoking or curing pork was indeed performed at this site. The trash midden discovered beneath the kitchen floor, provided the only substantial artifact assemblage from the Elijah Foley's tenure at the site. His material possessions reflected his wealth and status within the Lexington community, as suggested by the historical documentation. Within this same midden the later very plainly decorated ceramics were most likely associated with Thomas Foley or a later tenant may suggest a lower economic status. Although the lack of good archaeological context is problematic for this particular issue, the general trend between earlier and later ceramics exhibits a decline in decorative ceramics. This corresponds with the documented decline of the family gunpowder making business and Elijah Foley's declining involvement in the operation of that business. With Elijah Foley's death in 1843, the Foley heirs probably ran an agricultural operation at the site and then rented the property to tenants. This endeavor probably did not provide the wealth enjoyed by Elijah Foley.

Although there were only a few insights revealed by the archaeological assemblage, this assemblage provides an excellent comparative collection of a long term occupation site during the nineteenth century for the Lexington area. These types of sites are quickly disappearing into the suburban landscape and very few artifact assemblages have been curated from this region thus far. A comparison to other assemblages from other parts of Lexington could be useful. A preliminary comparison to sites such as the John Pope House, Ashland, and Waveland indicate that the Elijah Foley family, while living a somewhat wealthy lifestyle, did not live the same lavish lifestyles indicated by these other sites. Reasons for this may have to do with differences in the geographical and historical contexts. The community of South Elkhorn was small and situated at distance from Lexington. Its role as a commercial area in milling and gunpowder making may have attracted or created a few wealthier families like the Foleys, but, not on the scale of large agricultural operations or famous statesmen.

Perhaps the most important thing we learned from this site was the difficulty of conducting salvage archaeology. The lack of time, the limited excavation area, and the disturbed nature of the site heavily impeded the success of our investigations. Improved communication between the developer, historic preservation groups, and archaeologists could have allowed sufficient time to develop a research

Table 11. Ceramic Decoration Types From Unit 17 at the Foley House.

Type	Whiteware	White granite	Pearlware	Porcelain	Yelloware	Redware	Stone ware	Total
Undecorated	6	25	3	19	2	1	0	56
Transfer printed	14	0	8	1	0	0	0	23
Banded	0	2	2	0	0	0	0	4
Edge	0	0	1	1	0	0	0	2
Hand painted	2	0	3	4	0	0	0	9
Flow	5	0	0	0	0	0	0	5
Colored glaze	0	2	0	1	0	0	0	3
Salt glaze	0	0	0	0	0	0	9	9
Relief	0	5	0	0	0	0	0	5
Shell edged	4	0	3	0	0	0	0	7
Swirl	0	0	0	1	0	0	0	1
Decal, lustre, & relief	0	2	0	0	0	0	0	2
Clear/lead glaze	0	0	0	0	0	11	0	11
Total	31	36	20	27	2	12	9	138

design that would not impede the progress of the developer. With an adequate research design much more information could have been recovered from this site prior to site disturbance. This time factor would have allowed for the development of a much broader public involvement and developer involved project. Salvage archaeology would be served best by learning from the experiences at the Elijah Foley house site to improve the information collected and the benefits for all parties involved.

Despite the limits of this excavation, the Elijah Foley site is important for its contribution to our history and because this site was excavated. Excavations at this site illustrate that private developers, government, and volunteers can work together to salvage history. The lessons learned at the Elijah Foley site will help future salvage projects to be less inhibitive and more productive. It is hoped that this site has set a precedent and opened up a new cooperative attitude that will lead to more than just salvaging history.

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ARCHAEOLOGICAL INVESTIGATIONS INCORPORATING DIGITAL TERRAIN MODELS

By

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ABSTRACT

This research describes the application of digital terrain models to archaeological investigations. A digital terrain model can be developed from field survey data, and provides the archaeologist with a means of viewing an entire site from different directions and inclinations, and with differing amounts of vertical exaggeration. Four study areas were involved in this work. Work on the first two areas demonstrated the importance of a dense network of survey observations, and the importance of the horizontal and vertical survey networks in coordinating mapping. In addition, data reduction software was developed to speed data reduction and formatting for development of digital terrain models. On the final two areas, digital terrain models were developed to evaluate their use in archaeological interpretation. This work illustrated the need to plan for the development of digital terrain models as part of the project mapping. More importantly, however, it was demonstrated that a digital terrain model provides the archaeologist with a unique perspective of a site. This proved to be a significant aide in interpretation and in the planning of future archaeological work.

INTRODUCTION

Planimetric and topographic maps are routinely used to illustrate positional relationships between artifacts recovered during archaeological investigations. Artifacts found during archaeological work are located by their X, Y, and Z coordinates relative to the excavation datum. Artifact positions are then plotted to scale on project maps, supplemented by vertical cross sections as appropriate. Such mapping aids the archaeologist in understanding context, sequence of occupation, and functional relationships on site.

With computer aided mapping, the X, Y, and Z coordinates of features on site can be used to prepare a digital terrain model (also termed digital elevation model). Scollar, et al. (1990) define a digital terrain model as "a regular undulating surface approximating true surface relief." Such models can be scaled, rotated, inclined, or vertically exaggerated to provide additional interpretive information. Because X, Y, and Z coordinates of site features must be located for planimetric and topographic mapping, generation of a digital terrain model requires no additional collection of field data.

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This research reports on the authors' use of digital terrain models in the mapping of four archaeological sites in western Kentucky. Specifically, the following questions were addressed:

(1) How can digital terrain models be used in site interpretation?
(2) What changes are needed in field mapping to support preparation of digital terrain models?

PREVIOUS WORK

Field surveys for archaeological mapping employ plane surveying equipment and techniques typical of a large scale mapping project. Specific requirements for archaeological surveying are discussed in detail by Joukowski (1980). While different measurement techniques may be employed, the function of the mapping is to aid site interpretation by accurate depiction of the horizontal and vertical relationships between features located on site. The specific field points used for mapping are dictated by location of surface features and the nature of the terrain. Typically, topographic and planimetric maps of the site are prepared prior to excavation. Additional mapping is used to show artifact distribution across the site at different excavation levels.

Current surveying practice employs an electronic total station. This instrument combines an electronic theodolite, an infrared distance measuring device, and an electronic data recorder. Survey data can be downloaded to a computer and plotted as a topographic map using various survey software packages (Moffitt and Bossler 1998; Wolf and Brinker 1994). Employment of such equipment in archaeological field work both speeds the survey and facilitates collection of a sufficiently dense data set for accurate digital terrain modeling.

The X, Y, and Z coordinates of points located during mapping also can be used to develop a digital terrain model (DTM). Digital terrain models can be prepared using numerous software packages, and have been discussed extensively in the literature. A general view of digital terrain models as employed in geographic information systems (GIS) is provided by Kvamme (1983, 1990, and 1992) who has written extensively about the subject in the context of archaeology.

As noted by Wolf and Brinker (1994), two general modeling techniques are employed by digital terrain modeling software. The "gridding method" uses the elevations of points observed in the field to interpolate the elevation at the intersection of a regularly spaced grid. Three routines commonly used in interpolation, and employed in this research, are: (1) the inverse power method, (2) the Kriging technique, and (3) the method of minimum curvature. The mathematical bases for these methods are beyond the scope of this paper, but are described by Briggs (1974), Cressie (1991), Davis (1986), Franke (1982), Journel and Huijbregts (1978), Isaaks and Srivastava (1989), Oliver and Webster (1990), Ripley (1981), and Smith and Wessel (1990). It should be emphasized that regardless of the method used, the mathematical algorithm attempts to recognize regional trends in the surface being modeled. The digital model which results is the set of small planes defined by the grid cells.

The second general method for development of digital terrain models (which was not employed in this research) involves use of a triangulated irregular network (TIN) (Wolf and Brinker 1994). This technique produces a surface from a series of triangles joining points of observed elevations. Unlike the gridding methods, TIN holds field observations fixed and employs linear interpolation between the points. The surface that results is the set of triangles resulting from the interpolation. Mathematical descriptions of TIN development may be found in Guibas and Stolfi (1985), Lawson (1977), and Lee and Schachter (1980).

Several recent papers illustrate the use of digital terrain models in archaeological studies. Oetelaar (1993) used digital terrain models to show the location of artifacts on a Mississippian site (Bridges Site) in Illinois. Shackley, Hyland, and Gutierrez (1996) employed a digital terrain model to show the relationship between dome structures and lithic scatters on a site (Valle del Azufre) in Baja, California. Chrisman, et al. (1996) employed digital terrain models to illustrate surface configuration and artifact location on three excavation levels at Pendejo Cave, New Mexico. Krist and Brown (1994) used a digital terrain model in the simulation of caribou migration routes into Lower Michigan.

PROCEDURES AND ANALYSIS

Our research project involved preparation of digital terrain models for four sites (study areas 1-4) located in western Kentucky. Preliminary evaluation of field techniques needed to support digital terrain modeling software, and evaluation of the software itself, was conducted on the first three study areas. On the final area, digital terrain modeling was designed as an integral part of the mapping effort and was intended for use in archaeological interpretation.

Preliminary Work. Site 1 comprised Civil-War-era fortifications located on the bluffs on the east bank of the Mississippi River and now contained within Columbus-Belmont State Park, Hickman County, Kentucky. The objective of the work was the mapping of a star-shaped artillery emplacement with its appurtenant features. These included covered approaches some 3 m deep, a magazine, and outlying trenches, which together presented broken and confusing topography. Work was intended primarily to evaluate field procedures and software to be used for digital terrain modeling.

Surveying employed a simple traverse used for horizontal control; vertical control was provided by differential leveling. Mapping was done by radial observation and trigonometric leveling. The location and density of points observed was based on previous experience by one of the authors (Kellie) in preparing manually-drafted topographic maps.

Digital terrain models of Site 1 were prepared using SURFER software version 4.01 (Surfer Software 1990). SURFER was selected because it was inexpensive, easy to use, and available to the authors. This software requires an input data set consisting of the X, Y, and Z coordinates of each point mapped. The data are gridded using an algorithm of the user's choice (inverse power, Kriging, and minimum curvature in this research). Resulting grids can be smoothed using matrix or cubic spline smoothing. The terrain model can be prepared using orthogonal or perspective projection and user-defined rotations and inclinations. Vertical exaggeration can be changed to enhance or suppress surface features.

The models that resulted for Site 1 were very disappointing. Apparently, while the field data obtained--augmented by the judgment of the topographer--was of sufficient density to enable manual plotting, the data were not sufficiently dense to generate a digital terrain model which accurately represented the site. It was concluded from this work that a somewhat larger number of observations would be required if digital terrain modeling were to be successful. The need to carefully coordinate work between field parties and the need to base all work on common control networks was apparent. Further, the importance of data verification prior to modeling was noted.

Site 2, the Hite Site (I5MI134), was mapped for archaeological purposes prior to disturbance for construction. The object of the mapping was site characterization and location of Early Woodland artifacts and cultural features on the area. This site was located on the south bank of the Tennessee River at its confluence with the Ohio River near Little Cypress, Marshall County, Kentucky. The archaeological significance of this site is described by Schenian and Mocas (1993).

Site 2 was located on a level floodplain approximately 2 m above river stage. The river bank was steep, but regular. The site was clear, open, and flat. Because of this, the survey required a dense pattern of observations to accurately locate contours on the project map.

Following preparation of the topographic map of the site, it became apparent that the data set--because of its density--provided opportunity for the generation of a digital terrain model. The result of the above investigation was an acceptable model of the site (Figure 1). The only major problem encountered in modeling was a need to blank the area of the model that extrapolated field data to the water surface of the Tennessee River.

Site 3, the Crick Site (15Cw96), is located near Almo, Calloway County, Kentucky. This site included both open field and open woodland, and had gently rolling topography. The site contained contextual evidence of Early Woodland habitation and the largest in situ cache of Harrison County, Indiana-like chert Turkey Tails (N = 37 in situ; N = 44 out-of-context; 81 blades total) ever found east of the Mississippi River (Carstens 1984a, 1984b; Schenian 1987).

