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Cover: Slipper from the Two Sandals Rockshelter in Carter County.

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; and the dissemination of educational materials, such as the Kentucky Before Boone poster. On occasion, the Site Protection and Archaeology Program staff undertakes field and research projects, such as emergency data recovery at threatened sites.

This volume contains papers presented at the Fourteenth and Sixteenth Annual Kentucky Heritage Council Archaeological Conferences. The Fourteenth Annual Kentucky Heritage Council Archaeological Conference was held at Natural Bridge State Park in Slade, Kentucky in 1997 and the Sixteenth Annual Kentucky Heritage Council Archaeological Conference was held at the University of Kentucky in Lexington, Kentucky in 1999. Cecil R. Ison was in charge of conference details and local arrangements for the Fourteenth Annual Conference and Dr. Richard W. Jefferies was in charge of conference details and local arrangements for the Sixteenth Annual Conference. Their efforts are greatly appreciated. Heritage Council staff that assisted with conference proceedings included Site Protection Program Manager Thomas N. Sanders, as well as Staff Archaeologists David Pollack and Charles D. Hockensmith and Architectural Historian Jayne Fiegel.

A total of 21 papers were presented at the Fourteenth Annual Heritage Council Archaeological Conference. Of these two are included in this volume. Of the 19 papers presented at the Sixteenth Annual Kentucky Heritage Council Archaeological Conference, eight are included in this volume. This volume also includes a contributed paper that was presented at the Thirteenth Annual Heritage Council Archaeological Conference. As in years past, these papers provide a cross-section of archaeological research conducted in Kentucky. Some of the papers are the products of the research interests of the participants, such as those by Updike and Applegate. The papers by Ray, Gremillion, Mickelson, Mickelson and Lee, Matternas, and Gremillion, Jakes and Wimberly were supported in part by grants from the Kentucky Heritage Council. Other papers were produced as part of Section 106 related compliance projects or state funded undertakings. These include the papers by Bradbury, Creasman, Bradbury and Kerr, Pope, Ball, and Rossen. Figure 1 illustrates the general locations of major sites and project areas discussed in this volume.

I would like to thank everyone that has participated in the Heritage Council archaeological conferences. Without your support, these conferences would not have been as successful as they have been. Finally, I would like to thank Dr. Kristen J. Gremillion for agreeing to assist in the editing of this volume. Her efforts are greatly appreciated.

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

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

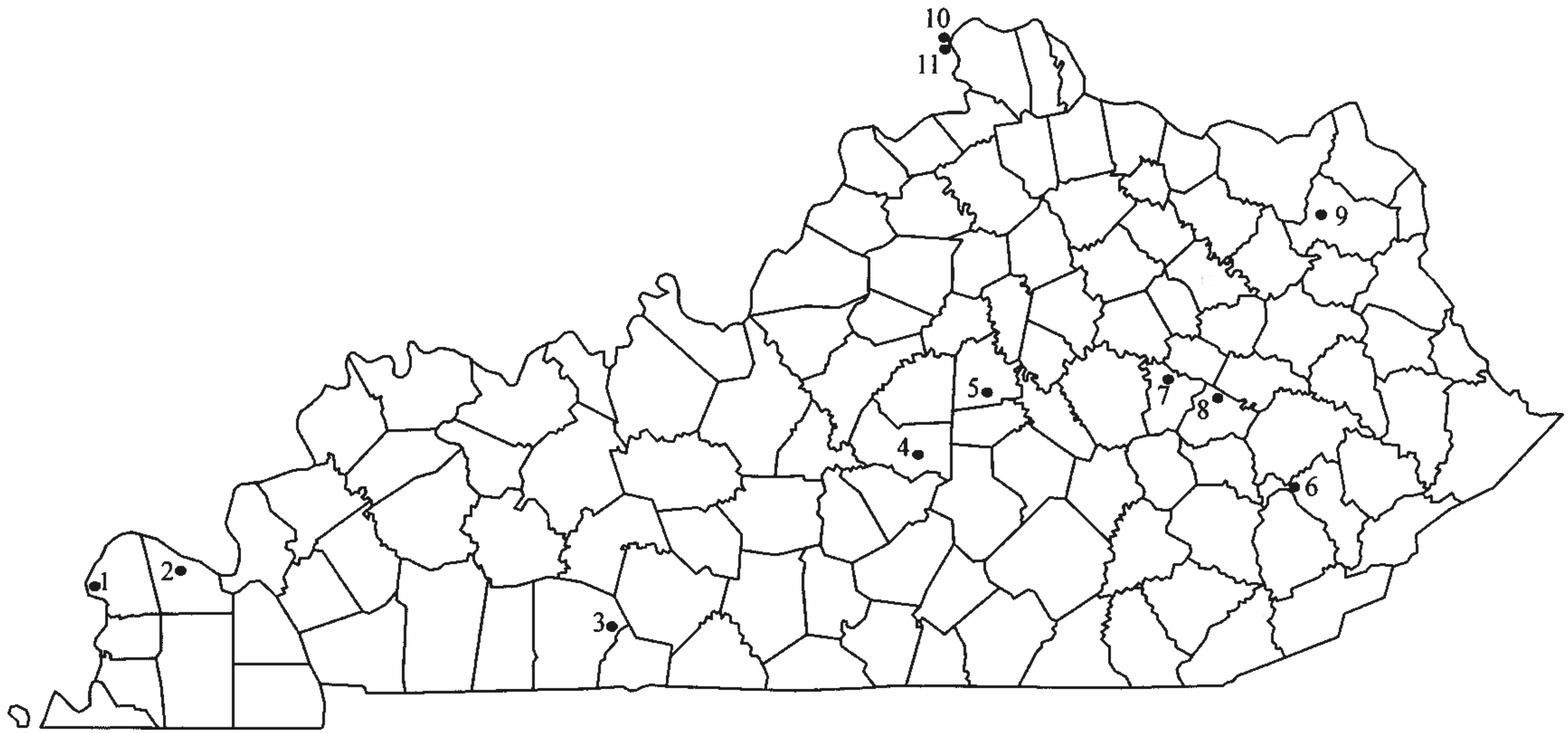

Figure 1. Location of Major Sites and Project Areas Discussed in this volume: 1, Wickliffe; 2, Hedden; 3, Watkins; 4, Upper Rolling Fork Valley; 5, Dry Branch; 6, Gays Creek; 7, Cottage Furnace; 8, Big Sinking Drainage; 9, Two Sandal Rockshelter; 10, Argosy Casino Project Area; 11, Greendale.

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ARCHAIC PLANT UTILIZATION AT THE HEDDEN SITE, McCRACKEN COUNTY, KENTUCKY

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ABSTRACT

There has been considerable discussion concerning the role played by wetland resources versus intensive nut exploitation in the reduction of group mobility and the aggregation of local populations that occurred towards the end of the Archaic period. Analysis of the large archaeobotanical collection from the Hedden site, a Late Archaic midden in McCracken County, Kentucky, contributes to this discussion. The Hedden site collection includes large amounts of nutshell, but also wild forms of starchy and oily seeds and a variety of wetland plants. Archaic plant utilization at the site combined specialized nut collecting with generalized broad-spectrum foraging. Because of their predictability and availability during lean winter months, wetland plants may have been a focal resource for Archaic settlement in western Kentucky.

INTRODUCTION

There has been considerable discussion concerning the role of wetland resources versus intensive nut exploitation in the reduction of group mobility and the aggregation of local populations that occurred towards the end of the Archaic period. This discussion has centered around archaeobotanical data from Illinois and Indiana (Brown and Vierra 1983; Jefferies 1982; Stafford 1991, 1994). The large archaeobotanical collection from a Late Archaic site in western Kentucky may shed new light on the issue. The Hedden site (15Mcn81) collection may in fact offer an opportunity to reconcile various perspectives expressed in the literature.

The Hedden site is a Late Archaic occupation in McCracken County, Kentucky. It was excavated in 1994 by Kentucky Transportation Cabinet archaeologists led by Betty J. McGraw, with crew assistance from Wilbur Smith Associates. The site is located on the Tennessee River floodplain near its confluence with the Ohio River. The site vicinity is characterized by a series of marshy sloughs. Six calibrated radiocarbon dates from the site have mid-points that range from 3958 to 2289 B.C. (Table 1).

Soil samples totaling 2,266 liters from 49 contexts, primarily large pit features, were processed and analyzed (Table 2, figures 1 and 2). The botanical collection (n=83,317 specimens), which includes nutshell, wood charcoal, and seeds, is one of the largest Archaic collections of plant remains recovered from a Kentucky site (Table 3). The wood charcoal reflects the mixed hardwood oak-hickory forest, as well as species such as beech and cane that reflect local wetland zones. The nutshell reflects a heavy focus on thick-shelled hickory and acorn, while carbonized seeds reflect a broad plant gathering component. Seeds representing eight aquatic wetland plants (sedges, pondweeds, and bulrushes) document the variety of wetland plants exploited during the Late Archaic period in western Kentucky.

Table 1. Radiocarbon Dates from the Hedden Site.

Provenience	Sample No.	C14 Age	Calibrated Date (2 sd)
Feature 19	Beta 93733	4420±60 BP	3317(3036)2913 B.C.
Feature 26	Beta 93734	4520±50 BP	3365(3309,3227,3186,3159,3126)3035 B.C.
Feature 28	Beta 93738	4030±50 BP	2854(2563,2524,2500)2456 B.C.
Feature 35	Beta 93735	4300±60 BP	3037(2906)2702 B.C.
Feature 38	Beta 93737	5130±50 BP	4033(3958)3795 B.C.
Feature 40	Beta 93736	3850±50 BP	2462(2289)2139 B.C.

This paper discusses the Hedden site data in terms of various archaeobotanical indices (for example, ubiquity, wood charcoal density, and wood-to-nut ratio) and compares the values to other sites from the Archaic and subsequent time periods. The various models presented for Archaic subsistence and settlement in the midwestern U.S. are discussed in light of the Hedden site data. It is argued that the wetland plants at Hedden, though low in frequency, reflect an important resource for Archaic settlement, particularly because of their predictability and availability during the lean winter months. Western Kentucky Late Archaic plant subsistence is best modeled as a mixed strategy of specialized collecting and processing (nuts) and more generalized foraging (wetland plants, fleshy fruits, and starchy and oily seeds).

METHODS

Soil samples were floated at the University of Kentucky Archaeobotanical Laboratory, using a heavily modified stainless steel Flote-Tech Tank that features an air compressor. After drying the floated samples, both light and heavy fractions were passed through a 2 mm geological sieve before sorting charcoal from uncarbonized contaminants such as roots. In open prehistoric sites like the Hedden site, only carbonized plant remains may be considered archaeological. Carbonized material such as nutshell and wood from the larger than 2 mm sample were then identified, counted, and weighed. Sievings smaller than 2 mm were scanned carefully for seeds. This procedure is followed because fragments of wood and nutshell smaller than 2 mm are difficult to reliably identify. Charcoal specimens larger than 2 mm are representative of smaller specimens, with the possible exceptions of acorn and squash rind (Asch and Asch 1975). Laboratory sieving thus saves considerable laboratory sorting time without a loss of information.

The samples were analyzed 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 (Panshin and deZeeuw 1970). Changes in the visibility of macroscopic characteristics that occur during carbonization were also taken into account, to insure maximum accuracy of identification (Rossen and Olson 1985). Very small wood specimens or specimens that were badly deformed during the carbonization process were classified

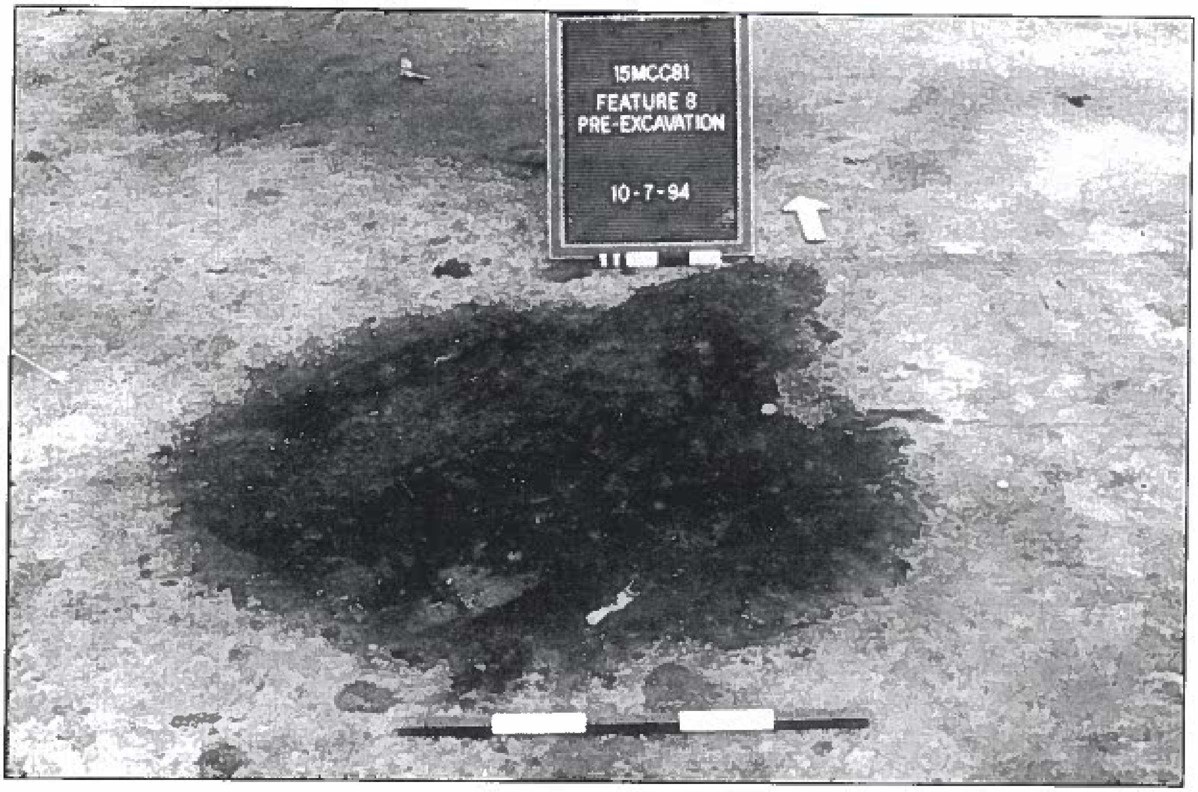

Figure 1. Pit Feature at the Hedden Site.

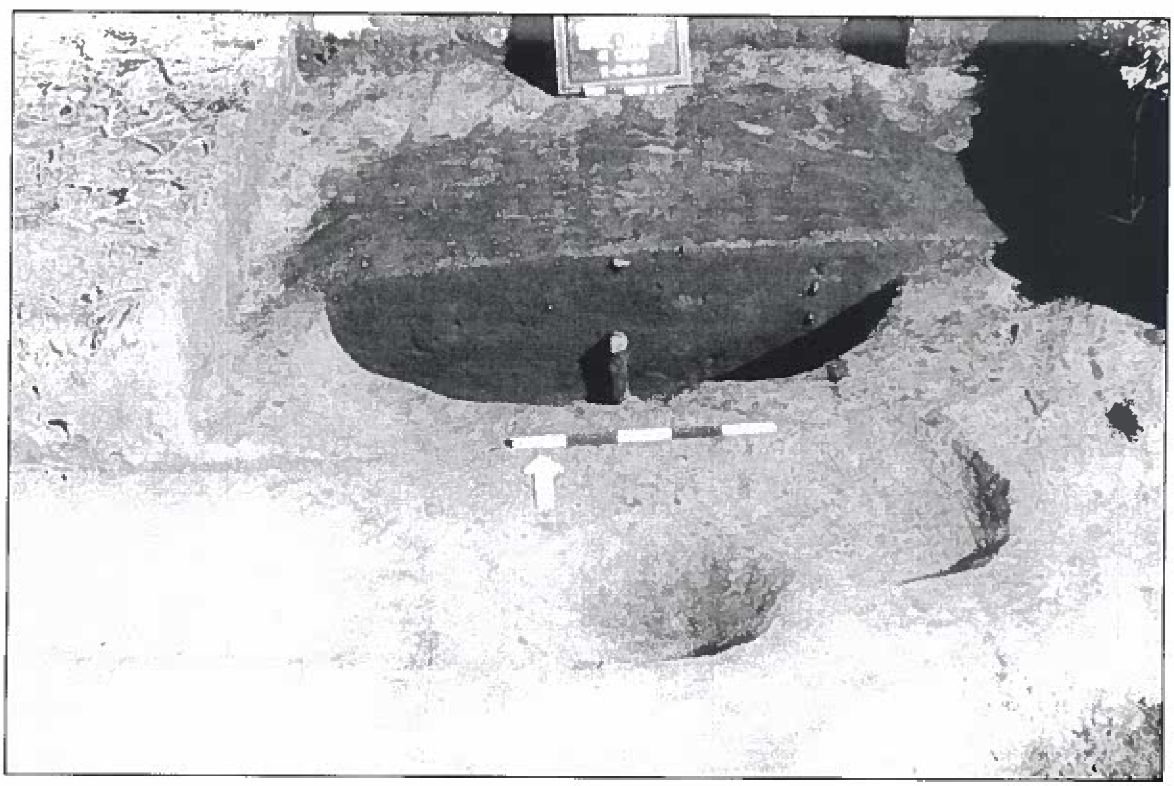

Figure 2. Profile of Pit Feature and Smaller Totally Excavated Pits at the Hedden Site.

Table 2. Nonwood Archaeobotanical Remains by Feature.

Feature #	Species					Volume Liters
	Hickory	Acorn	Black Walnut	Pecan	Other	
1	498	14				130
2	1,196	25	1			7
4	648	6			1 butternut	51
5	54	2				27
6	726	7			1 persimmon	54
7	308	4			1 chufa sedge 14 Fungus	11
8	1,331	28	3	4	1 hazelnut	63
10	3,727	13				98
12	2,393	12	1			56
14	275	1	2			10
16	39					4
19	5,066	19	6	2	1 sunflower	126
22	28		1			10
23	18					5
24	1,795	30	5	6		53
25	1,038	6	1			29
26	2,331	8	8	4		80
28	1,329	7				40
30	212	2	1			13
31	731	7		1	1 persimmon	19
32	646	7				30
34	3,319	18	3			65
35	13,837	129	17	8	2 persimmon 2 spikerush 1 grape 1 sunflower 1 bedstraw	9
35 (south)	564	2			1 grape 1 hornpondweed	8
36	73					70
37	159					15
38	35,810	368	86	108	13 hazelnut 1 butternut 3 bedstraw 2 chenopod 2 persimmon 1 sedge 1 pondweed 1 bulrush 1 oregongrape 1 grass 1 amaranth	771
40	752	6			1 flatsedge	24

as "unidentified." Similarly, nonwood specimens that were badly deformed were classified as "unidentified-general" and deformed or fragmented seeds were classified as "unidentified-seeds."

Table 3. General Classes of Carbonized Botanical Remains from 49 Contexts (2,266 liters) at the Hedden Site.

Botanical Class	Frequency	Pct Freq	Grams	Ubiquity
Nutshell	80,510	96.63	1,083.4	100.0
Wood charcoal	2,773	3.33	28.2	85.7
Seeds	34	0.04	------	22.4
Total	83,317	100.00	1,111.6	

Actual frequencies for nutshell types were recorded for lots containing fewer than 400 specimens. Nutshell frequencies for lots containing more than 400 specimens represent carefully constructed estimates and not exact figures. Estimates were derived in the following manner. Two hundred specimens were counted, this subsample was weighed, and the weight of the total sample was divided by the subsample. This number was then multiplied by 200. Estimates of the species composition of each sample were derived by identifying between 15 and 50 specimens. An estimate of the relative percentage of each species represented was then used to calculate the estimated frequency of each species in a sample. This is believed to be a reliable and efficient method for handling large lots of wood charcoal (Rossen 1991).

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 deposits (such as soil pH and ash content). The circumstances surrounding plant carbonization, including firing temperature and the amount of oxygen reduction present, also influence preservation. Soil particle size and inclusions affect whether or not carbonized plant remains are eroded or destroyed by mechanical grinding. At Hedden, the presence of delicate seeds (Figure 3) and large amounts of nutshell without eroded surfaces indicate good preservation of carbonized materials, including only minimal mechanical grinding of specimens. It is because of this unusually good preservation that analysis of the Hedden site archaeobotanical led to important insights into Late Archaic plant use in western Kentucky.

WOOD CHARCOAL

Wood charcoal (n=2,773) is unusually scarce in this collection. For virtually all Kentucky archaeological sites where systematic water flotation has been employed, wood charcoal is the most common archaeobotanical component. At Hedden, as well as at other Late Archaic sites, wood charcoal is only a minor botanical component of the archaeobotanical collection compared to nutshell.

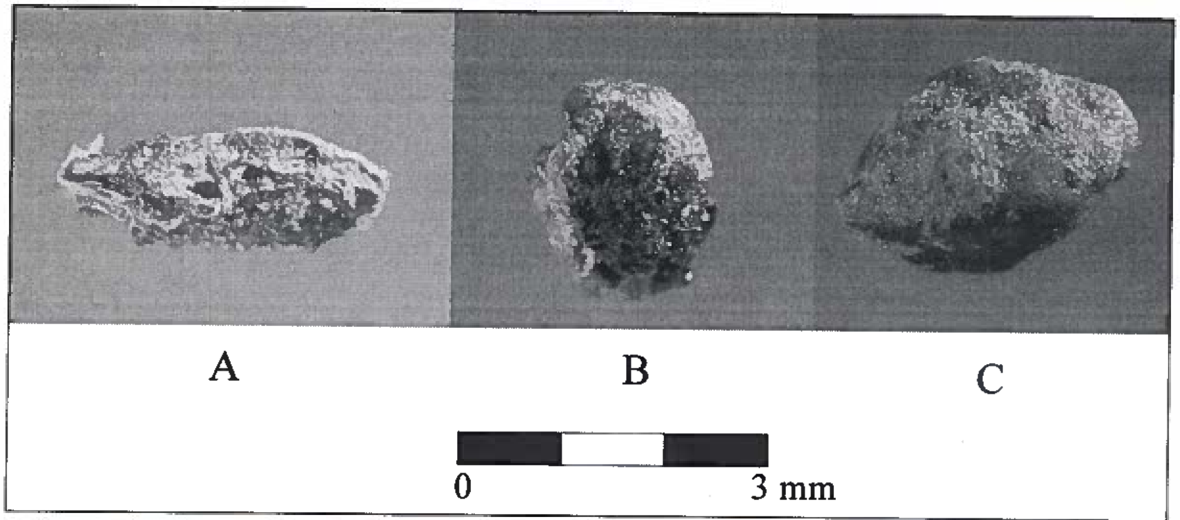

Figure 3. Representative Wetland Plants from the Hedden Site: a, hornpondweed; b, sedge; c, spikerush.

ABSOLUTE AND RELATIVE WOOD DENSITY

Two methods of quantifying the absolute density of wood charcoal in a site are indices of 1) wood-to-nut ratio and 2) frequency of wood charcoal per liter of floated soil (tables 4 and 5). These two indices illustrate the extreme scarcity of wood charcoal in the Hedden site collection, compared to other major archaeobotanical collections from sites in Kentucky and Illinois. The Hedden collection has the lowest wood-to-nut ratio ever recorded at a Kentucky archaeological site. It is similar to other Late Archaic assemblages but only one-fiftieth of the value of later sites, such as Chambers (a Mississippian site in Marshall County) and Hansen (a Late Woodland site in Greenup County) (Table 4). In terms of wood frequency per liter of floated soil, the Hedden site again displays the lowest value of the large flotation collections. Among large Kentucky collections, only the Watson site (a Late Woodland site in Boone County) has yielded an absolute wood charcoal density almost as low (Table 5). The Watson site had poor preservation conditions that required a massive flotation effort (Rossen and Hawkins 1995).

A comparison with other Late Archaic site collections from Kentucky and Illinois shows that the Hedden site has a typically low Archaic wood-to-nut ratio (Table 4). Other Archaic sites range from a high of 1.9 at Campbell Hollow, Illinois (Asch and Asch 1985) to a low of 0.02 at Go-Kart North, Illinois (Johannessen 1984a). In Kentucky, the Spadie site in Jefferson County produced a wood-to-nut ratio value almost identical to that of the Hedden site, and three nearby Archaic sites, with ratios ranging from 0.21 to 1.05 fill out the bottom of the list of sites in Table 4 (Lannie 1979). This indicates that there is a general trend for Archaic sites to have much less wood charcoal, particularly in relation to nutshell, than later Woodland and Late Prehistoric sites.

Three possible explanations may be postulated for the low wood-to-nut ratios at Hedden and other Archaic sites. First, wood preservation may be badly compromised by the age of the site. That is, wood charcoal may deteriorate much more rapidly after a threshold site age, and therefore most Archaic sites should have similar low wood charcoal frequencies. This trend is generally indicated in the available literature from Indiana and Illinois (Asch et al. 1972; Freudenrich 1980; Lopinot 1982; Stafford 1991, 1994). A similar pattern of extremely high nut density coupled with very low wood

Table 4. Wood to Nut Ratios of Selected Archaeological Sites.

Site	Period	Wood to Nut Ratio
Petersburg (15Be6)[12]	Middle/Late Fort Ancient	40.70
Thompson (15Gp27)[11]	Middle Fort Ancient	28.50
Guilfoil (15Fa167)[8]	Middle Fort Ancient	24.40
Watson (15Be249)[15]	Late Woodland	24.30
Fox Farm (15Ms1)[11]	Middle/Late Fort Ancient	23.00
Muir (15Js86)[10]	Early Fort Ancient	12.60
Slack Farm (15Un28)[13]	Late Mississippian component	11.00
Slack Farm (15Un28)[13]	Middle Woodland component	5.50
Shelby Lake (15Sh17)[2]	Late Woodland	2.80
Campbell Hollow, Il.[1]	**Late Archaic**	**1.90**
Hansen (15Gp14)[7]	Late Woodland	1.50
Chambers (15Ml109)[9]	Mississippian	1.50
Missouri Pacific #2, Il. (11S46)[3]	**Late Archaic**	**1.32**
Dyroff, Il. (11S463)[4,5]	**Late Archaic**	**1.20**
Rosenberger (15Jf18)[6]	**Late Archaic**	**1.05**
Longworth-Gick (Jf243)[6]	Early Archaic	0.27
Villier (15Jf110)[6]	**Late Archaic**	**0.21**
Highland Creek (15Un127)[14]	**Late Archaic**	**0.09**
Spadie (15Jf14)[6]	**Late Archaic**	**0.04**
Hedden (15McN81)	**Late Archaic**	**0.03**
Go-Kart North, Il. (11Mo552N)[4,5]	**Late Archaic**	**0.02**

Sources: [1]Asch and Asch 1985; [2]Hockensmith et al. 1998; [3]Johannessen 1983, [4]1984a, [5]1984b; [6]Lannie 1979; [7]Lopinot 1988; [8]Rossen 1987a, [9]1987b, [10]1988, [11]1992, [12]1993, [13]1994, [14]2001b; [15]Rossen and Hawkins 1995

Table 5. Wood Frequencies Per Liter of Floated Soil.

Site	Period	Freq. Wood/Liter
Petersburg (15Be6)[10]	Middle/Late Fort Ancient	110.6
Guilfoil (15Fa167)[6]	Middle Fort Ancient	85.2
Slack Farm (15Un28)[11]	Late Mississippian component	70.7
Fox Farm (15Ms1)[9]	Middle/Late Fort Ancient	62.3
Muir (15Js86)[8]	Early Fort Ancient	56.1
Shelby Lake (15Sh17)[1]	Late Woodland	47.0
Thompson (15Gp27)[9]	Middle Fort Ancient	42.9
Slack Farm (15Un28)[11]	Middle Woodland component	41.8
Chambers (15Ml109)[7]	Mississippian	27.7
Hansen (15Gp14)[5]	Late Woodland	20.0
Highland Creek (15Un127)[12]	**Late Archaic**	**3.2**
Dyroff, Il.[3,4]	**Late Archaic**	**1.8**
Missouri Pacific #2, Il.[2]	**Late Archaic**	**1.7**
Watson (15Be249)[13]	Late Woodland	1.6
Hedden (15McN81)	**Late Archaic**	**1.2**

Sources: [1]Hockensmith et al. 1998; [2]Johannessen 1983, [3]1984a, [4]1984b; [5]Lopinot 1988; [6]Rossen 1987a, [7]1987b, [8]1988, [9]1992, [10]1993, [11]1994, [12]2001b; [13]Rossen and Hawkins 1995 density has been noted at Middle to Late Archaic sites in southwestern Indiana from Lafayette to the mouth of the Wabash River (Cheryl Munson, personal communication 1995).

Second, the low wood charcoal density at Hedden may indicate the activities that occurred or did not occur at the site. Perhaps domestic activities such as cooking and fire building were not commonplace at Hedden, and thus the site is not truly habitational in nature. This might support the ideas of Claassen (1992), who has questioned the traditional interpretation of the Green River Archaic shell middens as domestic habitation sites. More variability in Late Archaic site wood charcoal values and densities should be expected in future research in order to support this hypothesis.

A third possible interpretation is that fuels other than wood were primarily used at the site. If thick-shelled hickory nutshell was a fuel source, nutshell levels would be archaeologically raised as wood charcoal levels became lower, producing the highly exaggerated nut-to-wood ratios of Archaic sites. This scenario would require caution in the interpretation of the large amounts of nutshell in Archaic sites as the result of intensive exploitation of a focal resource.

The main issue appears to be whether the low wood charcoal values at Hedden are 1) the product of site age and preservation, 2) the result of specialized site-specific activities, or 3) part of a broad preference for nonwood combustible fuel. The possible meaning of the high nuts and low wood charcoal trend is explored below in the final discussion.

WOOD SPECIES

The low wood density at Hedden is reflected in the low percentage of wood specimens that were identifiable and the relatively few species that were identified (Table 6). Only 45.3% of wood specimens were identifiable. In comparison, much higher percentages of wood charcoal were identifiable at sites, such as Muir (90.2%), Fox Farm (87.1%), Thompson (86.8%), and Chambers (71.9%) (Rossen 1991). In the case of the Hedden collection, most of the unidentifiable wood charcoal is the remains of twigs and small branches. These parts of the tree tend to have poorly developed or compressed macroscopic structure. Very few wood specimens from Hedden are the remains of tree trunks or large branches, the type of wood that would often be used in building or as firewood.

Table 6. Frequencies, Gram Weights, and Ubiquities of Wood Charcoal from the Hedden Site.

Species	Freq	Pct	Gm Wt	Pct	Ubiquity
Hickory (*Carya* sp.)	680	54.1	7.1	55.5	12.2
White oak group (*Quercus* sp.)	194	15.4	1.8	14.1	10.2
Beech (*Fagus grandifolia*)	117	9.3	1.0	7.8	6.1
Red oak group (*Quercus* sp.)	112	8.9	0.9	7.0	2.0
Pecan (*Carya illinoiensis*)	50	4.0	0.6	4.7	2.0
White ash (*Fraxinus americana*)	49	3.9	0.8	6.3	2.0
Yellow poplar (*Liriodendron tulipifera*)	36	2.9	0.4	3.1	2.0
Cane (*Arundinaria gigantea*)	19	1.5	0.2	1.6	2.0
Total identified wood charcoal	1,257	100.0	12.8	100.0	22.4
Unidentified wood charcoal	1,516		15.4		63.3
Total wood charcoal	2,773		28.2		85.7

Only eight species were identified, a low inventory compared with other sites such as Dreaming Creek (n=21), Muir (n=15), Thompson (n=16), or Chambers (n=16) (Rossen 1991). Hickory (*Carya* sp., n=680, 54.1% of identifiable wood) and the white oak group (*Quercus* sp., n=194, 15.4% of identifiable wood) are the most common taxa in the collection. These are almost always the most commonly recovered archaeological wood taxa in Kentucky, and are representative of the mixed hardwood oak-hickory forests that once covered much of the state (Campbell 1985; Rossen 1991). Beech (*Fagus grandifolia*) appears in three samples, and probably represents the moister bottomlands or wetlands areas near the site. Pecan (*Carya illinoiensis*), white ash (*Fraxinus americana*), yellow poplar (*Liriodendron tulipifera*), and cane (*Arundinaria gigantea*) all appear in trace amounts. The ubiquities (or percentage of samples containing a given species) are remarkably low for all taxa. Even the most common identified taxon, hickory, has a ubiquity of only 12.2% (that is, it appeared in only six of 49 contexts). Five of the eight identified wood taxa occurred in only one sample each (a ubiquity of 2.0%) (Table 6).

NONWOOD PLANT REMAINS

Nonwood plant remains, including apparent food remains, recovered from the Hedden site include nutshell and carbonized seeds (Table 7).

NUTSHELL

Nutshell is dominated by very large amounts of thick-shelled hickory (*Carya* sp.). Hickory nutshell represents 99.3% of all site nutshell by frequency (99.4% by weight), with a 98% ubiquity (appearing in 48 of 49 analyzed contexts). Throughout much of the Archaic and Woodland periods in Kentucky, hickory was a focal resource. Hickory nuts were valuable for their high protein and fat content, and relative 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 was in a "hickory nut soup," prepared by cracking 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. Among the Iroquois, hickory oil was also used as a hair oil and mosquito repellent (Waugh 1916:124). As previously mentioned, the large amount of hickory nutshell at the site raises the possibility that nutshell was archaeologically preserved at the Hedden site due to specific use and deposition factors. One possibility is that thick-shelled hickory nutshell was used as fuel.

A substantial quantity of acorn (*Quercus* sp.) was recovered, considering that its shell is thin and fragile and that it is usually underrepresented archaeologically (Asch and Asch 1975). The importance of acorn at the Hedden site may be inferred from its relative frequency; it appears in greater frequency than other nut species that usually are more common in archaeobotanical collections (see below). It also had a ubiquity of 77.6% (appearing in 38 of 49 contexts). Acorn is probably the most abundant and reliable southeastern U.S. nut, producing consistent annual masts while other species vary more in annual production. Acorns, however, 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, acorn collection may be simpler than collection of other nuts, and nutmeat yields are high, so the net energy potential of acorn may be similar to that of other nuts (Lopinot 1982:726).

Table 7. Frequencies, Gram Weights, and Ubiquities of Nonwood Plant Remains from the Hedden Site.

Type	Species	Freq	Gm Wt	Ubiquity
Nutshell	thick-shelled hickory (*Carya* sp.)	79,489	1,077.1	98.0
	acorn (*Quercus* sp.)	735	2.5	77.6
	black walnut (*Juglans nigra*)	137	3.0	28.6
	pecan (*Carya illinoiensis*)	133	.5	14.3
	hazelnut (*Corylus* sp.)	14	.1	4.1
	butternut (*Juglans cinerea*)	2	.2	4.1
	Total nutshell	80,510	1,083.4	100.0
Seeds (general)	persimmon (*Diospyros virginiana*)	6	--	12.2
	bedstraw (*Galium* sp.)	4	--	4.1
	grape (*Vitis* sp.)	2	--	4.1
	sunflower (*Helianthus* sp.)	2	--	4.1
	chenopod (*Chenopodium* sp.)	2	--	2.0
	amaranth (*Amaranthus* sp.)	1	--	2.0
	grass	1	--	2.0
	oregongrape (*Berberis* sp.)	1	--	2.0
Seeds (wetlands)	spikerush (*Eleocharis* sp.)	2	--	2.0
	bulrush (*Scirpus* sp.)	1	--	2.0
	chufa sedge (*Cyperus* sp.)	1	--	2.0
	flatsedge (*Cyperus* sp. cf. *compressus*)	1	--	2.0
	hornpondweed (*Zannichellia palustris*)	1	--	2.0
	pondweed (*Potamogeton* sp.)	1	--	2.0
	sedge (*Carex* sp. cf. *Aquatilis*)	1	--	2.0
	unidentified seeds	7		10.2
	Total seeds	34		22.4

Trace amounts of four other nut species (black walnut, pecan, hazelnut, and butternut) also were recovered from the Hedden site. These species were probably not as important as hickory and acorn. Black walnut (*Juglans nigra*) appeared in 14 contexts, for a ubiquity of 28.6%. Walnuts contain over three times more nutmeat (Styles 1981:82) and approximately 10% more protein and fat than hickory (Lopinot 1982:858-859). Walnuts are, however, much more difficult to process and prepare in bulk, and unlike hickory, the trees do not grow in solid stands. Pecan, a thin-shelled hickory (*Carya illinoiensis*), was found in seven contexts, a ubiquity of 14.3%. Pecans appear to have been prehistorically restricted to the westernmost areas of Kentucky; they do not appear in the many archaeobotanical collections from the central and eastern portions of the state.

Hazelnut (*Corylus* sp.) and butternut (*Juglans cinerea*) were recovered in trace amounts in two samples each. Much like walnuts, the hazelnut (either *Corylus americana*, the American hazelnut, or *Corylus cornuta*, the beaked hazelnut) is high in protein and easily stored (Krochmal and Krochmal 1982:6-8). Butternut is widespread in the eastern U.S. archaeological record in small amounts. Its nutritional content, processing, and use is very similar to that of black walnut. Butternut trees, however, only produce good harvests every two or three years, so butternut 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). The amount and availability of butternut in Kentucky is difficult to assess because a blight has drastically reduced its numbers in recent years.

CARBONIZED SEEDS

Carbonized seeds (n=34) are rare in the Hedden site collection (Table 7). Because of the very low frequencies involved, it is impossible to estimate the relative importance or dietary contribution of the food plants that are represented by carbonized seeds. Indeed, it is not possible in all cases to establish a plant's economic use. As an aggregate group of seeds, however, certain patterns emerge that are suggestive of broad dietary patterns at the site.

The fleshy fruits persimmon (*Diospyros virginiana*, n=6) and grape (*Vitis* sp., n=2) were recovered. Persimmon and grape are a minor component of many regional prehistoric archaeobotanical collections. Persimmon is common in both dryer upland and wet bottomland forests, and is common in Archaic sites of southern Illinois (Lopinot 1982:762). Persimmon and grape (along with blackberry) were the common fleshy fruit seeds at the Late Archaic Carlston Annis shellmound in Butler County (Wagner 1979). Fleshy fruits appear to have retained some importance throughout the prehistoric sequence, although persimmon was primarily relegated to more westerly areas of Kentucky.

The oily-seeded sunflower (*Helianthus* sp., n=2) and the starchy-seeded chenopod (*Chenopodium* sp., n=2) and amaranth (*Amaranthus* sp., n=1) were each recovered in trace amounts. Sunflower and chenopod became members of a series of native cultigens that were widely utilized throughout the southeastern and midwestern United States woodlands (Gremillion 1998; Smith 1987; Watson 1989). The status of amaranth is less clear, but it appears that it never attained the widespread economic importance of the other two plants in that region.

Wild versions of archaeological sunflower and chenopod are fairly easily distinguished from cultivated varieties; sunflower on the basis of size (Yarnell 1978) and chenopod on the basis of size, seedcoat thickness, and, most notably, a truncate margin cross-section and equatorial band that alters seed morphology (Smith 1987). Yarnell considered the case of sunflower in detail in his now-classic study, noting that original wild sunflower achene mean lengths were 4.5 to 5 mm, and that modern ruderal sunflowers have mean achene lengths of 4 to 7 mm, which is intermediate between wild and fully domesticated varieties (Yarnell 1978:291). According to Yarnell's compilations, the Kentucky prehistoric trajectory of sunflower achene growth was as follows: sunflowers from Late Archaic to Early Woodland sites such as Salts Cave, Mammoth Cave, Carlston Annis Shellmound, and Newt Kash Hollow, and from Middle to early Late Woodland sites such as Hooton Hollow, Haystack Shelter, and Rogers Shelter all exhibit achenes varying from 7 to 10 mm in length (Cowan 1979; Cowan et al. 1981; Wagner 1979; Yarnell 1969, 1978:292). Sunflower domestication further intensified during the Late Prehistoric period at Mississippian sites in Missouri and Fort Ancient sites in Kentucky and Ohio, where mean achene length reached 10 to 12 mm (Yarnell 1978:293). The two Hedden site specimens, from Features 19 and 35, measure 6 by 2.5 mm and 5 by 3 mm, respectively. These specimens appear to represent wild sunflowers, or, at best, the very earliest stages of domestication. The two chenopod specimens have simple biconvex cross-sections and thick seedcoats. These specimens clearly do not represent the cultivated variety of chenopod (*Chenopodium berlandieri*). Instead, they appear to either represent a wild collected plant or a fortuitous inclusion in the archaeological record (given that a single chenopod plant can produce 100,000 seeds).

Bedstraw (*Galium* sp.) (n=4) is one of the largest, most diverse plant genera of North America. Some archaeobotanists consider these seeds to be accidental inclusions in the archaeological record, because the seeds readily stick to clothing and hair (Asch et al. 1972). The extremely widespread archaeological recovery of this plant, including its occasional recovery in substantial frequency (such as at the multicomponent Site 15Sp26 in Spencer County, Kentucky [Dunn 1984], and the Capitol View site, a Fort Ancient site in Franklin County, Kentucky [Henderson 1992]) casts some doubt on the summary dismissal of its usefulness. As its name suggests, bedstraw could be used as a bedding material. The plant also may be eaten in salads, and used as dyes. In other regions of the U.S., the plant was historically used as a diuretic among the Ojibwa and as a perfume among the Omaha and Ponca (Gilmore 1931:63).

Oregongrape (*Berberis* sp.) (n=1) is a family of deciduous shrubs, some of which contain edible berries. This plant sometimes grows in the moist thickets of wetlands, and could be included with the wetlands plants described below, but it is not a true aquatic plant.

One long cylindrical seed was placed into the large grass family Gramineae. This seed could represent accidental burning and inclusion in the site, construction material, or a food source (see Hunter 1990).

CARBONIZED SEEDS--WETLAND PLANTS

Aquatic and wetland plants live in extremely dynamic conditions, and their habitats, spatial distribution, seasonality, abundance, and general availability are much more difficult to assess than those same characteristics of land plants (den Hartog and van der Velde 1988). In the words of Godfrey and Wooten (1979:2):

> Plants of a given species may be present in great abundance at one time, then disappear or become greatly diminished in number, reappear later, oftentimes several or many years later.

Seven species of wetland plants were recovered (Table 7, Figure 3). Only truly aquatic plants were included in this list. Bedstraw and oregongrape could also have been included, because they flourish in temporarily flooded areas, but they are not truly aquatic plants (Cook 1990:205). All of the wetland plants discussed below were recovered in trace amounts.

The approach taken here is to examine the specific characteristics of the archaeologically represented wetland plants in order to help understand their basic habitat tendency. From this it can be judged what portion of the wetlands may have been exploited, such as the wetlands peripheries (shore plants) or center (submerged or floating aquatics). All the plants listed below are considered wildlife food sources, and have edible seeds and/or edible roots and stems. The list includes true submerged water aquatics (pondweed and spikerush) and shoreline plants (flatsedge), as well as plants that are considered locally dominant in wetland ecosystems (hornpondweed and spikerush). Considered in aggregate, the plant list suggests a broad spectrum exploitation of edible wetland plants, although the intensity of exploitation cannot be estimated. These plants also tend to retain their seedheads for long periods of the year, and are thus available as a secondary "fill-in" food source during times of the year when other plant foods are scarce.

Bulrushes (*Scirpus* sp.) (n=1) are annual or perennial herbs with edible seeds, roots, and stems. They inhabit either shallow wetland or lake/pond shores, where they are an important food source for a variety of wild mammals and birds (Cook 1990:82; Godfrey and Wooten 1979:338-345). Great bulrush (*S. validus*) was identified in a Middle Archaic context at the Black Earth site in southern Illinois (Lopinot 1982: 782-783).

Chufa sedge (*Cyperus* sp.) (n=1) is a genus of annual or perennial grasslike herbs. Exact identification to species and habitat depends on the presence of mature seeds and spikelets, and knowledge of whether the given plant is annual or perennial (Godfrey and Wooten 1979:243).

Flatsedge (*Cyperus* sp. cf. *compressus*) (n=1) is similar to chufa sedge. However, its seeds are triangular and distinctive from more elongated chufa sedge seeds. Flatsedge is a wetland edge plant that thrives in wet sand or in areas of temporarily standing water (Godfrey and Wooten 1979:284).

Pondweed (*Potamogeton* sp.) (n=1) includes a large genus of perennial herbs that live in a wide variety of aquatic habitats. These plants may be either totally submerged or mostly submerged with floating leaves (Cook 1990:202). They are considered an important wildlife food source today for their leaves, stems, and achenes. Pondweed occurs occasionally in archaeological sites. As with the Hedden site, pondweed was recovered from Late Archaic deposits at the Rim Rock Trail site in Breckenridge County, Kentucky (Rossen 2001a) and at the Highland Creek site in Union County Kentucky (Rossen 2001b). It also has been found at the Thompson site, a Fort Ancient settlement in Greenup County, Kentucky (Rossen 1992:195-6), and the Pyles site, a Late Woodland settlement in Mason County, Kentucky (Rossen 1984). In southern Illinois, pondweed was recovered from Woodland period features at the Black Earth site (Lopinot 1982:782).

Hornpondweed (*Zannichellia palustris*) (n=1) is a totally submerged aquatic plant that is considered "gregarious" and "often, locally dominant" in wetlands (Cook 1990:222, Figure 3a). Hornpondweed was recovered from the Pyles site in Mason County, Kentucky (Rossen 1984).

Sedge (*Carex* sp. cf. *aquatilis*) (n=1) consists of a very large genus. As such, identification of particular species and habitat is extremely difficult, even with complete plant specimens (Godfrey and Wooten 1979:408, Figure 3b).

Spikerush (*Eleocharis* sp.) (n=2) is a wetland edge aquatic plant that lives in shallow water between 30 and 90 cm in depth (Godfrey and Wooten 1979:307). It is considered a locally dominant species in many southeastern U.S. wetlands (Cook 1990:76, Figure 3c).

NOTABLE ABSENCE OF SQUASH

The absence of squash (*Cucurbita* sp.) from this collection should be noted in passing. Squash has been found in several Archaic period contexts, including the Carlston Annis site in Butler County, Kentucky (Cowan et al. 1981; Heiser 1989; Kay et al. 1980; Marquardt and Watson 1977; Wagner 1979). The large flotation collection from the Hedden site cannot, however, confirm a widespread western Kentucky Archaic period use of squash. The use of squash may have been geographically sporadic and discontinuous. Illinois Late Archaic sites such as Go-Kart North, Koster, Dyruss, and Missouri Pacific #2 also did not produce squash despite notable water flotation efforts (Asch et al. 1972; Johannessen 1983, 1984a, 1984b). Another possibility is that squash was a plant of relatively little economic importance (hard-shelled varieties used for edible seeds) that would be archaeologically represented in only minor frequencies.

FOUNDATIONS OF THE "EASTERN AGRICULTURAL COMPLEX"?

The chenopod and sunflower specimens from the Hedden site, along with marshelder *(Iva annua)* and erect knotweed *(Polygonum erectum)* seeds recovered from Late Archaic deposits at the nearby Highland Creek site (Union County) (Rossen 2001b), raise the issue of the foundations of the "eastern agricultural complex," which was really a low-level horticultural system. These two Kentucky Archaic collections together contain four of the six recognized cultivated plants of the complex (the others being maygrass *(Phalaris caroliniana)* and little barley *(Hordeum pusillum)*. At both sites, it is clear from seed size, morphology, and low frequency of occurrence as well as radiocarbon dates that the recovered specimens represent wild plants. Prehistoric peoples certainly had long-term familiarity with plants in their wild forms prior to bringing them under cultivation, and, in the early stages of cultivation, plants do not display morphological changes (Roosevelt 1984). The two immediate issues are the 1) timing and 2) nature of the development of starchy-oily seed horticulture throughout the midwestern and southeastern United States Do researchers (or can archaeologists) see the local foundations of native plant horticulture in these Archaic assemblages?

The timing of the transition to seed horticulture remains poorly understood. Some eastern Kentucky sites like Cold Oak Shelter (Ison 1988; Gremillion 1998) show clear-cut seed horticulture by 1500 B.C. Earlier Late Archaic sites like Hedden and Highland Creek with wild precursors of cultivated plants begin to narrow down the time range of the onset of cultivation, that is, if there is one uniform regional time for its beginning. Certainly the presence of cultivated plants in their earlier wild states lends optimism to the search for a threshold date and a deeper understanding of the onset of eastern U.S. horticulture.

DISTRIBUTIONAL OBSERVATIONS

Spatial distributions of the archaeobotanical remains appear to be primarily related to the relative intensity of the water flotation effort. The field research design specified that one-half of all feature fill be collected for flotation. Later, that sample was cut in the laboratory in order to streamline the already large analysis effort. Based upon differences in the amount of soil floated from each feature, no reliable associations can be made between spatial distributions of plant remains and activity areas at the Hedden site. A few examples can illustrate this point.

Hickory nuts are ubiquitous across the site. The consideration of the distribution of all nut species together, however, shows a clear relationship between presence or absence and intensity of flotation effort. For instance, fragile acorn and pecan remains were recovered together in seven contexts (features 8, 19, 24, 26, 31, 35, and 38). This list includes six of the nine features from which more than 50 liters of soil was floated, and includes all five contexts from which more than 60 liters was floated (Table 2). There thus appears to be a sample volume threshold for recovering delicate nut remains.

The spatial distribution of wetland seeds may be related to flotation intensity and/or preservation (Table 8). Eight wetland plant seeds were recovered from four contexts: features 7 (Burial 2), 35, 38, and 40. Six of the eight specimens were recovered from features 35 and 38. These two samples together account for 954 liters, or 42.1% of all soil analyzed. It is not known if intensity of the flotation effort or general site preservation condition is the more important factor, but, as a rule of thumb, very intensive water flotation efforts tend to overcome poor botanical preservation in Kentucky sites (Rossen 1988; Rossen and Hawkins 1995).

Table 8. Distribution of Carbonized Wetlands Plant Seeds at the Hedden Site.

Provenience	Species	Seeds
Feature 38	2	3
Feature 35	3	3
Feature 40	1	1
Feature 7 (Burial 2)	1	1
Total	7	8

DISCUSSION

The large-scale water flotation effort at the Hedden site produced one of the broadest single-site archaeobotanical profiles ever from a Kentucky Archaic site. The collection indicates a strong economic focus on nuts, particularly thick-shelled hickory and acorn. Hickory shell also may have been used as a fuel instead of wood. Archaic sites do not necessarily have worse preservation in terms of overall remains, but it appears that preservation can vary greatly within an Archaic site. In order to recover a sufficient sample of carbonized seeds to assess their contribution to the Archaic diet, large-scale flotation efforts may be needed.

Besides a strong focus on nuts, various fruits and seeds were exploited. It is difficult to estimate the relative dietary importance of these plants due to their probable underrepresentation in the archaeological record. Fleshy fruits (persimmon and grape), starchy seeds (chenopod and amaranth), oily seeds (sunflower), and multipurpose plants (bedstraw) appear to have been utilized. Some of these plants (chenopod and sunflower) came under cultivation in Kentucky at some point during the Late Archaic period (Gremillion 1998; Ison 1988; Wagner 1979; Yarnell 1978). The chenopod and sunflower specimens from this collection, however, do not display morphological evidence of cultivation. Similarly, two other native plants that would become cultivated, marshelder and erect knotweed, were recovered in their morphologically wild forms from Late Archaic deposits at the nearby Highland Creek site (Union County) (Rossen 2001b). Given the low seed frequencies involved, it is probable that the chenopod and sunflower specimens from the Hedden site and the marshelder and erect knotweed seeds from the Highland Creek site represent wild plants. More archaeobotanical research at Kentucky Late Archaic sites may ultimately help pinpoint the exact timing of the earliest cultivation of starchy and oily-seeded plants in Kentucky.

One of the more interesting aspects of the Hedden collection is the presence in low frequencies of a wide variety of wetland plants. These plants represent wetland shorelines, edges, and relatively deep water environments. These few seeds point to the presence of a rich, diverse wetlands near the site, and the collecting activities by people familiar with the plants' properties.

Wetland aquatic plants have been cited as important to the Archaic adaptation of the lower Illinois River Valley, particularly in the floodplain zone (Brown and Vierra 1983; Stafford 1991:218-219). In these case studies, wetlands were modeled as a resource-rich zone that reduced group mobility, focused exploitation on a narrower range of resources, and concentrated local populations.

Much of the author's personal familiarity with broad spectrum Archaic hunter-gatherers comes from research related to archaeobotanical and ethnobotanical collections in southern Chile. At sites, such as Monte Verde (Ramirez 1989) and Pellines I (Andrea Seelenfreund, personal communication 1995), wetland sedges, bulrushes, spikerushes, and pondweeds were an important dietary component. Their year-round availability allowed them to be exploited during times of the year when other plant sources were scarce, and they provided specific dietary aspects (such as trace elements and salt) and medicinal properties that were unavailable elsewhere (Rossen and Dillehay 1997).

DIACHRONIC FINDINGS

The Hedden collection allows some preliminary observations to be made regarding diachronic issues of plant use. Wood charcoal is unusually scarce, which, especially in comparison to the abundance of nutshell, appears to be a general Archaic trend. It is not known whether there were alternative fuel supplies to wood, or if nutshell was sufficiently plentiful to serve as the primary fuel. In general, Late Archaic collections from Illinois and Tennessee contain very low frequencies of starchy and oily seeds (Asch et al. 1972; Asch and Asch 1985; Chapman 1977; Johannessen 1983, 1984a, 1984b), whereas eastern Kentucky rockshelters with their superior preservation produce substantial quantities (Cowan 1979; Cowan et al. 1981; Ison 1988; Gremillion 1998). Still unclear is the timing of the beginning of cultivation of the starchy and oily-seeded plants, and the relationship of early gardening to the use of nuts, wood, and wetland plants. Did the onset of plant cultivation signal a shift in the exploitation of nuts and/or a shift toward generalized wood exploitation? For how long and at what level of intensity were wetland plants exploited? Specifically, were wetland plants abandoned as a food resource when starchy-oily seeded native plants (mostly dryland annuals) came under cultivation? The Hedden site collection raises these issues for future investigation.

REDUCED MOBILITY, WETLANDS, AND NUTS

Reduced mobility and focused exploitation of relatively few resources, particularly nuts, appears to have been a general trend during the Middle Archaic period of the midwestern U.S. (Brown and Vierra 1983; Munson 1980:674; Stafford 1991). These trends apparently occurred against the environmental backdrop of the Hypsithermal Event, a relatively warm and dry period (ca. 4000-1000 B.C.). Ongoing debate centers on the exact nature of the environmental changes, resource zones, and diets that enabled population aggregation.

Some scholars have proposed that enhanced wetland and aquatic resources resulting from the Hypsithermal were attractive "pull" zones that reduced Archaic group mobility (Brown and Vierra 1983; also see Collins and Driskell 1979:1036). In contrast, Jefferies (1982:1485) postulated that the Hypsithermal reduced the size of large wetlands and eliminated many smaller ones, "pushing" groups out of some areas. In another variation of this theme, Nance (1988) suggested that in western Kentucky, the Hypsithermal caused a shift of nut-bearing tree communities toward the major river valleys, bringing nut and riverine resources into juxtaposition (Nance 1988:146). Although aquatic wetland resources are not specifically mentioned by Nance, they could presumably be included under a broad definition of "riverine" resources.

Research in southern Illinois and southcentral Indiana has led to a broader settlement view of Middle and Late Archaic peoples as oriented toward all river valleys (primary, secondary, and tertiary) instead of merely major valleys, with a heavy resource pull toward oak-hickory and mixed forest zones (Jefferies 1982:1483; Munson and Cook 1980:735-737). Researchers working in southern Illinois (Carrier Mills) and the Falls of the Ohio area of Kentucky have postulated that forest nut resources were concentrated enough to permit population aggregation to the point of semi-sedentism (Janzen 1977:141; Jefferies 1982:1484-1485). Despite the presence of aquatic plants at these sites, this model does not include wetland resources as a pulling or stabilizing force in enabling semi-sedentism.

More recently, scholars such as Stafford (1991, 1994) have sought more behavioral models of Archaic resource procurement and settlement, based on a structural change from broad-spectrum foraging to more specialized collecting activities (Binford 1980). Primarily on the basis of Illinois River valley data, Stafford envisioned a geographically broad adaptation of intensive exploitation of relatively few focal resources, especially nuts. Illinois and Indiana Middle Archaic sites all show extremely high nutshell and very low wood densities (Asch et al. 1972; Freudenrich 1980; Lopinot 1982; Cheryl Munson, personal communication 1995), and western Kentucky sites exhibit settlement patterning that led to similar focal resource expectations (Nance 1988). Despite this, Stafford (1991:225-228) emphasized problems with nuts as a focal resource, particularly their "patchiness," spatial and temporal variability, and narrow duration of availability. Stafford suggested that centralized extractive camps and processing stations were a solution to these problems. According to this model, Archaic settlement shifts and reduced mobility were based on new logistical efforts at more efficient nut exploitation, designed to mitigate unpredictability in space and time. Stafford (1994:232-233), in notable contrast to Brown and Vierra (1983), tends to see aquatic plants as incidental or non-determining resources, or as an additional minor patch to be exploited outside of the basic logistically specialized strategy.

The Hedden site collection may offer an opportunity to reconcile these varying perspectives on Archaic subsistence and settlement. The site is situated near a wetlands, and those resources were utilized on a broad spectrum level; various plant species from different areas of the wetlands were apparently collected. The site also has enormous deposits of nutshell, principally thick-shelled hickory and an appreciable amount of acorn and pecan. The very low wood charcoal density at Hedden might suggest a somewhat specialized camp and nut processing station, although this could be a general Archaic site trait that is not indicative of particular activities conducted at a site. Specialized or semi-specialized sites could also have been located to take advantage of a resource patch such as a wetland, particularly one that provides food resources during lean months. The Hedden collection thus offers hints of a plant exploitation strategy that combined specialized collecting and processing (nuts) with more generalized foraging (wetland plants, fleshy fruits, and starchy and oily seeds) in areas with juxtaposed dryland and wetland resources.

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THE ARCHAEOLOGICAL POTENTIAL OF SMALL SITES

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ABSTRACT

The majority of the archaeological record is likely comprised of low-density sites that represent limited activity loci or short-term occupations. Such sites are often deemed unimportant due to a low artifact count, low diversity of artifact classes, and lack of features. In many cases, it is these characteristics that make these sites important. The fine-grained nature of the assemblages recovered from these sites reflects their limited occupation span and function as opposed to the potentially coarse-grained nature of mixed assemblages from repeatedly reoccupied sites. In this paper, preliminary results from excavations conducted at the Greendale site (12D511), a Middle to Late Archaic site, are presented. The site was excavated as part of the Argosy Casino project. These analyses illustrate the potential of small or seemingly insignificant sites to provide important information concerning prehistory.

INTRODUCTION

Kelly's (1995) analysis of living or ethnographically known hunter-gatherer societies should make it clear to anyone that this mode of adaptation is highly diverse. The diversity among hunter-gatherer societies can be seen in patterns of diet, mobility, sharing, land tenure, exchange, division of labor, marriage, descent, etc. This diversity results from a range of environmental, technological, historical, social, and cultural factors. Because of the high degree of diversity among hunter-gatherer societies and the many factors influencing diversity, Kelly (1995) suggests that it is very difficult, if not impossible, to generalize about hunter-gatherer patterns or correlates. In other words, one can not assume that because two groups live in the same environment they will have the same subsistence, settlement, and social patterns. Kelly (1995) points out that if modern hunter-gatherer societies exhibit such great diversity, archaeologists may expect the same variation in the prehistoric past. Because of this, Kelly (1995:343) states that "we need then, to look at hunter-gather prehistory in terms other than broad typological categories such as generalized versus specialized, simple versus complex, storing versus nonstoring or immediate versus delayed return." Therefore, to reconstruct prehistoric cultural systems, whether they be hunter-gatherer, horticulturist, or agriculturist, researchers must, as Kelly (1995) and Binford (1983) have pointed out, identify the individual elements or parts of the system in order to put it together.

A cursory examination of the literature on archaeological site excavations in the middle Ohio Valley illustrates that the focus of institutional research and cultural resource management data recovery efforts has been directed towards sites exhibiting rich and diverse assemblages or towards the more spectacular mounds and earthworks. The former are typically large residential sites containing relatively thick middens or are typified by large numbers of features at the base of the plowzone. These large sites tend to yield a rich material assemblage including many artifact classes. In contrast, there has been little or no excavation of small archaeological sites, so that much of the regional archaeological database has generally been ignored. Small sites exhibit low diversity and limited numbers of artifacts and features, and are typically associated with one temporal period. The reasons for the bias towards the excavation of large sites rich in artifacts or burial mounds and earthworks are not the subject of this paper. Rather, the aim of this paper is to illustrate that the small seemingly unspectacular sites also contain a wealth of information and their investigation is essential. In order to reconstruct prehistoric cultural systems in the region archaeologists must adopt a more holistic view.

Several types of small sites can been identified. They include sites where the cultural materials 1) are confined to the plowzone, 2) are contained within the plowzone and subplowzone features, 3) are found in buried occupational loci, or 4) are located within buried occupational loci and associated features. The focus of this paper is on the latter.

PROJECT LOCATION AND ARCHAEOLOGY OF THE ARGOSY CASINO

Data for this paper is derived from intensive archaeological investigations conducted for the Argosy Lawrenceburg Casino between 1995 and 1997. The Argosy Lawrenceburg Casino development is located on the right bank of the Ohio River in Dearborn County, Indiana, approximately 10 km southeast of Cincinnati, Ohio.

ENVIRONMENTAL BACKGROUND

Dearborn County is located within the Dearborn Upland physiographic unit. The Dearborn Upland consists of a dissected plateau some 40 km in width and 120 km in length that encompasses southeastern Indiana (Malott 1922; Schneider 1966). It is characterized by broad flat upland plains and narrow ridges. Much of the Dearborn Upland, including Dearborn County, lies beyond the maximum advance of Wisconsin glaciation. It is dissected by deeply incised v-shaped valleys (Nickell 1981:1; Schneider 1966:42). The uplands vary in elevation from 213 to 335 m AMSL (Black 1934:182; Malott 1922:84). The Ohio River, with an average elevation of 138.68 m AMSL, represents the base towards which the streams draining the Dearborn Upland are cutting.

Bedrock within the project area consists of nearly flat-lying shales and limestones of the late Ordovician Maquoketa Group (Gray et al. 1972). Bedrock cherts have not been identified in local lithologies, although Laurel chert is known to have an outcrop distribution that includes portions of adjacent Franklin and Ripley counties to the north and west, respectively (Cantin 1996; Tankersley 1989:274-292). Although no prehistorically exploited bedrock resources are located within Dearborn County, chert cobbles from the Ohio alluvial gravels were used by prehistoric groups (Parish and McCord 1995:92). The bedrock uplands are sporadically covered with Kansan and Illinoisian tills (Gray et al. 1972). To the west of the project area, minor tributaries, like Tanner, Wilson, and Hogan creeks, contain extensive lacustrine deposits of the Atherton formation. These Pleistocene lake deposits developed when meltwater outwash blocked tributary outlets. Surface deposits within the project area consist of unconsolidated silt, sand, and gravel alluvium of the Martinsville Formation. These surface deposits overlie the outwash deposits to a depth of up to 9 m in thickness (Stafford 1995:51).

The study area is situated in the broad valley formed by the confluence of the Ohio and Great Miami rivers. The Ohio/Great Miami Valley in this area is about 3.5 km wide. In comparison, the Ohio River Valley above and below the confluence is relatively narrow (about 0.8 km wide). Adjacent upland bluffs rise ca. 122 m above the floodplain. The Ohio lies on the left side of its valley, at the foot of the bluffs, and has only a narrow wedge of floodplain on its left side. Likewise, the Great Miami courses along its left valley wall near the foot of the bluffs. On the right sides of the rivers, a broad floodplain extends from the edge of the rivers to the bluff line some 2-3 km in distance. This broad floodplain is characterized by a low relief flat varying between 140 and 145 m AMSL in elevation and represents an earlier meander belt of the Great Miami. Numerous paleochannels and channel fragments are evident across this broad floodplain (Stafford 1995:51-52). A large scroll bar and neck cut-off meander scar is a conspicuous feature of the floodplain. As late as 1847, this was the main channel of the Great Miami.

ARCHAEOLOGICAL BACKGROUND

The Argosy Casino investigations included subsurface reconnaissance and phase II and III investigations. The phase II and III investigations entailed: 1) the excavation of over 150 backhoe trenches, 2) the recovery of over 30 solid cores, 3) the hand excavation of over 1,200 m^2 of area including test unit and block excavations, and 4) the machine sampling of an area encompassing approximately 10,000 m^2. These investigations were conducted in three principal localities (landforms) on the west side of the valley.

The Argosy data demonstrate the following general characteristics:

1) Buried archaeological materials are ubiquitous in the upper 2-3 m of alluvial sediments deposited by the Ohio and Great Miami rivers.

2) Archaeological sites are associated with a variety of landforms including levee, ridge, point bar, and terrace features.

3) Although stratified remains are common, the vast majority of site components have relatively low archaeological visibility.

4) Occupation levels in trench exposures typically are characterized by low densities of diffuse charcoal, burnt soil, and fire altered rock. The presence of large rock (greater than 3 cm) in these fine-grained overbank sediments is one of the most compelling factors in determining that the remains represent prehistoric use of the landscape despite the absence of features and artifacts.

5) Features and artifacts are associated with less than half of the suspected occupation levels observed in trench exposures.

The seemingly low density of archaeological remains, as indicated by backhoe trench exposures, is borne out by the results of extensive hand excavations. Occupations are characterized by low densities of lithic debris and tools, although there is noticeable variation. Lithic densities of 1-2 flakes per m^2 are the norm. The highest densities, approximately 50-75 flakes per m^2, are restricted to small, localized areas within a few components. Tool densities, including all formed lithic artifacts, are much lower, possibly on the order of less than one per four m^2. In addition to the low density of tools, assemblage diversity tends to be low and dominated by utilized flakes. Features associated with the occupations are primarily pit hearths and/or shallow roasting pits. The occupations appear to represent short-term logistical camps. The function of some of the occupations is difficult to assess at this time, but variation in the density and diversity of the remains suggests possible residential, field camp, and specialized procurement activities.

THE GREENDALE SITE (12D511)

Now that the importance of small site archaeology and the archaeology of the project area have been outlined, an example is provided. The Greendale site (12D511) was excavated in advance of construction of a temporary remote parking lot for patrons while the permanent casino and other facilities were constructed. It is located on the left bank of a former channel, the Greendale Paleochannel, of the Great Miami River. The data recovery investigation at the Greendale site was conducted in two stages comprised of a 10% and 15% sampling scheme.

The initial sampling of the site area consisted of the hand excavation of 2 x 2 m units on a checkerboard pattern (Figure 1). This resulted in 116 m^2 being excavated. Cultural features and low densities of artifacts and fire-cracked rock generally occurred in the southern half of the eastern edge of the site. Intact cultural deposits covered about 750 m^2. The second stage of the date recovery consisted of the excavation of an additional 129 m^2. The units were grouped into five blocks (areas A through E) to expose and sample discrete occupation/activity loci (Figure 1).

The excavations documented two sediment/stratigraphic units. The uppermost unit consisted of a replaced topsoil, which was the result of borrowing activities associated with the widening of US 50. Sampling of this sediment unit recovered a small number of artifacts that included a shell tempered sherd, a Snyders hafted biface, and a Late Archaic stemmed cluster hafted biface. This material was clearly from a disturbed context. The sediment unit below the replaced topsoil was intact silty clay alluvium. Cultural materials occurred in the upper 20 to 30 cm of this sediment unit.

In the most productive areas, the buried cultural level was evidenced by features, scattered fire-cracked rock, charcoal flecked soils, flake debris, an occasional modified implement, and scattered bone and shell. The features occurred at the base of the topsoil and about 5-10 cm below it. It was apparent that several of the features had been truncated by previous construction activities.

A total of 68 features and seven postmolds was documented. Several of the postmolds formed an arc suggesting the possible remains of a small structure. The majority of the features tended to occur as relatively discrete concentrations consisting of hearths and/or charcoal- and rock-filled pits. The concentrations appeared to represent processing or kitchen areas. Artifacts and economic remains (bone and shell) were concentrated around these feature clusters (figures 2 and 3).

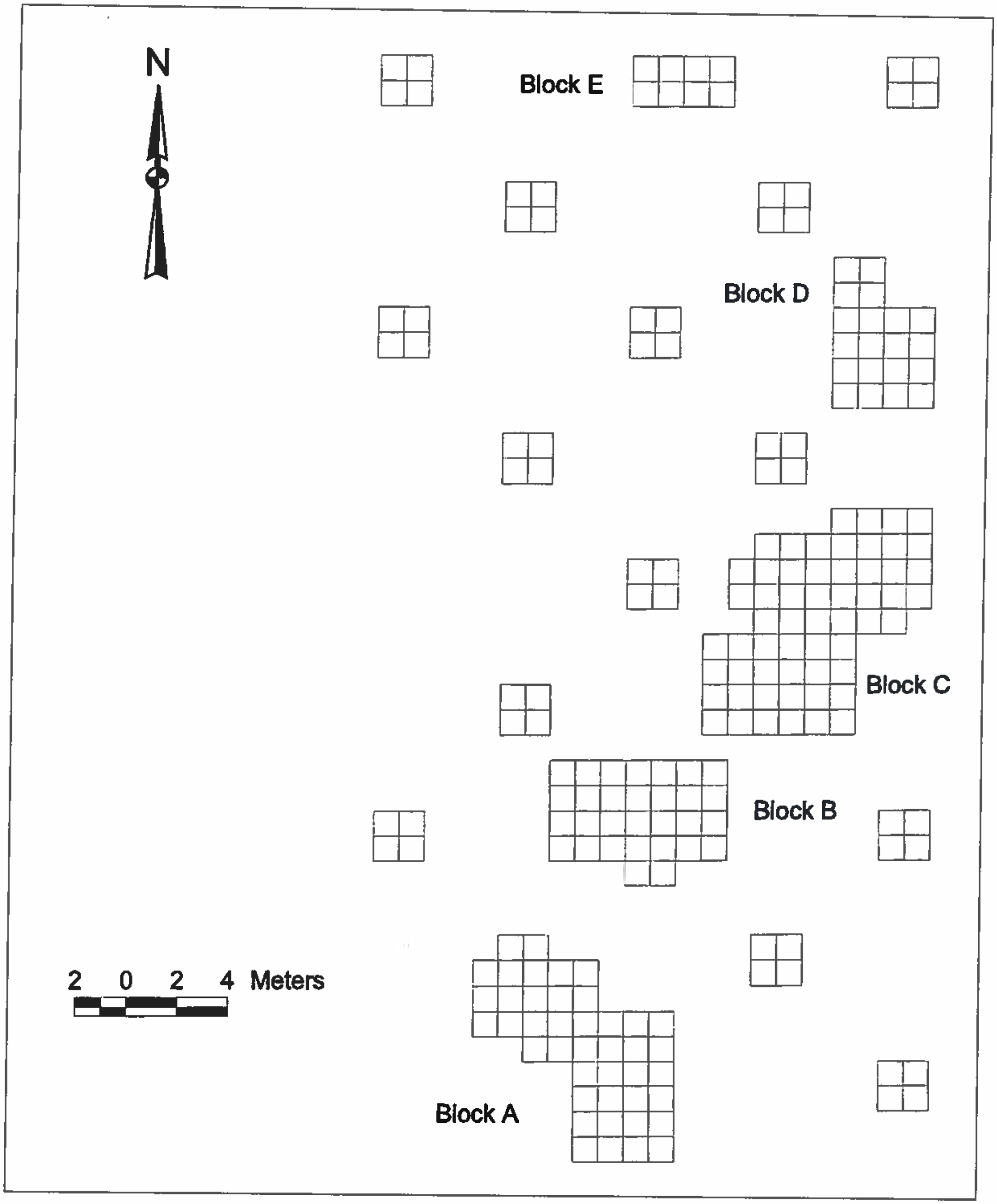

Figure 1. Areas Excavated at the Greendale Site, Including Systematically Spaced 2 X 2 M Units on a Checkerboard Pattern, and Block Areas (A Through E).

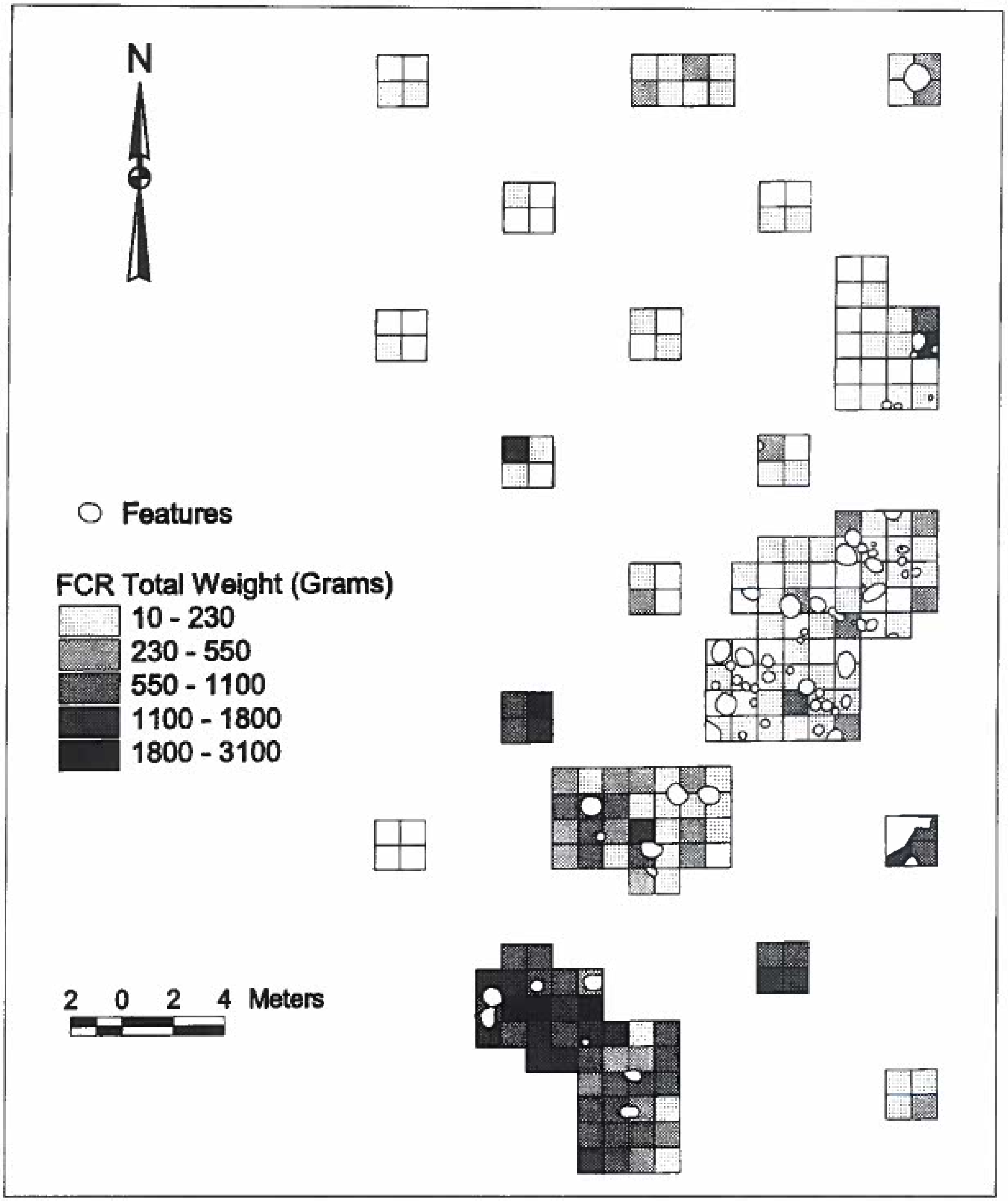

Figure 2. Density of Fire-Cracked Rock in Excavation Levels, all Levels Combined.

