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Southeastern Archaeological Conference

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Southeastern Archaeological Conference
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November 4-6, 1976

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PREFACE

The thirty-third Southeastern Archaeological Conference was held in Tuscaloosa, Alabama, November 4-6, 1976. John A. Walthall served as Program Chairman and Carey B. Oakley handled local arrangements. Ninety scholarly papers were scheduled, including a special symposium in honor of David DeJarnette. Most of the presentations from the latter session were published in 1978 as Special Publication 5 of the Southeastern Archaeological Conference. On Saturday afternoon many of the Conference participants enjoyed a delicious barbecue in the old Moundville tradition, held at Mound State Monument.

Twenty-five papers were submitted for publication subsequent to the meeting. These were transmitted to me at the Asheville SEAC meetings in 1981, and were copy-edited in 1982, with the assistance of Janet E. Levy, University of North Carolina-Charlotte. On behalf of the Southeastern Archaeological Conference, I extend our gratitude to Dr. Levy for her help, as well as to Ms. Susan Fabrick and Ms. Cindy Cart, Department of Anthropology, Florida State Museum, who conscientiously typed the final manuscript. The Florida State Museum absorbed the typing and mailing costs associated with this publication. Publication funds were made available by the Louisiana Research Foundation; the Lower Mississippi Survey, Peabody Museum, Harvard University; the Wentworth Foundation, founded by the late A. Fillmore Wentworth (William M. Goza, President); and the Coca-Cola Bottling Company.

William H. Marquardt
Gainesville, Florida
November 15, 1983

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Program of the 33rd Southeastern Archaeological Conference, 1976

Program Chairperson: John A. Walthall
Local Arrangements: Carey B. Oakley
The University of Alabama

Thursday, November 4

Morning

Welcome: Christopher L. Bramlett,
Assistant Vice President
for Research, The
University of Alabama

Symposium: The Late Pleis-
tocene in the Southeastern
United States

Chairperson: C. B. Curren
(U. of Ala.)

Discussants: S. Williams
(Harvard)
W. Haag (L.S.U.)

Session A

8:00 J. M. Adovasio, J. D. Gunn, J.
Donahue (U. of Pittsburgh)
and R. Stuckenrath (Smith-
sonian): Excavations at
Meadowcroft Rockshelter
1973-1976: A Progress Report

8:20 D. F. Morse (Ark. Arch.
Survey): The Central
Mississippi Valley

8:40 G. M. Clark (U. of Tenn.):
Pleistocene Geology of
Tennessee

9:00 C. Hubbert (U. of Ala.):
Recent Reserch into the
Paleo-Indian Period of the
Middle Tennessee Valley

9:20 A. E. Bogan (U. of Tenn.):
Pleistocene Vertebrate Fauna
of Tennessee

9:40 B. L. Purrington (Appalachian
State U.): Early Man and
Environment in the Southern
Appalachians

10:00 Break

10:20 J. Chapman (U. of Tenn.): Some
Thoughts on Early Archaic
Settlement and Subsistence
Systems in the Lower Little
Tennessee River Valley

10:40 L. Kimball (U. of Tenn.): Early
Archaic Tools Based on Strati-
fied Sites in Eastern Tennessee

11:00 P. Cridlebaugh (U. of Tenn.):
Morrow Mountain in the Middle
South

11:20 C. E. Smith (U. of Ala.):
Speculations On the Plant
Component of Paleo-Indian Diet

11:40 J. P. Brain (Harvard): A Provi-
sional Early man Sequence in the
Lower Mississippi Valley

Volunteered Papers: Intra-Site
Analysis and Interpretation

Chairperson: B. C. Keel
(National Park Service)

8:00 T. K. Black (U. of Mich.):
Biological and Social Analysis
of a Middle Mississippian
Cemetery: The Turner Site

8:15 B. M. Brooms (Ala. Hist. Comm.):
A Woodland-Mississippian Contact
Site in Southeast Alabama

- 8:30 B. M. Butler (Tenn.): The Yearwood Site: A Specialized Middle Woodland Occupation on the Elk River
- 8:45 B. Clay (U. of Kentucky): The Auvergne Mound and the Central Kentucky Bluegrass Project of Tulane University
- 9:00 A. Magennis (U. of Tenn.): An Investigation of the Mortuary Patterning at the Eva Site
- 9:30 D. Merritt (Fla. State): Excavations of a Timucuan Village Site in Northeast Florida
- 9:45 D. Peterson (Memphis State): Archaic Cremations in the Lower Tennessee Valley
- 10:30 M. Trinkley (U. of N. Carolina): Preliminary Investigations of a South Carolina Shell Ring
- 10:45 V. K. Fleming (Ohio State) and J. A. Walthall (U. of Ala.): Historic Aboriginal Occupation of the Gunterville Basin, Alabama
- 11:00 S. I. Goad (U. of Ga.): The Use of Copper in the Prehistoric Southeastern United States During the Woodland Period
- 11:20 Discussion

Thursday, November 4 - Afternoon

Symposium: The Late Pleistocene in the Southeastern United States

Session B

- 1:00 S. M. Gagliano, E. K. Burden and R. A. Weinstein (Coastal Environments, Inc.): Paleo-Indian and Late Quaternary Features, Northern Gulf of Mexico Coastal Zone
- 1:20 C. B. Curren (U. of Ala.): Paleo-Indian and Late Pleistocene Environment of the Alabama Coastal Plain
- 1:40 M. Frazier (U. of Fla.): The Faunal and Climatic Changes from Late Pleistocene to Middle Pleistocene in Florida and the Southeast
- 2:00 G. McDonald (U. of Fla.): Man in the Pleistocene of Florida
- 2:30 S. Cockrell (Fla. Dept. of Archives and History): The Florida Warm Mineral Springs Site
- 2:40 B. Waller (Fla. Anthropological Society): The Distribution of Bone Projectile Points within the State of Florida
- 3:00 F. H. Millard (Ga. State): A Multivariate Comparison of North Carolina and Arkansas Fluted Bones

Volunteered Papers:
Environmental and Subsistence Reconstruction

Chairperson: B. Smith (U. of Georgia)

- 4:15 J. E. Cobb (U. of Tenn.): The Owl Hollow Research Project: New Data on Late Middle Woodland Subsistence and Settlement in Lower Middle Tennessee

- 4:30 I. W. Brown and J. P. Brain (Harvard): Archaeology of the Natchez Bluffs Region, Mississippi: Hypothesized Cultural and Environmental Factors Influencing Local Population Movement
- 4:45 A. Fradkin (U. of Fla.): A Consideration of Snake Consumption Among the Aborigines of Florida
- 5:00 T. A. Kohler (U. of Fla.) Corn, Indians, and Spanish in North-Central Florida
- 5:15 M. A. Rolingson (Ark. Arch. Survey): Forest and Floods: Clues to the Mississippi Valley Floodplain Environment and Significance for Prehistoric Settlement in Southern Arkansas
- 5:30 Discussion
- Symposium: Quarry Site Research
- Chairperson: R. S. Dickens (Ga. State)
- 1:00 R. S. Dickens and L. F. Carnes (Ga. State): Introduction
- 1:10 A. R. Kelly (U. of Ga.): Lithic Site Differentiation: Quarries, Work Shops, Camps, and Caches
- 1:30 B. A. Purdy (U. of Fla.): Aboriginal Chert Procurement in Florida
- 1:50 R. S. Dickens and L. F. Carnes (Ga. State): Preliminary Investigations at Soapstone Ridge, DeKalb County, Georgia
- 2:10 C. T. Sheldon (W. Ga. College); Aboriginal Soapstone Exploitation in Carrol County, Georgia
- 2:30 S. I. Goad (U. of Ga.): Copper: Its Procurement and Use by the Indians of the Southeastern United States
- 2:50 T. A. Ferguson (U. of Tenn.): A Reconnaissance of Soapstone Quarries in Spartanburg County, South Carolina
- 3:10 Discussion
- 6:00 Business Meeting
- Friday, November 5 - Morning
- Symposium: New Developments in the Lower Mississippi Valley Ceramic Chronology
- Chairperson: J. W. Springer (N. Illinois U.)
- 8:00 W. G. Haag (L.S.U.): Poverty Point Period Pottery
- 8:20 J. R. Shenkel (U. of New Orleans): Ceramics of the Tchefuncte Period
- 8:40 A. Toth (L.S.U.): The Chronological Implications of Early Marksville Ceramics
- 9:00 J. W. Springer (N. Illinois U.): The Troyville-Coles Creek Ceramic Sequence at the Bruly St. Martin Site
- 9:20 V. P. Steponaitis (U. of Mich.): Late Prehistoric Ceramic Chronology in the Natchez Region
- 9:40 J.P. Brain (Harvard): Ceramics of the Eighteenth Century Tunica

Symposium: Recent Approaches to
Piedmont Archaeology in South
Carolina and Georgia

Chairperson: A. C. Goodyear
(U. of S. Carolina)
Discussants: B. C. Keel
(National Park Service)
R. S. Dickens
(Ga. State)

10:30 C. M. Baker (U. of Ga.): Some
Technological Considerations of
Quartz as a Raw Material for
Chipped Stone Implements:
Experiments and Applications

10:50 V. Canouts (S. Ill.): Excava-
tion Strategies and Results for
a Shallow Lithic Site on a
Piedmont Ridgetop

11:10 J. H. House (U. of S. Caro-
lina): Exploring Prehistoric
Utilization of the Inter-
Riverine Piedmont in South
Carolina: The Interstate 77
Survey

11:30 A. C. Goodyear (U. of S. Caro-
lina): Strategies and Results
in Model Building in the South
Carolina Piedmont: The Laurens-
Anderson Interstate Connector

11:50 Discussion

Volunteered Papers: Strategies
for Survey and Data Recovery

Chairperson: R. Thorne (Miss.)

8:30 W. O. Autry (Vanderbilt):
Archaeological Investigations
in the Upper Neuse River Basin
of Central North Carolina and
Evidences Relating to the Loca-
tion of Adshusheer and Enotown

8:45 G. D. Ellis (U. of S. Florida):
Archaeological Site Survey:
Problems in the Urban
Environment

9:00 H. G. Ayers (Appalachian State):
The Occupation of Ridgetop Sites
in the Blue Ridge Mountains by
Savannah River Archaic Peoples

9:15 J. P. Lenzer and B. Spencer
(Gulf South Research Institute):
Prehistoric Occupation of the
Outer Continental Shelf: The
Practicality of a Long-Term
Research Strategy Utilizing
Existing Seismic Data

9:30 S. Mullins (U. of Fla.): Survey
and Excavations in the Paynes
Prairie State Preserve, Alachua
County, Florida

9:45 M. Rushing and G. Spies (North
Gulf Coast Arch. Consortium):
Recent Archaeological
Investigations of Mound Island,
1Ba2 and Environs

10:30 E. W. Seckinger (U. of Ga.):
Predictive Settlement Analysis
in Central Georgia

10:45 S. South and R. J. Widmer (U. of
S. Carolina): A Subsurface
Sampling Strategy for
Archaeological Reconnaissance:
Implications for Coastal South
Carolina

11:00 R. J. Widmer (U. of S. Caro-
lina): Thom's Creek Settlement
Pattern on Cooper River Drainage
of Coastal South Georgia

11:15 L. N. Wood (U. of S. Florida):
An Interpretation of Survey
Results from a Study of C. F.
Industries, Inc. Property in
Northwestern Hardee County,
Florida

11:30 A.E. McMichael (W. Georgia College): Barrier Island Settlement Patterns

11:45 Discussion

Friday, November 5 - Afternoon

Symposium: The Research Potential of Shell Middens: Methodological and Analytical Considerations

Chairperson: T. M. Ryan
(S. Methodist U.)

1:30 J. L. Michie (U. of S. Carolina): Mechanical Water Screen for Midden Excavation

1:45 J. R. Shenkel (U. of New Orleans): Quantitative Analyses of Two Coastal Middens in Louisiana

2:00 L. E. Aten (National Park Service): Estimating Seasonality Using the Brackish Water Clam Rangia cuneata

2:20 T. M. Ryan (S. Methodist U.): The Use of Interlocking Steel Cofferdams in Excavating Submerged Archaeological Sites

2:35 W. H. Marquardt (U. of Missouri) and P. J. Watson (Washington U.): Excavation and Recovery of Biological Remains from the Carlston Annis Shellmound in Western Kentucky

3:30 L. E. Aten (National Park Service): Observations on the Use of Rangia cuneata as a C-14 Dating Medium and on the Implications of Its Population Characteristics for Settlement Distribution

3:50 G. H. Weir (Texas A&M): Preliminary Pollen Analysis of the Bayou Jasmine Shell Midden

4:05 W. B. Fawcett and P. R. McGuff (Texas Arch. Survey): Examination of Prehistoric Intra-Site Variability on the Texas Coast: Palmetto Bend Reservoir

4:10 C. Pearson (U. of Ga.): Seasonality in Coastal Georgia

4:40 Discussion

Symposium: Approaches to Anthropological Archaeology Under Contract

Chairperson: L. M. Raab
(Ark. Arch. Survey)

1:00 T. C. Klinger (Ark. Arch. Survey): A Critical Appraisal of "Significance" in Contract Archaeology

1:20 J. E. Price and C. R. Price (U. of Missouri): Understanding Man's Changing Role in the Natural Environment of the Ozark Border

1:40 S. South (U. of S. Carolina): Pattern Recognition in Historical Archaeology

2:00 D. F. Morse and D. G. Anderson (Ark. Arch. Survey): Zebree: An Example of Problem Oriented Contract Research in Northeast Arkansas

2:20 L. M. Raab (Ark. Arch. Survey): A Model of Prehistoric Deer Hunting in the Ozarks: An Example of Problem Orientation in Contract Archaeology

2:40 R. Brooks (Ark. Arch. Survey):
The Carroll-Boone Water
Transmission Line: An Example
of a Problem-Oriented Approach
to a Transect Sample in the
Ozark Highlands

3:20 J. Sperber (U. of Ark.):
Mississippian Socio-Political
Organization: An Alternative
Approach

3:35 C. H. Kleinhans (U. of Tenn.):
The Woodland-Mississippian
Interphase in the Normandy
Reservoir of Middle Tennessee

4:00 B. Smith (Corps of Engineers):
Cultural Resources Management
in the Louisville and Nashville
Districts, U.S. Army Corps of
Engineers

7:00 - 9:00 Special Showing: Art of
the Alabama Indians Exhibit.
Garland hall, U. of Ala. Campus

Saturday, November 6, Morning

Symposium: Studies in Alabama
Archaeology in honor of David
L. DeJarnette

Chairperson: J. B. Griffin
(Michigan)

8:00 D. W. Chase (Ala. Arch. Society)
A Taxonomic Appraisal of
Central Alabama Prehistory

8:15 C. B. Curren (U. of Ala.):
The Zooarchaeology of Alabama

8:30 N. J. Jenkins (U. of Ala.):
The West Jefferson Phase and
Alabama Archaeology

8:45 C. S. Peebles (U. of Mich.):
Mississippian Polity: Politics
and Ritual in the Southeast

9:00 J. A. Walthall (U. of Ala.):
Some Comments on Black Warrior
Valley Prehistory

9:15 J. W. Cottier (Auburn) and C. T.
Sheldon (W. Ga. College): Late
Aboriginal Cultural Development
in South Central Alabama

9:30 C. T. Sheldon (W. Ga. College)
and J. W. Cottier (Auburn): A
State Regional Scheme for
Cultural Resource Management

9:45 H. B. Ensor (U. of Ala.):
Archaeology at 1Je34-A Late West
Jefferson Phase Site

10:30 R. S. Dickens and J. H. Chapman
(Ga. State): Ceramic Patterning
and Social Structure at Two Late
Historic Upper Creek Sites in
Alabama

10:45 E. Sheldon (Ga. State):
Childersburg: Evidence of Euro-
pean Influences Demonstrated by
Archaeological Plant Remains

11:00 David DeJarnette and South-
eastern Archaeology: A Tribute
chaired by C. S. Peebles (U. of
Michigan) with contributions
from J. B. Griffin, S. B. Wim-
berly, W. G. Haag, C. Fairbanks,
and others

1:30 - 5:30 Afternoon

Barbeque at Mound State Monument

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THE OCCUPATION OF RIDGETOP SITES IN THE
BLUE RIDGE MOUNTAINS BY SAVANNAH RIVER ARCHAIC PEOPLES

Harvard G. Ayers
Appalachian State University

Introduction

The occupation of ridgetop sites in the Appalachian Mountains of the eastern U. S. has not been a subject of great concern to archaeologists. This lack of interest has resulted from the heavy emphasis on the excavation of sites located in the alluvial floodplains of the major rivers, mainly in Piedmont and Coastal Plain physiographic settings. This emphasis may be explained by at least two factors: (1) by far the majority of the evidence of Woodland and especially of Mississippian cultures is found in floodplain contexts, presumably due to their agricultural pursuits; (2) evidence of Paleo and Archaic, as well as later cultures, may be found in deeply stratified soil zones due to alluvial buildup. The latter factor allows the archaeologist to establish contemporaneity of data and allows these associations to be relatively placed in chronological order.