The survey data set was sufficiently dense for generation of a digital terrain model, and a number of models were prepared of the site. Figure 1 illustrates a model of the site based on a Kriged grid. The results of work on this site indicate that vertical exaggeration was very important to site interpretation. Further, the experimentation with different gridding algorigthms indicate a decided preference for use of the inverse power or Kriging methods. The minimum curvature algorithm appeared to over-generalize the site. Finally, the problem of data verification was addressed by preparation of a topographic map prior to terrain modeling. Incorrect elevations are readily apparent on the topographic map because incorrect data appears as a "bulls eye."

Integrated Mapping and Modeling. At Site 4, digital terrain models were prepared as an integral part of the mapping and interpretation at the Fort Star archaeological site (15Lv207) in Smithland, Livingston County, Kentucky. This site consists of Civil War fortifications that were to be mapped as part of an on-going archaeological investigation (Carstens et al. 1994) and conducted jointly by Murray State University and Livingston Central High School (Carstens 1997). The work done on this site was far more extensive than that performed on any of the other sites, and it was planned early in the investigation to incorporate digital terrain modeling as part of the project.

Background. When the Confederacy invaded Kentucky's neutrality in 1861 by building the fortifications at Columbus, Kentucky (Site 1 above), Federal troops, led by General Ulysses S. Grant, responded by taking Paducah and Smithland, Kentucky. Grant's men built Fort Anderson in Paducah, the largest civilian population center in extreme western Kentucky and also a traditionally southern-sympathizing town. In Smithland, a small rural community 17 miles north of Paducah located at the strategic Ohio and Cumberland rivers' confluence, Grant had General C.F. Smith construct two earthen, star-shaped fortifications: Fort Star and Fort Wright. Collectively these two forts are referred to as Fort Smith, in honor of C.F. Smith. Fort Wright overlooked the confluence of the Ohio and Cumberland Rivers and consisted of a half star-shaped, southerly-oriented earthen fortification housing an eight inch Columbiad

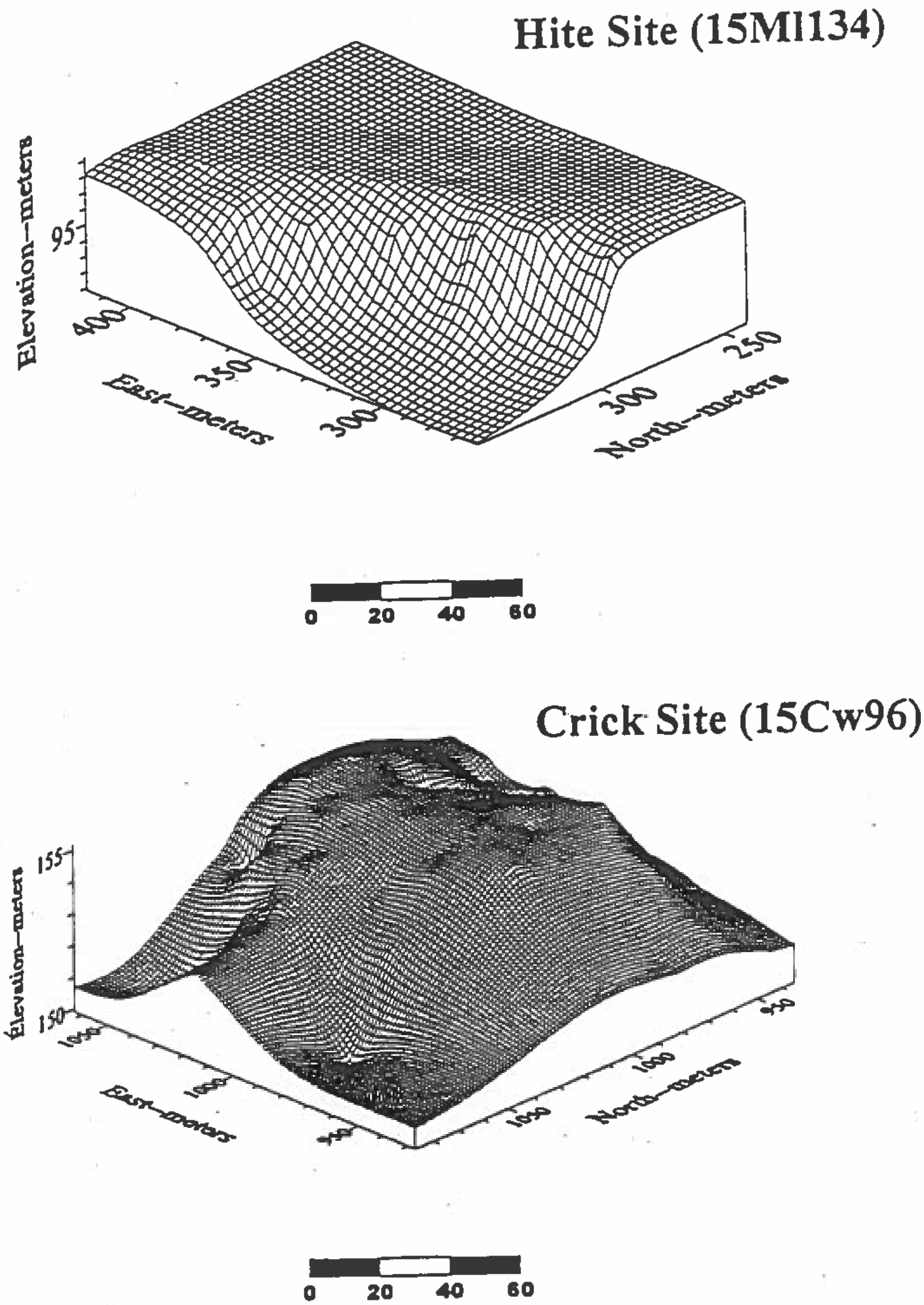


Figure 1. The Hite (15Ml134) and Crick (15Cw96) Sites Used as Study Areas Two and Three.

and a 32-pounder; more than 150 troops were stationed at this fort. Fort Star, the smaller of the two fortifications, was located about ½ mile south of Fort Wright (Scheller 1861). Its 32-pounder focused on the southern entry of Kentucky roads 70 and 453 from Tilene and Iuka, respectively, in anticipation of an attack from Confederate troops stationed at Forts Henry and Heiman up the Tennessee River or Fort Donelson up the Cumberland River.

Kentucky's commitment as a state remained with the Union, though secessionists in and near Smithland (and in western Kentucky) resented it enormously and wished to secede from Kentucky in order to join with western Tennessee as a separate secessionist state. Neither Fort Wright or Fort Star in Smithland or Fort Anderson in Paducah were built in "friendly" or sympathetic territories. Although no major actions took place against Forts Wright or Star throughout the war, a major battle took place at Fort Anderson in Paducah, the Federalists winning and maintaining ground.

Collectively, Forts Anderson, Star and Wright served as a staging ground for more than 20,000 Federal troops between December 1861 and February 1862 prior to Grant's historic thrust into the South in which Federal troops attacked Confederate strongholds at Forts Heiman, Henry, and Donelson. As noted above, it was these actions that resulted in the Confederate evacuation of the fortifications at Columbus. Between 1864-1865, a company of African-American (Colored Heavy Artillery, CHA) troops were stationed at Forts Anderson (8th CHA) and Star/Wright (13th CHA).

Thereafter, these three Federal forts remained garrisoned until November 1865 as a testimony to Federal control of the Ohio and Cumberland Rivers. Troops at these forts consisted of soldiers from Kentucky, Illinois, Indiana, and Missouri. Unfortunately, during the twentieth century, modern urban developments in Paducah and Smithland destroyed Forts Anderson and Wright. Today, only Fort Star's archaeological record remains intact and undisturbed and is the subject of recent archaeological studies by Murray State University (MSU).

With a grant from the National Park Service as administered by the Kentucky Heritage Council in Frankfort, archaeological investigations of Fort Star (15Lv207) began during the second week of March 1994, when nine MSU undergraduate archaeology students and two faculty members directed excavations in three areas of the fort, supervised the excavations of 204 Livingston Central High School students throughout the week's work, conducted a metal detecting survey of the fort environs, and mapped the site to create planimetric and topographic maps of the earthwork and surface features.

Eight, 1 x 2 m excavation units located on the south side of the site revealed a dry-laid brick feature consisting of a C-shaped brick hearth, the foundation of a dismantled flue with limestone floor, and a collapsed chimney. Cultural fill in and around the hearth included a polished bone ring, burned and unburned chicken, deer, and squirrel bones, a Federal-style general services brass button, a clasp knife blade, a hand-blown ink bottle, numerous hand-wrought nails and flat-glass fragments, lead spue, fired percussion caps, and white porcelain buttons.

Two, 1 x 2 m excavation units in the center of the gun emplacement failed to reveal any cultural features or evidence of how the 32-pounder was mounted. Future excavations planned for the edge of the half-lunar shaped gun emplacement may locate the rail or track on which the cannon was geared. One unspent 40 cal. brass cartridge was found within one of the excavation units as were several hand wrought nails.

A single 1 x 2 m excavation unit was placed in the middle of an L-shaped depression locally known as the "magazine." Excavations revealed the presence of a buried paleosol 90 cm below the surface of this feature in association with several aberrant brick fragments and several iron nails. The function of this feature remains unknown at this time, but it appears doubtful that it functioned as a magazine due to its size (too small) and the presence of iron nails associated with the structure fill. It is more likely that this feature functioned as a rifle pit protecting the unprotected north flank of the site.

FIELD SURVEYS AND MAPPING

Field surveys were conducted using radial observations and trigonometric leveling from a triaxial control network using a Pentax PTS II total station. Although the techniques involved were the same as those employed on the first three study areas, a much higher larger number of observations was obtained: some 255 points were mapped on the 0.7 ha site.

Initial mapping was done at a scale of 1:200. Both topographic and planimetric maps, as well as site cross sections were prepared manually. The three map types were extremely useful for comparing site layout, assessing spatial associations among the site's visible cultural features (e.g., ramparts, "magazine," brick structure, and gun emplacement), and for visualizing the volume of earth moved to create the half-star earthen fortification when it was constructed. Orthogonal projections also revealed where the site magazine may be located. These maps will be used for planning future archaeological excavations on site and for determining the best preservation management plan to be used for the site.

Following the initial mapping, field data were gridded using the inverse power, Kriging, and minimum curvature algorithms. SURFER version 6.0 was used for this work (Surfer Software 1995). From this data set, both topographic maps and digital terrain models were produced.

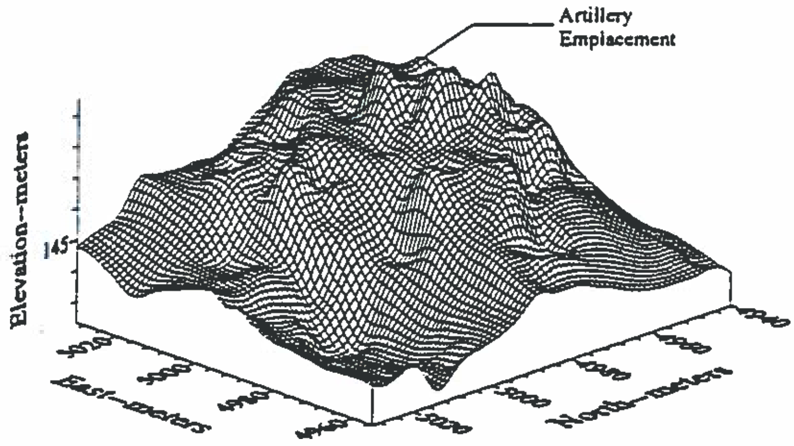
A topographic map and a surface model of Fort Star are shown in Figure 2. Two things should be noted when viewing these maps. First, the area shown on the map is somewhat smaller than the total area mapped. This is because additional observations beyond the mapped area were used in generating the grid from which both the topographic map and the surface model were prepared. Second, in areas where data was sparse, contours have been drawn based on elevations extrapolated by the gridding algorithm.

The gridded and smoothed data sets next were used to prepare a series surface models, some of which are shown in Figure 3. These were used to study the site from various tilts and rotations, and with different levels of vertical exaggeration. Finally, a contour map and a surface model of Fort Star are combined in Figure 4.

CONCLUSIONS

The first question posed at the beginning of this research dealt with the use of digital terrain models in archaeological interpretation. The second question considered the potential changes in field techniques needed to support digital terrain model development. These questions are addressed separately.