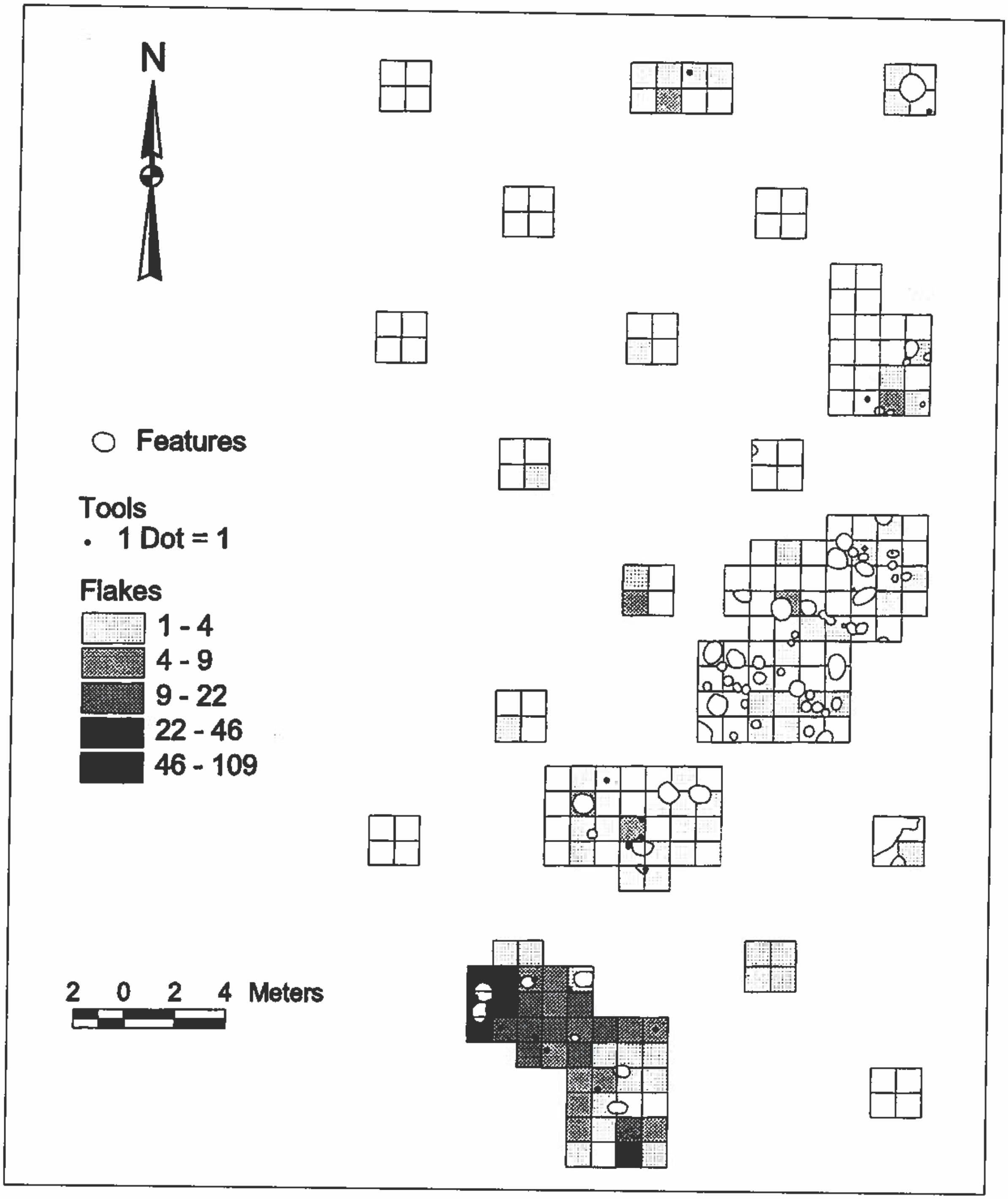

Figure 3. Density of Flake Debris and Tools in Excavation Levels, all Levels Combined.

One Matanzas cluster and one Brewerton cluster hafted biface were recovered within the intact cultural horizon indicating a Middle to Late Archaic age for the occupation. Four radiocarbon dates assayed from charcoal samples from features also confirmed this temporal placement (Table 1).

Table 1. Radiocarbon Dates for the Greendale Site (Phase I Date from Parish et al. 1996).

Feature	Beta #	Measured C14 Age	C13/C12 Ratio	Conventional* C14 Age	Calibrated Age 2 sigma ranges	Comments
Phase I						
236-2	91281	4650±80 BP	-25.0 o/oo	4650±80 BP	3635(3370)3105 B.C.	Wood
Phase II						
20	126551	5100±60 BP	-27.7 o/oo	5060±60 BP	3975(3805,3870,3805)3700 B.C.	AMS, Wood
25	126552	5140±60 BP	-26.0 o/oo	5120±60 BP	4035(3955)3780 B.C.	AMS, Wood
48	126553	5100±60 BP	-25.7 o/oo	5090±60 BP	3990(3940)3720 B.C.	AMS, Wood
* Conventional C14 Age is result of applying C13/C12 ratio correction to measured age.						

LITHIC ARTIFACTS

Lithic materials recovered from the site consist of 737 pieces of flake debris greater than 0.635 cm (¼ in), 1,246 pieces less than 0.635 cm, 35 pieces of thermal shatter, 24 cores, 27 bifacial implements, and 11 groundstone implements. As the Argosy materials are currently in the process of being analyzed, only a preliminary analysis of the Greendale site material is presented here. Due to the small sample of lithic materials recovered, a detailed analysis is possible. These analyses include using several different flake debris analytical methods, a low magnification microwear analysis of the chipped stone tools and all flake debris greater than 1.27 cm (½ in) in size, and a refitting study. These are briefly summarized below.

Flake Debris

Locally occurring Laurel chert accounts for almost 96% of the flake debris that could be identified as to raw material type. Just over 50% of this material is thermally altered. A low magnification microwear analysis (e.g., Odell 1977, 1979; Odell and Odell-Verreecken 1980; Tringham et al. 1974) indicates that almost 19% of the flake debris greater than 1.27 cm shows use-wear and ca. 30% of these are thermally altered. To date, just over 3% of the flake debris greater than 0.635 cm has been refit, though no formal refitting study has been conducted yet. A more formal refitting study is planned for the final analysis. Six flakes have been refit to several cores, three refit to two bifaces, and the remainder refit to other flakes. In most cases, the refits are within a single unit or between two adjacent units. In the few instances of refits occurring over a distance of several meters, these are between utilized flakes and cores. These data suggest that, for the most part, material was recovered where it was dropped and there was not a great deal of clean up of the site.

Given the small flake debris assemblage, it was possible to record several metric attributes of all flakes greater than 0.635 cm in size. This allows for the use of a continuum-based approach (Bradbury and Carr 1999; Ingbar et al. 1989; Shott 1996) to the flake debris analysis. In this approach, chipped stone tool production is viewed as a continuous process in which the relationship between flake attributes and the process of reduction is predictable. The method developed by Bradbury and Carr (1999) is used here. This analysis was conducted in two stages. First, individual flakes produced during core reduction are separated from those produced during tool production using discriminant functions developed from an experimental data set. This analysis uses only flakes exhibiting a complete platform as metric measurements are used in the discriminant function equations.

In the second stage of the analysis, flakes classified as tool production debris by the discriminant function equations are further analyzed using a regression formula that predicts what percentage of the tool had been completed when the flake was removed. This is accomplished using a standardized scale where 0.0 indicates that no reduction has taken place and 1.0 represents a completed tool. Resharpening and reworking of a tool will yield values greater than 1.0. Core reduction flakes misclassified as tool production by the discriminant functions will likely fall in the early portion of the continuum. The regression equation developed by Shott (1996) in his examination of a continuum model was also used as a check. All calculations were computed using a database program written by the second author.

Since the vast majority of flake debris is of one chert type, all cherts are combined for this examination and separated by thermally altered versus nonaltered chert. The continuum plot shows that the full range of tool production is exhibited by the nonaltered cherts, while the altered cherts are distributed from the middle to the final portions of the reduction sequence (Figure 4). In addition, a number of flakes are the result of resharpening (i.e., greater than 1.0). This pattern can be more clearly seen when histograms are created (figures 5 and 6). Again, the thermally altered cherts are more highly represented in the later portions of the continuum than nonaltered cherts. This suggests that tool manufacture, when it includes thermal alteration, proceeds from flake blanks, to partially reduced tools, to thermal alteration, then further reduction. Similar plots were also seen when the regression formula developed by Shott (1996) was applied to this data.

As a check of the continuum based approach, individual flake (e.g., Magne 1985) and mass analysis (e.g., Ahler 1989a, 1989b) approaches also were used. The individual flake analysis shows almost equal amounts of early, middle, and late stages of reduction, while the mass analysis data suggests an emphasis on tool production. Therefore, the mass analysis data matches the results of the continuum analysis. Given the correspondence between the mass analysis and the continuum analysis, it is suggested that the reduction stage analysis has misclassified middle and late stage reduction as early stage reduction in some cases. The analysis of several experimental data sets (e.g., Bradbury and Carr 1995, 1999) has shown that tool reduction debris is classified correctly at a higher rate when dorsal scars are examined rather than platform facets.

One half of the flakes classified as early stage based on facet count would have been classified as middle or late stage had scar count been used instead. Also, during the analysis, it was noted that a number of flakes appeared to have been detached using pressure flaking techniques. The small size of these flakes can sometimes result in misclassification in the reduction stage analysis as few exhibit multiple facets. These data suggest that the continuum and mass analysis approaches are correct. This finding will be investigated further in the final analysis.

In conjunction with this analysis, several bipolar flakes were identified, which indicates the presence of a bipolar technology. Several authors (e.g., Jeske and Lurie 1993; Kuitj et al. 1995) have noted that bipolar technologies are best viewed at the assemblage level, as not all flakes produced in this manner will exhibit the "classic" attributes of bipolar reduction. The percentages of flake portions are plotted along with several experimental assemblages in Figure 7.

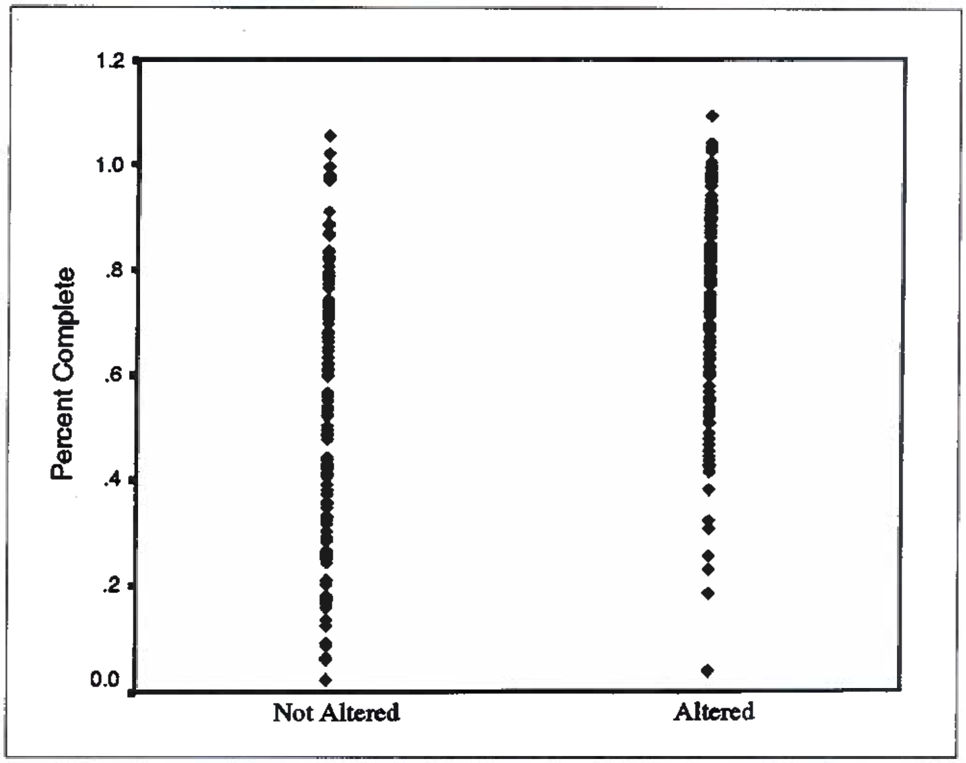

Figure 4. Continuum Plot for Thermally Altered and Nonthermally Altered Cherts.

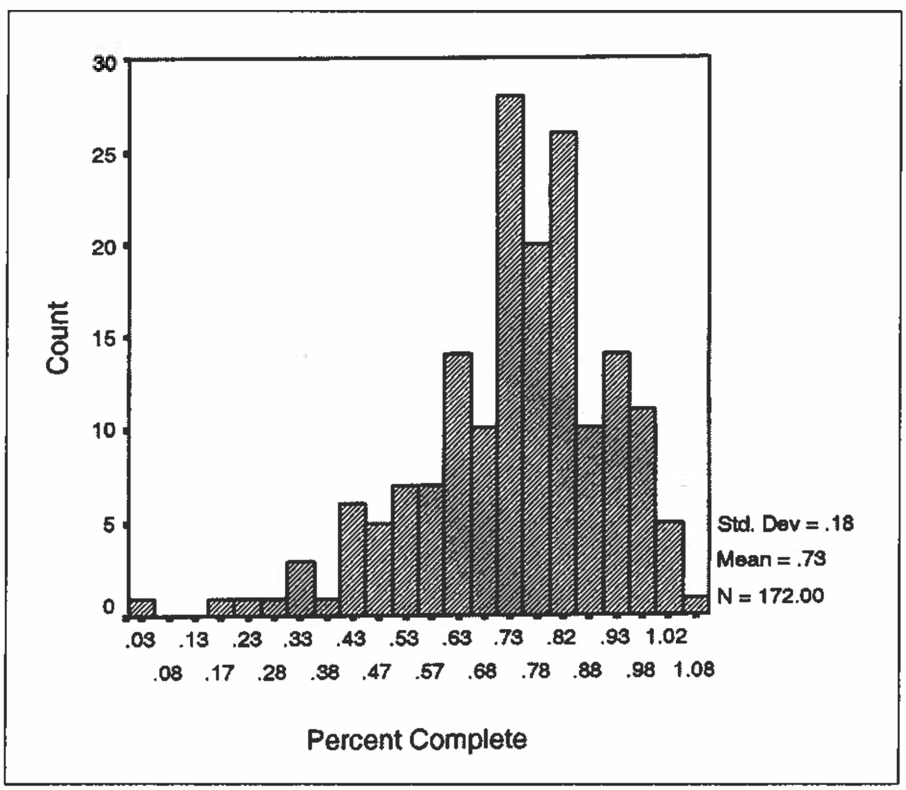

Figure 5. Histogram for Thermally Altered Cherts.

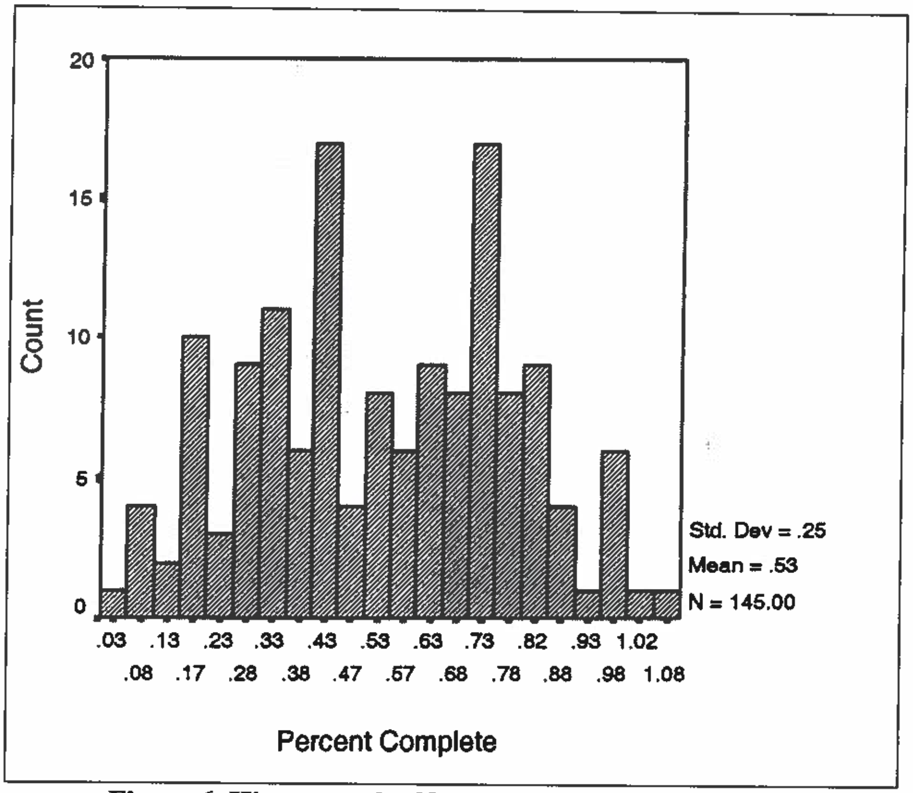

Figure 6. Histogram for Nonthermally Altered Cherts.

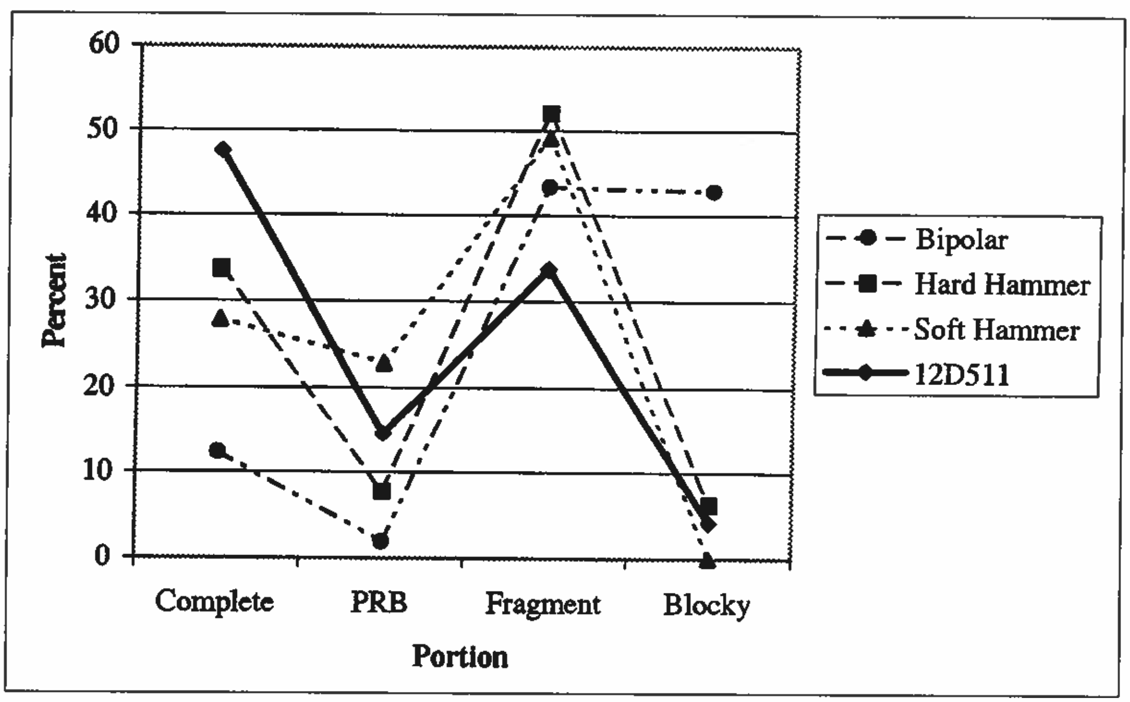

Figure 7. Percentages of Flake Portions Plotted Along with Several Experimental Assemblages. PRB = Platform Remnant Bearing Flakes (i.e., Flakes Retaining Platforms). The bipolar experimental assemblage is from Kuitj et al. (1995) and the hard and soft hammer experimental assemblages are from Bradbury and Carr (1995).

This plot shows that the majority of the flake debris is the result of hard and soft hammer percussion. Bipolar is likely only a minor part of the organization of lithic technology at the site. Other indications of a bipolar technology are the recovery of several bipolar cores and several bifaces that exhibit evidence of bipolar reduction after final manufacture.

Furthermore, the high numbers of flakes that are less than 0.635 cm in size (n=1,246) suggests a higher amount of tool reduction debris than is represented in the reduction stage analysis. The majority of these were recovered from flotation and constant volume samples as 0.635 cm mesh screens were used in the field. Further examination of this data is planned for the final analysis.

Modified Implements

Local raw materials again predominate both for tools and cores. Of the 27 modified implements, 25 were of Laurel chert, one was of Wyandotte chert, and one was indeterminate as to raw material. Of the 24 cores, 23 were of Laurel chert and one was of quartzite. Furthermore, 44% of the tools and 12.5% of the cores were thermally altered.

The chipped stone tools recovered from the site are all bifacial and most are in various stages of biface reduction. No unifacial or flake tools were recovered from the site. Thirty-seven percent of the bifacial implements are small fragments. Of these, 30% were broken during manufacture, 4% were broken from use, 26% exhibit no failures, and 41% are indeterminate as to failure type.

Sixty-eight percent of the bifaces exhibit either no evidence of use-wear or only edge grinding associated with tool manufacture. Implements used in a longitudinal motion (e.g., cutting or sawing) represent 21% of the use-wear. Impact, transverse (scraping, adzing), and lateral (boring, drilling) motions are each represented by one implement. Worked material for all but one of the used implements was soft resistance material. Such materials include vegetation, flesh, or hide.

All but one of the groundstone implements are notched cobbles, or what are commonly referred to as netsinkers. The remaining groundstone artifact is a piece of worked hematite.

Faunal Remains

Faunal materials recovered from the Greendale site have been identified by Dr. Richard Yerkes of the Ohio State University and additional shell was examined by Dr. William Dickinson. Yerkes examined 1,459 bone and shell fragments recovered from the excavations. Forty-nine percent of all of the bone fragments from the site are identified as coming from mammals and very small amounts are identified as bird, fish, and box turtle. The remainder is classified as unidentified vertebrates. The remains of snails and marine and freshwater clams account for two percent of the total. Tables 2 and 3 enumerate the faunal materials recovered from the Greendale site as reported by Yerkes.

The nature of the preservation conditions at the Greendale site is reflected in the fact that 267 (18%) of the 1,459 faunal elements recovered from the site were identified to species or family. Another 656 (45%) pieces were classified as mammal, bird, fish, reptile, or mollusk. When compared to the results from the other sites in the Argosy Project, with Paul W. Parmalee's (1981) analysis of the Late Woodland and Fort Ancient vertebrate remains from the nearby Haag site (12D19), and with Emanuel Breitburg's (1982) study of the large faunal sample from Archaic and Woodland components at the Carrier Mills site in southern Illinois, the percentage of faunal remains that could be identified is similar. It would appear that around 15% of the faunal remains from Ohio Valley sites can usually be identified to family, genus, or species. The preservation conditions and taphonomy at the sites in the Argosy Lawrenceburg Casino Project seem to be within the expected range.

Table 2. Faunal Materials Recovered from the Greendale Site.

	Features NISP**	Postmolds NISP**	Units NISP**	CVS units* NISP**	Totals: NISP**
Identified mammals					
Raccoon	6		1		7
Squirrel	6				6
Deer	21		119		140
Rodent	15	1		6	22
Canid	2		1		3
Opossum	1				1
Woodchuck	1				1
Unidentified mammals					
Large	13		50		63
Medium	132		2	17	151
Small	112	8		15	135
Unidentified	125	5	41	18	189
Birds					
Duck	1				1
Turkey	1				2
Unidentified large bird	2				2
Unidentified bird	25		3	3	31
Fish					
Sturgeon	1				1
Unidentified fish	41			11	52
Reptiles					
Box turtle	82				82
Molluscs					
Clam	11		4	12	27
Marine	4				4
Snail	1			2	3
Unidentified vertebrata	462	1	4	69	536
Totals	1,066	15	225	153	1,459

* CVS = Constant Volume Sample

** NISP = Numbers of Identified Specimens

Table 3. Summary of the Faunal Materials Recovered from the Greendale Site.

Species	NISP*	Percent	Percent (ID Only)
Total mammal	718	49.0	78.0
Total bird	36	2.0	4.0
Total fish	53	4.0	6.0
Total reptile	82	6.0	9.0
Total mollusc	34	2.0	3.0
Unidentifiable vertebrata	536	37.0	
Total	1,459	100.0	100.0

Species	NISP*	Percent
Mammals		
Large	203	38.0
Medium	163	31.0
Small	163	31.0
Total	529	100.0

Most of the white-tailed deer (*Odocoileus virginiana*) elements are antler fragments, which may have been curated and used to make tools. Worked antler was found in two features and one unit. In addition, two cut and notched deer longbone fragments were found in one feature. The remaining elements represent the extremities (e.g., lower legs and skull). The only "meaty" or high utility bones represented are a few medial shafts of femurs and tibias. There were not enough identifiable elements for a detailed analysis of deer butchering practices. Of the unidentified large mammal elements, one small scapula fragment has been tentatively identified as wapiti or elk (*Cervus canadensis*). The rodents are identified as coming from rats, mice, or voles (Cricetidae family). These rodents may not have been part of the aboriginal diet, but may have burrowed into the soil and died. As can be seen in Table 3, about equal numbers of small-, medium-, and large-sized mammals are present.

Copious amounts of terrestrial gastropod shells and freshwater mussel shell fragments were encountered during the excavation of the Greendale site. Dickinson analyzed a sample of the materials and his results are summarized in Tables 4 and 5. The terrestrial gastropods examined from the site are regarded as intrusive in the excavated material and naturally occurring. Whether the presence of mussel suggests this was a food source or whether the mussel shell remains were raw materials for the manufacture of tools or ornaments could not be determined. Although unlikely, they may have occurred on the site fortuitously.

Floral Remains

Floral materials recovered from the Greendale site have been identified by Dr. Gary Crites of the University of Tennessee. A preliminary analysis of this material has been completed (Table 6). The botanical remains identified in feature flotation samples collected at the site were somewhat limited in types and amounts. Nevertheless, of the 68 features excavated, 47 contained wood charcoal or other floral materials. The most ubiquitous identified material was walnut/hickory (Juglandaceae family) charcoal. Hackberry (*Celtis* spp.) was the only other wood charcoal identified. Two types of charred nutshell were identified, hickory (*Carya* spp.) and walnut/hickory (Juglandaceae family). Hickory shell was much more abundant than walnut/ hickory shell. The only other possible economic remains were wild grape (*Vitis* spp.) seeds and squash or gourd (*Cucurbita* spp.) rind.

Table 4. Terrestrial Gastropod Taxa Represented in the Greendale Site Assemblage.

Family	Genus	Species	Features MNI*	Units MNI*
Endodontidae	*Anguispira*	*Kochi*	1	3
	cf. *Anguispira*	*Kochi*	1	
Polygyridae	*Stenotrema*	*Stenotrema*		2
	Webbhelix	*Multilineata*	3	35
Polygyridae sp.			1	1
Succineidae	*Succinea*	cf. *Ovalis*		10
	Succinea sp.			2
	cf. *Succinea* sp.			1
Haplotrematidae	*Haplotrema*	*concavum*		1
Cf. Hydobiidae/Pomatiopsidae				2
Unidentified fragments			4	74
Total			10	131
* MNI = Minimum Number of Individuals				

Table 5. Freshwater Mussel Shell Taxa Represented in the Greendale Site Assemblage.

Taxon	Common Name	Features MNI*	Units MNI*
Amblema plicata	Threeridge	2	
Amblema plicata(?)	Threeridge		1
Elliptio crassidens	Elephant-ear		1
Elliptio dilatata	Spike	1	
Lampsilis cardium	Plain pocketbook	1	
Lampsilis sp. (?)			1
Pyganodon cf. Grandis	Giant floater		1
Unidentified fragments		37	96
Total		41	100
* MNI = Minimum Number of Individuals			

Table 6. Floral Remains Recovered from Features at the Greendale Site.

Observed Materials	Common Name	Count N	Weight g	Ubiquity n	Float volume l	Density g/l
Nutshell						
Carya spp.	hickory	642	6.99	3	60.0	0.1165
Juglandaceae	walnut	137	0.73	3	50.0	0.0146
Wood charcoal						
Celtis spp.	hackberry	2	0.06	1	10.0	0.0060
Juglandaceae	walnut	52	1.35	13	201.5	0.0067
Unidentified		418	5.34	26	476.0	0.0112
Cucurbita spp. rind	squash, gourd	2	0.02	2	30.0	0.0007
Vitis spp. seed	wild grape	2	0.01	1	35.0	0.0003
Residue			8.15	47	768.5	0.0106

DISCUSSION

The lithic materials recovered from the site are suggestive of short-term occupations with some scavenging and reuse of earlier materials. The procurement and processing of food items, most likely animal and fish, appears to have been an important activity represented by the modified implements.

Local raw materials were extensively used for chipped stone tool manufacture and the use of thermal alteration was an important part of the lithic technology. All portions of the reduction sequence are represented in the flake debris with an emphasis on tool reduction and maintenance. Expedient tools (i.e., utilized flakes) also are an important part of the technology at the site. Almost equal numbers of expedient and curated (e.g., bifaces) tools were recovered. In terms of used edges, however, twice as many expedient tools were used. Finally, groundstone implements that are a part of the lithic industry likely represent net sinkers.

The abundance of deer remains is typical of most prehistoric sites in the Ohio Valley. However, the presence of bones from raccoon, opossum, woodchuck, squirrel, and other small rodents suggests that several different mammal species were hunted by the inhabitants of the site. A variety of game, including turkey, ducks, fish, clams, and box turtle were taken from the aquatic, riparian, and wooded habitats near the Great Miami-Ohio river confluence. Furthermore, although a variety of faunal remains was found at the site, the number of elements associated with any feature or unit was quite low. The faunal samples seem to represent the remains of a few meals. As such, the faunal evidence appears to agree with the results of the lithic analysis which indicate that the site was not occupied for extended periods. The condition of the faunal material precludes any serious attempt to use the remains to determine the seasons of the year that the site was occupied.

The scarcity of floral remains at the site indicated either poor preservation or the inhabitants exploited a very limited range and amount of plants. The presence of squash or gourd rind at a 5th millenium B.C. site adds to mounting evidence for the use of squash/gourd during the late Middle Archaic (see Cowan et al. 1981:71; Crites 1991; Ison 1988).

As for the function of the Greendale site, it does not seem to have been an extractive camp given the relatively low density and diversity of material remains and the wide variety of animal remains identified. The density and diversity of material remains did suggest the site had a residential function; however, the material remains were probably left at the site in a series of brief occupations. Evidence that the site was a reoccupied short-term residence include the concentrations of fire-cracked rock, lithic debris, and tools around clusters of features, a lack of evidence of cleanup, and a high tool to flake ratio. The residential, but short-term nature of the reoccupations suggests that the Middle to Late Archaic populations that occupied the site consisted of relatively mobile groups. The spatial distribution of the features and remains indicates that reoccupation was relatively frequent; however, the individual occupations are spatially discrete. On the other hand, there was no evidence of storage, so it is possible that the people who used the site did not plan to return to it. The site also appears to have been repeatedly used by the same group. This is suggested by the overlap in the standard deviations of three of the four radiocarbon dates from the site.

CONCLUSIONS

Like the Greendale site, other small sites have been excavated in the Southeast that have provided detailed information not attainable from larger sites. Good examples include Sassaman's (1993) work on small upland sites in the South Atlantic Coastal Plain, Creasman's (1995) description of a small Early Archaic site in southeastern Kentucky, Carter's (1996) examination of a lithic scatter in eastern Kentucky, and Bradbury's (1998) analysis of Early Archaic biface manufacture at a small site in southcentral Kentucky. Furthermore, the majority of the archaeological record is likely comprised of these low-density sites that represent limited activity loci or short-term occupations. Such sites are often deemed unimportant due to low artifact counts, low diversity of artifact classes, or lack of features. In many cases, it is these aspects of the sites that make them important. The fine-grained nature of the assemblages from such sites reflects their limited occupation span and function as opposed to the potentially coarse-grained nature of mixed assemblages of repeatedly reoccupied sites.

Reasons that small sites hold greater research potential than larger, more complex sites include the mobility of the occupants, a smaller group size, and short-term use, which allows for greater clarity in site structure. As there are fewer periods of use, and therefore little overlap in occupational debris, the general integrity of artifact patterns in relation to features such as hearths may be preserved. Because of the limited nature of occupations, there is less of the palimpsest effect (e.g., Binford 1982; Stevenson 1991). In other words, the more a site is reoccupied, the greater the chance for distorting the original spatial arrangement of artifacts and features. As Sassaman (1993:133) argues, "small upland sites provide our greatest opportunity for defining the indirect archaeological correlates of individual household occupations." Such can be said of many small sites. By examining such sites, a more detailed analysis of the activities that took place at that location is possible. Additional artifact analyses also are possible with small site assemblages. They may include refitting studies, microwear analysis of the entire lithic assemblage rather than a sample, and more detailed spatial analyses.

Excavation and analysis of the Greendale site and the other Argosy sites illustrate the potential of small or seemingly insignificant sites to provide important information concerning prehistory. The goal of the Argosy investigation is to answer Kelly's (1995:343) plea "to approach archaeology not with the goal of assigning a site or time period to a particular typological pigeonhole, but with the intention of reconstructing different cultural elements -- diet, mobility, demography, land tenure, social organization -- as best we can, then assemble them, like piecing together a jigsaw puzzle with no picture on the box."

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THE RESEARCH POTENTIAL OF TEXTILE ARTIFACTS: AN EXAMPLE FROM CARTER COUNTY, KENTUCKY

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ABSTRACT

A prehistoric fiber slipper from Carter County, Kentucky was subjected to a variety of analytic techniques in order to collect information about its age, and the materials and methods used in its manufacture. A small sample of fiber from the slipper was accelerator dated at 630 B.C., producing a calibrated date of 825(790)525 B.C. The plant fibers of which it was made are relatively coarse and had been minimally processed. The source plant has not yet been identified, but probably can be once the appropriate comparative material is available. The slipper was constructed using a chevron pattern (two-strand, weft, countered, compact twining). The sole of the slipper is heavily worn in a way that suggests it was worn on the right foot. This series of analyses demonstrates the potential of well-preserved prehistoric textiles for enhancing our understanding of prehistoric technology and plant use in eastern North America.

INTRODUCTION

To date, textile artifacts have received relatively little attention from archaeological researchers working in eastern North America. One reason for this neglect is the rapid decay of organic materials under the typical regime of temperature and moisture found at most sites in the region. Remnants of bags, baskets, footgear, cordage and the like are consequently preserved only in unusual environmental circumstances such as cave interiors, some dry rockshelters, or in association with copper salts. These vagaries of preservation place constraints on the reconstruction of textile technology. However, there also seems to be a reluctance to acknowledge the cultural significance of textile artifacts, despite the obvious functional, social, and symbolic importance of carrying devices, clothing, cordage, and nets. Perhaps this attitude is partly a misconception based on the scarcity of such artifacts due to preservation bias. It could also be influenced by the fragmentary and fragile appearance of the recovered artifacts. An additional factor worth consideration is the cultural tendency to devalue women's work that has influenced textiles research even in areas with superior documentation (Barber 1994). Certainly the wealth of information gleaned from the study of textiles from contexts that encouraged better preservation, such as those from Peru, provides support for a more rigorous study of less aesthetically remarkable fragments from eastern North America. In any case, textile artifacts deserve more intensive study than they have traditionally received in eastern North American archaeology.

Textile technology, like lithic or ceramic technology, can be viewed as an evolutionary process in which functionally superior elements were differentially retained and transmitted. Of course this is not the only process involved, but it is a place to start. Selection, processing, and assembly of raw materials all vary in ways that have implications for the functional traits of the artifact. This paper illustrates, using an example from an eastern Kentucky rockshelter, how various analytic techniques can be employed to document the process of manufacture as it is reflected in the finished product. Eventually, such reconstructions can be used to test models of evolutionary change in textile technology.

PREHISTORIC TEXTILE INDUSTRIES OF EASTERN NORTH AMERICA

BASIC TECHNIQUES

Prehistoric textile technology in eastern North America is relatively poorly known because of the rarity of the artifacts themselves. Inferences about manufacturing techniques have often been based on ethnographic descriptions of traditional crafts among native groups rather than primarily upon analysis of the artifacts themselves (Densmore 1928; Whitford 1941; Willoughby 1938). A notable early exception is the work of Holmes (1884a, 1884b, 1891), who analyzed form and reconstructed textile artifacts from museum collections in the East in addition to investigating relevant ethnohistoric and ethnographic documents. More recently, analysis of prehistoric textiles from the region has expanded into new areas such as the use of textiles as indicators of social status and ethnicity (Carr and Maslowski 1995; Church 1984; Kuttruff 1988; Song et al. 1996; Sibley et al. 1996; Schreffler 1988), identification of fibers and fiber preparation techniques (Jakes 1996, 1997; Jakes et al. 1994), and analysis of textile manufacture as a series of production decisions (Carr and Maslowski 1995; Ericksen et al. 1997; Jakes and Ericksen 1996).

Textile production in prehistoric eastern North America utilized relatively few of the potential techniques that have been documented in other regions. For example, twining was the predominant technique, although oblique interlacing, braiding, and knotting were also employed (Peterson 1996). Looms and weaving are not known to have been used prehistorically, although Adair (Williams 1930) describes large frames and wooden looms and shuttles in use among Southeastern Indians during the late eighteenth century. Textiles that predate the Woodland period (pre-1000 B.C.) are typically utilitarian items such as bags, baskets, and footgear made of coarse fibers. The fine fabrics that have been discovered so far in archaeological contexts are usually associated with Hopewellian and Mississippian burials of high-status individuals. These generalizations are offered with the caveat that our knowledge of textile manufacture and the cultural significance of the artifacts themselves is probably incomplete.

Prehistoric eastern North Americans did, however, show considerable discrimination in the plants they selected as raw materials for textile artifacts. Many of the species reported in the literature are difficult or impossible to verify because details regarding identification techniques and criteria were not published (e.g., Jones 1936; Whitford 1941). However, ethnographic and ethnohistoric documentation indicate that a relatively small set of plants were preferred sources of fibers (Densmore 1928; Whitford 1941;Yarnell 1964). These include various species of dogbane (*Apocynum*) and milkweed (*Asclepias*), nettles (of the genera *Urtica*, *Laportea*, and *Boehmeria*), pawpaw (*Asimina triloba*), walnut (*Juglans nigra*), redcedar (*Juniperus virginiana*), mulberry (*Morus rubra*), willow (*Salix*), leatherwood (*Dirca palustris*), and rattlesnake master (*Eryngium yuccafolium*) (Jakes et al.

1994). Microscopic analysis of fibers comparable to those used in prehistoric textiles from the East has shown that certain plants (such as dogbane, milkweed, and the nettles) yield large volumes of fine, strong, and long fibers suitable for the production of fine yarns and fine fabrics labeled "Group 1" fibers). At the other extreme in terms of the degree of separation of fibers after processing are many of the bast fibers of woody plants (basswood, pawpaw, slippery elm), which produce fiber bundles rather than individual fibers. These raw materials are coarser and less "clean" than Group I fibers and are more appropriate for making items such as bags or mats that require less flexibility than fabrics. They also may be more amenable to preparation as "splits" of the inner bark used as is for the production of material of a coarser nature (cf. Densmore 1928).

The majority of prehistoric textile artifacts from the East come from caves and rockshelters with environments conducive to the preservation of organics. In addition to the "Bluff Shelters" of the Ozarks (Scholtz 1975), Kentucky caves and shelters have figured prominently in the documentation of textile technology. The Mammoth Cave system in the west central Kentucky karst region has yielded numerous examples of slippers, bags, and incomplete artifacts of unknown function (King 1974; Watson 1969). In the eastern part of the state, the sandstone cliffs along the Cumberland Plateau contain numerous overhangs whose aridity and sediment chemistry contribute to the preservation of many similar artifacts. Of the artifacts held in museums, few have been analyzed in any depth. It is likely that many more reside in private collections. Unfortunately, most of these textile artifacts come from disturbed or surface contexts, or were collected without recording of provenience, and few have been radiocarbon dated. These characteristics of the archaeological record have made it difficult to study the development and sociocultural significance of textile technology in prehistoric eastern North America.

THE COLLECTION FROM THE TWO SANDAL SHELTER

A collection of textile artifacts from the Two Sandal rockshelter in Carter County, Kentucky was selected to evaluate the potential of currently available analytic techniques for documenting the evolution of textile technology in the prehistoric East. The site, located in the Tygart's Creek drainage, is privately owned and has been disturbed over the years by unsystematic digging. Avocational archaeologist Matt Maley has been conducting salvage excavations at the site for several years and has recovered several perishable artifacts. In addition, he has been permitted to photograph artifacts in the landowner's private collection.

Three artifacts from the Two Sandal shelter were chosen for study. One was an Adena projectile point with a strand of plant material wrapped around its stem. It was recovered in a possibly disturbed layer in association with large quantities of hickory nutshells. The strand, which appears to be a grass blade or an inner bark "split," is wrapped several times around the point. This fiber wrapping would have been useful for suspending the point but not for affixing it tightly as would be appropriate for hafting a spear and contains no hole or gap indicating the past presence of a haft. A second artifact was a small (5.5 by 3 cm) fragment of a textile recovered at a depth of 55 cm below surface between two large rocks. It is made of a minimally processed, coarse fiber in a plain weave. The third artifact, a near-intact slipper, was recovered by the landowner prior to 1971 from subsurface deposits. Because of its integrity, this slipper became the focus of our analysis and serves as a reference point for our discussion of the research potential of textile artifacts from the prehistoric East.

THE SLIPPER AND ITS CONTEXT

The Two Sandal shelter is a large (50 by 15 m) overhang located in Carter County, Kentucky, in the Tygarts Creek drainage. The dry sediments within the shelter have preserved a wide variety of cultural material, both organic and inorganic. The depth of deposits (in excess of 1 m in some areas) suggest long-term prehistoric use. Most of the artifacts recovered by the landowner were unavailable for study, but the site appears to have produced numerous Adena points. Other materials recovered from the shelter include pottery (limestone and sandstone tempered), lithic artifacts, bone tools, and abundant organics (including bone and shell, a variety of plant material, hair, feathers, eggshell, and feces.

The sandal came from an undetermined location within the shelter. This situation is unfortunately all too common and has resulted in the near-absence of provenience information on textile artifacts from eastern Kentucky. Consequently, there is limited basis for a chronological framework for the development of textile technology in the region. In order to begin building such a data base, a small sample of material from the sandal was submitted for radiocarbon dating. Its radiocarbon age places its manufacture within the Early Woodland period (2580±60 B.P.: 630 B.C.) (Beta-92918). The calibrated age is 825(790)525 B.C. (Vogel et al. 1993; Stuiver et al. 1993; Talma and Vogel 1993; calibration provided by Beta Analytic, Inc.).

Because many of the intensively occupied prehistoric shelters in eastern Kentucky have substantial Early Woodland components, this date comes as no surprise. However, without reliable stratigraphic or chronometric data, it has been impossible to confirm assumed chronological placement for such artifacts, especially on multicomponent sites. So far, there is only one other direct radiocarbon date on a textile artifact from eastern Kentucky. A small twined fragment from the Cold Oak shelter returned an accelerator date of 2760±60 B.P.: 810 B.C. (cal 2-sigma range 1024[902]805 B.C.) (Gremillion 1995a). Together, the results from Two Sandal and Cold Oak demonstrate that textile industries were well-developed in eastern Kentucky by the first half of the first millennium B.C. Earlier finds of complete textile artifacts are still relatively rare in eastern North America (Andrews and Adovasio 1996).

ANALYSES

Analysis of the slipper from the Two Sandal shelter was undertaken to extract basic information on the techniques used in its manufacture, including the selection and processing of raw materials and the construction of the finished artifact. Decisions made at each step have implications for the functional qualities of the product and would have been guided by tradition as well as trial-and-error learning. Textile technology, like any other, is the product of selection mediated by human decision-making and thus tends to conserve and accumulate features that improve functioning within a particular environment.

Fibers

The first stage of manufacture involves the collection and preparation of plant fibers. Bast fibers (part of the phloem, a sclerenchymatous conductive tissue found in plant stems) are generally used. However, bast fibers vary greatly between taxa in characteristics that affect efficiency of the manufacturing process and the functional attributes of the finished artifact. Such characteristics include fiber length, strength, quantity, and ease of processing (Jakes et al. 1994). Thus, identification of fibers to the level of family, genus, or species provides information critical to the understanding of the evolution of textile technology. Examination of bast fibers at the molecular and cellular levels also has the potential to reveal processing methods.

Analysis of fibers from the slipper was conducted by Jakes at the Materials Analysis Laboratory of the Department of Consumer and Textile Sciences, The Ohio State University. Small subsamples of material were removed from the slipper and mounted on glass microscope slides with Permount mounting media for observation using a Zeiss Axioplan Research Microscope. Micrographs were taken with Ektachrome Type 64 tungsten film. Additional subsamples were mounted on a carbon planchette using carbon paste for examination employing a Jeol JSM scanning electron microscope. Both longitudinal and cross-sectional views were observed and micrographs were taken with Polaroid Type 55 film. Because the sample had never previously been studied in the Materials Analysis Laboratory, no further sample preparation (such as cleaning) was attempted. Instead, it was assumed that surface contamination may provide useful data for understanding the fiber's identity or its history.

Optical microscopic examination revealed multiple features in samples of the slipper material. Linear phloem fiber cells can be seen in association with rounded parenchyma cells, spiral thickening elements, tannin filled cells, and crystal inclusions in irregular shapes. A crystal in a druse shape was also observed. The fiber cells are thin and show no surface marks. Some of the fibers are twisted along their lengths while others are straight. The scanning electron micrographs show numerous surface deposits with occlude fiber surfaces (Figure 1). In one micrograph the impression left by parenchyma cells can be seen.

The fibers are not typical of Group I fibers, which have distinctive surface markings. Thus, they are not typical of those used in the fine fabrics from Hopewellian and Mississippian sites (Jakes et al. 1994; Jakes 1996). In fact, the fibers alone do not provide enough information to support identification. The presence of a variety of plant structures shows that the material was not well-processed. Rather, it appears that a section of plant stem was employed in its entirety as a yarn-like form. The level of processing may well be appropriate for the performance of the finished slipper, which was a utilitarian artifact designed for protection rather than primarily for decoration or display. The performance characteristics of coarse vs. fine fibers in footgear subjected to near-continuous wear on sandstone and uneven surfaces have not been empirically determined. Coarse fibers are harder, stiffer, and more resistant to abrasion and wear than are fine fibers, but they are also less flexible. Assuming that production of fine fibers yielded no functional benefit and if complex aesthetic design was not an important goal, further processing would have been inefficient.

The characteristics of the structures associated with the fiber cells may provide additional clues to identification, but at present nothing in the literature has been found that can confirm an identity. In addition, the initial scope of the Comparative Plant Fiber Collection was one in which only fine fibers were studied. The current plan to expand the collection to include more coarse fibers and plant sections with associated tissues may provide the opportunity to identify the materials in the sandal in the future.

Manufacture and Wear

The slipper was examined by Wimberley at the OSU Materials Analysis Laboratory at OSU. Unlike a sandal, the artifact has side and toe coverings; in contrast, a sandal is a sole portion with attachment straps added at the toe, ball of foot, and/or ankle to hold it to the foot (Figure 2). The slipper is quite worn, with part of the toe area completely worn away and a hole worn through in the sole portion at the heel. From the wear patterns it appears to have been worn on the right foot.

The slipper measures 22.3 cm from toe to heel and has a width of 7 cm. The sides are 2 cm high (4 cm at the back of the heel). The elements used in the side portion are finer than those used in the sole (4 mm as compared to 5.9 mm). There is some spreading outward of elements due to the compression of the fabric from the weight of the individual.

The passive elements for the twining construction are single and were bent in half to form the heel area and curved toward the toe section. In their present form, these yarns are not covered by active element yarns. It is possible that they were never covered, an option that would have made for less friction with the back of the heel. Alternatively, it is possible that the actively twined elements have worn away from the abrasive effect of the heel sliding up and down during walking. The twining interlacing pattern is sometimes called chevron or, more precisely, two-strand, weft, countered, compact twining (Figure 3). In this type of construction, two active elements S-twine around the passive elements from one edge across the sole to the other edge. As these active elements reach the two passive yarns of the edge, these two strands combine and interlace as a unit in a 2/1 basket interlacing pattern over and under the two outermost passive elements.

All yarns forming the main body of the slipper are singles with a twist angle range of 60-70 degrees. Active elements have a diameter of 4.5 mm. No ties were present at the heel or mid-section for attaching the slipper to the foot and no holes could be located where they might have originated. At the toe section the fabric was bunched to form a cup. Inside the bunched area a two-ply yarn with Z-twist and a diameter of 3 mm was found. It appears to have been inserted between the first and second passive elements and used as a drawstring to tighten the slipper at the toe area.

COMPARISONS TO OTHER CAVE AND ROCKSHELTER MATERIAL

In its method of manufacture and use of coarse fibers, the slipper is quite similar to others of comparable age recovered from the Mammoth Cave system (King 1974). They share the properties of chevron twining with elements of 3-4 mm in diameter and plied ties. Not surprisingly, the slipper from Two Sandal Shelter also closely resembles finds from other rockshelters on the Cumberland Plateau of eastern Kentucky. For example, the slippers curated at the William S. Webb Museum of Anthropology at the University of Kentucky from Red Eye Hollow, Newt Kash, and Hooton Hollow in Menifee County also were constructed using chevron twining. A remarkably intact example of a similar artifact, illustrated in Holmes (1891:35; Figure 9), is reported simply as a "cave relic" from Kentucky. The restriction of such perishable items to dry caves and shelters limits our ability to define the geographical extent of this textile tradition. However, it appears that slippers made from coarse

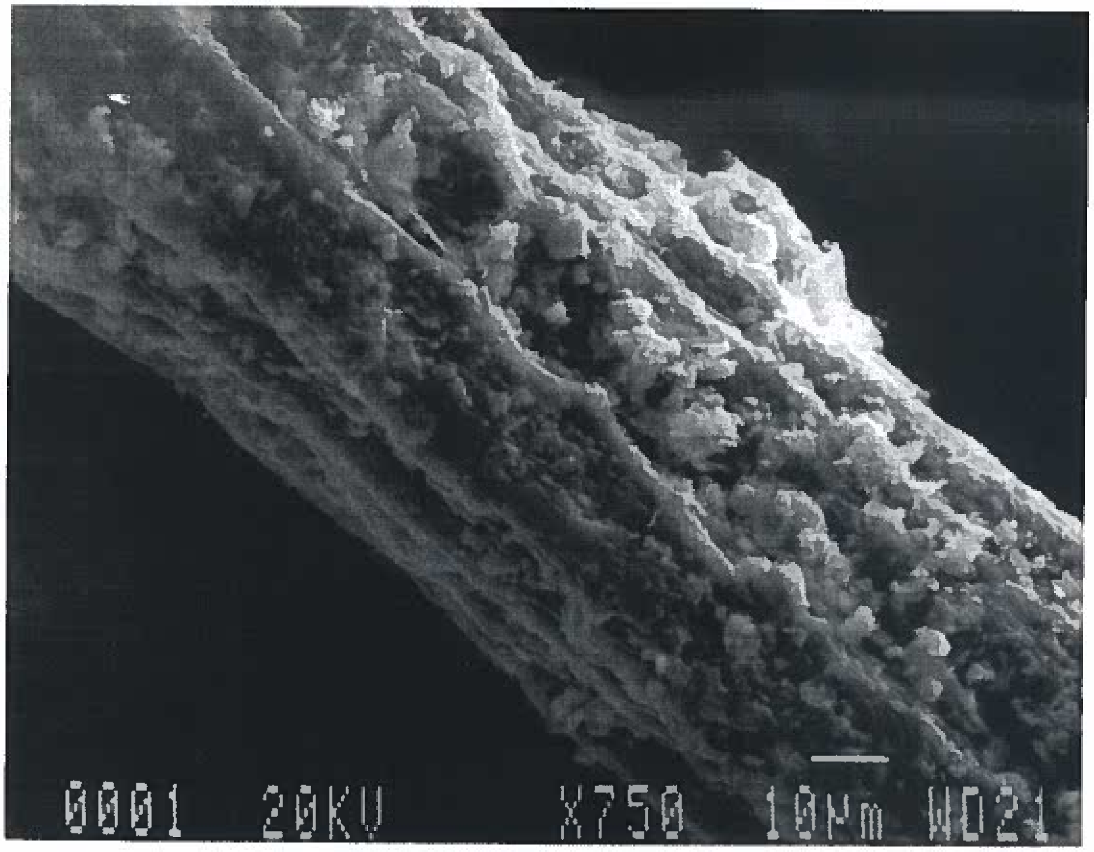

Figure 1. Scanning Electron Micrograph of a Fiber from the Slipper, Showing Adhering Materials. Scale bar = 10 microns.

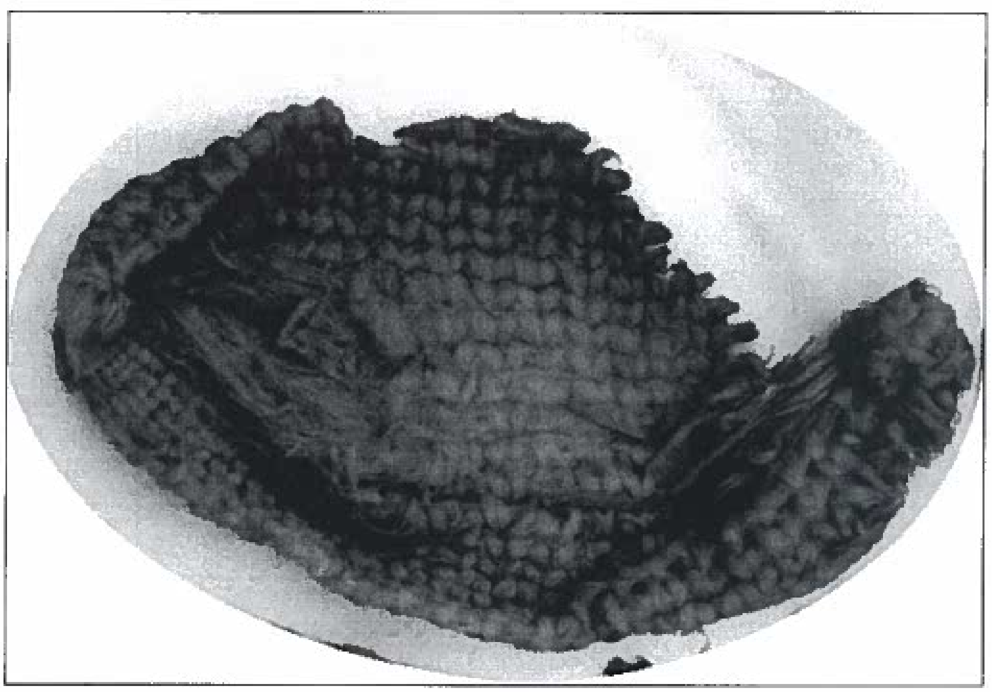

Figure 2. Slipper, Top View. Length, heel to toe: 22.3 cm; width: 7 cm.

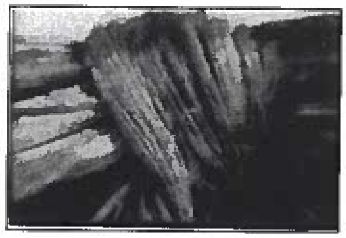

Figure 3. Closeup of Slipper Edge Showing Interlacing Pattern. Width of image represents 3.5 cm.

fiber using a chevron twining technique were in common use in parts of the middle Ohio River Valley after 1000 B.C.

DISCUSSION AND IMPLICATIONS

Analysis of the slipper from Two Sandal Shelter illustrates some of the directions that might profitably be taken as part of a serious effort to document the development of prehistoric textile technology in Kentucky. Since the majority of intact, well-preserved textile artifacts reside in museums or private collections, an appropriate first step would be to inventory existing materials and identify those that are priorities for further study. These artifacts can then form an initial data set for documenting technological and sociocultural aspects of textile manufacture in prehistoric Kentucky. The following areas of investigation would be particularly important to such an endeavor:

1. **Chronological placement of artifacts.** Since textile artifacts are rarely found *in situ* by professional archaeologists, in most cases this means obtaining direct dates on carbon from curated materials. Although costly, accelerator radiocarbon dates from carefully selected artifacts will be needed to construct a chronological framework.

2. **Analysis of the manufacturing process.** An evolutionary approach demands that textile artifacts be viewed as functional objects whose manufacture relied on a suite of complex and interrelated techniques. Textile technology evolves as techniques and methods accumulate differentially in the pool of cultural information. Human decision-making and natural selection are likely to favor variants that are relatively efficient. Efficiency (conceived broadly as benefits obtained minus costs incurred) can be assessed for the collection and processing of raw materials as well as the creation and performance attributes of the finished product (Ericksen et al. 1997). Functional comparisons of commonly used fibers and an assessment of the costs involved in collecting and processing them should be carried out. The ecology of fiber raw materials collection must be studied: what kinds of plants are likely to have been available in different environmental settings? How might the properties of fibers vary with season, climatic conditions, and habitat? How do different processing and manufacturing methods compare in terms of energy expenditure, complexity and difficulty, quantity, and performance of the product?

3. **Textile production as "women's work."** If in fact as ethnohistoric and ethnographic accounts for the East suggest, the making of slippers, bags, nets and the like was typically carried out by women, how might analysis of archaeological textiles enlighten us about gender roles? For example, many of the rockshelters in eastern Kentucky have produced materials reflecting various stages of the textile manufacturing process, from initial stripping and twining of fibers to finished (and most likely used and discarded) products (Gremillion 1995b, 1997). This is one of the relatively few instances in which such sites provide archaeological evidence of likely gender-specific activities. In fact, much of the artifactual assemblage from a typical rockshelter is likely to reflect the activities of women, such as pottery making, textile production, and plant food collection and processing. Combined with judicious use of ethnographic analogy, textile studies may provide an opportunity to pursue the elusive task of "engendering" the archaeological record using a scientific approach.

Archaeological textiles of eastern North America have been greatly underutilized, though they have much research potential. This potential is illustrated by analysis of a single artifact, the slipper from Two Sandal Shelter. From this one item it was possible to learn that craftspeople constructed simple, durable footgear during the Early Woodland period between 500 and 800 B.C. The fabrication method of countered twining, which produces a chevron or herringbone surface design, suggests attention to aesthetic considerations, since it requires more effort than a pattern of all S or Z twining. The use of the finer and plied yarn as a drawstring indicates a recognition that plied yarns are stronger than a similarly-sized or larger single yarn. This is due to the fact that the second level of twisting imparts more strength than a single twisting in which more fibers are present and finer plied yarns have more flexibility than thicker yarns. The joining of the two twining elements to a combined "single" over the upper edge suggests an understanding that the use of one element alone in a position vulnerable to abrasion could cause premature failure of the slipper. With two yarns combined, the resistance to wearing away is greater. Protection against mechanical stress may also account for the choice of coarse fibers to make the sandal. Although the specific plants used remain unidentified, it is hoped that enhancement of the Comparative Fiber Collection at OSU to include inner bark fibers will result in an identification. Microscopic analysis shows that potentially diagnostic morphological features are present, as are examples of crystals that may have diagnostic value.

This study shows that numerous techniques are available to take advantage of the rich collection of prehistoric textiles available from Kentucky. We hope that they will stimulate the interest of archaeologists in these rare but important artifacts.

ACKNOWLEDGEMENTS

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ARCHAEOLOGICAL INVESTIGATIONS AT THE GAYS CREEK SHELTER (15PE186), PERRY COUNTY, KENTUCKY

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ABSTRACT

Archaeological investigations conducted at the Gays Creek Shelter (15Pe186) by Cultural Resource Analysts, Inc. documented cultural remains associated with a Late Woodland/Late Prehistoric occupation. Given the artifact classes recovered, the density of remains, lack of cultural features, and the lack of midden development, it is inferred that the site served as a short-term, limited activity location. The site was likely visited on several occasions during the Late Woodland/Late Prehistoric period. The paper provides a summary of the Phase II investigations of the site.

INTRODUCTION

From October 6 to 9, 1998 archaeologists from Cultural Resource Analyst, Inc. conducted Phase II excavations at the Gays Creek Rockshelter (15Pe186), Perry County, Kentucky. These investigations documented cultural remains associated with a Late Woodland/Late Prehistoric occupation. Prehistoric use of the site appears to have been on a short-term basis. The site was likely visited on several occasions during the Late Woodland/Late Prehistoric period. This paper presents a summary of the excavations and analysis of the materials recovered. As the majority of the recovered materials were lithic artifacts, the focus of the paper is on this artifact class.

BACKGROUND

Gays Creek Shelter was first identified during a Phase I pedestrian survey of a proposed coal mine operation (Kerr 1998). The shelter was situated at the base of a sandstone bluff that overlooked a steep sideslope. An unnamed tributary of Gays Creek was situated at the base of the bluff line. Dimensions of the overhang were approximately 29 m (north-south) by 9.5 m (east-west) with an interior opening ranging from 0.3 to 13 m high (Figure 1). The southern portion of the shelter sloped towards the north, while the northern portion was relatively flat. The dripline of the shelter coincided with the steep sideslope resulting in the lack of a talus slope.

A low ceiling was present towards the back wall of the shelter in both the southern and northern portions of the site. This low ceiling extended out approximately 1 m from the back wall in the southern portion and was situated approximately 30 cm above ground surface. This portion of the site opened up to a maximum ceiling height of approximately 13 m. In the northern portion, the low ceiling extended almost to the dripline. At the back wall of the shelter, this ceiling was approximately 82 cm above ground surface and sloped up to 2.5 m. The northern section was approximately 6.4 m high at the drip line. Roof fall was scattered throughout the shelter, 1533 kg of which was weighed and discarded from units excavated during the Phase II investigations. None of this material showed evidence of thermal alteration.

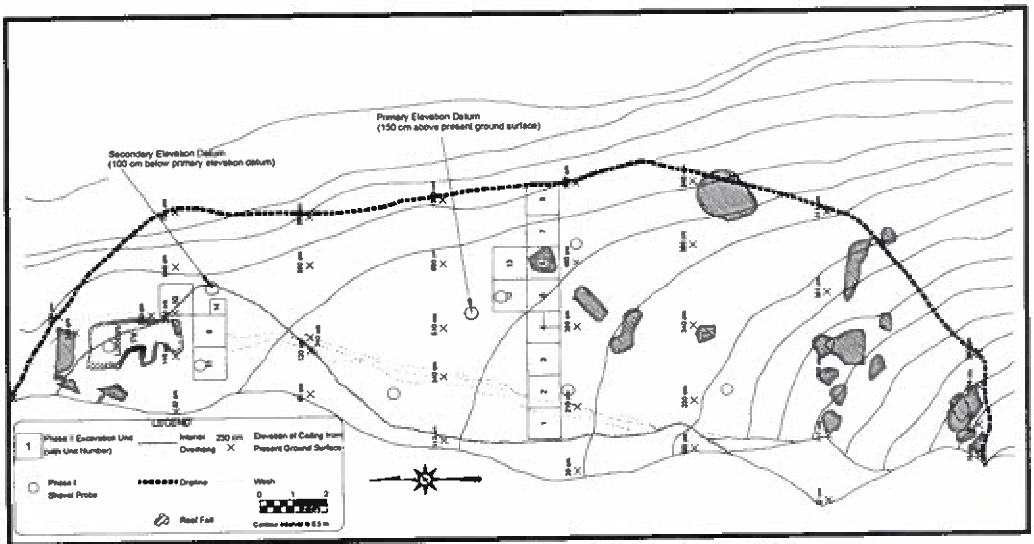

Figure 1. Schematic Planview of Gays Creek Shelter.

ARCHAEOLOGICAL INVESTIGATIONS

During the Phase I study, five screened shovel tests were excavated. Of these, four contained a low density of prehistoric artifacts. The shovel probes revealed a 20 to 33 cm thick soil horizon. A looter's pit (approximately 4 x 2 x .25 m in size) was observed in the northern portion of the shelter. Flake debris was recovered from the backdirt pile of this pit. No evidence of disturbance was noted in the southern portion of the shelter. A total of 18 pieces of flake debris was recovered from the Phase I investigations. These investigations indicated that soils were deeper in the northern part of the shelter. At the time of the Phase I investigations, the southern portion of the shelter was wet whereas the northern portion was dry. The Phase I report concluded that further testing was necessary to determine the nature of the site and if it was eligible for listing in the National Register of Historic Places (Kerr 1998:35).

At the time of the Phase II excavations, both the northern and southern portions of the shelter were dry. Test excavations at the Gays Creek Shelter consisted of the hand excavation of 14 units; 13 1 x 1 m units and one 50 x 50 cm unit (Figure 1). All removed fill was screened through 6.35 mm (1/4 inch) mesh hardware cloth. A trench comprised of eight adjacent 1 x 1 m units (units 1-8) was excavated in the southern portion of the shelter. Due to the low overhang, the trench was started approximately 1 m from the back wall and extended to the drip line. As a steep slope existed just beyond the drip line, no units were excavated outside the drip line. Four additional units, three 1 x 1 m units (units 9-11) and one 50 x 50 cm unit (Unit 14), were excavated in the northern portion of the shelter.

A soil anomaly was identified in units 5 and 6. It extended to the north; therefore, two additional units (12 and 13) were excavated to fully expose this anomaly. Upon further investigation, this anomaly was identified as a tree root. Another soil anomaly was identified in the south wall of Unit 6. It was determined to be a rodent run. No cultural features were observed.

All units were excavated in 5 cm levels until a culturally sterile, compact, rocky subsoil was encountered (levels 5 or 6). In most cases, at least two culturally sterile levels were excavated prior to encountering this rocky subsoil. One quadrant (SE) of Unit 4 was excavated an additional 20 cm into the rocky subsoil to determine whether more deeply buried cultural levels could be identified. No such horizons were encountered. The soil became more compact and the density of rock increased with depth.

Sediments in the eastern units were comprised primarily of silts and clay, whereas a higher density of sand was observed in the western units. Sandstone roof fall was also encountered throughout all horizons and increased with depth. A higher density of roof fall was noted close to the back wall of the shelter. The sediments became more compact with depth.

The northern portion of the shelter was investigated through the excavation of three 1 x 1 m units (9-11) and a 50 x 50 cm unit (14). These units were placed to the south of the looter's pit. The 1 x 1 m units basically formed a trench that extended from the back wall to just beyond the inner ceiling. The edge of the steep sideslope was situated just beyond the edge of the inner ceiling.

Due to the field observations of possible artifact movement, flotation samples were retained from levels 4 and 5 of Unit 11 to collect a sample of small-sized lithic material. These levels corresponded to the higher artifact densities observed in units 9 and 10. Due to the low artifact count for Unit 11, Unit 14 was excavated. This unit was excavated as a 50 x 50 cm unit due to the presence of a tree. Flotation samples were retained from levels 4 and 5 of this unit to obtain a sample of small-sized lithic debris.

RESULTS

Cultural material recovered from the Phase II excavations consisted of flake debris, two modified implements, and 17 fragments of faunal remains. The modified implements consisted of a Small Triangular cluster hafted biface fragment from Level 4 of Unit 3 and a unifacial implement recovered from Level 7 of Unit 10. The point was too fragmentary to confidently assign to one of the defined types within the cluster (i.e., Hamilton, Madison, Fort Ancient, etc.) or to one of the types defined for the Fort Ancient period in northeastern Kentucky (Henderson and Turnbow 1987; Railey 1992). Based on the recovery of this Small Triangular cluster hafted biface, a Late Woodland/Late Prehistoric association is suggested.

None of the recovered faunal remains could be conclusively associated with the prehistoric occupation of the shelter. Flecks of wood charcoal were also observed scattered throughout the shelter. A higher density of charcoal was observed in the northern portion of the shelter.

FORMATION PROCESSES

Prior to conducting the actual analysis of the recovered materials, it was necessary to consider their context. A number of authors (e.g., Butzer 1982; DeBoer 1983; Schiffer 1972, 1975, 1976, 1983, 1987; Waters 1996) have noted that post-depositional processes that may have had an effect on the recovered materials must be taken into consideration prior to making inferences concerning the behaviors that led to an assemblage's formation. In the case of the Gays Creek Shelter, observations during the Phase II excavations suggested that some post-depositional movement of artifacts may have occurred. These observations consisted of: 1) the slope (south-north) within the shelter; 2) the presence of small drainage gullies within the southern portion of the shelter; 3) observations during the Phase I investigations that indicated the southern portion of the shelter was wet; 4) the higher density of surface roof fall, relative to the remainder of the shelter, in the area around and to the south of Unit 1; 5) the low density of materials in the central units (i.e., units 2-4) in the southern portion of the shelter; 6) the relatively flat area associated with the smaller northern portion of the shelter; and 7) the higher density of materials in the northern portion of the shelter. The hypothesis that artifact movement occurred can be examined using several lines of evidence. In addition, inferences concerning the number of occupations represented can also be examined.

Rough rock recovered from all of the units was weighed and discarded in the field. A plot of rock weight by unit (includes only levels 1-4 as four levels were excavated in all units) shows that there is a relationship between the easting coordinate and the amount of rock recovered when the trench data for the southern portion of the shelter is examined (Figure 2). A similar pattern is also seen when the flake debris is plotted in a similar manner (Figure 3). In addition, there is a high ratio of large-sized debris (>1.27 cm) to small-sized debris (<1.27 cm). One would expect such a ratio if materials had been moved. Smaller artifacts would be more likely to be displaced by water than larger artifacts. Therefore, in cases where there is a high ratio of large to small artifacts, artifact movement must be considered. This is most pronounced in units 2 and 3. The above data suggest that there has been some post-depositional movement of artifacts and is consistent with the hypothesis of materials being displaced by water. These disturbances have most likely transported materials from the sloped southern portion and deposited them in the relatively flat northern portion of the shelter.

Given that there appears to have been some post-depositional disturbance to the shelter, it is important to assess whether the recovered materials represent a single or a multi-component occupation. This question can be assessed by examining the vertical distribution of flake debris (e.g., Nelson 1987). Peaks in artifact count by level should indicate where the main occupations took place. If the recovered material represents a single component, then there should be only one strong peak in artifact count surrounded by lesser amounts of material. Conversely, if multiple peaks are observed, or several levels exhibit high artifact densities, then multiple occupations can be inferred.

Materials were separated by position within the shelter (i.e., northern versus southern portion), and plots of flake debris by level were made (figures 4 and 5). The southern portion shows a peak in Level 2, while the northern portion exhibits a peak in Level 4. Both peaks are surrounded by much lower densities of material. Given that there is good evidence for the movement of materials from the southern to northern portions of the shelter, it is highly probable that materials recovered from both portions are associated. The greater depth of the northern material is likely a reflection of the increased deposition of sediments.

The above data are consistent with expectations of a single component (i.e., only one temporal period is represented). While a single component is suggested, it is recognized that this component may represent several prehistoric visits to the site within a relatively short period of time. For

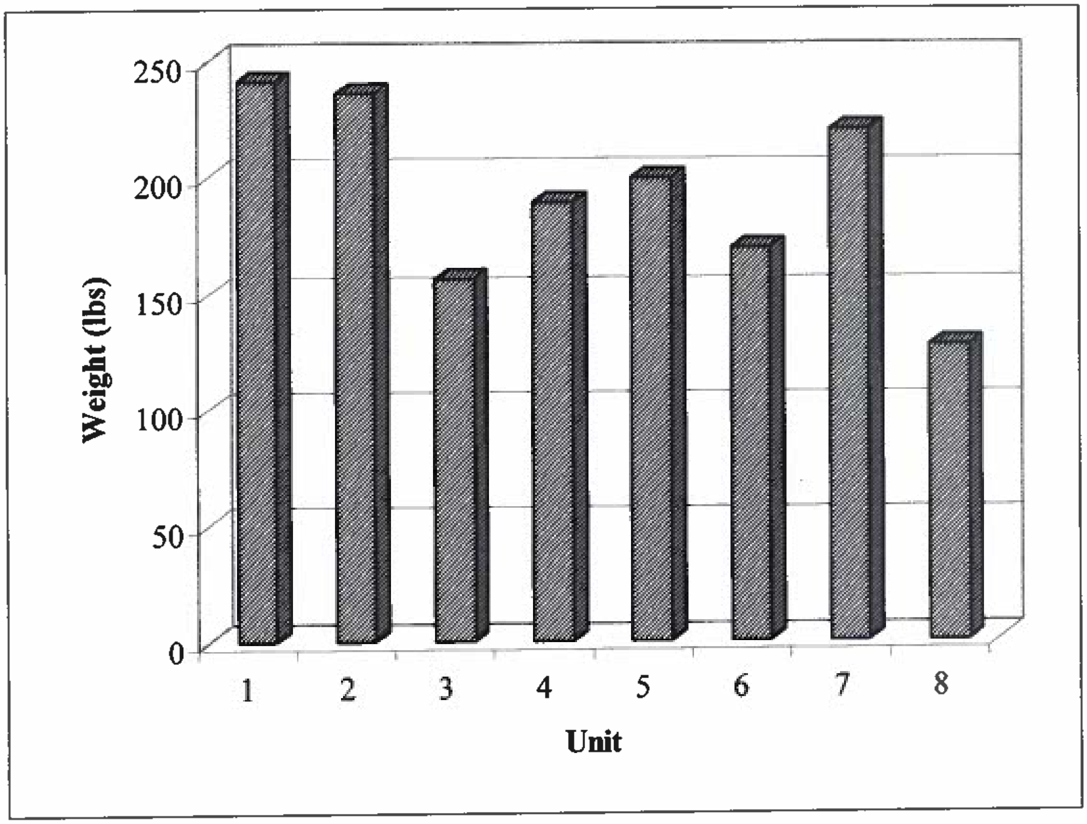

Figure 2. Weight of Rough Rock by Unit. Includes only levels 1-4. Unit 1 is the eastern most unit, Unit 8 is the western most unit.