Ridgetop sites, on the other hand, do not normally yield vertically stratified remains, and do not yield abundant evidence of late prehistoric cultures. Recent research in the Blue Ridge Mountain area, however, indicates a fairly heavy occupation of such sites by Archaic and perhaps Early Woodland peoples (White 1972; Purrington and Douthit 1976). Interestingly, these early cultures are also represented in floodplain sites, thus indicating the generalized nature of their exploitative patterns. A moderate shift of emphasis toward floodplain sites has been noted by Purrington and Douthit (1976) in Watauga County, North Carolina, for Late Archaic and Early Woodland peoples, but this may be, as they implied, due to the buried nature of earlier Archaic evidence in the floodplains. Recent excavation by Chapman in the Little Tennessee River area has indicated that Early Archaic evidence may be buried by 10 or more feet of alluvium (Schroedl, personal communication).

The fact that later cultures are not heavily represented at many ridgetop sites is of course, in a way, a strength of such sites. Archaic remains are not greatly contaminated by later ones. In addition, the seeming weakness of no vertically stratified remains at many of these sites is partially offset by horizontal separation of different components. At the Wakeman site in Watauga County, North Carolina, Appalachian State University archaeologists Burton Purrington and the author have found distinct horizontal separation of what we interpret to be individual occupations, probably individual campsites. Additional preliminary evidence of such sites was recently recovered by the author and others in conducting a reconnaissance survey of the New River area of Ashe and Alleghany Counties, North Carolina. Max White's excavation of the Evans Gap site (1972) and Gary Wilkins' survey and excavation of sites in the Alleghanies provide further recent information on ridgetop sites.

Description of the Wakeman Site

The Wakeman site (31Wt175) is located about 10 miles northwest of Boone, North Carolina, at an elevation of 4200 feet above sea level. It is situated in what has come to be called, topographically, a saddle. To the east and west of the relatively flat surface of the site the land rises abruptly while to the north and south, the land surface drops off. The site measures about 80 feet east-west, and about 130 feet north-south. Presently flowing springs are located about 100 feet to the north of the site and about 500 feet to the south.

Geologically, the site is located in a region characterized by a metamorphic rock type referred to as amphibolite. Such rocks are characterized by the preponderance of the mineral hornblende, with biotite, muscovite and quartz also being present. The nearest source of rock suitable for the manufacture of stone tools such as projectile points, knives, etc., except for quartz, is located about 20 miles to the west of the site. ASU geologist Fred Webb has recently tentatively identified the quartzite of the Savannah River Archaic as being Upper Cambrian from about 40 miles distant, to the west. Rhyolite could be acquired from volcanic deposits about 30 miles north of the site in the Mount Rogers area. Chert (including chalcedony and jasper), quartzite, rhyolite as well as quartz were all represented in the artifacts of the Wakeman site.

Up until its clearing some 75 years ago, the site was covered by a forest of mixed hardwoods, mainly chestnut, oak, and hickory. Presently, beech, yellow poplar, locust, and maple are to be found in the surrounding forested areas. Berries include blackberries, dewberries, raspberries, blueberries, and elderberries. Present day fauna observed by the author include turkey, ground hog, rabbit, squirrel, and grouse. In addition, deer and bear are known to be present in small numbers and elk were reported in early historic times.

Soils at the site are moderately developed with a well represented A, B, and C horizon. Artifacts are largely confined to the A and B horizons which have a total depth of about one foot. No plowing has occurred at the site so that disturbance is limited to animal burrows, recent road construction (on part of the site), and whatever disturbance might have been caused by humans walking over the area. Only one or two human-dug pits were observed in our excavation.

Excavation of the site was begun in the summer of 1975 and expanded in the summer of 1976. The artifacts recovered represented predominantly the Archaic and Early Woodland with a very slight representation of later periods. The earliest artifacts recovered were of the type Kirk serrated. This type dates to about 7500 B.C. at the St. Albans site (Broyles 1971). The latest artifact was a stemless triangular projectile point which probably dates to a post A.D. 1000 time. By far the heaviest occupation, however, was by the people of the Savannah River Archaic.

Before proceeding with a description of the Savannah River occupation of the site, the nature of the horizontal separation of components at the site will be described. It seemed that each square or block of squares represented a fairly homogeneous occupation. This was especially evident in

the different rock types represented by the flakes and tools from different units. For instance, one square yielded about a dozen, tiny (presumably) pressure flakes of jasper. Another square yielded about two dozen chalcedony flakes and/or artifacts. These rock types were rare or absent in all other squares. Two other areas yielded heavy concentrations of quartzite flakes and/or tools while few quartzite flakes were found elsewhere.

Thus, due to a relative lack of disturbance over most of the site (obviously excluding the road cut), it is felt that artifacts remained in pretty much the same position since they were left behind. Whereas most sites of such a shallow nature have been essentially contextually destroyed by the plow, this site has not. It thus became essential for the excavation procedure to record precisely in three dimensions the location of each flake, sherd, point, etc. The procedure we employed in the field consisted of measuring the distance from two square corner stakes (arc distance) and of calculating the elevation as determined from top of stake measurements. In addition, rough sketches were made in the field showing the position of each piece for a certain level. No plotting of artifacts from precise measurements was done in the field. Instead, computer plotting is being accomplished. A program utilized by Charles McNett and others at American University takes the raw field data and converts them to X, Y, Z coordinates. From this, plan views of the artifacts for a certain level or for the entire square may be plotted by the computer.

The knowledge of the Savannah River Archaic in the Watauga County area of northwestern North Carolina has increased over the last several years due to the survey and excavation program of Appalachian State University. During the excavation of 31Wt142 (the B. Taylor site) a large pit was discovered, the charcoal from which dated to 1740 +/- 80 B.C. (UGA - 1062). The charcoal was closely associated with a complete, quartzite Savannah River projectile point.

At the Wakeman site the Savannah River Archaic is represented by several concentrations of quartzite flakes and/or tools. The best defined quartzite concentration appears to have approximate dimensions of 20' by 20'. Within this roughly circular area, about 2500 flakes and/or tools have been found. Analysis of the artifacts from this complex is not complete and presents some real problems due to the raw material being quartzite. Wear and delicate chipping patterns are difficult to study. Edge angles, however, are expected to be of value in making gross functional distinctions. Only one Savannah River projectile point (of quartzite) has been recovered from the area. No quartzite projectile point blanks, rejects or broken points were present. One grinding stone and one possible ax were also recovered from this block of squares. The only floral or faunal remains found was one charred (hickory?) nut. Another concentration of quartzite flakes was located about 130 feet away from the first, but only one five-foot square has been excavated in that immediate area.

Conclusions

The Savannah River evidence at the Wakeman site is indeed puzzling. It represents a manufacturing station for quartzite tools; two to three thousand flakes and/or tools in a relatively small area of presumably rather short

occupation duration would certainly lead to that conclusion. But what was the purpose of this manufacturing station? Only one projectile point was recovered, and there was no evidence of projectile point manufacture. Only one grinding stone was recovered. Although the functional analysis of the quartzite tool types represented by this assemblage is only just being begun, it would appear that most of the tools are knives or scrapers. This might lead one to speculate that this site represents an animal processing station. Although no faunal material has been preserved, present faunal evidence and the present availability of abundant forage for deer, elk, etc., would support the idea of the presence of these animals in the past.

If projectile points were utilized in hunting animals in the vicinity of the site, they were obviously manufactured elsewhere, perhaps nearer the source(s) of the quartzite. This would seem logical in view of the fact that the nearest known source for this rock is about 40 miles and 3000 vertical feet from the Wakeman site. Why then were large quantities of raw material carried to the site to manufacture knife-scraper tools? The answer here might well lie in the fact that if one is only manufacturing projectile points, quite a bit of wastage is involved; the removal of this wastage at or near the quarry would yield an obvious savings in weight to be transported. On the other hand, the manufacture of knives and scrapers would be much less wasteful and in fact almost any sizable flake could conceivably be utilized with little or no retouch. Thus hundreds of tools could be produced from one core and little waste would have to be carried. If this is in fact the case, one might expect to find similar results at other sites in the area. Further, if the quarry area(s) could be located, extensive evidence of projectile point manufacture might be found.

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SOME TECHNOLOGICAL CONSIDERATIONS OF QUARTZ AS A RAW MATERIAL
FOR FLAKED STONE IMPLEMENTS: EXPERIMENTS AND APPLICATIONS

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During the past, many types of stone were selected by man to serve as raw materials for the manufacture of tools. If tool production was accomplished by either a percussion or pressure flaking technique, the raw material most often selected was one whose intended reduction could be completed by means of repeated conchoidal fractures. It might generally be true that raw material reduction and refinement strategies were closely related to the quality of siliceous stone available for use. On the other hand, even if the stone reduction technology was not conditioned in detectable measure by the type of stone utilized, few would disagree that, given a certain technique applied to different types of cryptocrystalline stone, the morphological characteristics of the resulting products would vary in a manner somewhat related to the properties of the different raw materials.

Raw material procurement strategies in the past probably varied in relation to a number of factors. The technological capabilities of a population in connection with its demographic and social structure, as well as natural environmental variables, broadly encompass more specific factors which influenced stone procurement and utilization patterns. Examples of factors which may have been important include the kinds of potentially usable lithic resources which occurred within a given population support area, the location of these resources within the same area, the degree of localization or dispersal of the resources, the volume of the resources, the ease with which they could be extracted, obstructing topographical features, and available means of transport, to name but a few. Whichever of these and other factors were most influential at any given prehistoric time-space coordinate, it is no doubt accurate to state that, in some cases, locally occurring lithic resources were utilized, while in others lithic resources were obtained from relatively long distances. The former example of stone resource procurement strategy appears to be evidenced by a Middle Archaic archaeological manifestation of the piedmont sections of Georgia and South Carolina.

In 1954, Joseph R. Caldwell (1954:37) reported the occurrence of "a distinctive, relatively early, chipped stone assemblage...at the Lake Springs site...on (the) upper Savannah River." The assemblage, because of its stratigraphic position and the predominant raw material represented, was named the "Old Quartz Industry." The Lake Springs assemblage was suggested to be "somehow related" to numerous surface sites in the Georgia and South Carolina piedmont which yielded only quartz artifacts. Indeed, such sites are numerous; however, their precise culture-historical affinity has not yet been demonstrated with satisfaction. Nevertheless it is true that the sites are related by the type of raw material utilized by their inhabitants. Since quartz occurs naturally in these areas, it may be inferred that local stone resource utilization was a characteristic pattern of economic pursuits during

at least some segments of the Archaic. It would seem appropriate, therefore, in an area where quartz was apparently selected, modified, and used with great frequency, to consider the properties of this raw material as they might condition the process of chipped stone tool manufacture.

A general characterization of the response of siliceous stone to force applied through a variety of flaking techniques has been provided by a number of authors (Crabtree 1972a, 1972b; Faulkner 1973; Leach 1969; Speth 1972, 1974, 1975). The dynamics of direct percussion flaking have received special attention, and a model has been presented accounting for the complex mechanics of producing hard hammer percussion flakes (Speth 1972). Less sophisticated studies have shown that morphological differences exist between flakes produced by hard and soft hammer percussors (Crabtree 1972b). Generally, a hard hammer flake is relatively thick and has a pronounced bulb of force. An erailure flake scar often appears on the bulb of force, and fissures or hackles commonly radiate outward from the point of impact on the inner surface of the flake. Compression rings or ripples are also commonly visible on the inner flake surface, and crushing may be evident at the contact area of the striking platform. Soft hammer flakes in comparison are relatively thin, exhibiting a diffuse bulb of force. Erailure flake scars are less common, and neither fissures nor compression rings occur except on the more isotropic siliceous materials. Platform crushing is rarely evident, and a lip or overhang often occurs on the proximal inner surface of a soft hammer flake.

None of these characteristics, however, is exclusively dependent on the type of percussor utilized. For example, a flake produced with a soft hammer may exhibit a pronounced bulb of force. Nevertheless, these characteristics generally may be used to distinguish the effects of using different percussors during direct percussion flaking. These criteria may be especially applicable in studying the process of flake production when model materials (e.g. glass, obsidian) exhibiting regular conchoidal fracture are utilized (Speth 1974:8). On the other hand, the degree to which the criteria are useful in studying other siliceous materials, such as quartz, has not been determined.

As a variety of cryptocrystalline stone, quartz is less homogeneous, less isotropic and more granular than, for example, chert or obsidian. Consequently, the response of quartz to some applied force may be expected to differ somewhat from other materials. Resulting flakes may also be expected to differ morphologically.

In order to evaluate and characterize the response of quartz to force applied through a direct percussion technique, an experiment was designed whereby two samples of flakes were produced from quartz nodules using both hard and soft percussors. The experiment was expected to provide data which would be useful in describing those attributes of flakes produced by percussion which might be peculiar to quartz. Further, the experiment was considered potentially to be useful for future studies attempting to discern aboriginal stoneworking techniques and reduction/refinement strategies where quartz, or similar granular stones, served as the raw material.

The quartz utilized in the experiment was obtained from a large outcrop in Putnam County, Georgia near the Oconee River. The location has been characterized as a quarry site (Dean Wood, personal communication, 1975); however, the prehistoric importance of the site is unknown, and the degree to which the area was utilized will have to be determined through additional investigation. There is no doubt however that the site was utilized, for concentrations of waste flakes in the vicinity of the outcrop indicate past stoneworking activities.

The material itself was a granular milky quartz which was fairly homogeneous although some impurities were present. Individual crystals in the stone were not observable without magnification; however, the crystals were sufficiently large to give the material a rough texture. Nodules selected averaged around 15 centimeters in their longest dimension. Angular nodules were chosen having edge angles roughly ranging between 50-75 degrees. Such angles provided natural striking platforms.

The direct percussion implements selected included a diorite hammerstone weighing 165 grams and the butt section of a white-tailed deer antler weighing 178 grams. The curvature of the hammerstone was approximately equal to the curvature of the antler viewed in cross-section. Following the experiment, the percussors were again weighed, and it was determined that the weight of each implement had been reduced. The hammerstone weighed 154 grams, and the weight of the antler was 173 grams.

The experimental procedure simply consisted of striking flakes from the quartz nodules using the respective percussion implements. Both the percussors and nodules were hand-held. Each implement was used to remove 100 flakes. In order to control for the striking platform angle, when possible, a soft hammer flake would be removed from a nodule and subsequently, a hard hammer flake would be removed adjacent to the previous flake scar. Nevertheless, the striking platform angle and the thickness of the platform were difficult to control except within certain limits.

During the experiment, after the removal of each flake, several observations were recorded. The first observation was whether or not flakes had inadvertently detached from areas of the nodules not contacted by the percussors. During preliminary experimentation, some flakes were seen to detach even from the opposite side of the cores from which a flake had been purposefully struck. A second observation was whether a flake broke into smaller fragments upon detachment. The number of flakes, if present, and their direction of fracture were noted. Finally, the distal fracture characteristics of each flake were recorded. When these observations had been made, each flake was placed in a separate appropriately labelled envelope. As stated previously, 100 soft hammer and 100 hard hammer flakes were produced for comparison.

The flake samples were analyzed and compared by using the set of discrete attributes outlined in Figure 1. Each flake was inspected under fluorescent lighting; and, after all observations were made, the frequencies of occurrence of each attribute for each flake sample were tabulated. These data were then compared, and, where relevant, evaluated with a chi-square statistic. The following results were obtained.

Only four cases of inadvertent flake detachment occurred during the production of flakes with the hammerstone. Only one case was observed when using the antler baton. All occurrences consisted of singular inadvertently detached flakes.

In both samples of flakes, bulbs of force were observed in very low frequencies. Only 8 hard hammer flakes and 4 soft hammer flakes exhibited bulbs of force. Even on these occasions the bulbs were quite diffuse and scarcely noticeable. Overall, in both flake samples only a slight swelling could be observed on the proximal inner flake surfaces. Erailure scars were noticeable on each of the soft hammer flakes exhibiting bulbs of force yet only 2 of the hard hammer flakes with bulbs of force exhibit erailures. Overall, the occurrence of erailures was quite infrequent and, when present, were actually questionable as to their existence. Both compression rings and fissures also occurred in very low frequencies. Compression rings occurred on only 4 hard hammer and 3 soft hammer flakes. Fissures were noticeable on 4 hard hammer flakes, but none were observed on flakes produced with a soft hammer.