Fort Star (15 Lv 207)
Livingston County, KY



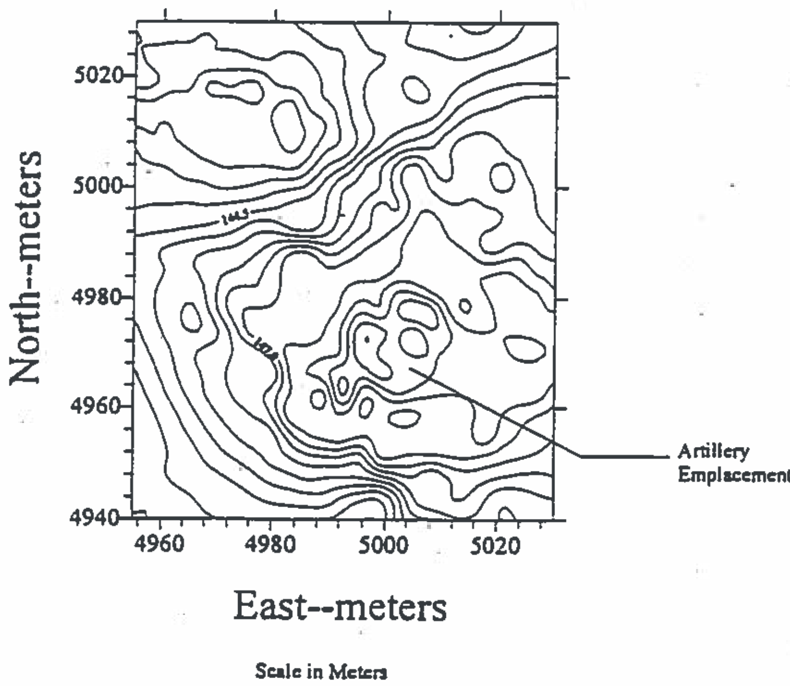


Figure 2. Surface Model and Topographic Map of Fort Star (15Lv207). Note the location of the artillery emplacement on drawing.

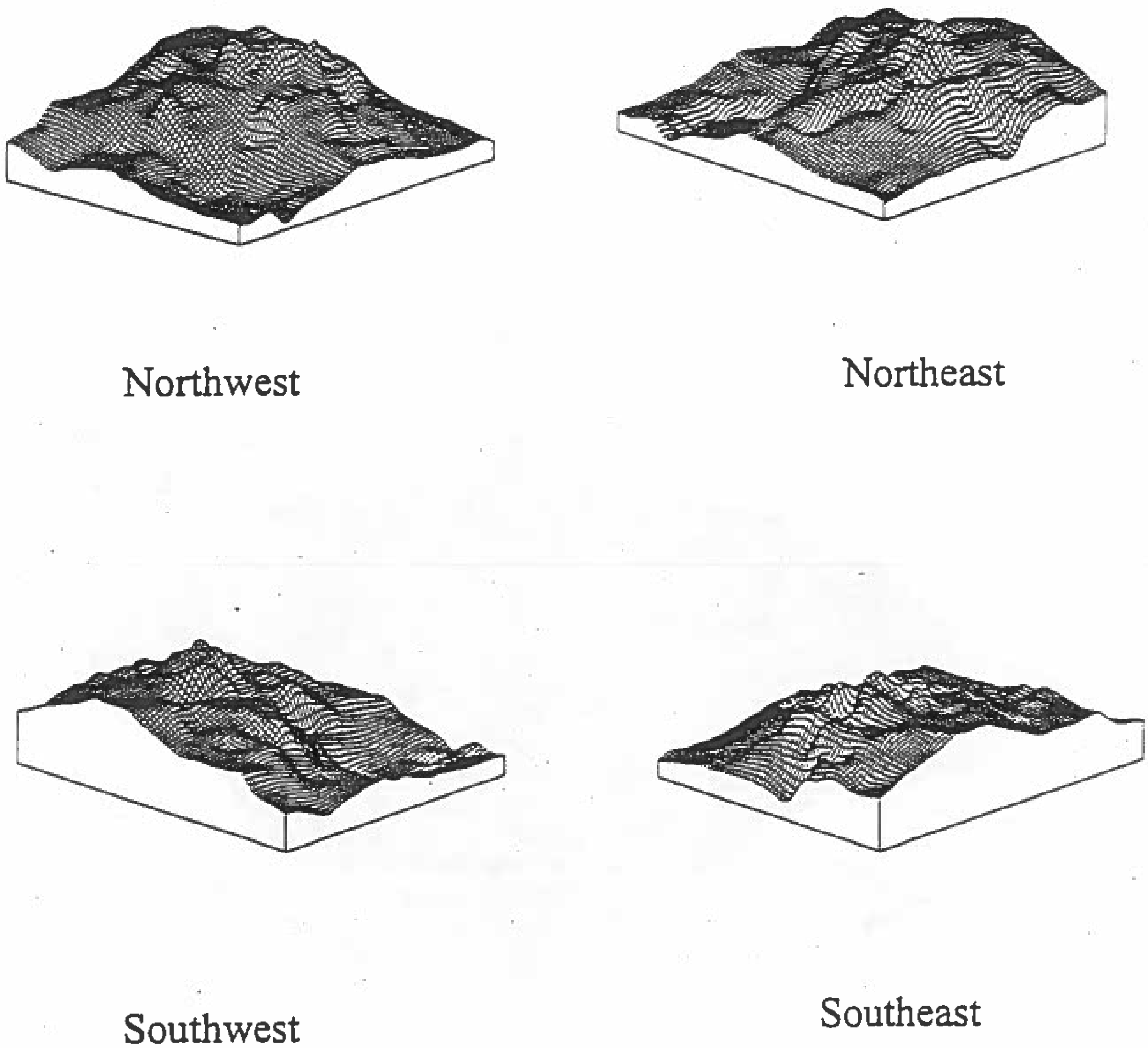


Figure 3. Surface Models of Fort Star (15Lv207) When Viewed from the Northwest, Northeast, Southwest and Southeast respectively. Vertical exaggeration and tilt are constant in the four models.

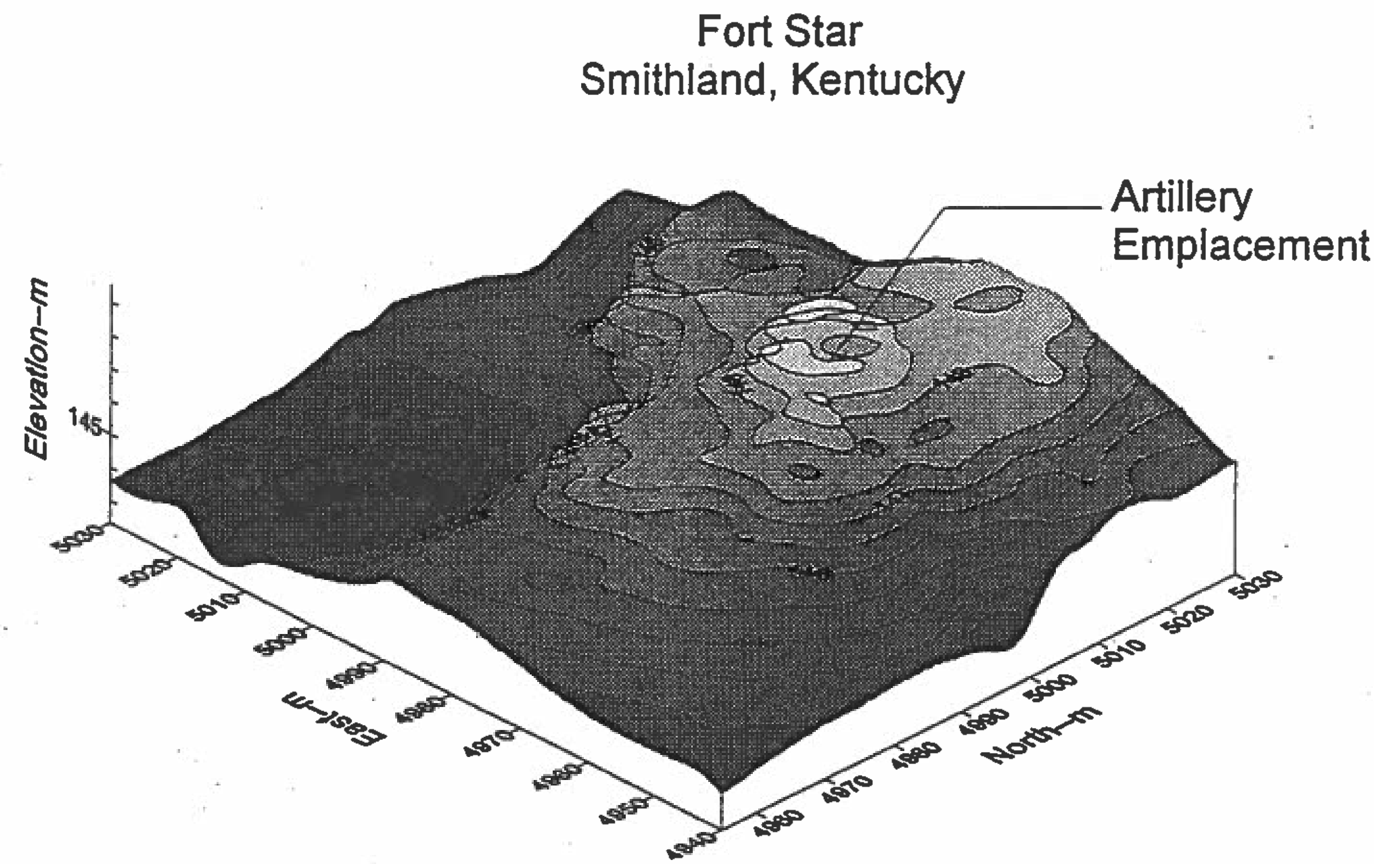


Figure 4. Combined Surface Model and Topographic Map of Fort Star.

DTM USE IN ARCHAEOLOGICAL INTERPRETATION

From an archaeological perspective, the digital terrain models developed for these projects allowed the archaeologist to visualize ("see") the three dimensional characteristics of the cultural landscape on a single plane. It is possible also to better define areas of archaeological significance within a site based on information shown by modeling techniques. Cultural landscape features are clearly present on surface models and are more definable (visible) than when simple topographic maps are used. Indeed, as a result of viewing the northeast and northwest surface models of Fort Star, it is possible to indicate the probable location of the site's magazine (to the north of the gun emplacement, down slope, and between two terrain shoulders), indicate how the magazine might have been constructed (log roof sodded over and capping a natural hill slope depression), and assist in the planning of further archaeological excavation. Digital terrain modeling today provides the archaeologist with a context with which to see the cultural landscape of a site in its entirety, and is, as a result, as significant to archaeology of the twenty-first century as black and white aerial photographs were to the advance of archaeology during the early twentieth century.

SURVEY INTEGRATION

This research disclosed several things which should be considered when attempting to integrate DTM development into routine surveying operations. First, in most cases, field observations are primarily intended to delineate the area immediately within and immediately outside the project area as required by the research contract. On the Fort Star project (Site 4) the intensity of observations outside this immediate area was sufficient for manual drafting of contours, but insufficient for computer based mapping using a gridding algorithm. Grid elevations are interpolated based on a "nearest-neighbor" algorithm. A few widely separated points (on a uniform surface, for example) are acceptable for manual drafting, but may result in an incorrectly portrayed gridded surface. If digital terrain models are to be a primary survey product, a more intensive (and expensive) series of field observations outside the immediate area to be mapped is necessary. This will mean a definite expansion of the mapping effort.

Second, one objective of the field work described on the Fort Star project was to determine how closely an 1861 map of the site prepared by U. G. Scheller conformed to the existing earthworks (Scheller 1861). The authors had little difficulty in locating the "star shaped" outline of the fort on the ground, and drawing it in planimetric view based on manually drawn contours. However, fort planimetry is not solely a function of topography since the outline of the works appear somewhat subdued as shown in Figure 4.

This intrigued the authors because it concerns how site features are actually perceived by investigators. Our conclusion is that this perception is the apparent combination and mental integration of both the linear relationships of break lines in the topography and the vertical expression of site features rather than the use of either alone.