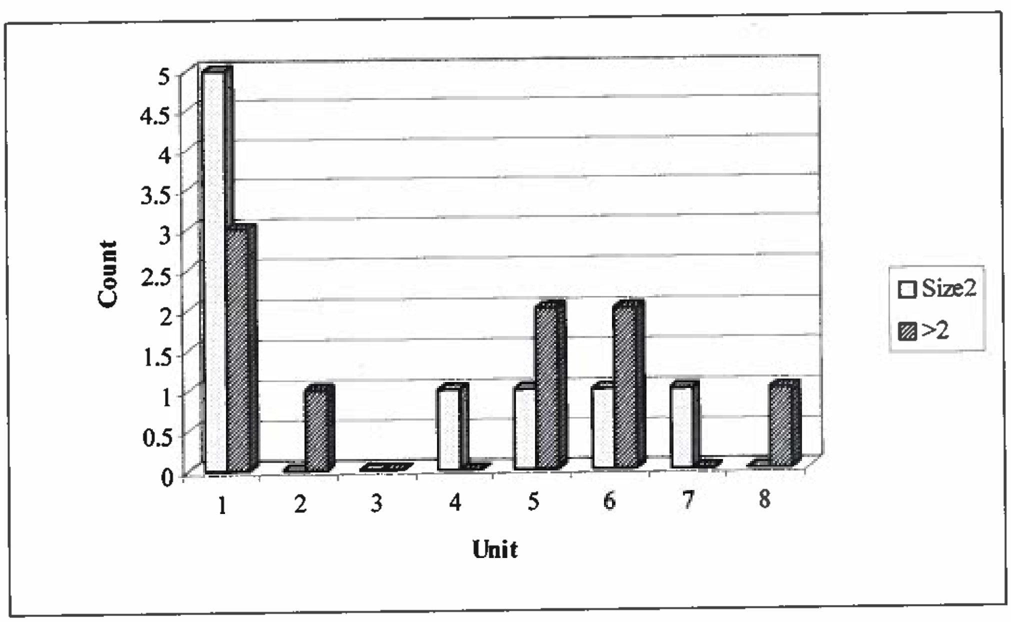

Figure 3. Flake Debris by Unit for East-West Trench in Southern Portion of Shelter. Size 2 is all flakes in the 0.635 cm screen, greater than Size 2 are flakes in the 1.27 cm and larger screens.

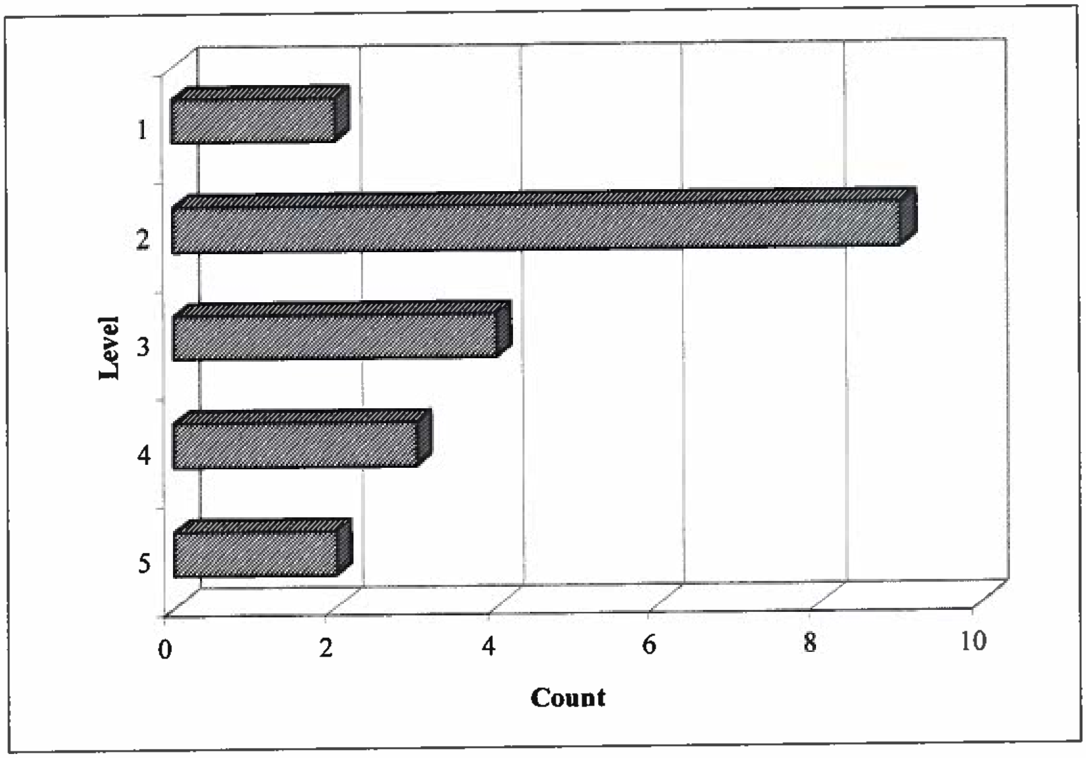

Figure 4. Flake Debris by Level, Southern Portion of Shelter.

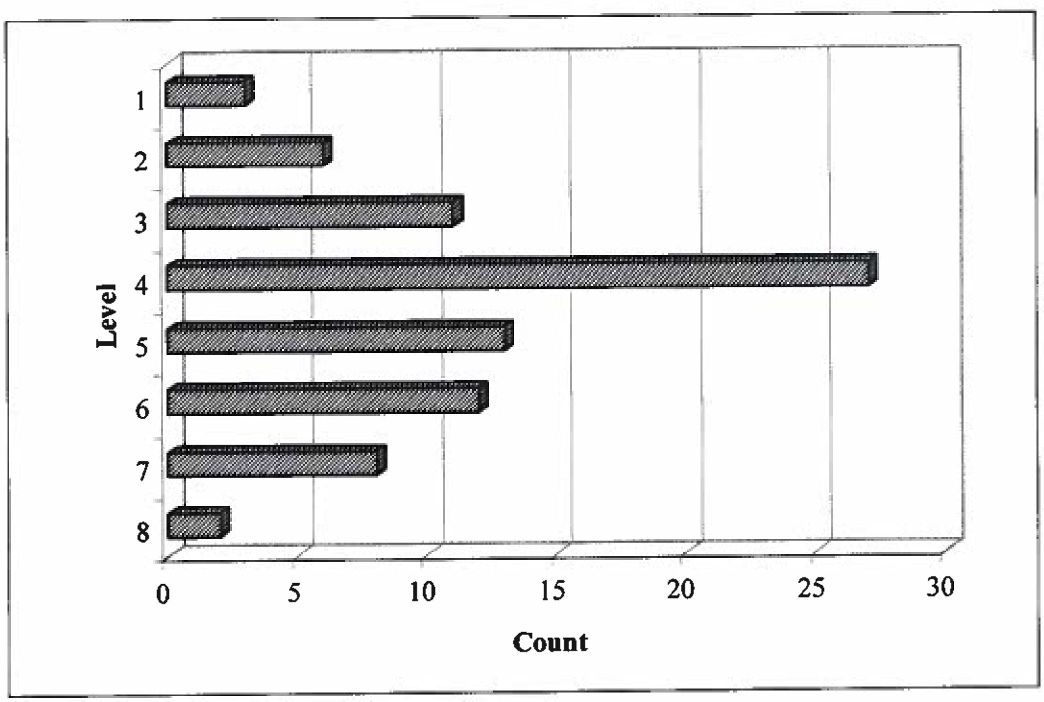

Figure 5. Flake Debris by Level, Northern Portion of Shelter.

analytical purposes, the recovered materials will be treated the residue of a single occupation. One potential form of bias in the data that needs to be considered is the loss of small-sized flake debris due to artifact movement. This will most likely cause an under-representation in the later stages of tool production as this form of reduction produces greater amounts of small sized debris than core reduction (e.g., Ahler 1989a, 1989b; Shott 1994). The movement of materials from the south to the north has disturbed the original spatial arrangement of artifacts to some degree. Because of this, the assemblage is considered as a whole and only general inferences are made concerning the prehistoric use of the shelter.

LITHIC ANALYSIS

A total of 101 (205.2 g) flake debris greater than 0.635 cm, 12 (1.3 g) flake debris less than 0.635 cm, two (0.5 g) thermal shatter, and two (4.6 g) modified implements was recovered from the Gays Creek Shelter during the Phase II excavations. As the only demonstrable cultural materials recovered from the shelter were lithic artifacts, the remainder of the paper will present the analysis of this material. Only the material recovered from the phase II excavations are considered here. Due to the low numbers of modified implements (n=2), most of the inferences concerning the use of the Gays Creek Shelter were derived from the flake debris analysis. This analysis was conducted in several stages. First, general comments based on the flake debris are presented. Next, a continuum based approach (e.g., Bradbury and Carr 1999; Ingbar et. al. 1989; Shott 1996) is applied to the flake debris analysis. Several authors have argued that several methods should be used in conjunction to provide multiple lines of evidence in lithic analysis (e.g., Bradbury 1998; Bradbury and Carr 1995; Carr 1994; Morrow 1997; Shott 1994). This approach is followed here. Inferences derived from the continuum based analysis are further examined by using both individual flake (e.g., Magne 1985) and mass analysis (e.g., Ahler 1989a, 1989b) methods.

As so few modified implements (n=2) were recovered from the Gays Creek Shelter, it was hypothesized that unmodified flakes may have been used as expedient tools. To test this hypothesis, low magnification microwear analysis was conducted on all flake debris greater than 1.27 cm in size. The reasoning behind only examining the larger size flake debris is that it is more likely to have been used than smaller sized debris. Yerkes (1987:117) has also shown that small sized flakes rarely exhibit evidence of use-wear.

The specific methods used follow that of other practitioners of the low magnification approach (e.g., Odell 1977, 1979, 1996; Odell and Odell-Vereecken 1980; Tringham et al. 1974). For the current analysis, a Wolfe stereoscopic microscope with a reflective light source was employed. The microscope was fitted with 20x eyepieces and 4.5x paired objectives. The magnification was continuously variable and ranged from14 to 90x. Implements were scanned for evidence of wear at 20x. If no wear was observed, the magnification was increased to 40x and the artifact was scanned a second time. As the main interest in the analysis lay in determining if the flake had been used or not, use-wear was recorded as a presence/absence variable. The use of magnification for the analysis was considered necessary as it has been shown that distinguishing used from unused specimens is highly prone to error without such equipment (e.g., Young and Bamforth 1990). Post-depositional damage (i.e., trampling damage, excavation damage, etc.) was not included as use-wear. Of the 26 flakes examined for use-wear, only four (15.5%) evidenced micro-scarring indicative of use-related damage. All were derived from local Breathitt chert. The recovery of these tools indicates the presence of an expedient industry at the shelter.

Modified Implements

The modified implements consisted of a Small Triangular Cluster hafted biface and a unifacial tool (Figure 6). Both were manufactured from Newman chert. The recovered uniface was manufactured on an early stage flake. All edges of the flake, except the platform, had been retouched. Similar implements have been referred to as thumbnail scrapers, which are common on Late Prehistoric sites (e.g., Railey 1992). The specimen was examined under the microscope for evidence of micro-scarring indicative of use. The distal end exhibited wear (rounding of the edge) indicative of its use in scraping soft resistance materials (e.g., hides).

The hafted biface fits within the Small Triangular cluster (e.g., Faulkner and McCollough 1973; Justice 1987). As previously noted, this cluster encompasses a number of morphologically similar, triangular arrow points associated with the Late Woodland and Early Mississippian periods, including such types as Madison, Hamilton, Fort Ancient, and Levanna. Due to the fragmentary nature of this specimen, no attempt was made to assign this implement to one of the triangular types defined for the Fort Ancient period (e.g., Henderson and Turnbow 1987; Railey 1992).

Flake Debris Analysis

Only two chert types, Breathitt and Newman, were identified in the flake debris recovered from the Gays Creek Shelter. Breathitt chert can be considered a local raw material, while Newman chert is a nonlocal source. Of the 97 flakes that could be identified as to raw material type, 72.2% (n=70) were Breathitt chert and 27.8% (n=27) were Newman chert. An additional four flakes were indeterminate as to raw material type. Though typologies (i.e., use of primary, secondary, tertiary types) are still commonly used in flake debris analysis, this method was not employed here as it has been demonstrated to be highly inaccurate (e.g., Bradbury and Carr 1995; Patterson 1981).

The examination of lithic reduction as a continuous process has been suggested as an alternative to stage based approaches (Bradbury and Carr 1999; Ingbar et al. 1989; Shott 1996). This approach views chipped stone tool production as a continuous process in which the relationship between flake attributes and the process of reduction is predictable (Bradbury and Carr 1999; Ingbar et al. 1989; Shott 1996). The method developed by Bradbury and Carr (1999) is used here. This form of analysis is conducted in two stages. First, individual flakes produced during core reduction are separated from those produced during tool production through the use of discriminant functions developed from an experimental data set. This analysis uses only flakes exhibiting a complete platform as metric measurements are used in the discriminant function equations. While flake completeness may be influenced to some degree by raw material type (Amick and Mauldin 1997), a flake can only have one platform; thus, the exclusion of distal and medial fragments should not bias the analysis to any great extent. The original discriminant analysis only used metric variables (Bradbury and Carr 1999). These consisted of mid thickness, bulb thickness, platform length, and platform width.

In the second stage of the analysis, all flakes classified as tool production debris by the discriminant function equations are further analyzed using a regression formula. Variables examined in the regression analysis consist of: platform facet count, log maximum width, and log scargrams (defined as dorsal scar count divided by weight). The regression equation predicts what percentage of the tool had been completed when the flake was removed. This is accomplished through the use of a standardized scale where 0.0 indicates that no reduction has taken place and 1.0 represents a completed tool. Resharpening and reworking of a tool will yield values greater than 1.0. These values can be multiplied by 100 if one wishes to convert these scores to standard percentage values. Core reduction flakes misclassified as tool production flakes by the discriminant functions will likely be placed in the early portion of the continuum. The regression equation developed by Shott (1996) in his examination of a continuum model was also used as a check. All calculations were computed using a database program written by the author.

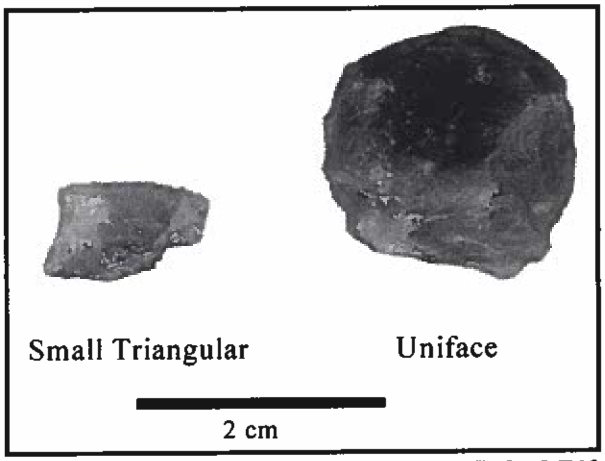

Figure 6. Small Triangular Cluster Hafted Biface and Uniface Recovered from Gays Creek Rockshelter.

A total of 47 (133.0 g) flake debris exhibited a platform and were used in the continuum based analysis. In the first stage, individual flakes exhibiting a platform were separated into core reduction and tool production debris using the discriminant functions developed from a number of experimental replications (Bradbury and Carr 1999). Only five of the flakes (two Newman and three Breathitt) were classified as the result of core reduction. The remaining 42 flakes were classified as tool production debris.

Next, the continuum regression equation was applied to all flakes classified as tool production debris by the discriminant functions. As can be seen in Figure 7, a longer portion of the continuum is represented by Breathitt chert. In addition, there appear to be breaks in the continuum line for both chert types. Newman chert shows a couple of flakes around 0.4, 0.6, and 0.8. This could be an indication of several different tools being reworked at the site. Breathitt chert shows a break between 0.5 and 0.6. This suggests that two separate tools were reworked. In addition, a couple of flakes were classified as greater than 1.0. This is evidence of resharpening of completed tools. A similar pattern was also seen when the regression formula derived by Shott (1996) was applied to all flake debris (core and tool production).

Next, an individual flake analysis method was used to classify each flake to a reduction stage. This classification is based on the method developed by Magne (1985) and provides a check of the continuum method. In this analysis, early stage reduction is viewed as all core reduction, middle stage reduction is viewed as the first part of the manufacture of tools, and late stage reduction is viewed as the completion and maintenance of tools.

When separated by reduction stage, 45.3% (n=43) of the flakes were classified as early stage. Equal amounts (27.4%, n=26) of middle and late stage reduction were represented. The high average weight of flakes in the 0.635 size grade (0.47 g) and the relatively low percentage of flakes represented in the 0.635 size grade (76%, compared to the 85% or greater typically produced by tool production) also supports this inference. It should be noted that these figures may be biased to some degree by the loss of smaller sized flake debris.

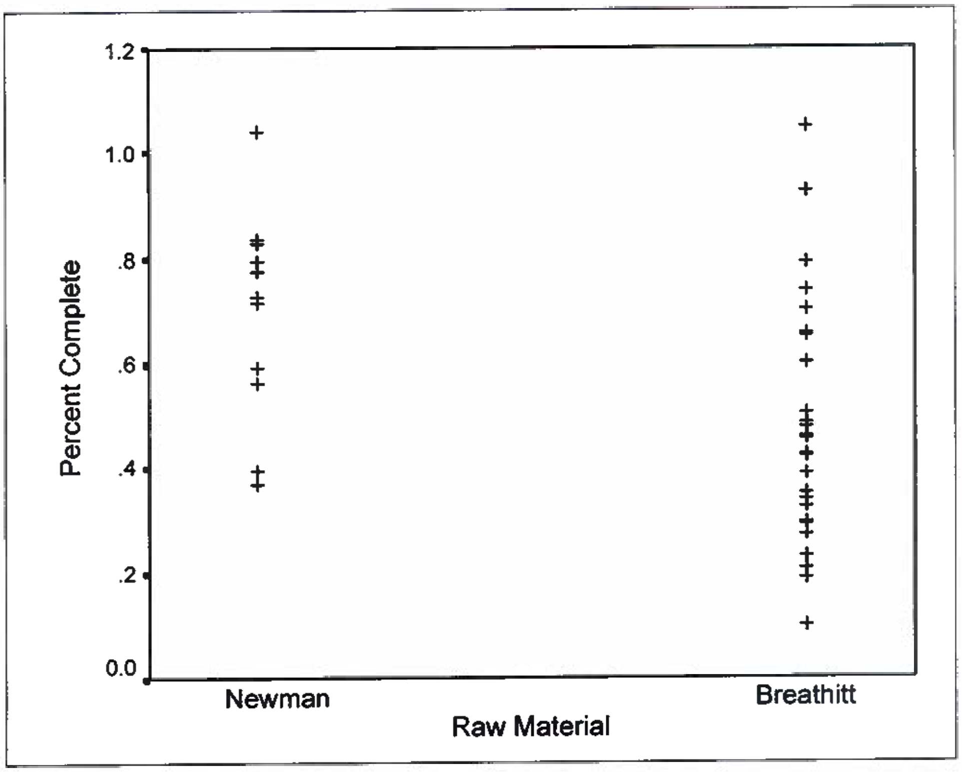

Figure 7. Percent Complete by Raw Material Type.

An examination of reduction stage separated by raw material is also informative (Table 1). Breathitt (56.9%) chert shows a higher percentage of early stage reduction than Newman (19.2%) chert. On the other hand, Newman chert exhibits a higher percentage of middle (42.3%) and late (38.5%) stage reduction. A chi-square test of independence shows that these differences are statistically significant (Table 1). General trends from the mass analysis data (e.g., Ahler and Christenson 1983) further support these inferences (Table 2). In general, these data corroborate inferences derived from the continuum-based analysis.

Table 1. Raw Material by Reduction Stage.

Raw Material	Early Stage	Middle Stage	Late Stage	Total
Newman	5	11	10	26
Breathitt	37	14	14	65
Total	42	25	24	91
χ^2: 10.649, Df: 2, p = 0.005				

Table 2. General Trends for Mass Analysis Data.

Raw Material	Avg Wt Size 2	Percent Size 2
Newman	0.309 g	85.2%
Breathitt	0.560 g	68.6%

One discrepancy, the higher amounts of early stage reduction Breathitt chert, however, is evident. It is possible that some core reduction debris was misclassified as tool reduction debris during the continuum analysis. Such misclassifications are expected to be associated with the earlier portion of the continuum (Bradbury and Carr 1999). Flake debris in Figure 6 in the 0.23 and 0.28 subdivisions may be an example of incorrectly classified core debris. Alternatively, the reduction stage classification may have misidentified some core reduction as tool production. It has been noted (Bradbury and Carr 1995, 1999) that tool production can be misclassified at a higher rate if platform facets are used to classify the flake. Sixteen (43.2% of early stage flakes) such flakes were classified in this manner, 12 of which would have been classified as middle or late stage reduction if the presence of dorsal scars had been used. Given the general trends from the mass analysis data, a higher amount of core reduction is inferred. In addition, the general trends for Newman chert are well within the range expected based on experimental tool production (Bradbury 1995). This suggests that none of the Newman chert recovered from the Gays Creek Shelter is the result of core reduction. Of the five flakes classified as early stage, four would have been classified as middle or late stage if dorsal scars had been used instead of platform facets.

Shott (1997; see also Bradbury 1998) has argued that knowing the kinds of debris present is important; however, knowing the amounts of debris is equally important. For example, if it is determined that flake debris recovered from a site was likely produced during the production of 20 bifaces, but only five bifaces were recovered from the site, then 15 were transported elsewhere. If the flake debris indicates 10 bifaces, and 10 bifaces were recovered from the site, then tool production activities were associated with producing tools to replace those exhausted during on site activities. Alternatively, the flake debris may indicate the production of five bifaces, whereas the recovered number was 10. This would indicate that a number of tools used on site were actually manufactured elsewhere. Each of these results has different implications for the behaviors that lead to assemblage formation. While methods to investigate such questions are still needed, it is possible to make rough estimates for the Gays Creek Shelter.

The average amount of flake debris produced during tool production was calculated by using data generated from an experimental assemblage (data in Bradbury 1995:Appendix B). Using this data, it was determined that, on average, 9.984 g of flake debris is produced during the manufacture of a single tool (i.e., biface thinning, final biface, uniface, and pressure flaking). Similar estimates could also be calculated for core reduction. However, given the low amounts of early stage debris (68.3 g) this was not conducted.

The total weight of all middle, late, and biface thinning flakes was 114.7 g. Dividing this figure by the average weight of flake debris produced during tool manufacture gives an estimate of roughly 12 tools (11.8) being reduced on site. Given that only two modified implements were recovered, this suggests that an additional 10 implements were partially reduced during the prehistoric use of the site that were not discarded on site.

DISCUSSION

Materials recovered from the shelter were almost entirely comprised of flake debris. A single component, Late Woodland/Late Prehistoric occupation is suggested based on the recovery of a Small Triangular cluster hafted biface. Two raw materials were used for chipped stone tool manufacture: Breathitt and Newman cherts. Breathitt chert showed a mix of core reduction and tool production debris. Newman chert was predominantly the result of tool reduction activities. It is suggested that the recovered material represents the reduction of a few tools, possibly during separate occupations of the shelter. Some of the Breathitt flake debris likely represents flakes produced during core reduction to make expedient tools. Four such tools were identified through microwear analysis.

Estimates of the number of tools reduced on site suggests that the recovered flake debris was produced during the reduction of 12 tools. Only two of these were recovered on site. Given the amount and kinds of debris recovered, it is suggested that this debris is the result of tool maintenance activities. Results of the microwear analysis suggest that few activities were conducted on site. Only two modified implements were recovered, one of which exhibited use. In addition, the condition of these implements (i.e., exhausted) suggest that they represent tools that were used elsewhere and were deposited on site as a result of retooling activities (Keeley 1982). Four flakes also exhibited use-wear and indicate the use of expedient tools on site.

Based on the low density of materials recovered and the lack of fire cracked rock, occupation of the shelter was likely on a short-term basis. The shelter most likely represents a limited activity location, possibly a hunting camp. Given that few used implements were recovered, it can be inferred that a limited range of activities, such as tool refurbishing, were conducted at the site. Such would be expected for a location used as a hunting stand or other temporary site (Binford 1978).

SUMMARY AND CONCLUSIONS

Archaeological investigations at Gays Creek Shelter documented cultural remains associated with a single-component, Late Woodland/Late Prehistoric occupation. Prehistoric use of the site appears to have been ephemeral. Given the artifact classes recovered, the low density of material, lack of cultural features, and the lack of midden development, the interpretation of the site as a short-term ephemeral occupation remains a viable interpretation. The site was likely visited on several occasions during the Late Woodland/Late Prehistoric period.

Materials recovered from the shelter were almost entirely comprised of flake debris. Two raw materials were represented; Breathitt and Newman cherts. Breathitt chert showed a mix of core and tool debris. Newman chert was predominantly the result of tool reduction activities. It is suggested that these materials represent the reduction of a few tools, possibly during separate occupations of the shelter. Some of the Breathitt chert debris likely represents flakes produced during core reduction to produce flakes for use as expedient tools. Four such expedient tools were identified through microwear analysis. Based on the low density of materials recovered and the lack of fire cracked rock, occupation of the shelter was likely on a short-term basis. The shelter most likely represents a limited activity location, possibly a hunting camp.

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ROCKSHELTERS AT THE HEADWATERS: AN ARCHAEOLOGICAL SURVEY IN THE BIG SINKING DRAINAGE OF EASTERN KENTUCKY

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ABSTRACT

Archaeologists understanding of the use of rockshelters by prehistoric people of eastern Kentucky owes much to the pioneering surveys and excavations of the team of William D. Funkhouser and William S. Webb of the University of Kentucky. Research carried out by Ohio State University was designed to assess the current status of three previously recorded sandstone shelters in Lee County, Kentucky and to document nearby sites. The research potential of Red Eye Hollow Shelter (15Le1), Little Ash Cave (15Le2), and Great Rock House (15Le6) has been largely destroyed by excavation, looting, and mining. However, collection of environmental and archaeological data from overhangs within .5 km of each of these sites permitted some inferences to be made about the characteristics that influenced their use by prehistoric people.

RESEARCH DESIGN

Over sixty years of archaeological research in the Big Sinking Creek drainage of Lee County, Kentucky has yielded important information concerning the origins of food production, the bulk of which comes from rockshelters. Due to distinctive micro-environmental conditions, many rockshelters within this drainage contain archaeological deposits in which many types of materials, such as organic remains, are exceptionally well-preserved. Several of the most archaeologically significant dry shelters in this area were investigated by William D. Funkhouser and William S. Webb of the University of Kentucky (Funkhouser and Webb 1929). These sites typically contained deep deposits of ash and domestic refuse, artifact caches, storage pits, and organic artifacts such as wooden pestles and textiles. All contained "hominy holes" (bedrock mortars) as well as lithic and ceramic artifacts now known to be characteristic of the Terminal Archaic and Early Woodland periods (ca. 1200-300 B.C.). Analysis of plant remains and human paleofeces collected from these sites has generated evidence of indigenous agriculture that predates the introduction of maize from Mesoamerica (Gremillion 1994; Smith 1994; Yarnell 1978).

The present project was developed with the primary goal of reassessing the status of the sites initially visited in the Big Sinking Creek drainage (BSCD) by Funkhouser and Webb and conducting systematic survey of a portion of the cliffline in the vicinity of each. These goals were deemed important because, despite their scientific significance, the "Ash Caves" of Lee County had not been archaeologically investigated since the 1920s. Four rockshelters originally visited by Funkhouser and

Webb were initially identified as targets for reassessment. Of these, three were reevaluated in order to assess their current status (degree of disturbance, presence of intact deposits, and potential for further excavation). These sites are Red Eye Hollow shelter (15Le1), Little Ash Cave (15Le2), and Great Rock House (15Le6). Big Ash Cave (15Le4) could not be visited because of failure to obtain landowner permission.

An additional goal of the project was to survey clifflines around each of the "Ash Caves" in order to determine the role played by these sites in the extensive upland settlement system of eastern Kentucky. Previous archaeological surveys within the BSCD (Ison and Faulkner 1995; Knudsen et al. 1983) had documented numerous sheltered sites (Gremillion 1993, 1995; O'Steen et al. 1991), but these investigations were limited to land owned and managed by the Daniel Boone National Forest. Thus, despite the existence of a rich artifactual and botanical record of plant harvesting and cultivation, relatively little information on settlement patterning in this region is available. This gap in knowledge is a significant one because the explanation of agricultural origins and development remains incomplete without some understanding of how prehistoric people used the landscape they occupied. The present project was designed to address this data gap by documenting variability in the use of rockshelters in the immediate vicinity of the three large, intensively occupied overhangs first visited by Funkhouser and Webb. Although limited to one type of landform, it was hoped that this survey would help in identifying environmental variables that may have been important determinants in the nature of human use of different overhangs.

A survey plan was devised that would include systematic reevaluation of the Funkhouser and Webb sites and documentation of additional rockshelters that could have been used by prehistoric groups. If the large shelters targeted for reassessment functioned as multipurpose, repeatedly occupied central places, it is possible that more specialized and briefer occupations may have been located in nearby rockshelters. A .5 km radius around each of the three major sites was selected as the survey target area. The .5 km limit was chosen primarily on the basis of time and personnel constraints, but it was also believed to offer a reasonably large sample of overhangs from which to collect environmental data.

FIELD METHODS

Fieldwork was conducted during the summer of 1996 by a three-person field crew (Katherine Mickelson, Andrew Mickelson, and Anne Lee). In each survey area, the focal site was first positively identified (Red Eye Hollow shelter, Little Ash Cave, and Great Rock House) and then subjected to a systematic surface collection. The surface collection consisted of a series of transects that extended from the drip line to the back wall of each shelter. The location of individual artifacts and relic collector sorting piles were mapped, and rocks and boulders were examined for features. Once all of the artifact sorting piles and features were identified, mapped, and photographed, a representative grab sample was taken from each of the artifact sorting piles. In addition to surface survey and collection, trowel tests were excavated to determine if any intact sediments remained. All sediment was screened through 3.18 mm (1/8 inch) hardware mesh. A detailed map was made of each shelter.

Within each survey area, clifflines were examined and all overhangs that were accessible to the crew were documented, regardless of the presence of archaeological materials. Documentation consisted of recording dimensions of the sheltered area, aspect, slope adjacent to the dripline, presence or absence of sediment, its general characteristics (i.e., moisture content, texture, and estimated grain size), distribution of roof fall, a general description of the condition of the shelter's immediate environment (i.e., vegetation and access to the nearest ridgetop), level of disturbance, and presence or absence of prehistoric and historic artifacts. When shelters with no sediments were encountered, they were located on a topographic map, a systematic surface collection was completed to identify features and artifacts, and the shelter was mapped using a tape and compass. In shelters where sediments were present, a minimum of one trowel test was excavated and its sediments screened through 3.18 mm (1/8 inch) hardware mesh. In trowel tests where rich organic materials, features, or middens were present a one-liter sediment/botanical sample was collected unscreened from each zone for future analysis.

A total of 146 rock overhangs located within the Corbin sandstone cliffline were recorded. Environmental data was collected on 126 shelters, 19 of which contained prehistoric materials.

INVESTIGATIONS OF THE THREE "ASH CAVES"

GREAT ROCK HOUSE (15LE6)

Great Rock House is a massive shelter located at the head of Sore Heel Hollow 30 m above an unnamed stream that originates within the shelter and flows into Bald Rock Fork. (Figure 1). The eastern half of the shelter was littered with large roof fall and large sandstone rocks that appear to represent niter mining spoil (Fig and Knudsen 1984). The central portion of the shelter was wet due to the active spring and the western portion of the shelter was covered either by thick vegetation or a thick gray sediment, which resulted from a large oil drilling pipe bisecting the shelter.

Great Rock House was described by Funkhouser and Webb (1929) as one of the largest shelters they encountered in the area. Due to extensive disturbance, they conducted no excavations at this site. However, in light of the fact that niter mining debris may in some cases protect prehistoric deposits from disturbance (Gremillion and Mickelson 1996), it was decided that some subsurface testing was warranted.

In order to assess the potential of cultural deposits in Great Rock House, a 50 x 75 cm unit and two 40 x 40 cm trowel tests were excavated at this site. None were placed along the eastern edge of the shelter due to extensive, looter trenches, heavy roof fall, and possible niter mining spoil. The unit (S.L. [Sampling Locus] 1) terminated on sandstone that covered the entire base of the excavation unit at 85 cm below ground surface. Two trowel tests were placed in the part of the shelter that did not appear to have been extensively disturbed by niter mining (although an oil well pipe that bisected the western portion of the shelter along the back wall had created a deposit of gray rock 7 cm thick). One trowel test (S.L. 2) was placed at the extreme western end of the shelter. It contained a thin reddish-brown lens with charcoal. The charcoal was probably associated with a rodent burrow that also contained small faunal remains and animal feces. The second trowel test (S.L. 3) was excavated to the northeast of S.L. 2. No artifacts were recovered from the unit and two trowel tests. The sediments at the site appear to be thoroughly disturbed to bedrock.

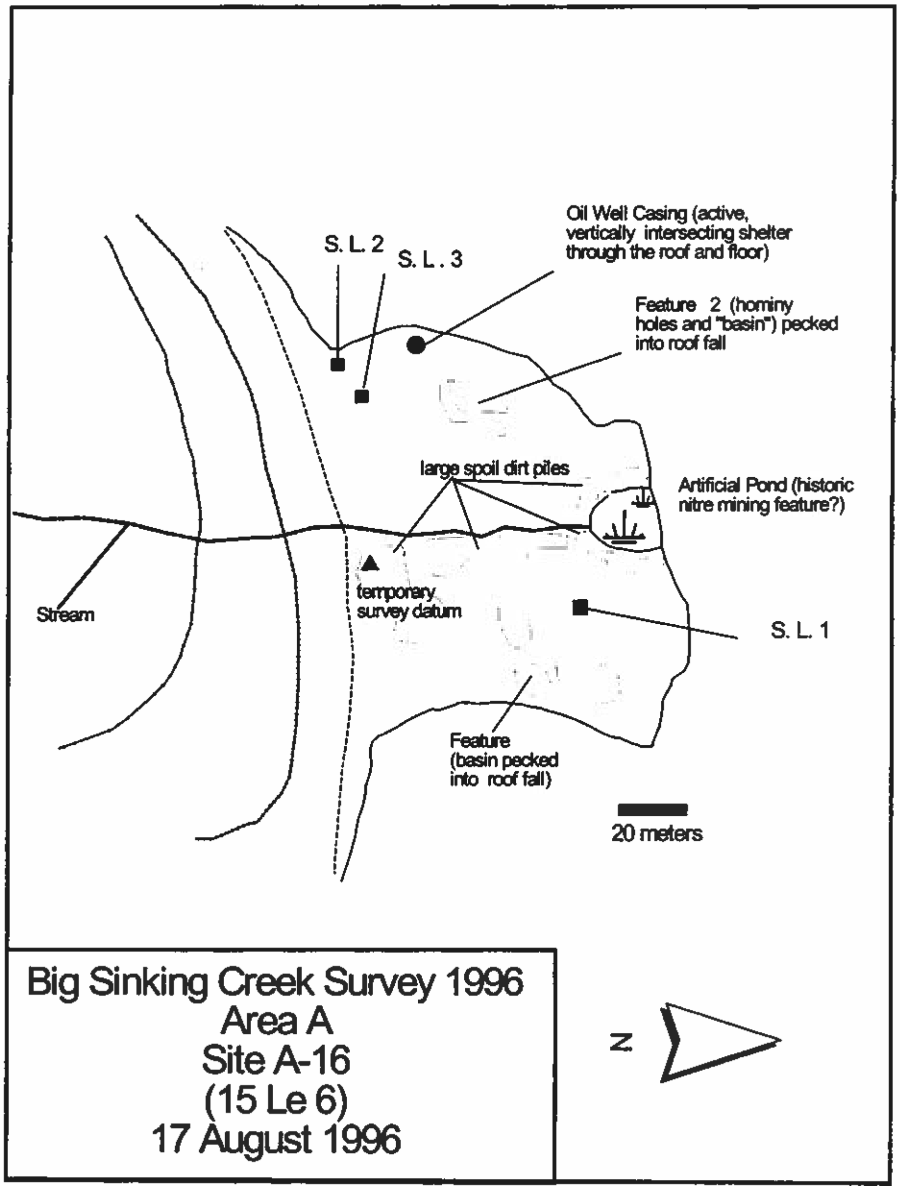

Figure 1. Plan Map of Great Rock House (15Le6).

Despite the fact that there were no intact archaeological deposits remaining in Great Rock House, several artifacts were recovered and two prehistoric processing features were documented. A systematic surface collection resulted in the recovery of 25 faunal remains, one cut shell, one chert flake, and numerous historic artifacts.

Feature 1 was located on a large rock in the eastern half of the shelter and appeared to have been pecked and ground into a large concave basin. Feature 2 was located on a large boulder near the back wall in the western portion of the shelter and consisted of a large processing feature and two adjacent "hominy holes." The area around all three features was heavily pecked. The large processing feature measured approximately 80 x 40 cm and at its deepest point extended to a depth of 33 cm. One hominy hole measured 20 x 20 cm with a depth of 21 cm, and the second was slightly larger (30 x 30 cm) but had a similar depth.

LITTLE ASH CAVE (15LE2)

Funkhouser and Webb's field crew completely trenched Little Ash Cave in the course of their 1929 excavations. This effort documented a wide variety and great quantity of prehistoric materials, including deep ash deposits, numerous features, a stone hoe, awls, shells, lithics, ceramics, and gourd fragments. Collections from Little Ash Cave that are curated at the William S. Webb Museum of Anthropology at the University of Kentucky appear to represent only a small proportion of the materials actually collected from the site. The collection does include a very large (22 by 12 cm) chipped limestone (?) hoe. Another item, though not actually observed in the course of the present investigation, is described as "wattle work of grey clay" in the museum catalog.

Several artifacts from Little Ash that are illustrated in Funkhouser and Webb (1929) were located in Webb's personal collection, which is now housed in the Museum of Anthropology that bears his name. These items included a shell "spoon" and a bone "handle" (Funkhouser and Webb 1929:70). The 1929 report also describes thick ash beds separated by thin strata of sand or clay, charcoal-filled pits, human burials (one flexed and one disarticulated), one dog burial, numerous bone tools, and food refuse. Lithic artifacts reported include groundstone items (a granite bannerstone, a slate gorget, and a hematite gorget, all fragmentary) and chipped stone projectile points (including examples of Adena stemmed forms, reworked Archaic (?) points, and a lanceolate preform). Gourd "shards" and small quantities of gravel tempered plain and cordmarked pottery were also recovered.

Three trowel tests were excavated at Little Ash Cave (Figure 2). All were of the same size as those excavated at Great Rock House. S.L. 1 was placed at the north end of the shelter and terminated at 21 cm below surface. The sediments at this location appeared to be intact and well-developed and contained neither ash deposits nor artifacts. S.L. 2 was situated to the southwest of S.L. 1 toward the interior of the sheltered area and terminated at 29 cm below surface. Due to the heterogeneity of the deposits, it is plausible that its sediments represent backdirt from Funkhouser and Webb's excavations, relic collecting, or both. The sediments associated with S.L. 3, which was located to the southwest of S.L. 2, consisted of 34 cm of a pale gray sand that contained shell, faunal remains, and lithic materials. Profiles of this trowel test revealed a mixture of yellow sand and gray, ashy deposits that confirmed initial observations of extensive disturbance and a lack of intact prehistoric deposits.

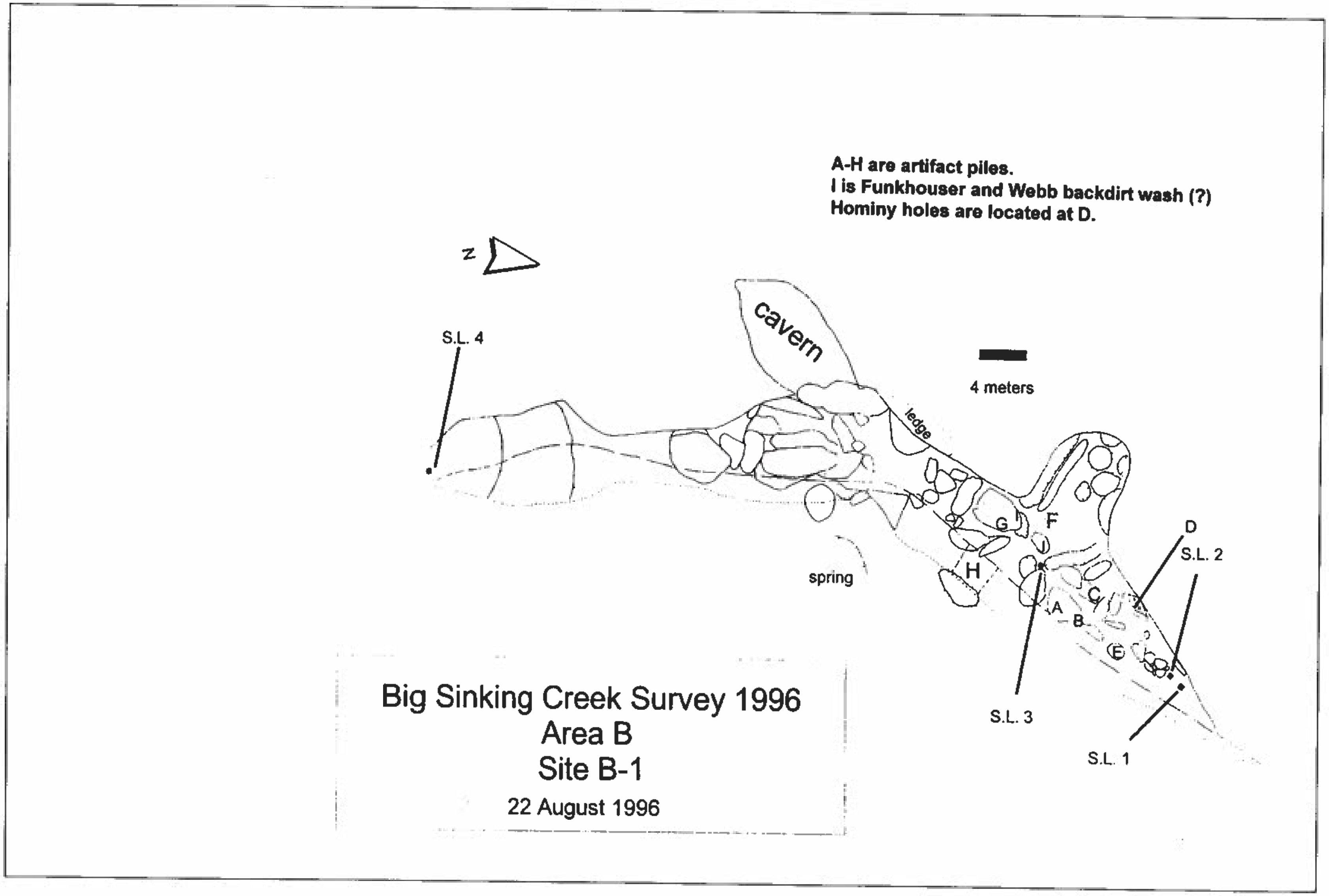

Figure 2. Plan Map of Little Ash Cave (15Le2).

Extensive relic collecting at Little Ash Cave was indicated by trenches, large pits, screening mesh, and several concentrations of artifacts discarded by collectors. Funkhouser and Webb reported two bedrock mortars ("hominy holes") near the front of Little Ash Cave. Additional pecked features of varying size and depth were recorded during the 1996 survey. The largest hominy hole measured 25 by 20 cm and had a depth of 57 cm, whereas the smaller ones appear to have been in the beginning stages of manufacture, being no more than 4 cm deep. Artifacts recovered during testing and surface collection included 167 lithics, 391 faunal remains, and six prehistoric ceramic sherds.

There appear to be no intact archaeological deposits remaining at Little Ash Cave. Funkhouser and Webb's large scale excavations resulted in the removal of most of the prehistoric midden. Subsequent relic collecting and the use of the shelter as a storehouse and stable for logging teams (Funkhouser and Webb 1929) have probably removed any remaining deposits.

RED EYE HOLLOW SHELTER (15LE1)

The Red Eye Hollow Shelter is located at the headwaters of the Big Sinking drainage. Funkhouser and Webb (1929) conducted a large-scale project that removed almost all of the midden deposits present at the site. They describe ash deposits ranging between 1.2 to 1.8 m (4 to 6 feet) in depth that contained numerous features, botanical remains, wooden pestles, mussel shells, textiles, lithic artifacts, and 14 burials. Most of the materials described in the original report could not be located in the William S. Webb Museum of Anthropology collection. The exception was a small collection of pottery that included plain and cordmarked sherds with limestone or sandstone temper. One sherd contained charred residue. Two bone artifacts from Red Eye Hollow Shelter were located at the museum in Webb's personal collection.

Initial observations suggested that there was only a remote possibility that intact deposits remained at the Red Eye Hollow Shelter (Figure 3). Extensive relic collecting was evidenced by large pits and concentrations of discarded artifacts. The materials recovered include 189 lithics, 131 faunal remains, one prehistoric ceramic sherd, and one worked bone fragment. A single trowel test, which terminated at 70 cm below the surface, was placed in the west central portion of the shelter but revealed no intact archaeological deposits.

Funkhouser and Webb reported three "hominy holes" within the Red Eye Hollow Shelter (all of which had been vandalized) and a fourth just outside the dripline. A fifth hominy hole was recorded in a small rock near the back wall in the course of the 1996 survey. According to Funkhouser and Webb, the large boulders containing the hominy holes were buried beneath the ash deposits and were not encountered until the ash bed had been removed. Also discovered at the base of the ash were two of the three wooden pestles reported in Funkhouser and Webb (1929). The pestles were observed to be of a size and shape to fit within the hominy holes at the site. Unfortunately, it was not possible to verify this observation or to use the pestles to indirectly radiocarbon date the mortars since the artifacts could not be located at the William S. Webb Museum of Anthropology.

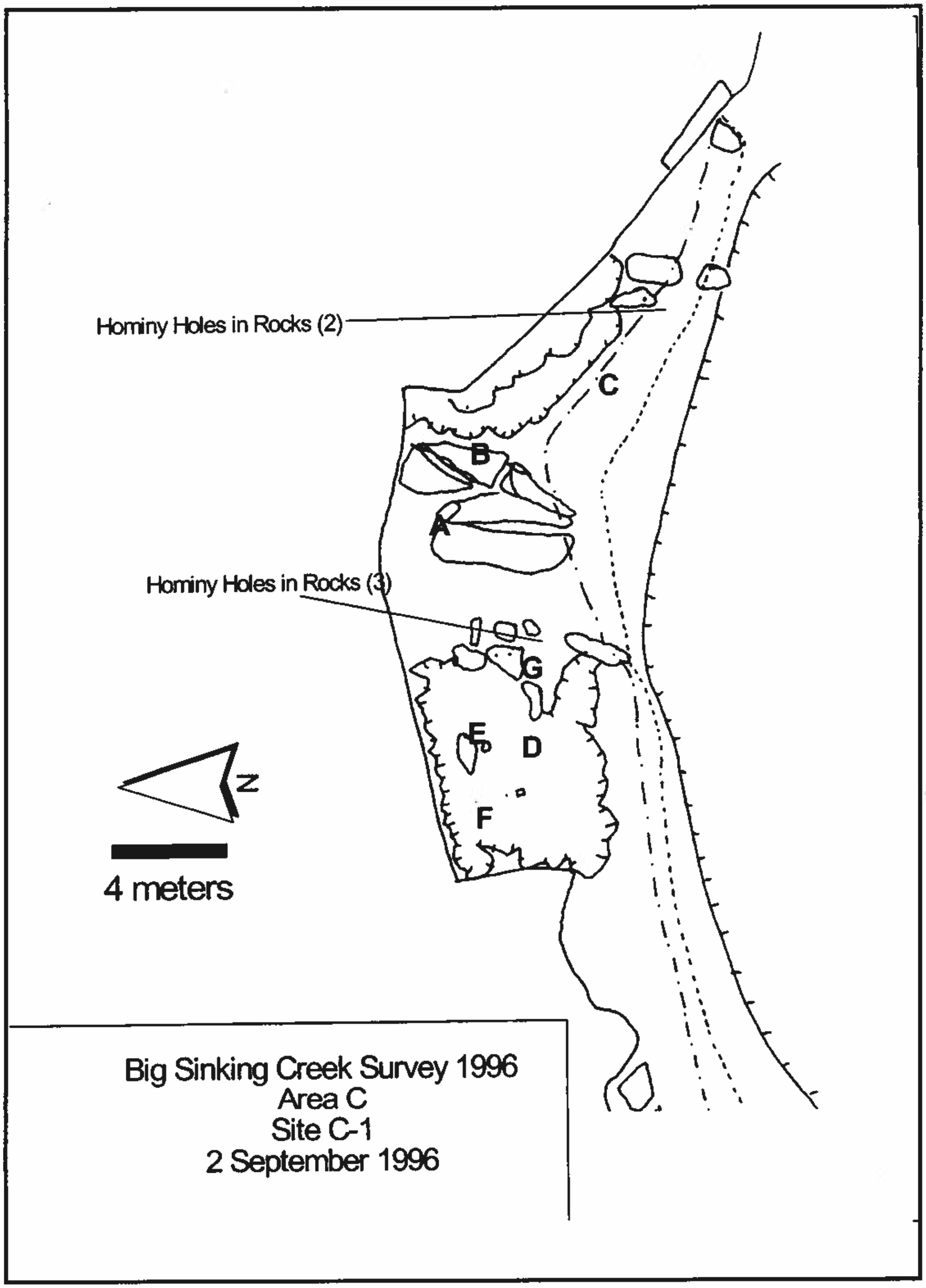

Figure 3. Plan Map of Red Eye Hollow Shelter (15Le1).

No intact archaeological deposits were discovered at the Red Eye Hollow Shelter. Its prehistoric midden, like that of Little Ash Cave, was largely removed by Funkhouser and Webb's excavations. However, the presence of food processing features and numerous artifacts from disturbed contexts attests to the importance of the site as a locus of human activity in prehistory.

SURVEY RESULTS

ARTIFACTS RECOVERED

This section reports lithic artifacts, ceramic artifacts, historic artifacts, and faunal remains collected during the survey of clifflines near the three "ash caves." In addition, to the three "ash caves," artifacts were recovered from 16 rockshelters. Botanical samples were collected from some of the surveyed shelters. However, most of the plant material was collected from surface contexts and likely represents natural accumulation since the time of prehistoric occupation. For this reason, botanical remains have not been systematically examined.

Lithics

Analysis and technological classification of lithics were based on experimental flintknapping following Flenniken (1981), Crabtree (1966), and Pecora (1994, 1996). Of the 19 rockshelters from which materials were recovered from, 16 contained chert artifacts, usually in the form of diffuse lithic debris. No diagnostic lithic tools were recovered during the survey. The majority of lithic artifacts (90%, or 609 of 617) were recovered from four rockshelters (Red Eye Hollow Rockshelter, Little Ash Cave, 15Le233, and 15Le245). Most of the lithic artifacts are classifiable as debitage (n=609), including two chert cores, one from 15Le244 and one from 15Le245. Four bifaces and four limestone fragments raise the total of lithic artifacts to 617. Although the samples from these sites are small, the analysis of lithic debitage suggests that early biface reduction dominates, followed by nonbifacial reduction/core reduction and late biface reduction stages (Gremillion and Mickelson 1997). Pressure flaking stages of lithic reduction were represented at only three sites. A number of chert cobbles exhibiting early stages of lithic tool manufacture were collected. Much of the chert debris appears to have been derived from local sources.

Ceramics

A small sample of ceramics (n=9) was recovered from two rockshelters during the Big Sinking Survey. Eight sherds were recovered from Little Ash Cave and one from Red Eye Hollow Shelter. All ceramics were recovered from the surface. Little Ash Cave produced a single sandstone tempered plain sherd. The remaining specimens were limestone tempered plain (n=3) and cordmarked (n=1), and sandstone tempered plain (n=1). The remaining sherds were less than 2 cm in size and were not further examined.

Faunal Remains

Analysis of faunal remains was completed by Anne B. Lee (Table 1). Overall the preservation of these specimens was excellent; only a very few showed signs of heavy weathering. Some of the specimens from Little Ash Cave showed green staining. Rodent and carnivore gnawing were noted, but had in most cases resulted in only minor damage. The variety of taxa recovered was impressive, ranging from egg shell and crayfish chelipeds to bones of large mammals. Considering this diversity, the fact that no identifiable fish remains were recovered may be significant, although the use of 3.18 mm (1/8 inch) screens for recovery may account for their absence. Also interesting to note is that there were no bird specimens that were identifiable to family or lower level, primarily due to the fact that diagnostic portions (e.g., articular surfaces) were missing; only shafts were recovered. This pattern may be a feature of how these small birds are processed by snakes or raptors.

Table 1. Summary of Faunal Remains.

		NISP									
Scientific Name	**Common Name**	**Le229**	**Le6**	**Le233**	**Le234**	**Le235**	**Le2**	**Le243**	**Le1**	**Le245**	**Le246**
Invertebrates											
Insecta	insects								1		
Gastropoda	Snails						2		2		
Bivalvia	Bivalves	9		8	2		16		5		
cf. *Elliptio* sp.	elephant-ear mussel								1		
cf. *Amblema plicata*	three-ridge mussel		1								
cf. *Cambarus* sp.	crayfish				1				1		
Vertebrates									1		
Rana/Bufo	frog/toad		1						2		
Rana sp.	true frogs		1		1						
Bufo sp.	true toads		1								
Colubridae	racer				1						
cf. *Lampropeltis getulus*	king snake		2								
cf. *Terrapene carolina carolina*	eastern box turtle		1	1	5		10		5		
Testudines	turtles		1	1			7		14		
Aves	Large bird				1		8		4		
Aves	Small bird				4	10					
Aves	Mammal	2		6	2	1	3	1	5	5	
Mammalia	Large mammal	1		26	6	9	196		96		
Mammalia	Medium mammal			15							
Mammalia	Small mammal		4	6	8				1		
cf *Ondatra zibethicus*	muskrat		1								1
Cricetidae	rats, mice		1								
Microtus sp.	meadow mice, voles		2								
cf. *Bos taurus*	domestic cattle		2								
cf. *Odocoileus virginianus*	whitetail deer			2	8		24		11		
Sciuridae	squirrels						1		1		
Sciurus sp.	tree squirrels			1							
Sciurus niger	fox squirrel				5						
cf. *Tamias striatus*	eastern chipmunk				4						
Procyon lotor	Raccoon						3				
Ursus americanus	black bear						1				
Unid. fragments			P				P				
Total		12	18	66	46	20	271	1	159	5	1

Some of the mammal (especially deer), turtle, and bird remains showed evidence of modification by fire (calcined, charred, and burned). Out of the vertebrate remains, only one specimen showed clear human non-fire modification (a worked deer ulna from Red Eye Hollow Shelter). Other specimens showed possible cutmarks (deer bone from Little Ash Cave and Red Eye Hollow Shelter). It is likely that the sample of bone and shell tools is biased due to long-term relic collecting at some of the sites. Funkhouser and Webb (1929) report a substantial number of worked bone and shell items from Big Ash Cave and Red Eye Hollow Shelter.

The bear was represented by a single element. Black bears are not present in the area today but are recorded in historic times in the eastern mountainous areas of North America (for further discussion, see Funkhouser [1925]). The presence of squirrels, mice, and related taxa can be explained by natural taphonomic activities (such as snake or raptor activity) and do not necessarily reflect human activity. All are native to this area and habitat, except for cattle (cow bone probably was deposited when rockshelters were used to house cattle in historic times).

Historic/Recent Artifacts and Components

A small sample of historic artifacts was recovered from six rockshelters during the Big Sinking Survey (n=23). The majority consists of mid- to late-twentieth century food and beverage containers associated with disturbed deposits. These artifacts and their context give some indication of the amount and type of human activity in recent times. There appears to be a positive correlation between the scale of relic collector disturbance and the presence and abundance of historic artifacts. Other late-twentieth century artifacts included relic collector box screens and discarded hardware mesh.

A single fragment of an iron pot with a handle was recovered from Site 15Le234. The pot fragment has an indented groove around the neck and a small handle and may represent a portion of a nested kettle used to process nitrates from sediments in the shelter. Niter mining is known to have occurred in shelters in the area and the presence of a large niter mining talus mound located in the western portion of the shelter indicates that such activities took place at Site 15Le234. Nitrates were processed by boiling both sediments and rocks in large cast iron kettles (Coy et al. 1984) and kettles often had flattened sides or grooves to facilitate nesting (De Paepe 1985). Based on this information, it is likely that the cast iron kettle was used in the processing of sediments and rocks for nitrates. Extensive and intensive niter mining activities were also evident at other shelters recorded during the survey.

A single worked freshwater mussel valve was recovered from surface deposits within Great Rock House. The shell has a cut extending from the center of the outer edge up towards the hinge. The cut is clean, rounded and appears to be modern.

SETTLEMENT ANALYSIS

The data collected from the overhangs encountered during survey were compiled and used to investigate in a preliminary way the environmental variables likely to have influenced human decisions about which shelters to occupy. It is assumed that prehistoric people were familiar enough with the landscape in which they lived to make informed choices based on a well understood set of options.

VARIABLES

The selection of variables for the analysis of general influences on site use was guided by both theoretical and practical considerations. The following account presents key variables chosen at the project outset and the justification for their inclusion in or exclusion from statistical analysis.

Distance to Nearest Stream

Accessibility of drinking water is of concern to humans everywhere, but how to measure its influence on settlement is somewhat problematic. Because of the dissected drainage system of the Cumberland Plateau and the consistency of rockshelter elevation, there is little variability between shelters in their proximity to streams. There are in some cases natural springs within overhangs, and opportunities may exist for capturing seepage or flow from the sandstone cliffs that were not discernable in the field. It was therefore difficult to assess and quantify availability of potable water from non-stream sources. For these reasons, distance to nearest stream was not considered in statistical analyses, although it should certainly be included in any larger-scale comprehensive landscape studies.

Length, Width, and Floor Area

The dimensions of the floor within each overhang placed constraints on the number of individuals that could be accommodated at any one time. Sandstone breakdown generally covers some portion of the floor, which would have further affected the attractiveness of the site. However, the degree to which a rocky floor acted to inhibit use is clearly culturally determined. Rather than attempt to factor in the impact of this variable in order to produce an estimate of "usable floor area," the variable chosen was the simple measurement of floor area in m^2. This measure is believed to capture much of the variability in space within each shelter.

Aspect

Aspect was determined as the predominant direction of the shelter opening. It was measured in degrees in the field. However, these measurements were translated into a nominal scale for purposes of analysis (the cardinal directions; see below). Aspect is likely to be an important determinant of use because it has a major effect on solar radiation. Sunlight has subjective value in terms of comfort as well as affecting biological processes important to health such as Vitamin D synthesis. As the basis of photosynthesis, it would have affected the productivity of nearby vegetation (including garden plots, if present), depending on other variables such as slope. However, solar radiation is also influenced by a variety of factors other than aspect.

Sediment Characteristics

Sediments within overhangs are composed mostly of weathered sandstone with varying admixtures of organic and anthropogenic constituents. Some lack sediment entirely or contain only shallow deposits. This variable was quantified on a binary scale (present or absent). The presence of sediment is as likely to be a consequence of human occupation as a determinant of it. If deep sediment predates human use, it might serve as an important criterion if construction of shelters and storage pits was a priority.

Access to Site, Access to Ridgetop

These variables are likely to have been important determinants of use. However, they were assessed subjectively in the field and would be difficult or impossible to quantify at present. Inclusion of these variables is best accomplished by undertaking a quantitative analysis of the costs of access to different resource zones that would be based on distance, slope, and vegetation characteristics.

STATISTICAL ANALYSIS AND RESULTS

Because the variables selected were originally measured at different scales, it was decided to convert interval or ratio scale variables to nominal ones. Although this procedure reduced the amount of information contained in the database, it allowed for an initial search for patterning. Sediment floor area was categorized as either large (> 100 m^2), medium (20-99 m^2) or small (< 20 m^2). Sediment was coded as either present or absent. Aspect was converted from compass degrees to north, south, east or west as follows: north, 315 to 359 and 0 to 45; east, 46 to 135; south, 136 to 225; west, 226 to 314.

The resulting data were grouped according to the variable "status," which dichotomized sites with evidence of prehistoric use ("positive") and those lacking it ("negative"). The appropriate classification was by no means clear in all cases. For example, Site 15Le232 was classified as positive for prehistoric use based on the presence of what appeared to be an anthropogenic midden, despite the failure to recover any artifacts during survey and shovel testing. This may represent an unusual case, in that occupied sites will yield at least a few artifacts or subsistence remains. It seems more likely, however, that the number of "sites" is greatly underestimated by reliance on artifact recovery as an indicator of human activity.

The variables size, sediment, and aspect were cross-tabulated by status (see Gremillion and Mickelson [1997] for data tables). The resulting contingency tables were compared with the chi-square distribution to test for significant ($p \leq .05$) relationships between rockshelter characteristics and their prehistoric use. Size proved to be a good predictor of use (mean = 24.42, df = 2, p=.002, n=126) (Figure 4). Occupied shelters were mostly large or medium in size, in contrast to unoccupied shelters, most of which were classified as small. This finding argues that size was an important determinant of use, although it is possible that some independent factor that has not been considered here, such as the preservational environment, may account for the greater representation of artifacts and other remains at the larger sites. This might be the case if size and the presence or prevalence of dry deposits are correlated. However, size makes intuitive sense as a criterion for occupation because a larger protected area means more space per individual and permits a wider range of activities to be carried out. Prentice (1996) found a similar relationship between size and shelter use in the Mammoth Cave National Park, with the subset of utilized shelters showing considerable deviation from the population of available overhangs, most of which were relatively small.

Aspect did not seem to have as significant an influence on shelter use. This result was unexpected, since there is enough variability within the study area to permit considerable selectivity in the orientation of sites and the amount of sunlight received. The results of cross-tabulation indicate a slight bias in favor of southern exposures among the occupied shelters and in favor of eastern and western ones among the unoccupied sites (mean = 5.60, df=3, p=.133, n=107 negative, 19 positive) (Figure 5). The test may be flawed because of low cell frequencies and should be interpreted accordingly. One potential bias affecting the statistical analysis is the imperfect relationship between crude aspect and actual solar radiation, which may vary considerably depending on the placement of shading elements such as vegetation and rocks. The predominant orientation of clifflines actually covered in survey is also influential and may introduce sampling error.

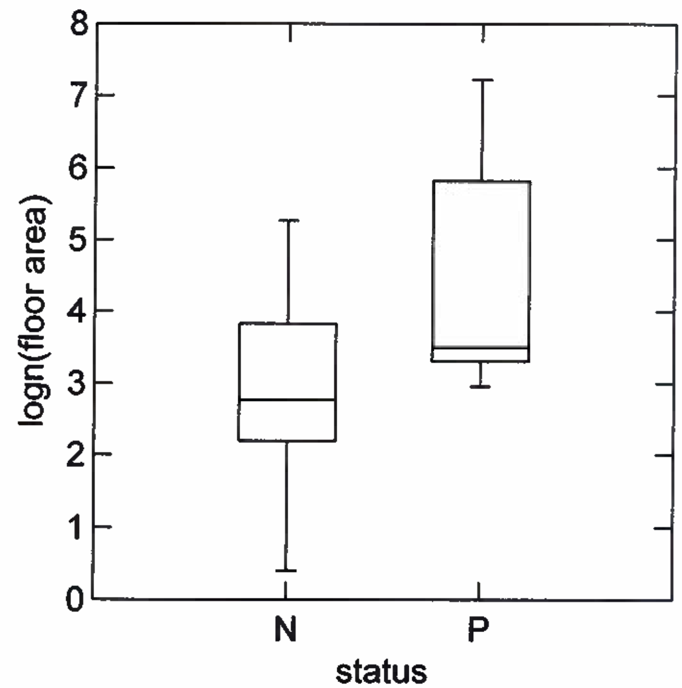

Figure 4. Boxplots Comparing Rockshelter Floor Area in Positive (Archaeological) and Negative (Nonarchaeological) Shelters.

DETERMINANTS OF PREHISTORIC ROCKSHELTER USE

Analysis of several environmental and structural variables of sandstone overhangs within the three study areas supports some initial expectations regarding rockshelter use and casts doubt on others. As anticipated, size *does* matter. There was a significant size difference between utilized and nonutilized overhangs, with large to medium sized shelters being favored for prehistoric occupation. However, the possibility does exist that the smaller shelters represent archaeologically invisible forms of human use. In light of this possibility, it might be worthwhile to explore the use of criteria other than presence of artifacts or midden to distinguish between occupied and unoccupied shelters. Similar questions can be raised about the relationship between presence of sediment and prehistoric occupation. Anthropogenic sediments are clearly a result, not a potential cause, of such occupation. However, buildup of sand from natural erosion might have been attractive as a matrix for storage. Alternatively, presence of sediment may be closely related to floor area and overall size of the overhang, in which case it should not be considered an independent determinant of use.

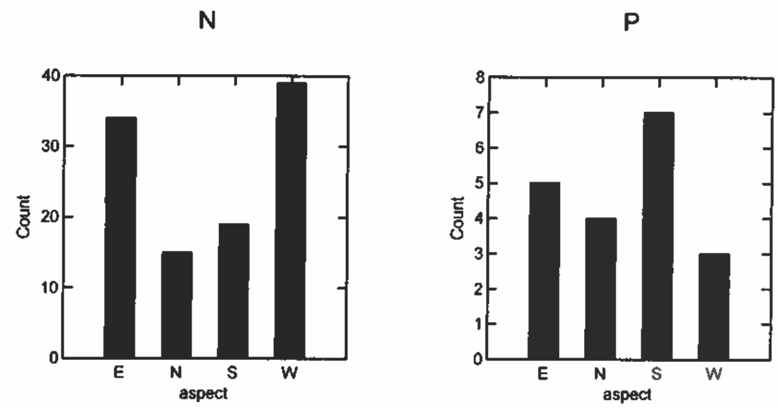

Figure 5. Bar Chart Comparing Frequency of Aspect Categories in Positive (P) and Negative (N) Shelters.

The weak support for a relationship between aspect and use was unexpected, since this variable affects the amount of solar radiation available within each shelter. This relationship should be investigated further using a larger site database. In the present study, sampling error may be powerful enough to skew the results. Perhaps more important is the imperfect relationship between actual solar radiation and aspect. Local topography and vegetation introduce variability that may cause shelters with identical aspects as measured by compass orientation to have very different degrees of exposure to sunlight and atmospheric elements such as wind. This finding suggests that aspect may be too crude a proxy for solar radiation in archaeological settlement analysis and should be superseded by more sophisticated measures offered by Geographic Information Systems (GIS), such as hillshade analysis. Future studies using GIS may allow archaeologists to more accurately identify and measure environmental variables related to aspect that may have influenced prehistoric use of overhangs.

CONCLUSIONS

Survey in the Big Sinking Creek drainage was successful in relocating and reevaluating three of the rockshelters initially visited or excavated by the research team of William D. Funkhouser and William S. Webb (Funkhouser and Webb 1929). Two of the sites, Red Eye Hollow Shelter and Little Ash Cave, appear to have little potential for further archaeological investigation due to the extensive nature of the earlier work, which impacted all of the prehistoric midden deposits. The third site, Great Rock House was not excavated by Funkhouser and Webb's team; however, like the other two, Great Rock House has long been subjected to vandalism targeting prehistoric remains. In all three cases, historic and modern activities related to logging, mining, and other types of resource extraction and intensive land use also have taken their toll by introducing pipelines, roads, and large beasts of burden (to name only some of the most significant sources of disturbance) into the rockshelter environment. Large, dry overhangs are attractive features of the landscape for both prehistoric and modern humans;

unfortunately for the archaeologist, the disruptive (even violent, in some cases) nature of many of the modern uses of rockshelters obscures or destroys the material remains of earlier activity. So although the curated collections from these sites are extremely important as research resources, the sites themselves have relatively little to contribute to archaeological knowledge.

Despite this finding, there are several reasons to be optimistic about the archaeological research potential of the Big Sinking Creek drainage and adjacent portions of the Kentucky River drainage in the Cumberland Plateau. The present project has demonstrated that a great deal of environmental data can be collected even from disturbed sites that can aid in developing a better understanding of prehistoric settlement patterns in the region. Data collected during archaeological surveys and excavations can be profitably combined with GIS databases to test hypotheses about prehistoric land use in eastern Kentucky. This area of investigation is extremely important for understanding the origins and development of prehistoric agriculture, which has been studied primarily through analysis of archaeobotanical collections from a limited number of archaeologically rich shelters. Both approaches are needed to encompass as comprehensively as possible the various ecological factors that influence the choices made by individuals and the adaptations of groups. A second reason for optimism about the research potential of the Big Sinking Creek drainage is the great variability in the physical characteristics of rockshelters (including their potential for preservation of archaeological materials) and their abundance in the sandstone cliffs of the Cumberland Plateau. Not all shelters are accessible enough to attract the attention of the casual artifact collector, and many that lack obvious signs of a rich deposit of artifacts nonetheless may contain subsistence remains that are neither marketable nor collectible. Third, previous investigations (Gremillion and Mickelson 1996) have shown that historic activities such as niter mining may actually protect prehistoric deposits from subsequent damage. The three survey areas covered during the present project illustrate some of the variability in environmental conditions, condition of archaeological resources, and potential for future research that exists in this part of the Kentucky drainage.

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CHERT RESOURCE AVAILABILITY, PROCUREMENT, AND USE IN THE UPPER ROLLING FORK RIVER VALLEY, MARION COUNTY, KENTUCKY

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ABSTRACT

This paper presents the results of the first systematic survey, sampling, and characterization of chert resources in Marion County as well as the first diachronic study of the procurement and use of chert resources in the upper Rolling Fork River valley. Four local chert resources and one nonlocal chert resource are described and the availability of each is discussed. Analyses of a sizeable collection of diagnostic artifacts from the study area indicate that Muldraugh chert was the preferred raw material from Early Archaic to Early Woodland times. A shift to Boyle chert was underway by Middle Woodland times and by the Late Prehistoric period, Boyle chert replaced Muldraugh chert as the primary lithic resource. Comparison of individual point types indicates variability in resource selection by specific knappers for each time period. The largest amounts of nonlocal raw material were imported to the upper Rolling Fork River Valley during the Early Woodland and Middle Woodland periods. Cortical analyses indicate that Boyle chert was procured predominantly from residual sources, whereas Muldraugh chert was procured from both alluvial and residual sources. Thermal alteration appears to have been practiced most commonly during Middle Archaic and Late Archaic times and used least frequently during early prehistoric and late prehistoric times.

INTRODUCTION

Despite a wealth of archaeological resources, very limited archaeological work has been conducted in Marion County. The earliest report on prehistoric sites and archaeological finds in Marion County dates back to the late-nineteenth century (Thomas 1891), but relatively little has been published about the prehistory of this county. In the early-twentieth century, the lack of reported sites relative to other counties in Kentucky led Funkhouser and Webb (1932:267-268) to believe that "archaeologically, Marion County has very little in the way of evidence of prehistoric occupation." This was a gross understatement based on a paucity of information and scarcity of high profile sites such as large earthen mounds, rockshelters, and caves. Even after 25 years of cultural resource management (CRM) work in the state, not one data recovery/mitigation project has been conducted in Marion County. In fact, only five small-scale test excavations have been conducted in the area. The remaining Marion County CRM projects consist of 12 reconnaissance surveys that were very limited in scope.

In addition to having an under represented cultural resource base, Marion County lacks specialized lithic resource investigations (e.g., determining the availability and use of local chipped stone raw materials). The need to correct this data gap was noted in the Kentucky State Plan (Jefferies 1990:221–223; Railey 1990:335–336). It was recognized that a study of differential selection and use of raw material types for the manufacture of chipped stone tools could help determine changes in the types of activities that were conducted at a site, changes in group mobility, and changes in economic processes such as exchange of nonlocal goods (Jefferies 1990:223). It was also recognized that in order to address these topics adequately, a good database on types and distributions of local and regional chert resources needed to be accumulated in and around specific research areas.

This study was conducted to help fill some of the data gaps in the archaeological record of Marion County. It is an investigation of the local lithic resource base combined with an analysis of chert artifacts from 16 sites located in the upper Rolling Fork River Valley. The goals of the study are: 1) to describe and define local chert resources in the upper Rolling Fork River Valley; 2) to determine the availability and distribution of these resources within the project area; and 3) to determine diachronic patterns of prehistoric procurement, use, and thermal alteration of these resources.

The study area is located in the upper reaches of the Rolling Fork River basin between the communities of Bradfordsville and Calvery in south central Marion County (Figure 1). In physiographic terms, the area includes the Rolling Fork main stem and its tributaries from the confluence of the Big South Fork and North Rolling Fork rivers at the east end to the confluence of Indian Lick Creek and the Rolling Fork River at the west end. The Rolling Fork River is a major southern tributary of the Salt River. It is situated along the Muldraugh Hills Escarpment in the Knobs physiographic region, which is a narrow belt that separates the Outer Bluegrass region from the Pennyroyal or Mississippi Plateau region (Karan and Mather 1977). The headwater area of the Rolling Fork River has incised deeply into Paleozoic strata since the early Pleistocene. The higher elevations of the project area (i.e., the Muldraugh Escarpment and outlying knobs) are composed of Mississippian–age formations; the lower elevations are composed of Devonian, Silurian, and Ordovician formations. Of these, two Mississippian formations (Borden and Harrodsburg), one Devonian formation (Boyle), and one Ordovician formation (Ashlock) produce knappable chert, but in variable quantities and qualities.

CHERT SAMPLING

Investigating the availability and distribution of various chert resources in and around a project area is crucial to interpretations of prehistoric procurement and use. The identification of local versus extralocal resources enables interpretations of mobility and/or exchange patterns of different prehistoric groups. But in order to conduct a study of chert utilization, a thorough understanding of the lithic resource base is needed. This involves determining the relative abundance, availability, general attributes, and range of variability of each chert resource within and adjacent to a project area. Periodic reconnaissances and preliminary investigations of chert resources in Marion County and surrounding areas have been conducted by the author since the early 1980s. These previous investigations and the intensive fieldwork conducted in conjunction with the present study provided the baseline data needed to differentiate local and nonlocal chert resources.