The frequencies of flakes which broke upon detachment from the nodules are listed according to fracture characteristics in Table 1. As indicated, a greater frequency of hard hammer flakes broke during their detachment. In order to evaluate the significance of this difference, a chi-square test was utilized which yielded the value of $\chi^2=12.7638$ with 3 degrees of freedom. The corresponding level of significance was approximately .005, suggesting a reasonably clear non-random association between the flake breakage characteristics and the percussion technique employed. With both samples, the predominant fracture was one which occurred longitudinal to the long axis of the flake.

Table 2 lists the flake curvature characteristics of the two samples. The majority of the hard hammer flakes exhibited no curvature while the majority of the soft hammer flakes were concave. Only a small percentage of flakes within either sample were convex. A chi-square test run on these data yielded a significance level of less than .025 ($\chi^2=8.3403$, d.f.=2), allowing the tentative rejection of the hypothesis that there was no difference between the samples.

The point of impact characteristics of the flakes within each sample are given in Table 3. Before these characteristics were noted, each flake was washed to eliminate minute particles of stone from the striking platform. This was done to simulate the effects of natural weathering which would reduce the shatter adhering to the surface of aboriginal flakes. The point of impact was undetectable in 70% of the soft hammer flakes; however, in the hard hammer sample, two-thirds of the flakes exhibited points of impact which were readily noticeable. In addition, 34% of the hard hammer flakes were indented on the inner surface of the flake at the point of impact. A chi-square test of these data gave a value of $\chi^2=29.2794$ with 2 d.f., suggesting that the observed differences between the samples was likely to occur by chance only once in a thousand times ($p<.001$).

When viewed under fluorescent lighting, fracture planes or force fractures were observed on the flakes with rather unexpected frequency (Table 4). No multiple fracture planes were observed. However, 30% of the hard

Figure 1. Qualitative attributes observed during the quartz flake analysis.

- | | |
|---|--|
| <p>A. Inadvertent Flake Detachment</p> <ul style="list-style-type: none"> 1 absent 2 singular 3 multiple | <p>I. Platform Configurations (Outer Surface)</p> <ul style="list-style-type: none"> 1 straight 2 concave 3 convex 4 angular 5 irregular |
| <p>B. Flake Breakage During Detachment</p> <ul style="list-style-type: none"> 1 absent 2 singular oblique 3 singular longitudinal 4 multiple oblique 5 multiple longitudinal 6 longitudinal & oblique | <p>J. Platform Configuration (Inner Surface)</p> <ul style="list-style-type: none"> 1 straight 2 concave 3 convex 4 angular 5 irregular |
| <p>C. Distal Fracture Characteristic</p> <ul style="list-style-type: none"> 1 hinge 2 step 3 feather 4 core | <p>K. Point of Impact</p> <ul style="list-style-type: none"> 1 absent, undetectable 2 present 3 present, indention |
| <p>D. Outer Flake Surface Characteristics</p> <ul style="list-style-type: none"> 1 flat 2 concave 3 convex 4 ridged obliquely 5 ridged longitudinally 6 irregular | <p>L. Compression Rings</p> <ul style="list-style-type: none"> 1 absent 2 present |
| <p>E. Lateral Margins</p> <ul style="list-style-type: none"> 1 parallel 2 symmetrical, not parallel 3 irregular | <p>M. Fissures</p> <ul style="list-style-type: none"> 1 absent 2 present |
| <p>F. Flake Curvature</p> <ul style="list-style-type: none"> 1 straight 2 concave 3 convex | <p>N. Force Fractures</p> <ul style="list-style-type: none"> 1 absent 2 singular oblique 3 singular longitudinal 4 multiple oblique 5 multiple longitudinal 6 longitudinal and oblique |
| <p>G. Bulb of Force</p> <ul style="list-style-type: none"> 1 absent 2 present | |
| <p>H. Eraisure Flake Scar</p> <ul style="list-style-type: none"> 1 absent 2 present | |

Table 1. Distribution of fracture characteristics among experimental flakes.

	absent	oblique	longitudinal	long. & oblique	Totals
hard hammer	52	10	30	8	100
soft hammer	76	4	15	5	100
Totals	128	14	45	13	200

Table 2. Distribution of curvature characteristics among experimental flakes.

	straight	concave	convex	Totals
hard hammer	46	40	14	100
soft hammer	35	59	6	100
Totals	81	99	20	200

Table 3. Distribution of point of impact characteristics among experimental flakes.

	absent	present	present, indentation	Totals
hard hammer	34	32	34	100
soft hammer	70	21	9	100
Totals	104	53	43	200

Table 4. Distribution of force fractures among experimental flakes.

	absent	oblique	longitudinal	Totals
hard hammer	70	6	24	100
soft hammer	81	3	16	100
Totals	151	9	40	200

hammer flakes exhibited singular force fractures, and 19% of the soft hammer flakes exhibited the same. A chi-square test was performed on the data to evaluate the observed differences with the results supporting the null hypothesis of association ($\chi^2=3.4013$, d.f.=2, $p>0.1$). The pattern in the observed data, nevertheless, suggests the potential for using this attribute to discriminate flaking techniques.

Both the inner and outer surfaces of the striking platforms were categorized according to their general configuration. The outer platform surface configuration was mainly a function of the quartz nodules' outer surface morphology. The inner surface configuration of the platform, on the other hand, was to some degree conditioned by the mode of flake production utilized. The frequency distribution of the inner surface platform characteristics is provided in Table 5. Although the chi-square test indicated differences between the samples to be at a rather low order of significance ($\chi^2=6.3807$, d.f.=4, $p>0.1$), the following observations were made.

A straight inner platform surface was noted on a larger percentage of the hard hammer flakes. Also, more of the hard hammer flakes had irregular inner platform surfaces. This possibly was related to the number of hard hammer flakes which were indented at the point of impact. By far the majority of the soft hammer flakes exhibited a convex inner platform configuration. The percentage of convex inner platform surfaces was greater for the sample of flakes produced with the antler baton.

The distal fracture characteristics of the flakes from both samples were very similar. Eighty-one of the 100 hard hammer flakes feathered from the nodules during their detachment while 84 of the soft hammer flakes feathered. The remaining flakes in each sample, 19 and 16 percent respectively, exhibited either step or hinge fractures. While these differences between the samples are not statistically significant, overall the proportion of hinge and step fractures is considered somewhat higher than would normally be expected.

The lateral margins of the flakes in each sample produced were essentially the same in configuration. Twenty-two and 24 percent of the hard and soft hammer flakes had symmetrical marginal edges with the majority in each sample being irregular. The flake edge configuration was probably dependent upon the outer core surface morphology and independent of the flaking technique employed.

Discussion

The results of the analysis indicate that the different flaking implements employed produced flakes, which in some cases, exhibited attributes whose frequency of occurrence was determined to be statistically significant between the samples. The criteria which were most useful in distinguishing between percussion techniques include the frequency and character of flake breakage during detachment, force fractures, point of impact characteristics, inner platform surface configuration, and flake curvature.

As noted, a relatively large number of flakes broke upon their detachment from the nodules. However, a significantly greater number of hard hammer flakes were observed to break. The majority of the breaks which occurred in each sample were longitudinal. The resulting fragments from such a break exhibit angular surfaces which are roughly perpendicular to the striking platform. That such a high proportion of angular flake fragments were produced during the experimentation may help to explain the frequent occurrence of similar items in aboriginal quartz artifact assemblages.

Commensurate with the occurrence of flake breakage during detachment were the relatively high frequencies of force fractures observed on flakes which had not actually fragmented. While the frequencies of force fractures within the samples were not statistically significant to a great degree, their relatively frequent occurrence may be a common phenomenon and may also be used to distinguish the types of percussion techniques employed for flake production.

Flake curvature was a characteristic found to be useful in distinguishing between percussion techniques. The statistical significance of the frequency variations between the samples was relatively high; however, these results are accepted with a degree of caution. It may be that the degree of flake curvature was related to the morphological characteristics of the nodules from which the flakes were produced. Further experimentation will be necessary to clarify the relationships. The most significant frequency variation between the samples was the observation of point of impact characteristics. The exact point of impact was not discernible on most of the soft hammer flakes. However, on 66 of the hard hammer flakes the point of impact was readily detectable. It is no doubt true that the hammerstone, because of its hardness, crushed the platform at the point of impact. The force of the hammerstone being focused at one particular point possibly also accounts for the relatively high frequency with which indentions were produced on the inner surface of the platforms at the points of impact. The presence and characteristics of the point of impact, then, are quite useful for discerning different techniques of flake production.

Viewed in connection with the point of impact characteristics, the inner surface configuration of the striking platform is also useful for distinguishing between flaking techniques. Though the frequency variations between the samples were not greatly significant, they do suggest an interesting hypothesis. Considering only those flakes whose platform inner surface was either straight or convex, it is readily seen that a greater number of soft hammer flakes had convex inner platform surfaces. The hard hammer flakes exhibited straight inner surfaces with greater frequencies. Taking into account the point of impact indentions on the hard hammer flakes and the corresponding relatively high frequencies and percentages of straight platform inner surfaces, it may be suggested that the force of a hard hammer serves to collapse the bulb of force to a detectable degree. This notion however requires further attention.

The overall results of the experiment and analysis indicate that hard hammer and soft hammer percussion flaking techniques, when applied to quartz, yield flakes which vary according to the frequency of occurrence of certain attributes. These findings suggest, therefore, that the experimental data may be useful to consider in attempting to discern prehistoric stoneworking techniques.

Application

In order to evaluate the feasibility of employing the set of qualitative attributes for this purpose, an analysis of a sample of unbroken quartz flakes from a prehistoric assemblage was undertaken. The flakes (N=100) were chosen from a surface collection obtained from 9Pm113, a multi-component site in Putnam County, Georgia. It should be noted that the precise culture-historical affinity of the sample and the degree to which post-depositional processes have altered the sample are both unknown.

Each of the 100 flakes was inspected under fluorescent lighting. A set of four attributes was referred to that included those from the experimental study which, in their various states, were found to be the best indicators of the different flaking techniques. These attributes are point of impact characteristics, flake curvature, inner platform surface configuration, and force fractures.

Following the observation of these attributes for each flake, their frequencies of occurrence were tabulated for the entire sample. As indicated in Table 6, the point of impact characteristics were fairly equally distributed. However, the distribution of the characteristics relating to flake curvature and inner platform configuration exhibited a somewhat different pattern.

In order to ascertain the relative significance of the frequency distributions for these latter characteristics, the entire sample of flakes was divided according to the three states of the point of impact attribute. This attribute was shown to be the most distinguishing criterion between the experimental samples. The results of chi-square tests run on these data (Tables 7 and 8) indicated only slightly significant distributional differences in the curvature ($\chi^2=7.6152$, d.f.=4, $p=1$) and inner platform surface characteristics ($\chi^2=17.8366$, d.f.=8, $p<.025$) according to the three sub-samples. These findings do not allow the rejection of the null hypothesis that there is no difference between the samples. Nevertheless, the general patterns of these data are in keeping with the results of the experimentation.

Force fractures were not observed in great frequency among the aboriginal flakes (Table 6). A chi-square test of these data demonstrated insignificant associations of force fractures with point of impact characteristics.

A separate sample of aboriginal quartz flakes (N=215) was randomly selected to measure the frequency with which flake breakage occurred during prehistoric stoneworking activities at this site. Although breakage characteristics (i.e. oblique, longitudinal, etc.) were not tabu-

Table 5. Distribution of inner platform surface characteristics among experimental flakes.

	straight	concave	convex	angular	irregular	Totals
hard hammer	21	4	57	4	14	100
soft hammer	16	4	70	5	5	100
Totals	37	8	127	9	19	200

Table 6. Distribution of flake characteristics within the aboriginal sample.

Point of Impact		Force Fractures	
absent, undetectable	39	absent	90
present	32	singular oblique	1
present, indentation	29	singular longitudinal	3
Curvature		multiple oblique	1
straight	37	multiple longitudinal	2
concave	56	long. & oblique	3
convex	7		
Inner Platform Configuration			
straight	29		
concave	3		
convex	46		
angular	6		
irregular	16		

Table 7. Distribution of curvature characteristics according to sub-groups of aboriginal flakes based upon point of impact characteristics.

	straight	concave	convex	Totals
absent	9	27	3	39
present	12	18	2	32
indented	16	11	2	29
Totals	37	56	7	100

Table 8. Distribution of inner platform surface characteristics according to sub-groups of aboriginal flakes based upon point of impact characteristics.

	straight	concave	convex	angular	irregular	Totals
absent	12	2	23	0	2	39
present	7	1	16	2	6	32
indented	10	0	7	4	8	29
Totals	29	3	46	6	16	100

lated, it was observed that, of 215 flakes, 141 (66%) were broken and 74 (34%) were complete. Although somewhat questionable, on theoretical grounds these data suggest that flake breakage occurred during flake detachment approximately 50% of the time. In any case, these data do point to the occurrence of a high incidence of flake breakage, a significant finding of the experimental study.

At this point it would be erroneous to employ the results of the present analysis in generalizing about stoneworking techniques utilized in the past at 9Pm113. The "mixed" nature of the sample studied as well as its small size preclude such generalizations. As stated, this was a study designed to evaluate the feasibility of using a certain set of qualitative attributes in order to discern past stone reduction techniques. As such the study can be termed at least a partial success. The attributes delineated for the experimental samples were also observable on the aboriginal flakes. In addition, the patterns of occurrence of these attributes on the aboriginal flakes were somewhat similar to the experimental findings.

Of course the attributes utilized are not the only ones which could be employed in studying the technology of quartz nodule reduction. In fact, a limitation of the subsequent comparative study was that flakes resulting from initial reduction activities were compared with those from an assemblage probably representing various stages of different reduction/refinement strategies. Also, the attributes chosen are technological, and their relationship to functional activities or stylistic configurations is unknown.

No continuous or quantitative attributes were employed in this study, a shortcoming which should be considered in future research dealing with this subject. It is also true that the attributes observed may occur on flakes independent of the percussion technique involved. However, with large samples of aboriginal flakes, the attributes used in this study, in conjunction with others, may be useful in characterizing technological developments at particular time-space coordinates and their possible change through time.

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THE BIOLOGICAL AND SOCIAL ANALYSIS OF A MISSISSIPPIAN CEMETERY
FROM SOUTHEAST MISSOURI: THE TURNER SITE, 23BU21A*

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In recent years, mortuary analysis has made important contributions to our understanding of prehistoric societies. Many of the studies which have been published have dealt with large, complex sites. Furthermore, they have examined undisturbed cemeteries containing the remains of well-preserved individuals. In general, poorly preserved and badly disturbed cemeteries have been written off as a waste of time. Another characteristic of these studies has been that the mortuary analysis is performed by an archaeologist who is dealing with information provided by a physical anthropologist. This presents some difficulties with well-preserved remains, but creates almost insurmountable problems when the skeletal material is in poor condition. I undertook the analysis of the Powers Phase burials in order to demonstrate two points: First, the analysis of disturbed, poorly preserved human remains can be profitable; and second, that mortuary analysis can be greatly facilitated when the entire analysis is performed by one person.

The Powers Phase was a Middle Mississippian society of Southeast Missouri. Excavations of Powers Phase sites have been conducted by the University of Michigan Museum of Anthropology. Burials from three sites of the Powers Phase were examined. The largest site of the phase, Powers Fort, a ceremonial center with a truncated mound, is located at the edge of the Ozark escarpment in Butler County. Limited excavations at Powers Fort yielded five adult and three infant burials. Two Powers Phase villages, Turner and Snodgrass, were nearly completely excavated. A cemetery which yielded 54 burials containing 118 individuals was excavated at the Turner site. However, Snodgrass, which is located just 200 yards from Turner, produced only six scattered adult burials from the village area, and several infant burials from beneath house floors.

A number of problems were encountered in the examination of the Powers Phase burials. First of all, with the exception of Powers Fort, the preservation of the skeletons was poor. Very few vertebrae, ribs, hands, feet, or long bone epiphyses were recovered. Second, when the existence of the Turner cemetery became known to pothunters, they descended on the site in droves and did a very effective job of looting the burials, destroying much of the skeletal material in the process. Third, during storage, bones from some of the burials somehow became mixed together. It is clear, therefore, that the Turner site cemetery will provide a test of the value of mortuary analyses under adverse circumstances. A number of physical analyses provided most of the basic data used for the social analyses. The most critical of these physical analyses were the assessment of age and sex.

*The detailed analysis is now in print: The Biological and Social Analysis of a Mississippian Cemetery from Southeast Missouri, 23BU21A, University of Michigan, Museum of Anthropology, Anthropological Papers 68. TKB 8/16/83.

Three methods were used for estimating age. Infants were aged by the development of the occipital bone, children were aged by dental calcification, and adults were aged by dental attrition.

Three methods of sexing were used in an attempt to determine the sex of as many individuals as possible. The use of three methods also permitted the cross-validation of the different methods. The three methods were based on the examination of the pelvis, the cranium, and the femur.