Third, the use of digital terrain models in this project did not substitute for planimetric and topographic mapping. However, the additional information obtained from the models amply repaid the time devoted to their preparation. Our experience to date with the preparation of digital terrain models does not indicate a simple "cookbook" approach. Data verification and the preparation of a topographic map based on the gridded data file are important first steps in the modeling process. Beyond that, it is necessary to experiment with gridding algorithm, tilt, rotation, vertical exaggeration, and line type and direction to accurately portray the features of the site being studied.

ACKNOWLEDGMENTS

Work on Fort Star, a component of the Federal Fort Smith Civil War site complex was made possible by grants in 1994 and 1995 from the National Park Service to the Kentucky Heritage Council in partial support of the work described in this paper. The authors wish to thank David Morgan, Kentucky State Historic Preservation Officer and his staff for their assistance with this project.

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ARCHAEOLOGICAL INVESTIGATIONS AT FORT SMITH, 15Lv207, A FEDERAL CIVIL WAR GUN EMPLACEMENT SITE IN SMITHLAND, KENTUCKY

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ABSTRACT

Archaeological investigations were conducted at a Federal Civil War gun emplacement at Fort Smith in Livingston County, Kentucky. These investigations were undertaken with the assistance of faculty and students from Livingston Central High School and Murray State University. This project is an excellent example of public archaeology and putting K.E.R.A. to work. This paper discusses the test excavations conducted at the gun emplacement and how high school students were exposed to archaeology.

INTRODUCTION

Site 15Lv207 is a Federal Civil War Gun Emplacement located near Smithland in Livingston County, Kentucky. Archaeological field investigations began during the second week of March 1994. Between March 11 and 18, 1994, nine Murray State University undergraduate students and two Murray State University faculty directed archaeological investigations (mapping, metal detecting, site test excavations, and videotaping of these activities), using and training more than 200 Livingston Central High School students and faculty. The following report briefly summarizes the findings of field and archival research and new questions posed by the research thus far completed.

MAPPING

The 15Lv207 site complex consists of two fortifications as depicted on the 1861 Scheller map (Figure 1). Although this map of the Fort Smith complex was known to exist prior to our field investigations, no detailed topographic or planimetric maps of the site complex were known to exist. Therefore, as part of our grant agreement, detailed maps of the site area were generated (see Kellie, Carstens, and Orth this volume). Unfortunately results of our 1994 and 1995 work in the vicinity of the northern-most gun emplacement demonstrated that the northern gun emplacement site and associated enlisted men camping areas had been destroyed completely through urban expansion in Smithland. The northern fort area, called Fort Wright, had been replaced by a senior citizens housing project and the encampment area has been leveled by bull dozing, construction of two swimming pools, and house and barn development. Metal detecting in this later area in March of 1995, failed to reveal any evidence whatsoever of mid-nineteenth century occupation. Mapping of the southern site area, called Fort Star, was accomplished through the supervision of Andy Kellie, Licensed Surveyor and Associate Professor of Engineering Technology at Murray State University (Figures 2 and 3). Along with his mapping,

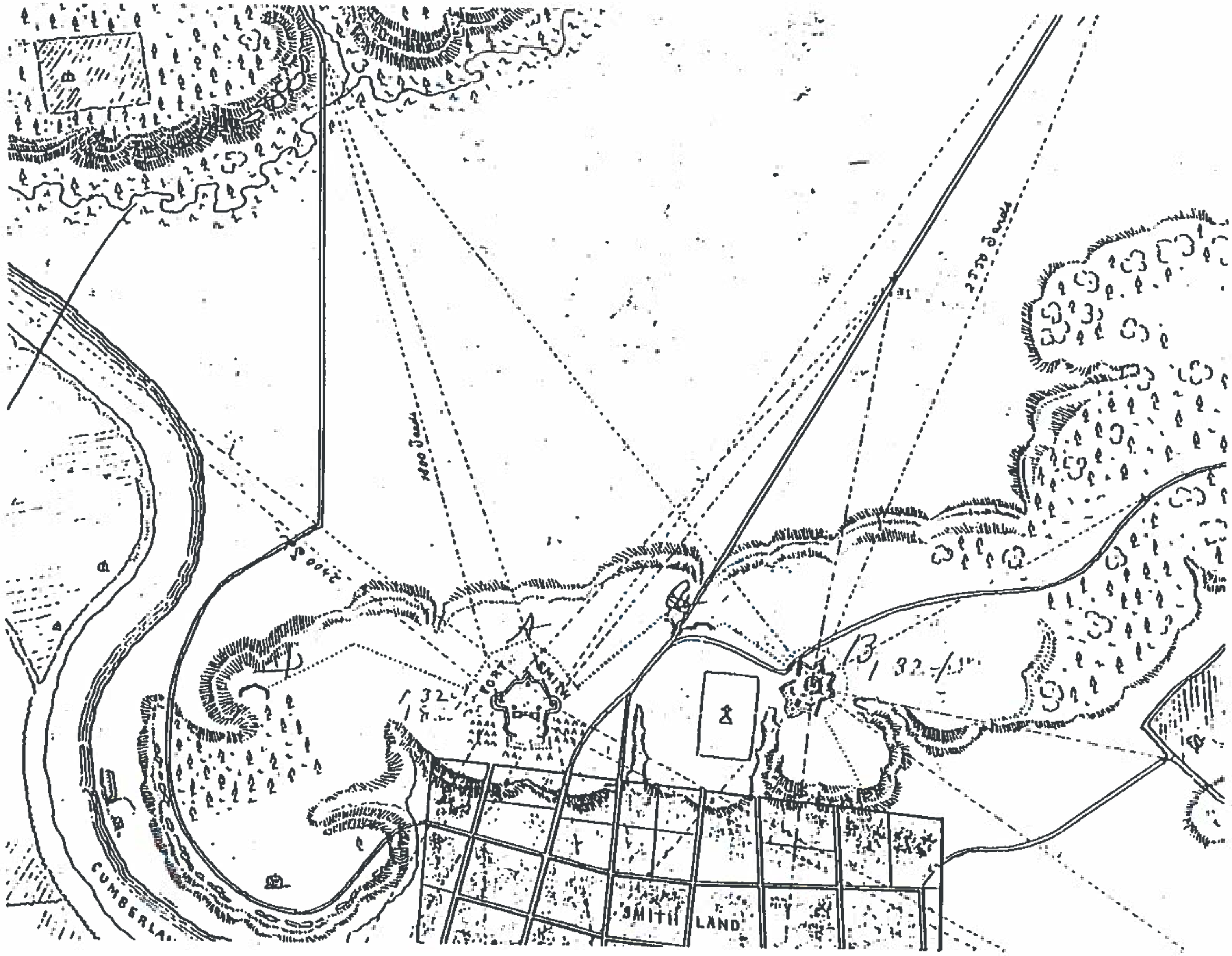

Figure 1. A Portion of the 1861 Scheller Map Depicting the Fort Smith Site Complex. "A" is the destroyed northern complex; "B" is site 15Lv207, the subject of this paper. North is to the left.

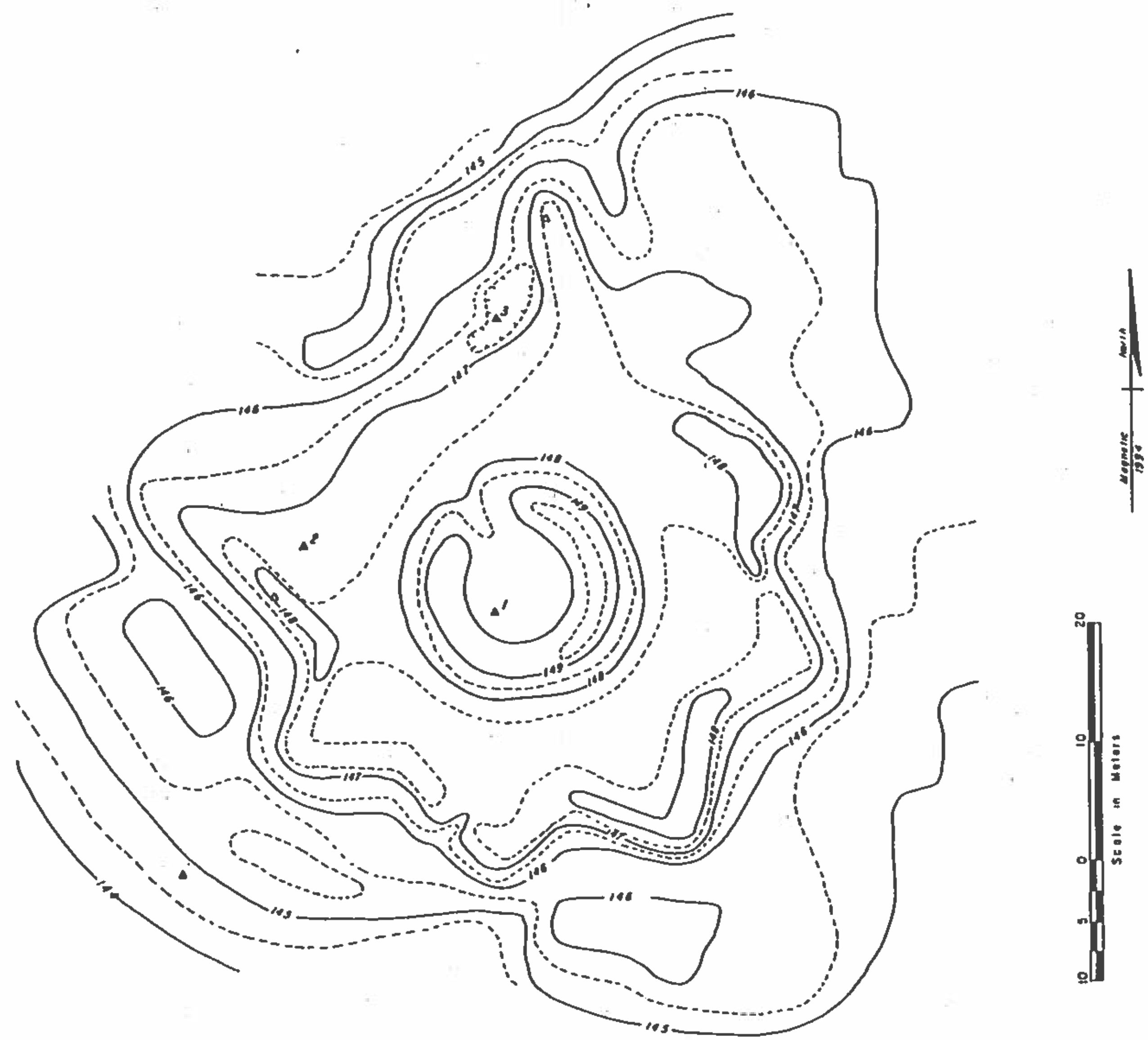

Figure 2. Topographical Map of Site 15Lv207 made by Andie Kellie. The contour interval is 0.5 m.