A total of 25 locations was formally sampled in the field. Most (n=17) samples were collected from Marion County; however, some were obtained from neighboring LaRue, Nelson, and

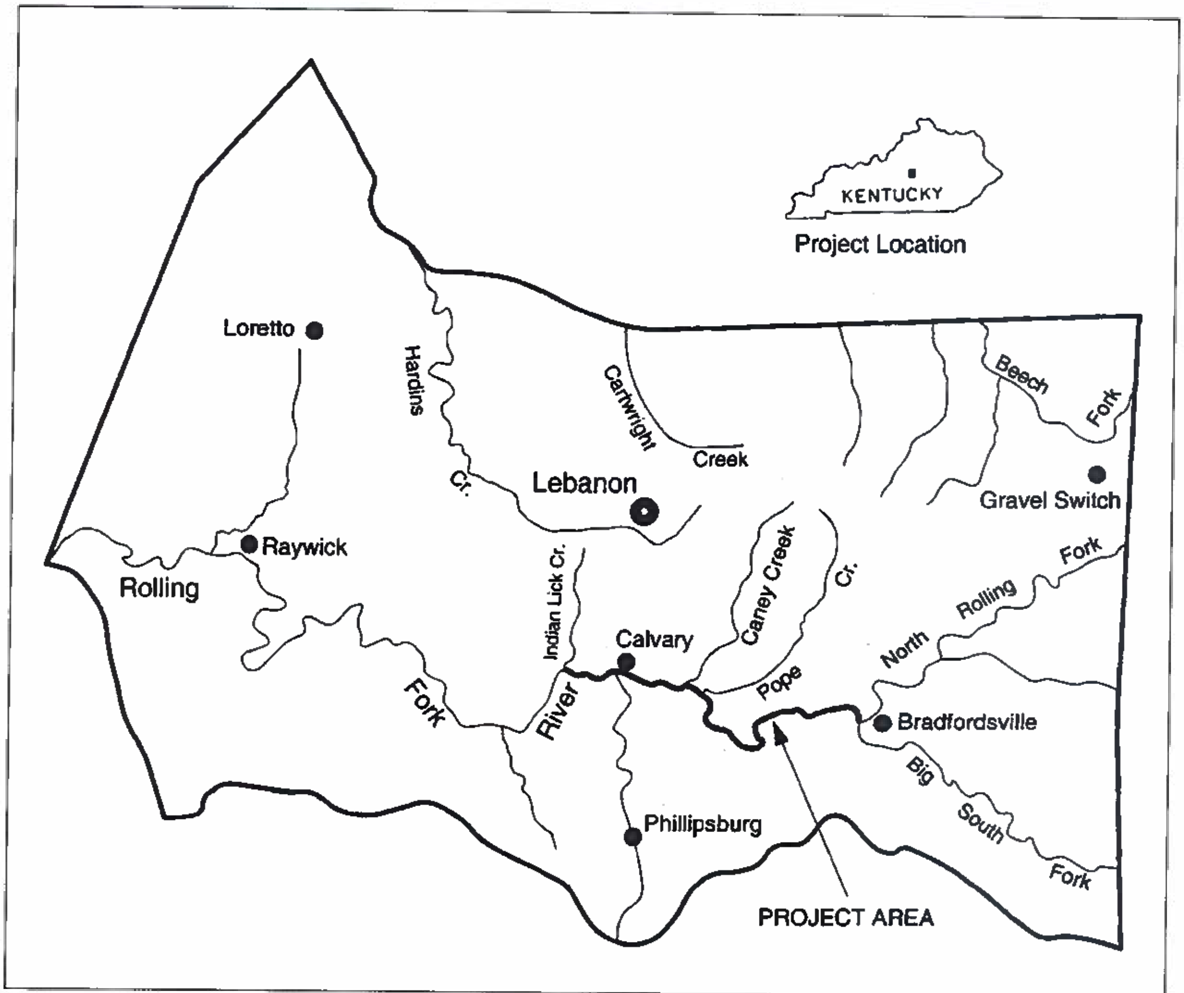

Figure 1. Location of the Project Area in the Upper Rolling Fork River Valley in Marion County.

Washington counties. In addition to these samples, reconnaissance sampling was conducted at several other locations in Marion County and surrounding areas for supplemental data, but these samples were not formally processed and recorded. Comparative sets of the field samples were donated to the Kentucky Heritage Council and the University of Kentucky William S. Webb Museum of Anthropology.

All field samples were plotted on geological quadrangle maps and were recorded as to specific source (i.e., whether the sample was collected from a bedrock source, a residual source, or an alluvial source). Whenever possible, the preferred method was to collect chert samples from *in situ* bedrock. If bedrock exposures were not present in a certain area, then residual deposits were collected from areas where a particular chert-bearing formation had been geologically mapped. Chert cobbles in several alluvial sources were also sampled to determine presence/absence of certain chert types, to compare changes caused by chemical weathering, and to determine the relative percentages of chert types in local gravel bars.

CHERT DESCRIPTIONS

Prior to this study, only three cursory references and no formal studies had been made regarding chert resources in Marion County (Fiegel 1984:59; Kerr and Hughes 1990:12; Muerer 1997:24). In the Outer Bluegrass region to the northwest of Marion County, two lithic studies (Boisvert et al. 1979; Gatus 1980) were conducted, but nearly all of the chert resources described in those reports were different from those found in the upper Rolling Fork River Valley of central Kentucky. The descriptions provided below, therefore, represent the first detailed characterizations of chert resources in Marion County. Five chert types are presented according to age. A sixth minor resource, Brassfield chert, occurs in western and northwestern Marion County but not in the upper portion of the Rolling Fork River Valley (Ray 1998:13–14). Each of the following chert descriptions includes a section on geologic context, a detailed discussion of physical attributes, the effects of heat treatment, and geographic distribution.

GILBERT CHERT

Geologic Context

Gilbert chert is derived from the Ashlock formation, which is composed of a lower Tate member and an upper Gilbert member. Since the Gilbert member is the only unit in the Ashlock formation that contains chert deposits, this chipped stone resource is called Gilbert chert. The Gilbert member consists of a thinly bedded fine-grained limestone that is interstratified with 10–20 cm thick beds of argillaceous limestone and fossiliferous shale (Moore 1978a, 1978b). Although chert is not abundant, it does occur in the upper beds of Gilbert strata. In the project area, the Gilbert member is approximately 4.6–7.6 m thick.

Description

There appears to be no previous description of this chert type in the archaeological literature pertaining to central Kentucky. Gilbert chert occurs in irregular lenticular nodules and anastomosing deposits within a limestone matrix, or more commonly, at the interface between limestone and shale beds. The nodules are generally small and thin, but a nodule measuring 8.6 cm long x 6.0 cm wide x 3.8 cm thick was recovered from the Rolling Fork River, and even larger nodules have been found in gravel deposits of Cartwright Creek in northern Marion County. The cortex is smooth to irregular and usually thin (1–4 mm). Gilbert chert is composed of white (10YR8/1), light gray (10YR7/1, 7/2), gray (7.5YR5/1, 6/1; 10YR5/1, 6/1), pinkish gray (7.5YR6/3), grayish brown (10YR5/2), dark gray (7.5YR4/1; 10YR4/1), and very dark gray (7.5YR3/1; 10YR3/1) colors. Although the chert is sometimes mottled, the matrix usually consists of a narrow banded or swirled pattern, especially near the cortex or in cross-section. The luster of Gilbert chert is usually low but may range to medium.

Most of the chert appears to be nonfossiliferous, but it may contain a few brachiopods, gastropods, and/or siliceous spicules. Inclusions consist of incipient fracture planes and pockets of unsilicified limestone or shale. The texture of Gilbert chert ranges from medium to fine-grained. Most of the chert is of relatively poor knapping quality, due to the thin irregular shape of the nodules and obstructive inclusions; however, a small percentage of the chert exhibits fair to good knapping qualities. Gilbert chert is not abundant, comprising less than 1% of the formation at any one locality. The distinctive banded and/or swirled appearance of Gilbert chert is a diagnostic trait in Marion County. As a result, it is not easily confused with other local chipped stone resources.

Heat Treatment

Gilbert chert appears to react variably to thermal alteration. One specimen revealed a noticeable change in color from light gray (10YR7/1) and gray (10YR6/1) to dark gray (7.5YR4/1), an improvement in texture from medium to fine-grained, and increase in luster from low to high. Another specimen exhibited more subtle changes in color (grayish brown [10YR5/2] to gray [10YR5/1]), texture (medium to fine), and luster (low to medium). Both specimens exhibited thermal stress fractures (e.g., crazing and potlidding), which suggest high temperatures are usually detrimental to Gilbert chert.

Distribution

The Gilbert member of the Ashlock formation outcrops in several localized areas in the upper Rolling Fork drainage basin. Within the project area, it outcrops at the North Fork–South Fork confluence, in the nearby valleys of Old Lick Creek and Cabin Branch, and along the middle reaches of Pope Creek and Caney Creek (Moore 1977a, 1978a). Upstream of the project area, it comprises the lower ridge slopes and strath terraces along the North Rolling Fork near its junction with Followell Creek, and along the Big South Fork upstream of Whippoorwill Branch (Moore 1977b, 1978c).

BOYLE CHERT

Geologic Context

The Boyle formation consists of a bioclastic coarse-grained limestone and fine to medium-grained dolomite. Locally the upper 1.5 m of the formation consists of a conglomerate of dolomite and chert cobbles up to 10 cm in diameter (Moore 1977a). Chert deposits occur irregularly throughout the formation, but chert is most common in the upper portion. The Boyle formation varies in thickness from 0–7 m in the project area.

Description

Boyle chert occurs in round, elongated, and irregular nodules and in discontinuous lenses and beds 3–15 cm thick. Large blocky fragments weathered from bedded deposits have been measured up to 30 cm long x 20 cm wide x 15 cm thick. The cortex is usually smooth to irregular and thin (1–5 mm). Boyle chert is somewhat variable in color including white (N9/0, 8/0; 10YR8/1), light gray (7.5YR7/1; 10YR7/1; N7/0), gray (N5/0, 6/0; 7.5YR6/1; 10YR6/1), pinkish gray (5YR6/2); light brownish gray (10YR6/2); light bluish gray (5PB7/1), bluish gray (10B5/1; 5PB6/1); light greenish gray (10Y7/1); dark gray (N4/0); light yellowish brown (10YR6/4); yellowish brown (10YR5/4); very pale brown (10YR7/3); and weak red (7.5R5/2; 10YR5/2). The weak red coloration may be due to natural thermal alteration (e.g., forest fires) since it was found only in residual deposits. The internal structure generally consists of an irregular mottling or blotchy pattern and sometimes as bluish gray centers surrounded by pinkish gray or light brownish gray.

The luster of Boyle chert is usually low to medium but ranges to high in the finest grained and darkest colored chert. Boyle chert is moderately to highly fossiliferous with predominantly medium to large crinoid columnals that are typically 2–5 mm in diameter. Other fossils found in the chert include twiggy and fenestrate bryozoa, siliceous spicules, brachiopods, and horn coral. Inclusions consist of occasional incipient fracture planes and fossil voids. The texture of Boyle chert is typically medium to fine-grained. The knapping quality is highly variable ranging from poor to excellent, but most of the chert is fair to good quality. Chert is relatively abundant, especially in the upper portion of the formation where it comprises approximately 10-35%. Although generally distinctive in the upper Rolling Fork River Valley, some of the darker-colored chert can resemble Muldraugh chert.

Heat Treatment

Moderate changes in color, texture, and luster occur in thermally altered Boyle chert; however, not all attributes appear to be advantageous to chert knapping. Color changes include pinkish gray (7.5YR7/2) to pale red (10R6/2); light gray (N7/0) to light gray (10R7/1) and gray (5YR5/1); brown (7.5YR5/3) to weak red (2.5YR5/2); bluish gray (5PB5/1) to gray (N6/0); and light brownish gray (10YR6/2) to reddish gray (10R6/1). One medium-grained sample exhibited an improvement to a fine-grained texture, a second fine-grained sample showed no change, and two other fine-grained samples exhibited detrimental changes to an irregular, crenulated-like texture. Luster generally increased.

Distribution

The Boyle formation outcrops along the banks of the Rolling Fork River throughout the study area. It also outcrops along major tributaries such as Cabin, Medlock, Arbuckle, Pope, Caney, Cloyd, and Indian Lick creeks (Moore 1974, 1977a, 1978a, 1978b). The Boyle formation also occurs along the North and South Forks of the Rolling Fork River.

MULDRAUGH CHERT

Geologic Context

Muldraugh chert is derived from the upper portion of the Borden formation, which in the project area is composed of the New Providence, Nancy, Halls Gap, and Muldraugh members (Moore 1977a, 1978a, 1978b). Chert appears to be largely confined to the Muldraugh member, although Moore (1977a, 1978a) indicates minor deposits in the Halls Gap member. The Muldraugh member, whose type site is located just south of Phillipsburg in southern Marion County, consists of interstratified siltstone, dolomite, and limestone (Kepferle 1971:11). Chert is usually a major component of the dolomite and limestone beds in the middle-upper part of the member. The Muldraugh member varies from 12.2-33.6 m thick in the upper Rolling Fork River Valley (Moore 1977a, 1978a, 1978b; Sable and Dever 1990:45). The Muldraugh member appears to be a lateral equivalent of the Fort Payne formation located in southcentral Kentucky (Sable and Dever 1990:48-49).

Description

Muldraugh chert occurs in continuous and discontinuous beds approximately 5-25 cm thick. At the Muldraugh member type site, chert occurs in at least four continuous beds in the middle-upper portions of the unit. In the lowest bed, chert is intercalated with unsilicified limestone, whereas most of the upper beds are solid chert. The cortex is smooth to irregular in texture and is usually thin (1-3 mm), but the cortex of highly weathered pieces may be as much as 7 mm thick. Muldraugh chert exhibits a wide range of colors, including white (N8/0; 10YR8/1), light gray (N7/0; 10YR7/2), gray (N5/0, 6/0; 10YR5/1; 2.5Y5/1), dark gray (N4/0), very dark gray (N3/0), bluish gray (5PB5/1; 10B5/1), dark bluish gray (10B4/1; 5PB4/1), light brownish gray (10YR6/2), pale brown (10YR6/3), very pale brown (10YR8/2), yellowish brown (10YR5/4), grayish brown (2.5Y5/2), and weak red (10R4/4). After extensive weathering in alluvial deposits, most of the chert lightens in color with dark blue fading to gray or light gray and brown changing to yellowish brown or off-white. The reddish-colored chert, exhibited by a residual sample, may have been produced by natural fires since none of the *in situ* samples exhibited red colors. The internal structure of Muldraugh chert generally consists of an irregular mottling of light and dark colors. While luster is predominantly low to medium, the finest-grained and darkest chert exhibits high luster.

Muldraugh chert ranges from nonfossiliferous (predominant) to highly fossiliferous. In general, the most fossiliferous chert occurs in the upper portion of the Muldraugh member near its contact with the Harrodsburg formation. The most common fossils are crinoids with lesser quantities of twiggy and fenestrate bryozoa, siliceous spicules, and brachiopods. Inclusions consist of incipient fracture planes, thin white chalcedonic veins, unsilicified (calcitic) fossils, and occasional calcareous and calcitic blebs and voids. The texture of Muldraugh chert is generally coarse to medium; however, fine-grained chert is not uncommon. Knapping quality varies from poor to good and is occasionally excellent; however, the majority exhibits only fair knapping quality. Chert comprises approximately 10-25% of the Muldraugh member. The majority of Muldraugh chert in Marion County is easy to identify (especially strongly mottled specimens). Some fossiliferous bluish-colored chert, however, resembles dark-colored Boyle chert, and light-colored crinoidal chert is difficult to distinguish from Harrodsburg chert. Also, in some areas a solid very dark gray chert found in the uppermost beds of the Muldraugh member resembles nonlocal St. Louis chert and a black (bedded) form of Fort Payne chert found in Taylor County. Because of its stratigraphic position and visual similarities, some may confuse Muldraugh chert with its lateral equivalent, Fort Payne chert located to the south; however, the modal ranges of the two cherts are considered distinct enough to be separate types.

Heat Treatment

Thermal alteration usually produces significant color changes in Muldraugh chert. For example, of five samples that were heat treated, pale brown (10YR6/3) changed to weak red (7.5R4/4); light brownish gray (2.5Y6/2) changed to weak red (7.5R4/2); very pale brown (10YR8/2) and light yellowish brown (10YR6/4) changed to pale red (10R7/4) and weak red (10R5/4), respectively; white (10YR8/1) and grayish brown (10YR5/2) changed to pale red (10R7/2) and reddish gray (10R5/1), respectively; and grayish brown (2.5Y5/2) changed to weak red (10R5/4). Texture and luster also generally increased one degree (e.g., medium to fine texture and low to medium luster).

Distribution

The Muldraugh member of the Borden formation outcrops throughout the project area and the upper portion of the Rolling Fork River Valley in southern Marion County. It occurs all along the upper portion of the Muldraugh Escarpment on the south side of the river valley, and it caps the isolated ridge systems and outliers (knobs) on the north side of the river valley (Moore 1974, 1977a, 1978a, 1978b). Redeposited Muldraugh chert dominates the gravel deposits in the Rolling Fork River and its southern tributaries, and it is a major component in most of the northern tributaries

HARRODSBURG CHERT

Geologic Context

In Marion and neighboring counties, the Harrodsburg formation is composed primarily of a light gray, very coarse to medium grained, calcarenitic limestone (Kepferle 1966, 1973; Moore 1978b). The limestone may be crossbedded, and in places it may be silicified into tabular and bedded masses 15–30 cm thick (Kepferle 1966, 1973). The Harrodsburg formation averages about 9 m thick in central Kentucky (Sable and Dever 1990:56). The lower portion of the formation tends to produce the most chert. In the project area, most of the formation has been reduced by weathering to a cherty residuum 1.5–4.6 m thick (Kepferle 1973).

Description

Within the study area, Harrodsburg chert occurs mostly as blocky residuum that caps upland ridge summits. In southwestern Marion County and in LaRue County, Harrodsburg chert has been found in discontinuous beds 3–15 cm thick. The cortex is generally irregular or rough and very thin (<1 mm); however, highly weathered residual chert may exhibit a cortex up to 5–10 mm thick. The color of Harrodsburg chert may include white (N9/0; 2.5Y8/1; 10YR8/1), very pale brown (10YR8/2; 10YR7/3), pale brown (10YR6/3), light gray (10YR7/1; 10YR7/2), gray (10YR5/1, 6/1), grayish brown (10YR5/2), light brown (7.5YR6/4), brown (10YR5/3), and strong brown (7.5YR5/6). It may also weather to a reddish brown (5YR4/3, 5/4) and a pale red (2.5YR7/3; 5R6/4). The chert generally occurs as a fine mottling of two or more of these colors due to differential staining of fossils and the encompassing matrix. The luster of raw Harrodsburg chert is always low or dull.

Harrodsburg chert is highly fossiliferous with predominantly crinoidal detritus. It also contains fragments of brachiopods, twiggy bryozoa, and siliceous spicules. Fossil forms are often obscured by replacement and difficult to identify. Inclusions consist of incipient fracture planes and numerous fossil voids, which inhibit smooth conchoidal fracture. Texture is predominantly coarse and the knapping quality is very poor or poor (<5% of knappable quality); however, in localized deposits (i.e., highly silicified beds) the chert grades to a medium texture with fair to good knapping quality. Harrodsburg chert is not abundant in the project area except in localized upland residual deposits. Although there are no known diagnostic traits, its highly fossiliferous nature with characteristic fossil voids helps differentiate it from other Mississippian cherts. Nevertheless, it is often very difficult to distinguish Harrodsburg chert from highly fossiliferous Muldraugh chert. Indeed, in some areas where the uppermost beds of the underlying Muldraugh member consist of bioclastic limestone, there is a gradation of the formations (Moore 1974) and inclusive chert deposits.

Heat Treatment

Thermal alteration produces moderate to significant changes in Harrodsburg chert, especially in terms of color. For example, reddish brown (5YR5/4), brown (10YR5/3), and white (10YR8/1) cherts became dusky red (10R3/3), weak red (10R4/4), or pale red (2.5YR7/2). Slight to moderate improvements also were noted in texture and all specimens exhibited a medium luster (on flaked surfaces) after heat treatment.

Distribution

Harrodsburg chert occurs mostly in the southwestern portion of Marion County and extends into neighboring Taylor, Nelson, and LaRue counties. In the upper Rolling Fork River basin, the

Harrodsburg formation has not been mapped east of the tributary valleys of Caney Creek and Medlock Creek (Moore 1977a, 1978a). Unmapped residual deposits, however, cap some of the higher knobs east of these tributaries, and redeposited cobbles of Harrodsburg chert occur in gravel deposits of the Rolling Fork River. In the Calvery area, Harrodsburg chert occurs in localized deposits on the summits of knobs and narrow ridges.

ST. LOUIS CHERT

Geologic Context

The St. Louis formation consists predominantly of a very fine to medium grained limestone or dolomite with variable amounts of siltstone and shale (Moore 1968, 1976a). Some beds are highly fossiliferous and are characterized as biocalcarenites (Sable and Dever 1990). In some sections of the formation, chert is locally common to abundant in nodular and bedded forms. In other sections, it is sparse to nonexistent. The chertiest sections appear to be in the middle to upper portions of the unit. The St. Louis formation is variable in thickness in western Marion County and adjacent areas. It is only approximately 5 m thick on New Market Knob, but it is about 30–67 m thick in parts of Taylor, Green, and LaRue counties (Kepferle 1966; Moore 1976b, 1978b). The lower portion of the overlying Ste. Genevieve formation contains cherty deposits practically indistinguishable from those in the upper part of the St. Louis formation, and the contact between the two is gradational and highly debatable (Sable and Dever 1990:67–69). In some areas where both formations outcrop, it is essentially impossible to differentiate residual deposits. For simplicity, the dark–colored chert that occurs in both units is referred to as undifferentiated St. Louis chert in this report.

Description

In western Marion County and surrounding area, St. Louis chert occurs in discontinuous lenses and beds 2-7 cm thick and in elongated or round "ball" nodules approximately 3–10 cm thick. The cortex is usually smooth to irregular, light colored, and relatively thin (1–4 mm), although some nodules exhibit cortical rinds up to 1 cm thick. St. Louis chert generally occurs in two varieties: a relatively poor–quality light gray variety and a high–quality dark gray variety (Ray 1998:20-21). Artifacts made from the light gray variety are rarely found in Marion County, whereas artifacts knapped from the dark gray variety are not uncommon. Only the dark gray variety of St. Louis chert is described in this report; hereafter, it is referred to as simply St. Louis chert.

In Marion County, St. Louis chert occurs in gray (10YR5/1, 6/1; 5Y5/1), dark gray (N4/0; 7.5YR4/1), very dark gray (N3/0), light brown (7.5YR6/3), brown (7.5YR4/3, 4/4), reddish brown, (5YR5/4, 4/3), and dark grayish brown (10YR4/2) colors. The matrix is generally a homogeneous dark color or a subtle mottling of dark colors. The luster of St. Louis chert is generally medium to high. Although fossils are present in the chert, they are usually completely obscured by the dark coloration. Inclusions consist of incipient fracture planes and occasional quartz blebs, but the most characteristic inclusions are rhomboidal voids where calcite crystals have weathered out. The texture of St. Louis chert is predominantly fine but grades to medium. The knapping quality of the majority of this chert is good, but it ranges from fair to excellent. The best quality chert occurs in ellipsoidal or spherical nodules. It is not typically abundant but may be so locally. St. Louis chert is not easily confused with other cherts in Marion County; in fact, the solid dark gray, highly lustrous, fine–grained appearance of this chert in combination with calcitic voids is considered diagnostic of St. Louis chert.

To the west and northwest in Hardin, Meade, and Breckinridge counties in Kentucky and Harrison and Crawford counties in southern Indiana, dark gray undifferentiated St. Louis chert (differentiated as Ste. Genevieve chert in some studies) occurs in much larger quantities and exhibits fewer flaws and inclusions that produce a superior quality resource to the St. Louis chert generally found in Marion and LaRue counties. The dominant colors of this nonlocal St. Louis chert include gray (N5/0, 6/0), dark gray (N4/0), very dark gray (N3/0), dark bluish gray (5PB4/1), and grayish brown (2.5Y5/2).

Heat Treatment

Gray (N5/0), very dark gray (N3/0), and dark bluish gray (5PB4/1) colors of St. Louis chert exhibit very little or no change in color after heat alteration. The only exception was a grayish brown (2.5Y5/2) border adjacent to the cortex that changed to a weak red (10R4/3) color. The texture and luster of St. Louis chert also showed little or no change. There often are two indications that St. Louis chert has been heat altered. Conchoidal fractures generally produce more rings or ripple marks, but more significantly, the chert often exhibits detrimental side effects such as potlids, crazing, and/or crenulations.

Distribution

Although St. Louis chert does not occur within the project area, limited residual deposits are present on the summit of one of the highest elevations in Marion County called New Market Knob, located 5–15 km west of the study area (Moore 1978b). The chert deposits at this upland location are sparse (especially the high-quality dark gray variety) and are therefore unlikely to have provided an exploitable source of St. Louis chert. The only other primary deposits of St. Louis chert in Marion County occur at the head of Salt Lick Creek and Clear Creek in the extreme southwest corner of the county (Moore 1976a) approximately 18–28 km southwest of the project area. The high-quality, dark variety of St. Louis chert, however, appears to be very scarce in this area as well. The next closest known source of dark-colored St. Louis chert is located on the west side of Otter Creek in southeast LaRue County approximately 30-40 km west of the study area. Most of the St. Louis chert in this area, though, exhibits a distinctive reddish brown or rootbeer coloration. The closest known exploitable source of the high-quality, dark, bluish-gray colored St. Louis chert is located in the Sonora area in southeast Hardin County approximately 60–70 km west of the project area. Additional deposits of this high quality, bluish-gray St. Louis chert occur further to the northwest in Meade and Breckinridge counties. Relatively high quality St. Louis chert also occurs in Pulaski and Rockcastle counties approximately 70–80 km east-southeast of the project area; however, the St. Louis chert in this area occurs in lesser quantities and is generally a lighter shade of gray than that exhibited by the majority of St. Louis chert artifacts found in the upper Rolling Fork River Valley.

CHERT AVAILABILITY AND GRAVEL BAR TESTS

For the purposes of this report, a *local* resource refers to raw material that was readily available from a specific location on a daily basis. This roughly equals the distance a knapper could leisurely walk in a day divided by two (roundtrip), or a resource located within 10 km of the project area. A *nonlocal* resource, on the other hand, refers to any raw material located more than 10 km from a specific location. Based on these definitions, St. Louis chert is considered a nonlocal resource in relation to the project area, whereas Boyle, Muldraugh, Gilbert, and Harrodsburg cherts are local resources. The distribution of primary and residual deposits of the local chert resources has been delineated in the previous section. These local resources not only outcrop within the project area but they also occur as secondary, redeposited alluvial gravels in the Rolling Fork River and its tributary streams. Rounded cortical surfaces on numerous initial reduction artifacts recovered from bottomland sites in the Rolling Fork River Valley reveal that alluvial chert was a significant source for the procurement of lithic materials.

The systematic examination of alluvial chert is an important aspect of evaluating prehistoric chert exploitation (Amick 1981; Gatus 1983; Ray 1982, 1992). Testing for the relative quantities of chert types in stream deposits allows for a better interpretation of the variability in the abundance of local raw materials. These relative data found in the natural environment can then be compared to artifactual data from archaeological sites to ascertain potential prehistoric preferences for, and selection of, raw materials.

Tests of stream–deposited cobbles were conducted on three gravel bars of the Rolling Fork River. One gravel bar was located near the mouth of Arbuckle Creek and the other two were located at the mouths of the Big South Fork and North Rolling Fork arms of the Rolling Fork River. Four 1 x 1 m units were placed at each of the tested gravel bars. Each nodule with a long axis of 8 cm or larger and a thickness greater than 2 cm was identified as to rock type by removing a few flakes by hard hammer percussion. The gravel bar test data reveal considerable variability in the relative quantities of alluvial cobbles of Muldraugh, Boyle, Gilbert, and Harrodsburg cherts. In addition to chert cobbles, quartz geodes, shale, siltstone, and limestone nodules were present in the gravel deposits. Totals for each rock type are presented in Table 1.

If unknappable rocks (quartz geodes, shale, siltstone, and limestone) are excluded from the sample, a representative quantification of the four local chert resources is apparent. Nearly 70% of the tested chert cobbles was Muldraugh chert, about 23% was Harrodsburg chert, and approximately 8% was Boyle chert (Table 1). The dominance of Muldraugh chert in the gravels is due to the cherty nature of the Muldraugh member and the thickness of the strata (up to 34 m thick) relative to the other chert–bearing units in the drainage basin. Although the Harrodsburg and Boyle formations can be quite cherty in some places, these formations generally contain lower percentages of chert than the Muldraugh member. The Harrodsburg and Boyle formations also are less than one–third to one–quarter the thickness of the Muldraugh unit, and thus contribute much less chert to alluvial deposits. Although present in the river gravels, no cobbles of Gilbert chert were recorded during the gravel bar tests. This is a reflection of its relative scarcity.

Table 1. Gravel Bar Composite Data.

	Mouth of Arbuckle Creek Test Site 1		**Mouth of North Fork Test Site 2**		**Mouth of Big South Fork Test Site 3**		**All Test Sites Total**		**Chert Cobbles Only**	
Rock Type	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Muldraugh Chert	75	58.6	44	31.0	37	28.0	156	38.8	156	69.3
Boyle Chert	10	7.8	5	3.5	2	1.5	17	4.2	17	7.6
Harrodsburg Chert	13	10.2	16	11.3	23	17.4	52	12.9	52	23.1
Siltstone	24	18.8	55	38.7	52	39.4	131	32.6		
Limestone	3	2.3	14	9.9	12	9.1	29	7.2		
Geode	3	2.3	8	5.6	5	3.8	16	4.0		
Shale					1	0.8	1	0.3		
Total	128	100.0	142	100.0	132	100.0	402	100.0	225	100.0

DIACHRONIC ANALYSES

Upon completion of the fieldwork and processing of the materials recovered, chert artifacts from 16 prehistoric sites were selected for lithic analyses (Ray 1998:Table 5). Nine of the sites are located in bottomland settings and seven sites are situated in upland areas. The 16 sites are part of a provenienced artifact collection from the upper Rolling Fork River Valley assembled by the author. A total of 485 diagnostic artifacts classifiable as to point type and cultural affiliation/time period were included in the study. Over 50 separate point types were identified in the collection (Ray 1998:Table 9), but most are represented by only a few specimens. These diachronic analyses focused on 10 point types with 12 or more specimens. A few of these point types are presented in Figures 2–7. All time periods are represented in the collection. However, the Paleoindian and Late Woodland periods are poorly represented and are omitted from the discussions due to small sample size.

CHERT UTILIZATION

The first diachronic analysis identified all 485 diagnostic artifacts as to raw material type. In general, it appears that Muldraugh chert was the favored or primary chipped stone resource for manufacturing hafted bifaces in the upper Rolling Fork River Valley from Early Archaic through Early Woodland times (Table 2). This is especially true of the Early Archaic and Late Archaic periods in which diagnostics made from Muldraugh chert were two to three times as common as the next most common (secondary) resource (Boyle chert). By Middle Woodland times, however, a shift from Muldraugh to Boyle chert is apparent as well as significant importation of nonlocal St. Louis chert. During the Late Prehistoric (Fort Ancient/Mississippian) period, Boyle chert replaced Muldraugh chert as the preferred or primary raw material---at least for the production of triangular arrow points. The other two local cherts, Harrodsburg and Gilbert, served as tertiary or incidental resources.

Based on the generalized data (Table 2), nonlocal St. Louis chert apparently served as a tertiary resource during the Early Archaic, Middle Archaic, and Fort Ancient/Mississippian periods. A significant increase in the utilization of St. Louis chert occurred in the Early Woodland and Middle Woodland periods, during which this high grade raw material was used as a secondary resource. It is unclear whether this phenomenon was the result of direct or indirect procurement; but indirect procurement (i.e., trade) of high quality cherts appears to have been common during these times (Hofman and Morrow 1984; Morrow et al. 1992; Struever 1973; Struever and Houart 1972; Winters 1984).

Better indications of chert selection and preference by specific prehistoric knappers are obtained by examining individual point types. Unfortunately, the sample size of most point types is small and provides only tentative indications of chert use. Only point types represented by 12 or more specimens are considered (Table 3). The most common Early Archaic type in the project area is Kirk Corner Notched. Muldraugh chert was the primary resource that was utilized by Kirk Corner Notched knappers and Boyle chert was an important secondary resource. The most common Middle Archaic projectile point type in the upper Rolling Fork River Valley is Godar. Although the majority of Godar points were knapped from Muldraugh chert (47.1%), a significant percentage (39.7%) was made from Boyle chert. As a result, the earliest significant use of Boyle chert in the upper Rolling Fork River Valley appears to have been by Godar knappers. Other local and nonlocal cherts associated with Godar points represent tertiary resources. Late Archaic Matanza and McWhinney point types indicate a primary reliance on Muldraugh chert; this is especially true of the McWhinney type. Matanza knappers appear to have utilized Boyle chert as a secondary resource.

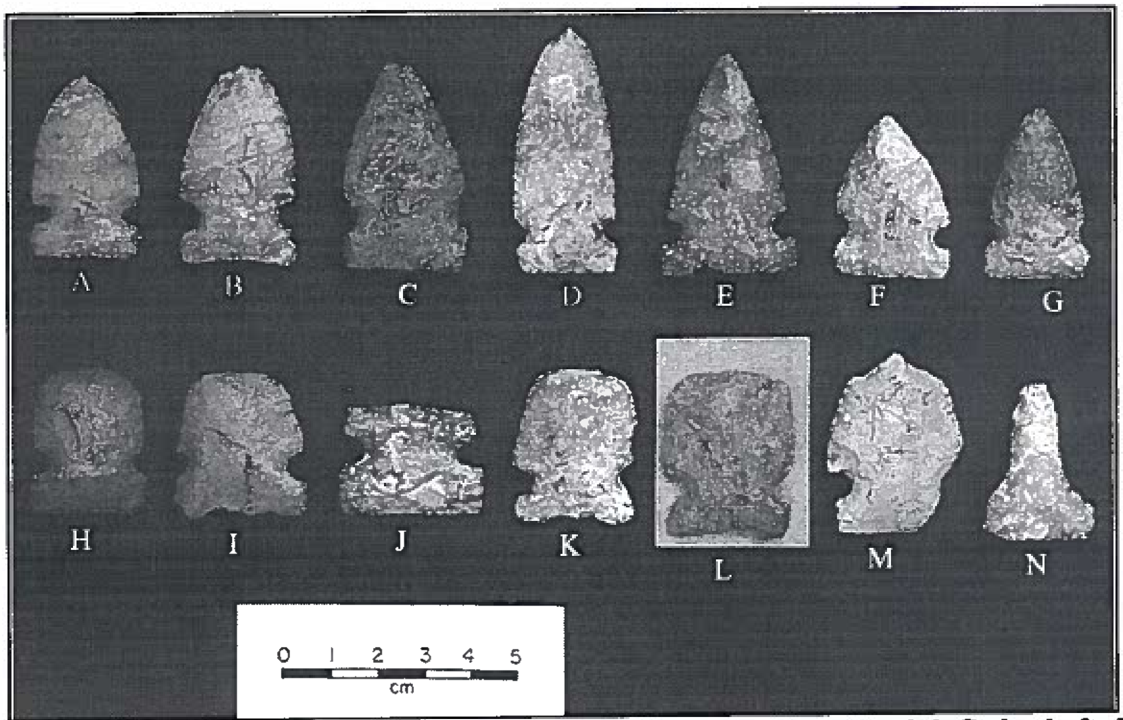

Figure 2. Middle Archaic Artifacts: a-g, Godar projectile points; h-l, Godar hafted endscrapers; m, Godar hafted graver; n, Godar drill. Chert Types: a-c, h-j, Muldraugh; d-g,k,n, Boyle; l, Harrodsburg; m, Unidentified.

Figure 3. Late Archaic Artifacts: a-c, Karnak Stemmed projectile points; d-e, McWinney projectile points; f-l, McWinney hafted endscrapers. Chert Types: a-g, i-k, Muldraugh; h, Harrodsburg; l, Gilbert.

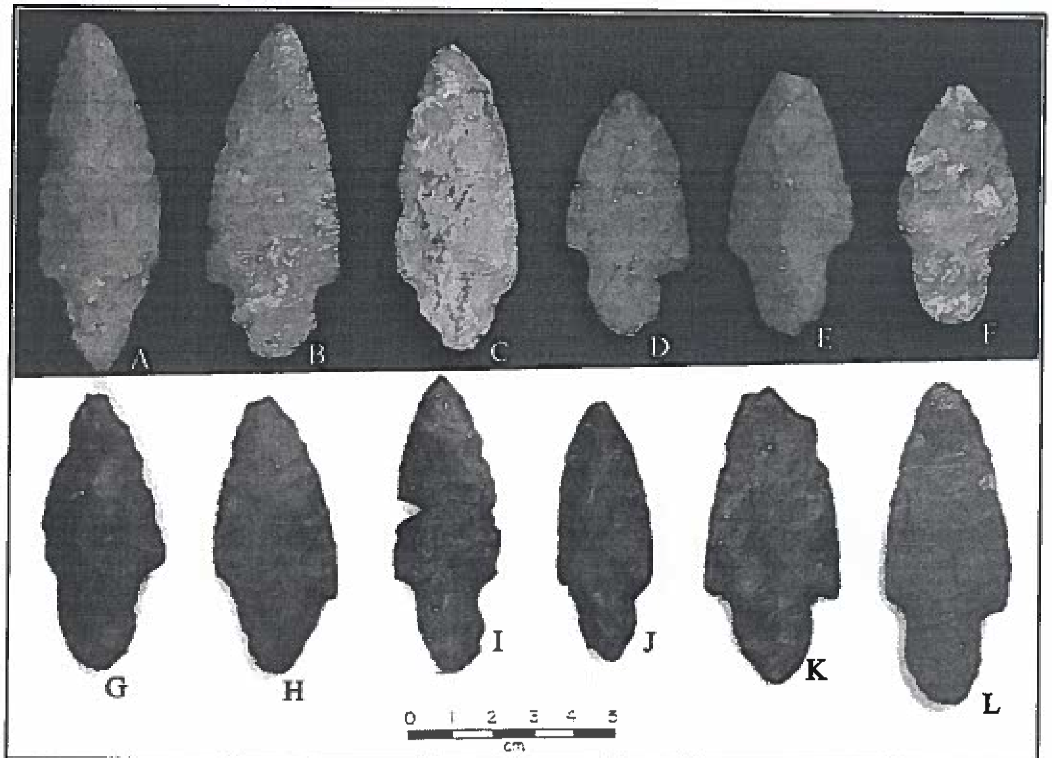

Figure 4. Early Woodland Projectile Points: a-l, Adena. Chert Types: a-f, Muldraugh; g-j, St. Louis; k, Fort Payne; l, Unidentified.

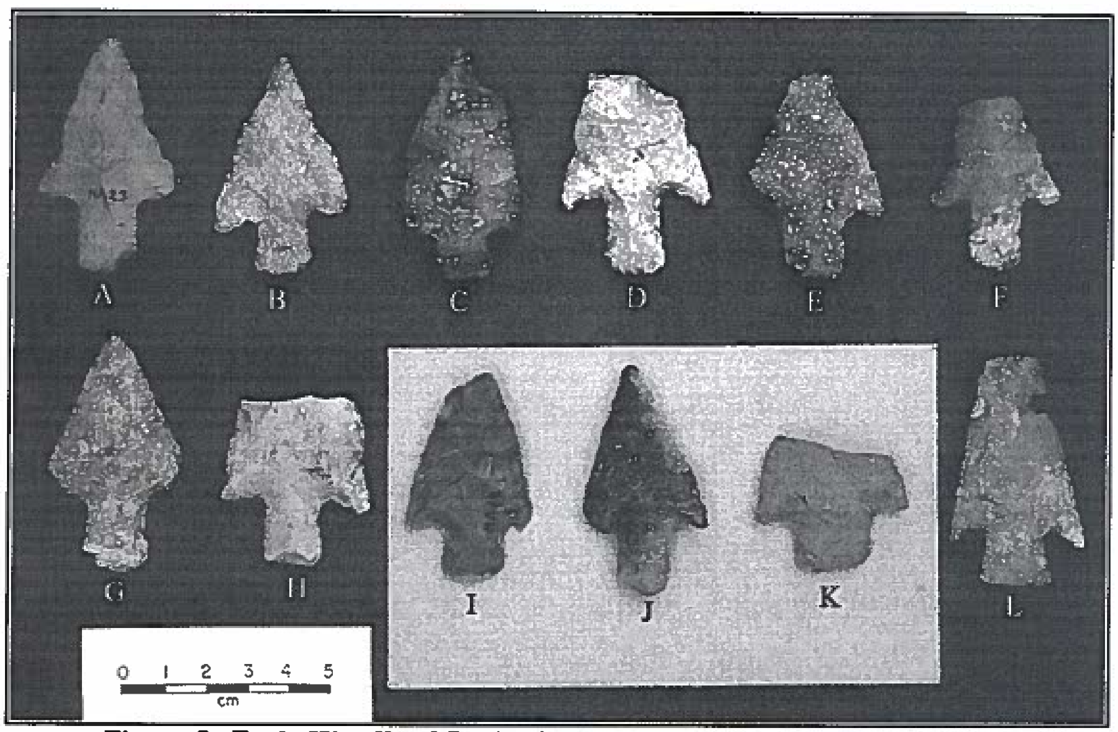

Figure 5. Early Woodland Projectile Points: a-j, Buck Creek; k-l, Wade. Chert Types: a-c, k, Muldraugh; d-h, l, Boyle; i, St. Louis; j, Unidentified.

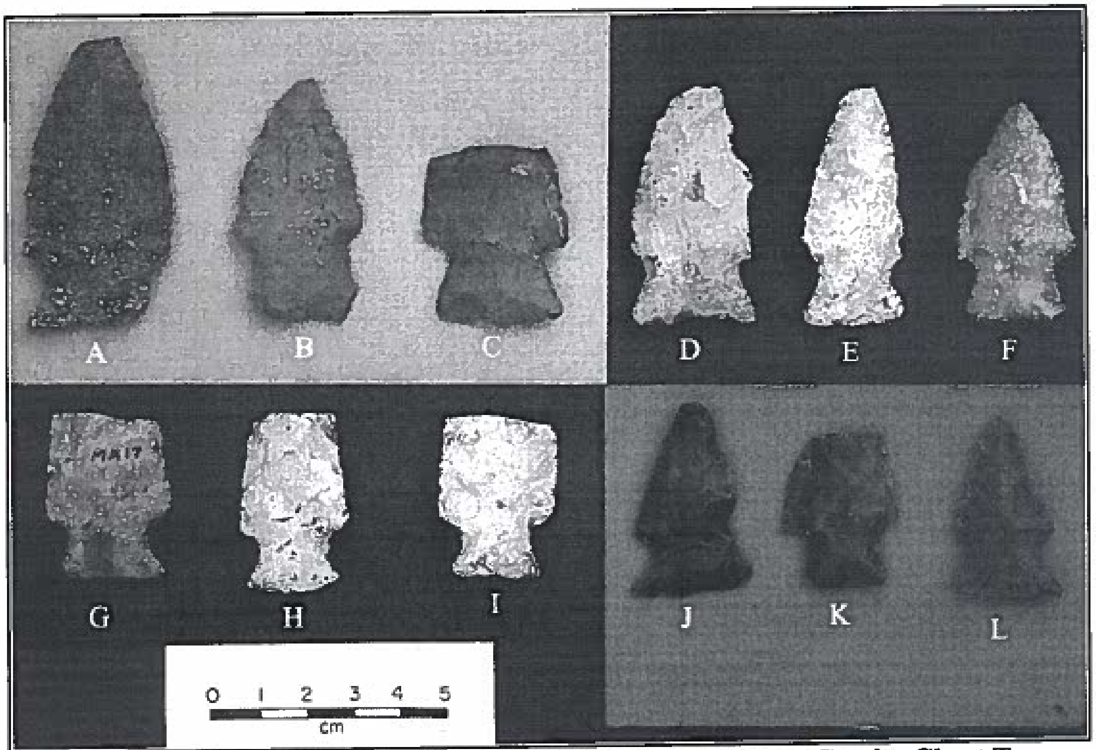

Figure 6. Middle Woodland Projectile Points: a-l, Bakers Creek. Chert Types: a-c, Muldraugh, d-i, Boyle; j-l, St. Louis.

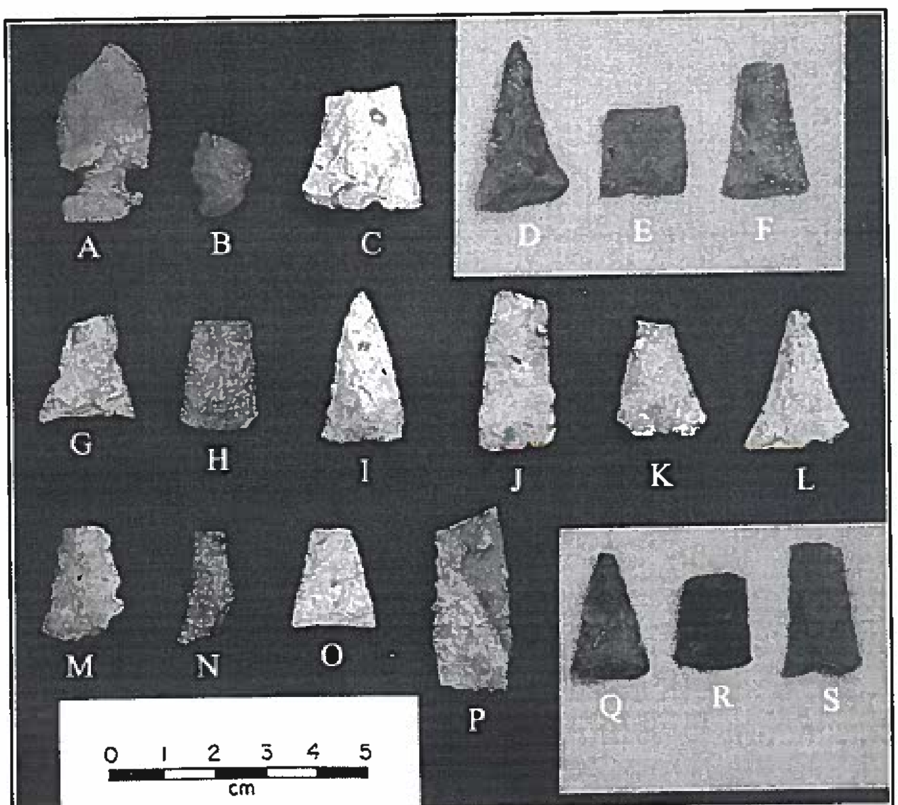

Figure 7. Late Woodland and Late Prehistoric Projectile Points: a, Raccoon Notched; b, Washington; c, Madison preform; d-s, Madison arrowheads. Chert Types: b,d,e, Muldraugh; a,s, St. Louis; r, Fort Payne; q, Unidentified.

Table 2. Raw Material by Cultural Period.

	Paleoindian		Early Archaic		Middle Archaic		Late Archaic		Early Woodland		Middle Woodland		Late Woodland		Fort Ancient/ Mississippian		Total	
Raw Material	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Boyle	2	33.3	14	24.1	39	36.8	21	22.8	45	28.1	14	31.8			12	70.6	147	30.3
Muldraugh	2	33.3	37	63.8	54	50.9	62	67.4	69	43.1	13	29.5	1	50.0	2	11.8	240	49.5
Harrodsburg					4	3.8	4	4.3	4	2.5	2	4.5					14	2.9
Gilbert			2	3.4	1	0.9	1	1.1									4	0.8
St. Louis	2	33.3	2	3.4	4	3.8			31	19.4	12	27.3	1	50.0	1	5.9	53	10.9
Fort Payne									3	1.9					1	5.9	4	0.8
Unidentified			3	5.2	4	3.8	4	4.3	8	5.0	3	6.8			1	5.9	23	4.7
Total	6	100.0	58	100.0	106	100.0	92	100.0	160	100.0	44	100.0	2	100.0	17	100.0	485	100.0

Table 3. Point Type by Raw Material.

	Boyle		Muldraugh		Harrodsburg		Gilbert		St. Louis		Fort Payne		Unidentified		Total	
Type	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Early Archaic																
Kirk Corner Notched	3	25.0	7	58.3			1	8.3	1	8.3					12	100.0
Middle Archaic																
Godar	27	39.7	32	47.1	4	5.9			2	2.9			3	4.4	68	100.0
Late Archaic																
Matanza	9	25.7	21	60.0	2	5.7							3	8.6	35	100.0
McWhinney	1	4.5	18	81.8	1	4.5	1	4.5					1	4.5	22	100.0
Early Woodland																
Adena	3	4.1	43	58.9	2	2.7			18	24.7	3	4.1	4	5.5	73	100.0
Buck Creek	31	64.6	10	20.8					5	10.4			2	4.2	48	100.0
Saratoga	1	4.8	14	66.7	2	9.5			3	14.3			1	4.8	21	100.0
Middle Woodland																
Affinis Synder			2	16.7	2	16.7			5	41.7			3	25.0	12	100.0
Bakers Creek	11	50.0	6	27.3					5	22.7					22	100.0
Fort Ancient/Mississippian																
Madison	12	70.6	2	11.8					1	5.9	1	5.9	1	5.9	17	100.0

While Archaic knappers appear to have been relatively consistent in the selection of Muldraugh over Boyle chert, the Woodland periods are characterized by a greater diversity in lithic resource utilization (Table 3). Three Early Woodland point types are considered. The most common is the Adena type. This Early Woodland subsample clearly indicates that Adena knappers preferred local Muldraugh chert (58.9%) as their primary resource. It is interesting that for the first time nonlocal St. Louis chert (24.7%) was exploited as a secondary resource and that locally available Boyle chert (4.1%) was only marginally used by Adena knappers. In addition to St. Louis chert, other nonlocal/exotic cherts (Fort Payne and unidentified) are also represented, which suggests that Adena peoples were probably involved in extensive trade networks, particularly to the south and west. Mid-sized Saratoga points, which exhibit straight to slightly expanded stems and "snapped" bases, represent a radical departure in hafted biface technology from large contracting stemmed Adena points. Nevertheless, utilization of local and nonlocal resources was similar to Adena. Fully two-thirds of Saratoga points were knapped from Muldraugh chert and nonlocal St. Louis chert was the second most common lithic resource that was utilized. Chert resource preferences as revealed by Adena and Saratoga points contrast strongly with that of Buck Creek points. Nearly two-thirds of the 48 Buck Creek (or Dryroff) points were manufactured from Boyle chert and only one-fifth of these points were knapped from Muldraugh chert. In comparison to Adena points, only a few Buck Creek points were manufactured from nonlocal St. Louis chert.

Whereas Early Woodland point types revealed a significant increase in the use of high-quality St. Louis chert, an even greater exploitation of this nonlocal raw material is indicated by Middle Woodland points. Although sample size is relatively small, St. Louis chert comprises approximately 42% of the Affinis Snyders points, making it the primary resource utilized by Affinis Snyders knappers. In addition to St. Louis chert, other nonlocal and exotic chert types were used to make Affinis Snyders points. If the unidentified (nonlocal/exotic) chert category is combined with St. Louis chert, then two-thirds of Affinis Snyders points were manufactured from chert resources outside the Rolling Fork River drainage basin (Table 3). Of the locally available cherts, Affinis Snyders knappers appear to have utilized Muldraugh and Harrodsburg cherts as secondary resources. In contrast, Bakers Creek points reveal a greater emphasis on local cherts as primary and secondary resources. For example, half of the Bakers Creek points were manufactured from Boyle chert and just over one-quarter was made from Muldraugh chert. A significant percentage (23%) of Bakers Creek points also was made from nonlocal St. Louis chert, although less than Affinis Snyders.

By Late Prehistoric (Fort Ancient/Mississippian) times, a shift to Boyle chert as the primary lithic resource is clearly evident. Over 70% of the small sample of Madison arrow points were made from Boyle chert compared to approximately 12% that were knapped from Muldraugh chert. Besides locally available Boyle and Muldraugh, two nonlocal chert types (St. Louis and Fort Payne) and an unidentified chert resource were used to make Madison points.

A comparison of diachronic chert use in the upper Rolling Fork River Valley with other regional chert studies is difficult due to differences in chert types, resource availability, and projectile point classifications. Some general trends, however, are apparent particularly in regard to the utilization of nonlocal resources. At Carrier Mills, the utilization of nonlocal Cobden (St. Louis) chert was highest in the Middle Woodland period followed by the Late Archaic–Early Woodland and Early Archaic periods; the lowest usage was during Middle Archaic and Late Prehistoric times (Jefferies 1982:1465, 1490). Seeman (1975) and Boisvert (1979) report similar diachronic patterns of Harrison County (St. Louis/Ste. Genevieve) chert use in southern Indiana and northern Kentucky. These results generally match the use of nonlocal St. Louis chert in the upper Rolling Fork area. In regard to the use of local resources, Boisvert (1979:950–951) reports a relatively consistent use of Muldraugh chert as a primary resource from Early Archaic through Early Woodland times in Jefferson County, another pattern found in the chert data from Marion County.

In contrast to the Marion County data, Boyle chert appears to have been the primary resource that was utilized during most prehistoric periods in Garrard County (Schlarb and Lane 1999), and it comprises the majority of Adena points recovered from the Peter Village site in Fayette County and the Wright Mound in Montgomery County (observation of collections curated at University of Kentucky Museum of Anthropology). The differences in chert use, however, are due more to resource availability than resource selection, since Muldraugh chert is scarce in or totally absent from Garrard, Fayette, and Montgomery counties.

HEAT TREATMENT

The practice of heat treating chert in the upper Rolling Fork River Valley changed dramatically through time (Table 4). Sample size is small for the earliest period, but it is probable that Paleoindian knappers rarely if ever intentionally heat treated chert. Intentional thermal alteration of chert appears in the Early Archaic period but it is still a relatively minor practice. The highest occurrence of heat treatment is found in the Middle Archaic period (64.2%) and succeeding Late Archaic period (58.7%). It declines significantly in the Early Woodland period (13.1%) and appears to have been largely abandoned as a practice by the Middle Woodland and Fort Ancient/ Mississippian periods.

Table 4. Heat Treatment by Period.

	Not Heat Treated		Heat Treated		Total	
Period	**N**	**%**	**N**	**%**	**N**	**%**
Paleoindian	5	83.3	1	16.7	6	100.0
Early Archaic	48	82.8	10	17.2	58	100.0
Middle Archaic	38	35.8	68	64.2	106	100.0
Late Archaic	38	41.3	54	58.7	92	100.0
Early Woodland	139	86.9	21	13.1	160	100.0
Middle Woodland	44	100.0			44	100.0
Late Woodland	1	50.0	1	50.0	2	100.0
Fort Ancient/Mississippian	17	100.0			17	100.0
Total	330	68.0	155	32.0	485	100.0

Heat treatment of individual point types (with greater than or equal to 12 specimens) is presented in Table 5. With less than 9% exhibiting evidence of thermal alteration, Kirk Corner notched points in the upper Rolling Fork River Valley apparently were rarely heat treated. Godar appears to have been the most commonly and consistently heat treated point type, and it was uniformly heat treated regardless of chert type. Matanza points were also commonly heat treated, as were McWhinney points. Cook (1976:138–145) also found relatively high incidences of heat treatment among Middle–Late Archaic points (Karnak Stemmed, Matanza, and Godar) from the Koster site. Buck Creek and Saratoga points were thermally altered in relatively small but noticeable quantities, whereas Adena points were rarely heat treated. None of the Affinis Snyders and Bakers Creek dart points or Madison arrow points exhibited evidence of thermal alteration.

Table 5. Heat Treatment by Point Type.

Point Type	Not Heat Treated N	%	Heat Treated N	%	Total N	%
Early Archaic						
Kirk Corner Notched	11	91.7	1	8.3	12	100.0
Middle Archaic						
Godar	13	19.1	55	80.9	68	100.0
Late Archaic						
Matanza	9	25.7	26	74.3	35	100.0
McWhinney	11	50.0	11	50.0	22	100.0
Early Woodland						
Adena	70	95.9	3	4.1	73	100.0
Buck Creek	36	75.0	12	25.0	48	100.0
Saratoga	17	81.0	4	19.0	21	100.0
Middle Woodland						
Affinis Snyder	12	100.0			12	100.0
Bakers Creek	12	100.0			12	100.0
Fort Ancient/Mississippian						
Madison	17	100.0			17	100.0
Total	208	65.0	112	35.0	320	100.0

CHERT PROCUREMENT

Lithic procurement patterns were investigated by analyzing the relict cortical surfaces on initial reduction artifacts such as tested cobbles, cores, decortication flakes, and primary bifaces. Highly patinated and smooth, water-worn cortical surfaces were identified as stream deposited or alluvial chert, whereas angular and grainy cortical surfaces were identified as residual chert. Although all artifacts from the 16 prehistoric sites were examined for relict cortical surfaces, most of the data was derived from nondiagnostic initial reduction artifacts. As a result, the cortical data reveal no diachronic trends in chert procurement.

A total of 242 cortical artifacts was examined and classified by chert and cortex type. Muldraugh and Boyle cortical specimens numbered over 100 each compared to less than 10 cortical artifacts each for St. Louis, Harrodsburg, and Gilbert cherts. The cortical data (Table 6) indicate that the procurement of raw material from various lithic sources differed significantly according to chert type. For example, approximately half of Muldraugh chert was procured from alluvial sources and half was obtained from residual sources, regardless of topographic setting. In contrast, the vast majority of Boyle chert (from upland and bottomland sites) was procured from residual sources. This difference is probably a reflection of resource availability according to source type. As reconnaissance surveys and gravel bar testing in the project area revealed, Boyle chert is readily found in residual deposits wherever the Boyle formation outcrops, but it comprises a relatively minor component (7.6%) of chert cobbles in the Rolling Fork River. Muldraugh chert, on the other hand, occurs as residuum in the uplands surrounding the river valley, and it is the most dominant rock type in gravel bars of the river.

Table 6. Cortical Data

Sites	Muldraugh Chert Resid-ual N %	Muldraugh Chert Alluv-ial N %	Boyle Chert Resid-ual N %	Boyle Chert Alluv-ial N %	St. Louis Chert Resid-ual N %	St. Louis Chert Alluv-ial N %	Harrodsburg Chert Resid-ual N %	Harrodsburg Chert Alluv-ial N %	Gilbert Chert Resid-ual N %	Gilbert Chert Alluv-ial N %
Upland	18 43.9	23 56.1	52 91.2	5 8.8	5 100.0	0 0.0	2 100.0	0 0.0	0 0.0	2 100.0
Bottom-land	37 49.3	38 50.7	40 80.0	10 20.0	4 100.0	0 0.0	3 75.0	1 25.0	1 50.0	1 50.0
Total	55 47.4	61 52.6	92 86.0	15 14.0	9 100.0	0 0.0	5 83.3	1 16.7	1 25.0	3 75.0

Although small in number, cortical artifacts knapped from St. Louis chert (Table 6) suggest that the majority of this high-quality nonlocal chert resource was obtained from residual deposits, possibly from localized quarry contexts. A similar observation that Harrison County (St. Louis/Ste. Genevieve) chert was acquired almost exclusively from primary contexts (i.e., residual or bedrock) was noted by Collins (1979:583) in material from the Longworth-Gick site in Jefferson County.

SUMMARY AND CONCLUSIONS

This project resulted in the first systematic survey, sampling, and characterization of chert resources in Marion County, as well as the first diachronic study of the procurement and use of chert resources in the Rolling Fork River Valley. It is an initial step toward investigating and answering some of the research topics identified in Kentucky's comprehensive state plan for archaeological resources (Pollack 1990). The upper Rolling Fork River Valley is relatively rich in chert resources with four chert-bearing geologic units contributing to local residual and alluvial sources. As a result, there was a plentiful and varied supply of chert resources readily available to prehistoric knappers throughout the project area during all prehistoric periods. The local chert resources, however, vary significantly in quantity. The most attractive resources were Boyle and Muldraugh cherts. Boyle chert generally exhibits the finest texture, and thus highest knapping quality; however, the Boyle formation does not produce a large quantity of chert nor does it outcrop over a wide area. As a result, it tends to occur in localized areas. The Muldraugh formation, on the other hand, produces large quantities of readily available chert, but of slightly lower quality. The Harrodsburg formation also produces chert in sizeable quantities but the vast majority of it is unknappable. Gilbert chert occurs in both poor and good knapping qualities, but it is the scarcest resource in the upper Rolling Fork River Valley.

Based on analyses of 485 diagnostic chert artifacts from the project area, it appears that, overall, Muldraugh chert was the preferred raw material from which projectile points/knives were manufactured from Early Archaic through Early Woodland times (ca. 8,000–200 B.C.). A shift to Boyle chert is evident during the Middle Woodland period and by Late Prehistoric times, Boyle replaced Muldraugh as the primary chert resource that was utilized in the project area. The reason for this Late Prehistoric shift to Boyle chert is still unclear but it may be related to changing technologies (i.e., from bifacial tool production to flake tool production).

Most individual projectile point types in the Rolling Fork collection yielded too few specimens on which to base reliable exploitation patterns. The data from a few point types, produced strong indications of resource preference, whereas others are more subtle. For example, Godar knappers appear to have exploited Muldraugh and Boyle cherts on a nearly equal basis. If the relative quantities of these two chert types are considered, however, the scarcer occurrence of Boyle chert suggests there may have been some Godar selection for Boyle chert over the more readily available Muldraugh chert. On the other hand, Matanza and McWhinney knappers had a clear preference for Muldraugh chert.

Early Woodland points exhibited the greatest differences in chert exploitation. Of the local chert types, Adena and Saratoga knappers focused on Muldraugh to the near exclusion of Boyle. In strong contrast, Buck Creek knappers preferred to utilize Boyle chert as their primary resource. Although some may be tempted to associate contemporaneous long-stemmed points such as Adena and Buck Creek, significant differences in chert exploitation suggest the knappers that produced Adena points were probably unrelated to knappers that made Buck Creek points. Relatively high percentages of nonlocal and exotic raw materials were used to make Middle Woodland points. In regard to local chert resources, however, Boyle chert appears to have been the favorite among knappers of Bakers Creek points. Boyle chert was also the clear preference among Late Prehistoric knappers that produced Madison arrow points.

Little can be said about the remaining two local resources, Harrodsburg and Gilbert cherts, except that they were minimally exploited and that they served as tertiary and/or incidental resources throughout prehistory. The limited exploitation of Harrodsburg and Gilbert cherts reflects their poor knapping quality and their scarcity within the project area.

Diagnostic artifacts made from nonlocal St. Louis chert were identified in all time periods except the Late Archaic. Although it generally occurs in relatively small quantities during much of prehistory in the upper Rolling Fork River Valley, this fine-grained, high-quality chert became a very important commodity during Early Woodland and Middle Woodland times. The highest exploitation of this nonlocal chert appears to have been by knappers who manufactured Affinis Snyders points. St. Louis chert also was very important to knappers of Adena and Bakers Creek points. Several investigators (Hofman and Morrow 1984; Jefferies 1982; May 1980; McNerney 1975; Morrow et al. 1992; Winters 1984) have noted the importance of high quality, bluish-gray St. Louis chert to Middle Woodland groups located in southern Illinois and in the general vicinity of the lower Ohio River Valley. The relatively large percentage of Early and Middle Woodland point types, in the upper Rolling Fork River Valley, that were made from nonlocal St. Louis chert (tables 2-3) may reflect participation in Early-Middle Woodland exchange networks and socioeconomic ties between the central Knobs region and the Mississippian Plateau region to the west and northwest. Although the exact source(s) of the bluish-gray St. Louis chert that was imported into the project area is unclear, relict cortical surfaces indicate that most of it was obtained from residual (possibly quarry) sources and that at least some of it arrived in nodular form.

Determining what factors were responsible for the diachronic shifts in the exploitation of local chert resources is beyond the scope of this paper. Possible factors, however, include resource availability (localized or widespread across the landscape), variable quantities (abundant or scarce), variable knapping qualities (good versus poor), variability in raw material morphology (size and shape of raw material), changing lithic technologies (from biface tool production to flake tool production), and the practice of heat treating chert (present or absent). The specific reasons for different patterns of procurement and use of nonlocal resources through time are also unclear, but they may be related to changing mobility patterns and/or the establishment and maintenance of socioeconomic exchange networks. Future studies on chert artifacts from the upper Rolling Fork River Valley could help elucidate some of the factors that were responsible for determining differential chert resource selection, procurement, and use.

Diagnostic chert artifacts from the project area revealed significant diachronic shifts in the practice of thermal alteration. Heat treatment apparently was rarely practiced by Paleoindian and Early

Archaic knappers. The highest occurrence of heat treatment is found in the Middle Archaic and Late Archaic periods, especially among Godar, Matanza, and McWhinney points. The practice of thermal alteration declines significantly during the Early Woodland period and varies widely between point types. Very few Adena points were ever heat treated, whereas one–fifth and one–quarter of Saratoga and Buck Creek points, respectively, were thermally altered. By Middle Woodland and Late Prehistoric times, knappers appear to have largely abandoned the practice of heat treating chert. Analysis of cortical artifacts indicated that the sources from which the primary chert resources (i.e., Boyle and Muldraugh) were procured differed significantly. The data reveal that Boyle chert was procured predominantly from residual sources, whereas Muldraugh chert appears to have been procured roughly equally from residual and alluvial sources.

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THE WATKINS SITE (15LO12) REVISITED: PREVIOUS RESEARCH, NEW INTERPRETATIONS, AND RECENT ARTIFACT ANALYSIS

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ABSTRACT

The Watkins site (15Lo12) is a multicomponent Archaic-Woodland-Mississippian site in Logan County with two conical mounds and a habitation area. Between the 1960s and 1980s, research related to the site involved amateur excavations of Mound A that uncovered 48 graves of Woodland-Mississippian affiliation, an anthropometric study of Mound A skeletal remains, and trench excavations in the habitation area that exposed the remains of an alleged Middle Woodland rectangular wall-trench feature. The purposes of this paper are to disseminate information about the previous work at the site, which is largely unpublished, to suggest new interpretations about the site based on prior research, and to present the results of a recent analysis of artifacts previously recovered from the habitation area. Based on earlier work at the site coupled with the recent artifact analysis, it is suggested that: Mound A burials may be divided into two zones (more elaborate Middle Woodland Zone I and less elaborate late Middle Woodland to Mississippian Zone II); that variation in mortuary treatment within Mound A burials is due to temporal and social (sexual division of labor, achieved status) factors; that sexual dimorphism in skeletal remains may reflect sexual division of labor; and that the inhabitants of the Watkins site used predominantly small, locally available raw materials for the manufacture of lithic tools.

INTRODUCTION

The Watkins site (15Lo12) is a multicomponent Archaic-Woodland-Mississippian site in Logan County. The two conical mounds and habitation area that comprise the site are located at 570 to 580 m above sea level near a bend in Clear Fork Creek, which empties into the Gasper River about 3 km to the north (Figure 1). Mound A, the larger of the two mounds, currently measures 22 by 15.5 m with the long axis oriented northeast-southwest. It is approximately 1.5 m high. About 62 m southwest of Mound A is a smaller mound, Mound B, which measures approximately 18.6 by 15 m by about 1 m high. A habitation area is present to the east of the mounds. All areas of the site have been impacted by agricultural activity, and Mound B, though never excavated, has a gas line running through it.

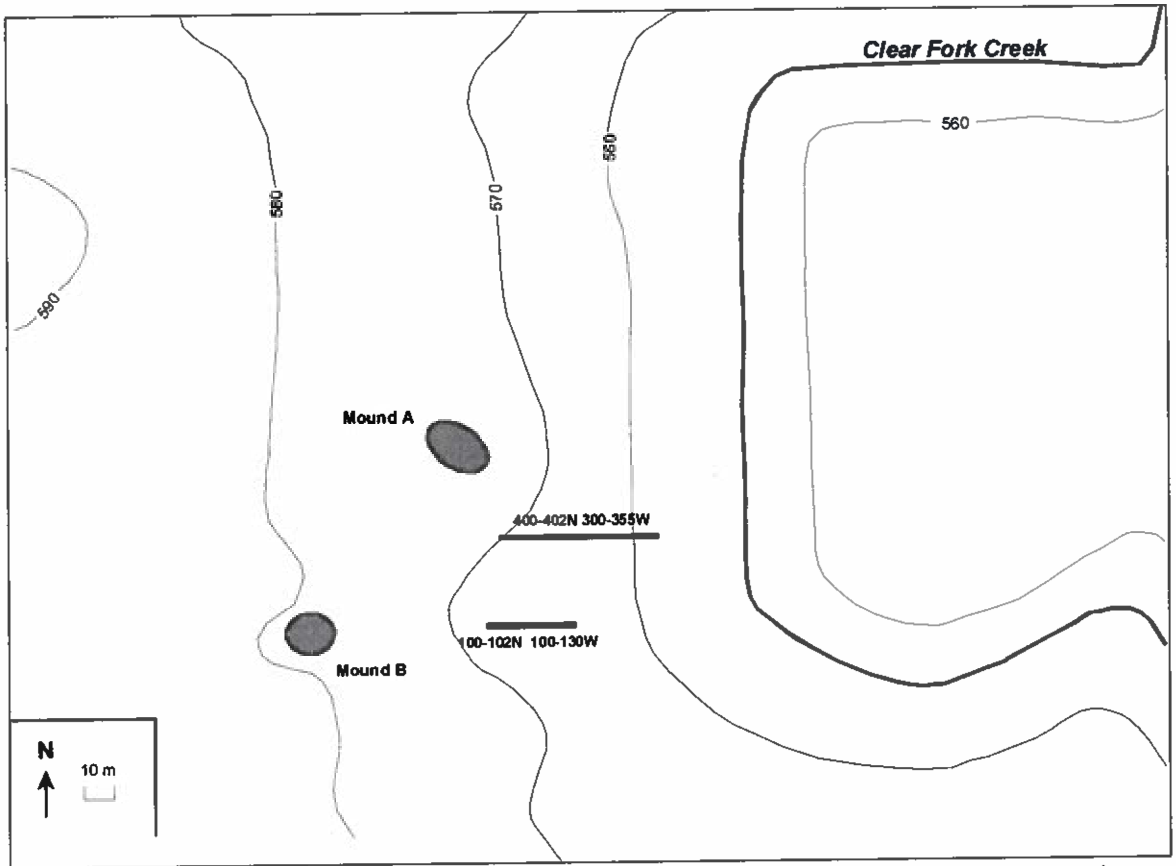

Figure 1. Map of Watkins Site Showing Two Burial Mounds and Approximate Locations of Two Excavation Trenches.

Between the 1960s and 1980s, several research projects were conducted at the site or with site collections. Amateur excavations of Mound A in the late 1960s uncovered 48 graves; the researchers concluded that Mound A represents a predominant Middle Woodland component and provides perhaps the earliest evidence of stone box graves in the area. An anthropometric study of some of the skeletal remains was completed by Lloyd Chapman in the early 1970s, providing information about age, sex, osteometrics, and pathologies for 23 individuals. Work at the site resumed in the late 1970s and 1980s when Jack Schock excavated three trenches in the habitation area, exposing one four-sided wall-trench feature that was assigned to the Middle Woodland component.

The purpose of this paper is three-fold. Because none of the previous studies have been published in a format that is easily accessible to the archaeological community, one goal of this paper is to disseminate information about these projects based on documentation currently curated at the Western Kentucky University Anthropology Laboratory. To this end, site maps, tables of burial and feature data, and artifact inventories are included in this report. A second goal is to use the previous research to suggest new interpretations about the site in terms of mortuary treatment, osteometric evidence of sexual dimorphism, and the age of the wall-trench feature. The third goal is to present the results of a recent analysis of over 20,000 artifacts, mostly lithics, from the habitation area.

PREVIOUS RESEARCH AT THE WATKINS SITE

MOUND A EXCAVATIONS

Archaeological investigations at the Watkins site began in the 1960s with the excavation of prehistoric graves in Mound A. Upon discovering evidence of looting that "destroyed the central portion of [Mound A]" at the Watkins site, the landowner requested that the Southern Kentucky Chapter of the Tennessee Archaeological Society conduct excavations in Mound A (Ray n.d.:1). The work was done between 1965 and 1970 under the supervision of H. Stanley Ray, chapter president.

After sketching and photographing Mound A and establishing spatial controls, a test trench designed to document the mound's stratigraphic profile was dug along the base line. Finding no internal stratigraphy, workers excavated the mound in 1.5 m squares taken down in unspecified levels to sterile subsoil or an arbitrary depth (usually 1.2 m). "All graves and features were left in position and exposed throughout the [excavation]. A heavy plastic covering was placed over the mound during weekdays. Measurements and observations were made before the burials were removed" (Ray n.d.:9). Ray (n.d.) did not indicate if excavated sediments were screened.

Forty-eight burials were exposed and documented, and the skeletons in fair condition were collected. Only burials numbered 1 to 36 are described in Ray's (n.d.) unpublished report of investigations; the remaining 12 burials are documented by field forms and photographs. Burials 1-33 (including 18A and 30A) were excavated in 1965, burials 34-36 and 43 in 1966, burials 50 and 51 in 1967, burials 52(1), 52(2), 53, 54, 55(1) and 55(2) in 1968, and Burial 56 in 1970. The burial plan view in Figure 2 is reconstructed from original field forms, but not all burials could be spatially placed in the mound due to insufficient data. Table 1 summarizes data for the Mound A burials as best can be reconstructed from field forms, photographs, and the report manuscript; more detailed tabulations may be obtained from the author.

Of the 48 excavated burials, 31 (64.6%) were in-flesh inhumations, four (8.3%) were cremations, three (6.3%) were bundle burials, and 10 (20.8%) are unspecified or ambiguously reported. Thirty-one (64.6%) of the bodies were placed in complete or partial stone box graves, four (8.3%) in pits with one-two limestone slabs and/or a limestone cap rock, nine (18.8%) in pit graves, and four (8.3%) in unspecified graves. Twenty-nine of the 31 (93.5%) in-flesh inhumations are extended while two (6.5%) are semiflexed. Six (12.5%) graves contained the remains of infants and subadults and 35 (72.9%) contained adults; the remaining seven (14.6%) individuals could not be aged or were ambiguously reported. In terms of sex determinations, 23 (47.9%) could not be sexed, 13 (27.1%) are female, and 12 (25.0%) are male.