When cranial form was examined, the presence and degree of cranial deformation was noted. When this characteristic was analyzed, no sexual bias in either presence or intensity of deformation could be detected.

An analysis of stature was performed and it produced two main results. First, there is nothing exceptional about the stature of the Powers Phase people when they are compared to other Mississippian populations. Second, I developed a healthy skepticism of the methods of reconstruction of stature and the validity of the analysis of statural differences within and between prehistoric populations.

The analysis of the dentitions of the burials not only gave data on age, but provided a great deal of information regarding the health of the Powers Phase people. The relationship of dental disease to age has been elucidated, and it has important consequences for many earlier studies of dental disease. I was able to demonstrate that what appears to be a declining occurrence of caries/cavities with respect to age is in fact just the contrary. Although the absolute frequency of caries does decline, the frequencies of abscessed teeth and teeth lost before death increase with respect to age. When the frequencies of all three forms of dental disease are compared to age, it can be shown that dental disease becomes more frequent with increasing age. Since most studies of dental disease do not consider the ages of the affected individuals or the numbers of lost teeth, their results are misleading.

I attempted to determine the age of weaning by examining the crowns of the teeth for lines of enamel hypoplasia. These lines are thought to result from various systemic disturbances occurring during the calcification of the teeth. I thought that the shift to a protein poor diet after weaning might make the children more susceptible to disease, perhaps resulting in the interruption of growth and the formation of lines of enamel hypoplasia. I found that the frequency of hypoplastic lines peaked between ages 1.5 and 4.0 years. Whether this peak represents the age of weaning is uncertain, but it is not an unreasonable age when it is compared to ethnographically described groups.

The examination of the teeth finished the physical analysis. The first of the social analyses involved the construction of a life table for the Turner site from the information compiled in the age determinations. The first life table was quite unrealistic as it made very little allowance for infant deaths. This shortage of infants was compensated for and a new life table was composed. This life table was then fitted to one of the model life tables constructed by Weiss (1973), since these were believed to be more biologically realistic. The man-years statistic from this life table was then used in an attempt to determine whether all the burials at the Turner

cemetery could have been made by people living in the Turner village. If a population is demographically stable and stationary, the number of man-years represented by the dead of that community will equal the number of man-years lived by the contemporary population. Two estimates of population or man-years were needed, one from the cemetery, and one from the village. The total number of man-years represented by the cemetery was easily computed from the life table value for man-years. The life table gave a total of 2226 man-years for a base population of 100. The minimum number of individuals buried at Turner was 118, so the total man-years represented by the cemetery was calculated by multiplying 1.18 times 2226, resulting in about 2600 man-years.

Several different methods were used to estimate the population of the Turner village. Naroll's method, based on the floor area of the structures, gave a population which worked out to be less than three people per structure. Cook and Heizer's method, also based on floor area, gave a population of 310, or nearly eight people per structure. These two estimates probably represent the minimum and maximum for the number of inhabitants per structure. Multiplying these by an estimate for the average number of years of occupancy of a structure yields a good estimate of the number of man-years lived on the Turner site. Dr. James E. Price, who excavated the site, has argued convincingly that the site could not have been occupied for more than five years, and was probably inhabited for something more like two years. When these figures are multiplied times the population estimates for the village, they give a maximum of 1550 man-years for the village. Even if the village had the maximum population of 310 for 7.5 years, this would be only 2325 man-years, which is still less than the estimate of 2600 man-years which was computed for the cemetery. This indicates that either the Turner site was occupied much longer than we suspected, or the cemetery was used by more than the locally resident population.

A likely source for those extra burials would be the Snodgrass village, which was only 200 yards away and which had only six adult burials. With the Cook and Heizer method, the population of the Snodgrass site may be estimated at 626. This gives a total population for Turner and Snodgrass of 936. If we assume that both sites were occupied for approximately two and a half years, the combined man-years estimate for the two sites is 2340. This figure is close to the estimate of 2600 man-years for the Turner cemetery. While this does not demonstrate that most of the dead from the Snodgrass site were buried at Turner, it certainly indicates that this is a reasonable proposition.

The final social analysis was an attempt to elucidate certain aspects of the social organization of the group or groups burying at Turner. It has been suggested that smaller sites, such as Turner, functioning within a larger ranked system will appear egalitarian in their organization. Thus, the problem here was to determine whether any elements of ranking could be discovered in the burial patterning at Turner. The lack of any indications of ranking would not necessarily mean that the Powers Phase was not a ranked society, but that Turner when considered by itself was essentially egalitarian. I proceeded by looking for aspects of the structure of the burials which could not be explained in terms of the age and sex of the individual burials.

A series of cross-tabulations was made and tested to see whether any significant associations could be found among burial form, individual age and sex, orientation, and the number of individuals per burial. The cross-tabulations were tested for significance with the G-statistic, which is approximately distributed as chi-square and may be tested against the critical values found in a table of chi-square values.

The distinctions discovered in the cross-tabulations may be quickly summarized. Burial form was related to age: only adults were buried as bundles, and, with two exceptions, only children were buried as single skulls. Burial form was also related to the number of people in a burial, because bundle burials occurred only in multiple burials. Age was unrelated to the number of persons in a burial, and sex was unrelated to burial form or to the number of persons in a burial. When the orientation of the extended burials was tested against individual age and sex, there were no significant results. It is interesting to note, however, that almost all of the burials were oriented along an ESE-WNW axis, most of them with their heads to the ESE.

I then tested to see if there was any assortative burying of individuals on the bases of age or sex. A binomial expansion was used to calculate the expected occurrence of each combination of individuals. The expected occurrences were then compared to the observed frequencies. No significant deviations from expectations were observed in the combinations of adults with juveniles, of males with females, or of juveniles with adults of either sex. So, without yet considering the artifacts occurring with each burial, very little structure could be observed in the burial patterning. Such structure as has been observed was related to age alone.

It was mentioned earlier that the cemetery had been successfully looted. Very few pots remained in place with the burials. However, Dr. Price was able to photograph all of the looted vessels. From these photographs, it is clear that the composition of the ceramic assemblage differs between the cemetery and the Turner and Snodgrass villages. Most of these pots were simple, undecorated vessels. The only differences to be expected in their associations with individuals in burials are differences in quantity, not kind. And, if the number of disturbed burials is any indication of the number of burials which had pots in them, then very few burials could have had more than one pot. Most of the undisturbed burials had no pots with them, and those that did were not distinguished by age or sex. Very few other artifacts were placed with the burials, so no clear patterns of age or sex association could be observed. However, it was apparent that no artifacts were intentionally included with the individuals who were buried as bundles.

The picture that emerges is of a cemetery in which the only distinctions in treatment are age-based. Individuals under age two were not buried in the cemetery, and individuals under age 15 were not buried in the form of a bundle. Certainly, no evidence for a ranked society was discovered at Turner. However, I suspect that when more skeletal material from the Powers Phase becomes available for analysis, ranking might be detectable on an inter-site basis.

One of the points I wanted to make was that mortuary analysis can be facilitated when the physical and social analyses are performed by the same person. I speak from my own experience when I say that I much prefer to work with osteological data I have compiled myself because I know where any weaknesses occur in the analysis and can adjust subsequent analyses to account for them. This was the case when I chose not to use stature as a variable in the social analyses because I believed the estimated statures to have too great an error for them to be of any value for further analysis.

I believe I have amply demonstrated the first point I intended to make, that mortuary analysis is still a profitable pursuit, even when the circumstances of the investigation are less than ideal. The Turner site featured poorly preserved and badly disturbed human remains, yet I was able to learn important information regarding the health, the size and the social organization of the population.

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PALEO-INDIAN IN THE LOWER MISSISSIPPI VALLEY

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Until very recently, it was believed that the alluvial soils of the Mississippi Valley were of such recent deposition that evidence of man's occupation during the Paleo- and Meso-Indian eras could not be found. Such occupation was assumed (Phillips, Ford, and Griffin 1951:429), but it was expected that those sites which river action had not destroyed would be too deeply buried ever to be recovered (Haag 1961). Thus, the investigation of Valley prehistory was thought to be restricted to that period after standing sea level had been reached and the Mississippi had largely stopped aggrading (Phillips, Ford and Griffin 1951:295-296). Fisk (1944) assigned river stages A through 20 to this period and estimated a duration of 6000 years, of which only the last 5000 years were thought to be archaeologically recoverable (Haag 1961:322).

Recent geological and archaeological work has considerably changed the picture. Relict surfaces untouched by recent alluviation have been revealed in the Yazoo Basin (Fig. 1), the focus of this study, which are far more than 5000 years old (Saucier and Kolb 1967; Saucier 1974). Archaeological finds dating back to the Paleo-Indian era have been found on these surfaces (Brain 1970).

Even earlier surface deposits have been determined along the western margins of the Valley. Parts of the Western Lowlands in northeastern Arkansas may date as far back as 35,000 years (Saucier 1968, 1974). Although much of the surface has been reworked by subsequent stream action, sites and artifacts pertaining to the Paleo-Indian era have been located both there and on more recent relict braided stream surfaces in the Eastern Lowlands (Redfield, n.d.; Redfield and Moselage 1970; Perino 1967; Morse 1969, 1970, 1975). These sites and artifacts are in situ on the floodplain. Although the evidence is as yet inconsiderable, enough has been retrieved to establish clearly an identity -- in specific artifactual types as well as general cultural pattern -- with "early man" sites elsewhere across the continent (see Mason 1962; Williams and Stoltman 1965).

The earliest identifiable remains date to approximately 10,000 B.C. with the appearance of Clovis points and the cultural pattern that they would seem to represent (Fig. 2). The Mississippi Valley has one of the richest paleontological concentrations of Pleistocene megafauna in the eastern United States, and some evidence of the coexistence of man with this fauna has been accumulated. Three of the most famous examples are: the possible relationship of an early tool complex and megafaunal remains at Avery Island, Louisiana (Gagliano 1964, 1967; Haag 1965), the apparent find of a human pelvis in a fossil-bearing stratum near Natchez, Mississippi (Dickeson 1846; Wilson 1895: one of the earliest scientific demonstrations of the antiquity of man in the Americas; Quimby 1956), and the association of stone tools and mastodon bones at Island 35 above Memphis, Tennessee (Williams 1957). It is reasonable to assume through these associations -- if they are reliable indicators -- that man was also certainly hunting those large animals. If a

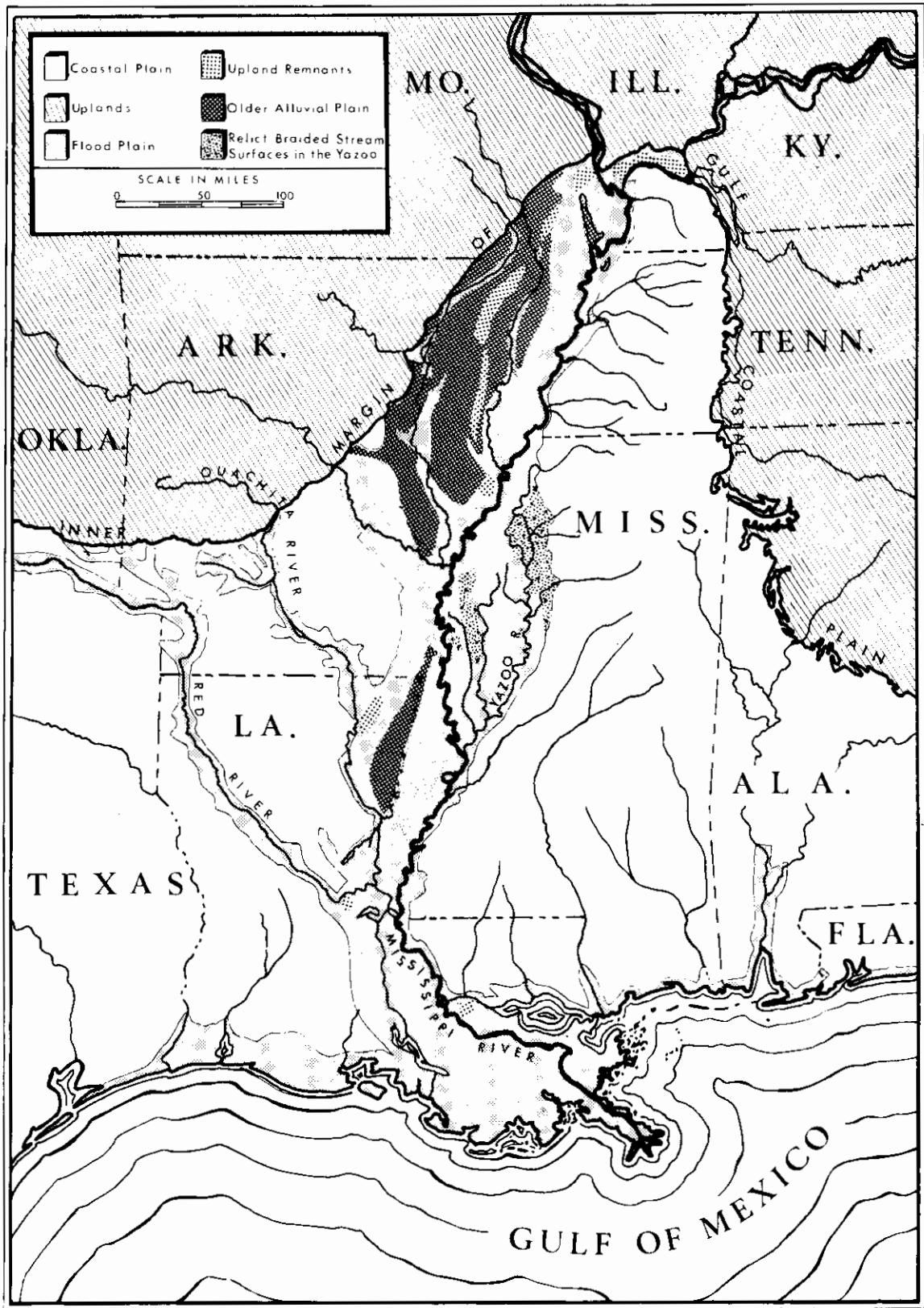


Figure 1. The geology and topography of the Lower Mississippi Valley.

catalogue of Pleistocene mammalian fossils found on a few gravel and sand bars in the bed of the Mississippi River south of Memphis during a one-year period in 1969-1970 is any indication, then the first Indians in the Valley must have fared quite well. Even in this very limited test 68 specimens were recorded and included Mammut, Mammuthus, Megalonyx, Bison, and Equus (Kaye 1970). The bones showed no effects of water action or wear, and it was clear that they had not been far removed from their original location, presumably a fossil bone bed within the alluvial valley.

The artifactual evidence for this period is scanty, indeed, the only certain indicators being a number of Clovis type points which have been recorded for northeastern Arkansas (Morse 1969: 17), a "convex-parallel-sided" variety from the Curtis Station site in the northern Yazoo (Sam Brookes, pers. comm., Nov. 1975), and a single "triangular" Clovis (Fig. 3a) from the Helm site (19-M-14) in the southern Yazoo Basin. All of the Yazoo sites to be discussed here, and most of the finds, are confined to the relict braided stream surfaces created before the Mississippi assumed its meandering pattern in this region some 9-10,000 years ago (Saucier 1974). These surfaces are not impressive geological features, but nevertheless they are striking in the landform of the alluvial valley. On the basis of this minimal evidence, a hypothetical Helm phase is proposed as the local Yazoo manifestation of a Clovis-related occupation (Fig. 4). The distribution of this occupation beyond the Yazoo, and the relationship to northeastern Arkansas, awaits further evidence.

What other tools might be included in a Clovis complex at these sites, many of which are multicomponent, is presently a matter of conjecture as no sites of this period have yet yielded sufficient stratigraphic results, apparently due to deflation of the relict surfaces (this problem has led to desperate efforts by some investigators, as illustrated in Fig. 5). However, at other sites in the eastern United States where these same varieties of Clovis points have been found, an associated flake-tool and blade industry has usually been present. Included are end scrapers, unifacial side scrapers, knives, blades, graters, and other miscellaneous stone and bone tools. A tool kit of the sort described above, well suited for killing and butchering wild game, was widespread at this period. Clearly, it epitomizes a basic subsistence pattern, the manifestation of which may vary among diagnostic artifact types according to shifts in emphasis, but which shares a common industry specially adapted to hunting. That the large Pleistocene megafauna were a prime target may be accepted, while at the same time it is unreasonable to expect that they were the sole concern. The Paleo-Indian adaptation was not that restrictive, and could not have been if those early peoples were to survive - as we know they did - in future generations which saw the demise of that bounteous fauna.