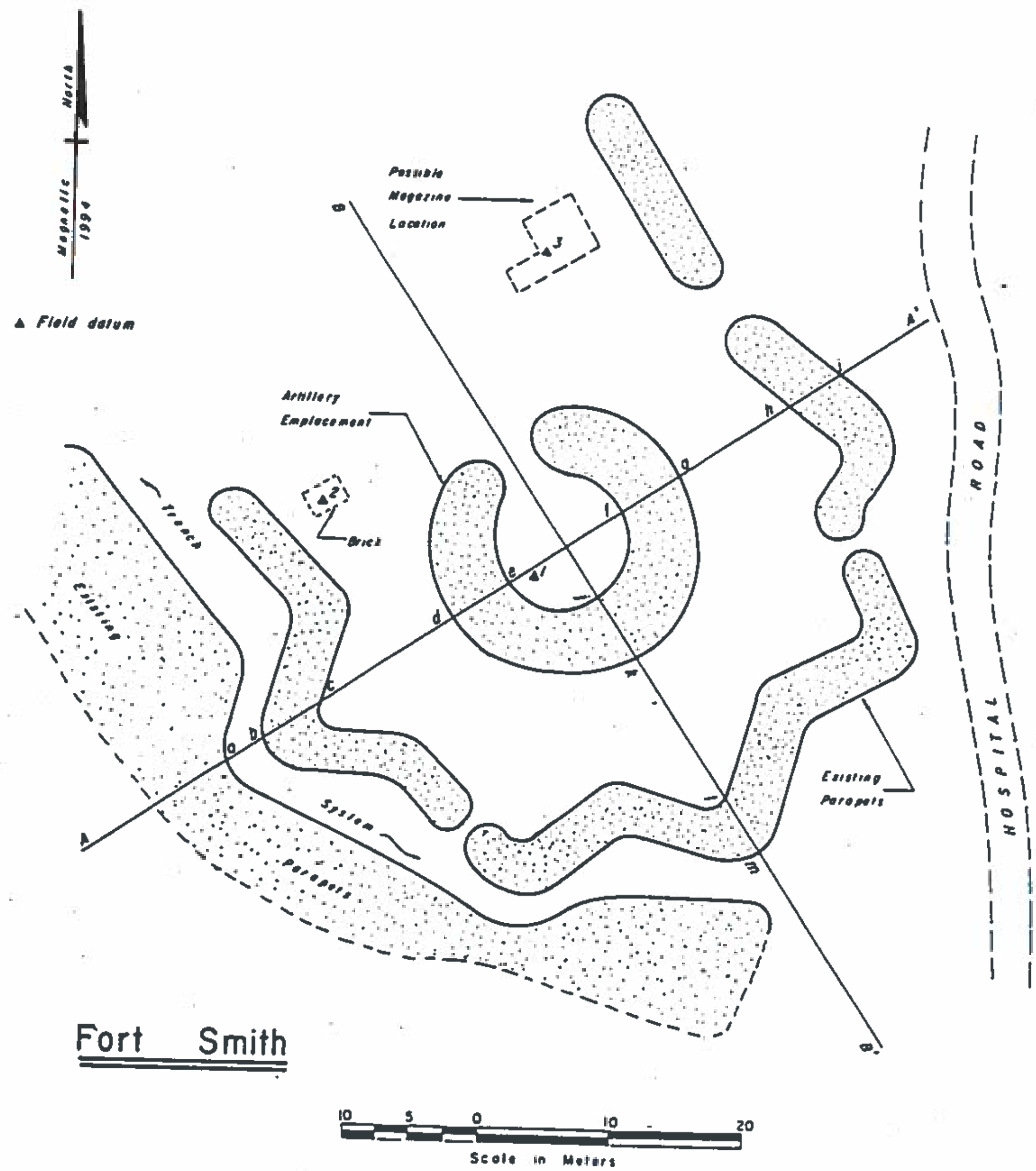

Figure 3. Planimetric Map of Site 15Lv207 by Andy Kellie.

which reveals a rather symmetrical pattern to this star-shaped earthwork. Kellie also established several site datums which were tied into the site maps (Field Datums 1-3). and left at the site for later field operations and subsequent excavation control points.

Kellie's mapping revealed that the general orientation of Fort Star is north-northwest to south-southeast so that the commanding view of the gun emplacement is to the east. south. and west. Our archival research determined that one. 32-pounder (that is a cannon having a 20.5 cm [8 inch] diameter and shooting a pointed, tube-shaped projectile weighing 14.4 kg [32 pounds]). was mounted in this southern gun emplacement (a 32- and 64-pounder were mounted in Fort Wright about 1.6 km (1.0 mile) from 15Lv207; See Scheller Map, Figure 1). Fort Star. site 15Lv207. commanded the southern road entries. now designated as Kentucky highways 253 and 70 coming from Gilbertsville and Tilene, respectively, as well as the flat plains between two major lines of hills (Figure 1). The cannon of Fort Wright were trained on the Cumberland River. should a Confederate attack come from upstream via Fort Donelson (in Dover. Tennessee). up the Cumberland River.

Connecting the two fortifications was a dirt road (Figure 3) termed "Hospital Road." Half-way between both fortifications stood (it was recently torn down), an antebellum Greek Revival style home, which served as one of three hospitals for the Fort Smith complex (during its peak, just prior to the Federal attack on Fort Donelson, more than 15,000 Federal soldiers were garrisoned within the Fort Smith complex). "Hospital Road" is an important piece of the cultural landscape from Smithland's past. The road is inexplicably tied to the history of 15Lv207. Archaeological investigations --metal detecting survey-- by Carstens, Haneline, and Tucker (1994). failed to reveal any metallic cultural evidence in the area of the road that abuts the fortification. Nonetheless, this road should receive further study as a piece of cultural landscape associated with the Fort Smith site complex.

METAL DETECTING

A thorough examination of the surface of 15Lv207 in the area between the two existing parapets and horseshoe-shaped gun enclosure, and the area between the site and the suspected magazine and brick concentration (Figure 3). was made with two. Bounty-Hunter metal detectors. Each positive reading on the metal detector was field-flagged. then subsequently mapped with transit. plotted and removed from the soil and placed into a labeled container on which were recorded field plot number. site number. date, and names of field workers. Some difficulty with false readings was encountered as a result of high ferric oxide content in the eroded. cherty-sandstone conglomerates. Otherwise. it appears that the only concentration of metallic objects (principally nails. but also what appears to be fragmented portions of an old pot-bellied stove). were located in the northern portion of the site between the brick concentration (west) and the suspected position of the fort's magazine (east) (Figure 3). With the exception of one 25.64 cm (10 inch) metal file found on the west central edge of the gun emplacement parapet, no other metal was discovered in the site area with the metal detector. However. neither the parapets nor areas outside the parapets were examined with metal detectors, but should be during a later stage of this research.

EXCAVATIONS

A total of eight 1 x 1 m test units were excavated during the first phase of the grant (only six were required by the grant). Excavation units were dug in 1 x 2 m units in each of the three cultural features (A, B, and C): the magazine (C), the gun emplacement (B), and the brick concentration (A). Each of these areas will be discussed below.

Field methods for all three excavations included troweling by 10 cm arbitrary levels (except deeper, sterile levels in the "magazine," which were shoveled out by 10 cm levels) screening all cultural fill through 0.64 cm (0.25 inch) mesh hardware cloth, collecting all cultural materials from the screen, isolating features, drawing/photographing features (e.g., the brick concentration), drawing/photographing wall profiles, and backfilling (except for the uncompleted brick feature, which will need additional excavations to its east and west in order to define the function of the brick concentration).

MAGAZINE

The actual function of the "magazine" is not known. It is referred to as the "magazine" simply because local Smithland lore refers to this L-shaped depression as the fort's magazine. Its field location even supported a labeled flag stating "magazine," on the day we arrived to begin our fieldwork. Excavations in the "magazine" did not support that conclusion.

A single 1 x 2 m test excavation was placed in the center of the depression forming the magazine feature in hopes of uncovering a wooden foundation, or original floor, or remnants of any munitions that might have been stored in the "magazine." The pit fill, above the 90 cm below datum mark, contained only a few aberrant brick fragments in a loamy clay matrix (7.5YR5/8). Immediately below the 90 cm mark were several iron nails and spikes of various sizes. (Magazines usually used copper or brass nails or wooden pegs to avoid the possibility of sparks.) In profile, the original "ground" level or decayed floor in this depression was identified in the south and east walls at a depth of 90 cm below ground level. It was approximately 2 cm thick, and very dark (10YR4/0) in color. No other cultural materials were found in the "magazine." At this point all that can be said is that a large L-shaped depression approximately 8 m in circumference was dug originally to a depth of about 90 cm below ground level. The pit (with wood/organic floor?) was left open for a period of time and decaying matter discolored the soil black, during which time several handmade brick fragments were deposited. The pit was abandoned and was allowed to fill gradually with a fine light brown colluvial loamy clay which previously had been dug from the pit and piled around the pit's edges to form an embankment. Future excavations of the "magazine" should cross-section the "walls" of this human-made feature to better define the function of this semi-filled earth depression. The "magazine" may have functioned as a rifleman's pit or held some other function, although without further excavation assigning any function to this L-shaped depression is highly speculative.

GUN EMPLACEMENT

In the center of the site is a circular, horseshoe-shaped earthen parapet, 1.5 m high, that protected a flat circular interior region housing the site's large cannon (Figures 1-3). Cannon of this size (32-pounders) frequently weigh about (9,000 pounds) (Fort Wayne Cannon Reproductions, personal communication, 1994). Such weight could easily buckle an earthen floor, so two 1 x 2 m excavation units (Units B-1 and B-2) were placed in the central area of the gun emplacement to determine the kind of flooring on which the cannon rested, brick or wood.

Although no flooring was found, indirect evidence of flooring, nails, was recovered from both excavation units. Both units contained very little cultural debris, except for several dozen nails, and one pistol bullet, ca. 40 caliber, recovered in situ with a coarse FF size gun powder still encased within it. Both excavations units were sterile within the upper 10 cm of deposits.

It appears that a wooden floor, possibly green oak cut from the clearing of the site's ridge top, might have been used to support the massive weight of the large cannon. It is also possible that a front pintel mount (carriage) held the large cannon on top of the oak floor and that small iron wheels on a metallic track allowed the gun to pivot from 90 degrees east to 270 degrees west. Similar mounts were common for both Federal and Confederate 32-pounder cannon (the recreated 32-pounders at Fort Donelson, Tennessee are mounted this way).

If excavations in the central gun emplacement continue, they should be placed along the northwestern and southeastern portion of the interior gun emplacement to locate the track on which the large cannon pivoted, otherwise, additional excavations within the central gun emplacement would be meaningless.

BRICK FEATURE

Inside the western parapet was a small mound, less than 30 cm high, and approximately 4 m in circumference (Figure 3). On top of the small "mound" were several holes from vandals, measuring about 40 cubic cm. Scattered within the leaf litter on top of the mound were several handmade brick fragments. A 1 x 2 m excavation unit, oriented north-south, was placed in the area of brick concentration to discover the origin of the brick and its association to the gun emplacement. Before any excavating began, however, all brick, brick fragments, associated nails, screws and other cultural materials found on the site's surface were piece plotted on standard MSU square sheet paper including bricks outside the 1 x 2 m area lying adjacent to the unit. Consultation with Paducah brick expert, Bill Black, Jr., indicated that the bricks were handmade. The bricks appeared to be similar in texture and composition to other mid-nineteenth century brick that Black had observed throughout the region previously. They also seemed to consist primarily of soft-bricks, no clinkers (clinkers are usually used for outside walls, being a harder brick, they weather better than "softer" bricks like those being found).

Excavations began in Test A after all of the surface bricks had been plotted. Bricks appearing to be out-of-context were removed to Black's residence for further study. Bricks appearing to be in situ were left in context and excavations proceeded slowly around them at 10 cm arbitrary intervals. As dirt was removed, more bricks were encountered as were more nails, presenting an even more complex construction pattern. Black was called back to the site several more times for continued evaluation of the bricks, for an appraisal of the possible structure, and for an overall evaluation of how this structure related to the rest of the site.

A regular pattern to the bricks began emerging between the first and second level in Test A, almost completely filling the 1 x 2 m excavation unit. According to Black, the manner in which the bricks were laid was "amateurish," suggesting that either the bricks were laid in a hurry, or that the person laying the bricks had not had any previous brick-laying experience (e.g., a task assigned to a soldier).

In April of 1995, additional excavations were placed to the east and west of the main brick structure revealing that the brick structure was a brick fireplace with chimney (now collapsed). To the east of the brick concentration was the C-shaped fire box, filled with ash, nails, bone, and porcelain (officer's) dress shirt buttons, and other artifacts associated with the Civil War occupation of the site. Outside the hearth was the neck of a bitters bottle, remnants of fired percussion caps, and a brass enlisted soldier's button (general service). West of the main brick structure were the scattered remains of the collapsed chimney. Plans are now underway to preserve this brick feature so it may add to the overall interpretation of the site.

As noted previously, there were numerous machine cut (ca. 1850-1890) nails associated with the brick feature. A study of the nails associated with the bricks was accomplished by Tucker (1996) who concluded that possibly a log structure, probably covered with clapboards and having a brick or brick and wooden floor, covered this portion of the site. The structure probably had a tin roof. It would appear that the fireplace and structure were built on site to offer protection to the soldiers during inclement weather, and may have been used as officer's quarters or simply as the quarters for the officer-of-the-day. A close examination of the 1861 Scheller map does indicate "something" structural in the area where we uncovered the archaeological evidence of a brick-wood-tin structure (Figure 1).