While a formal osteological study was not conducted, anecdotal notes about stature, teeth condition, and pathologies were recorded by Ray (n.d.) and the other excavators during the course of investigation of Mound A. Estimated heights of six adult males and two adult females ranged from 1.22 to 1.73 m. Notable tooth wear and decay was documented for adults as young as 20-30 years and up to over 70 years (burials 21, 28, 30, 33, and 36); however, the teeth of some adults (burials 17, 23, and 27) were in good condition. Skull and vertebral deformation was noted for three individuals (burials 3, 6, and 19), but the excavators were unsure whether the deformation was ante-mortem or post-mortem. An adult male (Burial 18) had a Bakers Creek point embedded in the right humerus and an untyped Woodland biface in the vicinity of the vertebral column. A healed break of the tibia or fibula was noted for one adult male (Burial 50).

Table 1. Summary of Burial Data for Mound A at the Watkins Site.

Burial	Sex	Age (years)	Pattern	Crypt	Grave Items
1	unknown	infant, 1-4	reburial, bundle	stone box	absent
2	unknown	adult	cremated, secondary	pit	absent
3	female	adult, 35-44	fully extended	pit	present
4	unknown	adult	cremated	pit w/ slabs	absent
5	unknown	adult	cremated?	stone box	absent
6	female	adult, 20-30	fully extended	stone box	present
7	unknown	adult	extended? cremated?	stone box	absent
8	male	adult, 20-30	fully extended	stone box	present
9	female	adult, 31+	fully extended	stone box	present
10	male	adult, 26+	fully extended	Stone box	present
11	unknown	infant, 1-4	extended	Stone box	present
12	unknown	adult	semi-flexed, cremation	Stone box	present
13	male	adult, 30-40	fully extended	Stone box	present
14	male	Adult	semi-flexed	pit w/slabs	present
15	female	adult*	bundle	Pit	present
16	unknown	Unknown	not indicated	Stone box	present
17	female	adult, 31+	fully extended	stone box	present
18	male	adult, 23+	fully extended	stone box	present
19	female	adult, 23+	fully extended	stone box	present
20	unknown	adult	fully extended	stone box	present
21	female	adult, 30-40	fully extended	pit	present
22	unknown	child	extended	pit	absent
23	female	adult, 30-40	fully extended	stone box	present
24	male	adult	fully extended	not indicated	present
25	female	adult	fully extended	not indicated	present
26	female	adult	fully extended	stone box	present
27	male	adult, 28+	fully extended	stone box	present
28	male	adult	fully extended	stone box	present
29	male	adult	fully extended	pit	present
30	male	adult, 40+	fully extended	stone box	present
31	unknown	adult	not indicated	in Burial 29	present
32	female	adult, 30	bundle	pit w/ slabs	present
33	female	adult, 20-30	semi-flexed	stone box	present
34	unknown	adult	fully extended	pit	present
35	unknown	adult	extended?	pit w/slab	absent
43	unknown	unknown	fully extended	not indicated	not indicated
50	male	adult, 30-40	fully extended	stone box	present
51	unknown	unknown	not indicated	stone box	present
53	unknown	unknown	not indicated	stone box	present
54	unknown	unknown	not indicated	stone box	present
56	unknown	child, 1-3	fully extended	stone box	present
18A	unknown	infant, 1.5	not indicated	not indicated	not indicated
30A	unknown	child	not indicated	in Burial 30	absent
36(42)	male	adult, 70+	fully extended	pit	present
52(1)	unknown	adult	not indicated	stone box	present
52(2)	unknown	adult	not indicated	stone box	present
55(1)	female	adult, 40s	fully extended	stone box	present
55(2)	unknown	unknown	extended?	stone box	present

Data compiled from Ray (n.d.), Chapman (1972), Hoffman (1997), SKC TAA field notes

* cranium is adult, but field notes indicate Burial 15 was child under 6 years

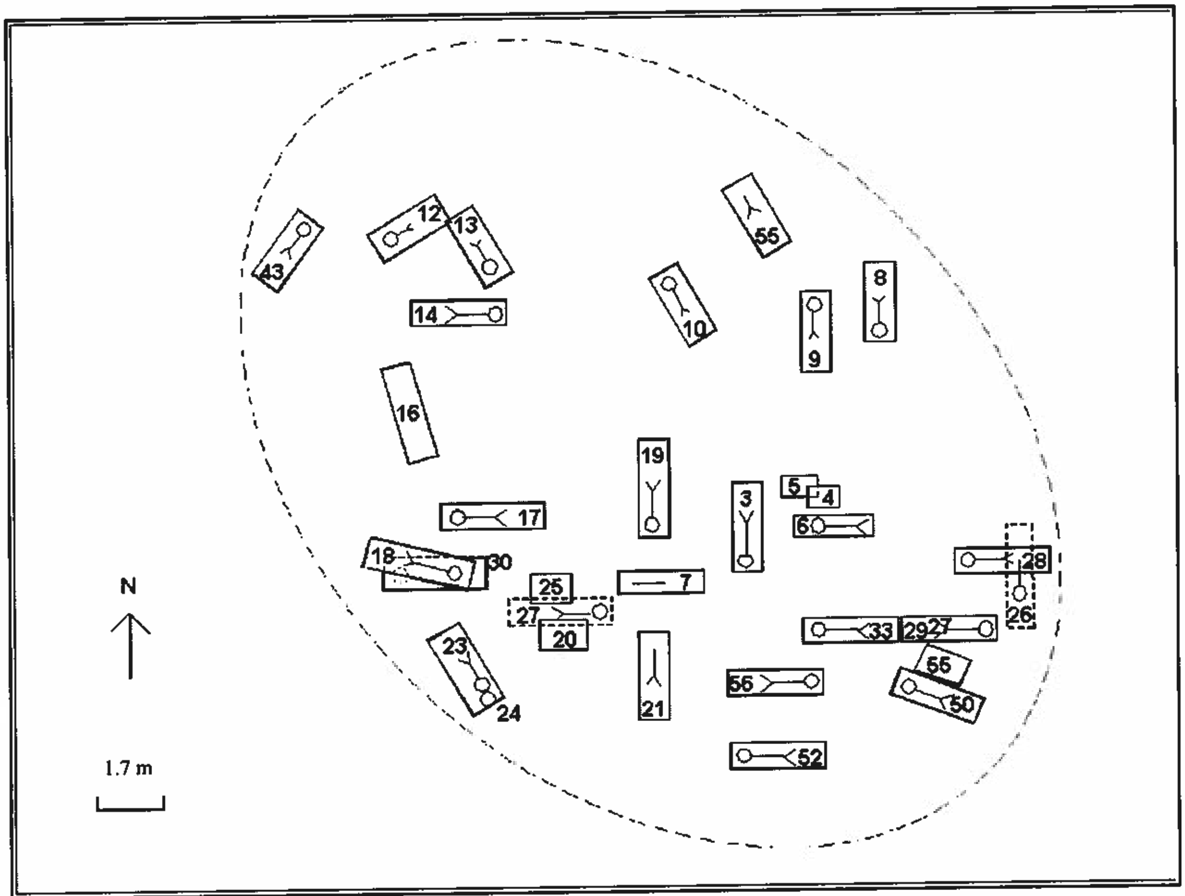

Figure 2. Planview of Burials in Mound A.

A variety of artifacts were recovered from the Mound A burials: lithic tools and cores, pottery, charcoal, periwinkle shell, turtle and other shell, worked and unworked animal bone, a copper artifact, and mica. Ray (n.d.) did not distinguish between artifacts that were intentionally placed with the bodies versus those that were part of the burial fill.[1] The 15 hafted bifaces recovered from graves were typed by archaeologists from the Alabama Archaeological Society and include Kirk Corner Notched, Big Sandy, Copena, Motley, and Bakers Creek. Metric lengths, widths, and thicknesses of the hafted bifaces are provided by Ray (n.d.). Pottery was sent to the University of Tennessee for identification; most sherds are limestone tempered and have plain or cordmarked exterior surfaces. Identified ceramic types include Candy Creek Cordmarked and Mulberry Creek Plain. One limestone tempered, tetrapodal, decorated vessel was found in Burial 12.

Ray (n.d.) assigned some of the burials to one of three zones according to their depth, associated artifacts, and type of grave. The oldest Zone I burials (3, 6, 8, 9, 12, 14, 17, 19, 26, 27, and 33) have grave items, are associated with well-made stone crypts, and occur at the lowest levels of the mound. Burials 10, 18, 21, 23, 24, and 30 assigned to Zone II are associated with more poorly constructed stone crypts and have few grave items. The simplest graves, which occur just below the surface in Zone III and include burials 13, 28, and 29, lack stone elements and are described by Ray (n.d.:26, 37) as "simple." Ray contended that burials 8, 14, and 30 represent interments of the most important individuals, chiefs and subchiefs. Finally, based on artifactual remains like diagnostic lithics and pottery as well as mica and copper, Ray (n.d.:44-45) suggested that Mound A represents an Early-Middle-Late Woodland "Burial Complex" with "mostly a Hopewellian type focus" but also a "Mississippian influence in the upper levels."

Ray (n.d.) identified several nongrave features during the course of excavations. Within Mound A, two fire pits and a small hearth or remains of a funerary meal were documented. Postmolds were found to the northwest of the mound; some formed a double-post pattern, which was interpreted as evidence of a "hut site" in the habitation area. These off-mound excavations were to be described in part two of the site report, which was never written.

While some of the artifactual and skeletal material excavated by Ray and associates is currently unaccounted for, other materials were presented to the landowner or were donated to one of several facilities including the Russellville Public Library, Western Kentucky University, the Children's Museum in Nashville, and the University of Kentucky. Donations to the latter included a skeletal collection representing 23 individuals from Watkins Mound A; this material became the focus of the second research project related to the Watkins site.

OSTEOLOGICAL ANALYSIS

An osteological study of Watkins Mound A skeletal material was conducted by Lloyd Chapman (1972), while a University of Kentucky undergraduate. The sample consisted of 23 individuals that had been donated by the Southern Kentucky Chapter of the Tennessee Archaeological Society to the University of Kentucky: Burials 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 18A, 19, 21, 23, 24, 27, 28, 30, 42, and 50. The state of the remains that Chapman worked with varied considerably due to differential preservation and postdepositional disturbances. Because the amateur excavators stored skulls separately from postcranial remains, some skulls were misplaced and are lacking from several individuals in the University of Kentucky collection. Hence, Chapman's cranial measurements were limited to five individuals. Chapman determined age and sex, recorded anthropometric data, and assessed pathologies.

Chapman (1972) determined that of the 23 individuals, 10 are males, five are females, and eight are too fragmentary to sex. Based on epiphyseal union, pubic symphysis morphology, and tooth eruption, Chapman determined that 18 of the 23 individuals are adults, three are subadults, and two could not be aged. According to Chapman, none of the individuals were between seven and 18 years old. These data are included in Table 1.

Chapman made a number of biometric measurements of adult limb bones, pelves, and skulls. Measurements include limb bone length, maximum diameter of limb bone at midshaft, humerus and femur head maximum diameter, iliac breadth, ischium length, cranial length and breadth, nasal height, palate breadth, and mandible length. In total, Chapman recorded data for over 50 metric traits for those skeletal elements that were adequately preserved.

Finally, Chapman noted pathologies and anomalies in five individuals, all males. Three (burials 13, 18, and 27) exhibit vertebral lesions, which Chapman (1972:25) attributed to male-oriented activities causing "strain on the back that pulled the intervertebral disc away from the vertebral body." Fused vertebrae were noted in two individuals (burials 27 and 30). One adult male (Burial 30) exhibited skeletal changes associated with osteoarthritis and osteophytosis. Tooth pearls and a bony growth in the maxillary sinus were documented on one individual (Burial 50). As was noted by Ray (n.d.), the right humerus of the adult male associated with Burial 18 was split longitudinally by a projectile point, which was found embedded in the bone at the time of excavation.

HABITATION AREA

Shifting from the burial mound to the habitation area to the east of the mounds, the third research project associated with the Watkins site encompassed field schools conducted in 1977, 1987, and 1989 by Jack Schock of Western Kentucky University. Schock excavated three trenches to subsoil, uncovering prehistoric features and recovering artifacts. Planviews of the trenches (figures 3 and 4), feature descriptions (Table 2), and excavation descriptions (below) are reconstructed using student field notes currently curated at the Western Kentucky University Anthropology Laboratory.

Trench 400-402N 300-355W, which is the closest of the three trenches to Mound A, was excavated in 1987 (Figure 3). Four unspecified pits (including two that were assigned a number, features 3 and 4) that contained lithics, faunal remains, acorn, and pottery were identified below the plowzone (Table 2). Feature 4 contained limestone tempered pottery. Another possible pit feature was located in this trench, as were two possible postmolds (features 1 and 2); no artifacts were recovered from the possible postmolds and students did not record in their field notes if any artifacts were recovered from the possible pit feature (Table 2).

Trench 100-105N 170-240E was excavated in 1977 (Figure 4). Four features that were assigned numbers as well as 17 probable or possible postmolds were encountered. Features 1 and 2 were hearths or unspecified pits, while features 3 and 4 were interpreted as wall-trenches. The distance between the wall-trenches was about 25 m, and no attempt was made to associate the two as part of the same structure. Feature 1 contained a Mississippian triangular biface, other lithics, pottery, faunal remains and charcoal. Feature 2 yielded pottery, fire-altered rock and faunal remains, and Feature 4 contained lithics and faunal remains. Feature 3 was devoid of artifacts (Table 2).

Trench 100-102N 100-130W was excavated in 1989 (Figure 4). One of the features found in this trench was a rectangular wall-trench structure with open corners and corner posts (Figure 4). This structure measured approximately 7.5 x 9.5 m for an area of 71 m^2. Features 14 and 16, respectively, correspond to the western and eastern wall trenches of the structure. Feature 14 was 8.5 m long and 12-20 cm wide and yielded, among other artifacts, Middle Woodland simple stamped, limestone tempered pottery. Feature 16 had a length of 8.5 m and a width of 12-20 cm. It yielded limestone tempered pottery, a Bakers Creek biface, and other artifacts (Table 2). Based on the diagnostics and the assumed association with Middle Woodland burials in Mound A, the structure was interpreted as the earliest evidence of a rectangular structure in southcentral Kentucky.

Other features in this excavation trench include four pits or hearths (features 11, 12, 17 and 22), one stratified fire pit (Feature 15), three numbered postmolds (features 14A, 21, and 23), and three unnumbered postmolds (Figure 4). Most features contained some combination of lithics, pottery, faunal remains, and charcoal. Limestone tempered pottery was recovered from features 11, 12, 14A, 15, 17, and 22, and an Adena or Robbins biface was found in Feature 15 (Table 2).

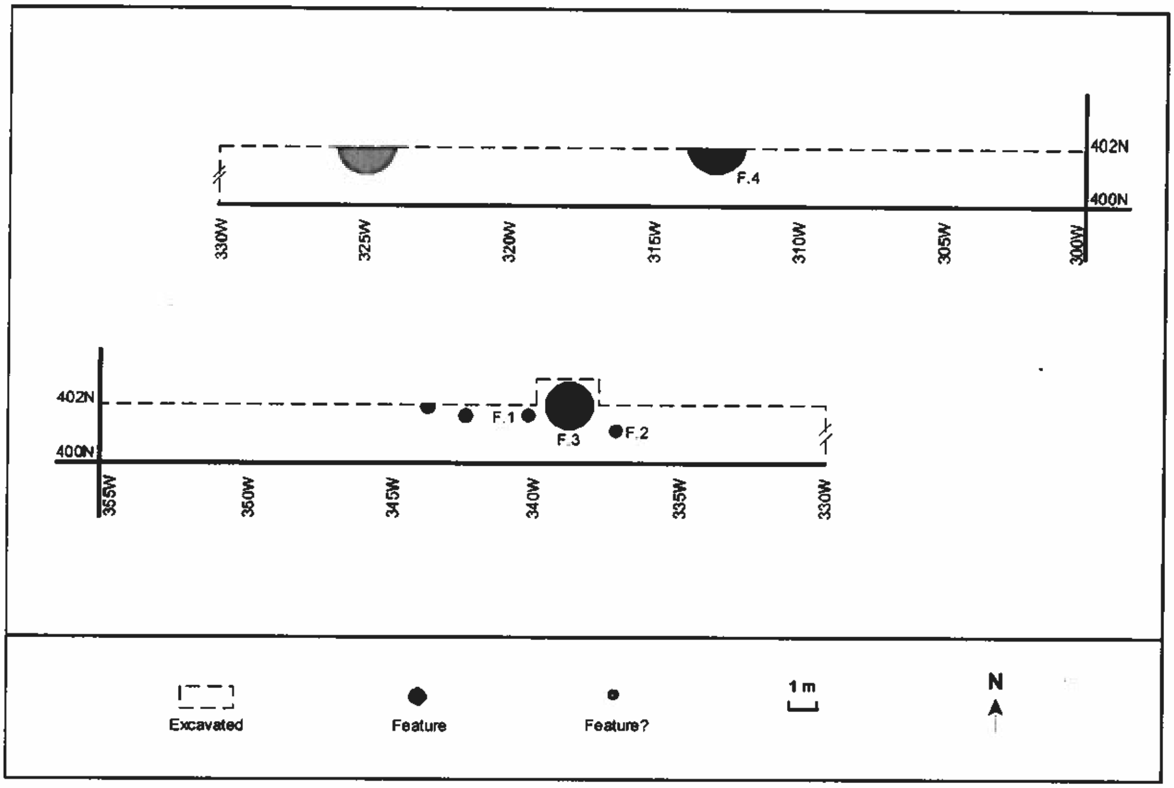

Figure 3. 400N Excavation Trench and Prehistoric Features.

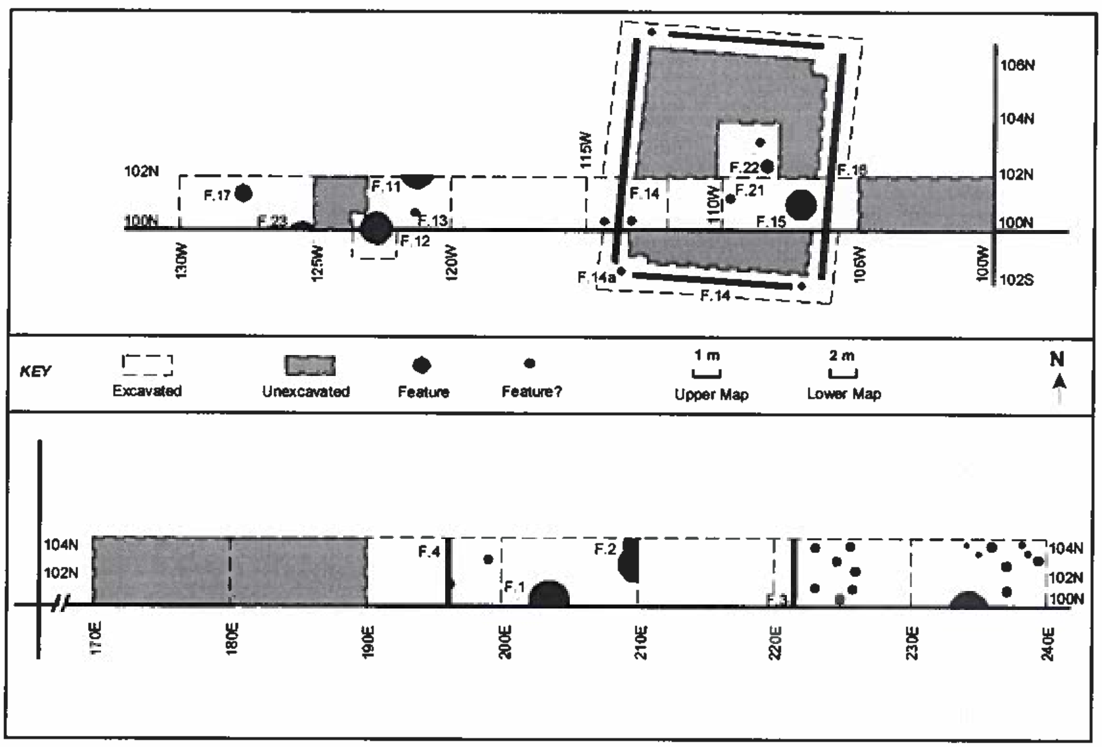

Figure 4. 100N Excavation Trenches and Prehistoric Features.

Table 2. Features Excavated in the Habitation Area of the Watkins Site. Data from Student Field Notes.

Feature	Function	Dimensions (cm)	Diagnostics	Other Artifacts
Trench 100-102N 100-130W				
11	Fire pit	30 x 20 x 32	Limestone tempered pottery	Charcoal, burned and unburned bone, clay nodules, flint
12	Refuse receptacle or trash pit	40 x 25 x 25	Limestone tempered cordmarked pottery	Bone, flint
13	-	-	-	Flakes and bone fragments
14	Wall-trench (west wall)	8.5 m x 12-20	Limestone tempered cordmarked pottery, unidentified point	Bone, flint
14A	Postmold	-	Limestone tempered pottery	Flint, turtle shell, bone
15	Fire pit or cistern	104 x 83 x 92	Adena or Robbins biface, limestone tempered pottery	Stone pestle, turtle and other shell, bone, nut shell (walnut), flint, clay nodules, ash, charcoal, burned limestone
16	Wall-trench (east wall)	8.45 m x 12-20	Limestone tempered pottery, Bakers Creek point	Charcoal, flint, bone, burned limestone, clay nodules
17	Related to cooking?	Approximately 40 x 25 x 25	Limestone tempered pottery	Flint
21	Postmold	18 x 18 x ?	Unidentified point	Bone, burned limestone, gravel, flint
22	Pit, unspecified	20 x 25 x 30-40	Limestone tempered cordmarked pottery, unidentified point	Flint, daub, burned limestone, bone
23	Postmold	14 x 15.5 x 25	-	Bone, flint, rocks around perimeter
Trench 100-102N 170-240E				
1	Hearth or pit	-	Mississippian triangular point	Flint, pottery, bone, charcoal, fire-altered rock
2	Hearth or pit	-	-	Pottery, fire-altered rock, bone
3	Wall-trench	-	-	-
4	Wall-trench	-	-	Bone, flint
Trench 400-402N 300-355W				
1	Postmold	-	-	-
2	Postmold	-	-	-
3	Pit, unspecified	-	-	Flint flakes, burned limestone, pottery, bone, acorn
4	Pit, unspecified	-	Limestone tempered pottery	Flint flakes, burned limestone, bone, pottery, charred acorn

NEW INTERPRETATIONS OF PREVIOUS RESEARCH

In this section, the results of previous research at the Watkins site are reexamined and new interpretations about the site in terms of mortuary treatment, osteometric evidence of sexual dimorphism, and the age of the wall-trench structure are posited. Interpretations of mortuary treatment and osteometric evidence presented in this paper may be evaluated with data from sites similar to Watkins in terms of location, function, and period of habitation. The age of the wall-trench structure may be evaluated through more work at the Watkins site, as previous investigations points to the likelihood that additional structures are present at this site.

MORTUARY TREATMENT

Based on a reexamination of the distribution of burials from Mound A, their construction, and the types of artifacts contained therein, some revisions of Ray's (n.d.) assignment of burials by zone can be suggested (Table 3). While Ray assigned only 20 burials to zones, the author was able to associate 46 of the 48 burials with a zone. Identification of two rather than three zones of burials seems warranted since the burials Ray assigned to zones II and III are similar in terms of chronologically diagnostic artifacts and burial patterns. Assuming that burials within an individual zone are associated and represent some relative temporal interval of mound use, the assignment of burials to a zone is important for subdividing the interments into chronological units before intrazonal and interzonal comparisons of mortuary treatment are made.

Zone I includes 28 burials that were found approximately 91 cm below the mound surface: 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 14, 15, 17, 19, 20, 22, 23, 24, 26, 27, 30, 30A, 32, 33, 34, 50, 52(1), and 55(1). With two exceptions, the depth of the base of these graves ranged from 71 to 122 cm below the surface.[2] Of the Zone I burials, 20 (71.4%) are interred in stone box graves, five (17.9%) in pits, two (7.4%) in pits with stone slabs or cap rocks, and one (3.6%) in unspecified graves.

Table 3 summarizes the artifactual remains found in Zone I burials. Twenty-four (85.7%) of the 28 Zone I graves contained some kind of artifact, and 21 (75.0%) yielded at least one of the 28 types of noteworthy[3] grave items: body placement on stone slabs, periwinkle sprinkled over the body, charcoal from fires over the body, red ochre, nine types of lithic tools, mica, pottery vessels or pipes, seven types of bone tools, three types of shell tools, a breast plate, or copper (Table 3). Almost half (n=13 or 46.4%) of the Zone I burials contained three or more of the noteworthy grave items; of these, 11 are stone box graves. Zone I burials contained a diverse range of grave items; of the 40 types of grave items documented at the site, Zone I burials contained 36 (90.0%) types. The greatest diversity of grave items for an individual burial is 42.5% (17 of 40 types of grave items) for Burial 30. All (100.0%) of the 28 types of noteworthy grave items are associated with Zone I burials.

Diagnostic artifacts recovered from Zone I burials include limestone tempered pottery sherds, some of which (e.g., burials 8 and 33) may have been associated with the bodies based on field sketches, a tetrapod ceramic vessel incised with a bird motif, an Adena point, a quartz Motley point, a Bakers Creek point, an unspecified Woodland point, two unspecified triangular points, bladelets, mica, and copper. Based on these artifacts, it is probable that Zone I burials are Middle Woodland in age.

Table 3. Grave Items from Watkins Site: Mound A Burials Sorted by Sex.

				Noteworthy Grave Items													Other Grave Items								
Burial Number	Bottom depth (cm)	Sex	Age	Body on stone slabs	Periwinkle	Charcoal over body	Red ochre	Chipped stone tools	Groundstone tools	Mica	Pottery vessel	Pottery pipe	Bone tools	Bone ornaments	Worked shell	"Breast plate"	Copper	Unworked lithic	Burned limestone	Pottery sherd	Fired clay	Unworked bone	Unworked shell	Charred plant mat'l	Ash
Zone I Burials (n=28)																									
8	102	M	A	x	x	x		x						x					x	x	x	x		x	
10	71	M	A	x	x	x	x	x												x		x			
14	122	M	A	x	x			x		x			x		x					x		x	x	x	
24	?	M	A		x	x		x							x				x			x			
27	112	M	A	x	x?	x		x								x		x				x			
30	89	M	A		x			x	x			x	x		x		x			x		x	x	x	
50	74	M	A		x			x										x		x		x		x	
3	110	F	A		x			x					x							x		x			
6	102	F	A										x							x		x		x	
9	122	F	A	x	x			x					x							x			x	x	
15	91	F	A		x																				
17	79	F	A	x	x		x	x							x					x		x	x	x	
19	103	F	A		x	x	x			x	x		x							x		x			x
23	71	F	A	x	x	x		x												x		x			
26	99	F	A		x																			x	
32	89	F	A		x?		x														x		x		x
33	84	F	A										x							x		x		x	
55(1)	76	F	A																					x	
1	91	?	I																						
2	76	?	A																						
5	110	?	A																						
11	81	?	I		x	x	x															x			
12	109	?	A	x	x		x	x			x							x						x	
20	84	?	A		x			x												x		x	x	x	
22	97	?	SA																						
30A	89	?	I																						
34	76	?	A															x		x				x	
52(1)	38	?	A		x																	x		x	
Zone II Burials (n=18)																									
13	23	M	A	x		x						x								x			x		
18	58	M	A					x										x	x	x	x			x	
28	36	M	A		x			x												x		x		x	
29	53	M	A		x															x				x	
36	41	M	A	x				x												x				x	
21	51*	F	A			x																			
4	20	?	A	x																					
7	36	?	A																						
16	10	?	?		x	x														x		x			
18A	?	?	I																						
31	?	?	A					x														x		x	
35	46*	?	A																						
43	56	?	?																						
51	<30	?	?		x			x												x		x		x	
53	23*	?	?		x			x																x	
54	46*	?	?																					x	
55(2)	64	?	?		x																			x	
56	61	?	I					x																x	

Table 3. Continued.

				Noteworthy Grave Items													Other Grave Items								
Burial Number	Bottom depth (cm)	Sex	Age	Body on stone slabs	Periwinkle	Charcoal over body	Red ochre	Chipped stone tools	Groundstone tools	Mica	Pottery vessel	Pottery pipe	Bone tools	Bone ornaments	Worked shell	"Breast plate"	Copper	Unworked lithic	Burned limestone	Pottery sherd	Fired clay	Unworked bone	Unworked shell	Charred plant mat'l	Ash
Unknown Zone Burials (n=2)																									
25	?	F	A		x																	x			
52(2)	?	?	A		x																	x		x	
A = adult, I = infant, SA = subadult, M = male, F = female																									
*depth is to cap rock																									

Of the 28 Zone I burials, seven (25.0%) are males, 11 (39.3%) are females, and 10 (35.7%) are of undetermined sex. While sample sizes are small, visual examination of the artifacts found with Zone I adult males and females (n=18) shows possible sex-based differences (Table 3). There is a greater diversity of lithic tool types in male burials at 2.3 types/burial in contrast with female burials at 0.6 types/burial. About 57.1% of male burials have lithic bifaces, in contrast to 27.3% of female graves. All of the male burials contained unworked animal bone, whereas 63.6% of the female burials yielded unworked faunal remains. Charcoal over the body is observed in 57.1% of the male graves, as opposed to 18.2% of the female graves. Only male burials yielded copper, groundstone celts and adzes, chipped stone and bone scrapers, bone bracelets or gorgets, and ceramic pipes, whereas only female burials contained pottery vessels. There is a higher percentage of female burials (45.5%) with bone awls and needles compared to male burials (28.6%). Might these differences in grave items reflect sex-based division of labor? In contrast with these dissimilarities between adult male and female burials in Zone I, males and females were interred in stone box graves in similar proportions (72.0% of each sample).

Twenty-four (85.7%) of the 28 Zone I interments are adults, one (3.6%) is a subadult, and three (10.7%) are infants. While similar proportions of adults (70.8%) and nonadults (75.0%) were buried in stone box graves, there appear to be differences in the artifacts found with adults, subadults, and infants[4] (Table 4). About 92.0% of the adult burials have one or more types of grave items, including several types of manufactured artifacts, in contrast with one (25.0%) of the nonadults. Items found in the infant graves, which may be grave goods or part of the grave fill, are raw materials and unworked artifacts (periwinkle, red ochre, charcoal, and animal bone). Though the sample sizes are small, these data suggest that during the Middle Woodland period social status within the Watkins community may have been achieved rather than ascribed.

As there was nothing about the depths of, or grave items and chronological diagnostic artifacts associated with, the remaining 18 burials that justifies their subdivision, all were assigned to Zone II: 4, 7, 13, 16, 18, 18A, 21, 28, 29, 31, 35, 36, 43, 51, 53, 54, 55(2), and 56 (Table 3). Grave depths in Zone II range from 10 to 64 cm and average 41 cm.[5] Ten (55.6%) of the Zone II burials are stone box graves, four (22.2%) are pits, two (11.1%) are pits with cap or side rocks, and two (11.1%) are unspecified types.

Table 4. Grave Items from Watkins Site: Mound A Burials Sorted by Age.

				Noteworthy Grave Items														Other Grave Items							
Burial Number	Bottom depth (cm)	Sex	Age	Body on stone slabs	Periwinkle	Charcoal over body	Red ochre	Chipped stone tools	Groundstone tools	Mica	Pottery vessel	Pottery pipe	Bone tools	Bone ornaments	Worked shell	"Breast plate"	Copper	Unworked lithic	Burned limestone	Pottery sherd	Fired clay	Unworked bone	Unworked shell	Charred plant mat'l	Ash
Zone I Burials (n=28)																									
2	76	?	A																						
3	110	F	A		x			x					x							x		x			
5	110	?	A																						
6	102	F	A										x							x		x		x	
8	102	M	A	x	x	x		x						x					x	x	x	x		x	
9	122	F	A	x	x			x					x							x			x	x	
10	71	M	A	x	x	x	x	x												x		x			
12	109	?	A	x	x		x	x			x							x						x	
14	122	M	A	x	x			x		x			x		x					x		x	x	x	
15	91	F	A		x																				
17	79	F	A	x	x		x	x							x					x		x	x	x	
19	103	F	A		x	x	x			x	x		x							x		x			x
20	84	?	A		x			x												x		x	x	x	
23	71	F	A	x	x	x		x												x		x			
24	?	M	A		x	x		x							x				x			x			
26	99	F	A		x																			x	
27	112	M	A	x	x?	x		x								x		x				x			
30	89	M	A		x			x	x			x	x		x		x			x		x	x	x	
32	89	F	A		x?		x													x		x		x	
33	84	F	A										x							x		x		x	
34	76	?	A															x		x				x	
50	74	M	A		x			x										x		x		x		x	
52(1)	38	?	A		x																	x		x	
55(1)	76	F	A																					x	
1	91	?	I																						
11	81	?	I		x	x	x															x			
30A	89	?	I																						
22	97	?	SA																						
Zone II Burials (n=18)																									
16	10	?	?		x	x														x		x			
43	56	?	?																						
51	<30*	?	?		x			x												x		x		x	
53	23*	?	?		x			x																x	
54	46*	?	?																					x	
55(2)	64	?	?		x																			x	
4	20	?	A	x																					
7	36	?	A																						
13	23	M	A	x		x						x								x			x		
18	58	M	A					x										x	x	x	x			x	
21	51*	F	A			x																			
28	36	M	A		x			x												x		x		x	
29	53	M	A		x															x				x	
31	?	?	A					x														x		x	
35	46*	?	A																						
36	41	M	A	x				x												x				x	
18A	?	?	I																						
56	61	?	I					x																x	

Table 4. Continued.

				Noteworthy Grave Items														Other Grave Items							
Burial Number	Bottom depth (cm)	Sex	Age	Body on stone slabs	Periwinkle	Charcoal over body	Red ochre	Chipped stone tools	Groundstone tools	Mica	Pottery vessel	Pottery pipe	Bone tools	Bone ornaments	Worked shell	"Breast plate"	Copper	Unworked lithic	Burned limestone	Pottery sherd	Fired clay	Unworked bone	Unworked shell	Charred plant mat'l	Ash
Unknown Zone Burials (n=2)																									
25	?	F	A		x																	x			
52(2)	?	?	A		x																	x		x	
Depth is to cap rock																									
A = adult, I = infant, SA = subadult, M = male, F = female																									

There are more differences than similarities between Zone II and Zone I burials in terms of grave items (Table 3). Fourteen (77.8%) of the 18 Zone II burials have at least one type of grave item, and 13 (72.2%) of 18 Zone II burials include at least one of the noteworthy types of burial items. These percentages are comparable to those for Zone I (85.7% and 75.0%, respectively). However, in contrast with the 90.0% of Zone I, only 15 (37.5%) of the 40 types of grave items documented at the site were found in Zone II graves. Only two (11.1%) of the 18 burials (burials 13 and 36) have more than three types of noteworthy grave items, in comparison to 46.4% of Zone I burials. Only eight of the 28 noteworthy burial items were observed in Zone II burials (body placement on stone slabs, periwinkles scattered over the body, and charcoal from fires over the body that may be grave goods, chipped stone bifaces, scrapers, drills and other worked items, and a pottery pipe). Noteworthy grave items are associated with 28.5% of the Zone II burials compared to 100.0% of Zone I burials. None of the Zone II burials contained red ochre, mica, pottery vessels, worked bone, worked shell, or copper. The greatest diversity in grave items for a Zone II burial is only 15.0% (6 of 40 types of grave items) for both burials 28 and 36, compared to 42.5% for Burial 30 in Zone I. Therefore, in comparison with Zone I burials, a smaller percentage of Zone II burials yielded three or more noteworthy grave items, and there is less diversity in the noteworthy and other burial items.

While there is potential for overlap, Zone II burials are more recent than Zone I burials as evidenced by stratigraphic placement and diagnostics. Zone II burials yielded a few chronologically diagnostic artifacts that are late Middle Woodland to Mississippian in affiliation: two Bakers Creek points, an unspecified Woodland point, two unspecified triangular points, a ceramic elbow pipe, shell tempered sherds, and limestone tempered sherds. Some of these materials may have been associated with burials, based on field notes (e.g., Burial 29).

Comparison of Zone II adult burials by sex is hampered by small sample size, but there do appear to be sex-based differences. While in Zone I the sex-based differences appear to be in grave item diversity and types as opposed to quantity, in Zone II there appear to be sex-based differences in the quantity of grave items (Table 3). The only material found with the single adult female burial in Zone II is charcoal scattered over the body, which may not be an intentionally placed grave item. The five male burials, however, together contained 14 types of grave items, six of which are considered noteworthy burial items, and two of the male burials yielded more than three types of noteworthy grave items. Lithic tools are the most common type of grave item found in the male burials, which was the case with the Zone I adult male burials as well, along with pottery sherds and charcoal found at the same level as the body.

The Zone II burials included 10 (55.6%) adults, two (11.1%) infants, and six (33.3%) individuals of indeterminate age. Though the sample sizes are small, the Zone II burials are similar to the Zone I burials in that there appear to be age-based differences in grave items (but not crypt type). Only one of the two infant burials contained grave items, which consisted of two worked lithic artifacts and charcoal. In contrast, eight (80.0%) of the 10 adults yielded some type of burial item, most commonly lithic artifacts as well as pottery sherds and charcoal found at the same level as the body (Table 4). Again, perhaps this indicates the practice of achieved rather than ascribed status.

In conclusion, revisions to the assignment of burials to zones within Mound A are proposed. Twenty-eight burials are assigned to stratigraphically lower Zone I, and 18 burials are in Zone II; two burials could not be placed in a stratigraphic zone. Comparison of burials within and among zones showed patterns that warrant further investigation with other data sets (Table 5). The most elaborate burials in terms of diversity and types of grave items are in Zone I. Sex-related differences in grave items of adult burials in both zones may indicate sexual division of labor, a proposition that gains further support based on osteological data, as described in the next section. The burial items associated with Zone I and Zone II individuals vary between adults and subadults, being more numerous and elaborate with the adults and suggesting that social status may have been achieved rather than ascribed. Differences in Mound A burials, then, may reflect chronological and social factors.

Table 5. Comparison of Zone I and Zone II Burials from Mound A of the Watkins Site.

	Zone I		Zone II	
Number of Burials	28		18	
Depth of Burials (cm)	**Average** 91	**Range** 71-122	**Average** 41	**Range** 10-64
Crypt Types	**Number**	**Percentage**	**Number**	**Percentage**
Stone box grave	20	71.0	10	56.0
Pit	5	18.0	4	22.0
Pit w/ stone slabs	2	7.0	2	11.0
Unspecified	1	4.0	2	11.0
Grave Goods				
Total diversity (of 40 types)	36	90.0	15	37.0
Noteworthy diversity (of 28 types)	28	100.0	8	29.0
Number graves with goods	24	86.0	14	78.0
Number graves w/ 1 noteworthy	21	75.0	13	72.0
Number graves w/ 3+ noteworthy	13	46.0	2	11.0
Sex				
Male	7	25.0	5	28.0
Female	11	39.0	1	5.0
Unknown	10	36.0	12	67.0
Age				
Adult	24	86.0	10	56.0
Subadult	1	3.0	0	0.0
Infant	3	11.0	2	11.0
Unknown	0	0.0	6	33.0
Chronological Placement	Middle Woodland		late Middle Woodland to Mississippian	

An examination of diagnostic artifacts associated with the Mound A burials suggests that Ray (n.d.) was correct in concluding that the burial mound was used during the Woodland and Mississippian periods. Ray (n.d.) suggested that Mound A was predominantly a "Hopewell type" manifestation, and the reevaluation of temporal-cultural diagnostics presented here concurs that the 28 Zone I burials, which constitute 60.9% of the burials that could be placed in a zone, are Hopewellian. The 18 Zone II burials range in temporal affiliation from late Middle Woodland to Mississippian periods based on diagnostic artifacts. Charcoal from the Mound A burials is curated at several Kentucky universities; it would be advisable to obtain radiocarbon dates from a sample of the burials in order to evaluate the temporal affiliations for these burials put forth in this paper.

SEXUAL DIMORPHISM

Chapman's (1972) osteometric measurements for 12 individuals, 10 of which are from Zone I and two from Zone II of Mound A, were averaged by sex[6] and the percentage of sexual dimorphism[7] was calculated. Although sample sizes are small, the averages suggest that there are differences between the seven males and five females in limb, pelvis, and skull measurements (Table 6). Sexual dimorphism in humans has been interpreted to reflect nutritional stress, sexual selection, or sexual division of labor that is more evident in food collectors than food producers (Brown 1970; Frayer 1980; Hall 1982; Murdock and Provost 1973; Sciulli et al. 1991). The limb, pelvis, and skull data are discussed individually.

Thirty of Chapman's (1972) limb bone measurements were averaged (15 traits, left and right sides each). Limb bone average measurements are consistently smaller for females. Excluding one trait (left-side humerus midshaft maximum diameter) for which male and female averages were equal, the percentage of sexual dimorphism for the remaining 29 values range from 1.9 to 17.3% (Table 6). The percentage of sexual dimorphism for the maximum lengths of limb bones were compared with those reported by Sciulli et al. (1991) for Terminal Late Archaic populations in Ohio and were found to be similar or larger. Using the maximum femur lengths for the Watkins site sample as reported by Chapman (1972), male and female average statures were estimated[8] and the percentage of sexual dimorphism was calculated for stature at 9.6% (left side) and 7.3% (right side). Averaging 8.45%, the percentage of sexual dimorphism in stature for the Watkins sample is comparable to that (8.5%) reported by Sciulli et al. (1991:256) for Terminal Late Archaic populations in Ohio. As Sciulli et al. (1991:247) concluded that this percentage of sexual dimorphism in stature suggested "at least a degree of sexual division of labor" associated with food collecting in the Ohio populations, a similar suggestion is made for the Watkins site sample.[9]

Average pelvic measurements differed for the males and females in the Watkins site sample. The percentage of sexual dimorphism in pelvic measurements ranged from 9.5% to 16.9% for minimum iliac breadth, maximum length of auricular surface, and ischium length (Table 6). Not unexpectedly, the percentage of sexual dimorphism for breadth of the sacro-sciatic notch is -4.1%, meaning the notch is wider in females than males.

There was considerable variation in the percentages of sexual dimorphism for the 24 skull traits. One trait, total facial height, yielded a percentage of zero as the male and female measurements were equal. For eight of 24 skull measurements of the cranium, face and mandible, the percentages ranged from 1.7% to 30.4% (Table 6). For the remaining 15 skull traits, the percentages ranged from -0.5% to -50.0%, meaning the average measurements for females were greater than those for males.

Table 6. Percent of Sexual Dimorphism for Adults from Mound A, Watkins Site (Adapted from Chapman [1972]).

Long Bones	Difference (F/M) left	Difference (F/M) right
Humerus Length	9.6%	8.7%
Humerus Head Max. Diam.	13.8%	15.9%
Humerus Midshaft Max. Diam.	0.0%	9.3%
Humerus Midshaft Min. Diam.	1.9%	17.3%
Ulna Length	10.5%	5.5%
Ulna Shaft Length	11.0%	10.0%
Radius Length	12.2%	8.6%
Femur Length Bicondylar	8.9%	7.3%
Femur Length Trochanteric	9.8%	6.8%
Femur Midshaft Diam. A-P	14.2%	14.3%
Femur Midshaft Diam. M-L	9.1%	7.9%
Femur Head Max. Diam.	9.8%	11.1%
Tibia Length	8.6%	6.5%
Tibia Diameter Nutrient A-P	13.7%	8.7%
Tibia Diameter Nutrient M-L	3.1%	3.0%

A=anterior, P=posterior, M=medial, L=lateral

Pelvis	Difference (F/M)
Iliac Breadth Min.	16.9%
Auricular Surface Max. Len.	9.5%
Ischium Length	13.8%
Sacro-Sciatic Notch Breadth	-4.1%

Skull	Difference (F/M)
Maximum Length	3.9%
Maximum Breadth	-2.5%
Minimum Frontal	-0.5%
Basion-Bregma Height	-5.1%
Auricular Height	7.4%
Total Facial Height	0.0%
Upper Facial Height	-7.7%
Nasal Height	-16.7%
Nasal Breadth	-16.0%
Nasion-Basion Length	-1.8%
Nasion-Prosthion Length	-30.6%
Left Orbital Height	-5.9%
Left Orbital Breadth	10.0%
Palate Length	20.4%
Palate Breadth	-2.4%
Foramen Magnum Length	14.9%
Foramen Magnum Breadth	30.4%
Mandible Length	-0.7%
Bicondylar Breadth	12.4%
Bigonial Breadth	-2.6%
Left Ramus Height	-5.3%
Left Ramus Min. Breadth	1.7%
Symphseal Height	-20.0%
Body Thickness	-50.0%

While statistical tests of significance for these differences are needed, one might posit that the skeletal sample from Watkins Mound A shows evidence of sexual dimorphism and that the sexual dimorphism in limb bones and stature may be indicative of sexual division of labor.

AGE OF WALL-TRENCH STRUCTURE

A revision to the possible age of the wall-trench structure in the habitation area south-southeast of Mound A is posited. Instead of a Middle Woodland affiliation, it is suggested that the rectangular wall-trench structure was constructed during the Mississippian period, a suggestion that is more in line with our knowledge of wall-trench structures elsewhere in the upper southeastern United States (Lewis 1996), and that the wall-trench was backfilled with midden containing Middle Woodland ceramics. Additional work at the site might resolve this issue.

ANALYSIS OF HABITATION-AREA ARTIFACTS

As part of this study, over 20,000 artifacts from the habitation area were examined and sorted (Table 7). These materials are curated at the Western Kentucky University Anthropology Laboratory. About 91.0% of the artifacts are lithics, in particular flakes. Significant quantities of angular chunk and shatter, burned limestone, and pieces of chert cortex were identified. Several hundred chipped stone tools were identified, including utilized flakes, preforms, biface fragments, and hafted bifaces. Ten chipped stone hoe fragments/flakes and six bladelets made of local cherts are present in the collection. About 6.0% of the artifacts are pottery, which is predominantly plain or simple stamped and limestone tempered, and clay nodules or daub. Faunal remains, more of which are burned than unburned, account for 3.0% of the artifacts. There are also charcoal samples from several contexts in the habitation area.

The prehistoric inhabitants of the Watkins site relied heavily on locally available St. Louis and Fort Payne cherts. The chert raw materials (nodules and tabular pieces) are small in size, which is reflected in the somewhat small sizes of debitage in general. All stages of lithic reduction are represented in the flake sample; 3.8% of the flakes are primary decortication, 32.6% are secondary decortication, 20.5% are primary, 26.0% are secondary, and 17.0% are thinning flakes (Table 7).

Diagnostic hafted bifaces are Hamilton, Madison, Bakers Creek, Lowe, Steuben, Chesser, Motley, Copena, Adena, Dickson Cluster, Turkey Tail, Delhi, Ledbetter, Pickwick, Saratoga, Late Archaic Stemmed, Lamoka, Raddatz, Pine Tree, and Kirk. While 14 (24.1%) of the 58 hafted bifaces could not be assigned to a stylistic type, the remaining 44 (75.9%) fall into the following temporal periods: 6.9% (n=4) are Mississippian, 27.6% (n=16) are late Middle Woodland to Mississippian, 12.1% (n=7) are Middle Woodland, 6.9% (n=4) are Early Woodland, 15.5% (n=9) are Late Archaic, 1.7% (n=1) are Middle Archaic, and 5.2% (n=3) are Early Archaic. Thus, the Watkins site area may have been used for a considerable length of time, but based only on the percentages of stylistic hafted biface types there were more intense occupations during the Middle Woodland to Mississippian periods when Mound A was used.

Comparing the three excavation trenches, the highest percentage (58.0%) of artifacts was derived from units and features in the 100-102N 100-130W trench. About 41.0% of the artifacts were recovered from the units and features of the 100-105N 170-240E trench, where the rectangular wall-trench structure was discovered. Excavation trench 400-402N 300-355W yielded only 1.0% of the artifacts.

SUMMARY AND CONCLUSIONS

This paper is intended to disseminate information about the Watkins site, a prehistoric mound-habitation complex in southcentral Kentucky. To this end, information was presented about previous work on Mound A and the habitation area as compiled from original burial forms, field notebooks, and unpublished manuscripts, and maps were reconstructed using field forms and field notebooks.

The first archaeological investigations at the site involved excavation of 48 burials from Mound A (Ray n.d.). A majority of the burials were in-flesh inhumations of adults fully extended in stone box graves. Materials and artifacts found in the graves include lithic tools and cores, Candy Creek Cordmarked and Mulberry Creek Plain sherds, a limestone tempered tetrapodal vessel, charcoal,

Table 7. Artifacts by Provenience.

	100-102n Trench		100-105e Trench		400-402n Trench		Trench Features		Site	
	n	%	n	%	n	%	n	%	n	%
Lithics										
1 decort	201	1.8%	131	1.5%	0	0.0%	22	1.2%	354	1.6%
2 decort	1,785	16.4%	1,094	12.2%	15	7.0%	150	8.3%	3,044	13.9%
primary	1,412	12.9%	386	4.3%	12	5.6%	106	5.9%	1,916	8.8%
secondary	1,458	13.4%	846	9.4%	5	2.3%	117	6.5%	2,426	11.1%
thinning	457	4.2%	1,059	11.8%	3	1.4%	67	3.7%	1,586	7.2%
broken	4,013	36.8%	3,307	36.9%	5	2.3%	297	16.5%	7,622	34.8%
utilized flake	234	2.1%	88	1.0%	8	3.7%	17	0.9%	347	1.6%
modified flake	19	0.2%	10	0.1%	5	2.3%	0	0.0%	34	0.2%
preform I	41	0.4%	19	0.2%	30	14.0%	14	0.8%	104	0.5%
preform II	17	0.2%	7	0.1%	22	10.3%	2	0.1%	48	0.2%
biface frags	45	0.4%	21	0.2%	24	11.2%	9	0.5%	99	0.5%
hafted bifaces	16	0.1%	11	0.1%	27	12.6%	4	0.2%	58	0.3%
hoe frags-flake	8	0.1%	0	0.0%	2	0.9%	1	0.1%	11	0.1%
chunk	276	2.5%	148	1.6%	2	0.9%	23	1.3%	449	2.1%
shatter	148	1.4%	428	4.8%	0	0.0%	27	1.5%	603	2.8%
pot lids, spalls	14	0.1%	22	0.2%	0	0.0%	2	0.1%	38	0.2%
cores	61	0.6%	27	0.3%	1	0.5%	4	0.2%	93	0.4%
tested cores	23	0.2%	15	0.2%	1	0.5%	5	0.3%	44	0.2%
utilized cores	14	0.1%	9	0.1%	0	0.0%	1	0.1%	24	0.1%
modified cores	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
burn limestone	12	0.1%	327	3.6%	0	0.0%	130	7.2%	469	2.1%
cortex	71	0.7%	264	2.9%	1	0.5%	15	0.8%	351	1.6%
bladelets	3	0.0%	3	0.0%	0	0.0%	1	0.1%	7	0.0%
fire-altered SS	1	0.0%	95	1.1%	0	0.0%	4	0.2%	100	0.5%
utilized chunk	1	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.0%
util. concretion	1	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.0%
bevel biface	1	0.0%	0	0.0%	2	0.9%	0	0.0%	3	0.0%
Total	10,332	94.7%	8,317	92.7%	165	77.1%	1,018	56.6%	19,832	90.6%
Ceramics										
sherds	70	0.6%	32	0.4%	24	11.2%	120	6.7%	246	1.1%
sherdlets	468	4.3%	95	1.1%	7	3.3%	146	8.1%	716	3.3%
clay nodules	23	0.2%	229	2.6%	8	3.7%	192	10.7%	452	2.1%
Total	561	5.1%	356	4.0%	39	18.2%	458	25.5%	1,414	6.5%
Faunal Remains										
unburned	10	0.1%	104	1.2%	9	4.2%	145	8.1%	268	1.2%
burned	10	0.1%	190	2.1%	1	0.5%	132	7.3%	333	1.5%
turtle	0	0.0%	2	0.0%	0	0.0%	14	0.8%	16	0.1%
other	0	0.0%	1	0.0%	0	0.0%	30	1.7%	31	0.1%
Total	20	0.2%	297	3.3%	10	4.7%	321	17.9%	648	3.0%
Grand Total	10,913	49.8%	8,970	41.0%	214	1.0%	1,797	8.2%	21,894	100%

periwinkle shell, turtle and other shell, worked and unworked animal bone, a copper artifact, and mica; unfortunately, existing documentation of the mound excavations does not clearly distinguish between items that were grave goods versus those recovered from grave fill. Ray (n.d.) assigned 20 of the burials into one of three zones based on stratigraphic position and artifactual remains, suggesting that the more elaborate lowermost Zone I burials were Middle Woodland or Hopewellian in affiliation and the less elaborate Zone II-III burials were associated with later Woodland and Mississippian occupations at the site.

Reevaluation of Ray's (n.d.) data suggest that division and reassignment of 46 burials into two zones is warranted on the basis of stratigraphic position and grave items. The 28 burials associated with Zone I, which as Ray (n.d.) suggested are likely Middle Woodland in age, show sex-related and age-related differences in burial items that may reflect sexual division of labor and the practice of achieved status, respectively. Sex- and age-related differences in grave items are also noted for the 18 late Middle Woodland-Mississippian burials associated with Zone II. Zone I burials are more elaborate than Zone II burials in terms of crypt type and grave items. As such, differences among Mound A burials reflect chronological, sex-based, and age-based differences in mortuary treatment.

Chapman's (1972) osteological analysis of 23 individuals from Mound A was the second archaeological research project related to the Watkins site. Chapman determined ages and sexes, recorded anthropometric data for over 50 metric traits, and identified pathologies and abnormalities in five male skeletons, including vertebral lesions reflective of male-oriented physical stress (again supporting the idea of a sexual division of labor), fused vertebrae, osteoarthritis, osteophytosis, tooth pearls, and a bone fracture caused by a projectile point.

The metric data collected by Chapman (1972) were sorted by sex and evaluated for evidence of sexual dimorphism. Long-bone measurements for the five females were consistently smaller than those of the seven males. With the exception of the sacro-sciatic notch, female pelves were smaller than male pelves. Female measurements for one-third of the skull traits were smaller than male measurements, but female data for the remaining two-thirds were larger. These data suggest some degree of sexual dimorphism.

Sexual dimorphism in limb bones and stature may reflect sexual division of labor associated with food collecting, an interpretation that was also suggested based on the differences in grave goods of males and females in Mound A burials and in the vertebral lesions noted by Chapman (1972) for several males. The degree of sexual dimorphism in limb bones and stature documented for the Watkins site might be expected since the data are based primarily on Zone I burials, which are Middle Woodland in age and therefore predate the advent of intensive maize-based food production (Lewis 1996; Railey 1996). It would be helpful to compare the percentage of sexual dimorphism for the Watkins site sample to percentages for skeletal samples from nearby Mississippian sites where maize use is common (Lewis 1996).

Investigations conducted by Schock in the Watkins site habitation area involved excavation of three trenches and led to the identification of 19 numbered features and numerous unnumbered features as well as the recovery of tens of thousands of artifacts. The most notable discovery was that of a 7.5 x 9.5 m wall-trench structure with open corners and corner posts, which Schock interpreted to be Middle Woodland in age based on ceramics. In this paper, however, it has been suggested that the structure was constructed during the Mississippian period and that the wall-trench was backfilled with midden containing Middle Woodland ceramics.

Analysis of materials from the habitation area excavations reveal a reliance on local St. Louis and Fort Payne cherts and reduction of chert raw material to finished tools on site. Pottery sherds are of limestone tempered and shell tempered plain and cordmarked varieties. Diagnostic hafted bifaces indicate the site was used from the Early Archaic to Mississippian periods, but the highest percentage of diagnostic hafted bifaces is associated with the Middle Woodland to Mississippian periods.

The aforementioned interpretations related to chronological, sex-related and age-related differences in mortuary treatment, sexual dimorphism, and the age of the rectangular wall-trench structure evidenced at the Watkins site should be tested using data sets from comparable sites and the Watkins site itself. The Watkins site, though impacted by modern farming and other cultural processes, still has the potential to aid in the understanding of past human life in southcentral Kentucky.

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FOOTNOTES

[1]The mound excavation report (Ray n.d.) and field notes were examined for clues to distinguishing grave goods from artifacts in the grave fill. In the excavation report, for example, Ray (n.d.) noted that the artifact cache found with Burial 9 included unworked animal bone in addition to worked artifacts. In describing Burial 10, Ray (n.d.:13) noted that "abundant amounts of red ochre were found with" the body, and "periwinkle shells had been thrown in on the body. Small fires had been built on and around the body. Also in the grave were small animal bones," suggesting that these items had been placed with the body. However, grave associations are less clear in other burial descriptions. For instance, "periwinkle shells were scattered in (or over) the grave fill" and "were scattered about the skull and placed on the chest" of Burial 14 (n.d.:15-16). Ray (n.d.:29) reported that "periwinkles and charcoal were discovered in the grave fill, all the way down to the burial itself" of Burial 17 and "ceremonial rites had been undoubtedly been [sic.] practiced inside the grave, because of the heavy concentration of charcoal, pottery sherds, animal bone, and periwinkles." Field sketches of a number of excavated graves show flint, pottery, bone, charcoal, and periwinkle at the same level as and associated with the bodies. While artifacts not commonly classified as grave goods (e.g., ceramics, charcoal, unworked animal bone, lithic debitage) were documented as being both associated with bodies and in the grave fill, making their significance unclear, there is more documentation indicating these items were grave goods.

[2]Though depth was not recorded, Burial 24 was placed in Zone I as it was associated with Burial 23, which was 71 cm below the surface, and has noteworthy grave items. Burial 52(1) was included in Zone I because, although the cap rock was only 38 cm below the surface (the depth to the base of the grave was not recorded by the excavators), field notes indicate it was under Burial 56, which is placed in Zone II, and it was similar to Burial 32, which was found at a depth of 89 cm below the surface and was included in Zone I.

[3]These items are considered noteworthy because they are nonlocal materials, labor-intensive materials or items, manufactured items, or items apparently placed intentionally with the body as indicated by field notes.

[4]While age was held constant in a general sense when comparing only adult male and female burials of Zone I, it is not possible to hold sex constant when comparing age groups since sex is unknown for the four subadults and infants.

[5]The depths of Zone II burials are somewhat complicated in that the depths recorded for five of the burials (21, 35, 51, 53, and 54) are depths to the cap rocks instead of the grave bottoms. Based on field documentation

recording both cap stone depth and grave bottom depth for a number of burials, the crypts of Mound A range from 15 to 76 cm in the vertical dimension. Hence, the grave bottom depths for Burials 21 (cap rock at 51 cm), 35 (cap rock at 46 cm), 51 (cap rock at 15 to 30 cm), 53 (cap rock at 23 cm) and 54 (cap rock at 46 cm) could be as little as 15 cm greater or as much as 76 cm greater, putting the estimated grave bottom depths at 66 to 127 cm for Burial 21, 30 to 107 cm for Burial 51, 38 to 99 cm for Burial 53, and 61 to 122 cm for burials 35 and 54. Based on the smaller of these estimated basal depths, and the paucity of grave items associated with these burials, their inclusion within Zone II is warranted. On a different note, the depths of Burials 18A and 31 were not recorded by the excavators, but they are included in Zone II due to circumstantial evidence. Burial 18A is associated with Burial 18, which is 58 cm deep and, like other Zone II burials, lacks substantial grave items. Field notes indicate that Burial 31 was found on Burial 29, which is included in Zone II due to its depth and grave items.

[6]Due to the small number of measurable males from Zone II, samples from the two zones were combined for this analysis.

[7]Percentage of sexual dimorphism is calculated using the formula $\frac{M\bar{x} - F\bar{x}}{M\bar{x}} * 100$ where $M\bar{x}$ is the male mean and $F\bar{x}$ is the female mean (Frayer 1980).

[8]The stature formula for male Native Americans is 2.45 (femur) + 43.56 and for female Native Americans is 2.86 (femur) + 22.10 (Sciulli 1990).

[9]In a similar study, Frayer's (1980) analysis of sexual dimorphism in the stature of European populations showed that the percentage of sexual dimorphism decreased from 8.6% in the Upper Paleolithic period to 7.5% in the Mesolithic to 5.9% in the Neolithic. Frayer (1980) attributed this decline in stature sexual dimorphism to the shift from food collecting to food producing and the consequent reduction in exclusivity in sexual division of labor.

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SITE STRUCTURE, ACTIVITIES AND REFUSE: A STUDY OF TWO FEATURES EXCAVATED AT THE DRY BRANCH CREEK SITE (15ME62), A FORT ANCIENT SITE IN THE UPPER SALT RIVER VALLEY, MERCER COUNTY, KENTUCKY

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ABSTRACT

This paper reports on the analysis and interpretation of two Fort Ancient refuse-filled pits excavated at the Dry Branch Creek site (15Me62) located in the upper Salt River Valley, in Mercer County, Kentucky. Excavations at the Dry Branch Creek site were coordinated by the Kentucky Transportation Cabinet in compliance with Section 106 of the National Historic Preservation Act of 1966. Systematic recovery and recording of artifacts and organic remains, usewear analysis, and measurement of the volume of excavated deposits permit comparisons of densities of materials from two pit features. Based on these comparisons, inferences are made concerning the types of activities undertaken in the vicinity of the two pits.

INTRODUCTION

Previous excavations at Fort Ancient and Mississippian sites have identified activity zones and feature clusters that have revealed a great deal about the organization of late prehistoric communities and households (Henderson 1992; Mehrer and Collins 1995; Milner 1983; Nass and Yerkes 1995; Sharp and Pollack 1992). Most discussions of household activities, however, tend to address broad developmental or integrative problems from a regional or inter-regional perspective. Researchers have demonstrated that there is much to be learned about relations between household organization, labor allocation, and daily life in relation to such processes as productive intensification, exchange, ritual and ideology, and power relations (Hatch 1995; Jackson and Scott 1995; Nass and Yerkes 1995; Pollock et al. 1996; Rogers 1995; Welch and Scarry 1995). These studies underscore the importance of research structured from a household and community perspective. Households are important units of production and consumption and it is at the household level that the impacts of broader-ranging social and economic changes would most likely be felt (Pollock et al. 1996; Rogers 1995; Welch and Scarry 1995).

To explore variation between households requires a detailed and contextual understanding of domestic activities and their material and social dimensions. Archaeological correlates of activities and their contexts include structures and features used for work, storage and refuse disposal, manufacturing by-products, and tools. Arguably, features are one of the more important units of analysis employed by archaeologists. Features are commonly described in the literature in terms of their size, shape and contents, classified in relation to presumed functions, and analyzed spatially. However, rarely are features subjected to careful, systematic analysis structured to address variation in the locations and social contexts of activities and their related technologies.

In this paper, a feature is defined as a fixed association of items that reflect spatial and material dimensions of storage, refuse disposal, and work-related activities (after Doran and Hudson 1975:8). Following this definition, patterning in the ceramic and lithic artifact assemblages from two features excavated at the Dry Branch Creek site is examined in order to better understand activities in relation to tool technologies, production, and discard practices. The analysis is structured specifically to explore linkages between depositional contexts (after Schiffer 1987), artifacts, and their attributes. The Dry Branch Creek site is a Fort Ancient site located in the upper Salt River Valley in Mercer County, Kentucky (Figure 1). Excavations at the site were undertaken in the summer of 1998 by Wilbur Smith Associates and coordinated by the Kentucky Transportation Cabinet in compliance with Section 106 of the National Historic Preservation Act of 1966. Relative dating of diagnostic Jessamine Series ceramics and four chronometric dates obtained from features 22 and 47 suggest a Fort Ancient occupation that spans the period between A.D. 1200 and 1400.

The location of the two pits, their spatial associations with a possible structure, and material contents suggest a domestic setting. Feature content and spatial associations are used to identify the context and kinds of activities that may have occurred in and around the features. The data used include broken ceramic vessels, stone tools used for hunting, processing food, and manufacturing goods, debitage from the manufacture of stone tools, and usewear observed on the edges of *ad hoc* flake tools. Artifact frequency, density, and diversity measures are used to examine variation within and between the two feature assemblages. Although excavations sampled only a small portion of the site, results indicate that when systematically examined, features can provide new insights into the organization and material expression of work-related activities and refuse disposal. The contents of the two features and associations among artifacts varied along dimensions relating to whether the locale was used for a particular activity, or for the discard of general domestic refuse.

ARCHAEOLOGICAL INVESTIGATIONS AT THE DRY BRANCH CREEK SITE

The earliest published account of prehistoric occupations in the upper Salt River Valley appeared in 1881 in a report published by the Smithsonian Institution entitled "Mounds in Boyle and Mercer Counties, Kentucky" (Linney 1881). Working under the auspices of the Kentucky Geologic Survey, Linney mapped the locations of several mounds and villages and recorded observations on artifacts he encountered while conducting surveys in these two counties. Between Harrodsburg and Danville, Linney's map depicts three low-lying earthen mounds, seven burial sites, and at least four probable habitation sites. Linney (1881:605) provides the following

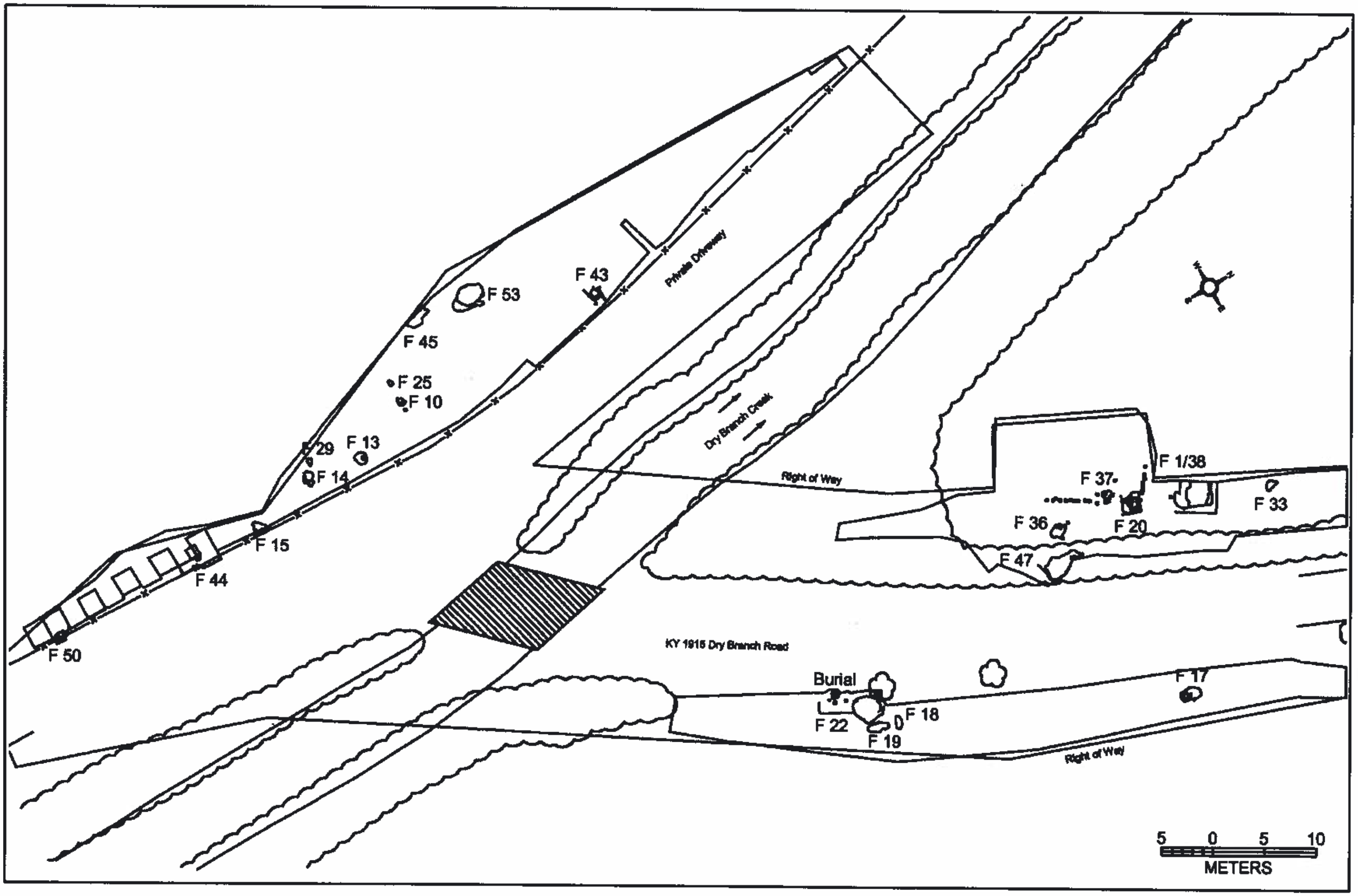

Figure 1. Project Area and Locations of Excavated Features Discussed in the Text. Inset Shows the Location of the Dry Branch Site in the Fort Ancient Cultural Area and the Locations of Fort Ancient Sites Mentioned in the Text (the Base Map for the Insert after Henderson 1998:Figure 2-2.)

description of one mound and village site (Site "A" on Linney's map) located on the west bank of the Salt River in the vicinity of the Dry Branch Creek site:

> The mound stood 200 yards from the stream. Between those points there must have been a village of huts or some form of habitation; for even now, when the ground is freshly plowed, there is a regular parallelogram, where the uniform lines of black earth, charcoal, and burnt bones show the former presence of fires long continued at that point. Within this area have been found a great number of specimens of broken crockery, plain and ornamented in crossed lines; grooved axes of greenstone; celts in greenstone, jasper, agate, hornestone, and limestone; pipes, arrow and lance heads, chisels, grinding stones, pestles, sinkers, flint flakes and cores, ornaments in slates and other colored stones; bones of fish and many animals, horns of deer and elk, teeth of bears, etc. Some of these may have been thrown up by the plow and scattered over the space near the mound (Linney 1881:605).

The sites mapped by Linney in the late nineteenth century were later included in the statewide archaeological survey conducted by Webb and Funkhouser (1932). In a discussion of the archaeological survey work in Kentucky conducted in the late nineteenth and early twentieth centuries, Clay (1985:20) identifies Linney's site "A" as the Fort Ancient village complex known as the Mercer Village site (15Me15). Located on a bend in the Salt River at its confluence with Dry Branch Creek, the Mercer Village site is immediately adjacent to the Dry Branch Creek site locale (Figure 1).

John Carter, a student at the University of Kentucky, surveyed the Mercer Village site and excavated two 1 x 1 m test units in 1960 (Carter 1961; Henderson 1998). Although limited in extent, Carter's excavations documented the presence of subplowzone features, probable structures, and midden deposits. Diagnostic artifacts indicated that the site dated to the Late Prehistoric period. In 1985 archaeologists affiliated with the Kentucky Heritage Council visited the site, collected a sample of artifacts from its surface, and nominated it for listing in the National Register of Historic Places (Railey 1985). The Mercer Village ceramics are assigned to the Jessamine Series. Based on relative dating and comparative data, the materials from Mercer Village suggest an early middle Fort Ancient occupation (Henderson 1998:311-319; also see Turnbow and Sharp 1988).

The Dry Branch Creek site is located on the bank of the Salt River opposite the Mercer Village site. The project right-of-way corresponded to a proposed bridge replacement over Dry Branch Creek on KY 1915 (Figure 1). Testing of the site in 1995 and 1996 by archaeologists with Wilbur Smith Associates determined that it was eligible for listing in the National Register of Historic Places (Fenton et al. 1996). Shell and limestone tempered ceramics and triangular projectile points suggested that the occupation dated to the middle Fort Ancient period (A.D. 1200-1400). Subsequently, a data recovery plan was developed and coordinated by staff with the Environmental Division of the Kentucky Transportation Cabinet, Kentucky Heritage Council, and Wilbur Smith Associates (McBride 1997). The mitigation plan was designed to document the organization of the portions of the site that fell within the project right-of-way boundaries. Areas of the site within the right-of-way were mechanically stripped to locate, map, and excavate subsurface features, midden, and structures (McBride 1997:17). A total of 1,390 m^3 were removed during the course of this study.

The project right-of-way covers approximately 3,000 m^2 and borders both the west and east sides of Dry Branch Creek approximately 100 m south of where it flows into the Salt River (Figure 1). Low energy colluvial and alluvial deposition has preserved intact archaeological deposits at the site on both sides of the creek in a 30 to 40 cm thick buried A-horizon soil. The stratigraphy is well-defined and relatively horizontal in most areas, although some irregularities occur as a result of changes in the floodplain topography, intrusive historic and prehistoric features, erosion, and modern agricultural practices. Depending on the depth of the alluvium, cultural deposits occur within 10 to 50 cm of the modern ground surface.

Mechanical stripping revealed the presence of over 40 features and a possible structure indicated by two intersecting postmold lines. Two overlapping rows of posts oriented north-south measure approximately 4 m in length, and one of the north-south lines intersected a 3.7 m long row of postmolds oriented east-west. Just on the inside of the east line of the postmolds is a small pit feature (Feature 37). A second pit feature (Feature 20) is located just inside the north wall at its intersection with the east wall. To the north and east are other pit features of varying size, shape, and content, including a large, circular pit (Feature 47). On the east side of KY 1915 is a large, shallow basin feature (Feature 22). Two small, irregular pit features are present to the east and north of Feature 22, and a single, flexed adult burial is located 2 m to the south (Figure 1).

Although the structure and nearby features on the east and west sides of the road may not be contemporary, previous research has shown that Late Prehistoric settlements (Fort Ancient and Mississippian) typically consist of structure-feature clusters that cover an area of between 20 and 40 m (Henderson 1992:233, Figure 5; Milner 1983:69, 160, Figure 74). The single structure and nearby pits on the west side of KY1915 occur within a 20 m area. If the features on the east side of KY 1915 (Feature 22 locus) are included with the structure on the west side of KY 1915, the distance covered is within 40 m (Figure 1).

Previous testing of the site on the west side of Dry Branch Creek in 1995 and 1996 determined that the site extended further to the west of the present right-of-way boundary. A possible structure basin filled with refuse, two isolated, *in-situ* whole vessels, and a thin midden deposit were documented in this area (Fenton et al. 1996; McBride 1997). Scraping within the revised right-of-way revealed additional features that included large, empty pits, small refuse pits, and another isolated whole vessel (Feature 10) (Figure 1). Although it is possible that the vessels were associated with burials that have completely decomposed, there is no evidence at this time to support this interpretation. Thus, the possibility that the vessels were associated with domestic contexts must be considered.

METHODOLOGICAL AND INTERPRETIVE ISSUES

Most artifacts recovered from the Dry Branch Creek site were found in feature contexts. It should be emphasized, however, that the limited horizontal coverage of the site areas investigated prohibits interpretation of activity organization at the site level. If, however, a pattern of refuse disposal in features located in and around structures is typical for the settlement at Dry Branch Creek, and if one assumes that everyday activities occurred in and around structures, then there is little reason to think that refuse was discarded great distances from its origin.