During the period of ca. 9000 - 7500 B.C., the archaeological evidence for the Paleo-Indian is still meager. Nevertheless, a few points have turned up in the Yazoo Basin which are suggestive of forms intermediate to earlier and later types, while at the same time showing clear affinities to other

established types outside the Valley. The most interesting find, which may be attributed to the earlier part of the period, is a Folsomoid (Midland-like) point (Fig. 3b) which was found at the Busey site (18-M-23) located on a relict surface in the west-central part of the basin. Also assigned to this period are a small number of points which might be typed as Plainview, Scottsbluff, and Quad (Fig. 3c-e), as well as some fine, but untypable, fragments of large lanceolate points (Fig. 3f).

In terms of temporal continuity, there is an obvious formal relationship between the Folsomoid type of point, and the Quads which probably occur at the very end of the period. The Quads are definitely native products as they are made from local cherts. The Scottsbluffs, however, were certainly an import, perhaps representing the introduction of new peoples from the west. The material is a very fine-grained tan or cream chert from some distant source (perhaps Texas, as suggested by Gagliano and Gregory 1965b: 3). The form and workmanship are equally foreign. In the face of such diversity, it may seem inconsistent to assume that the same basic flake and blade industry accompanied all of these points, but it does not appear that a major change in subsistence pattern happened. However, this is mere conjecture until the exact complement of the tool kit has been determined.

Terminal Paleo-Indian occurred during the millennium 7500-6500 B.C. The inclusion of this interval in the Paleo-Indian era is a moot point, although it is defensible on typological grounds. (This may not be enough when we eventually get beyond a strictly formal/historical approach in the study of early man.) Despite the variation which will be presented, the artifacts were clearly derived from the lithic traditions of the earlier Paleo-Indian periods. However, it should also be added that the sites which had material assignable to this period often had artifacts from the earlier periods, as well, so that it would seem that while a certain evolution in artifact forms occurred, the basic pattern of life remained relatively constant. Although some of these same sites also occasionally produce artifacts assignable to later eras, there is a clear break according to the present data in the overall distributions of the artifact types involved.

In this period, no less than during the preceding ones, the Paleo-Indian tradition is clearly evident in the presence of a superb lithic technology, which is often still manifested in the selection of "foreign" or "exotic" materials. Also characteristic is the superior workmanship of the projectile points, as exemplified by the fine pressure flaking, retouching, basal grinding and thinning. Many points are "fluted," but this technique more often consists of detaching multiple small flakes than one large one. There is a great variety in forms, yet even here there is an obvious relationship between categories (which in this case, may be another way of saying that all are derivable from the same antecedents).

The point type most diagnostic of this period is the classic concave-based Dalton, of which at least several varieties may be recognized, following Duffield's (1963) lead in introducing type-variety nomenclature to lithic classification: Dalton, Meserve, and Carl (Redfield, n.d.: 74-76;

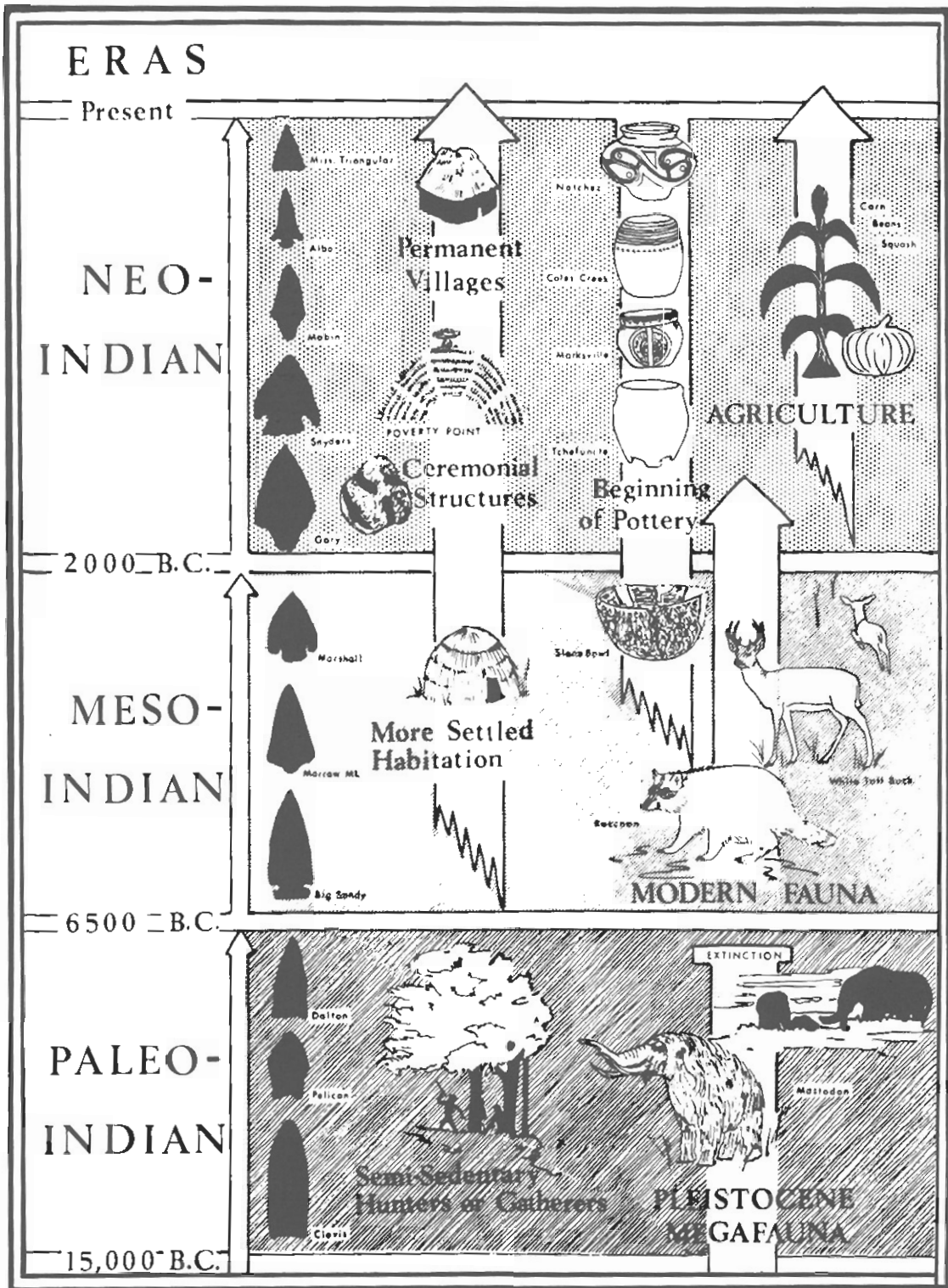


Figure 2. Prehistoric eras of the Lower Mississippi Valley (after Williams, Toth and Kean 1966).

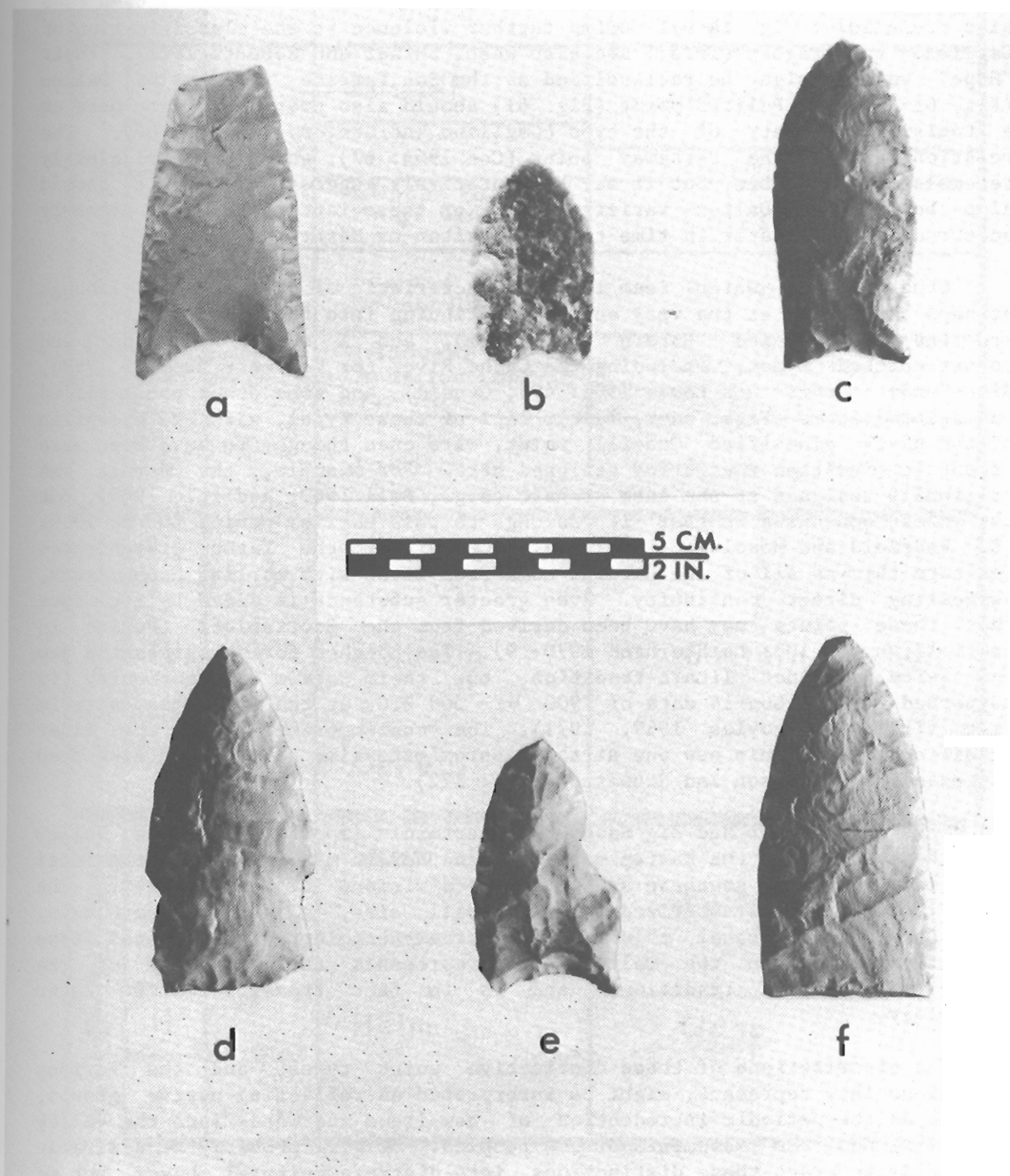


Figure 3. Paleo-Indian Projectile point types from the Yazoo Basin (proveniences parenthesized): a, Clovis (Helm); b, Folsomoid (Busey); c, Plainview (Townes); d, Scottsbluff (Grace); e, Quad (Shaw); f, unclassified lanceolate (Shaw).

Gagliano and Gregory 1965a: their San Patrice, variety "St. John"). Examples of Dalton and Carl points from the Yazoo are illustrated in Figure 6a-h (see also Brain 1970: Fig. 1a-p). Doing further violence to the classification of Gagliano and Gregory (ibid.; see also Webb, Shiner and Roberts 1971), their "Hope" variety might be reclassified as the San Patrice variety of Dalton (Fig. 6i-k). The Pelican point (Fig. 6l) should also probably figure here as a Louisiana variety of the type (Gagliano and Gregory ibid.: 69). The relationship of the Hardaway point (Coe 1964: 67), which the Carl closely resembles, is arguable, but it may be tentatively suggested that it should also be made a Dalton variety. All of these latter varieties probably occurred somewhat later in time than the Dalton or Meserve.

Other points which seem to be characteristic of this period, although perhaps appearing at the very end and continuing into the Meso-Indian era, are the square-based Hardin (Fig. 6m), and a number of side- and corner-notched types, including the Cache River (or Kessel - Broyles 1969), Big Sandy (Lewis and Lewis 1961: 40), Geneill, and some other unclassified but related forms (Figs. 6n-r, 7a-c). All of these types, with the exception of the newly classified Geneill point, were once thought to have been more recent in time than the period assigned here. For example, the Hardin was originally assigned to the late Archaic (e.g., Bell 1960; Redfield 1966), but the latest consensus is that it belongs to this earlier period (Morse 1969: 18; Redfield and Moselage 1970: 34. Certainly, the Yazoo proveniences indicate this as all of the Hardins come from sites with earlier components, suggesting direct continuity. Even greater substance is added by the fact that these points may have been derived from the Scottsbluff (Perino in Redfield, n.d.: 103; Luchterhand 1970: 9). The notched forms represent a new and quite distinct lithic tradition, but their claim to antiquity is supported by a carbon-14 date of 7900 +/- 500 B.C. at the St. Albans site in West Virginia (Broyles 1969, 1971). The contemporaneity of the older traditions with this new one at that approximate time horizon has also been suggested by Rolingson and Schwartz (1966: 122).

The Cache River and Big Sandy were certainly imports into the Valley from the east, while the Dalton varieties and Hardin may represent the local traditions in the southern and northern divisions of the Valley. The Geneill, which is characterized by its small size, slightly concave base, delicate flaking, basal thinning, and corner notching, is a local type distantly related to the Dalton. It represents the very end of the Paleo-Indian lithic tradition, and is in fact transitional to later technology.

The distributions of these distinctive point types, and the various traditions they represent, might be interpreted as reflecting native groups, as well as the periodic introduction of new items and ideas into the Valley with or without the movements of new peoples. It will probably be desirable eventually to group these distinctions into discrete cultural phases, but we do not yet have the necessary distributional data to do so. As a small start, however, phases initially defined by points of the Dalton type may be tentatively recognized for southeast Missouri (the Bloomfield Ridge phase - Williams 1954), for northeast Arkansas (the Lace Phase - Redfield and Moselage 1970; Morse 1971), and for the Yazoo Basin (the Shaw phase - Brain 1970).

<i>Era</i>	<i>Per.</i>	<i>Time</i>	<i>Phase</i>	<i>Culture or Cultural Tradition</i>
NEO-INDIAN	VI	1600	Russell	Mississippian
	V		Lake George Winterville	
	IV	1200	Crippen Point Kings Crossing Aden	Coles Creek
	III	800	Bayland Deasonville	Baytown
	II	A.D. 1	Issaquena Anderson Landing Tuscola	Marksville
	I	1000	Jaketown	Poverty Point
MESO-INDIAN		2000		
	III	3000	Old Basin	Eastern Archaic
	II	4000	Still Gin	
I	5000	Geneill		
PALEO-INDIAN		6000		
	IV	7000	Shaw	Plano
	III	8000	Busey	
	II	9000	Helm	Llano
I	10,000			
		15,000		

Figure 4. Regional chronology of the southern Yazoo Basin.

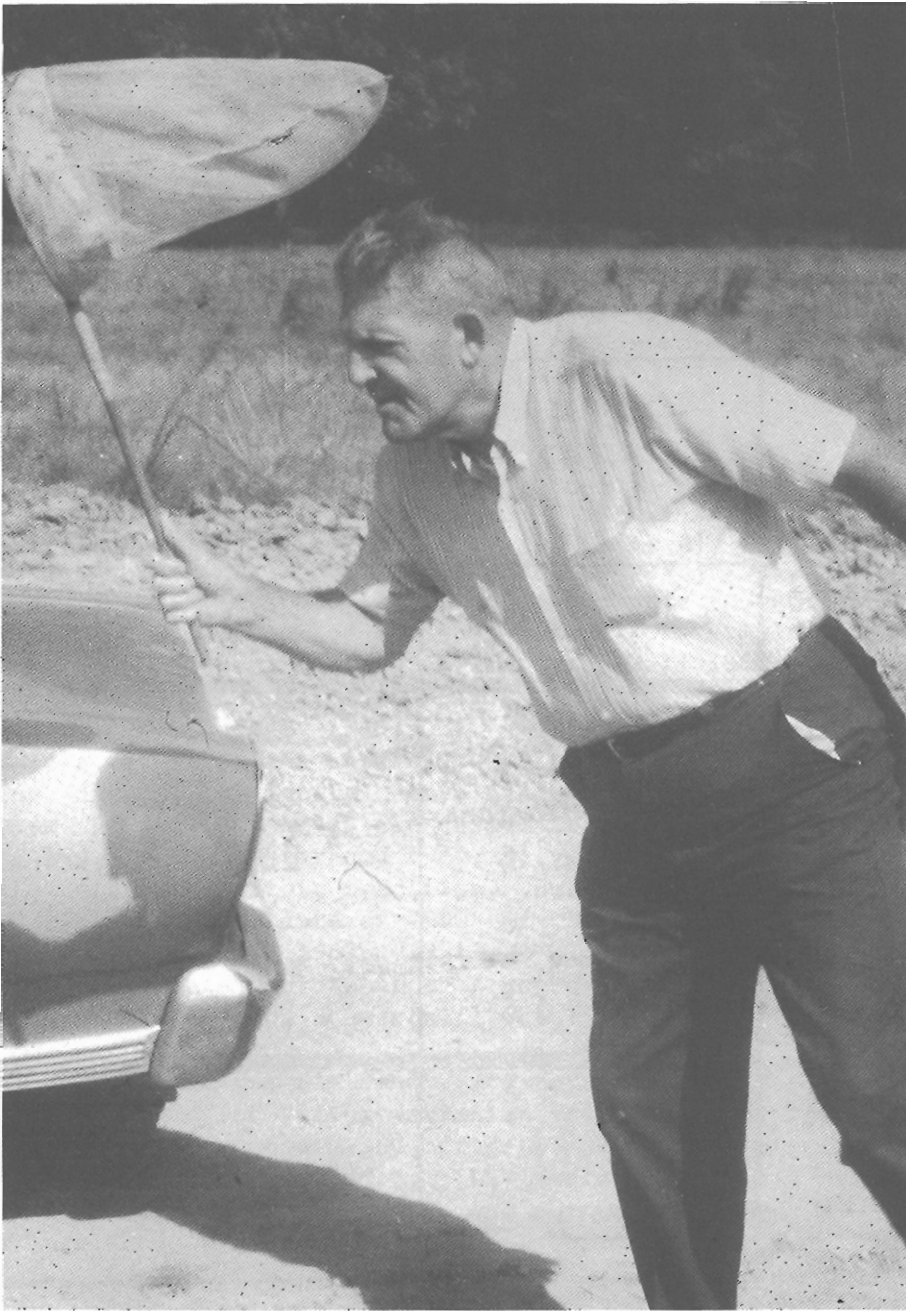


Figure 5. Robert S. Neitzel pursues an elusive point at the Helm Site (May 1970).