ARCHIVAL WORK

Several sources were examined for archival records regarding Fort Smith: *The War of Rebellion* records, which contain several autobiographies (e.g., Gen. Lew Wallace), passing references to Fort Anderson (in Paducah) and Fort Donelson (in Tennessee): the Adjutant General records for Kentucky, Illinois, Indiana, and Missouri, and the National Archives in Washington, D.C.

By far the most detailed accounting of daily activities at Fort Smith were found in the Day Books of Fort Smith in the National Archives (U. S. War Department 1901). These handwritten documents are still being transcribed and await further analysis, but will add greatly to explaining the day-to-day existence of the Federal Civil War soldier at Fort Smith.

KENTUCKY EDUCATIONAL REFORM ACT (K.E.R.A.) INVOLVEMENT

Part of this research project (and stipulations of our 1994 NPS/KHC grant) included the use of high school students and faculty (and community) from Livingston Central High School into the archaeological project. As stated previously, more than 200 students and faculty from LCHS participated in the week long excavations at Fort Smith. The excitement in their eyes carried over into the classroom, according to Meg Tolley, Teresa Lang, and Debbie Bell, the principal teachers bringing students to the site (the site is located immediately behind LCHS and atop a bluff). The high school students were very enthusiastic about learning. Not only because this Civil War site was behind their high school, but because it represents the very roots of their community. Students learned archaeology through "hands-on" experiences, mapping with the transit, excavation, running the metal detectors, and so forth. In April of 1994, the author met with all of the Smithland teachers during an in-service day to discuss other K.E.R.A. activities in a working-across-the-curriculum brainstorming session. The 1994 NPS/KHC grant helped to make archaeology public and to instill the idea of higher education to students not previously considering attending college. This grant has changed the curriculum at Livingston Central, too, where now (1997) students enroll in introductory anthropology and archaeology classes. As Norm Snider of the Kentucky Council on Higher Education said, "this project is an excellent example of putting the Kentucky Education Reform Act (K.E.R.A.) to work in the high school (Snider quoted by Millikan, 1994).

ACKNOWLEDGMENTS

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direct support of faculty (Andie Kellie), students (Meranda Caswell, April Haneline, Scott Kayse, Josh McNally, and Kathleen Tucker) from Murray State University, faculty from Livingston Central High School (especially Debbie Bell, Vicki Conyer, Doris Cothran, Edward Doom, Teresa Lang, and Meg Tolley), administration members of LCHS (Tom Counts, Principal, and Harry Loy, Superintendent, Francis Rushing, Secretary), and more than 200 students from Livingston Central High School. Assisting with logistics and local support were Ian Young, Livingston County Soil Conservationist, and Rex Smith, Livingston County Judge Executive. Lastly, Joe Brent, Civil War historian from the Kentucky Heritage Council, proved to be a very valuable resource person who first suggested we conduct this study, involve the high school students, and who provided us with a copy of the 1861 Scheller map. Without Joe's help, and the help of the aforementioned people, this project would not have been possible.

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IN THE DAYS OF THE "GRAND WATER POWER:" DEVELOPMENT AND DECLINE OF THE GRIST MILL INDUSTRY IN NORTHERN KENTUCKY

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ABSTRACT

During the early nineteenth century, water-powered grist mills were vital to rural communities in the Ohio Valley. Mills often served as gathering places for local farmers, and as foci for the development of crossroads and small communities. By the 1840s, the development of the steam engine began to change the character of the local milling industry. By the last quarter of the nineteenth century, all but a few of the mills serving Boone, Campbell, and Kenton counties were steam-powered. Usually associated with larger communities, most of the steam-powered mills provided goods for the commercial market rather than for individual farmers.

The development and decline of the Crisler-Gulley Mill in Boone County serves as an example of how the increased use of steam power changed the character of rural mills and their associated communities in northern Kentucky. Based on an archaeological survey of the Crisler-Gulley Grist Mill and archival research, the historical development of the Crisler-Gulley Mill is traced from its probable construction date to the end of its operation. The plight of its owners' is then discussed in a larger context related to the decline of water-powered milling in northern Kentucky.

INTRODUCTION

The construction of mills in the Ohio Valley began soon after Euro-American immigrants settled the area in the late eighteenth century. By the early nineteenth century, settlers had erected permanent mills along the rivers and streams of the region. The first grist mills in northern Kentucky were water powered, taking advantage of permanent streams such as Gunpowder Creek in Boone County.

During the early part of the nineteenth century, water-powered grist mills were important to the rural communities of the Ohio Valley (Apps and Strang 1980; Garber 1970; Jackson 1971; Rawson 1963; Storck and Teague 1952). Operated by local farmers and businessmen, mills often served as gathering places for local farmers, and as foci for the development of crossroads and small communities. By the 1840s, however, the development of the steam engine began to change the character of the local milling industry. By the last quarter of the nineteenth century, all but a few of the mills serving Boone, Campbell, and Kenton counties were steam-powered. Usually associated with larger communities, most of the steam-powered mills provided goods for the commercial market rather than for individual farmers. They also served larger populations than their smaller, water-powered predecessors.

The development and decline of one water-powered grist mill in Boone County serves as an example of how the increased use of steam power changed the character of rural mills and their associated communities in northern Kentucky. Based on an archaeological survey of the Crisler-Gulley Grist Mill and archival research, the historical development of the Crisler-Gulley Mill is traced from its probable construction date to the end of its operation. Its owners' situations are then placed in a larger context related to the decline of water-powered milling in northern Kentucky.

SITE DESCRIPTION

The Crisler-Gulley Grist Mill was built in the early nineteenth century along Gunpowder Creek about 3.2 km (2 miles) south of Burlington, the county seat of Boone County. The mill site, a complex of milling related features, is situated in an isthmus of land created by a large stream meander of Gunpowder Creek (Figure 1). While the mill setting remains rural, only one of the three nineteenth century roads that intersected at the mill still exists as a county road. The other two roads have been largely abandoned and exist only in small sections as local farm roads. Instead of being a crossroads between Burlington, Union, and Florence, the mill site currently stands at the end of a dead-end road.

The site complex includes two archaeological sites, four structures, and one standing building (Figure 1). The two archaeological sites include the stone foundation of the grist mill and a set of stone pier foundations reported to be from a saw mill. The four structures are other features associated with the milling operation. A set of stone walls (first structure) marks the sluice gate at the entrance to the mill race. The second structure is the easternmost segment of the mill raceway situated between the sluice gate and the mill dam (Figure 1). The mill dam constitutes the third structure. The western section of mill race between the grist mill foundation and the stone piers is the fourth structure. The one standing building on the property is a small hall and parlor house constructed in the early to mid-nineteenth century (McAlester and McAlester 1988).

The first miller had cut through a narrow neck of land formed by the stream meander to create the entrance to the mill race. He positioned the entrance to the raceway at a sharp bend in the creek, so that the water flow was directed toward the sluice gate. The water then flowed through the sluice gate into the raceway. The surrounding hill slope created a narrow channel at least 88 m (290 feet) in length that fed the water into a large mill pond.

The mill pond had been excavated into an upper terrace of Gunpowder Creek, overlooking the other side of the meander. Constructed of dry laid limestone, the mill pond dam measured at least 35 m (115 ft) in length. At over 2.7 m (9 ft) at its highest point, the dam's stonework included at least 21 courses of cut limestone blocks.

The grist mill was situated just southwest of the dam (Figure 2). Stone pier supports connected the mill pond with the overshot wheel. The stone piers supported a wooden continuation of the mill race. Massive stonework foundations supported a wood-framed mill building. The foundation was constructed of limestone slabs chiseled to form rectangular blocks (Figure 3). Dry-laid, the stonework now ranges from 10 to over 30 courses in height. The foundation dimensions indicate a building approximately 12.2 m x 9.8 m (40 ft x 32 ft). At the southeast corner of the foundation, a massive stone buttress supported the end of the wood flume constructed between the dam and the mill building (Figures 2 and 3). Water from the flume would have powered the overshot wheel. The wood wheel was positioned along the southern wall of the grist mill.

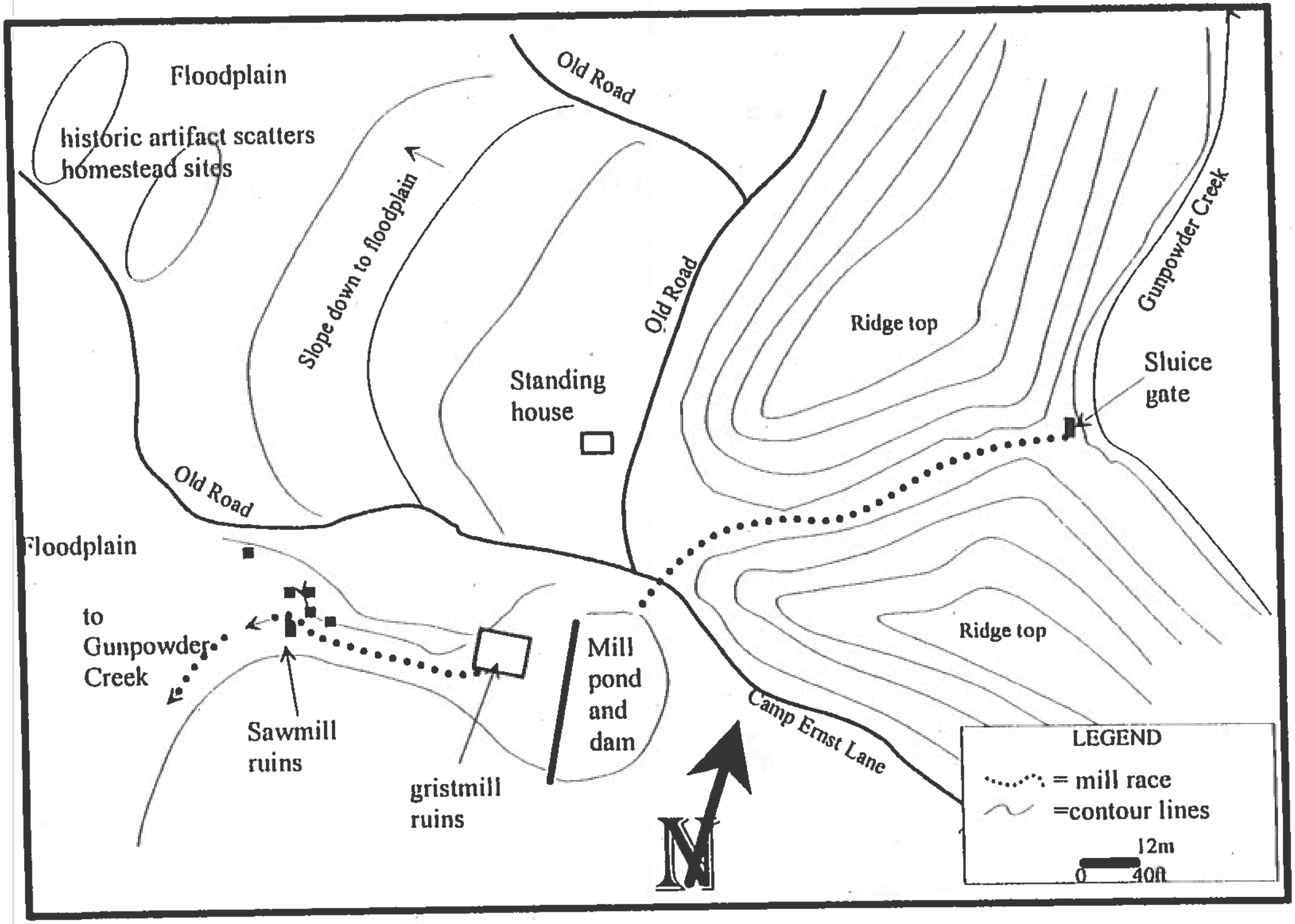

Figure 1. Map of the Crisler-Gulley Grist Mill in Boone County, Kentucky Showing its Related Features.