The contextualization of trash pits as places of refuse disposal allows questions about the use and discard of artifacts to be addressed. Variation in feature content and structure may also enable inferences to be made about how people organized space and economic activities (i.e., production and consumption) within their communities, the kinds of social and economic relations that occurred within and between households, the duration and nature of occupations, and the organization of work. Archaeological indicators of production include tools and facilities used in the production process and by-products of production, including the composition of samples of plant and animal remains. The presence of artifacts in their contexts of use and discard are indicative of consumption (Pollock et al. 1996).

This study is based on the premise that households are important units of production and consumption. It examines archaeological correlates of activities in order to better understand the nature of depositional contexts in relation to site structure issues. Dimensions of variation in the artifact content between and within the two features is considered in order to determine the feasibility of identifying and differentiating between refuse, processing and storage activities, and their contexts.

Ethnographic and archaeological research suggests that storage and trash disposal areas are recognizable and can be differentiated (Kent 1999:91; Spector 1993). Using simple diversity measures and descriptive statistics based on artifact category and functional data, Kent (1999) found that midden deposits tended to be less diverse than storage contexts. She suggests that one reason why artifact differences exist between refuse and storage areas is that the latter are often located in close proximity to activity areas. A cross-cultural review of external activity areas by Kent (1987:20-22) determined that nearly all activities occur within 11 m of buildings. Rogers (1995:84) cites results reported by Mehrer (1988:131) for Mississippian settlements in the American Bottom that are consistent with Kent's observation. Milner's (1983) study of debris patterns in and around structures at the Turner site, a Mississippian site located in the American Bottom, determined that items were commonly disposed of in structures or abandoned features immediately adjacent to them. Presumably, different types of activities were performed at or near formal and informal storage areas. It may not be unreasonable to expect, therefore, that the byproducts of activities were incorporated in various kinds of depositional contexts in close proximity to the locations where activities occurred. Thus, by contextualizing features as fixed associations of items it may be possible to identify and differentiate between storage, work areas, and refuse disposal patterns.

In some cases, researchers have documented features that served principally as receptacles for refuse. At the Turner site, Milner (1983:160, 161) observed that debris in features increased with distance from a structure, perhaps reflecting periodic sweeping of houselots. A similar pattern of refuse disposal may account for the doughnut-shaped middens documented at the Florence site in central Kentucky, and at Sun Watch in Ohio. Both sites date to the middle Fort Ancient. Researchers have determined that at the Florence site, refuse was disposed of in pits located behind structures (Sharp and Pollack 1992:216-218). At Sun Watch, refuse was disposed of in pits located between structures and an open plaza ringed with burials (Nass 1989; Nass and Yerkes 1995).

To assess variation in the material content of features, Kent (1999) applied a descriptive statistic designed to measure the relative diversity of items contained within feature deposits in terms of both evenness and richness. The number of objects in a feature is divided by the number of categories associated with the feature, which results in a mean number of objects per category for each feature. Two caveats are necessary. First, the descriptive statistic is used here to begin to determine the presence of patterning in the data that may signal functional and context-specific differences between the two feature assemblages. Thus, the selection of categories and attributes were those that appeared relevant for depicting dimensions of material, functional, and formal variation for the artifact categories considered at this time. Second, the resulting values should be interpreted in a relative sense, and should not be equated with specific interpretations of activities assigned to individual features. A relatively higher mean value may denote more object discard and, by extension, more activity redundancy. According to Kent (1999), greater activity redundancy is a characteristic of trash dumps, but may also reflect functionally-discrete activity areas. A low mean value may denote more categories and, therefore, may reflect a greater range of activities performed at a locus relative to the number of objects discarded (Kent 1999:82).

The objects and categories used in this study are artifact types and subtypes defined on the basis of a variety of attributes pertaining to raw material, morphology, and function. The mean number of objects per category measure, frequency distributions, and density measures are used to characterize and compare the contents of the two pits (features 22 and 47). Associations between artifact classes and particular attributes chosen to convey information on technology, raw material, and function are also examined. A Hund Wetzler reflected-light microscope with magnifications ranging between 50x and 400x was used to assess wear patterns on a sample of utilized flakes from the two features identified on the basis of macroscopic usewear. A total of 31 flakes have been examined from Feature 22, 17 of which have recognizable usewear. A total of 81 flakes, 45 with recognizable usewear, were examined from Feature 47. Usewear data for formal tools is not included in the present study. Interpretations were based on experimental tools in the collection of the author. Taken together, detailed artifact type and attribute data are used to determine if features 22 and 47 can be differentiated on the basis of material content and activity diversity. First, however, it is necessary to consider the two contexts in question in greater detail.

THE CONTEXTS

Features 22 and 47 are located in fairly close proximity to one another (Figure 1). Both features contain high densities of artifacts. Together, over 80% of the artifacts recovered from the east side of Dry Branch Creek derive from features 22 and 47. The features are located on opposite sides of KY 1915, on a gentle sloping colluvial fan. They were dug into a weakly developed A-horizon soil and are defined at elevations between 254.65 and 255.02 m above mean sea level. The upper 20 or 30 cm of both features was disturbed by plowing and backhoe operations; thus, it is not possible to determine the full original size of the pits. The size of Feature 22 as excavated is larger than Feature 47. Feature 22 is subrectangular to circular in shape, covers approximately 7.0 m^2, and is 20 cm deep (Figure 2). Feature 47 is circular in shape, covers an area of approximately 1.6 m^2, and is 25 cm deep (Figure 2). The volume of the features was approximated based on the formula for a circle. The estimated capacity of Feature 22 is 1.27 m^3, and .78 m^3 for Feature 47.

Feature 22 may have been originally dug as a basin for some type of structure or dwelling. Fort Ancient structure basins similar in size and shape to Feature 22 have been documented at the Muir site in central Kentucky (Turnbow and Sharp 1988:43-56), and at Emergent Mississippian sites in the American Bottom (Milner 1983). Feature 47 may have been dug for use as a formal or informal storage pit, processing area, or borrow pit. Both features have only one fill deposit, a dark organic-rich soil. A light, compact soil that contained pockets of ash, charcoal, and small pieces of limestone occurred below the primary fill deposit in Feature 22, and some compact clay deposits were evident at the very bottom of the basin. The dark, organic soil in Feature 47 was restricted to an area covering ca. 1 m^2 and contained large deer bone fragments. A lighter, compact soil sloped up and outward from the feature center and appeared to form a ring around the dark, organic-rich soil.

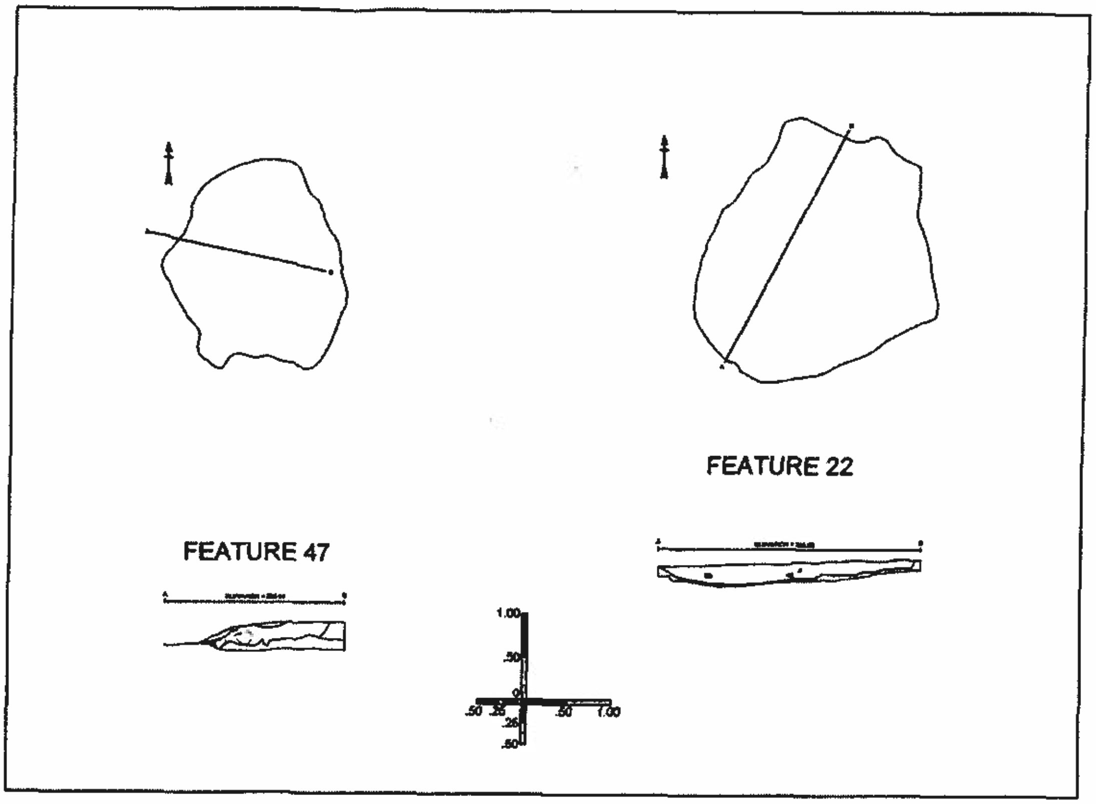

Figure 2. Features 22 and 47 Planviews and Profiles.

Overall, Feature 22 contained more and larger pottery sherds than did Feature 47, and portions of several vessels have been reconstructed from the broken sherds in Feature 22. The Feature 47 ceramic assemblage appears to consist principally of small sherds from several different vessels. Also, sherds in Feature 47 are not as well-preserved as those in Feature 22. The majority of sherds in both features are from limestone tempered, cordmarked vessels. In addition to pottery, both features contained bone, carbonized plant remains, chipped stone debitage, and tools.

RADIOCARBON DATES

Four carbon samples consisting of wood charcoal were submitted to Beta Analytic for chronometric dating (Table 1). Two samples were selected from each of the two features to obtain dates for the upper and lower portions of the pits. The intercept calibrated dates overlap between cal A.D. 1220 and 1280, indicating an early middle Fort Ancient date for the use of the two features. The date ranges for the upper and lower feature deposits overlap at the one and two sigma calibrated range, thus it is likely that the deposits accumulated over a brief period of time. Although dates from more than two features are required to bracket the occupation span for the portions of the site that fall within the project area, the overlap in the date ranges for the two features may indicate a terminal date for the site occupation prior to A.D. 1400.

Table 1. Radiocarbon Dates from Features 22 and 47.

Sample No.	Conventional Radiocarbon Age, 1 Sigma s.d.	Calibrated Date, 2 Sigma s.d. (Intercept)	Context
Beta-126975	840±60 BP	A.D. 1035(1220)1285	Feature 22, upper
Beta-126976	720±70 BP	A.D. 1205(1285)1400	Feature 22, lower
Beta-126977	740±60 BP	A.D. 1205(1280)1390	Feature 47, lower
Beta-126978	840±80 BP	A.D. 1020(1220)1295	Feature 47, upper

THE POTTERY ASSEMBLAGE

A total of 3,056 sherds (9,473 gm) were recovered from features 22 and 47. The majority of sherds in each feature are small, being less than 4 cm^2 in size. These small sherds account for three-quarters of the pottery from both features. Because of their small size and minimal information content, small sherds were not included in subsequent analyses. Of the sherds larger than 4 cm^2, body sherds comprise between 88% and 93% and rims between 6% and 7% of the ceramic collections from both features. Appendages are rare in the assemblage: only three handles were found in each of the two features.

Forms

Based on an initial assessment of the ceramic assemblage, the majority of the ceramics appear to be derived from jars (Figure 3a-h). These types of vessels are the primary vessel form associated with Late Woodland, and early and middle Fort Ancient sites (Turnbow and Henderson 1992). Jars recovered from these sites tend to have rounded or slightly angled shoulders (Turnbow and Henderson 1992; Turnbow and Sharp 1988).

Four jar rim orientations are represented in the ceramics from features 22 and 47: direct, incurvate, recurved, and flared. The most common rim orientation is slightly flared. Lips tend to be flat or flat/rounded and undecorated, although examples of cordmarked lips are present in the collection. A variety of handles also are associated with both features (Figure 3i-k): loop-straps; thick parallel-sided straps; and a thin convergent-sided strap. One handle has a groove (Figure 3j) in the center that is similar to handles from Muir (Turnbow and Sharp 1988), Coy Mound (O'Shaughnessy and Wilson 1990), and Turpin (Griffin 1966).

The jars from both features are tempered with limestone and/or shell; however, the most common temper is limestone (80%). Mixed limestone and shell tempered sherds comprise between 11 and 14% of the ceramics from each feature, and shell tempered sherds comprise between 3 and 6% of the ceramics from each feature. Jar exterior surfaces are cordmarked, plain, or in some cases consist of a combination of plain and cordmarked surfaces, but the majority of the sherd surfaces are cordmarked (89%). Initial examination of the ceramics from both features suggests that decorated sherds are rare.

A possible relationship between temper and surface treatment is indicated by the ratio of plain sherds to cordmarked and plain sherds. The ratio for shell tempered sherds is .87, which suggests that shell tempered vessels may have had plain exterior surfaces. The ratio for limestone tempered sherds is .27, suggesting that limestone tempered vessels may be characterized by cordmarked exterior surfaces. The ratio for sherds with both shell and limestone temper is .45. Ceramic assemblages from Fort Ancient sites in central Kentucky that date to between A.D. 1000 and 1300 are characterized by a high percentage of cordmarked and limestone tempered sherds (Turnbow and Henderson 1992; Turnbow and Sharp 1988).

Relative Frequency, Density and Mean Number of Objects per Category Measures

Excluding sherds smaller in size than 4 cm^2, the distribution of ceramic categories and types varies between the two features (tables 2 and 3). For example, fired clay occurs more frequently in Feature 22 compared to Feature 47, perhaps reflecting the presence of a hearth or fired area associated with Feature 22. In general, ceramics occur less frequently in Feature 47 compared to Feature 22, and sherds in Feature 47 are more weathered than sherds recovered from Feature 22. Differences in the state of preservation of the ceramics from features 22 and 47 could be the result of several factors: structural differences between the features affecting variation in exposure to the elements; secondary deposition of refuse from associated surfaces; or variation in the amount of ash and limestone in the deposits associated with the two features.

Exterior surfaces of Fort Ancient vessels are typically cordmarked, plain, or some combination of the two, although sherds with net, fabric-impressed, and checked stamped surfaces are present in some site ceramic assemblages (Turnbow and Henderson 1992:118). Vessels with smooth surfaces and those with smooth and cordmarked exterior surfaces tend to occur more commonly later rather than earlier in the Fort Ancient temporal sequence (Turnbow and Henderson 1992, Figure X-1; Turnbow and Sharp 1988). The ratio of cordmarked pottery to all cordmarked and plain sherds suggest that cordmarked vessels are more common in Feature 22 than in Feature 47 (Table 4). Since the calibrated dates for the two feature contexts overlap, it is unlikely that the variation in surface treatment is temporal. Rather, differences in associated vessel functions, use-life, and discard rate may account for the differences in the ceramics recovered from the two features (Pauketat 1987).

The density of sherds (not including sherds < 4 cm^2) by weight in Feature 22 is 4,682.7 gm per cubic meter, and 1,775.6 gm per cubic meter for Feature 47. Not only is sherd density higher in Feature 22 compared to Feature 47, but the mean number of objects per category is higher for body sherds and rims (Table 5). Differences in the mean values may indicate differences in activities reflected by the two feature contexts. Ceramics, however, pose interpretive problems using the mean number of objects per category statistic, since the number of objects reflect sherd counts and not actual vessels. Nevertheless, the measure does suggest differences in the composition of the ceramic assemblages that may relate to such factors as differential ceramic breakage rates, discard patterns (Pauketat 1987:12), and the different uses of the pits or activities that occurred in their

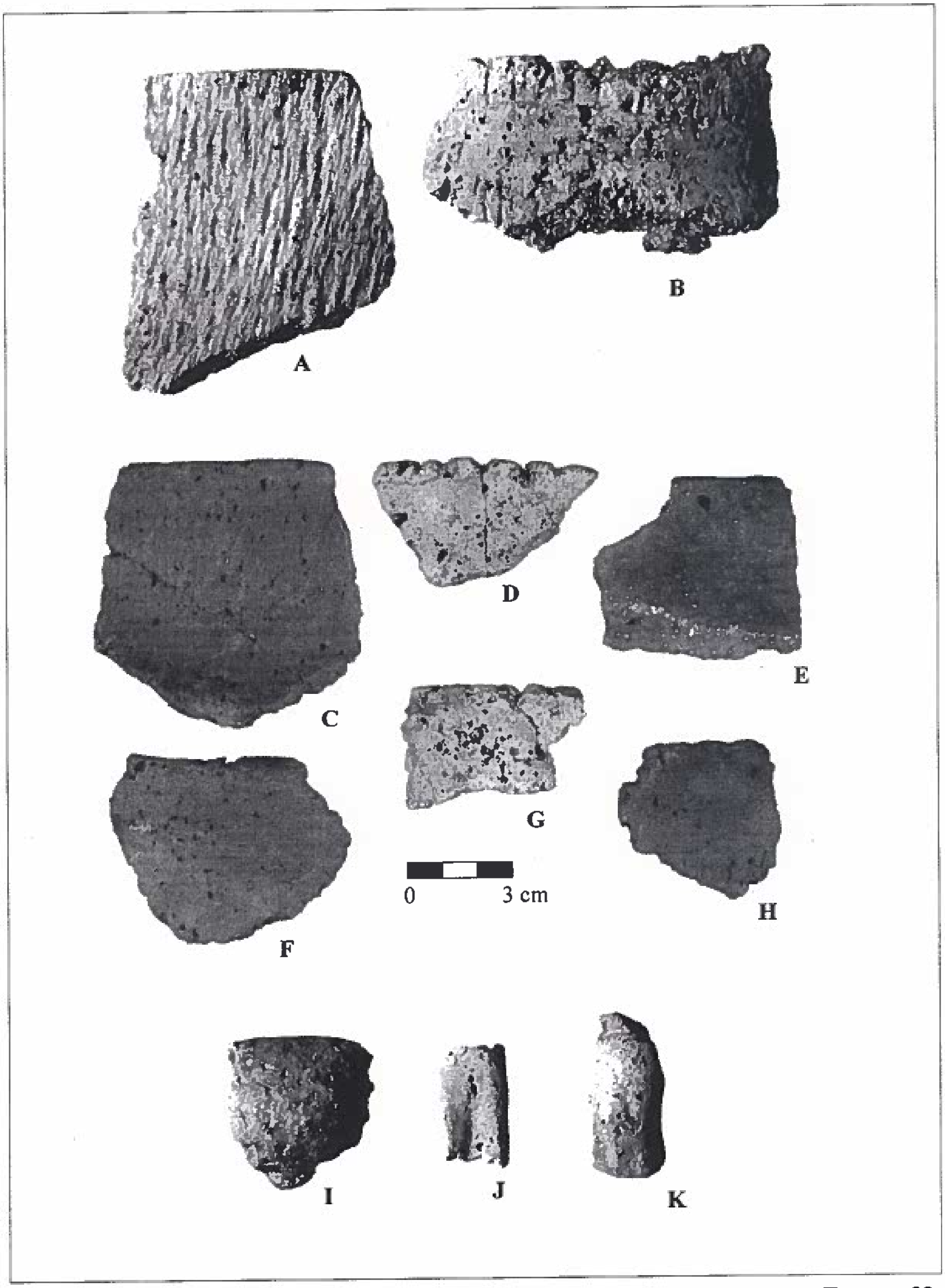

Figure 3. Ceramics: a-b, jar rims from Feature 47; c-h, jar rims from Feature 22; i, thin convergent-sided strap handle from Feature 47; j, loop-strap from Feature 22; k, thick strap from Feature 22.

vicinity. Although the numbers of categories do not differ greatly between the features, the number of objects per category is markedly higher for Feature 22 compared to Feature 47. The higher mean number of objects per category for Feature 22 reflects not only a higher density of pottery in Feature 22, but also a higher frequency of occurrence of partial vessels. Feature 22 also contains a higher number of rim categories compared to Feature 47 (Table 5). Assuming that there is a relationship between rim type and vessel function and rim form, then a wider range of vessel types may be present, or may have been disposed of, in Feature 22 compared to Feature 47. Considering the category and attribute data together, it may not be unreasonable to suggest that Feature 22 contained a number of whole or partially whole vessels of varying size and form, while Feature 47 contained small, weathered sherds from a number of different vessels, perhaps discarded or swept into the feature from surrounding surfaces.

Table 2. Ceramic Category Counts, Weight, and Density (gm/m^3).

Category	Feature 22	Feature 47
Fired Clay	1,128 108.6 85.5 gm/m^3	230 89.9 294.8 gm/m^3
Fired, Tempered Clay	27 11.7 9.2 gm/m^3	—
Body/Base Sherds (> 4 cm^2)	512 5,517.4 4,344.4 gm/m^3	160 1,144.5 1,467.3 gm/m^3
Rim Sherds	31 280.6 220.9 gm/m^3	15 109 139.7 gm/m^3
Strap Handles	3 26.8 21.1 gm/m^3	3 40.6 52.0 gm/m^3
Sherdlet (< 4 cm^2)	1,644 1,668 1,313.3 gm/m^3	686 681.7 873.9 gm/m^3

OTHER ARTIFACTS

Although ceramics account for between 44% (Feature 47) and 56% (Feature 22) of the total inventory of artifacts from the two features, other items are also present.

Table 3. Ceramic Surface Treatment and Temper Type Counts, Weights and Density (gm/m^3).

Surface Treatment	Temper Type	Feature 22	Feature 47
Weathered	Limestone	38 290 228.3 gm/m^3	13 55 70.5
	Shell	2 11 8.7 gm/m^3	1 4 --
	Mixed	13 111 87.4 gm/m^3	6 30 38.5
	Other	3 25 19.7 gm/m^3	1 6
Cordmarked	Limestone	314 3,809 2,999.2 gm/m^3	79 509 653
	Shell	2 9 7.1 gm/m^3	1 3
	Mixed	30 282 222.0 gm/m^3	9 64 82
	Other	--	1 4
Plain	Limestone	90 746 587.4 gm/m^3	55 493 632
	Shell	12 77 60.6 gm/m^3	8 99 126.9
	Mixed	28 313 246.4 gm/m^3	4 26 33.3
	Other	4 20 15.7 gm/m^3	---
Incised	Limestone	3 18 14.2 gm/m^3	---
	Mixed	2 33 26 gm/m^3	---

Table 4. Ratios of Cordmarked Sherds to Cordmarked Plus Plain Sherds.

Context	Cordmarked	Plain	Cordmarked/ (Cordmarked + Plain)
Feature 22	346	134	.72
Feature 47	90	67	.57

Table 5. Ceramic and Rim Type Classes[1], Objects and Objects/Category Measures for Features.

Locus	Material Class	Number of Categories	Number of Objects	Objects/ Categories
Feature 22	Body sherds	13	547	42.1
Feature 47	Body sherds	11	179	16.3
Feature 22	Rim types	10	26	2.6
Feature 47	Rim types	6	12	2.0

[1]Body and rim sherd classes and categories based on combinations of surface treatment, vessel portion, rim characteristics, and temper.

Fired Clay

Nondescript fragments of fired clay occur in both features (Table 2). The derivation of this material is unknown. However, possible sources include construction material, facilities such as hearths, or some other episode of *in-situ* burning (Milner 1983:41; Wagner 1986:60). The burned clay is fairly localized in Feature 22 where 86% by weight occurs in one quadrant. The concentrated nature of fired clay in Feature 22 may reflect the remnants of an internal hearth, or alternatively, a discrete depositional episode.

Rock

Unmodified and modified rock occurs in both of the features and includes chert, limestone, and hematite, as well as chipped stone debitage, tools, and a sandstone pipe bowl fragment found in Feature 22. Unmodified chert and limestone density is greatest in Feature 22, and hematite was found only in Feature 47 (Table 6).

Chipped Stone

The chipped stone collection from the two features includes a range of formal tools and debitage types, as well as utilized flakes (tables 7 and 8) (figures 4 and 5). Flakes are the most

Table 6. Unmodified Rock by Count, Weight, and Density.

Feature	Pebble Chert	Unmodified Lexington Limestone	Limestone	Hematite
Fea. 22	3 13 gm 10.2 gm/m^3	4 5 gm 3.9 gm/m^3	1 5 gm 3.9 g/m^3	—
Fea. 47	6 37 gm 47.4 gm/m^3	3 25 gm 32.0 gm/m^3	80 4,947 gm 6,342.3 gm/m^3	46 40 gm 51.3 gm/m^3

Table 7. Chipped Stone Artifact Class Counts and Weights for Local and Other Raw Materials.

Raw Material	Cores	Chunks/ Shatter	Flakes (includes utilized and unutilized)	Bifacial Tools	Unifacial Tools
Local Chert	6 75.9 gm	61 317.6 gm	1283 1286.1 gm	25 73.1 gm	18 160.2 gm
Other/Unknown			54 31.1 gm	2 .6 gm	

Table 8. Biface and Uniface Tool Type Percentages.

	Fea. 22		Fea. 47		Total
Tool Type	Freq.	Percent	Freq.	Percent	Freq.
Broken Triangular Point	2	11.1	6	21.4	8
Biface, Staged	2	11.1	2	7.1	4
Burin	2	11.1	3	10.7	5
Biface Fragment	4	22.2	6	21.4	10
Drill	1	5.6	3	10.7	4
Graver	1	5.6	2	7.1	3
Scraper	1	5.6	--	--	1
Wedge	--	--	1	3.6	1
Uniface	--	--	1	3.6	1
Retouched Piece	5	27.8	4	14.3	9
Total	18	100.0	28	100.0	46

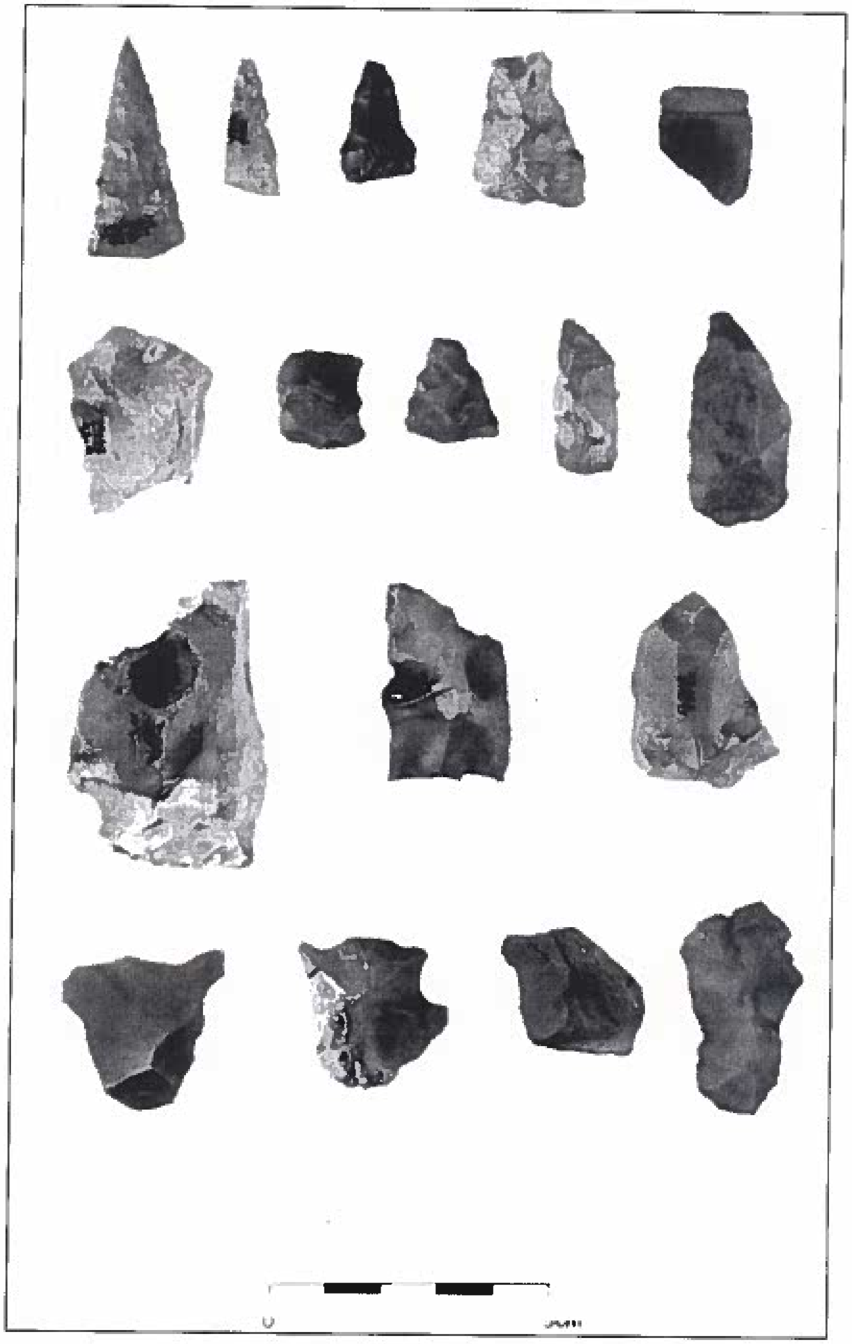

Figure 4. Chipped Stone Tools from Feature 22: top row, bifacial tools including a triangular projectile point, drill/perforator, knife, and sandstone pipe bowl fragment at upper right; middle two rows, examples of cutting, scraping, and perforating tools; bottom row, utilized flakes.

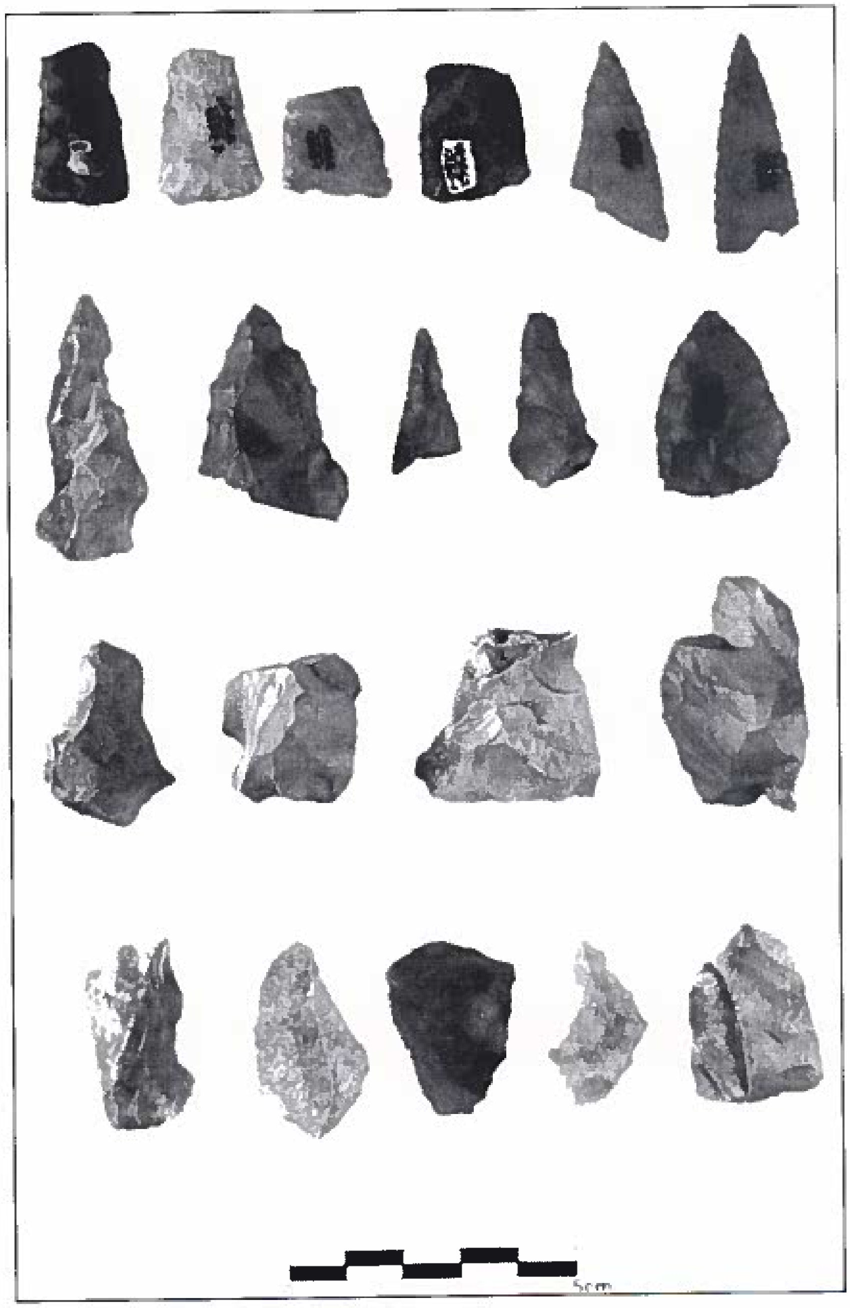

Figure 5. Chipped Stone Tools from Feature 47: top row, triangular projectile point fragments; middle two rows, cutting, perforating, and scraping tools; bottom row, utilized flakes.

common artifact type, and local Lexington Limestone Chert is the most common raw material. Other researchers have noted that lithic collections from Fort Ancient and Mississippian sites are typically dominated by flakes of locally available raw materials (Brose 1982; Milner 1983; Pollack and Hockensmith 1992; Railey 1992; Smith 1995:234; Turnbow and Sharp 1988).

Artifact Frequency, Density and Mean Number of Objects per Category Measure

Although chipped stone items are common in both features, the density of debitage and tools is higher in Feature 47 compared to Feature 22 (tables 9 and 10). The higher density of debitage and tools may indicate that lithic items were discarded more frequently or in greater quantities in Feature 47 compared to Feature 22. On the other hand, the greater frequency of occurrence of lithic items in Feature 47 may be a reflection of the kinds of activities that involved the use of stone tools in the Feature 47 locus. The two features can also be differentiated on the basis of the relative percentages of different tool types, which may reflect variation in the kinds of activities in which the tools were used in before they were disposed of (Table 8). For example, there are proportionately more triangular points and utilized flakes discarded in Feature 47. By way of contrast, there are more bifacial knives and retouched flake tools discarded in Feature 22.

Table 9. Chipped Stone Debitage by Count, Weight and Density.

Feature	Flakes	Chunk/Shatter	Core
Feature 22	409 371.7 gm 292.7 gm/m3	18 67 gm 52.7 g/m3	3 35.7 gm 28.1 g/m3
Feature 47	496 639.9 gm 820.4 gm/m3	33 237.7 gm 304.7 gm/m3	4 41.2 gm 52.8 gm/m3

Table 10. Chipped Stone Tool Classes by Count, Weight and Density.

Feature	Bifacial Tools	Unifacial Tools	Utilized Flakes	Total
Feature 22	11 30.4 gm 23.9 gm/m3	7 51.1 gm 40.2 gm/m3	38 138.6 gm 109.1 gm/m3	56
Feature 47	19 63.1 gm 80.9 gm/m3	9 94.1 gm 120.6 gm/m3	80 240.4 gm 308.2 gm/m3	108

Since discarded flakes in archaeological sites can originate as a result of manufacturing and use-related activities, it is important to be able to differentiate between the two kinds of activities. Information pertaining to raw material availability, technology, and intended tool function can be inferred based on knowledge of chert sources, attributes of flakes, and signs of wear. For example, the number of scars on flake dorsal surfaces has been used by some researchers as a key attribute with which to interpret tool production stages, particularly in the case of biface technologies. However, comparatively little attention has been given to the identification of modified and unmodified flake tool technology, tool design, and use, despite the importance of *ad hoc* flake tools among late prehistoric groups (Barber 1978; Brose 1982; Gero 1991; Koldehoff 1987; Smith 1995:234; Yerkes 1987).

In the present study, attributes related to raw material selection, flake dorsal scar patterns, and usewear are used to examine technological and functional dimensions of variation in the flake assemblages from the two feature contexts. Raw materials were identified as either local or nonlocal. Local cherts include those that were available in the immediate site locale. Nonlocal refers to raw material that may have been obtained from locations beyond the immediate vicinity of the site. Dorsal scar categories divide the flake assemblage into two groups: flakes with less than two dorsal scars, and those with two or more dorsal scars (tables 11 and 12). Interpretation of the dorsal scar data requires making the simplifying assumption that if lithic assemblages typically include a mix of bifacial and flake tool technologies, and if biface technologies produce shaped tool forms whereas flake tool technologies do not, then the number of dorsal scars present on flake surfaces will increase as the complexity of the manufacturing process increases. Flakes with more than two dorsal scars, therefore, may reflect manufacturing waste from the production of bifacial tools. On the other hand, flakes with two or fewer dorsal scars may reflect *ad hoc* tools manufactured intentionally for use. Usewear data for a large sample of utilized flakes from Mississippian sites in the American Bottom indicate that used flakes typically have two or fewer dorsal scars (Yerkes 1987).

Table 11. Dorsal Scar Data for Feature 47.

Chert Type	DS 0-2	DS>2	Total
Local	137	484	621
Nonlocal	8	29	37
Total	145	513	658

Table 12. Dorsal Scar Data for Feature 22.

Chert Type	DS 0-2	DS>2	Total
Local	294	144	438
Nonlocal	22	8	30
Total	316	152	468

While flakes in both dorsal scar categories occur in both features, they are not evenly represented. There are proportionately more flakes with two or fewer dorsal scars in Feature 22 (.67) compared to Feature 47 (.22). By way of contrast, there are proportionately more flakes with greater than two dorsal scars in Feature 47 (.78) compared to Feature 22 (.34). The observed differences in the dorsal scar attributes, therefore, may reflect variation in the material representation of technologies and related activities at the two feature loci. Specifically, technologies and activities associated with the production of formal shaped tools may characterize Feature 47, although unmodified flake tools are also present. On the other hand, technologies and activities that involve the manufacture and use of unmodified flake tools may be reflected to a greater extent than bifacial tool technologies in the lithic materials from Feature 22.

Results of an ongoing usewear study have confirmed that the majority of flakes identified as utilized based on macroscopic characteristics were, indeed, used prior to discard. Although it is anticipated that utilized flakes not identified by visible wear are presently unaccounted for, the usewear data confirms that numerous utilized flakes were disposed of in both features. Additionally, variation in the distribution and appearance of use polishes on the tool edges suggests that many of the Feature 22 flakes were used to process meat, while several of the Feature 47 flakes show evidence of having been used to process woody materials. Meat polish is characteristically restricted to the immediate edge area where it occurs as a well-defined, dense band of unlinked polish elements. In contrast, wood polish is typically intrusive and, when sufficiently developed, the individual polish elements link and form an altered surface that appears domed and generally has a very smooth surface texture. Although the usewear study is incomplete at this time, the results are promising and serve to underscore the utility of usewear studies to provide a detailed and context-specific understanding not only of activities, but also the relation between activities and expedient flake tool industries common in Late Prehistoric period lithic assemblages (Smith 1995:234). For example, the association of potential woodworking tools with the manufacture of arrow points may connect some portion of the utilized flakes in Feature 47 to arrow making activities.

The frequent occurrence of broken triangular points and flakes with more than two dorsal scars suggest that activities relating to the manufacture and maintenance of triangular arrow points may have occurred in or around Feature 47. In this regard it is of interest to note that five of the six triangular points in Feature 47 are proximal fragments. It is expected that proximal fragments would be routinely discarded when retooling arrows. It is also of interest to note that of the 29 nonlocal chert flakes in Feature 47, nearly three-quarters (.72/n=21) retain two or more scars on their dorsal surfaces, a pattern that may indicate an association between arrow point technologies and particular resources. In contrast, the elevated frequency of flakes with two or fewer dorsal scars in Feature 22 may reflect the presence of by-products of expedient flake manufacture. Feature 22 also contains higher frequencies of what may best be interpreted as general purpose cutting tools, including bifacial knives and utilized flakes.

The higher density of lithic debitage and tools in Feature 47 is reflected in the higher mean number of objects per category measure (Table 13). Although the number of categories as defined in the present study do not differ markedly between the two features, the relatively higher number of objects per category for Feature 47 suggests more discard of both manufacturing waste and tools at this locus. Characteristics of the lithic data already discussed suggest that the contents of the two features include items that reflect activities related to tool manufacture, use, and maintenance. High densities of flakes characterize both feature loci, but detailed attributes suggest that they may represent by-products of different manufacturing activities. In the case of Feature 47, lithic debitage may reflect discard of manufacturing by-products associated with arrow point production. In contrast, debitage in Feature 22 may reflect discarded used flakes and by-products of the manufacture of flake tools, although it is expected that some portion of the debitage reflects biface production.

Table 13. Lithic Mean Number of Objects per Category Measures.

Feature	Debitage Categories			Tool Classes			Tool Types		
	#obj.	#cat.	Mean (#obj./#cat.)	#obj.	#cat.	Mean (#obj./#cat.)	#obj.	#cat.	Mean (#obj./#cat.)
Fea.22	430	3	143.3	56	3	18.6	18	8	2.25
Fea.47	533	3	177.6	108	3	36.0	28	9	3.11

Utilized flakes are more common in Feature 47 than in Feature 22. The higher rate of discard of this artifact category may reflect a higher use and discard rate of flakes used in wood-working activities. By way of contrast, utilized flakes in Feature 22 may reflect a general domestic assemblage comprised of flake tools used to process foodstuffs and to manufacture everyday goods. The higher discard rate of triangular point bases in Feature 47 suggests refuse from a specific activity, perhaps retooling arrows.

INTERPRETATION OF THE FEATURES

Having assessed the material contents of the two features, what does this more detailed examination tell us? Overlapping radiocarbon dates raise the possibility that the two features were contemporaneous. Both features date to the early portion of the middle Fort Ancient period. The density and range of artifact classes contained in both features indicate that they were places where refuse was discarded. In both features there is variability in the densities of discarded materials, although no clear stratigraphic levels were present. It was also noted during excavation of the features that artifacts were oriented both horizontally and vertically. At a general level it would not be incorrect to interpret the two features as refuse pits. Upon closer inspection, however, the depositional histories of the two features appear to be more complex than implied by the label, "refuse pit."

Although similar kinds of artifacts were recovered from both features, there are considerable differences between them. Overall, Feature 22 contained a greater diversity of artifacts, while Feature 47 is characterized by a more redundant artifact assemblage. The greater diversity of artifacts in Feature 22 may be due to its larger size or use as a general refuse facility. The less diverse assemblage in Feature 47 may reflect the kinds of activities that occurred in the vicinity of the feature. Feature 22 contained more burned clay than Feature 47 and pockets of ash are not present in Feature 47. Considerably more limestone fragments were present in Feature 47 than Feature 22. Hematite and a bone awl were items found only in Feature 47. The larger of the two features, Feature 22, contained considerably higher densities of ceramic debris, particularly large conjoinable and well-preserved sherds from a range of vessel forms and sizes. Feature 47 contained fewer, smaller, and more eroded sherds. On the other hand, Feature 47 contained more chipped stone, including by-products related to the manufacture of arrow points and expedient flake tools used in a range of tasks, especially wood-working. Feature 22 had more flakes that may have been manufactured for use as *ad hoc* tools for a range of tasks, especially animal processing. Bifacial knives and retouched flakes also occurred more frequently in Feature 22. Both features contained carbonized plant remains and deer bone. Only Feature 22 contained antler and a sandstone pipe fragment (Figure 5).

Feature 22, possibly dug as a structure basin, contained a range of classes of artifacts that included: 1) debris from the manufacture of chipped stone tools; 2) tools used in animal and plant processing tasks, hunting, and stone working; 3) finished products discarded after use including pottery, whole and broken stone tools used to pierce, cut, scrape and incise, and a sandstone pipe fragment; 4) mussel and clam shells; 5) deer antler fragments; and 6) burned and unburned animal bone, charcoal, and ash. Feature 47, possibly dug as a processing or storage pit, contained: 1) debris from the manufacture of chipped stone tools; 2) tools used in hunting, animal, and plant processing tasks; 3) finished products discarded after use including pottery, broken arrow point bases, and other chipped stone tools used to pierce, cut, incise, and wedge; 4) limestone and hematite; and 5) burned and unburned animal bone.

The ceramic materials in Feature 47 may reflect refuse from sweeping associated surfaces. The lithic data may be interpreted to reflect work activities related to hunting. Thus, the contents of Feature 47 may reflect a combination of primary and secondary refuse. By way of contrast, the broader range of items recovered from Feature 22, including a pipe fragment, byproducts of manufacturing, food preparation and consumption, and the use of less formal chipped stone technologies, may reflect ordinary domestic refuse. Accepting the argument that common expedient flakes were often utilized by women (Gero 1991:174), then women's work may be disproportionately reflected by the discarded items in Feature 22. By the same token, if one assumes that hunting was men's work, then male activities may be reflected to a greater extent by the items in Feature 47.

It is conceivable that the debris dumped into the two pits comes from a number of different sources and, therefore, reflects the activities of several productive groups or households. However, comparative data from Fort Ancient and Mississippian household contexts suggest that while households may have varied in size, status, and extent of involvement in subsistence and other productive activities, most domestic units manufactured their own tools and engaged in similar kinds of activities (Nass and Yerkes 1995). For example, at Blain Village and Sun Watch, two middle Fort Ancient sites in Ohio, certain features contained elevated frequencies of hunting-related items. Robertson (1984:258-259) interpreted the lithic data at Sun Watch to reflect a ceremonial context for hunting-related activities organized at the community level. Nass and Yerkes (1995:77-79) have interpreted the same data to reflect the residence of a community leader. Their comparative study of Mississippian and Fort Ancient households at the Range site and at Sun Watch indicated that the largest households within each community may have had been involved in surplus production and accumulation to a greater extent than others (Nass and Yerkes 1995:79). At the Blain Village site, the pit that contained elevated frequencies of lithic debris and triangular points was located in the vicinity of two structures (designated as features 5 and 42) and other features (Prufer and Shane 1970:27-28). Comparisons between the contents of Feature 47, features at Blain Village, and Sun Watch indicate that hunting was an important aspect of Fort Ancient domestic economies. Although it is conceivable that hunting involved ritual activities on certain occasions and at some locations, the available data suggests that hunting was a domestic-centered activity. Scale of participation in hunting or participation in hunting-related rituals, however, may reflect variation along such social and economic dimensions as status, wealth, economic organization, or household composition. To explore these ideas further, however, requires a more comprehensive and detailed examination of household-related contexts, activities, and material culture.

In summary, patterning in the feature artifact assemblages most likely represents three kinds of depositional contexts that can be associated with household-feature cluster(s): secondary contexts used for general household refuse disposal (Feature 22); primary or secondary contexts used for the disposal of materials related to discrete activities that may have occurred in the vicinity of features, such as processing animals or hunting-related items (Feature 47); and, secondary deposition of materials from cleaning surfaces associated with features (possibly Feature 47).

CONCLUSION

Patterning in artifact assemblages from the two different features excavated at the Dry Branch Creek site varied along dimensions that may relate to whether the feature was associated with processing activities, or whether it was a facility for generalized refuse disposal. The usewear data and distributions of utilized flakes indicate that different tasks may have occurred in the vicinity of the two features. These tasks may be related to the processing of certain kinds of resources by particular work groups or individuals. The usewear data also indicates a probable relation between the use of flakes in particular tasks, their rate of discard, and, hence, variation in the frequency that utilized flakes occur in particular feature contexts. Data from one of the Dry Branch Creek features (Feature 47) and analyzed features from other Fort Ancient sites suggest that processing tasks related to hunting can be identified at certain feature locales within household complexes. The organization of, and extent of participation in, hunting activities and related rituals, however, may have varied in relation to the status, size or composition of a household, or in relation to a particular occasion.

These results indicate that new insights into domestic economies, site structure, technology, and social relations can be obtained from detailed studies of feature artifact assemblages. Rather than simply reflecting refuse, intrasite patterning in ceramic and lithic data can be related to the kinds of activities that occurred in and around features as elements of domestic settings, the ways people organized specific activities, and the kinds of tools and technologies used by particular groups of people. It is argued here that explanations of patterning as it relates to household activities cannot be obtained from traditional feature typologies or artifact inventories only. Rather, detailed comparative studies are needed to examine quantitative and qualitative variability in feature content, artifact density, and diversity (Kent 1999), and to explore relations between raw materials, artifact condition, use, and use-life. This work does not require the application of new methods or techniques. It does, however, require the formulation of problem-oriented research that focuses analysis on the linkages between depositional contexts (Schiffer 1987), artifacts, and attributes.

Underlying this work has been the conviction that structuring analysis to better understand activities enhances understanding of social relations, and hence, people (Claussen 1991). The results reported here should be considered preliminary, since critical data on the faunal and botanical remains, and ceramic vessel form and function are lacking. It should also be stressed that the excavated contexts at the Dry Branch Creek site are limited to portions of what was obviously a larger settlement composed of several households. Nevertheless, the results of this study demonstrate the potential of contextualizing features as fixed associations of items that can be used to identify and differentiate between storage, work activities, and refuse (Pollock 1990; Wright and Pollock 1989). Because of the several lines of evidence needed to do so, new avenues for exploring dimensions of variation in social and economic relations at the household level are opened.

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MORTUARY VARIATION AND SPACE: A GLIMPSE OF MEANING IN WICKLIFFE'S MOUND C CEMETERY

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ABSTRACT

The arrangement of graves in Late Prehistoric cemeteries was a means of communicating ideas about the dead. When associated with other grave features, it is possible to determine aspects of the intended message. Space and five dimensions of mortuary variability from Wickliffe's Mound C Cemetery were examined to learn if and how these features were manipulated as part of the mortuary expression. Aspects of the cemetery's general structure, body treatment, age, and multiplicity were patterned across the mound and cemetery area. Space was used as a means of communicating community solidarity and among certain graves, emphasizing social investment.

INTRODUCTION

Death is a traumatic social event. Human societies frequently use death as a means of linking the living and events that occurred in their lifetime with the past. The dead and past events form an integral part of a community's heritage. For many cultures, this tie is so important that space is set aside for interaction between the living and the dead. These areas can be defined by multiple concentrations of human remains and artifacts used in mortuary rituals. When detected as part of a cultural deposit, especially when there is evidence that these rituals have been practiced numerous times at the same location, cemeteries can be examined to provide evidence of the social structures of past societies (Chapman and Randsborg 1981:2-3).

One former focus of mortuary rituals is located at the Wickliffe Mound Group (15Ba4), a Middle Mississippian mound and village complex located on the bluffs overlooking the confluence of the Mississippi and Ohio rivers in Ballard County, Kentucky. Wickliffe's Mound C Cemetery contains the remains of several hundred Late Prehistoric Native Americans; no fewer than 200 graves have been detected in archaeological excavations over the last 60 years (Matternes 1996:299). Variation in burial form has been documented, indicating that mortuary ritual expression was not rigidly standardized, but the distribution of these features across the ritual use area has not been examined.

Humans regularly use the dead as a means of social communication and as such, diversity in Mound C's mortuary tradition can be hypothesized to represent a means of information transmission. The focus of this paper is to determine whether location in the formal burial area served to convey and emphasize social features about the dead and the living.

DYNAMICS OF MORTUARY COMMUNICATION

Humans treat death as a rite of passage. Not only does death involve the permanent physical removal of a community member, it creates a social void where the rights, duties, and obligations of the deceased are immutably interrupted. These obstacles are overcome by transforming the living's dynamic social qualities into fixed, static social classifications (Saxe 1970:7). This conversion is mediated through social displays or rituals. Mortuary rituals utilize a "language" of written, spoken, visual, material, gestural, and symbolic associations to communicate how both the dead and the living have been repositioned in the community structure, in a manner that is supportive of both the dead and the community as a whole (O'Shea 1984:287; Radcliffe-Brown 1964:324; Randsborg 1989:85). Successful mortuary rituals are generally grounded on a community's framework of beliefs and material symbolism (McGuire 1988:440).

Within the framework of a community's ideology, mortuary expressions are based on the dead's physical and social qualities. Throughout life, humans acquire biological, ascribed, and achieved characteristics; these serve to guide the individual (or actor) through interactions with others (Goodenough 1965:4). The sum of these qualities (or social personality) defines what roles or identities an actor may legitimately assume. At death, a formal attribution of the actor's "true" place in the community is clarified by the surviving actors. Those who are responsible for organizing and performing mortuary rituals associate the various means of communication, including verbal and auditory, visual, gestural, and material mediums, with select aspects of the dead's social personality. Components of a social personality that are emphasized by the mortuary ritual and subsequently accepted by the target audience become integrated within the surviving community's heritage.

A larger audience can be addressed if the symbolized features can be communicated beyond the initial point of transmission. Material symbolisms, particularly those visible beyond completion of the ritual, serve as references for reaffirming and legitimating aspects of the community's structure (Goffman 1959:77; Hall 1980:12). Some of these survive into the archaeological record. Through an examination of potential material expressions against a common means of communication, it is possible to learn how a community chose to transmit information and perhaps identify social qualities that it felt were important.

SPACE AS A FORM OF MISSISSIPPIAN COMMUNICATION

The passage of information from one individual to the next can be accomplished in a variety of ways. When the audience receiving this knowledge transcends a single moment in time, the utilized method must also be able to communicate across time. In nonliterate societies, information transmission over time is frequently accomplished through a material medium. Where the dead are placed represents one form of material communication.

Placement of the dead provides two distinct forms of information. First the dead are spatially situated within the community as a means of associating the dead's social personality with other community functions. Among Mississippian communities, graves may be placed in socially reserved spaces, such as plazas or mounds, implying that the social personalities materialized by the dead were also restrictive (Anderson 1994:313-314; Hatch 1976:137, 139). Many regional centers contain discrete assemblages of graves in close association with domestic areas (Holland 1991:194; Kreisa

1988:166; Larson 1971:66; Morse 1990:75; Nash 1972:13; Peebles 1971:83). These burial localities associate the assembled social personalities with the living area of a given clan or neighborhood. Among dispersed communities, concentrating graves in a central facility unites the social personalities within a common expression (Milner 1984a:477-479). These structures imply that relationships existed among the separate communities. Placement of the dead functioned as a means of transmitting information about the social composition of a given community.

Second, location within a mortuary facility is an important means of emphasizing aspects of an individual personality. Spatial segregation in Mississippian cemeteries is common and may be evidence of kin group differentiation (Black 1979:7; Fisher-Carroll 1997:102; Goldstein 1981:63). At Norris Farm, placement within a given row was influenced by the deceased's age and sex (Santure 1990:69). Mainfort (1985:567-568) has found that age, sex, and wealth differences were emphasized by grave location among historic Native Americans.

Even within a locale set aside for mortuary purposes, space can be seen as a means of emphasizing information about the dead. This component of Late Prehistoric mortuary programs can be used to help discriminate other intentional forms of mortuary variability and provide some indication of the message communicated by space. To find other forms of material communication, six dimensions of mortuary variability (general cemetery structure, body treatment, orientation, grave multiplicity, age, and sex) were independently examined.

GRAVES AT THE WICKLIFFE MOUND GROUP

The distribution of graves at the Wickliffe Mound Group has at best received cursory investigation. Early chroniclers observed a dichotomous relationship between placement of adults in Mound C and infants in Mound D (Hunt 1942:25-26; B. King 1937:89). More recent investigations, however, suggest that use of Mound D for intensive habitation and the original excavation strategy may have over-emphasized Mound D as a subadult burial facility (Wesler 1988:89, 1989). Infant burial at Wickliffe is more likely associated with domestic use areas than it is with a specialized facility. Pre-World War II investigations at Wickliffe noted the presence of adults in certain areas, including Mound B, Mound F, and possibly protostructures in Mound D; some of these probably included substantial grave goods (Wesler 1990). Wesler's review of the existing documentation concludes that these grave locations and contents emphasized the presence of specialized (elite?) social personalities.

Most adult remains are associated with the Mound C cemetery. This facility was originally assumed to contain graves from the initial village occupation (B. King 1939:41-44; F. King 1934:16). More recent examinations, however, indicate that Mound C's architecture is a relatively late addition. Several smaller mounds were initially constructed and then consolidated into a single structure (Wesler 1996:284-292). The original functions of the smaller mounds are unknown. Prior to abandonment of the village, use of the larger mound was discontinued and a thick midden containing late occupation debris accumulated on top of it. Most if not all graves in Mound C were deposited during the late village occupation (Matternes 1999:74-76). Matternes (1996:314-315) has argued that the mortuary programs exhibited in the village and the cemetery follow different aspects of the same general pattern.

GENERAL CEMETERY STRUCTURE

The Mound C cemetery was initially examined to learn how the facility was organized. A planview map of excavations indicate that the cemetery measures about 22 m on the north-south axis and spans at least 25 m in the east-west dimension (Figure 1). It probably forms an oval structure. It is conservatively estimated to encompass about 350 m^2. A little over 42.0% of the facility has been archaeologically examined.

The center of the cemetery is on the summit of Mound C. The mound occupies a prominent point, forming part of the village's central area. The cemetery was visibly situated in the daily activity area and provided a large prominent point with lots of available surface for funerary activities. Burials tend to be densely congregated within a circumscribed space extending only a few meters beyond the margins of the mound. While no physical evidence of an enclosure has been found, the space set aside for funerary ritual activity appears to have been specifically defined by the burial community.

From the sampled areas, graves do not appear to be evenly distributed. Their placement may imply that some form of internal structure was present. The large 1932 excavation block forming the southern end of the cemetery provided a continuous area capable of exploring spatial patterning. To discern the presence of rows Goldstein's (1980:99) method for row discrimination was attempted. Patterns of graves were independently scored by six of my colleagues at the University of Tennessee, but no agreement could be reached on the location of rows (Matternes 1997). Graves could also form clusters within the cemetery. Using Kintigh and Ammerman's (1982) spatial application of K-Means Cluster analysis, evidence for clusters was assessed but none could be distinguished from random patterning (Matternes 1998). While these examinations do not preclude the possibility that internal structures are part of the cemetery arrangement, their form and exact location cannot be confirmed with the existing data. General grave distribution may be a function of other social issues.

THE MOUND'S SUMMIT

Within the cemetery there are indications that space was designated for different mortuary activities. In the center of the cemetery there is an area lacking interments; this equates with the central portion of the mound's summit. The presence of burials on the summit (forming the interior margin) suggests that space within the summit, not the summit proper, was reserved for special use or deemed unsuitable for burial.

Late prehistoric mortuary facilities were not limited to burial areas; rather, they frequently contained special function areas. Throughout the central Mississippi Valley, specialized mortuary structures or charnel houses have been detected (Emerson et al. 1983:294; Goldstein 1980; Jackson 1992:107-112; Marshall 1965; Perino 1971). These buildings appear to have served as foci for non-graveside mortuary activities, including storage, processing, and possibly veneration of the dead (Adair 1930:192; Milner 1984a:470; Swanton 1946:724-729). They were commonly placed on prominent and/or central points in a cemetery. Central mortuary areas have also been noted as places for soft tissue reduction, principally as crematories (O'Brien and Marshall 1994:154-168; Perino 1967). It is possible that the center of the Mound C Cemetery was reserved for similar mortuary functions.

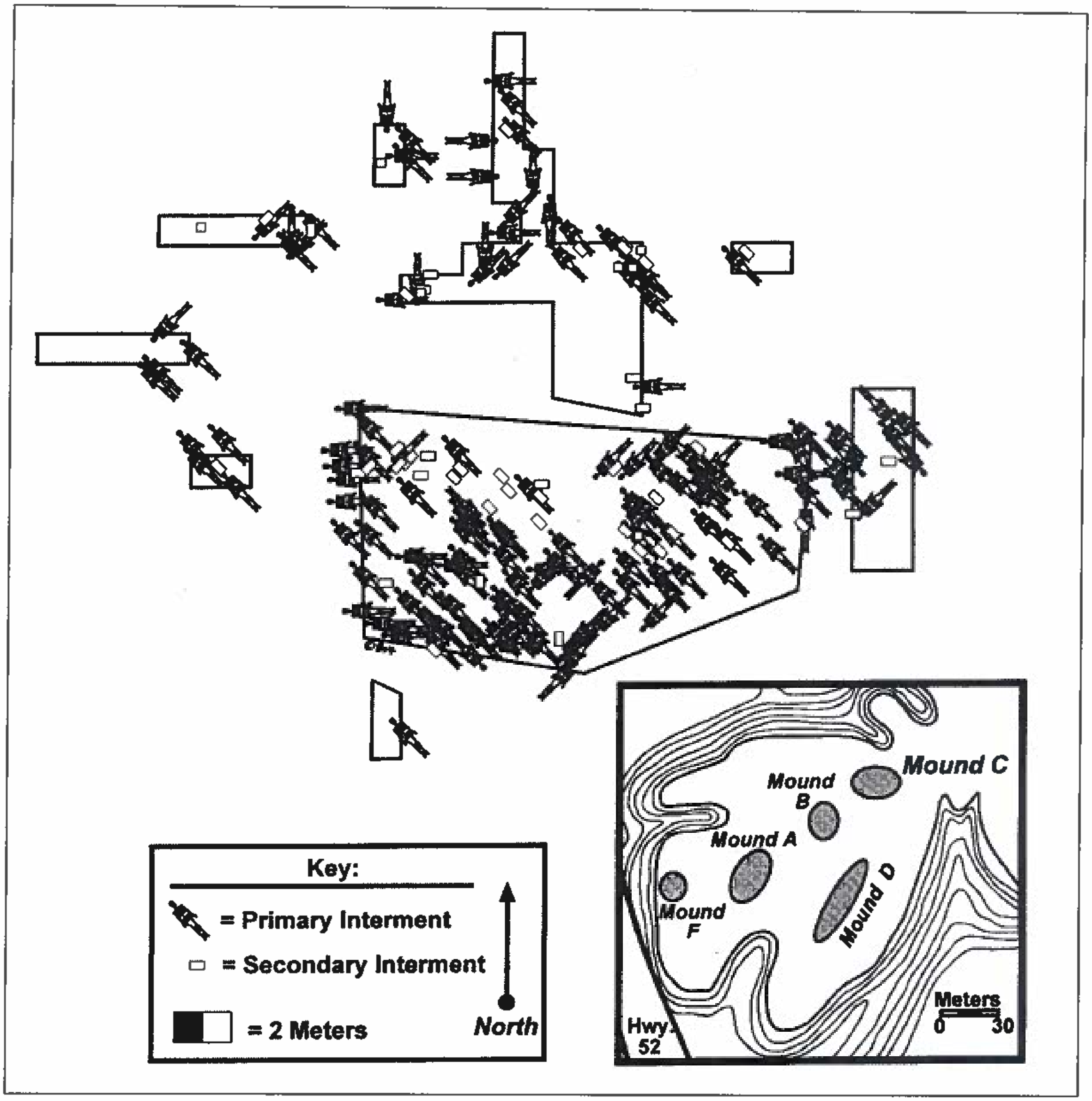


Figure 1. Planview of Mound C Cemetery.

Since no structural details have been recovered from the summit's matrix, determining the exact role that Mound C's summit played in the mortuary program is challenging. The maximum size of the central empty space was calculated to be 53 m^2. A comparison with Mississippian period floor plans indicates that a variety of structural forms could have been located within the central space (Table 1). Admittedly the evidence is weak, but it is possible that a charnel or some similar type of mortuary structure may have been constructed on the top of Mound C. Despite claims by King (F. King 1934:16), no evidence of a crematorium has been documented in Mound C (Matternes 1996:306, 309).

Table 1. Area Estimates for Structures from Selected Mississippian Sites.

Site	Number of Structures	Mean Floor Area (M^2)
Central Area Mound C	1(?)	≤53.00
Wickliffe (15Ba4)	2	20.76
Morris (15Hk49)		
Single Post	2	56.64
Wall Trench	10	40.12
Chambers (15Ml109)	1	32.00
Jonathan Creek (15Ml14)	79	34.49
Lilbourn (23Mn38)	3	10.69
Hess (23Mi55)	4	29.25

Centering the cemetery on the mound's summit suggests that the mound was a focal point for mortuary activity. The question then is whether the space occupied by Mound C affected where graves were located in the accompanying mortuary facility. It was hypothesized that if the Mound's summit engendered a positive social meaning about the dead in the community, then interments would be concentrated near the center of the facility.

To test this, a cemetery center point was approximated from the average midpoint distance between burials forming the central margin. Distance measurements were then taken from this to a midpoint defined in each burial. Only graves with center points in excavated areas were used, resulting in a maximum sample of 149 interments. Distances to the center point of each excavated and unexcavated 1 m unit were then obtained to control for differences in excavation area. In Table 2, grave frequencies by distance from the cemetery's center are presented. Over 87.0% of these interments were located from 3 to 9 m from the cemetery's center. Unfortunately, this distance also accounted for about the same proportion of the total area excavated in the Mound C Cemetery. To learn whether excavation area and burial frequency followed the same pattern, these two variables were compared, using a Kolmogorov-Smirnov Two Sample Test (K.S.). The null hypothesis for this test stated that the distributions were indistinguishable. A low 'D' value indicated that these distributions were similar and the accompanying probability estimate ('P') emphasized that random sampling could easily result in these two distributions. Failure to reject the null hypothesis implied that the magnitude of excavation had affected burial frequency. In other words, since the excavated portion of each distance interval was not equal to that in other intervals, grave counts for each interval were simply reflecting the number of graves encountered and not their distribution across space. As a means of correcting for this bias, the number of graves per distance interval was divided by the excavated area. The resulting density estimate indicates only a very slight trend towards burial close to the cemetery's center.

Table 2. General Dimensions* of the Cemetery's Burial Field.

Interval Distance*	Total Area	Excavated Area** In Burial Field	Proportion of Total Area Excavated	Number of Burials	Burial Density
0-0.99	2.00	0.00	0.00	0	0.00
1-1.99	12.00	0.00	25.00	0	0.00
2-2.99	14.00	0.00	53.64	0	0.00
3-3.99	5.83	3.00	51.28	8	2.66
4-4.99	20.00	10.65	52.20	19	1.78
5-5.99	28.38	12.38	43.62	18	1.45
6-6.99	39.56	15.56	39.33	18	1.15
7-7.99	42.00	15.82	37.66	27	1.70
8-8.99	47.00	20.25	43.08	18	0.88
9-9.99	44.00	19.53	44.38	22	1.12
10-10.99	32.00	9.41	29.40	8	0.85
11-11.99	21.00	3.74	17.80	4	1.06
12-12.99	>8.00	>5.00	<100.00	5	1.00
13-13.99	>5.00	>5.00	<100.00	2	0.50

Kolmogorov-Smirnov 2 Sample Test: (Excavated Area in Burial Field) X (No. of Burials): D=0.112; P=0.37

*All measurements in meters/square meters.
**Does not include central empty space and historic disturbances.

BODY TREATMENT

Modification of the deceased's physical remains or body treatment indicate how the corpse was prepared and utilized as a symbol of the deceased and their social qualities. Graves in Mound C generally reflect three forms of body treatment - individuals were buried in the flesh, producing articulated primary interments or they were reduced to a hard tissue state and then interred as a secondary or disarticulated mass. (Matternes [1996:306, 309] reports the presence of cremated human bone, however, there are very few indications that these remains represent an intentional burial). Graves containing both primary and secondary forms were also observed.

The sample was divided by body treatment and the degree of homogeneity estimated between unit and grave form frequency, using a K.S. Test. A very low 'D' value for primary interments indicated a high degree of sample homogeneity. In Figure 2, note the close relationship between these two variables. Unit sample size probably biased this representation. In contrast, secondary interments produced a high 'D' value, indicating that unit and secondary frequencies were heterogeneous assemblages. Secondary interment frequency is considerably less biased by unit sample size, suggesting that there is a spatial difference between primary and secondary forms. Multiple body treatment sample sizes prohibited a detailed analysis. They were found only in distance intervals with more extensive excavation areas, inferring that unit biases may be affecting their distribution.

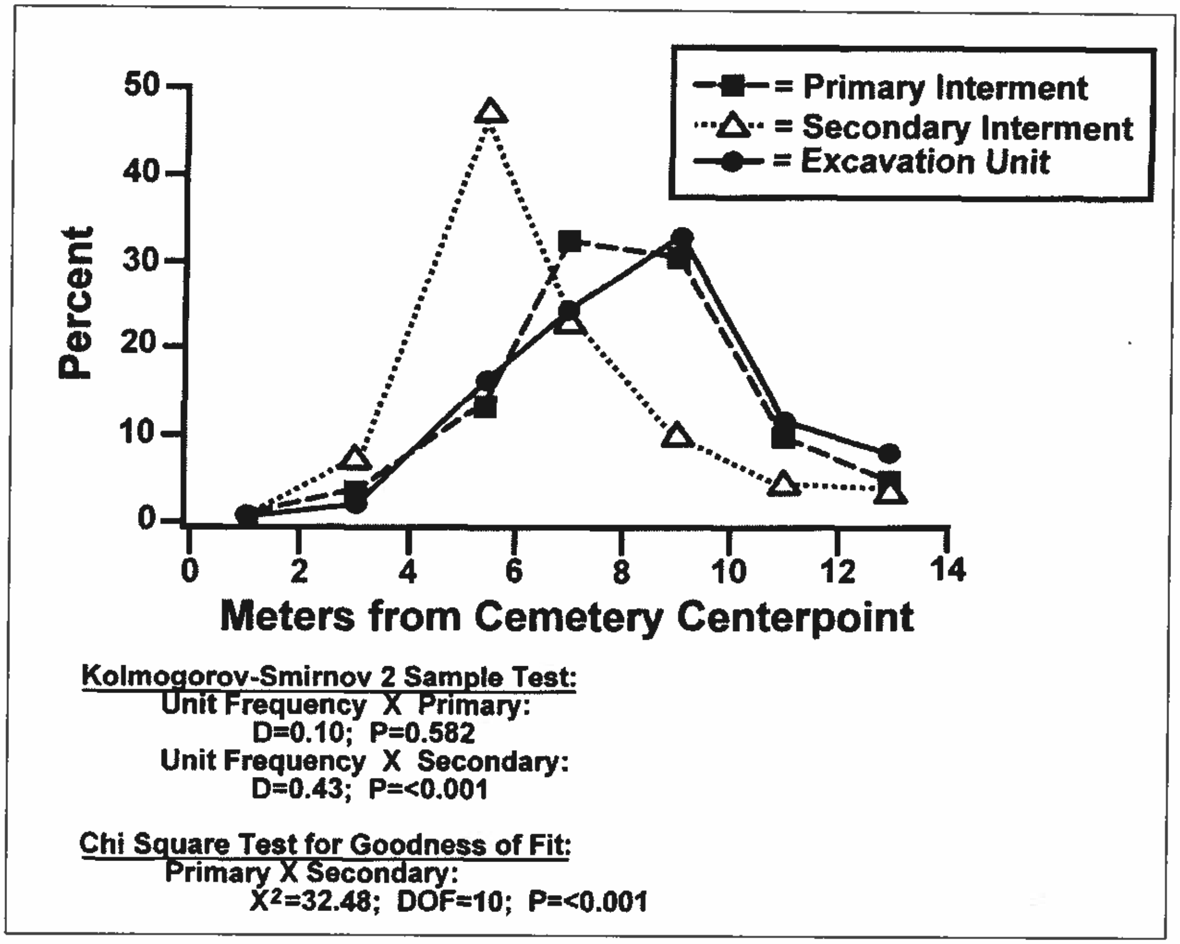


Figure 2. Relationship Between Body Treatment and Distance from the Summit.

Results of Chi Square Test for Goodness of Fit comparison of primary and secondary interments indicate that meaningful differences exist between body treatments. Secondary burials tend to be more concentrated around the mound's summit, while primary interments may be dispersed throughout the burial field. Secondary body treatment and space appear to be linked forms of communication.

MULTIPLE INTERMENTS

Some graves contain several people. As a social display, funeral rituals involving multiple interments are not focussed on the individual, rather they must address all social personalities present. In Mound C, the role of the dead in a funerary event was recorded by solitary or group deposits. Determination of grave multiplicity follows the methods outlined by Matternes (1994:42).

Graves were divided into two groups: those containing one individual and those bearing a multiple interments. Disturbed and chance skeletal inclusions were not included in the latter category. In Figure 3, note that the frequency of single and multiple interments do not follow the same pattern. In general, multiple interments are more likely to be placed close to the cemetery's center, while single graves conformed more closely to the unit excavation proportion. These observations were confirmed by K.S. testing. Both unit and single interment grave distributions could easily be reflecting the same pattern, while multiple interments reflect distinct variations in patterning.

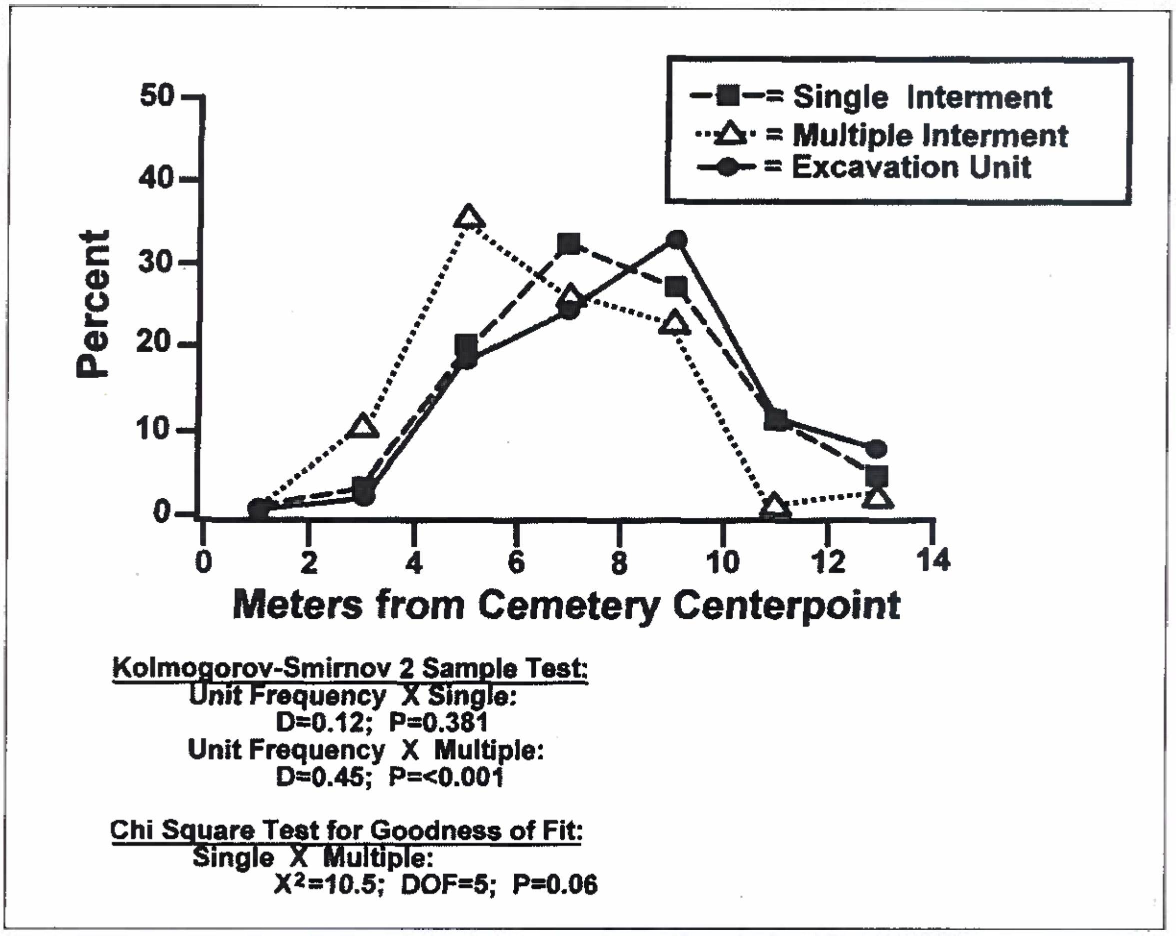


Figure 3. Relationship Between Multiplicity and Distance from the Summit.