In discussing the artifacts assignable to this period, it is at last possible to consider a more comprehensive lithic artifactual assemblage in addition to the projectile points. Since these tools are recognized as Paleo-Indian forms, the same basic assemblage has been suggested for the earlier periods; now, however, we have a certain association. While there is considerable evidence that the points were often reworked and used as knives, scrapers, graters, or drills (e.g., Morse 1975), these tools were also

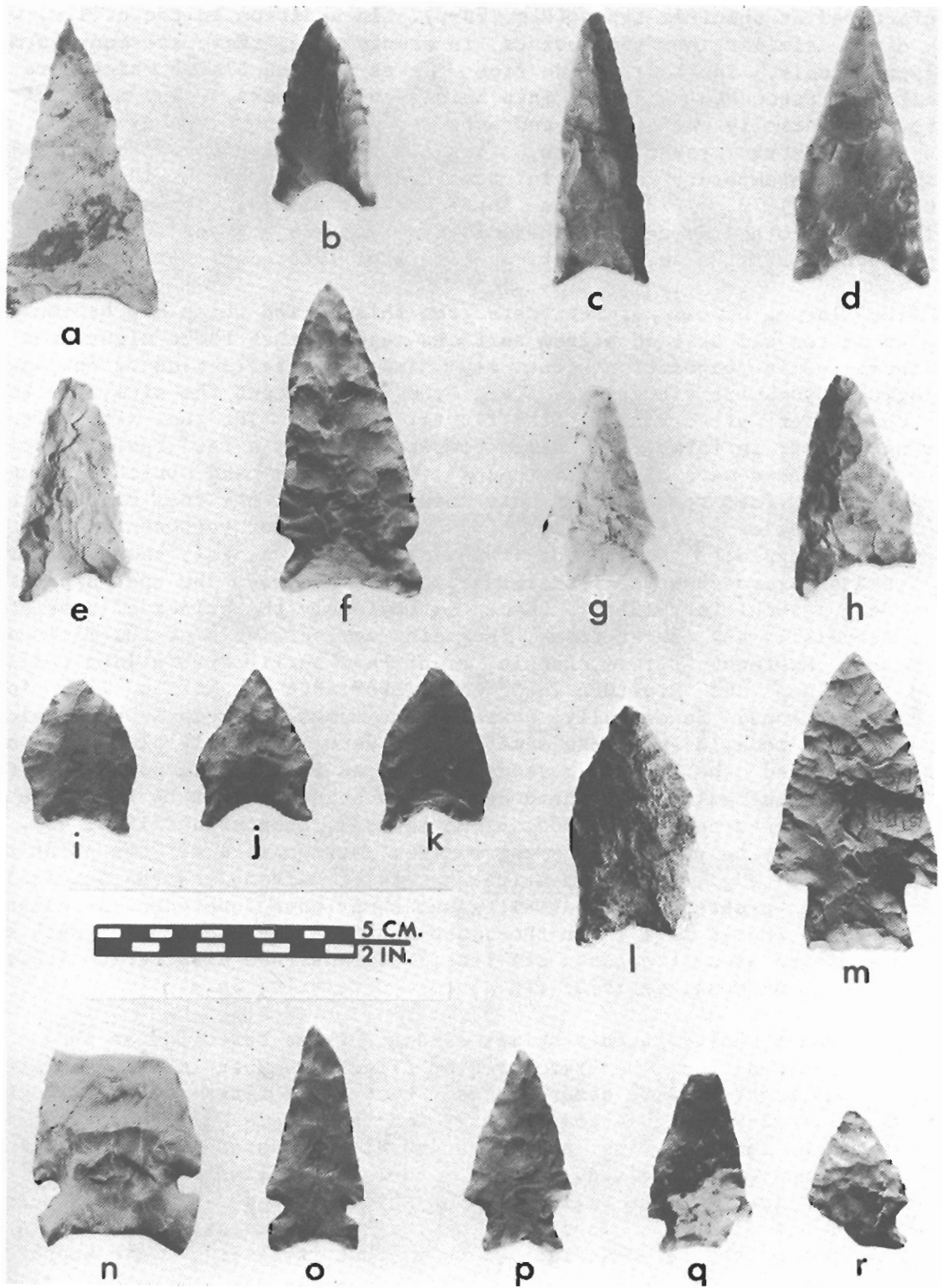


Figure 6. Late Paleo-Indian projectile points from the Yazoo Basin (proveniences parenthesized): a-d, Dalton, var. Dalton (Helm, Shaw); e-h, Dalton, var. Carl (Shaw, Helm, Cypress Thicket); i-k, Dalton, var. San Patrice (Geneill); l, Pelican (Shaw); m, Hardin (Helm); n, Cache River (Cypress Thicket); o, Big Sandy (Geneill); p-r, Geneill (Geneill, Helm).

manufactured as specific types (Fig. 7d-p). In addition to the drills, which are often similar to the points in manufacture, there are many forms of unifacial tools. These were made from flakes or true blades which were then gracefully retouched and made into knives and scrapers. To many of the latter, especially the smaller end scrapers which were probably hafted, were also added extra graver points. Rough, bifacially flaked tools are also known from contemporary sites in northeast Arkansas (Redfield and Moselage 1970; Morse 1973, 1975; Morse and Goodyear 1973). These tools may be indicative of other aspects of the lifeway which are not yet fully understood (e.g., Morse 1971; House, Klinger, and Schiffer 1975; Schiffer 1975).

The large number of artifacts from this period which are beginning to turn up on the old braided stream surfaces suggest that there might have been an increase in population (but may also be a reflection of the special geological-hydraulic situation, i.e., the more recent the site, the better the chance of preservation from fluvial action). The tool kit, although showing variety in forms, was really composed of only a few basic functional types, and those were clearly intended for killing and butchering game. Whatever other food resources may have been utilized, the tool kit - with the possible exception of the heavy bifaces - had not yet been specifically adapted to exploit them. For this reason, a broadly based pattern of exploitation, crosscutting several ecozones would seem the most appropriate model (e.g., Schiffer 1975). Game was obviously the principal subsistence base, especially the larger forms, including any survivals of the Pleistocene megafauna. Mastodons, for example, might have survived this late (Williams 1957; Williams and Stoltman 1965; Morse 1969; but see Martin 1967 for a contrary opinion). Essentially, however, the mammalian fauna was completely comparable to today's and these same species were certainly plentiful enough to have provided the basic sustenance for an increase in population (Haag 1965: 281). The evidence at hand definitely suggests that by this time deer were the prime target (Webb 1965: 6; Morse 1970; Luchterhand 1970: 42). The smaller game may be reflected in the smaller average size of the point types of this period (e.g., the San Patrice variety of Dalton, and the Geneill), as well as the greater number of sites which may have functioned as temporary hunting camps (Morse 1971). In the Yazoo Basin, alone, dozens of such sites have been found along the banks of fossil streams (see also Perino 1965: 19, and Redfield and Moselage 1970: Fig. 3 for comparative data).

In summary, based on this skimpy evidence three Paleo-Indian phases have been hypothesized for the Yazoo region (Fig. 4). Most importantly, it now appears, and might soon be demonstrated, that man first entered the Lower Mississippi Valley as the contemporary of the late Pleistocene mammalian fauna, which included the horse, ground sloth, mastodon, mammoth, and a number of now-extinct bison. It is probable that climatic conditions were such at that time that the Valley had an environment especially conducive to such forms of life. The importance of the Lower Mississippi Valley in the consideration of the Paleo-Indian, then, is that it seems to have supported a larger megafauna population than can be demonstrated in most other locales, and thus if big game was indeed an important target of early man then the Lower Mississippi Valley should also be the repository for considerable Paleo-Indian archaeology. The fact that this is not generally the case may in part be attributed to ongoing geological causes (the continual reworking of the alluvial valley by the river), but also to the fact that scholarly attention and research have been aware of the possibilities for only the last few years. The fact that there are the notable exceptions in northeast

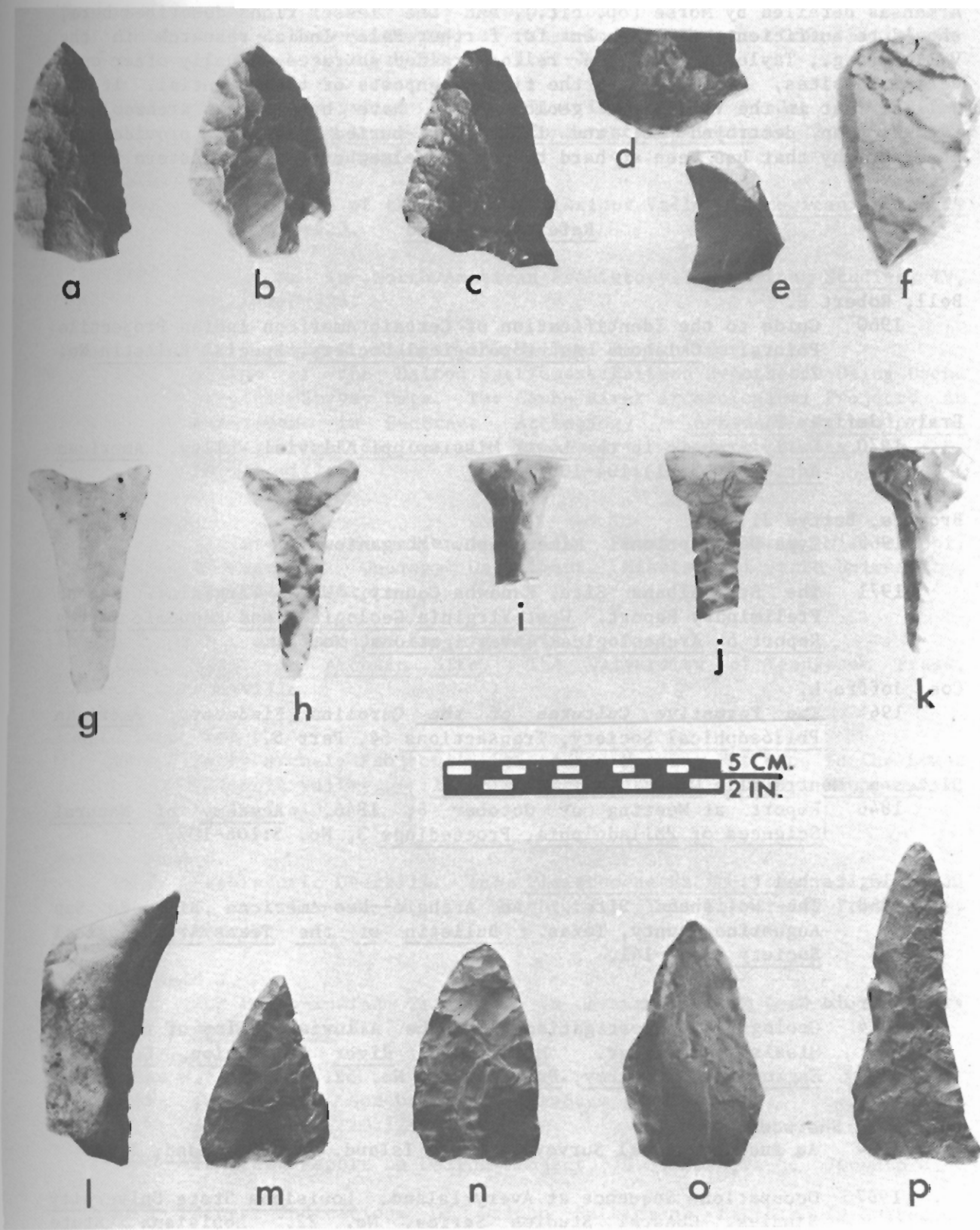


Figure 7. Late Paleo-Indian artifacts from the Yazoo Basin: a-c, unclassified corner-notched points with fluting; d-f, small flake scrapers, all with graver points (pointing right); g-k, drills; l, flake knife; m-p, bifacial knives.

Arkansas detailed by Morse (op. cit.), and the lesser finds described here, should be sufficient encouragement for further Paleo-Indian research in the Valley (e.g., Taylor 1975). The relict braided surfaces actually offer only deflated sites, but they are the first signposts of the potential. It may well be that in the Valley the geology will have helped the archaeology, rather than destroyed it, and in deeply buried deposits provide the stratigraphy that has been so hard to come by elsewhere in the eastern United States.

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ARCHAEOLOGY OF THE NATCHEZ BLUFFS REGION, MISSISSIPPI:
HYPOTHESIZED CULTURAL AND ENVIRONMENTAL FACTORS
INFLUENCING LOCAL POPULATION MOVEMENTS

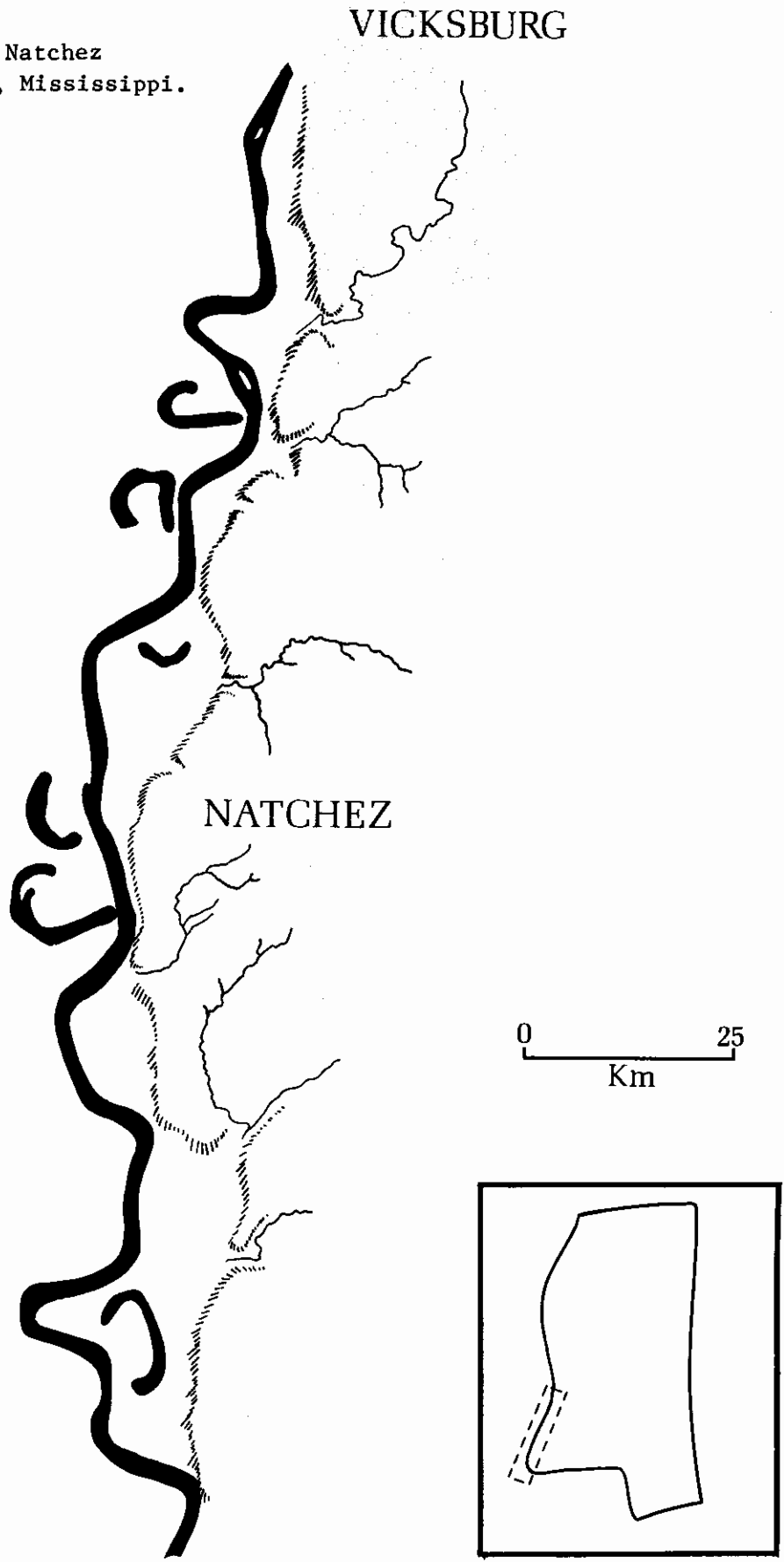
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In the summers of 1971 and 1972, the Lower Mississippi Survey of Peabody Museum, Harvard University, conducted archaeological investigations in the Natchez Bluffs region (Fig. 1). This is an archaeological zone comprising the loess bluff hills on the left bank of the Mississippi River between Vicksburg and the Mississippi-Louisiana border. Human occupation of this area was continuous from late Paleo-Indian times to the present. Although regional occupation was continuous, survey has revealed the popularity of certain locales during each cultural period, and sometimes marked settlement shifts have been detected in the various phases within each period. Settlement preferences were no doubt in many cases affected by historical factors, yet we believe that the patterns presented in this paper were directly related to changes in the social and physical environment.