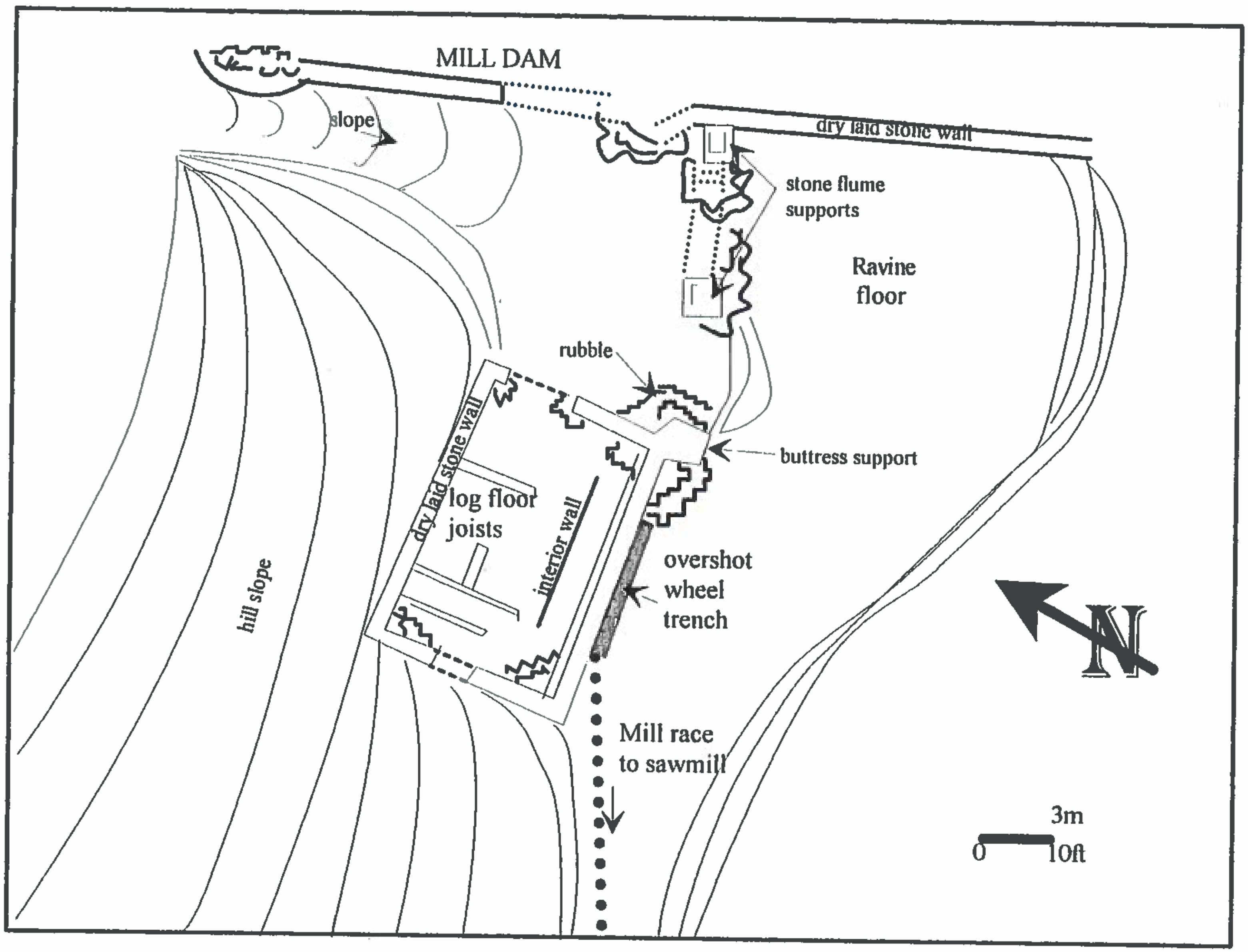

Figure 2. Planview Map of the Crisler-Gulley Grist Mill in Boone County, Kentucky.

Figure 3. Photograph of the Crisler-Gulley Grist Mill Foundation in Boone County, Kentucky.

Three hand-hewn, floor joist beams still lay where they had fallen inside the foundation. The beams demarcated at least three room divisions for the main floor of the mill. Debris filled the lower level of the foundation, sealing the cellar and lower floor. The beams lay on top of this debris.

Archaeological testing at the site encountered segments of the "French Buhr" millstones within the foundation walls. French millstones were composite, made up of four to ten or more segments bound together by an iron strap (Garber 1970:134; Webb 1994:14). Portions of both the upper and the lower grinding stones were found.

The iron cog turned by the overshot wheel was also found inside the foundation. The property owner believes that many other artifacts related to the milling operations, including the iron straps that held the mill stones together, may be found within the mill foundations.

Beyond the grist mill, the mill race flowed southward through a steep ravine for another 35 m (115 ft). The ravine opened up at that point into a broad area situated on a slight slope. Only a few stone pier foundation supports and several large piles of limestone still stand at this end of the raceway (Figure 1). Asserted to be a saw mill foundation by the current property owners, the configuration of the piers would support a long, narrow superstructure. This would correspond to historical descriptions of rural saw mills. They were usually simple, often open air, structures. No evidence can be seen of where the wheel was situated, or how it was configured. However, it may have been an undershot wheel because the piers are situated at the same or at a slightly higher elevation than the mill race; unlike the mill dam and the elevated piers at the grist mill foundation.

A standing house was situated within several hundred feet of the grist mill foundations. The small, hall and parlor house had a well-constructed perimeter foundation of dry-laid limestone, very similar in construction technique to the mill foundation. A massive stone chimney stood at one end of the house. The construction techniques are similar enough between the house and mill foundations to suggest that the same person may have constructed both buildings.

HISTORICAL BACKGROUND

The mill can be traced to the early nineteenth century through deed and census research (Figure 4). Lewis Crisler was the first documented owner of the subject property. An immigrant from Virginia, Crisler was among the earliest Euro-American settlers in the Gunpowder Creek area (Crisler Family History n. d.). Lewis Crisler bought 124.8 ha (312 acres) in two parcels along the central portion of Gunpowder Creek, 108.8 ha (272 acres) in 1817 and an additional 16 ha (40 acres) in 1828 (Boone County Deeds 1817 and 1828). Based on existing documentation, he built a mill of some type on the property during that period. In 1834 when he sold the 124.8 ha (312 acres) to two brothers, Alfred and Joseph Chambers, the deed stated that the property included the "residence [and] mills of said Lewis Crisler." Within two years, the Chambers' brothers sold the land and "residence... with the mill on said place" to John Riddell and Job Popham. One month later, in 1836, the two men sold the property to Jeremiah Garnett.

Garnett owned the 124.8 ha (312 acres) until 1843. The 1840 census records, however, did not list occupations so it is unclear whether Garnett was the miller, or leased the mill to someone else (U.S. Census 1840). In 1843, Garnett sold the 124.8 ha (312 acres) and mill to two brothers, Stephen and William Graves. By that time, the deed referred to the mill as "the Grand Water Power." This rather fancy title illustrates how the owners were portraying the mill to the local inhabitants.

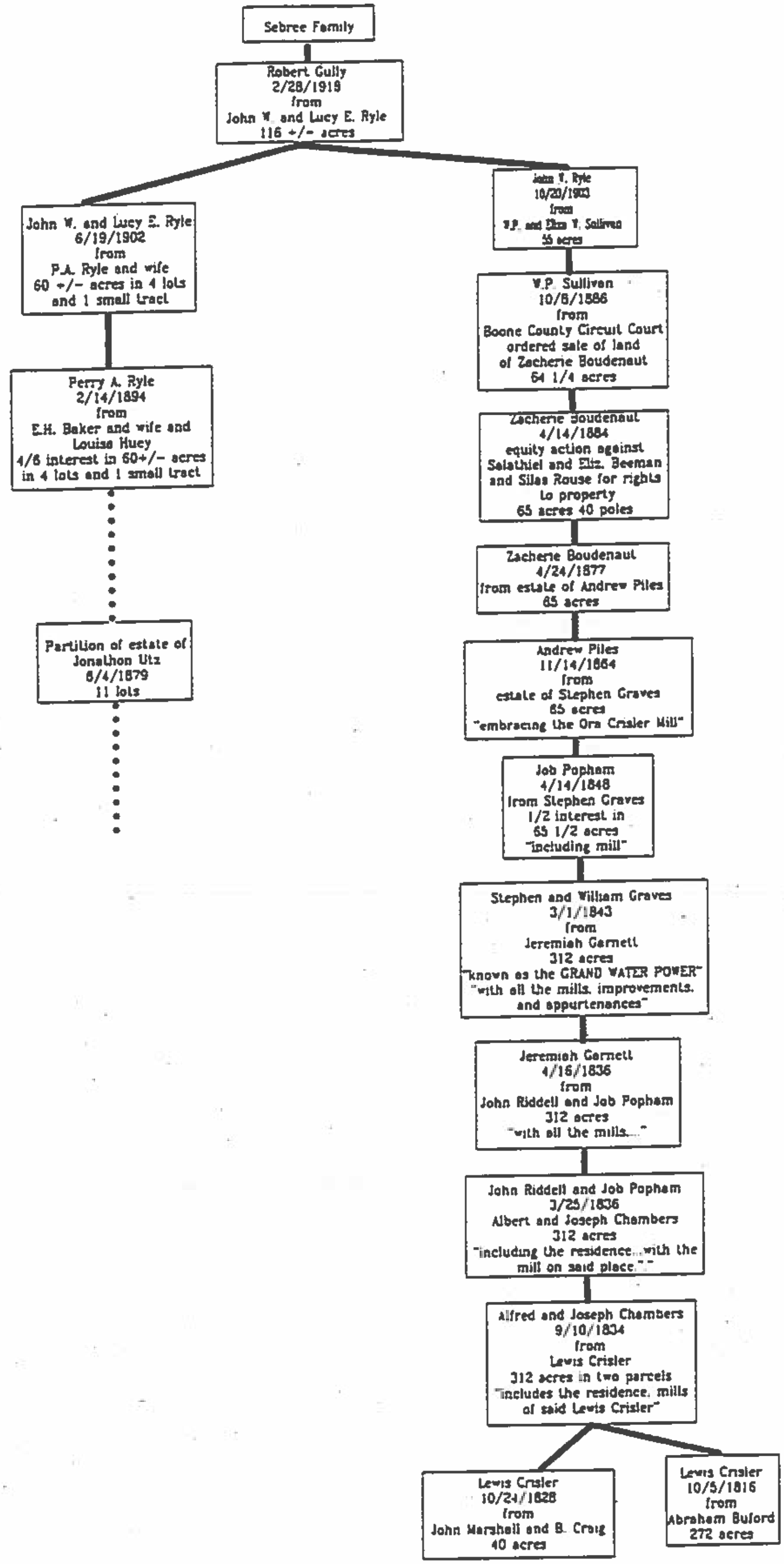

Figure 4. Deed History Chart of the Crisler-Gulley Grist Mill in Boone County, Kentucky.

After William Graves' death in 1848, Stephen Graves sold a half share in 24 ha (60 acres) that included the mill to Job Popham. Popham briefly had owned a share in original larger acreage in the 1830s with John Riddell. It is possible that Popham had been the miller during that whole period. Certainly in 1850, two years after he bought his half share, both the regular census and the Manufacturing Census Schedules included Popham as a miller on Gunpowder Creek (U.S. Census 1850; U.S. Manufacturing Census 1850). The census record described Popham as a 54 year old Virginia native who practiced milling as his occupation. The 1850 Manufacturing Schedules illustrates that he processed wheat and corn with a gross value of $8,000 for the year.

Popham apparently never sold his half share in the mill property, although he died in 1863. However, he was not present in the 1860 census for that part of Boone County (U.S. Census 1860). The 1860 census did list an Andrew Piles as the miller at that location. Piles was a 46 year old Virginia native who had lived in Boone County since at least 1850, although he was listed as a farmer in the 1850 census.

In the late 1850s, Piles bought 22 ha (55 acres) south of the Crisler-Gulley Mill in Boone County. In 1860, he sold this property to Stephen Graves, the owner of the other half of the mill site. It is possible that he and Graves traded this property for the half share in the mill tract, although no deed record could be found. When Stephen Graves died in 1864, Piles filed a lawsuit against Graves' estate, claiming ownership not of the 22 ha (55 acres) , but of the 26 ha (65 acres) that included the mill. It is unclear why none of Popham's descendants filed a lawsuit or contested Piles' claim. It is possible that Popham's family and Andrew Piles had made a transaction. No record of the possible transaction could be found during this research.