A Chi Square test comparison of single and multiple graves revealed marginally significant differences. These grave forms did not appear to be sampling the same sets of behavior. Corporate representation probably carried a slightly different meaning than single interments. Location within the cemetery may have helped to express or emphasize this funerary representation.

SEX

One of the most visible role determinants among living community members was their gender. Sixty-seven graves containing single, noncorporate interments were suitable for a biological assessment of sex, following the methods outlined by Matternes (1994:43-45, 47-48). A frequency plot by distance from the cemetery's center revealed a considerable degree of similarity between gender and excavation unit totals (Figure 4). Small sample sizes precluded valid observation within 1 m intervals; however, pooling of 2 m intervals and subsequent testing indicated that at best there were minor differences between unit excavation frequency and sex. The distribution of excavation units probably biased the spatial pattern of these samples. Males were noted to possess a peak in the 6-8 m interval and this difference may account for the greater difference between males and unit frequencies.

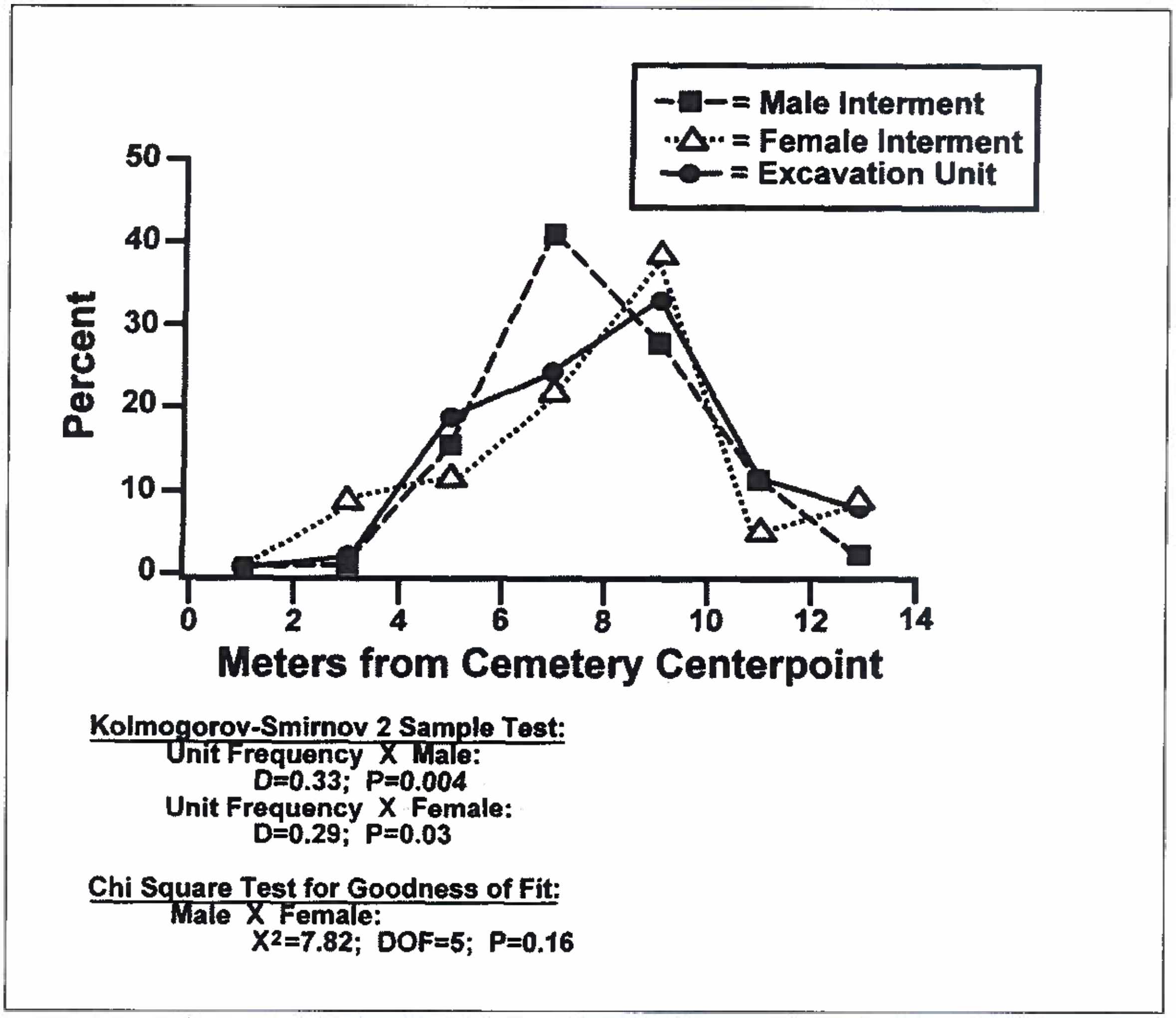


Figure 4. Relationship Between Sex and Distance from the Summit.

A Chi Square Goodness of Fit comparison between sexes provided a value of 7.82. Failure to disprove this test's null hypothesis suggests that these data provide no evidence of sample independence. Sex and distance cannot be distinguished from random sampling. Sex may not be an agent affecting placement in the cemetery.

AGE REPRESENTATION

Mound C's life table emphasizes that there are age intervals where survival rates increase or decrease (Matternes 1995). Death during infancy, generally considered the most dangerous period in a person's life, entailed interment outside the confines of the formal cemetery. This spatial association with a critical life period implies that age affected burial placement. Using major changes in the Qx or Probability for Survival value from Mound C's life table to identify major changes in mortality, single interments capable of providing an age at death estimate were examined. Age evaluation of 58 graves followed the methods outlined by Matternes (1994:45-47).

The burial assemblage was divided into three groups: Subadults (under 21 years), Young Adults (21 to 30 years) and Adults (over 30 years). Small sample sizes required examination in 2 m intervals. A plot of the frequencies indicated that while adult distributions compared favorably with the excavation unit dispersement, subadults were strongly concentrated in the 4-6 m distance interval (Figure 5). High K.S. test results for subadults and distance indicate a strong deviation away from the excavation unit frequencies. Notable differences were observed between excavation frequency and young adults, suggesting that these individuals may also possess an independent distribution, but sample sizes are too small to place much confidence in this difference. Graves containing adults possessed less meaningful differences from distance, but clearly are following a pattern similar to the young adult form. It is possible that an age gradient-distance relationship is present. A Chi Square Goodness of Fit comparison between Subadults and a pooled Young Adult-Adult sample indicated that these two assemblages were not samples of the same age-distance relationship. Youth and proximity to the cemetery's center appear to be features communicating social information.

ORIENTATION

Mound C also displays considerable variety in grave orientation. Harn (1980:66) has suggested that directionality communicated information about the individual and family or clan affiliations in Mississippian society. To assess this hypothesis with Mound C's data, orientations were defined by dividing a compass into eight 45 degree arcs and assigning graves to the direction which best approximated their position (Matternes n.d.). Since secondary interments could not be demonstrated to possess a principal direction, a sample of 146 graves was initially examined by general plane of orientation (three secondary interments possessed no discernable orientation). Small sample sizes once again reduced visibility to 2 m intervals. Figure 6 demonstrates that all orientation planes followed the same pattern formed by excavation unit frequency. While seemingly heterogeneous 'D' values were present between orientation plane and unit frequency, low frequencies among most forms preclude placing faith in these results. Only the NW/SE orientation plane, demonstrating little heterogeneity from unit frequency, has a statistically valid sample size. Evidence for direction away from excavation unit frequency was not found. Sample sizes were too small to pursue orientation among extended interments, where primary orientation could be established.

Graves oriented NW/SE and a pooled sample of other orientations were compared to learn if differences between these sub-samples were tangible. The resulting Chi Square and 'P' values indicated no difference between samples. General plane of orientation does not appear to be related to distance from the cemetery's center.

CONCLUSIONS

There is ample evidence that the arrangement of space during the Late Prehistoric period was highly meaningful. Houses, plazas, temples, and mounds were commonly arranged to convey information about the community. This concept was not exclusive to the world of the living. By examining the spatial patterning of burials within a cemetery, some insights can be gained into the message that was being conveyed by the observed distribution of graves.

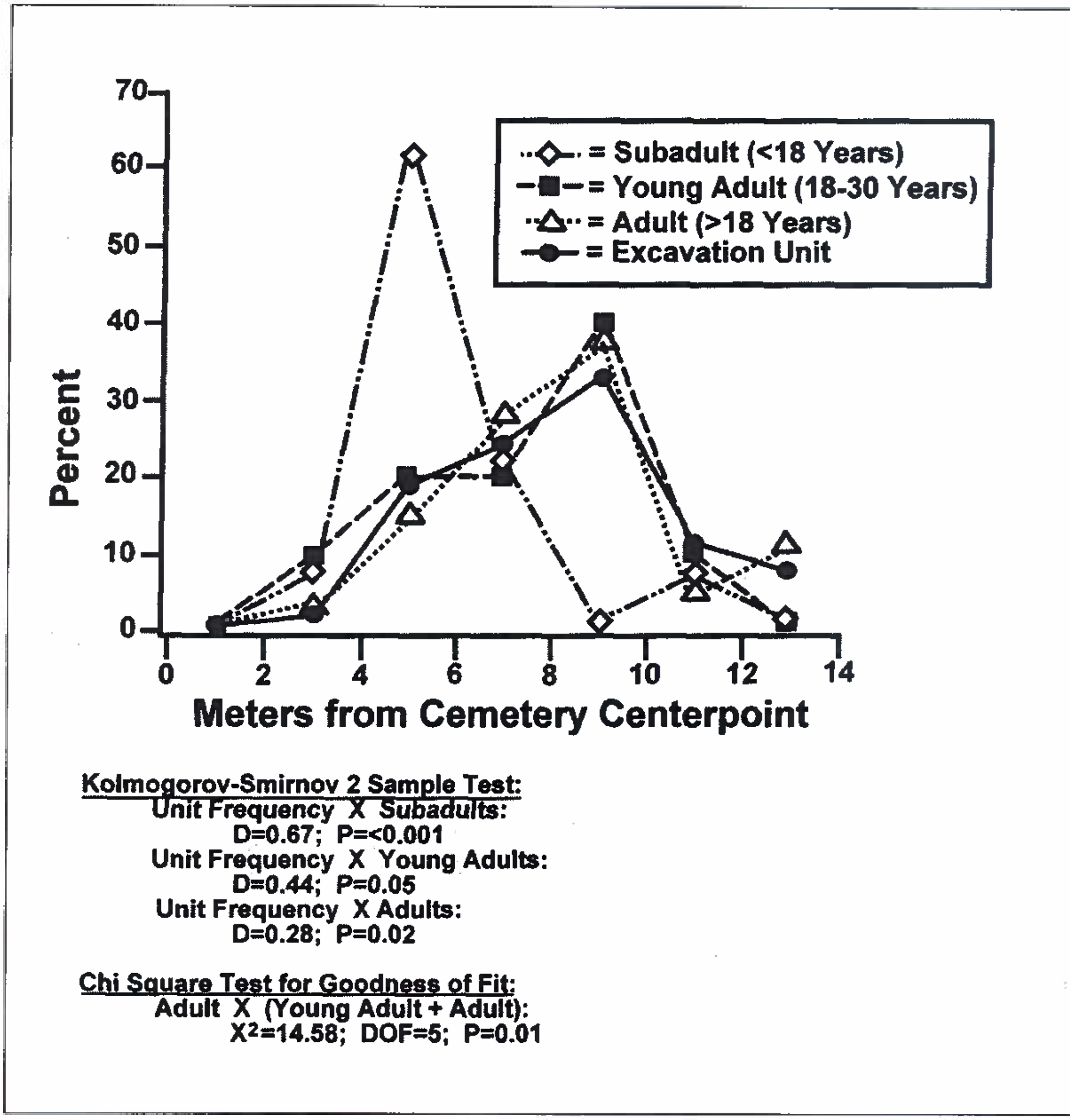
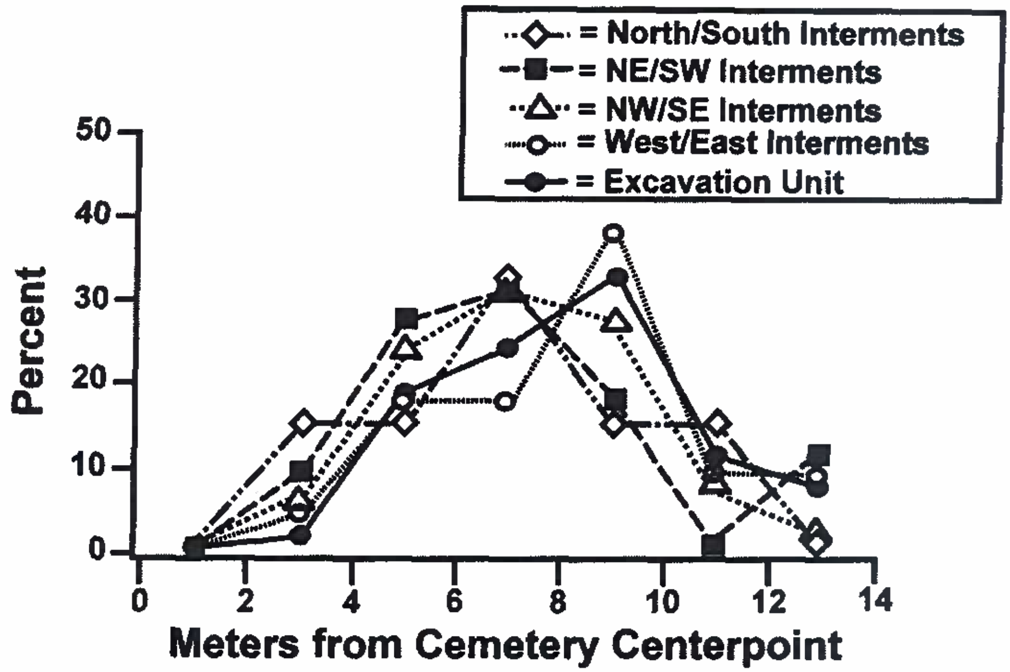


Figure 5. Relationship Between Age and Distance from the Summit.

The Mound C Cemetery was a permanent receptacle of social personalities. The association of these social entities with one another appears to be a form of material communication, with the dead representing complementary elements of a communal social unit. It may have been formed by a single village, dispersed communities, or a segment from a larger settlement, but the dense accumulation of graves within a restricted area is evidence that these people thought of themselves as a unified entity. This implies that one aspect of space was to communicate divisions in the social structure. Nonmembers, such as infants and possibly higher status personages, were buried elsewhere, hence, some social divisions are not present. The cemetery lacks spatial segregation commonly associated with competing families or social or political divisions. Given that the cemetery was used during a period of social transition, expressions of solidarity were perhaps more important than emphasizing factions within the community.



Kolmogorov-Smirnov 2 Sample Test:

Unit Frequency X North/South:
D=0.34; P=0.337
Unit Frequency X Northeast/Southwest (NE/SW):
D=0.38; P=0.008
Unit Frequency X Northwest/Southeast (NWSE):
D=0.20; P=0.020
Unit Frequency X West/East:
D=0.29; P=0.091

Chi Square Test for Goodness of Fit:

Northwest/Southeast X Pooled Orientations:
X^2=4.80; DOF=5; P=0.44

Figure 6. Relationship Between Orientation and Distance from the Summit.

Graves in Mound C are not uniformly distributed across the cemetery; rather, within the facility at least two distinct areas appear to be present. The lack of interments on Mound C's summit is evidence that this prominent point in the cultural landscape was reserved for other functions. It is suggested that the association between the summit and surrounding burial field is not random, but that it, too, is a form of material communication. Previously, Matternes (1996:314) has suggested that the Mississippian program of interment, disinterment, and reinterment is evidenced at Wickliffe. This program produces the same types of material assemblages found at charnel facilities. While placement of the cemetery on a prominent rise in the landscape (i.e., Mound C) is consistent with other Late Prehistoric mortuary facilities (see Milner and Schroeder 1992:61), it may also have emphasized the exclusive nature of summit based activities. Use of the mound may serve to take advantage of its restrictive status and apply this meaning to community membership. Milner (1984b:234) has suggested that the use of reserved space in mortuary areas, principally to hold a charnel structure, may have helped bind communities into a single cohesive unit. In Mound C emphasis on community cohesion may have been an important social message.

Not all dimensions of mortuary variability are associated with space. Some graves possess physical attributes whose relationships with space emphasize components of the social personality. Interments containing community members who died outside the range of normal age at death expectation (i.e., not very young or very old) seemed to be buried close to the cemetery's center. A similar relationship was noted among graves containing the social embodiments of more than one individual and those who had undergone skeletal disarticulation prior to final interment. In each of these circumstances, there is evidence that the social investment behind each grave's skeletal representation was greater than among the contrasting forms. It is suggested that as a means of emphasizing those qualities that increased community involvement (i.e., youth, secondary treatment or multiplicity), these graves were placed closer to the focus of mortuary ritual.

It is important to recognize that these spatial associations apply only to high investment burials. A model of the cemetery's spatial structure emphasizes that burials with distinct spatial patterns tend to be located around the cemetery centerpoint (Figure 7). This is not, however a segregated area. Graves with features associated with less or normal degrees of social investment, including gender, orientation, individual, adult, and fleshed interments are not affected by these distributions. Most secondary interments, for example, are located within the central area, but not all. More importantly, this interval contains plenty of primary interments, whose distribution appears to be random across the entire cemetery. Space within the cemetery was used as a means of communication for only a small component of the entire mortuary assemblage.

Mortuary space in Mound C is a multidimensional structure serving to communicate information to and about the community. Like space, graves are also multidimensional, serving to inform an audience about the personalities and social environments that existed in the past. Deciphering material 'languages' from archaeological data is not an easy task. There are no Rosetta Stones to ease translation. It is possible, however to unlock some of the messages and use this information to learn about this community's heritage. In this manner the ideas of the past can be unlocked and understood by a modern audience.

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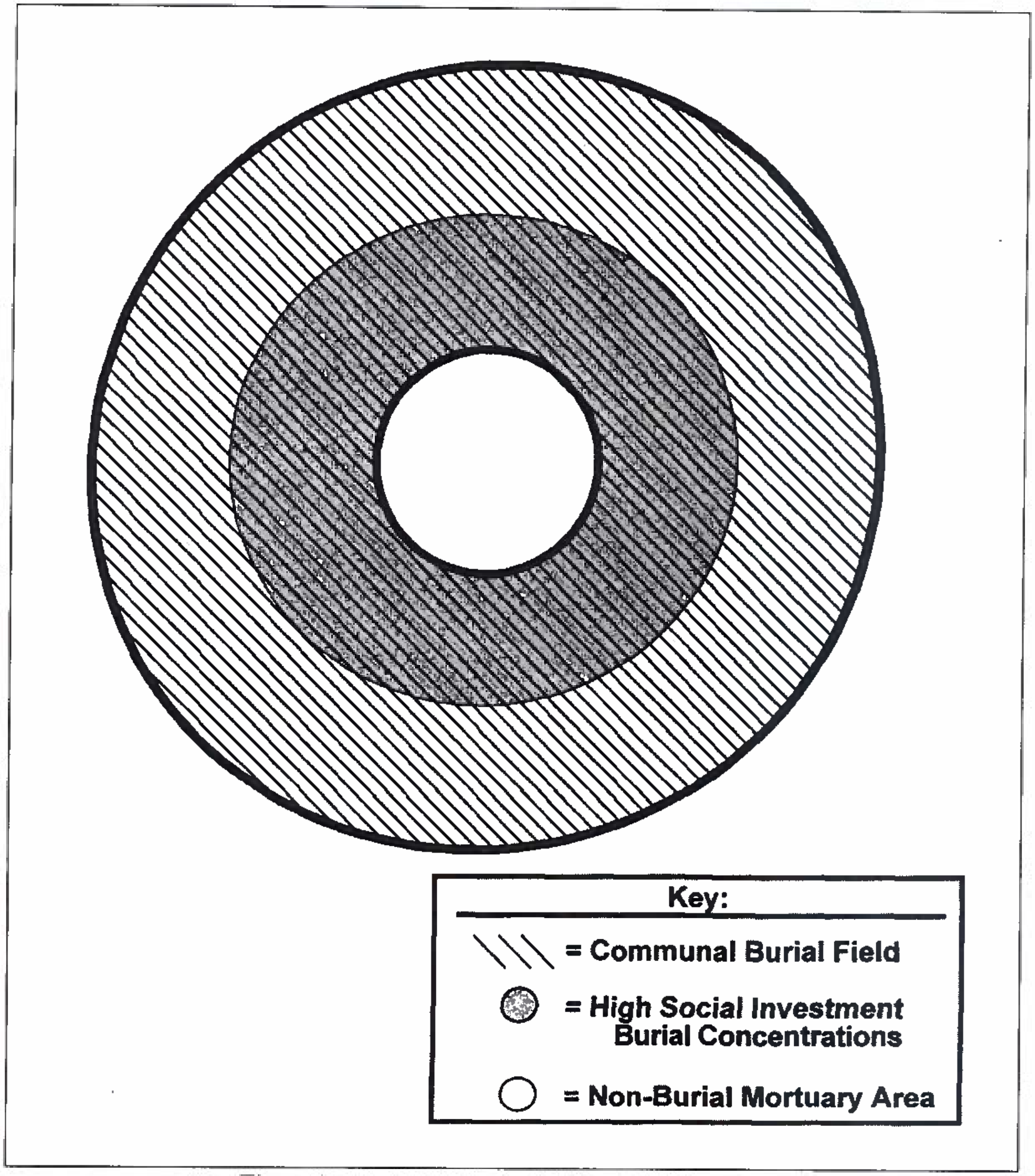

Figure 7. Model of Mound C Cemetery Structure.

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COTTAGE LIFE: ARCHAEOLOGICAL AND HISTORICAL INVESTIGATIONS AT A NINETEENTH CENTURY IRON MAKING COMMUNITY AT THE COTTAGE FURNACE, ESTILL COUNTY, KENTUCKY

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ABSTRACT

During 1998, research was conducted on the Cottage Furnace in Estill County, Kentucky. This research included historical and archaeological investigations. Archaeological investigations included excavation of two historic house sites associated with the Cottage Furnace. The focus of the research was to determine the age, socioeconomic status, household composition, and ethnicity of the households that lived at these two sites using archaeological and historical data.

INTRODUCTION

When many think of an industrial community the mine and mill towns of the west come to mind, or perhaps the steel mill towns of the upper Ohio Valley. In Kentucky, the some of the best examples of industrial communities are the many coal-mining towns of the Eastern and Western Coalfields. However, there was an earlier and less studied example of an industrial community: the iron plantation. During the first half of the nineteenth century, iron making was one of Kentucky's primary industries. Furnaces were located in the northeastern, eastcentral, and western regions of the state. Before the Civil War, Kentucky's iron production was one of the highest in the nation. The majority if not all of these furnaces were iron plantations. They were located on large tracts of land with a small community at the furnace, and a more dispersed community of miners and colliers on the surrounding landscape. The furnace companies raised crops and livestock for sufficiency, and had stores for other material goods.

This paper will begin to build an understanding of these communities using the example of Cottage Furnace. In order to understand this or any industrial community the industrial process must be understood. Without this industrial process, the community would not have existed. An understanding of the industrial process also provides an important context for the people who are being studied. In the next section of this paper an overview is presented of the blast furnace technology and iron plantations. This will be followed by a history of the Red River Iron District and its place in Kentucky's and the nation's iron industry. The next section will present the results of the archaeological research conducted at Cottage Furnace.

BLAST FURNACE TECHNOLOGY

During the first half of the nineteenth century many mid-Atlantic and southern United States iron furnaces were located on large tracts of land rich in iron ore, limestone, and timber for making charcoal (Gordon 1996). In the Northeast, it was more common to establish iron furnaces in existing communities. This seems to be more the case in communities with navigable rivers and canals (Gordon 1996). Besides the use of water for transportation, blast furnaces needed water for power; either for turning waterwheel-operated blast machinery, or for making steam in steam powered furnaces.

There were three necessary raw materials for making iron: ore, limestone, and charcoal. On the iron plantations of the Mid-Atlantic and South, these materials could be hauled by wagon to the furnace. In the Northeast they were procured elsewhere and transported to the furnaces (Gordon 1996). Later in the nineteenth century this became the common practice for most furnaces as railroads and better shipping became available (Council et al. 1992).

Ore mining involved dredging bogs, digging open pits, or sinking shaft-type mines to procure the ore. There were four main types of iron ore mined and smelted in the U.S. during the nineteenth century: bog ores, hematite, limonite, and magnetite. The predominate ore in the Red River Iron District was limonite, which included several varieties of brown iron hydroxides. In its pure form limonite contained 59.8 to 62.9% iron. Limonite was valued because it reduced easily (Council et al. 1992; Gordon 1996). Once mined, the ore was hauled to the furnace where it was stored until it was needed.

During the early-nineteenth century the most common fuel for furnaces was charcoal. Anthracite and bituminous coal and coke became important fuels during the middle and latter half of the nineteenth century. Charcoal was made by cutting wood and placing it in a pit or kiln dug into the ground. Oak, sugar maple, and beech were highly prized woods, although other species of hard and softwoods were used (Council et al. 1992; Gordon 1996).

The final raw material needed to make iron was limestone. Limestone was used as flux in the iron making process. During the manufacturing process, flux was added to the furnace with the ore and charcoal. The flux removed the remaining impurities as slag (Council et al. 1992).

Typical blast furnaces from the nineteenth century followed two forms: the stack and the copula. The stack furnace consists of a truncated pyramid, anywhere from 6.1 to 15.2 or 18.2 m (20 to 50 or 60 feet) in height (Figure 1). The heavy stone or brick exterior of the furnace contained a combustion chamber that was lined with firebrick or a refractory stone. Near the bottom of the furnace, cut sandstone blocks lined the interior. The shape of the interior of the furnaces varied but they were always narrower at the top and wider at the base or bosh. Below the bosh, the furnace constricted again. This lower constriction functioned in two ways. First, it held up the burden of the furnace, and secondly, it funneled the molten iron to the hearth (Council et al. 1992; Overman 1854; Seely 1981; Weitzman 1980).

The molten iron and slag worked its way through the burden to the hearth or crucible, where it collected until it was tapped. Tuyeres, pipes for emitting air into the furnace, were located just above the floor of the hearth. On one side of the furnace there was an opening to the outside, this was known as the forebay. At the bottom of the forebay was the damstone, which held back the molten iron and slag. The damstone had a hole normally blocked with clay that allowed iron to run from the hearth. Slag ran from the furnace overflowing the damstone, or through a cinder notch in the damstone. All of this activity took place in the working arch or run-out arch. Other arches were located on one or more sides of the furnace. These allowed access to the tuyeres, and were known as tuyere arches (Council et al. 1992; Gordon 1996; Seely 1981; Weitzman 1980).

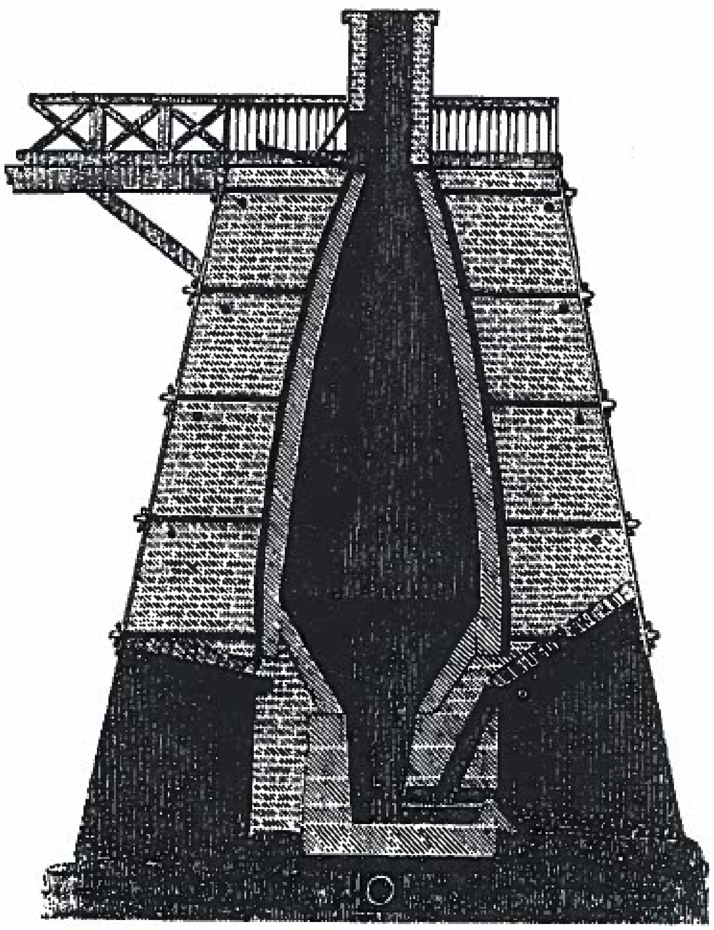

Figure 1 . Nineteenth Century Charcoal Iron Furnace (Overman 1854:152).

All blast furnaces needed ancillary machinery and structures for their operation. Machinery for getting air into the furnace was one of these crucial activities. If the air entered the tuyeres directly then the furnace was known as a cold blast furnace. However, if air could be heated such a furnace was known as a hot blast furnace. Air was heated for several reasons. First, hot air helped achieve the right temperatures in the furnace for smelting iron. Secondly, heated air made the furnace more efficient, conserving fuel (Council et al. 1992; Gordon 1996; Overman 1854; Seely 1981).

Other important elements of the blast furnace were the charging deck and the casting shed. The charging deck was a platform level with the top of the furnace that allowed the charges of ore, fuel, and limestone to be dumped into the furnace opening (Council et al. 1992; Gordon 1996; Overman 1854; Weitzman 1980). Often the furnace was constructed next to a hill or other natural raised location, simplifying the construction of the charging deck. In this case, a trestle would be built to bridge the difference between the top of the furnace and the hillside. Fuel, ore, and flux were generally kept in a storehouse before charging.

Casting sheds were located adjacent to the working arch of the furnace and kept the workers out of the weather. They had sand floors for casting the iron pigs. Before tapping the furnace, workers would use wooden forms to make molds in the sand to catch the molten iron and form it into the pigs. Molds for other items were also employed in the casting shed if the furnace made more than pig iron (Council et al. 1992; Gordon 1996; Overman 1854).

Other industrial buildings associated with furnaces might be ore pits and kilns, lime kilns, blacksmith shops, machine shops, stables, offices, homes for workers, or even entire communities (Council et al. 1992; Gordon 1996; Norris 1964; Overman 1852, 1854; Weitzman 1980).

THE IRON PLANTATION

During the early- and mid-nineteenth century, it was common to place a blast furnace in an area that had plentiful iron ore, timber, and limestone. Furnace companies often owned several thousand acres of land from which to draw these materials (Gordon 1996). Often these "iron plantations" as they were known would have a small community near the furnace, which consisted of the house of the manager and houses of other furnace employees, such as molders, founders, guttermen, and fillers (Walker 1966). Ore miners and colliers, who comprised the majority of furnace workers, lived in dispersed houses in the surrounding forests either at the ore banks or near the charcoal kilns (Dew 1994). It seems that it was common for families to live and work together in the furnace industries. Boys worked under their fathers, and some iron plantations had women cooks and perhaps women colliers (Dew 1994; Walker 1966). Before the Civil War in the North, this work was done by free whites and African-Americans, while in the South, it was common to have an entire slave crew or an integrated crew (Dew 1994). Like agricultural plantations, iron plantations relied on livestock and food crops they raised themselves as well as store bought foods and other material goods.

As the nineteenth century progressed, the iron plantation mode of production fell from favor, because of the rise of better transportation. By the 1850s, railroads and canals could move bulky raw materials to urban centers where labor was plentiful. However, this was not always the case, as evidenced by the Kentucky's Red River Iron District.

THE RED RIVER IRON DISTRICT

Kentucky's place in the history of American iron making is well-established. Perhaps best known is the Hanging Rock district, encompassing the northeast section of the state and southern Ohio. William Kelly began his early work with steel making in western Kentucky during the 1850s.

Less known was the Red River Iron District, which has received scant mention in historical works. Founded in the 1790s and existing until the 1880s, the Red River iron district was Kentucky's first iron district and helped contribute to Kentucky's place in the top 10 iron producing states during the first half of the nineteenth century. The district was located on the Red and Licking rivers among the rolling hills of east central Kentucky. To understand how the district fits into regional and national iron making trends the district can be divided into three temporal periods; initial settlement and growth, 1790-1830; continued expansion, 1830-1860; and reconstruction and decline, 1860-1880.

INITIAL SETTLEMENT AND GROWTH

Iron making was among the first industries west of the Alleghenies. As settlement moved further west, the difficulty of moving heavy iron objects necessitated locating and exploiting iron ores as soon as practically possible. Early settlers in Kentucky were no different in this regard.

The first blast furnace in Kentucky was built in 1791. Jacob Myers, a Virginian, built the Bourbon or Slate furnace, on Slate Creek, a tributary of the Licking River (Moore 1884:205; Swank 1884:219). The first blast was made in 1792. The Bourbon Furnace had a capacity of 2727 kg (3 tons) a day, and was powered by the waters of Slate Creek. Limonite ores were mined 3.3 km (2 miles) away and hauled by wagon to the furnace. Joshua Ewing, a supervisor at the furnace, stated that it used 2727 kg (3 tons) of ore to make 909 kg (1 ton) of iron (Moore 1884:205). Between 1792 and 1795 the Kentucky Militia was stationed at the furnace and the ore banks for the protection of the laborers from Indian attack (Enoch 1997:40; Swank 1884:220).

Local tradition holds that Myers wanted to build the furnace to make 38 liter (10 gallon) kettles for boiling sap and salt. The furnace also manufactured castings, 45.6 liter (12 gallon) pots, Dutch ovens, salt and sugar kettles, dog irons, flatirons, and skillets, all items desirable on an expanding frontier. As cash was scarce, barter was the common method used to acquire furnace products. Slave labor became important during this period, and would remain important until the Civil War (Enoch 1997:37, 112). Owning or hiring slaves for industrial enterprises was not unknown at the time, and was very common in Virginia (Dew 1994).

In 1798, Slate Forge was built 5 km (3 miles) above the furnace. This forge converted pig iron into bar iron. Swank (1884:220) stated that products from the furnace and forge were shipped to the Licking River where they were shipped to markets in Cincinnati and Louisville. During 1799, Thomas Deye Owings began to acquire shares in the furnace, and by 1806, he was the sole owner.

The Red River Iron Works, located at present day Clay City, was built in 1806. William Clark and Robert Smith, both of Clark County, Kentucky, purchased 59 ha (147.5 acres) on and adjacent to the Red River, and all riparian rights to the river in 1805 (Clark County Deed Book 7:96; 7:100; Jillson 1964:18). Clark and Smith also had a law passed to open navigation on the Red River (Jillson 1964:19; Littell 1811:249). Like Bourbon Furnace, the furnace worked limonite ores located on the surrounding hills. Unlike the earlier Bourbon Furnace and Slate Creek Forge, the Red River Iron Works was "integrated," having the furnace and the forge in one location, most likely because there was enough waterpower to power both. By 1815 Thomas Deye Owings was the owner of the Red River Iron Works, Bourbon Furnace, and the Slate Creek Forge (Estill Deed Book C:47).

Owings procured a government contract for cannon balls and shot for the military during the War of 1812 (Enoch 1997:138; Jillson 1964:24; Swank 1884:220). After the war, the Bourbon

Furnace and the Red River Iron Works continued to make castings and bar iron (Jillson 1964:26). To survive the recession following the War of 1812, in 1816 Owings mortgaged the entire Red River Iron Works including 30 slaves (Estill Deed Book A 340-343; Jillson 1964:26). By 1820, markets were suffering, and Owings was in financial trouble.

Little is known about blast furnace communities during this period. The pattern appears to be a community built at a water-powered furnace and or associated forge located on a river or larger stream. The owner or his manager, often related, lived at the furnace and there was a small community of houses for other workers nearby. Workers such as miners and colliers most likely lived near their places of work in the surrounding hills. Slaves most likely provided the majority of the labor during this period, but documentary sources say nothing about where they lived or their household compositions.

CONTINUED EXPANSION 1830-1860

By 1830, the Hanging Rock district was becoming the prominent iron producing region of the state. Between 1817 and 1834, 13 furnaces were built in that region. A dozen forges were located around the state making bar iron and iron for the state's first rolling mill, erected in 1829 (Swank 1884:222-23). The year 1830 saw the first shift in technology in the Red River district. The furnace at the Red River Iron Works was dismantled and moved 16.7 km (10 miles) up Hardwick's Creek to the top of Furnace Mountain, because hauling ore from the mountain was becoming costly. In addition, timber resources were being depleted near the iron works (Jillson 1964:28; Moore 1884:206; Verhoeff 1917:159).

When the furnace was re-erected in 1831, it was known as the Estill Steam Furnace. The title reflected a key change in the iron industry from the use of water to steam to power the air blast. With steam technology, furnaces eliminated the tie to the river bottom. Steam engines were powered by steam created in boilers using exhaust gas from the iron making process (Moore 1884:207).

Unfortunately, little is known of furnace operations during this period. There does not appear to be a manufacturing census for 1830. In the 1830 manuscript census John C. Mason was enumerated as a resident of Estill County. His household included: one white male 15-20, eight white males 20-30, one black male slave 10-24, 26 black male slaves 24-36, 10 black male slaves 36-55, three black male slaves 55-100, one black female slave under 10, and one black female slave 24-36 (Estill County Census 1830:237). Mason, Wheeler and Company built Estill Furnace; therefore, Mason's household may represent either the furnace construction crew or the employees of the Red River Iron Works. It was unclear who was operating Bourbon Furnace at the time, but it seems likely that John C. Mason had someone operating it in his stead.

A rolling mill was added to the Red River Iron Works in 1837. It contained seven furnaces, two trains of rolls, and five nail machines. The second major change in technology in the district occurred when the rolling mill used coal for fuel. The coal was transported by boat down the Kentucky River to the mouth of the Red River where it was transferred to wagons and hauled the remaining 15 km (9 miles) up the river. Often the river was too low, making the source difficult to use, and the coal was not the best quality for making iron (Owen 1861:473; Eubank 1927:17; Verhoeff 1917:159).

There were several interesting things recorded in the 1850 manufacturing census. First, the Red River Iron Works used $2,000 dollars more pig iron than the value of what Estill Furnace made. This suggests that they were rolling iron from somewhere else, or that the extra cost was accrued hauling the pig iron from the furnace to the rolling mill. Secondly, the Red River Iron Works had reverted to charcoal for fuel at the works. This likely suggests that the supply and quality of mineral coal could not meet the demands of the works. Lastly, the Clear Creek Furnace, located in nearby Bath County, made only pig iron. Unlike its counterpart on the Red River, which was still making a variety of products, Clear Creek was focusing on one product. This was the beginning of the next and final phase of iron production in the region, export of a partially finished good.

John C. Mason and Samuel Wheeler, Mason's brother-in-law, built Cottage Furnace in 1854. Wheeler died later that year, and his interest was carried on by his wife Caroline and J. L. Wheeler (Madison County Circuit Court Book 16:374). The next technical innovation applied in the district was the hot blast stove. Cottage Furnace was built with a hot blast system (Table 1), the first in the Red River Iron district.

Table 1. Dimensions of the Cottage Furnace.

Height	38'
Diameter of bosh	10' 6"
Batter of bosh	55°
Diameter of throat	3' 2"
Height of hearth	6'
Diameter at top of hearth	3' 4"
Diameter at bottom of hearth	2' 8"
Number of tuyeres	2
Diameter of tuyeres	3 ½"
Height of tuyere above bottom of hearth	2' 8"
Number of boilers	2
Diameter of boilers	3'
Length of boilers	46'
Number of blast cylinders	2
Diameter of blast cylinders	3' 4"
Stroke of blast cylinders	one 6', one 5'
Diameter of steam cylinder	1' 41/2"
Stroke of steam cylinder	6'
Moore 1884:208	

The first blast at the furnace was in 1856. Lesley (1859:126) reported that the furnace was operating on "ubcarboniferours or subconglomerate gray carbonate ore," and it operated for 18 weeks making 658 metric tons (725 tons) of pig iron, using the hot blast system.

By 1857 Josiah A. Jackson and Jesse W. Jones were operating Estill Furnace. Jones was the resident manager. In 1858 the furnace operated 18 weeks and made 629 metric tons (693 tons) of car wheel iron (Lesley 1859:126). The Red River Iron Works operated under the control of Jackson, and had three knobling furnaces, and one water powered hammer, making 227 metric tons (250 tons) of bar iron a year. The rolling mill had seven furnaces, two trains of rolls, and five nail machines. In 1857, 163 metric tons (180 tons) of merchant bars were made (Lesley 1859:214, 258).

Mason and Wheeler made an agreement with Pierce, Ginter and Vaughn for control of Cottage Furnace in 1859. The agreement stated that Pierce, Ginter, and Vaughn received

> the Cottage Furnace and all appurtenances, consisting of all the land which they (Mason and Wheeler) own within three miles of said furnace and all thereon and rights of way to get it which they have obtained or owned and all the iron ore which they own within five miles of said furnace and the right of way and other privileges owned by them to obtain said ore. Also all the personal property belonging to them which consists of all partnership property which belongs to said Mason and Wheeler at said furnace consisting of mules, cows and calves, hogs, iron ore, tools, wagons, oxen, store goods, and office and kitchen furniture. Corn in the field, vegetables and all personal property belonging to them at the furnace except pig iron and scraps (Madison County Circuit Court Book 16:374).

For this, Pierce, Ginter, and Vaughn were to make and deliver 181 metric tons (200 tons) of pig iron per year for Mason and Wheeler until 544 metric tons (600 tons) was made. This iron was to be delivered at Irvine on the Kentucky River when the river was navigable. It was then shipped to Louisville. The agreement also provided that if Pierce, Ginter, and Vaughn did not follow through with the agreement then the property reverted back to Mason and Wheeler (Madison County Circuit Court Book 16:375).

Josiah A. Jackson also had a change in his business in 1859 when he closed the rolling mill. Most authors think that this happened because of the cost of suitable coal (Lesley 1859:258; Moore 1884:206). However, if he was using charcoal in 1850 then the expense of coal does not explain why he closed the mill. The reason may lie in a general lack of fuel, depletion of timber resources, and lack of coal, or it may be a market-induced shift in production. The 1860 manufacturing census can shed some light on this theory.

Only 227 (250 tons) of the 544 (600 tons) metric tons of pig iron made at Estill Furnace was converted into another product, in this case blooms. It is safe to make this assumption because Cottage Furnace was not in operation in 1860, and none of the furnaces on the Licking River were working either. Rather, the majority of the pig iron was shipped out, presumably to the car wheel foundries in Louisville. Pig iron from the Estill Furnace was highly desired for making railroad car wheels (Owen 1861:473). This shows how the market for iron had changed, causing furnaces to adapt from making a variety of iron items to making only pig iron for export and further refining at another location.

Although Cottage furnace was not in operation in 1860, there were people living and presumably working at the furnace. The census enumerated 20 people at the furnace, including two ironmasters, a molder, a blacksmith, and a mechanic. Two other men were listed as having jobs that were furnace related; one was a "coal fiddler," and the other an "ore digger." Each of these men lived in the Irvine precinct, which was located directly south of Cottage Furnace. The furnace was included within this precinct by 1870, making it likely that these men were doing work for Cottage Furnace rather than for Estill Furnace or the Red River Iron Works.

This information was not very helpful for defining the community at the Cottage Furnace. Yes, there were people enumerated that had jobs ascribable to furnace activities, and they had families. However, five people at the furnace and two working in the woods did not make a full contingent. Because the deal with Mason and Wheeler required 181 metric tons (200 tons) of pig iron a year, Pierce, Ginter, and Vaughn would have had a crew preparing the furnace for operation. Either some of the laborers were working there, or they were using a crew that did not show up in the census. If they were hiring crews of slaves from other owners then the owner would be assessed for the slave in the tax records and in the Slave Schedule of the 1860 census. It is also possible that Vaughn and Giner did not do much to prepare the furnace. This suggestion is supported by their absence in the tax records and the Manufacturing Census. That Cottage Furnace does not appear in the tax rolls again until 1868 lends support to this suggestion.

RECONSTRUCTION AND DECLINE 1860-1880

In 1861 civil war broke out in the United States, causing an interruption in iron making in the Red River District. Today, Kentucky is considered a southern state; however, in 1861 the majority of Kentucky's residents sided with the Union cause. This was especially true of the eastern mountain region. Because of this allegiance, the South was cut off from a major source of iron, further stifling their limited industrial base. Little is known about the Civil War period in the Red River Iron District.

In 1865, a new company was chartered, the Red River Iron Manufacturing Company, it purchased the tracts owned by the former Red River Iron Works. These included the forge and rolling mill on the Red River, and the Estill Steam Furnace and its surrounding land. The company's officers were Fred and Frank Fitch, who were brothers from New York. However, Frank had been in Kentucky earlier; he was enumerated as the ironmaster at the Red River Iron Works in 1860.

Due to the war-time shut down, Pierce, Ginter, and Vaughn had not kept up their arrangement with Mason and Wheeler at Cottage Furnace. An agreement was reached that if David R. McKinney and Brothers would make the 544 metric tons (600 tons) of iron due Caroline Wheeler and the Mason heirs, they would be deeded the Cottage Furnace property (Madison County Circuit Court Book 16:374).

In 1868, the Red River Iron Manufacturing Company undertook its largest project, the erection of two new furnaces, a town, and a tramway system connecting Estill Furnace, the new town of Fitchburg, and Scott's Landing on the Kentucky River (Collins 1874:168). Like the other furnaces in the region, these were masonry; however, they were built into one solid rectangular mass rather than two separate truncated pyramids. They were equipped with a hot blast system, and with bell and hopper charging devices (Moore 1884:208). Again, the evidence is clear that the Red River District was very much in tune with current technical innovations available in other iron districts.

In 1869, Rodgers, or Roberts, Gartner, and Baum owned the Cottage Furnace. They incorporated as the Cottage Furnace Iron Manufacturing Company (Acts of the Kentucky Legislature 1869:15).

By 1870, Cottage Furnace and the Red River Iron Manufacturing Company were reaching their zenith. The 1870 Manufacturing census recorded that the Cottage Furnace Iron Manufacturing Company had one furnace with 100 male employees over 16 and 25 male employees under 16. In the previous year the furnace was in operation seven months, and used 4,082 metric tons (4,500 tons) of iron ore and 112,0000 hectoliters (320,000 bushels) of charcoal. During the course of that time, the furnace made 1,451 metric tons (1,600 tons) of pig iron valued at $80,000 (Estill County Manufacturing Census 1870).

The 1870 manufacturing census discriminated between different activities at the furnace. The iron mine at Cottage Furnace had 40 male employees over 16, and 10 male employees under 16. The census further recorded there was a blacksmith shop and a wagon shop employing four males and two males, respectively (Estill County Manufacturing Census 1870).

The manuscript census for 1870 enumerated 54 individuals that had jobs directly associated with Cottage Furnace, and six individuals with jobs that may have been associated with the furnace. This is well short of the 181 employees reported in the manufacturing census, and may suggest that some of their employees were seasonal, or that the census was taken between blasts when miners and colliers would have been working, making them more prevalent.

In 1870, the Red River Iron Manufacturing Company was operating three furnaces, the Estill Steam Furnace and the two new furnaces at Fitchburg. The Estill Furnace employed 50 men for 10 months and made 1406 metric tons (1,550 tons) of pig iron. The two furnaces at Fitchburg employed 250 men for 10 months and made 816 metric tons (900 tons) of pig iron (Estill County Manufacturing Census 1870). The 1870 manuscript census lists 236 individuals with iron making jobs at the Estill and Fitchburg furnaces.

During the early 1870s, Cottage Furnace and the Red River Manufacturing Company furnaces continued to operate; however, disaster was on the horizon. The last blasts were conducted during 1873-74. This was because of the financial panic of 1873, which brought much of the nation's iron industry to a standstill.

Moore (1884:28) provided a succinct discussion of why this region ultimately failed. Prior to the panic of 1873 when iron prices were high, the cost of transportation was not enough to render iron making unprofitable, as "ore, charcoal, and labor are all cheap." However, when iron prices fell, it began to cost too much to ship the pig iron out to Louisville or Cincinatti. At the time, it cost between seven and ten dollars per ton for shipping (Moore 1884:28). This was all by river, which was a great gamble at best, as the nearest railroad was over 33 km (20 miles) away.

Ultimately, markets improved and iron production picked up again in regions that had transportation. Demand for iron increased developments in using mineral coal for fuel and rich ores from the upper Midwest. These furnaces could made iron much more cheaply than the isolated furnaces could.

ARCHAEOLOGY AT COTTAGE FURNACE

Archaeological research at Cottage furnace focused on the community. The Daniel Boone National Forest contracted with Michigan Technological University Department of Social Sciences to accomplish this work. Since the project was to examine house sites, an attempt would be made to look into issues that could provide information about this community. These issues were chronology, economic shifts, economic status, demographics, and ethnicity.

FIELD INVESTIGATIONS

Two sites (15Es89 and 15Es90) were selected for excavation (Figure 2). Site 15Es90 was one of several sites that were impacted by logging in the early 1990s, while Site 15Es89 was a new site. Site 15Es89 was located just above the road to the Cottage Furnace picnic area and was chosen for its intactness.

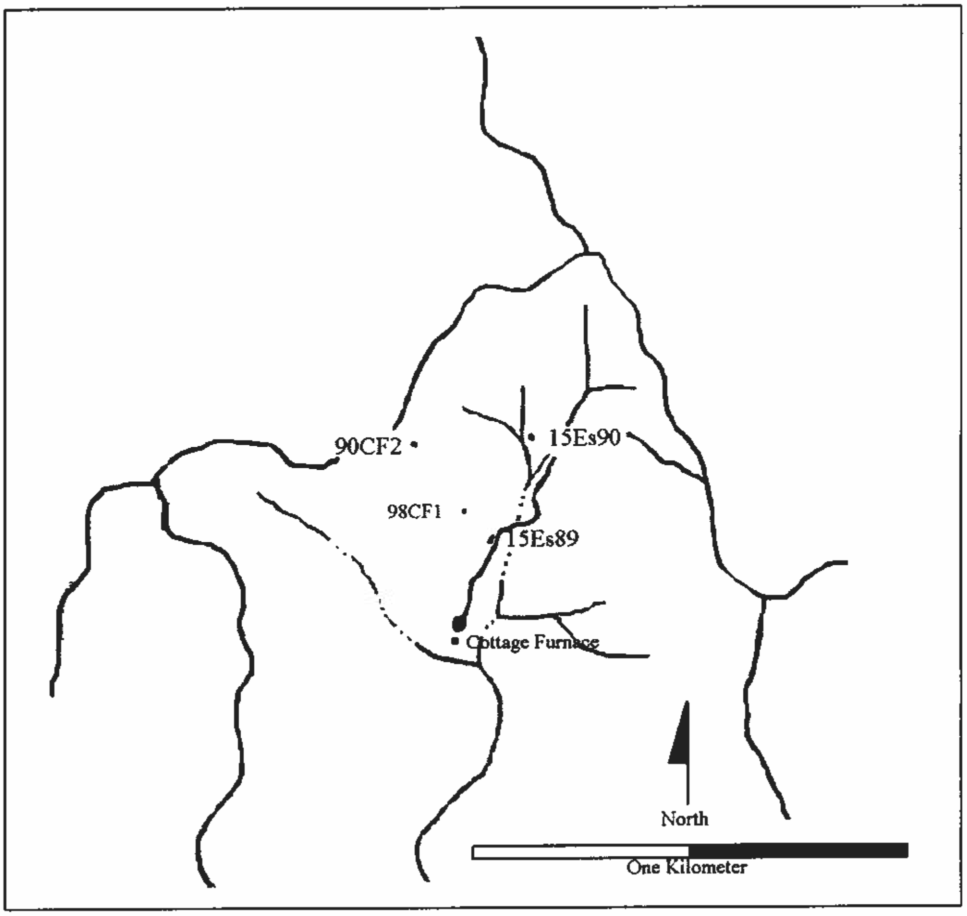

Figure 2. Location of Sites at Cottage Furnace.

At Site 15Es89, portions of a low limestone wall were observed on the surface, and 30 of the 36 shovel tests excavated at this site contained cultural material. Units 1 and 2 (2 x 2 m) were placed in areas with rich cultural deposits (Figure 3). In addition, Unit 1 was placed in an area where it was thought the northwest wall of the structure was located. Not satisfied with the rather equivocal results an attempt was made to further define the northwest corner of the structure and to determine if the interior of the structure contained a cellar (Unit 3; 1 x 3 m). Unit 4 (1 x 2 m) was placed to the south of the limestone wall to test the deposits in this portion of the site (Figure 3).

Each unit was rather rich in artifacts. Over 3,000 artifacts representing prehistoric and historic usage of the site were recovered. These included: flakes, an abrader, four triangular projectile points, 582 historic ceramic sherds, 267 pieces of container glass, iron kettle fragments, 678 cut nails, window glass fragments, faunal remains, and personal artifacts.

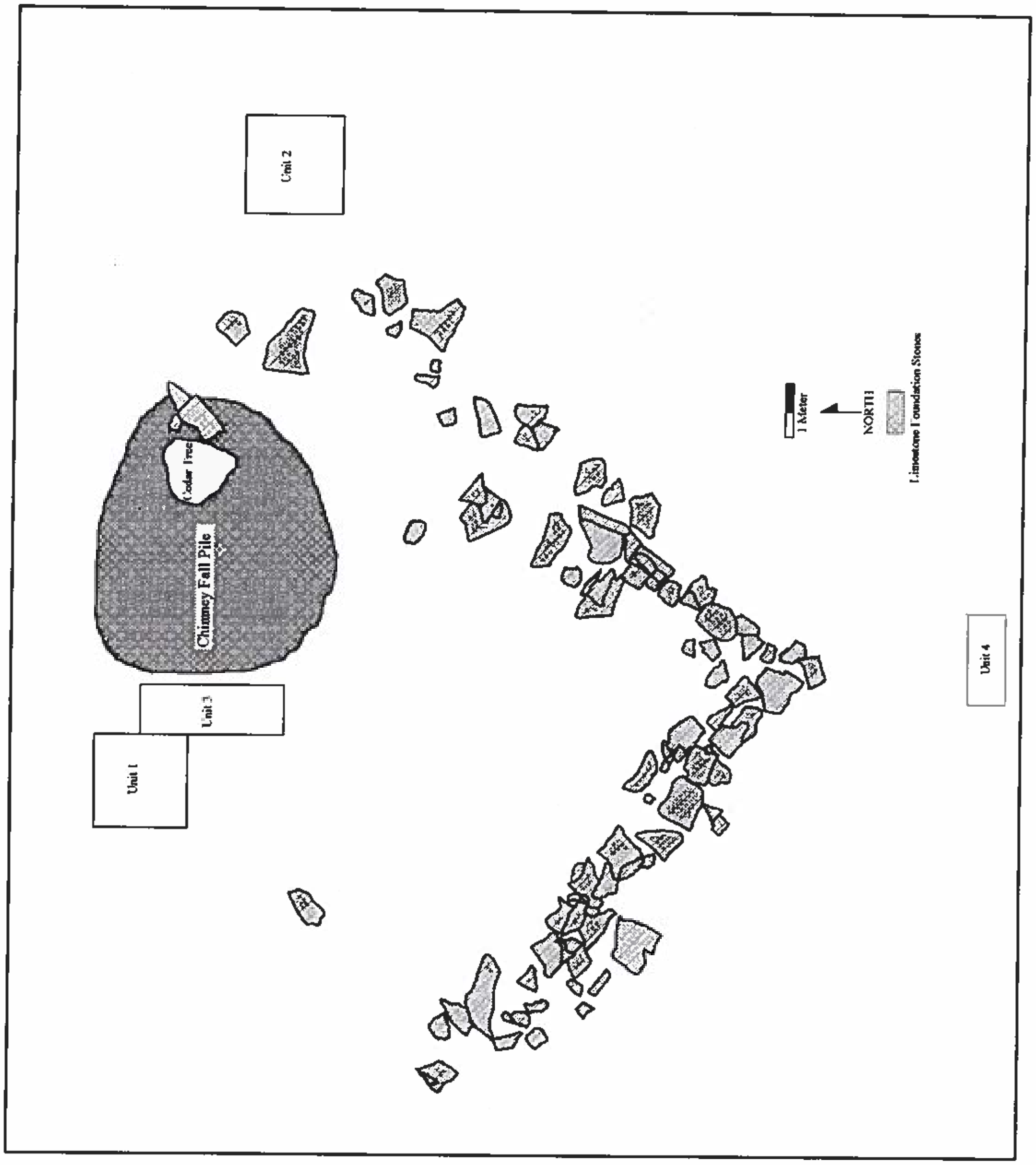

Figure 3. Site Map of Site 15Es89.

Site 15Es90 was located to the north of the furnace. This site was situated on a narrow bench between the mountainside and a small intermittent stream. A large pile of rock and brick, which was visible on the surface, was interpreted as a chimney fall (Figure 4).

By comparison, only 582 artifacts were recovered from five excavation units. Again, some prehistoric materials were recovered, but not as many as at Site 15Es89. With only a pile of rock to go by, seven positive shovel tests, and limitations posed by the nearby hillside, units 1 and 2 (1 x 2 m) were placed between the rock pile and the stream bed. Both proved inconclusive with respect to the orientation of the structure, and neither had many artifacts. Unit 3 (1 x 3 m) was excavated as an extension of Unit 2 into the rock pile. This unit determined the orientation of the fireplace. The majority of the artifacts found at Site 15Es90 were recovered from Unit 3. Unit 4 (1 x 2 m) was placed in the "yard area" in an attempt to obtain a sample of midden comparable to what was found at Site 15Es89. Unit 5 (1 x 2 m) was placed to examine some rocks that were detected during an attempt to find subsurface features with a split spoon soil core.

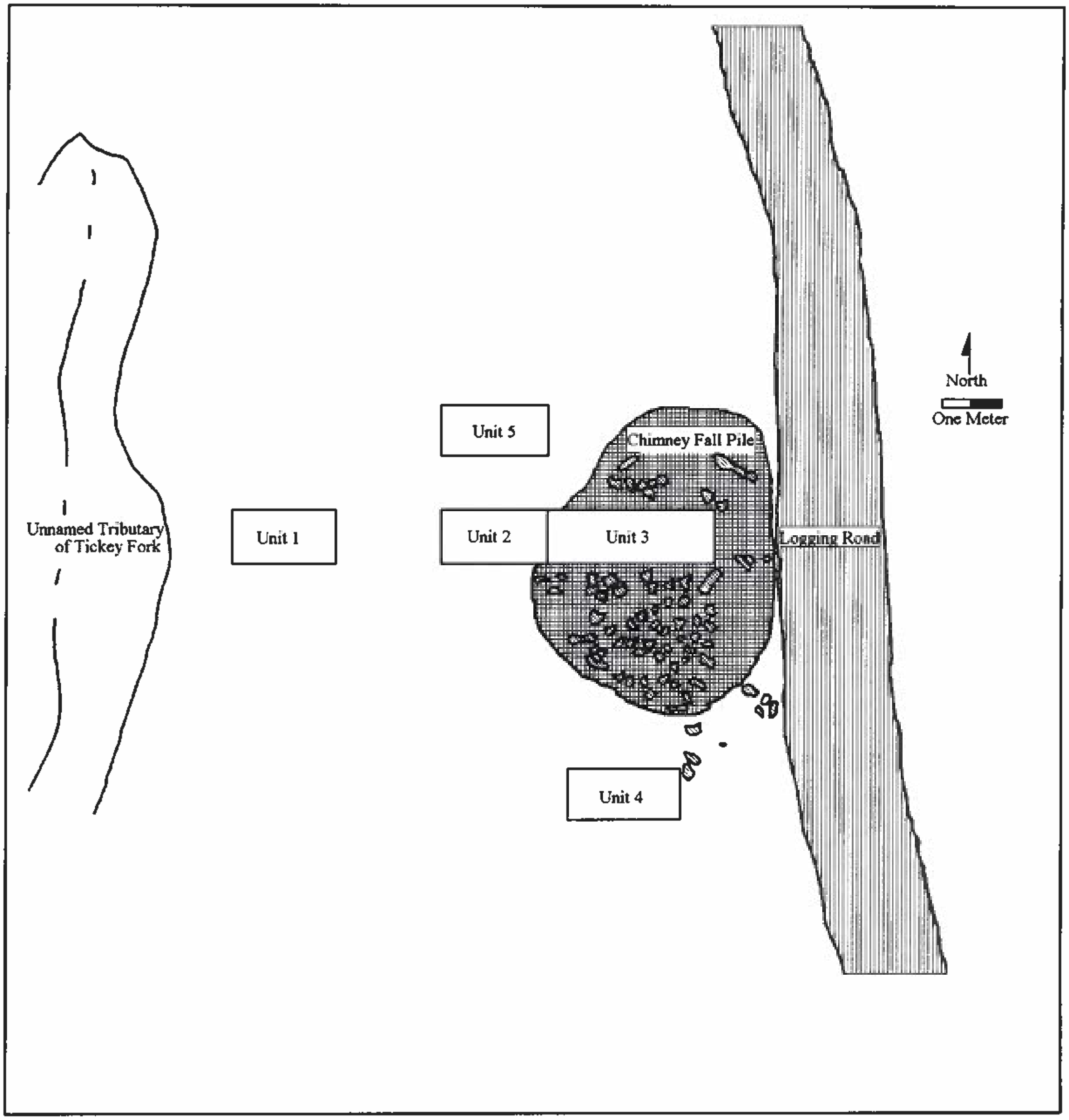

Figure 4. Site Map of Site 15Es90.

INTERPRETATIONS

Chronology

The initial question was to identify the ages of the sites that were excavated. Historical research suggested that the furnace location was not occupied until 1854. It is possible that farming families lived in the surrounding valleys, and perhaps on the broad ridgecrests; however, this remains unclear. The first mention of Cottage Furnace and people living and working there is May of 1854, with a notation in the Estill County Court Minute Book. The furnace has "M & W 1854" carved in the lintel stone of the arch, further suggesting an erection date of 1854. Lesley (1859:126) stated that the furnace made its first blast in 1856. Mason and Wheeler appeared in the tax book for the first time in 1857, and continued to appear until 1860. They sold the property to Pierce, Ginter, and Vaughn in that year. Cottage Furnace, like others in the district, closed during the Civil War, causing Pierce, Ginter, and Vaughn to fail. They reverted the property to Mason and Wheeler's heirs who sold it to the McKinney brothers in 1868. Either through sale or trade, the partnership of Rodgers, Baum, and Gartner acquired the property, and became the Cottage Iron Manufacturing Company in 1870. In 1872, the Fitch brothers and Samuel Worthey, who incorporated the Cottage Iron Company, bought them out. This company operated until 1874 when the effects of the panic of 1873 closed the Red River Iron District. No further mention of Cottage Furnace was located in governmental or historical documents. A farm family, the Pucketts, was living near the furnace when the U. S. Forest Service acquired the property in the 1930s. Therefore, with some certainty, the furnace location was occupied sporadically from the mid-1850s until the mid-1870s and perhaps earlier and later by farming families in the general vicinity of the furnace.

Archaeologically, the data from sites 15Es89 and 15Es90 support these dates. Mean ceramic dating and window glass dating were used to date the sites. The primary dating procedure was mean ceramic dating, a method created by Stanley South (South 1971). This method uses a mean date from the range of dates during which a ceramic type was manufactured. A mean date for each type of ceramic was calculated, added together, and the sum divided by the number of sherds from a particular provenience or the entire site assemblage (Table 2).

Table 2. Mean Ceramic Dates for Sites 15Es89 and 15Es90.

Site 15Es89		Site 15Es90	
Provenience	**Date**	**Provenience**	**Date**
Unit 1 Level 1	1860	Unit 1 Level 1	1859
Unit 1 Level 2	1859	Unit 1 Level 2	1860
Unit 2 Level 1	1862	Unit 2 Level 1	-
Unit 2 Level 2	1860	Unit 2 Level 2	-
Unit 2 Level 3	1860	Unit 3 Level 1	-
Unit 3 Level 1	1863	Unit 3 Level 2	1855
Unit 3 Level 2	1860	Unit 4 Level 1	1860
Unit 4 Level 1	1861	Unit 4 Level 2	1863
Unit 4 Level 2	1860	Unit 4 Level 3	1865
Shovel Tests	1875	Unit 5 Level 1	1892.5
Entire Assemblage	1865	Entire Assemblage	1863

The mean ceramic dates from Site 15Es89, which range from 1859 to 1875, suggest that the site was occupied during the period of the furnace's operation. However, these dates should be used with some caution. An end date of 1890 was used for the whitewares and ironstones. The reasoning behind this was that, since these ceramics continue to be manufactured today, whitewares should be assigned a date range of 1830 to the present and ironstones a date range of 1840 to the present. However, if these date ranges were used the mean ceramic dates for whiteware and ironstone would have been much later than that suggested for other artifacts from Site 15Es89. For example, only cut nails were recovered from this site, suggesting that the house at this site was built and its use discontinued, in this case burned, before the use of wire nails became common during the 1890s and early 1900s.

Makers' marks on ceramics can also be used for dating purposes. Only two marks were recovered from Site 15Es89. One was the mark of the Goodwin Brothers Pottery in East Liverpool, Ohio, with a date of ca. 1880 (DeBolt 1994:57). This date suggests that there was an occupation of the site after the furnace closed, perhaps by one of the farm families; however, the occupation was apparently not extensive, since few other late-nineteenth and early-twentieth century ceramics and other artifacts were recovered from this site. The other mark was from an unidentified, and therefore undated, English pottery maker in the Burslem region.

Also among the kitchen artifacts were two other distinctive artifacts that have established date ranges. The artifacts were Albany slipped stoneware and amethyst container glass. Albany slipped stoneware accounted for over 38% of the stonewares. It has a date range of1830 to 1920, but was most common after 1875. The second artifact was amethyst container glass. Amethyst accounted for 6% of the container glass, and 15% of the pressed glass. Amethyst glass was most common from 1880 to 1920. The recovery of the Albany slipped stoneware and the amethyst container glass also point to the presence of an historic an occupation at Site 15Es89 that postdates the furnace operations.

Window glass has been shown to increase with thickness through time. A variety of methods of measuring this change and using the measurements for dating purposes exist (Ball 1983; Roenke 1978; Moir 1982, 1987). For the purposes of this study, Moir's method was used. It was based on window glass from a variety of rural sites in Texas, the formula being: Initial Date = (84.22 x mean) + 1712.7.

The window glass dates from Site 15Es89 are somewhat earlier than the mean ceramic dates, but many match exactly or are within a year or two of the mean ceramic date for that provenience (tables 2 and 3). The range of 1832-1867 also is somewhat early; however, the range may indicate that window glass was not replaced often during the occupation of the site. Window glass dating is not an exact science; regional variations and lag time between the date of manufacture and installation need to be considered. However, despite its potential dating problems the window glass seems to corroborate the results of the mean ceramic dating.

The mean ceramic dates from Site 15Es90 are similar to those from Site 15Es89, suggesting that the sites are contemporary, with Site 15Es90 having a slightly earlier occupation (Table 2). It can be argued that the results from Site 15Es89 were more precise because the date was based on 582 sherds, while the Site 15Es90 date was based on only 38 specimens. Like Site 15Es89, the mean ceramic dates for whiteware and ironstone were calculated with an end date of 1890, except for two decalcomania sherds, which have beginning dates of 1890. Only two hand painted sherds were recovered from Site 15Es90. They yielded a mean date of 1850.

Table 3. Window Glass Dates for Sites 15Es89 and 15Es90.

Site 15Es89		Site 15Es90	
Provenience	**Date**	**Provenience**	**Date**
Unit 1 Level 1	1839	Unit 1 Level 1	1872
Unit 1 Level 2	1858	Unit 1 Level 2	-
Unit 2 Level 1	1860	Unit 2 Level 1	-
Unit 2 Level 2	1839	Unit 2 Level 2	1897
Unit 2 Level 3	-	Unit 3 Level 1	1883
Unit 3 Level 1	1863	Unit 3 Level 2	1880
Unit 3 Level 2	1867	Unit 4 Level 1	1897
Unit 4 Level 1	1856	Unit 4 Level 2	1883
Unit 4 Level 2	1843	Unit 4 Level 3	1822
Shovel Tests	1832	Unit 5 Level 1	1830
		Unit 5 Level 2	1847
Entire Assemblage	1854	Entire Assemblage	1872

Although the mean ceramic date of 1863 suggests that Site 15Es90 is older than Site 15Es89, which had a mean ceramic date of 1865, the occupation of Site 15Es90 may have started later than it did at Site 15Es89. It also appears to have been occupied longer, as evidenced by the presence of sherds that dated to the mid-nineteenth century, and sherds from the late-nineteenth and early-twentieth centuries. The presence of both cut and wire nails further corroborates the suggestion that Site 15Es90 has components that date from the furnace period (most likely the second) or post-Civil War period and after, or that it represents a continuous occupation.

In general, the window glass dates from Site 15Es90 are later than the window glass dates from Site 15Es89, and are representative of the later occupation of the site (Table 3). Exceptions to this pattern are the dates from Unit 4, Level 3 and Unit 5, levels 1 and 2. The dates from these three contexts are very early. This is most likely the result of small sample size, as the dates from Level 3 of Unit 4 and Level 1 of Unit 5 were each calculated from one sherd, and the date from Level 2 of Unit 5 was derived from four sherds. It was also worth noting that while Unit 5 had the earliest window glass dates it also had the latest mean ceramic dates. This suggests that this unit had been impacted during the course of logging, which resulted in the mixing of deposits in this area of the site.

In summary, sites 15Es89 and 15Es90 had artifacts that dated to the 1854-1874 use of the furnace. Site 15Es89 had more pre-1860s ceramics than Site 15Es90, and had no late-nineteenth century diagnostic artifacts, such as decalcomania-decorated sherds and wire nails, suggesting that the site was occupied until the 1880s. Site 15Es90 had a similar mean ceramic date and a later window glass date. The presence of later artifacts, such as decalcomania sherds and wire nails, suggests that Site 15Es90 was most likely occupied during the post-Civil War period, and was either continuously occupied or sporadically occupied until the early-twentieth century.

Economic Shifts

Once the chronology was established, questions could be posed concerning shifts in ownership of the furnace property, and how those shifts might be evidenced in the archaeological record. One way to address these questions was to examine records concerning the provisioning of the Cottage Furnace community, but there were no extant records of this company. Archaeologically, it was anticipated that at least one stratified feature would be documented at sites 15Es89 or 15Es90. However, none were documented during the course of this study. Due to the short period of occupation (1854 to 1874) and the nature of the "yard" deposits documented at each site, it was not possible to identify stratigraphic difference in the artifacts recovered from excavation unit levels.

Site 15Es89 may contain information relevant to examining questions related to how changes in ownership affected the Cottage Furnace community. As interpreted, it was built later than the construction of the furnace, and may be the result of an influx of workers during the late-1860s and early-1870s. The problem with this suggestion is the furnace would have required a similar number of workers prior to the Civil War, as it did after, and they would have needed housing. The 1860 census records only five male employees in four households, suggesting that the rest of the crew was not present, or were present as rented slaves owned by others and not enumerated at the furnace, although they lived there. Rented slaves often lived in a communal bunkhouse rather than individual houses or cabins (Dew 1994:111). If this were the case, then one of the other sites (90CF2 or 98CF1) may represent this earlier use of the Furnace, or it may be represented by a site that has yet to be located.

Status

While archaeological evidence of the shifts in company ownership remained elusive, there were differences in status between the two sites. For the purposes of this paper, ceramics and architectural remains will form the basis of the examination of status differences. (Faunal remains were to play a role in this portion of the analysis; however, the paucity of faunal remains from Site 15Es90 did not allow for much comparison.)

Most status studies are based on ceramics and they tend to utilize nearly complete vessels, or assemblages with lots of nearly complete vessels (Miller 1980, 1991). Due to the highly fragmentary nature of the assemblages from sites 15Es89 and 15Es90, which came primarily from yard midden and not features, such as privies or trash pits, standard methods of status determination could not be utilized. Therefore, a sherd count method was applied (McBride and McBride 1987:148-150). This method used ware types, decorative motifs, and the averaged values of vessels from Miller's indices to create an average (tables 4-6).

Table 4. Decorative Types Used for Status Indicators.

Ware Type	1855 Value
Undecorated cream-colored ware (Equivalent to whiteware on mid-nineteenth century sites)	1.00
Minimal decoration (shell edge, banded, stamped, sponged, or slipped)	1.16
Hand painted floral motif	1.30
Transfer printed	2.50
Ironstone	2.50
McBride and McBride (1987:148-49)	

Table 5. Ceramic Values by Sherd Count from Site 15Es89.

Ware	Count	1855 Index Value	Average Value
Plain Whiteware	332	1.00	332.00
Minimal Decorated Whiteware	12	1.16	13.92
Hand Painted Whiteware	5	1.30	6.50
Transfer Printed Whiteware	18	2.50	45.00
Ironstone	135	2.50	337.50
Total	502		734.92=1.46

Table 6. Ceramic Values by Sherd Count from Site 15Es90.

Ware	Count	1855 Index Value	Average Value
Plain Whiteware	23	1.00	23.00
Minimal Decorated Whiteware	1	1.16	1.16
Hand Painted Whiteware	2	1.30	2.60
Transfer Printed Whiteware	0	0.00	0.00
Ironstone*	5	2.50	12.50
Total	31		39.26=1.26
* The two decalcomania sherds were not included due to their known late date.			