Morris Davis, the Vice-President of the Geology and Geography section of the AAAS, at the turn of the 20th century, remarked that there was a direct relation between the meanders of the Mississippi River and the pattern of European settlement. He noted that the river wound back and forth through the swampy floodplain, only touching the bluffs at a few places, but at each place a town was formed (James 1975:11). Consequently, when the river shifted, these towns were abandoned. Harold Fisk, in his volume on the geology of the Lower Mississippi Valley (1944), reconstructed the courses of the Mississippi River as it changed through time. Roger Saucier (personal communication) has warned that Fisk's reconstructions are faulty in many respects, but it is possible that the sequence of channels for short stretches of the river are correct. In this paper we will examine the late prehistory of the Natchez Bluffs region and its relationship to the changes in the course of the Mississippi River in light of the historic settlement model presented by Davis.

Settlement studies have long been of interest to archaeologists. Leslie Spier's work on North American Zuni ruins at the beginning of the century (1917) was one of the first demonstrations of its utility, but not until Gordon Willey's publication of Prehistoric Settlement Patterns in the New World (1957) did the potential of these studies become readily apparent to all. There have been many new and exciting approaches to settlement archaeology since the late 1950s, particularly the recent borrowing of geographic models such as the principle of least cost (Fritz and Plog 1970; Gumerman 1971) and central place theory (Flannery 1972; Haggett 1965; Steponaitis n.d.). Another approach to settlement archaeology is to reconstruct completely the settlement patterns, from historic and ethnographic studies, of the aboriginal group(s) which occupied the region one is interested in. The purpose of this method is to extend the historic reconstruction into prehistory for comparison with the excavated remains. This method, which includes the investigation of community layout, regional

Figure 1. The Natchez Bluffs Region, Mississippi.



distribution of villages, daily, monthly, and yearly activity cycles, subsistence systems, etc., has a number of problems, the most obvious being the extent to which an analogy can be drawn. Continuity of a group in a region is often hard to prove.

Fortunately, continuity can be demonstrated archaeologically in the Natchez Bluffs region. The historic Natchez Indians were located in approximately the center of the region depicted in Figure 1. Their cultural roots in this area extended back at least to the beginning of the Plaquemine culture at about A.D. 1200, and undoubtedly to the beginning of the Coles Creek culture at approximately A.D. 700. Although there is excellent historic settlement information on the Natchez Indians, seemingly a perfect vehicle for forming ethnographic models to be tested by archaeology, there is a practical problem of the terrain in this area. The major obstacles are the rough topography and the kudzu jungle environment. A further difficulty confronted in site survey is the tremendous amount of erosion which has occurred over the centuries, as well as the recent economic shift of the area from cotton cultivation to livestock pasturage.

There were a number of reasons why investigations were conducted in the Natchez Bluffs region. One purpose was to fill in an archaeological gap. Extensive work had been completed in the Yazoo Valley to the north, the Tensas Valley to the west, and the Lower Red River Valley to the southwest; but, with the exception of some early spotty surveys by Brown (1928), Moorehead (1932), and Ford (1936), and some later excavations by Neitzel (1965), we knew very little about the prehistory of Mississippi's loess bluff hills. A second, more important reason was to examine the human utilization of the interface between diverse ecological zones--the floodplain of the Mississippi on the one hand, of which we already had some control, and the flat pinewood forests to the east on the other. A third goal of the survey, a product of our interest in French-Indian interaction in Colonial Louisiana, was to locate the historic Natchez Indian villages and associated French concessions.

The area of investigation was surveyed in the following manner: All of the bluff/valley interface, from Vicksburg to the Mississippi-Louisiana border, was covered by foot survey, up to a distance of approximately three miles from the edge of the bluffs. In addition, the entire drainage of St. Catherine Creek was subjected to an intensive foot survey. This was the 18th century home of the Natchez Indians.

The region was divided into eight arbitrary zones, zones which we felt may have had ecological significance to their occupants. The first five zones were termed Exterior, as they were positioned at the immediate interface of the Mississippi Valley and the geologically earlier uplands. The first zone consisted of the talus slopes situated beneath the bluffs, gently grading into the floodplain of the Mississippi River. The second zone consisted of the steep narrow ridge complexes located up to one-half mile east of the western bluff edge. The third zone included the broad flat areas arranged along the bluff edge and again stretching no more than one-half mile to the east of the edge. The fourth zone comprised the floodplains of secondary streams in those areas where they emerged into the Mississippi's floodplain. The fifth zone was the floodplain of the Mississippi River. The last three zones comprised the Interior region. The steep narrow ridges

overlooking the floodplains of secondary streams comprised the sixth zone. The seventh zone consisted of the floodplains of the secondary streams; and the broad gently rolling hills, intermediate to the other zones throughout the area, constituted the final zone. All of the Interior zones were arbitrarily set at greater than one-half mile from the interface of the Mississippi River and the western bluff edge.

In plotting the distribution of sites by phase and period, within these respective zones, we began to notice a curious settlement pattern developing. Early sites in the Natchez Bluffs region were fairly evenly distributed throughout the area, but by approximately A. D. 700 a radical change in settlement location preferences began to occur in the early phases of the Coles Creek period. Settlement patterns for each phase have been carefully examined in our research; but, for the purpose of this presentation, all of the Coles Creek components have been plotted on one map (Fig. 2). The construction of pyramidal mounds was a major innovation of this period. At least four, possibly six, Coles Creek mound complexes were discovered in the Natchez Bluffs region, the most impressive being the Smith Creek and Feltus sites. Both of these sites were located at the immediate interface of the Mississippi Valley and the upland region. The Feltus site had at least four mounds, these having been arranged around a plaza. The largest mound was situated on the bluff edge facing east. In attempting to understand why two very similar sites should have been built under almost identical conditions at about the same time, we hypothesized that the developments were responsive to a shift in the course of the Mississippi River. Sometime in the latter half of the first millennium A.D. as the Coles Creek culture was developing in the Lower Red River Valley and the Tensas and Yazoo Basins, the Mississippi River abandoned the Walnut Bayou meander belt, which it had occupied during channel stage 10, and established a new meander belt along the eastern margin of the valley close to the bluffs (Fig. 3). Its new course, channel stage 11, was reconstructed from Fisk's volume on the geological investigations of the Lower Mississippi River (1944). In this reconstruction, there were only five points at which the waters of the Mississippi approached the bluffs. It first came in contact at a point just below the mouth of Bayou Pierre. Several Coles Creek components were discovered in this area, but none of them anywhere near as impressive as the Feltus site located at the next juncture of bluff and river. After passing Feltus, the Mississippi swerved toward the west. It next hit upon the bluffs at a point where the present-day St. Catherine Creek emerges from the uplands. Our survey did not reveal a strong Coles Creek component in this area although Warren K. Moorehead (1932:160) reported that the Linwood site, with a 28 foot high pyramidal mound, had once been situated on the lower reaches of St. Catherine Creek at its junction with the floodplain of the Mississippi River. The Smith Creek mounds were built at the next place the waters of channel 11 washed against the bluffs. After passing Smith Creek, this ancient river course touched once more against the bluffs of our survey area. Approximately ten miles south of Smith Creek a large plateau was located at this contact point. It was not large enough to have supported a mound complex like that at Smith Creek or Feltus, but a rich collection of material was found on this plateau nevertheless. This was the At Last site; and it dated, almost exclusively, to the Coles Creek period.

If there is, in fact, a correlation between the course of the Mississippi River and the construction of major mound complexes, one would

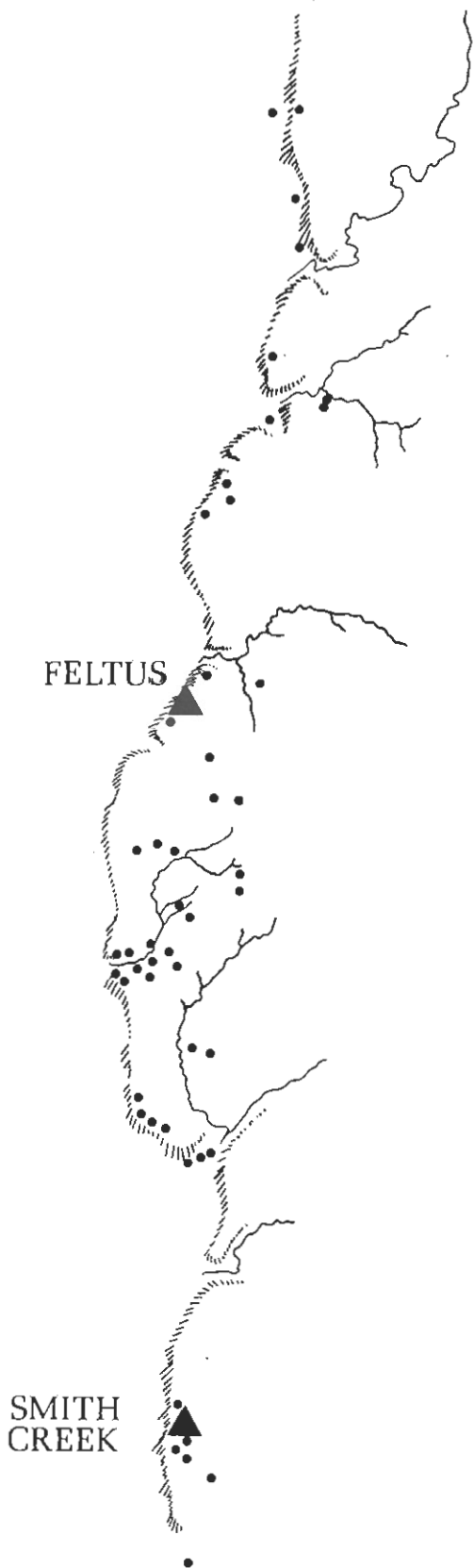


Figure 2. Distribution of Coles Creek Period Components.

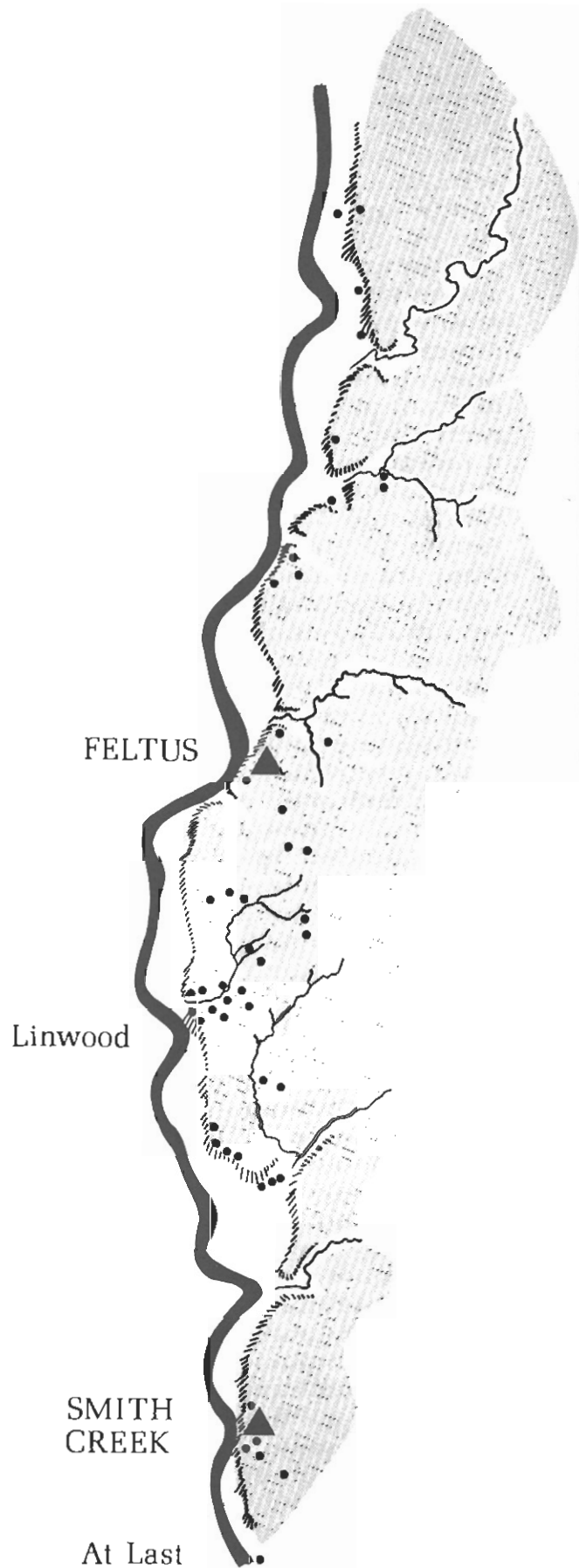


Figure 3. Distribution of Coles Creek Period Components with Contemporary River Course.

expect, by the historic settlement model presented by Davis, the same pattern to occur if the river changed its course. We believe that the Gordon phase, the last phase of the Coles Creek period, was in existence during channel stage 12 of the Mississippi River. This course had not changed appreciably from the preceding channel; but the following course, Fisk's channel 13, did differ markedly (Fig. 4). We believe that the river followed channel stage 13 during the Anna phase of the Mississippi period. Again examining the points at which the river made contact with the bluffs, we notice that the northernmost junction was accompanied by the construction of the Yokena mounds. The Yokena site consisted of at least three mounds and an associated village. Its principal mound faced towards the west. The next place the river approached the bluffs was just beneath the modern village of Grand Gulf. Several Anna phase components were discovered in this area but no major mound complexes. Their absence may be related to the fact that, with the exception of the Petit Gulf Hills, the Grand Gulf region is characterized by some of the most treacherous terrain in the Natchez Bluffs region.

Similar to channel stage 11, the next joining of the bluffs and river occurred directly below the mouth of Bayou Pierre. Although major Coles Creek mound construction was lacking in this area, for reasons of which we are unsure, the Anna peoples were kept extremely busy. Windsor, one of the largest mound complexes in the Natchez Bluffs region, was erected at this location. Windsor had four mounds, the largest one, greater than 30 feet high, being situated farthest to the west.

After passing Windsor, the stage 13 channel of the Mississippi swerved away from the bluffs not returning to them until a short distance above the modern city of Natchez. The river, hitting somewhat to the south of Feltus, made a small meander loop, touching the bluffs at two closely-spaced points. Between these points and sitting upon a large plateau overlooking the Mississippi Valley was the Anna site. Anna had eight mounds, six of which were arranged along the fringes of the plateau. Its principal mound, as at Windsor, was situated on the western extremity of the plaza.

Continuing to the south, the stage 13 channel of the Mississippi touched the bluffs twice more, once at a point between St. Catherine Creek and the Homochitto River and once at the lower boundary of our survey area. Although Anna phase components did occur, contrary to expectations they did not amount to much.

The breakdown in the settlement pattern of major sites being situated at river/bluff contact points became even more pronounced in the following Foster and Emerald phases of the Mississippi period (Fig. 5). The northern part of the Natchez Bluffs region still adhered somewhat to the pattern. The river moved a good distance from the Yokena site; and, as expected, materials later than the Anna phase have not appeared at this site. The Glass site, located to the north of Yokena, became a regional center during the Foster and Emerald phases; and the site was situated adjacent to the contemporary flow of the Mississippi River. Four, possibly five, pyramidal mounds were arranged around a plaza at this site, the highest having a present height of nine meters.