Andrew Piles was the owner of record by 1864. He had been the miller at the site since at least 1860, when he had appeared in the census record. He apparently did not earn above $2,000 in gross receipts because he did not appear in the Manufacturing Schedules for 1860. The 1870 census listed Piles as a farmer, although he still owned the mill property (U.S. Census 1870). None of the mills listed in the Manufacturing Schedules for 1870 could be identified as this specific mill (U.S. Manufacturing Census 1870).

After the death of Andrew Piles in 1877, the 65 acres and the mill became a source of family dispute and lawsuits for the next nine years. In 1886, Andrew Piles widow, Margaret, filed a lawsuit against her children for the property. The Boone County Circuit Court ordered the land sold to settle the lawsuit. The deed for that sale refers to the mill as "the old mill," perhaps indicating that it was no longer in operation (Boone County Deeds).

The property changed hands several times over the next twenty years until Robert Gulley bought the mill property and some additional acreage in 1918. The property still remains in the Gulley family.

DISCUSSION

Named the Crisler-Gulley Mill for the first owner (Crisler) and the most current owners (Gulley family), the mill complex's history clearly illustrates the early importance of water-powered milling to local communities. The massive stonework of the grist mill must have been very impressive to the local farmers. The operators would have wanted the mill to appear to be modern and capable of providing for all their customers' needs. Certainly the name, "the Grand Water Power," given to the mill by its owners in the 1840s exemplifies one of their methods for advertising the mill to the local population. The mill apparently continued as a viable business into at least the early 1850s, based on Job Popham's presence on the 1850 Manufacturing Schedule. His operation was one of the larger mills represented in that Schedule.

A review of the Manufacturing Schedules for the mid- to late nineteenth century may be used to demonstrate that the decline of mills such as the Crisler-Gulley Mill can be related directly to the development of steam engines for milling production (U.S. Manufacturing Census 1840 - 1880). If a business earned at least $2,000 in gross revenue for the census year, it was included in the Schedules. The information provided in these Schedules is quite comprehensive, including useful data on labor, production schedules, and the machinery/equipment used by each business.

A comparison of the Schedules for Boone, Campbell, and Kenton counties, the three contiguous counties in northern Kentucky, provides information about the development of the steam-powered milling industry and the decline of water-powered milling. Table 1 illustrates how the number of steam mills increased in each decade. Beginning in 1870, the number of steam mills increased dramatically, while water-powered mills continued to decrease. The Manufacturing Schedules offered two classification choices for the miller: commercial or custom production. According to the 1870 and 1880 Schedules, virtually all the steam-powered mills were providing their products for the commercial market. All the water-powered mills listed custom production as their primary source of income.

Table 1. Water and Steam-Powered Mills in Boone, Campbell, and Kenton Counties.

	1850		1860		1870		1880	
	WATER	STEAM	WATER	STEAM	WATER	STEAM	WATER	STEAM
BOONE	1	1	0	3	2	3	2	2
CAMPBELL	0	0	0	0	0	4	0	4
KENTON	2	0	0	0	1	4	0	8
TOTAL BY WATER TYPE	3	1	0	3	3	11	2	14
TOTAL BY YEAR	4		3		14		16	

Commercially, the steam-powered mills earned much higher revenues, on average, than their water-powered counterparts. Several of the steam mills were rather large compared to the water-powered mills, grossing more than $50,000 in a given census year. None of the water-powered mills earned more than $4,000 in any given year.

The Crisler-Gulley Mill is representative of water-powered mills in nineteenth century northern Kentucky. Popham's operation in 1850 was the only time the mill appeared in the Manufacturing Schedules. It was one of only two water-powered mills listed for 1850. Although the mill was probably in operation in 1860 according to Piles' appearance in the census records, it did not appear in the

Schedules again. By 1870, Piles was listed as a farmer. No other nearby residents were listed as millers on the 1870 census, suggesting that Piles had not leased the operation to another operator.

The 1883 atlas still listed a grist mill at the location (Lake 1883) (Figure 5). However, no evidence could be found for its continued operation. No one appeared as a miller in the census records for the Crisler-Gulley Mill location. One man, Augustus Weaver, operated a mill upstream on Gunpowder Creek and appeared on the 1883 atlas and in the 1880 Manufacturing Schedules. By 1886, the Crisler-Gulley mill was called "the old mill" in a deed, indicating that it was no longer in operation.

Why the operators of the Crisler-Gulley Mill did not convert to steam to keep up with the developing industry is not clear. However, some speculations may be offered. The construction of the massive stonework foundations would have seemed impressive in the 1830s and 1840s; but would have made any subsequent alterations to the building or its internal configuration difficult. Any physical changes needed to accommodate steam boilers and other associated processing equipment would have been an expensive and difficult proposition. The operators evidently did not have the capital to make the conversion. This seems likely since no operator of the Crisler-Gulley Mill made the Manufacturing Schedule after 1850.

Other mills in the counties did make that transition, including the Weaver Mill mentioned above. According to the earlier Manufacturing Schedules, Weaver used both water and steam power. By 1880 he was listed as using only steam. Weaver was fairly successful, making the Schedule for all four decades that it was produced. He was also close enough to the Crisler-Gulley Mill to have provided competition for the milling needs of the nearby farmers.

The decline of water-powered milling may be seen in a review of the 1883 atlas map of the counties, as compared with the census records (Lake 1883; U.S. Census 1880). By 1883, three mills were actually listed as " old mills" on the atlas. Only a total of eight water-powered mills were listed for all four decades of the manufacturing census. The three old mills comprised a fairly large percentage of that total.

The 1880 Manufacturing Census Schedule only listed two water-powered mills in operation. Both were in Boone County and have been identified with two mills located on Middle Creek in the western part of the county. Both are shown on the 1883 atlas (Lake 1883) (Figure 5).

CONCLUSIONS

The decline of the family owned grist mill, whether water or steam powered occurred quickly after the late nineteenth century. In the late 1880s, small family mills, usually steam powered, could still provide a decent living. Between then and the end of World War I, many millers became discouraged due to economics directly related to the development of improved machinery and steam power (Apps and Strang 1980; Garber 1970; Swanson 1963). Other social and economic factors that developed throughout the nineteenth century also contributed to the decline of the small local mill. These factors included the passage of a number of laws dealing with the manufacture of food products throughout the latter part of the century (Garber 1970).

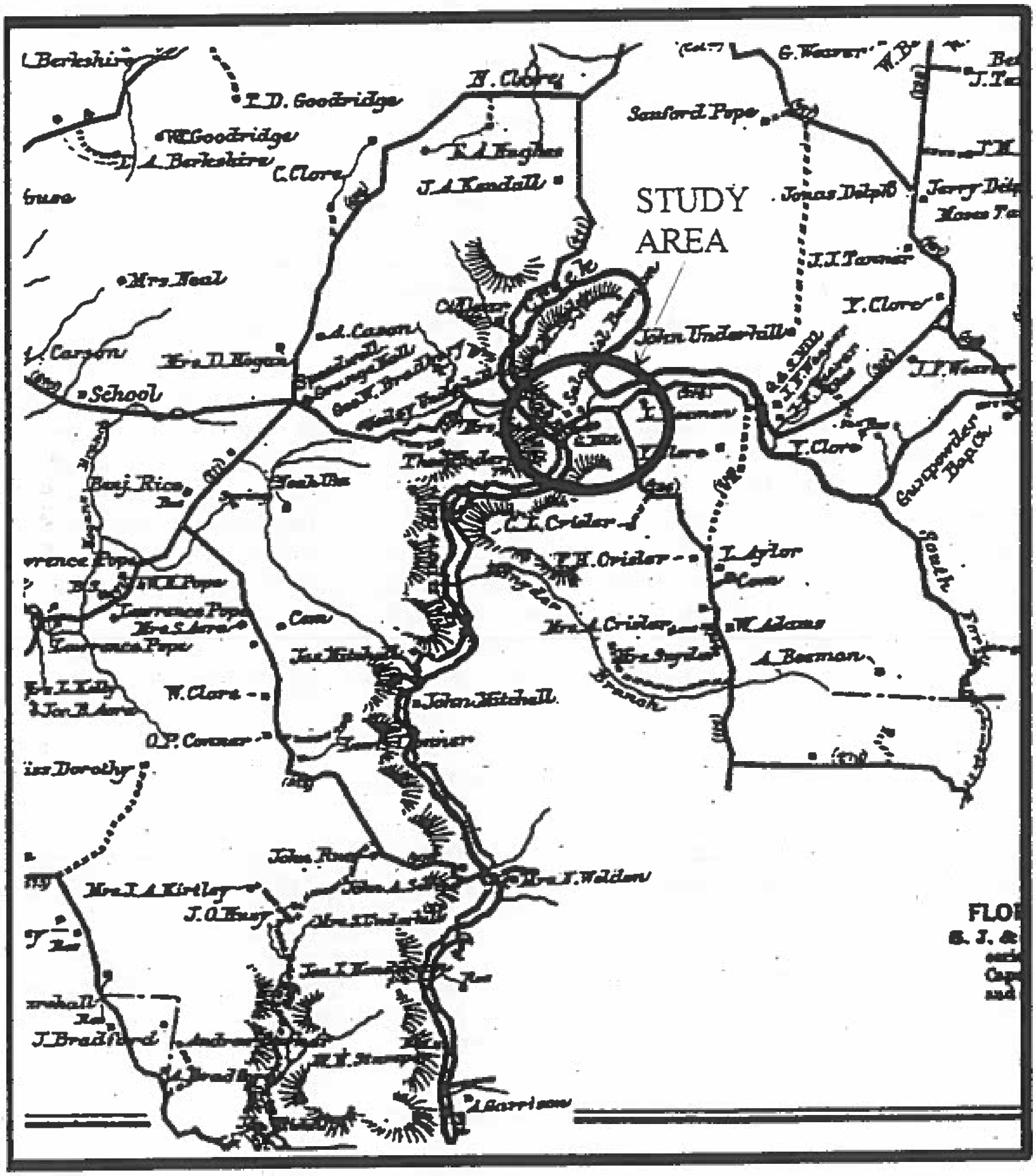

Figure 5. Section of a Map by D. J. Lake and Company (1883) Showing the Location of the Crisler-Gulley Grist Mill in Boone County, Kentucky.

The development of steam engines in the early nineteenth century, followed by large merchant roller mills in mid-century, provided economic incentives for the development of commercial scale milling throughout the United States (Apps and Strang 1980). Many local millers tried to expand, adding steam boilers and rollers when possible. However, many found they could not make enough to pay off their debts. Turnover in ownership became enormous. Many inexperienced owners took possession, but lacked the knowledge to make their mill a profitable enterprise. They were often forced to sell or had their mills taken from them by foreclosure (Garber 1970). Some millers converted to grinding corn and other grains for livestock feed when they could not compete with the finer flours produced by the rolling mills (Apps and Strang 1980).

The Crisler-Gulley Mill is an example of the fate of many family owned, water-powered mills that had been built in northern Kentucky during the first half of the nineteenth century. They were unable to expand or modernize their operations with steam boilers and rollers, and so could not keep up with their more successful competitors. These competitors often established their businesses closer to emerging commercial and industrial centers such as Covington and Newport.

Research on the milling industry in Minnesota encountered a similar situation (Apps and Strang 1980). They found that the few decades from the mid- to late nineteenth century marked the transition from decentralized mills on almost every stream, to large centralized mills situated near major industrial centers (Apps and Strang 1980:87). The large industrial, steam-powered mills were not as tightly linked to permanent water sources as the water-powered mills had been. In northern Kentucky, most of the later nineteenth century steam mills were located either in, or just outside, of local cities such as Covington and Newport. The water-powered mills were limited by their need for a quickly renewable, and predictable water supply. By the end of the nineteenth century, the Crisler-Gulley Mill was certainly not in operation. The fate and fortune of one water-powered mill stands as an example of the effects of modernization on many of the smaller, rural industries that operated in northern Kentucky in the nineteenth century.

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