The 1855 ceramic values were used to be comparable with the McBride's results. The average of 1.46 (Table 5) from Site 15Es89 is higher than their highest average of 1.42, which was the home of a wealthy merchant (McBride and McBride 1987:150). Site 15Es90's ceramic value 1.26 (Table 6), falls into the middle of the McBride and McBride's sample. It is close to the value of 1.24, which obtained from the residence of a clerk. The lower value at Site 15Es90 than at Site 15Es89, might be due to sample size as the sample from Site 15Es90 is much smaller than the sample from Site 15Es89. If questions concerning sample size are set aside and the calculated values considered valid, then the differences may reflect chronological differences. As interpreted, Site 15Es90 is a later site, where it would have been more likely to encounter plain whitewares rather than earlier more expensive decorated sherds. These plain sherds would result in a lower calculated value.

Despite the possible sample size and temporal problems with the ceramic assemblages, there appears to be a difference in status between the two sites. This difference can be seen and further defined through an examination of the architectural remains documented at the two sites. Site 15Es89 had a low-mortared limestone foundation wall and a chimney fall pile exposed on the surface. Site 15Es90 had only a chimney fall pile exposed on the surface. Subsurface investigations at Site 15Es89 documented additional portions of the low-mortared wall and a corner of the chimney base at this site, but did not encounter a cellar. Excavations at Site 15Es90 did not encounter walls, piers, posts, or a cellar, but excavation of the chimney fall pile did document a portion of a clay mud chinked hearth.

During the course of fieldwork at the Greenwood Furnace Community, Greenwood Pennsylvania, Paul Heberling encountered a variety of architectural remains (Heberling 1987:199-216). Greenwood was a much larger iron making community than Cottage Furnace, with discernable neighborhoods and industrial areas. Heberling excavated five sites, each one in a different neighborhood, and determined the status of the site's residents based on architecture, ceramics, glassware, and income rank.

Most of Heberling's (1987) categories are self-explanatory (Table 7); questions may arise concerning determining the elevation from the foundation alone. Heberling (1987:209) explained that piers never supported more than one story, a dry wall foundation supported no more than one and one-half stories, and mortared foundations more that 40 cm (16 inches) wide were associated with houses of two or more stories.

Table 7. Variables Used for Determining Architectural Scale.

Architectural Element	Value
Foundation Plan (Outside Dimensions)	
1974 Less than 280 square feet	1.00
1975 281-350 square feet	1.50
1976 351-500 square feet	2.00
1977 501 plus	2.50
1978 El or addition	0.50
Foundation Type	
None	1.00
Piers	1.50
Dry wall on surface	1.50
Dry wall in trench	2.00
Mortared wall	2.50
Elevation	
One story	1.00
One and one-half story	1.50
Two story	2.50
Heating Plant	
Fireplace only	1.00
Stove, one flue	1.50
Stoves two or more flues	2.00
Soft coal; hard coal	+.25; +.50
Cellar	
Partial	1.50
Full	2.00
Heberling (1987:209-210)	

The architectural scale for sites 15Es89 (Table 8) and 15Es90 (Table 9) suggested that Site 15Es89 had a higher ranking. The architectural average for Site 15Es89 fell in the middle of Heberling's (1987) Greenwood neighborhood being similar to that of teamsters and keepers, while the value for Site 15Es90 was lower than his lowest average value, which was for Greenwood's "Colliers Row."

The final indicator of status was to be faunal remains. Site 15Es89 produced 186 animal bones and fragments, while Site 15Es90 only produced three specimens, making comparisons difficult. However, the faunal remains from Site 15Es89 did provide information about species and butchering practices. The predominant species at Site 15Es89 was pig, with smaller numbers of cattle and chicken represented. Wild species (squirrel and possibly groundhog and frog) supplemented the resident's diet. All skeletal elements of the pig were represented in the faunal assemblage, suggesting that pigs were being raised and butchered at or near the site. Ribs, a limb bone, and a tooth represented the cattle assemblage. The furnace company from its inception until the 1870s raised pigs and cattle. It is not clear just where the livestock were raised; most likely in one of the adjacent drainages, or possibly by one of the farmers living near the furnace.

Table 8. Architecture Attributes and Scale from Site 15Es89.

Architectural Element	Scale
Foundation Plan	
20' by 18' = 360 square feet	2.00
Type	
Mortared Wall	2.00
Elevation	
Two Story	2.50
Heating Source	
Fireplace	1.00
Cellar	
None	0.00
Average	1.50

Table 9. Architectural Attributes and Scale from Site 15Es90.

Architectural Element	Scale
Foundation Plan	
Less than 280 square feet	1.00
Type	
None	1.00
Elevation	
One Story	1.00
Heating Source	
Fireplace	1.00
Cellar	
None	0.00
Average	1.00

Marks on the bones revealed that the dominant method of butchering was cutting and chopping. Only one bone had marks congruent with sawing meat. Butchering marks have been used to assess status, suggesting that meat that was cut or chopped was more likely from lower status sites (Wagner 1995:240). However, the presence of more plate (n=31) than bowl sherds (n=9) suggests that cuts of meat, associated with higher status, rather than lower status stews and soups made with chopped meat, were common meals. Therefore, chopping was probably the result of common butchering practices rather than a marker of economic status.

In summary, archaeological evidence suggests that the residents of Site 15Es89 had a higher status than those that lived at Site 15Es90 based on the ceramic and architectural remains. McBride and McBride (1987) and Heberling (1987) went further, using historical records to corroborate the ceramic and architectural scales. In the McBrides' sample from Mississippi, the occupation and social and economic status of the residents was known. Heberling was not as fortunate. At Greenwood he had some oral history and the census records, but he did not have any other records to identify the residents of the site. Like Greenwood, Cottage Furnace did not leave any records, and the census was very vague as to where those enumerated lived. In 1860, Cottage Furnace was listed as a place where the census was taken, and its precinct seems to include a much larger area than just the furnace community. In 1870, Cottage Furnace was enumerated as a portion of the Irvine Precinct, which appeared to cover the entire Cow Creek drainage. Estill Furnace and the Red River Iron Manufacturing Company Furnaces at Fitchburg were recorded in the Miller's Creek Precinct, suggesting that it was possible to discern who was working at each furnace. Differences in status can readily be seen from the real estate values and personal property values recorded in the census records. These values are presented as an average for each job category (figures 5 and 6).

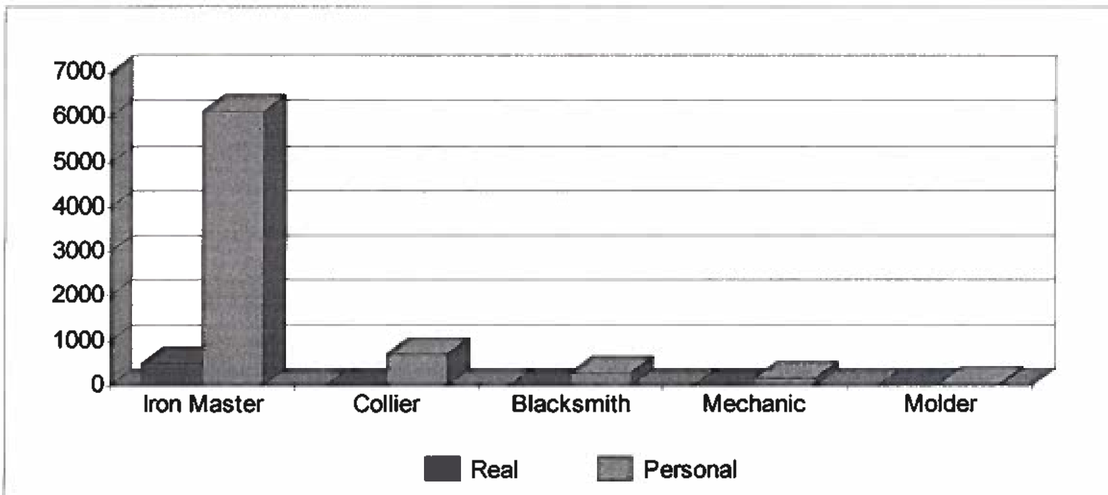

Figure 5. Real Estate and Personal Estate for each Job Category from the 1860 Manuscript Census (values in dollars).

Demographics

One of the most important aspects of the study was to understand how many people lived at Cottage Furnace and how these households were organized. For example, were households of single men common as at other industrial enterprises, or were there more families?

Prior to the Civil War in the Red River Iron District, the most common pattern seemed to be that the ironmaster would have a large household consisting of his family and a number of free white males and male slaves. Few female slaves of any age were recorded in the census records, suggesting that it was more common to have single males rather than families of slaves. Census records did not record how many structures these people occupied, but it seems doubtful that they all lived in the same house. In 1860, only five men and their families appeared to be living at the Cottage Furnace (Figure 7). Surprisingly, only one was a boarder; both iron masters lived in the same house. Neither of them was enumerated as a slave owner in the 1860 slave census, therefore if they used slaves they must have rented them from other owners. It is also possible that some of the people enumerated as "farmer" or "laborer" worked at the furnace or in the charcoal kilns and iron mines when not engaged in agriculture. As stated before, Cottage Furnace was involved in agriculture, and it is possible that some of these people raised crops and livestock to feed the furnace employees.

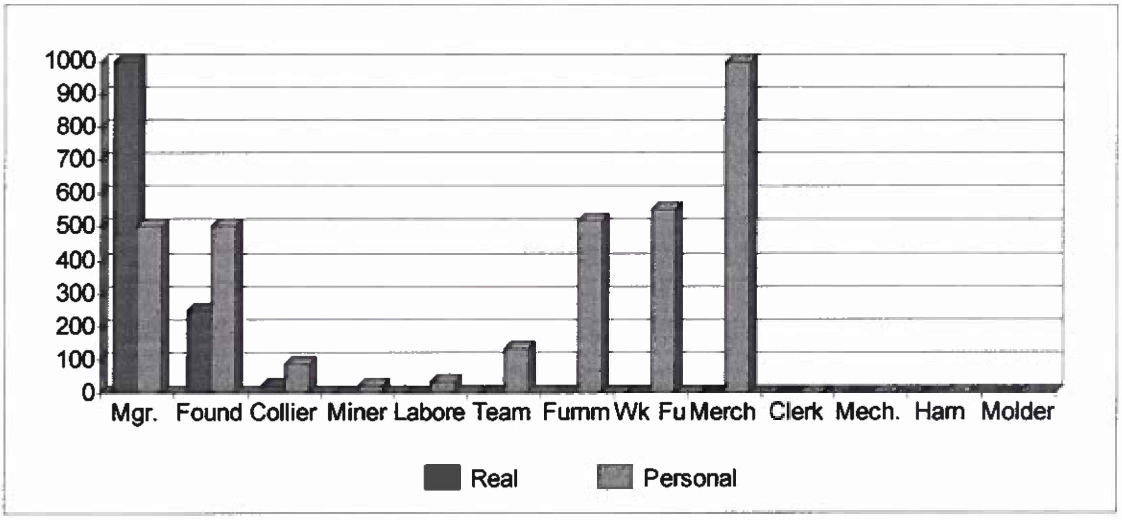

Figure 6. Real Estate and Personal Estate for each Job Category from the 1870 Manuscript Census (values in dollars). Mgr.=manager, Found.=founder, Labore.=laborer, Team=teamster, Furnm.=furnaceman, Wk.Fu.=works @furnace, Merch.=merchant Harn=harness maker.

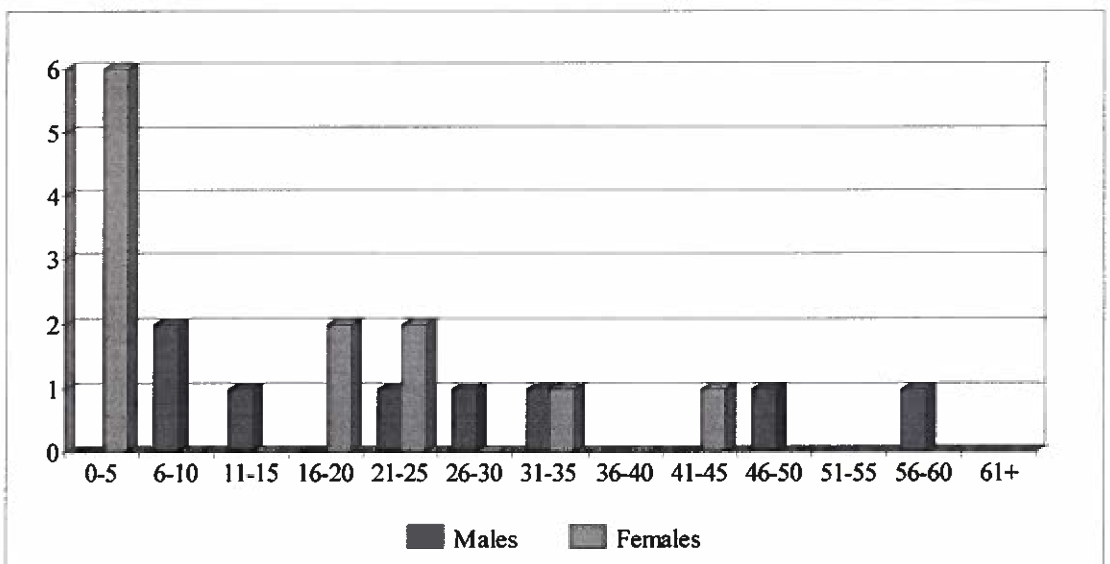

Figure 7. Enumerated Population by Age at Cottage Furnace from the 1860 Manuscript Census

The best demographic data comes from the 1870 manuscript census (Figure 8). Fifty-eight males listed furnace-related jobs for their occupations. These males lived in 44 households that had one or more individuals employed in the iron industry at Cottage Furnace. These houses were occupied by 231 individuals.

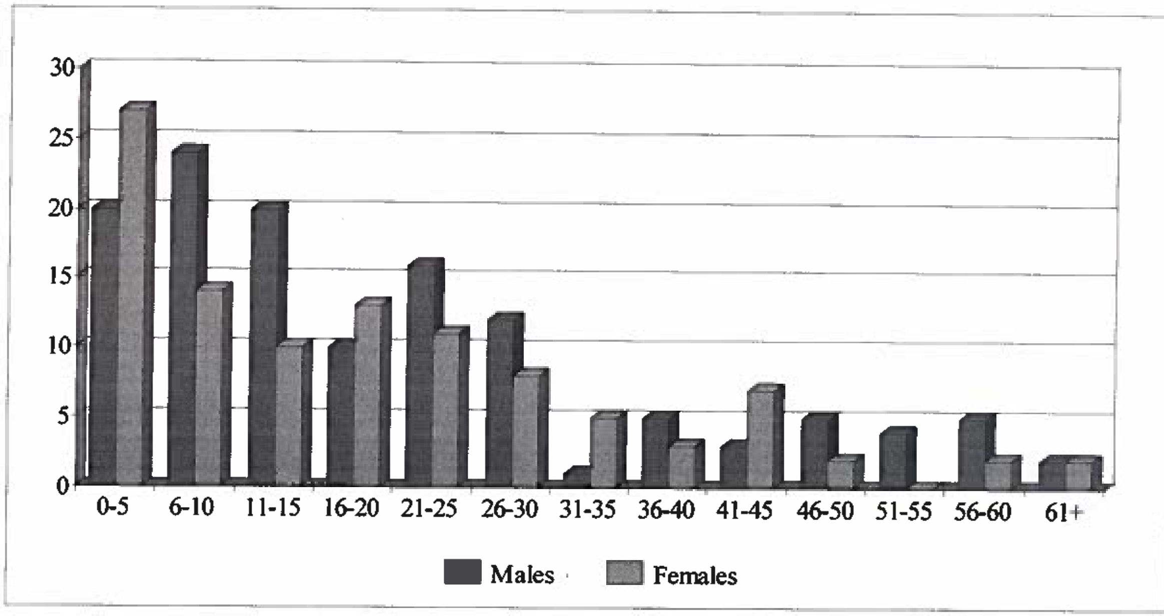

Figure 8. Enumerated Population by Age at Cottage Furnace from the 1870 Manuscript Census.

There were 127 males and 104 females in households with furnace workers. Children under the age of ten represented 36.8% of the people associated with Cottage Furnace. Subadults aged 11 to 20 accounted for 22.9% of the population, while adults in the 21-30 range accounted for 20.4%. Adults over the age of 30 accounted for 19.9% of the population. It seems that there was a trend for families with large numbers of children to be present at Cottage Furnace rather than large groups of single men.

The average age of furnace employees was 34.4 years with the laborer category having the most variation in age ranging from 12 to 73 years old. Colliers had the second highest variation (12 to 58 years old), and miners were third with a range in age from 13 to 45 years old. Two of the laborers were subadult children of a founder, and one a subadult child of a teamster, suggesting that young subadult males may have been working under their fathers.

Concurrent with gender, age, and occupation, census data also provided valuable information on household composition and geographical clustering of furnace workers. Relatively few of the workers lived in what might be termed a boarding house. Fifteen of the 58 men enumerated as workers for Cottage Furnace in the 1870 census were boarders. Of these, only seven lived in three houses that had households of unrelated people suggestive of a boarding house. The rest of the boarders lived with other workers, or with farm families near the furnace, the charcoal pits, or ore mines. The remainder of the workers lived in single family dwellings, suggesting that this was the preferred housing type.

It has been suggested that the iron plantation usually had a small-nucleated village or community near the furnace for the core furnace workers, while the colliers and ore miners lived dispersed in the surrounding forests. There is evidence of this at Cottage Furnace. In Figure 9, note the cluster of structures near the furnace. While this map does not show mines or specifically identify miners houses, charcoal kilns, or colliers houses, it does give the impression of the small and clustered nature of an iron plantation.

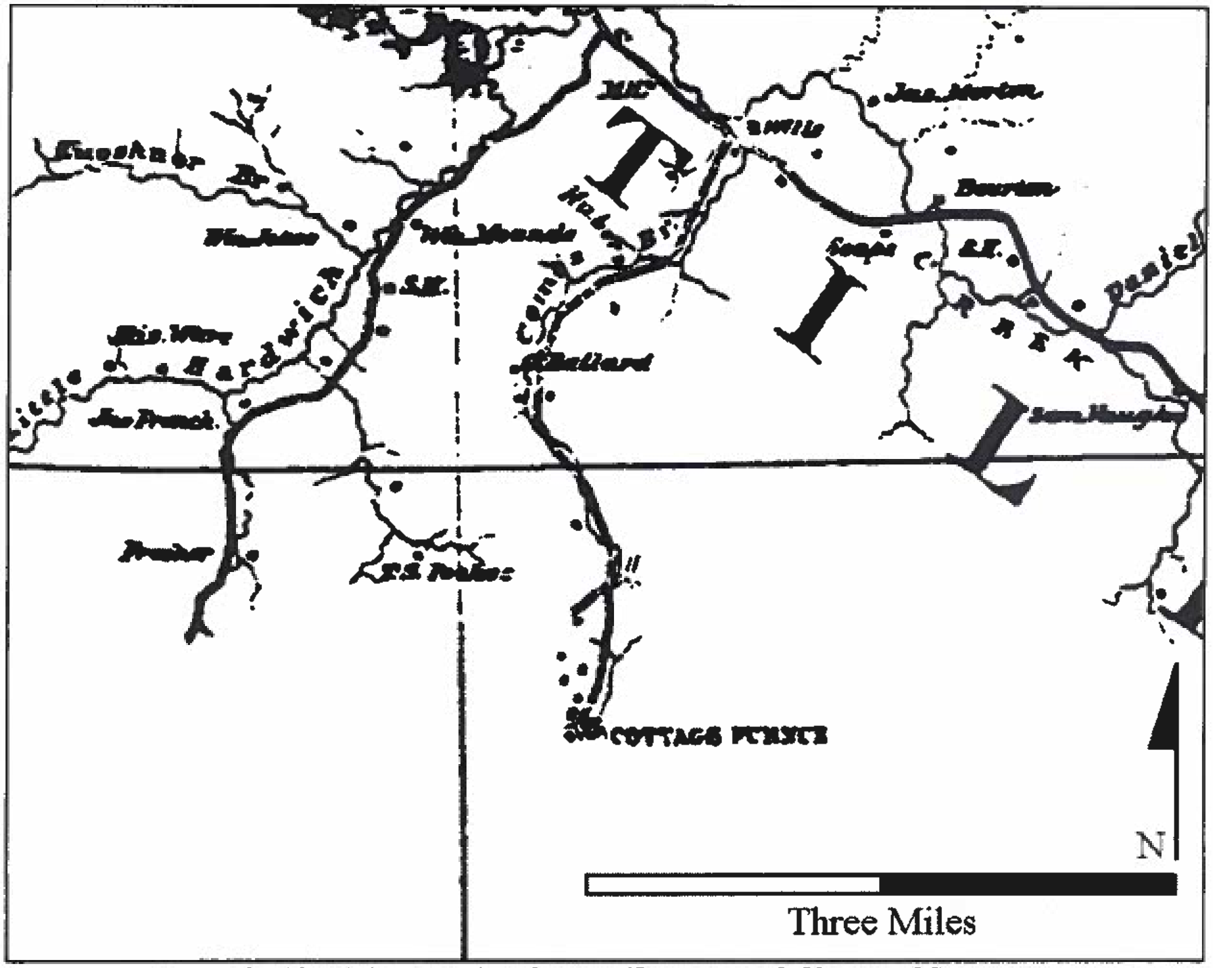

Figure 9. 1877 Map showing Cottage Furnace and Cluster of Structures.

Census data suggested that there were seven clusters of furnace related workers. The largest group of 21 households contained the majority of the individuals that gave their occupation as laborer, works at Cottage Furnace, furnace man, teamster, molder, founder, merchant, mechanical engineer, teacher, and harness maker. Only four individuals gave their occupation as collier, and three gave miner. Interspersed with this group were 11 individuals who gave Farmer as their occupation. After the main cluster there was a small four-household group that included the manager and clerk, then two miners and a collier. Five households later were two more Colliers, and then there was a break for 23 households. An 11-house cluster was next, consisting of seven colliers, one miner, and one individual that claimed he "works at Cottage Furnace." Eight households further were two collier households, and 19 households later was a teacher with two laborers, three miners, and another laborer. From these data, there appears to be a core cluster of families with furnace occupations, while families who made charcoal and mined ore seem to have been in clusters away from the furnace. Unfortunately, the enumerator did not record where these people lived, other than the Irvine Precinct. Census enumerators generally followed the major roadways, which primarily followed creek drainages, although some ridgecrest roads were present. Enumerating by creek drainage may be suggested by the longer gaps between households. If the enumerator went up one side of a drainage, down the other, and back up the next drainage he would have re-encountered individuals living near the top of the mountain where the furnace was located. From tax and deed records the Cottage Furnace owned and operated on 400 ha (10,000 acres), and claimed title to all land within a 5 km (3 mile) radius of the furnace. Therefore, some of the clusters of colliers or miners may have lived several kilometers from the furnace, but still within the Irvine Precinct further confusing attempts to place them spatially.

Archaeologically, evidence of families and children remained sparse. A singular blue glass bead and decorative buttons might suggest the presence of women at Site 15Es90. One small heart shaped locket or jewelry box plate was recovered from Site 15Es90, suggestive of an item worn or owned by a woman or girl. A toy gun barrel and two clay marbles from Site 15Es90 were the only artifacts recovered from either site that suggested the presence of children.

Ethnicity

The last issue that was examined was ethnicity. Throughout its history African-American slaves and Freedmen played an important role in the Red River Iron District. The first mention of slaves came in the 1790s at the Bourbon Furnace. Thomas Deye Owings owned 30 slaves at the Red River Iron Works during the 1810s. John C. Mason had 41 slaves working at the Red River Iron Works or Estill Furnace in 1830. In 1840, Mason had 17 slaves working at the Slate Creek Forge. Tax records report that Mason and Wheeler owned one slave at the Cottage Furnace in the late 1850s. Jackson and Jones owned four slaves at the Estill Furnace during this time. After the Civil War, free African-Americans continued to work in the iron industry, at Estill Furnace and the Red River Iron Manufacturing Company furnaces at Fitchburg. One African-American household was enumerated at Cottage Furnace in 1870. At Fitchburg, 12.3% of the enumerated employees were African-Americans. Racial tensions came to a head during the summer of 1871, when an armed group of the Ku Klux Klan attacked Fitchburg, forcing the African-American residents to leave.

Documentary evidence of the presence of African-Americans at Cottage Furnace was limited to the two mentioned references. Extensive searches of other available materials did not reveal any more clues. Based on precedents in other southern iron districts, the use of rented slaves might explain why so few people were enumerated at Cottage Furnace in 1860. The presence of only two African-Americans in the 1870 census may suggest that African-Americans, either enslaved or free, did not play much of a role in the iron industry at Cottage Furnace. Archaeologically, no artifacts were recovered that were directly ascribable to an ethnic group.

CONCLUSIONS

The archaeological investigations at Cottage Furnace have shown that there were differences between the two sampled sites. While two sites may not represent the entire community, and there are other sites in the surrounding area that may have higher or lower status indicators, the archaeological data suggest there was some social stratification in regards to access to goods and in housing types. Unfortunately, an individual or a family could not be ascribed to the house sites. The census data presented suggests there were some clusters of furnace workers, but there was little stratification based on employment beside the generally dispersed nature of the colliers and miners. Therefore, it can only be suggested that Site 15Es89 was the home of a higher status worker, such as an iron master, founder, or merchant. Likewise, Site 15Es90 may have housed a lower status worker, a laborer, miner, or collier. Later, it appears the site was reoccupied.

It was somewhat surprising that artifacts suggestive of families were not more prevalent given the census data. The census data suggested that the furnace community was more like an agricultural community rather than a male-dominated industrial enterprise. Families, rather than boarding houses with single men, seem to be the most common household type. Lastly, archaeological evidence of Antebellum industrial slavery or Postbellum African-American households remained elusive.

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GUN SMOKE BY THE RIVER: FIREARM-RELATED ARTIFACTS FROM THE ARGOSY CASINO PROJECT, DEARBORN COUNTY, INDIANA

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ABSTRACT

The interpretive potential of firearm-related artifacts recovered from purely civilian sites is frequently unappreciated by many historical archaeologists. An examination of arms related materials from a series of house lots at the Argosy Casino in Dearborn County, Indiana, led to several insights into firearms ownership and use in this portion of the Ohio River Valley from the years following the Civil War until the Great Depression. The nature and distribution of these materials has allowed for a preliminary assessment of the variety of weapons and Minimum Number of Firearms (MNF) per household, the economics and applications of firearms usage, hunting patterns, and the market share held by various ammunition manufacturers.

INTRODUCTION

Though firearms and associated artifacts are typically few in number on any given site, historical archaeologists have long been aware of the presence of munitions-related materials throughout the region. Indeed, materials of this nature have been recovered from a variety of civilian sites within the general Ohio Valley region. Analysis of these materials has yielded both interesting and useful insights (e.g., types and caliber of weapons used and the chronology of popular acceptance of changing firearms technology) into the appearance and use of these items since the early colonial period. Examples of such regional studies include the James White Second Home site (ca. 1788-1852) in Knoxville, Tennessee (Faulkner 1984:136-140); Zumwalt's Fort (late 1790s-ca. 1930), a pioneer homestead in St. Charles County, Missouri (Cotter and Gilbert 1979; Waselkov 1979:80); the First Hermitage site (1804-1860) on the grounds of President Andrew Jackson's plantation near Nashville, Tennessee (Smith 1976:192-194); Waveland (1847-1956+), a plantation in Fayette County, Kentucky (Pollack and Hockensmith 1985:45); and the ca. 1880-1885 Crawford-Nurre sawmill in Williamsburg, Kentucky (Ball 1998). Routinely small in size, these assemblages tend to reflect hunting-related activities. Firearms ownership and use were not restricted to rural areas as evidenced by the fact that every major urban archaeological project undertaken within the city limits of Frankfort, Kentucky, has also yielded firearm-related artifacts (cf. Ball 1996; Deiss 1988:75-77; Esarey et al. 1993:40, 53; Fay 1986:102-104; Genheimer 1988:94).

The present paper will specifically examine an assemblage of firearm-related artifacts recovered from a series of houselots adjacent to Lawrenceburg, the location of the Argosy Casino project on the right bank of the Ohio River in Dearborn County, (southeastern) Indiana. As will be discussed below in greater detail, both the nature and distribution of these materials have provided a number of insights into firearm ownership and usage in this portion of the state. A detailed project report is presently being prepared by Dr. Hank McKelway of Cultural Resource Analysts, Inc., of Lexington, Kentucky. For present purposes, it is sufficient to note that all or most of the sites discussed herein were occupied by German immigrants or their children in the years following the Civil War (Creasman 1998:77-99).

ARTIFACT TYPOLOGY

A total of 62 firearm-related artifacts was recovered from the Phase III excavations conducted at various historic era sites situated within the Argosy Casino project boundaries (Table 1). Metal preservation was generally poor at these sites and corrosion, oxidation, and rust tended to be the rule rather than the exception for the firearms portion of the assemblage. Virtually the entire sample is reflective of civilian firearms use. Though numerically small, examination of these diverse gun-related artifacts has led to some interesting insights into the ownership and use of firearms in this portion of the central Ohio Valley from shortly after the Civil War to sometime prior to World War II.

Despite the shift within archaeology toward the utilization of metric measurements, this paper will retain traditional English units as expressed in caliber, gauge, projectile weight, and cartridge case dimensions, since these units of measure are commonly used to refer to and classify fire-arm related artifacts. As appropriate, these units will be further defined within the text. The following discussion and interpretive observations will address two questions: "What was found?" and "What have we learned from it?" The order of artifact discussion will follow that presented in Table 1. A subsequent section will assess various approaches toward the analysis and interpretation of these artifacts as they relate to the use and ownership of firearms in a small portion of Dearborn County, Indiana.

CARTRIDGE CASES

Though "cartridges" existed as early as ca. 1570 (NRA 1989:35), the metal encased form known today was an outgrowth of the development of ignition (priming) compounds created by mixing fulminates and other explosive materials for use in percussion cap weapons. Following the 1807 introduction of fulminate of mercury as a primer in lieu of finely ground (FFFFg) gunpowder, a number of early self-contained cartridge types were developed. These included a paper-cased cartridge containing an integral centerfire primer made by Samuel Pauly of Switzerland in 1812, pinfire cartridges developed by Casimir Lafaucheux in France in 1835 (cf. NRA 1981:34-35), and needlefire cartridges produced by Johann von Dreyse in Prussia in 1840 (NRA 1989:37-40). Among these various creations was a tape-primed revolver invented by American dentist Dr. Edward Maynard in 1845. This method employed a small amount of fulminate compound suspended between two elongated but narrow strips of paper that were rolled and placed in the upper handle of the weapon. Though tape-primed weapons have long been obsolete, Dr. Maynard's invention has survived into the modern age as paper caps used by generations of children as a form of amusement (Coates and Thomas 1990:73; NRA 1989: 40).

Table 1. Firearm-Related Artifacts by Type and Site.

	Site					
Sub-group/Item	**12D507**	**12D508**	**12D515**	**12D517**	**12D520**	**12D521**
Rimfire (all)						
.22 Short	-	5	1	-	3	3
.22 Long/Long Rifle	2	6	1	-	2	1
.22 Extra Long	-	1	-	-	-	-
.32 Short	-	-	-	-	2	-
.38 Short	-	1	-	-	-	-
.44 Short	-	-	-	-	-	1
Centerfire Pistol						
.32 centerfire	1	-	-	-	-	-
.32 S&W	-	-	-	-	1	1
.38 S&W	-	1	-	-	3	1
Centerfire Rifle						
.32 Extra Long Ballard	-	1	-	-	-	-
Shotshell						
10 gauge (solid brass)	-	-	-	-	1	-
10 gauge (paper wall)	-	1	-	-	-	-
12 gauge (paper wall)	-	7	-	1	6	1
16 gauge (paper wall)	-	1	-	-	-	-
18 gauge (paper wall)	-	-	-	-	-	1
.410 bore (paper wall)	-	-	-	-	1	-
Projectiles						
minie ball (0.537" diameter)	-	-	-	-	-	1
minie ball (0.691" diameter)	-	-	-	-	1	-
Gun/gun parts						
Revolver	-	-	-	-	1	-
Hammer	-	-	-	-	1	-
Site totals	3	24	2	1	22	10
Percent of sample	4.8%	38.7%	3.2%	1.6%	35.5%	16.1%
Total firearm-related artifacts	62					

The year 1845 also witnessed the appearance in France of the .22 Flobert BB Cap. Developed by Louis Flobert for use in arcade target rifles, this cartridge represented a modified (rimmed) percussion cap that closed around the base of a bullet. Powered only by its priming compound and restricted to short distance shooting, this cartridge led to the development of the .22 Short round in 1857 for use in the first Smith and Wesson revolvers (Barnes 1997:380; Supica and Nahas 1996:37). The final decades of the nineteenth century produced numerous permutations of ignition systems (the most notable of which were Boxer and Berdan centerfire primers), case dimensions and configurations, powder charges and types (the first "smokeless" gun powders were introduced in the late 1800s), and projectile sizes, designs, and compositions (for example, the first metal jacketed bullets were produced in the 1880s in response to the increased velocities of then new "smokeless" powder) as literally hundreds of cartridges were developed for both civilian and military applications (cf. Ball 1997a; Barber 1987; Barnes 1997; Coates and Thomas 1990:73-74; Datig 1956, 1958, 1967; Hogg 1978:28-33; Huon 1988; Layman 1998:62-80; Lewis 1972; Logan 1948; McDowell 1984: NRA 1989:40-46; Suydam 1960; Treadwell 1873). Well before the end of the Civil War, all muzzle-loading small arms were effectively obsolete.

All of the Argosy Casino cartridge cases were fabricated from drawn brass (see Frost 1990 and Lewis 1972 for discussions on metallic cartridge case manufacture). The majority of the recovered cartridge cases and shotgun shell bases had suffered from varying degrees of deterioration and other damage. In some instances, elements of the case and/or headstamp (maker's mark) were sufficiently intact to allow for accurate identification. In other instances, cases had deteriorated to the point that identification was problematical and an examined remnant could be related to two or more distinct but dimensionally similar cartridges. A comparison of the dimensional attributes of these cases (Table 2) revealed the presence of several types of cartridge cases representing those used in both revolvers and rifles.

Rimfire Cartridges

Of the 58 recovered cartridge cases, 29 (50.0%) reflected rimfire (RF) ignition types. Within this collection there are 25 examples of .22 caliber cases (caliber being a measure of bullet diameter in increments of 0.01 or 0.001 inch). Twelve cases were derived from .22 Short (introduced 1857) ammunition and another 12 represented either .22 Long (introduced 1871) or similarly dimensioned .22 Long Rifle (introduced 1887) cartridges. An examination of the 19 legible headstamps on these cases indicated production by at least three manufacturers: Remington (n=16), Peters (n=2), and U. S. Cartridge Company (n=1). Ammunition of this type was widely used in numerous makes and models of derringers, revolvers, and rifles (cf. Hogg and Weeks 1992; NRA 1981; Schwing and Houze 1996); it is not possible to determine the type of weapon in which these rounds were fired. These cartridges (particularly .22 Long Rifle) remain in active production and literally billions of rounds are manufactured each year.

A single example of a .22 Extra Long Rimfire case was recovered from Site 12D508. Representing an extended version of the .22 Long RF round, this cartridge was introduced about 1880 and discontinued in 1935. This cartridge was variously used in rifles manufactured by Winchester, Ballard, Remington, and Wesson, and revolvers produced by Smith & Wesson and others. Originally loaded with six grains of black powder, this round fired a 40-grain outside-lubricated bullet that was subsequently adapted by the industry to the .22 Long Rifle round introduced in 1887 (Barnes 1997:381).

Two cases identified as .32 Short Rimfire were recovered from Site 12D520. This case was introduced in 1860 and remained in limited production as recently as 1990. It was initially used in revolvers manufactured by Smith & Wesson but was later adapted to a variety of other handguns (e.g., Colt, Allen, Blue Jacket, Enterprise, Favorite, and Whitney) and rifles (e.g., Remington, Stevens, and Winchester) (Barnes 1997:385). Weapons chambered for this cartridge were produced as late as 1936. This cartridge was originally produced with an 80-grain lead bullet of 0.316 inch diameter and loaded with nine grains of blackpowder (Barnes 1997:385, 394).

Table 2. Provenience, Dimensional, and Chronological Data for Factory and Recovered Cartridge Cases.

Cartridge Type/ Site	Catalog Number	Rim Diameter	Base Diameter	Length	Headstamp	Chronology
Rimfire						
.22 Short RF	Factory	0.273"	0.225"	0.432"	-	1857+
12D508	#1016	0.267"	0.225"	0.440"	"P" (Peters)	1895-1934
12D508*	#1046	0.260"	0.241"	0.429"	"P" (Peters)	"
12D508*	#1410	0.272"	0.228"	0.416"	"US" (US Cartridge Company)	1869-1926
12D508	#1569-1	0.273"	0.230"	0.414"	"U" (Remington)*	1885-P
12D508	#1569-2	0.271"	0.237"	0.419"	None	"
12D515	#325	0.270"	0.235"	0.418"	"U" (Remington)*	"
12D520	#623	0.272"	0.226"	0.431"	"U" (Remington)*	"
12D520	#1362	0.278"	0.246"	0.418"	"U" (Remington)*	"
12D520	#2401	0.271"	0.244"	0.421"	"U" (Remington)*	"
12D521	#377	0.268"	0.230"	0.413"	"U" (Remington)*	"
12D521	#684	0.285"	0.230"	0.415"	"U" (Remington)*	"
12D521	#720	0.266"	0.230"	0.416"	"U" (Remington)*	"
.22 Long RF	Factory	0.275"	0.225"	0.595"	-	1871+
.22 Long Rifle RF	Factory	0.275"	0.225"	0.595"	-	1887+
12D507	#370	0.272"	0.228"	0.626"	"U" (Remington)*	1885-P
12D507*/**	#487	0.270"	0.228"	0.608"	"HI/U/SPEED" (Remington)	>1926
12D508*	#1212	0.269"	0.238"	0.611"	Illegible	1871+
12D508	#1409	0.268"	0.225"	0.610"	"U" (Remington)*	1885-P
12D508*	#1558	0.274"	0.231"	0.611"	"U" (Remington)*	"
12D508	#1877-1	0.272"	0.235"	0.608"	"U" (Remington)*	"
12D508	#1877-2	0.276"	0.235"	0.624"	"U" (Remington)*	"
12D508*	#2068	0.272"	0.238"	0.606"	illegible	1871+
12D515	#326	0.268"	0.226"	0.606"	"U" (Remington)*	1885-P
12D520*	#1603	0.272"	0.228"	0.613"	illegible	1871+
12D520*	#3243	0.274"	0.232"	>0.485"	illegible	"
12D521	#180	0.268"	0.235"	0.610"	"U" (Remington)*	1885-P
.22 Extra Long RF	Factory	0.275"	0.225"	0.750"	-	1880-1935
12D508	#553	0.270"	0.235"	0.800"	"U" (Remington)*	1885+
.32 Short RF	Factory	0.377"	0.318"	0.575"	-	1860+
12D520*	#319	0.365"	0.325"	0.585"	"US" (US Cartridge Company)	1869-1926
12D520*	#1552	0.370"	0.334"	0.571"	"US" (US Cartridge Company)	"
.38 Short RF	Factory	0.435"	0.376"	0.768"	-	1865-1940
12D508***	#2625	0.436"	0.385"	0.781"	"H" (Winchester)	1867+
.44 Short RF	Factory	0.519"	0.445"	0.688"	-	1861-1940
12D521*	#545	0.484"	0.474"	0.795"	illegible	1861+
Centerfire pistol						
.32 Colt	Factory	0.374"	0.318"	>0.92"	-	1875-P
.32 Long Colt	Factory	0.374"	0.318"	0.92"	-	1880?-1940?
.32 centerfire						
12D507*	#306	0.373"	0.326"	<0.516"	illegible	1875+
.32 S&W	Factory	0.375"	0.335"	0.61"	-	1878+
12D520*	#1446	0.377"	0.342"	0.595"	"US/ -2 S&W" (US Cart. Co.)	1878-1936
12D521*	#224	0.375"	0.343"	0.592"	"UMC/ 32 S&W" (Union Metal.)	1878-1916

Note: Impressed "U" headstamp first used by Union Metallic Cartridge Company (UMC) of Connecticut beginning 1885. This mark continued to be used after its merger with Remington Arms Company in 1916 (Barber 1987:48).

Table 2 (Continued).

Cartridge Type/ Site	Catalog Number	Rim Diameter	Base Diameter	Length	Headstamp	Chronology
.38 S&W	Factory	0.433"	0.386"	0.78"	-	1877+
12D508*	#1919	0.430"	0.390"	0.765"	"W.R.A.Co./ 38 S&W" (Winchester)	"
12D520*	#2231-1	0.439"	0.393"	0.771"	"UMC/ 38 S&W" (Union Metal.)	1877-1916
12D520*	#2231-2	0.437"	0.396"	0.769"	"RE--/ 38 S&W" (Remington)	1877+
12D520	#2323	0.432"	0.389"	0.772"	"REM-UMC/ 38 S&W" (Remington)	1916+
12D521*	#87	0.435"	0.413"	<0.591"	"U.S.C.CO./ 38 S&W" (US Cartridge Co.)	1877-1936
Centerfire Rifle .32 Extra Long Ballard	Factory	0.369"	0.321"	1.24"	-	1876-ca. 1900
12D508*	#958	0.408"	0.362"	1.304"	"U.M.C./ -- C.F.W". (Union Metallic)	"

* Case partially to heavily corroded, bent, and/or crushed.
** Nickel plated case (likely post-World War II production).
*** Unfired cartridge. Bullet badly corroded; "as is" overall length = 1.119".
Sources: Ball (1997a); Barber (1987); Barnes (1997); Logan (1948); NRA (1989).

One example of a .38 Short Rimfire case was found at Site 12D508. This round was introduced ca. 1865 and production ceased in 1940. A number of revolvers (e.g., Allan, Colt, Enterprise, and Whitney) and rifles (e.g., Ballard, Remington, and Wesson) used this cartridge. This round was loaded with 18 grains of blackpowder and fired a 0.375 inch diameter, 130-grain outside lubricated bullet (Barnes 1997:386).

Site 12D521 yielded the only recovered example of a .44 Short Rimfire cartridge. Introduced about 1864-1865, production was discontinued in the 1920s. It was used in handguns manufactured by firms such as Allen, Connecticut Arms & Manufacturing, Forehand & Wadsworth, and Remington (Barnes 1997:387). This round was loaded with 15-17 grains of blackpowder and fired a 0.446-inch-diameter bullet weighing 200-210 grains (Barnes 1997:387, 394). These cartridges could also be fired in weapons chambered for .44 Long Rimfire ammunition.

Centerfire Pistol Cartridges

Eight of the centerfire cartridges represented types that are normally associated with revolvers. One case recovered from Site 12D507 had deteriorated to the point that it could only be generally related to similarly dimensioned cartridges such as the .32 Colt (introduced 1875, still in production) or .32 Long Colt (introduced 1880s? and discontinued in the 1940s?) rounds (cf. Barnes 1997:244-245, 274).

Sites 12D520 and 12D521 each yielded one example of the .32 S&W cartridge. These rounds were introduced in 1878 and remain in active production. One reason for its continued appeal has been this round's adaptability to a wide variety of relatively lightweight and inexpensive handguns. This cartridge was originally loaded with nine grains of black powder and fired a 0.312-inch-diameter lead bullet weighing 85 grains (Barnes 1997: 243, 274).

A total of five .38 S&W cartridge cases were identified. These cases were recovered from sites 12D508, 12D520, and 12D521. This cartridge was introduced about 1877 and remains in active production. Well suited for use in lighter-weight revolvers, this round was originally loaded with blackpowder and fired a 0.359-inch-diameter 145-grain lead bullet (Barnes 1977:257, 274).

Centerfire Rifle Cartridges

A single, badly deteriorated case was tentatively identified as an example of the .32 Extra Long Ballard round introduced in 1876 and discontinued about 1920 (Barnes 1997:110). Displaying a Union Metallic Cartridge Company headstamp, this case was recovered from Site 12D508. These cartridges were used in single-shot sporting and hunting rifles manufactured by Marlin, Remington, Stevens, and Wurfflein. This round was loaded with 20 grains of FFg blackpowder and fired a 0.317 inch diameter lead bullet weighing 115 grains (Barnes 1997:110, 148). This case was the only centerfire rifle round recovered.

SHOTGUN SHELLS

In common with their pistol and rifle counterparts, the development of self-contained loads for shotguns began at least as early as 1836 with the invention of a pinfire round by Frenchman Casimir Lefaucheaux, one year after his introduction of a similarly ignited pistol cartridge. Notably, the weapon that fired this round was a side-by-side double-barreled, hinged-frame shotgun that served to provide the classic double-barreled design still in production (Hogg 1978:216). Except for the pin protruding from the lower portion of its brass wall, the shell itself was effectively identical in configuration to shells produced at the present time. Such shotgun shells were in regular production until at least the late 1800s (Barnes 1993:391).

The advent of self-contained shotgun shells and a related need to establish standards for the firearms industry were instrumental in the passage of the Gun Barrel Proof Act of 1868 by the British Parliament. This act defined gauge as the number of identical round lead balls that could be made from one pound (453.662 g or 0.454 kg) of lead. Thus, a designation such as "12 gauge" means that the unrestricted bore of a given weapon is equal to the diameter (0.729 inch) of a round ball of lead weighing precisely 1/12 of a pound (NRA 1989:182-184). Centerfire shotgun shells in their current form were developed after the Civil War and were variously manufactured with either solid brass cases or, for reasons of economy, wound paper base wads and moisture resistant paper walls (Barnes 1997:396). The more widely produced pre-World War I paper walled shells included (in decreasing size) 4, 8, 10, 12, 14, 16, 20, 24, 28, and 32 gauge (cf. Ball 1997b:132; Barnes 1997:395-408; Stadt 1995). Of these, only the 10, 12, 16, 20, and 28 gauge remain in regular production in the United States and the standard shotgun shell for most sporting, military, and law enforcement applications is the 12 gauge.

A total of 20 shotgun shells were found at the Argosy sites (Table 3). Present were 10 gauge (n=2; introduced 1870s), 12 gauge (n=15; introduced 1870s), 16 gauge (n=1; introduced 1870s), 18 gauge (n=1; 1870s), and .410 bore (n=1; introduced 1916) shells. In common with the

Table 3. Provenience, Dimensional, and Chronological Data for Factory and Recovered Shotgun Shells.

Shell Gauge and Type/Site	Catalog Number	Rim Diameter	Base Diameter	Height	Headstamp	Chronology
10 gauge (solid brass)	Factory	0.933”	0.890”	varies	-	1877-1949
12D520*	#3671	0.905”	0.878”	2.266”	Illegible	1870+
10 Gauge (paper wall) 12D508	#1083	0.922”	0.878”	0.378” (no rings)	“W.R.A.Co/ No 12/ Rival” (Winchester)	1894-1897
12 gauge (paper wall)	Factory	0.886”	0.850”	varies	-	1877+
12D508*	#1213	0.875”	0.816”	0.325” (no rings)	“U.M.C.CO/ No 12/ NEW CLUB” (Union Metal.)	pre-1916
12D508*/**	#1610	0.871”	0.814”	>0.482”	“--/ No 12/ FIELD” (Western)	1898+
12D508*/***	#2005	0.876”	0.826”	1.059”	“REM-UMC/ No 12/ ARROW” (Remington)	post-1916
12D508*	#2235-1	0.875”	0.835”	0.316” (2 rings)	“WINCHESTER/ No 12/ NUBLACK”	1905-1938
12D508*	#2235-2	0.881”	0.821”	N/A	“WINCHESTER/ No 12/ REPEATER”	1900-1938
12D508	#2307	0.877”	0.819”	0.322”	“U.M.C.Co/ No 12/ NEW CLUB” (Union Metallic)	pre-1916
12D508*	#2495	0.875”	0.822”	0.508” (3 rings)	“DOMINION/ MADE IN/ No 12/ CANADA/ CANUCK”	post-1886
12D517*	#687	0.881”	0.848”	0.492” (3 rings)	illegible	1870+
12D520*	#133	0.874”	0.828”	0.336”	“U.M.C.Co/ No 12/ NEW CLUB” (Union Metallic)	pre-1916
12D520*	#579	0.880”	0.821”	N/A	“WESTERN/ No 12/ XPERT” (Western)	1898+
12D520*/****	#1028	0.868”	0.842”	>0.438”	“NO-/MADE IN USA/ US/ --K”	-
12D520*	#1439	0.877”	N/A	N/A	“[W]INCHESTER/ No 12/ REPEATER” (Winchester)	1900-1938

Table 3. (Continued).

Shell Gauge And Type/ Site	Catalog Number	Rim Diameter	Base Diameter	Height	Headstamp	Chronology
12D520*	#1439	0.877"	N/A	N/A	"[W]INCHESTER/ No 12/ REPEATER" (Winchester)	1900-1938
12D520*	#1476	0.872"	0.814"	>0.295"	"P.C.C./ No 12/ LEAGUE" (Peters Cartridge)	1887-1934 (maximum date range)
12D520 (fragment)*	#1508	N/A	N/A	N/A	"-A/ Co/--" (WRA?)	1870+
12D521*	#196	0.884"	ca. 0.838"	>0.261"	"W.R.A.CO./ NO 12/ RIVAL" (Winchester)	1884-1897
<u>16 gauge (paper wall)</u>	Factory	0.819"	0.744"	varies	-	1878+
12D508	#901	0.810"	0.746"	0.326"	"U.M.C.Co./ No 16/ NEW CLUB" (Union Metallic)	pre-1916
<u>18 gauge (paper wall)</u>						
12D521*	#427	0.872"	N/A	<0.261"	"WESTERN/ No 18/ FIELD"	1898+
<u>.410 bore (paper wall)</u>	Factory	0.535"	0.477"	varies	-	1916+
12D521*	#427	0.484"	0.474"	0.795"	illegible	1916+

* Base partially to heavily corroded, bent, and/or crushed.
** Knurled surface on upper base wall.
*** Illegible embossed block lettering around top of base.
**** Embossed spiral grooves (<u>not</u> rings) around base.
Sources: Ball (1997b); Barber (1987); Barnes (1997:395-411); Logan (1948); Matunas and Griffin, eds. (1995:366-370); Stadt (1995).

recovered cartridge cases, most examples were corroded and/or bent to varying degrees. With a single exception, all were of wound paper base wad construction. Within this sample, 16 legible headstamps demonstrated manufacture by at least six different ammunition makers: Remington (n=1); Winchester (n=6); Union Metallic Cartridge Company (n=4); Western (n=3); Peters (n=1); and Dominion (Canadian; n=1). Aspects of the production of these shells as it relates to artifact interpretation will be discussed below.

Two items in particular deserve some degree of additional description. A single full-length <u>10 gauge brass shotshell</u> was recovered from Site 12D520. Though the headstamp on this deteriorated example was illegible, it may be noted that Winchester produced such loadings from 1877-1949 (Ball 1997b:132; Stadt 1995). The construction of these now-obsolete cases is shown in Figure 1.

Also of note within the assemblage was a paper-wound brass base derived from an <u>18 gauge</u> shotshell. Recovered from Site 12D521, this base was headstamped "WESTERN/ No 18/ FIELD." Barnes (1997:404) notes that this was primarily a European shotgun shell. The Western Cartridge Company went into business in 1898 (Logan 1948:201). It is known that the U.S. Cartridge Company also produced a small quantity of shotgun shells in this gauge (Barnes

1997:414). It may be noted that Winchester did not manufacture these types of shotgun shells (cf. Ball 1997b; Stadt 1995).

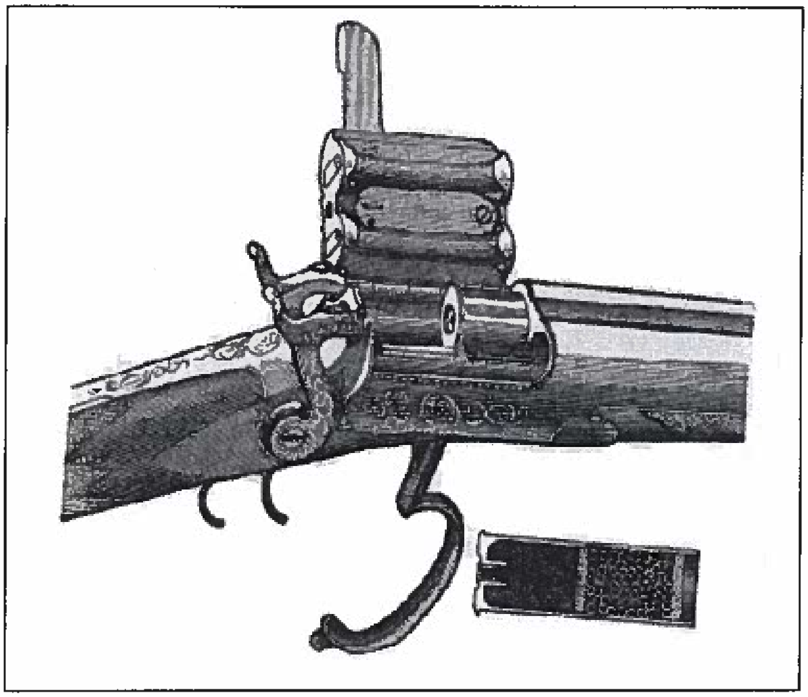

Figure 1. Late-Nineteenth Century Breech Loading Shotgun Using Full Length Brass Cases (Reproduced from Hart 1982:93).

PROJECTILE - BULLETS

The only projectiles recovered during the course of excavations were two minie balls (Table 4). Chronologically out of place with the balance of the assemblage, these examples were from sites 12D521 and 12D520. Bullets of this nature were designed by French army officer Major Claude Minie and were first used in 1840 in conjunction with the special needle-fire bolt-action rifle developed by Johann von Dreyse in Prussia (NRA 1989:39-40). Typically issued in the form of paper cartridge ammunition (Coates and Thomas 1990:67-68; Lewis 1972), such bullets were widely produced by both Union and Confederate armories and munitions contractors.

Both bullets were heavily oxidized. Bullet weight (Table 4) is expressed in grains, a lesser-used English measurement (1.0 pound = 16 ounces = 7,000 grains). Though neither example appears to be specifically identified by McKee and Mason (1995), their configuration, size, and weight suggests that they were fired in full-sized military longarms. Both examples were unfired and clearly display mold marks from nose to base indicating their method of manufacture. The occurrence of these items in purely civilian contexts suggests that they were obtained as souvenirs of the then recent Civil War and subsequently lost or discarded. Three unfired minie balls found under comparable circumstances have been reported from excavations in Frankfort, Kentucky (Ball 1996:92).

Table 4. Dimensions and Weights of Recovered Lead Minie Balls.

Catalog number	Site 12D521 #3501	Site 12D520 #2166
Weight	453 grains	511+ grains*
Basal diameter	0.530"	0.672"
Length	1.026"	1.145"
Body profile	Cylindro-ogival	Cylindro-ogival
Cavity type	Ogival	Ogival
Cavity depth	0.206"	0.402"
Nose profile	Pointed	Rounded
Number of grooves	3	3
Groove type	Normal groove	Normal groove
Groove depth	0.014"	0.022"
Groove height	0.043"	0.038"
Groove base height	0.015"	0.032"

Exceeded scale capacity.
Note: descriptive terminology conforms to McKee and Mason (1995:18, 20-21).

GUNS AND GUN PARTS

Gun parts were infrequently encountered during the course of the Argosy investigations and only two such items were recovered. The larger and more interesting of these was the major portion of a small handgun from Site 12D520. This item was a heavily rust-encrusted small steel frame revolver featuring a sheathed spur trigger and "extreme" bird's-head grips (cf. NRA 1981:227, 228). Two representative examples of similarly shaped revolvers are depicted in Figure 2. The spur trigger design was introduced on the Smith & Wesson Model No. 1 revolver in 1857 (Supica and Nahas 1996:36). The intact plain wooden grips (likely walnut) of the recovered example exhibit a single grip attachment screw situated ca. 1.15 inches above the bottom edge of the frame. The hammer was not visible. The barrel of the piece is missing, apparently broken off due to metal deterioration.

Though it is not possible to determine if the barrel was round or octagonal (both were common on such revolvers), the bore in "as is" condition displays an interior diameter of ca. 0.268 inch. A portion of the left side of the cylinder shows evidence of fluting. The measurable portion of the cylinder is at least 0.892 inches in length. Two chambers are relatively open for inspection. One of these had a measurable inner diameter of 0.190 inches. The spacing of these chambers in concert with cylinder length suggests that this was a seven shot weapon designed to fire .22 Long or Long Rifle cartridges. The condition of the piece precludes determining if this was a fixed (mounted in frame) or tip-up barrel firearm. In general terms, such revolvers tended to be inexpensive to moderately priced and were produced by numerous firms during the period ca. 1857 into the 1890s in calibers from .22 to .41 (cf. Hogg and Weeks 1992; Schwing and

Houze 1996). Most of these weapons utilized rimfire ammunition. Over 200 manufacturers and brand names have been recorded for these handguns (NRA 1981:12; Webster 1958). The recovered example would warrant further conservation efforts.

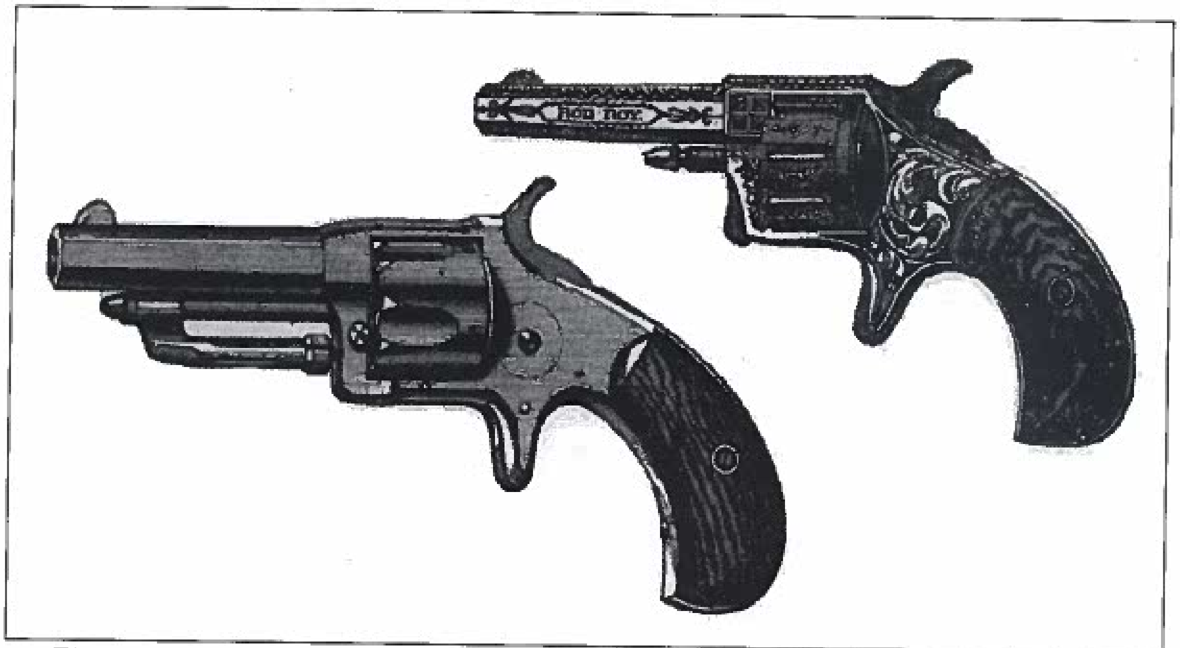

Figure 2. Examples of Late-Nineteenth Century Spur Trigger, Bird's Head Grip Revolvers (Reproduced from Rowe 1982:48).

Also recovered from Site 12D520 was a single gun part, a hammer stylistically derived from a revolver. Though corroded, the item is generally complete and exhibits knurling on the upper surface of the hammer spur and evidence of plating (likely nickel). This piece is fashioned from neither steel nor brass and appears to have been made from cast zinc as shown by a slightly battered area along the object's narrow front surface that displays a coarse, granular texture gray in color. This item measures 1.495 inches in maximum length and 0.224 inches in thickness. It weighs 194.3 grains (including some small amount of encrustation). On the basis of the material of its manufacture (far too soft for routine use in a firearm), it is possible that this gun part was derived from a toy gun (cap pistol?).

INTERPRETIVE REMARKS

The analysis of the firearms related materials from the Argosy Casino excavations has produced several insights into the use and role of weapons in the central Ohio River Valley. Among the various interpretive avenues examined are assessments of the assemblage chronology, general nature of firearms usage, the number of firearms represented on each site, an overview of shotgun hunting applications, and access to munitions markets.

The chronological position of the aggregate assemblage ranges from 1857 (the introduction of the .22 Short RF) to ca. 1940 (the approximate end of production of various early cartridges such as the .38 Short and .44 Short RF, and the Winchester "Nublack" and "Repeater" shotshells). The occurrence of several cartridges introduced in the 1870s (see tables 1 and 2) and the appearance of relatively late rounds (notably the .410 bore shotshell base introduced in 1916) suggest that the bulk of these materials likely date to the period ca. 1870 to 1930.

For purposes of this assessment, the cartridge case sample was separated into three general categories of likely use: general shooting (represented by all .22 caliber Short, Long, and Long Rifle cases), self defense (all cartridges normally associated with handguns), and hunting (rifle cases and all shotshell bases). As summarized in Table 5, general shooting activities - target practice and small game hunting - accounted for 41.4% of the recovered cases. Self defense and handgun marksmanship resulted in the expenditure of 20.7% of the cartridge cases while hunting accounted for 37.9% of the recovered rounds. Rifle and shotgun usage, however, was markedly different. Only two cases (9.0% of hunting subgroup) were used in rifles. The other 20 shell bases (90.9% of subgroup) reflect use in shotguns.

Table 5. Application of Cartridge Types by Function.

Application/Cartridge Type	Item N	Subtotal N	Subtotal %	Activity Group N	Activity Group %
General shooting .22 RF (S/ L/ LR)	24	24	41.4%	24	41.4%
Self defense Handgun - .32-.44 RF Handgun - .32-.38 CF	 8 4	12	20.7%	12	20.7%
Hunting Rifle - .22 Extra Long Rifle - .32 Extra Long Ballard	 1 1	2	3.5%		
Shotgun (all)	20	20	34.4%	22	37.9%
Totals/ Percentages	58	58	100.0%	58	100.0%

A related avenue of inquiry relates to the number of firearms actually used or present at each site during the course of its active occupation. Determination of the Minimum Number of Firearms (MNF) per site (Table 6) is based upon the assumption that the family living at each site in fact owned and used the weapons that fired the recovered rounds. Factors such as casual discard by visitors or souvenirs of an outing in the country being inadvertently lost can not be discounted. It is further presumed that the recovered cases are in fact reasonably representative of the degree of usage of their associated firearms by the occupants of each site. Accordingly, the types and varieties of cases recovered from these sites suggests that a minimum of 26 firearms were owned by the former residents of these properties. As determined by this analysis, this aggregate firearm census consisted of at least five weapons chambered for .22 caliber rimfire ammunition, nine handguns (all revolvers), two rifles, and nine shotguns.

It is not unexpected that the calculation of a firearm/ammunition ratio (Table 5) reveals that the most widely used cartridges were fired in weapons chambered for .22 caliber rimfire ammunition with 4.8 rounds expended per firearm. As these cases can not be confidently segregated by weapon type, the occurrence of any .22 caliber case must be interpreted as representing only one weapon though in all likelihood more than one firearm using this cartridge is present in the assemblage. Such ammunition was, and still is, the least expensive cartridge type.

Table 6. Minimum Number of Firearms (MNF) Represented within the Aggregate Assemblage.

Site	.22 RF (all)	Handguns (revolvers)	Rifles	Shotguns	MNF per Site
12D507	1	1 (.32 S&W)	-	-	2
12D508	1	1 (.32 Short RF) 1 (.32 S&W) 1 (.38 S&W)	1 (.22 X-Long) 1 (.32 X-Long Ballard)	1 (10 ga.) 1 (12 ga.) 1 (16 ga.)	8
12D515	1	-	-	-	1
12D517	-	-	-	1 (12 ga.)	1
12D520	1	1 (.32 Short RF) 1 (.32 S&W) 1 (.38 S&W)	-	1 (10 ga.) 1 (12 ga.) 1 (.410 bore)	7
12D521	1	1 (.44 RF) 1 (.32 S&W) 1 (.38 S&W)	-	1 (12 ga.) 1 (18 ga.)	6
Firearms by type	5	10	2	9	26
Number of related rounds	24	12	2	20	58
Firearm/ Ammunition ratio	1:4.80	1:1.20	1:1.00	1:2.22	1:2.23

Shotgun use was relatively extensive with a firearm/ammunition ratio of 2.22 shells per weapon. The comparatively greater frequency of their occurrence in contrast to handgun (1.20 rounds per firearm) and rifle (1.00 round per firearm) cartridges suggests that in this area shotguns served as the practical "work horse" firearm among more powerful weaponry.

A comparison of ammunition costs as reflected in major mail order house catalogues from the 1890s through the 1920s (Table 7) serves to place these shooting preferences in an economic context. Clearly, the majority of .22 caliber rimfire cartridges (i.e., .22 Short, Long, and Long Rifle) were the least expensive marginally effective rounds available. Their relatively extensive use is not surprising in light of the cost per shell (.22 Short) ranging from just under $.0025 in the 1890s to just over $.003 in 1927. Though blackpowder-loaded paper-wall 12 gauge shotgun shells could be purchased for just over one cent in 1895 and about three cents in 1927, it should be noted that in relative terms, these shells were almost six to nine times more expensive than the less powerful .22 caliber rimfire cartridges. The marked difference in price could only be justified by the consumer in terms of the increased likelihood of this weapon in securing game.

Table 7. Cost of Ammunition from 1895-1927.

Cartridge/ Shotgun Shell	1895 Montgomery Ward & Co.	1897 Sears Roebuck	1902 Sears Roebuck	1923 Sears Roebuck	1927 Sears Roebuck
Source	Dover Publications (1969:470. 473, 475)	Isreal, ed. (1976)	Bounty Books (1969:322-323)	Schroeder, ed. (1973:790-791)	Mirkin (1970:508-509)
Rimfire					
.22 Short	$.12/50	$.12/50	$.12/50	$.18/50*	$.16/50*
.22 Long	$.15/50	$.15/50	$.14/50	$.24/50*	$.22/50*
.22 Long Rifle	$.15/50	$.15/50	$.14/50	$.28/50*	$.25/50*
.22 Extra Long	$.47/100	$.46/100	$.43/100	N/A	N/A
.32 Short	$.26/50	$.26/50	$.24/50	$.45/50	$.41/50
.38 Short	$.42/50	$.42/50	$.38/50	N/A	N/A
Centerfire Pistol					
.32 S&W	$.44/50	$.44/50	$.39/50	$.77/50	N/A
.38 S&W	$.54/50	$.54/50	$.48/50	$.89/50	N/A
Centerfire Rifle					
.32 Extra Long Ballard	$.72/50	$.72/50	N/A	N/A	N/A
Shotshell					
10 gauge (solid brass)	$.80-$1.20 /25**	$.80-$1.20 /25**	N/A	N/A	N/A
10 gauge (paper)	$.38-$.55 /25	$.38-$.50 /25	$.39-$.45 /25	$.91-$.94 /25	$.94/25
12 gauge (paper)	$.34-$.45 /25	$.30-$.40 /25	$.34-$.45 /25	$.73-$.81 /25	$.67-$.71 /25
16 gauge (paper)	$.33-$.38 /25	$.30-$.35 /25	$.35/25	$.74/25	$.77/25
.410 bore (paper)	--	--	--	$.67/25**	$.57/25**

Smokeless powder (all other listings loaded with blackpowder).
** Empty brass cases only; many such hulls were intended to be reloaded by the shooter.
N/A: Not listed in cited references.

Centerfire cartridge cases intended for use in semi-automatic handguns are notably absent. All recovered examples were straight walled, rimmed types indicating their use in revolvers in marked contrast to the "rimless" cartridges developed specifically for use in early (and subsequent) semi-automatic handguns, which were beginning to appear on the American market about 1900 following the pioneering work on these weapons by German-American Hugo Borchardt, Germans Georg Luger and Theodor Bergmann, American John Moses Browning, Englishman Sir Hiram Stevens Maxim, Austro-Hungarians Andreas William Schwarzlose and Josef Laumann, and others (cf. Hogg 1978; Hogg and Weeks 1992). Such weapons became increasingly popular after ca. 1920 with the return of World War I veterans who had been exposed to the U.S. Army's Colt Model 1911 .45 ACP and other semi-automatic pistols of that period.

An examination of one shotshell attribute (base height) has afforded some insight into the likely use of this weapon within the project area. Among the 20 recovered shotshell bases, only 10 wound-paper bases were sufficiently intact to allow for measuring the height of the shellhead (i.e., brass base). As arranged by height, this data is presented in Table 8.

Table 8. Comparison of Shotgun Shell Base Heights.

Shellhead Height	Gauge/ Bore	Site (cat. #)
Low brass		
0.316"	12	12D508 (cat. #2235-1)
0.322"	12	12D508 (cat. #2307)
0.325"	12	12D508 (cat. #1213)
0.326"	16	12D508 (cat. #901)
0.336"	12	12D520 (cat. #133)
0.378"	10	12D508 (cat. #1083)
Medium brass		
0.492"	12	12D517 (cat. #687)
0.508"	12	12D508 (cat. #2495)
Very high brass		
0.795"	.410	12D521 (cat. #427)
1.059"	12	12D508 (cat. #2005)

The examined sample fell into three generalized height ranges: "medium" (n=6); "high" (n=2); and "very high" (n=2) (cf. Ball 1997b:135). The height of the brass was used by the manufacturer to accommodate an inversely-dimensioned wound-paper base wad. In other words, a "high" base accommodated a low paper wad while a "low" base was used with a comparatively higher paper wad. The potential interpretive significance of the relative height of the brass head of the shotgun shell has been explained as follows:

> During the paper-shell era, solid paper wads (in the shell base) were made in high, medium, and low configurations, depending on the [amount of] powder being used. A high base wad was called for when small powder volumes were used.
>
> The brass height was inversely related to base height. If the top of the brass was at the same level as the top of the base wad, tubes would often separate at the head when the cartridge was fired. So low-based shells - those with a large, heavy powder charge - used high brass so the brass would be above the top of the base wad (NRA 1989:185; see also Barnes 1997:396).

The chronology of most of the shotshell sample suggests that these items were originally loaded with black powder, a material of rather uniform volume per given unit of weight. In practical terms, a "high" base and related low paper wad would accommodate a lesser number of lead pellets of comparatively larger diameter. Alternately, a "low" base and a higher paper wad would be best suited for use with smaller-diameter shot consisting of many more pellets per shell. Within the project area, the shotgun was likely employed on a generally even basis to hunt small mammals and birds ("low" brass), and medium-sized mammals and migratory waterfowl (10 and 12 gauge "medium" and "high" brass).

The nature of the recovered rimfire and centerfire pistol cartridges suggests that they were likely expended in any of a number of low- and medium-priced revolvers of the period. In contrast to the cases from the recovered collection, rounds such as the .45 Long Colt and .44 S&W would have tended to be associated with better grade "top of the line" firearms. The rust encrusted spur trigger revolver recovered from Site 12D521 provides very tangible evidence of a preference within the project area for less expensive weapons.

The recovery of 47 cartridges cases and shotshell bases displaying legible headstamps provided the opportunity to access market share and distribution network effectiveness (Table 9). Represented were cartridges and shotgun shells produced by at least seven different ammunition manufacturers. Present in the assemblage were materials made by Remington (42.5%), Winchester Repeating Arms (17.0%), Union Metallic Cartridge Company (14.9%), U.S. Cartridge Company (10.6%), Western (6.4%), Peters (6.4%), and Dominion (2.1%). Though certainly indicating a preference for American-produced ammunition, the diversity of firms represented clearly indicates ready access to supply channels. This availability was enhanced by both the area's proximity to Cincinnati and its numerous stores, and the large inventories of ammunition offered via mail order (all such deliveries were required to be made by freight). It is interesting to observe the relatively low market share of ammunition produced by the Peters Cartridge Company (in independent operation from 1887-1934) in light of that firm's location in Kings Mill, Ohio, about 20 miles northeast of downtown Cincinnati and the Ohio River (Barber 1987:83; Logan 1948:10).

Table 9. Ammunition by Type and Manufacturer.

	Rimfire			Centerfire			Shotgun shells				
Manufact-urer	**.22 Short**	**.22 L/LR**	**other RF**	**.32 S&W**	**.38 S&W**	**other CF**	**10 ga**	**12 ga**	**other shotshell**	**N**	**%**
Remington	8	8	1	-	2	-	-	1	-	20	42.5
Winchester	-	-	1	-	1	-	1	5	-	8	17.0
Union Metallic	-	-	-	1	1	1	-	3	1	7	14.9
U.S. Cartridge	1	-	2	1	1	-	-	-	-	5	10.6
Western	-	-	-	-	-	-	-	2	1	3	6.4
Peter's	2	-	-	-	-	-	-	1	-	3	6.4
Dominion (Canada)	-	-	-	-	-	-	-	1	-	1	2.1
Subtotals	11	8	4	2	5	1	1	13	2	47	100.0
No Headstamp/ Illegible	1	4	1	-	-	1	1	2	1	11	-
Total	12	12	5	2	5	2	2	15	3	58	-

In summary, the present analysis of firearm-related artifacts from the Argosy Casino project has served to suggest several useful and informative avenues of investigation for archaeologists. Though most prior studies of such remains have focused on military installations (e.g., Mansberger and Stratton 1996; Staski and Johnson 1992) or battlefields (e.g., Fox 1993;

Fox and Scott 1991; Haecker 1994; Sivilich 1996), there is much to be learned from materials collected from purely civilian sites. Beyond mere identification, the variety of cartridge case types and related data referable to the firms that manufactured them allow investigators to address questions relevant to the number of firearms present on sites, the economics of firearm usage, hunting patterns, and the marketing of ammunition. As shown by the Argosy Casino assemblage, these households possessed a minimum of 26 firearms. The relative abundance of weapons chambered for less expensive .22 caliber rimfire ammunition stands in marked contrast to the lesser numbers of rifles and shotguns used by these households. In terms of weapons larger than .22 caliber, shotguns were likely the firearm of choice for more practical applications such as hunting. Among those cartridges and shotgun shells still displaying a legible headstamp, ammunition produced by Remington alone accounted for over 40% of the market share, more than twice its closest competitor. Clearly, the analysis of such remains can assist in addressing heretofore unanswered questions concerning the household use of firearms.

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