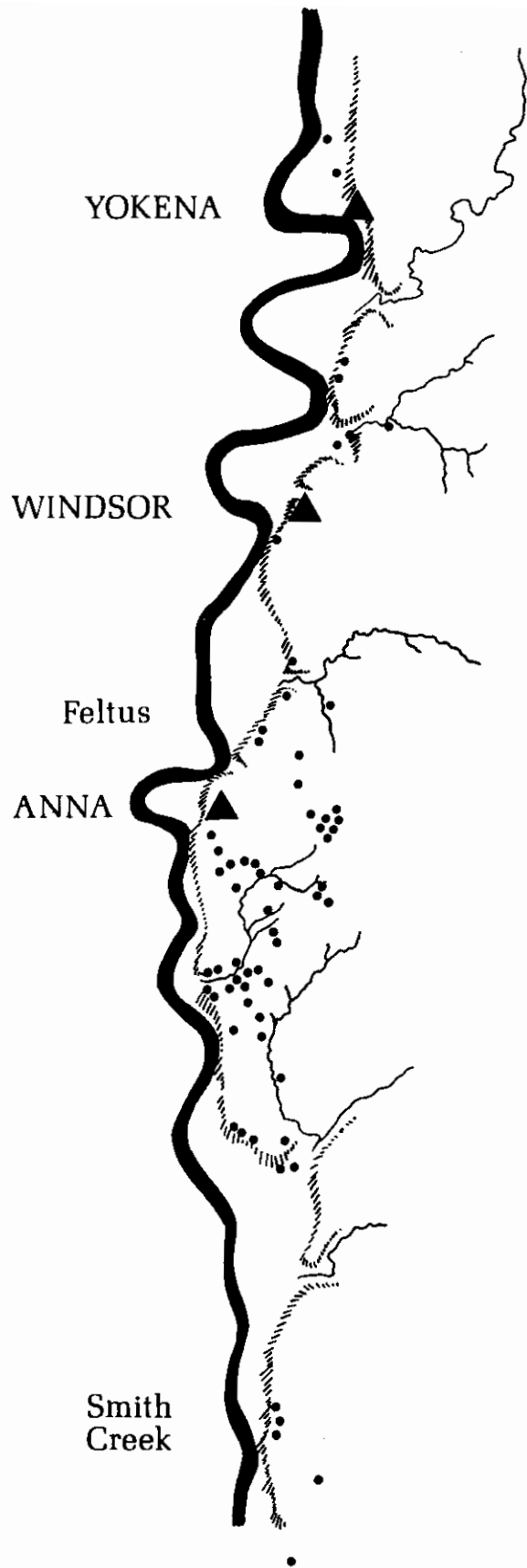


Figure 4. Distribution of Anna Phase Components with Contemporary River Course.

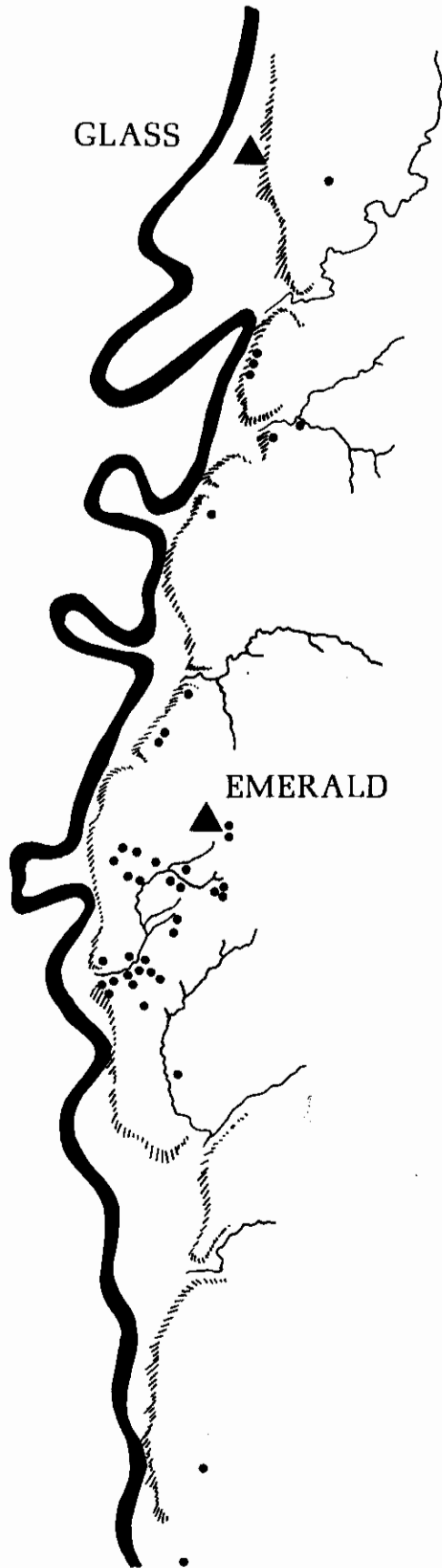


Figure 5. Distribution of Foster and Emerald Phase Components with Contemporary River Course.

Once the stage 15 channel moved below the Big Black River, the settlement pattern seems to have broken down. We see that the river still flowed past the Windsor site, but this site was only sparsely occupied during the Foster phase and was entirely abandoned by the Emerald phase. The Anna site, from what we can tell, was only sparsely occupied during these periods even though the river had not moved appreciably from its location. The Mississippi approached the bluffs an additional four times after passing Anna, and yet we discovered no settlement responses to these changes. In fact, both during and after the Anna phase, there seems to have been a marked move away from the river.

Depicted in Table 1 are the numbers of Interior and Exterior sites occupied in each respective phase of the Coles Creek and Mississippi periods. As stated earlier, Exterior sites are arbitrarily defined as occupations situated no farther than one-half mile from the bluff/Mississippi Valley interface. All sites located beyond this one-half mile limit have been classified as Interior. The percentages are represented graphically in Figure 6. We have also recorded two earlier phases in the figure to demonstrate settlement location continuity through the Coles Creek period. One can easily see that the percentage of Exterior and Interior occupation remained fairly constant and equivalent until the Anna phase. Although both the Interior and Exterior zones were well represented in the Anna phase, the shift toward Interior settlement undoubtedly began at this time. The shift increased markedly during the Foster and Emerald phases, reaching its climax in the historic Natchez phase.

<u>Period</u>	<u>Phase</u>	<u>Exterior (%)</u>		<u>Interior (%)</u>		<u>Total</u>
Mississippi	Natchez	6	19.4	25	80.6	31
	Emerald	10	23.3	33	76.7	43
	Foster	10	28.6	25	71.4	35
	Anna	28	41.8	39	58.2	67
Coles Creek	Gordon	11	45.8	13	54.2	24
	Balmoral	19	51.4	18	48.7	37
	Ballina	10	50.0	10	50.0	20
	Sundown	8	53.3	7	46.7	15
	Total	102		170		272

df=7
 $\chi^2=16.467$

Table 1. Relative popularity of Exterior and Interior settlement locations in the Coles Creek and Mississippi Periods.

We decided to test the statistical significance of the observed changes by applying the chi-square test. Our null hypothesis was: choice of settlement location (Exterior or Interior) was independent of cultural phase. Our alternative hypothesis was: choice of settlement location (Exterior or Interior) was dependent on cultural phase. Significance level was set at 0.05 for a nondirectional test. Therefore, with seven degrees of freedom, the null hypothesis would be accepted if the chi-square value was less than 14.0671. As shown in Table 1, the chi-square value was greater

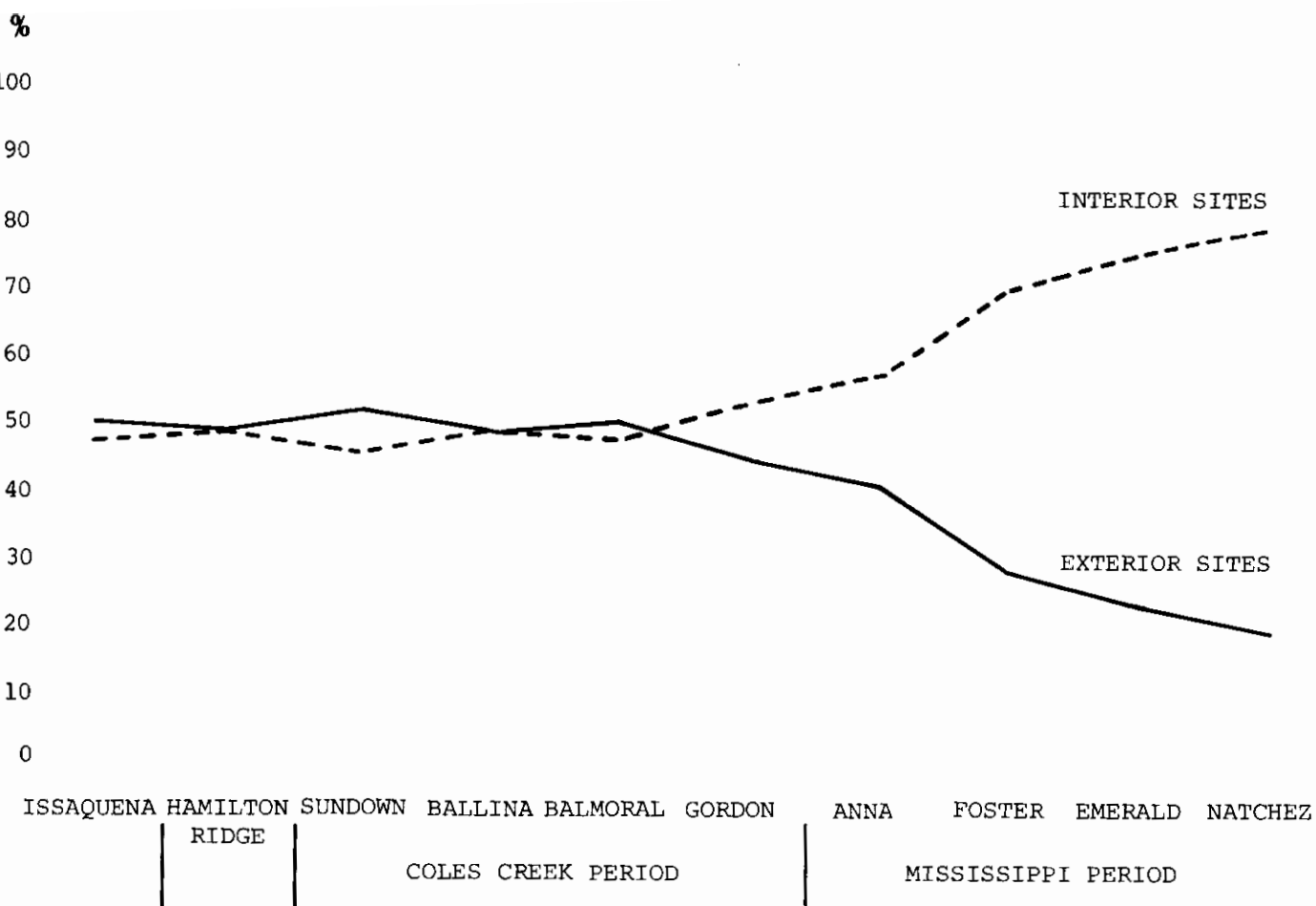


Figure 6. Popularity of Exterior vs. Interior Site Locations through Time.

than 14.0671, so the null hypothesis was rejected. This test does not demonstrate causality, but it does indicate that settlement location and cultural phase were dependent variables in the Natchez Bluffs region.

A closer look at the culture history of the area may shed some light on why there was a settlement shift toward the Interior during and after the Anna phase. It is interesting that the Emerald Site (figure 5), the second or third largest mound structure in North America, had its first stage constructed in the Anna phase. The site attained its florescence in the following Foster and Emerald phases. The site layout paralleled, in detail, the form of the abandoned Anna Site. Emerald also had its largest mound on the western edge of a broad flat plateau, and, similarly arranged along the periphery of the plaza, were a number of smaller tumuli. In many ways, the Emerald Site was almost a duplication of Anna. However, the sites differed in one major respect. Whereas the Anna peoples constructed their mounds on a natural bluff at the edge of the Mississippi Valley, the people who built the Emerald Site moved over seven miles inland, constructed an artificial bluff,

and then placed a series of mounds around its edge. For some reason, these Plaquemine people wanted their ceremonial center to look exactly like that at Anna, but they did not want it to be located at Anna. Perhaps an Interior position was more protected, or perhaps the positioning of a major site near the Natchez Trace, a route whose history extends far into the past, was designed to take advantage of interior trade. We really do not know, but, as demonstrated in De Soto's travels, a great deal of warfare was occurring in the valley during the late Mississippi period, and being located on the banks of the main thoroughfare may have been an invitation for trouble.

To no one's great surprise, it has been demonstrated in this paper that settlement patterns cannot be explained by simple cause-and-effect models. The direct relation between river/bluff contact and the location of historic settlements, observed by Davis, can indeed be seen at certain times in the late prehistory of the Natchez Bluffs region, but in any cultural ecological study man's relationship with other men must always be taken into consideration. Rowlands, in his article, "Defence: a Factor in the Organization of Settlements," tells us that in lowland forest areas such as New Guinea and parts of South America settlements are usually located near rivers, the rivers serving as the peoples' highways. However, the natives often place their settlements back a little and conceal them in a belt of vegetation for fear of raiders who use the rivers (1973:455). We believe a parallel situation was occurring along the Natchez Bluffs region in the late Mississippi period. Archaeology of Mississippian settlements and early Spanish accounts have revealed the frequency of warfare in the Lower Mississippi Valley. We believe that this phenomenon is reflected in the settlement pattern changes in the Natchez Bluffs region and, consequently, offer the hypothesis that the interregional social environment was peaceful at the time the major mound complexes were constructed along the ancient channels of the Mississippi River, that is, during the Coles Creek and early Mississippi periods.

As a final note, we may not really have to go too far into the past to test this particular hypothesis of the relationship of social environment to settlement preference. Again looking at the historic period, surely when the War Between the States engulfed the Mississippi Valley the people of the river towns, situated along the contact points of river and bluff, must have reconsidered their choice of settlement location. A study of their reactions under changing physical and social stimuli at times leading up to, during, and after the war would provide an appropriate independent test of the hypotheses we have presented in this paper.

Acknowledgments

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EXCAVATION STRATEGIES AND RESULTS FOR A SHALLOW LITHIC
SITE ON A PIEDMONT RIDGETOP

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During the summer of 1976, Winthrop College at Rock Hill, South Carolina, expanded its anthropology curriculum to offer a summer archaeological field school. Endeavoring to develop a responsible program, the department instituted a two-part class and field course. For direction in planning field operations, the college sought the advice and cooperation of the Institute of Archeology and Anthropology at the University of South Carolina in Columbia.

Although numerous archaeological sites occur in the Rock Hill area, a fact to which amateur collectors can readily attest, systematic archaeological investigations and information about the county were extremely limited. However, an archaeological survey for the Interstate-77 highway project which by-passed Rock Hill had just been completed under the direction of John House at the Institute. The survey had located a small Archaic site area approximately two and one-half miles from campus, and this site was selected on the basis of logistical and operational criteria for excavation by the field school.

This decision had several advantages. The students had an opportunity to perceive ongoing archaeological research in a multi-stage format. They could appreciate the background planning, survey analysis, model-building, and decision-making that were involved and that could not have been initiated and planned during a short summer session. They were also introduced to some of the current major legislative mandates for protecting and preserving archaeological resources, in this case, in the context of federal highway environmental impact statements.

As part of a multi-stage research project, the student's efforts would contribute significant information about the subsurface nature of this and similar sites prior to the mitigation studies proposed for sites adversely affected by the highway. This information would be valuable in anticipating forthcoming research and methodological problems, and the data would be used, incorporated by the I-77 researchers long after the closing of the Winthrop field school, which at this point was considered a pilot venture to gauge student and community interest. Thus, the decision seemed an appropriate compromise between an in-class or on-campus "dig" as has been recently advocated by Turnbaugh (1976) and setting up a program which would require elaborate follow-through commitments.

The site of 38YK25A, hereafter referred to as the Mt. Holly site, is located at the base of the north slope of one of the rolling hills of the South Carolina Piedmont. An intermittent drainage bounds the base of the slope, and a permanent water source in Taylor Creek lies 1000 meters to the west. This creek empties into the headwaters of Fishing Creek which flows into one of the piedmont's major drainages, the Catawba River. Definition of

the site area was based on a surface scatter of flaked lithic debris. A low density occurrence of this material trended northward for a couple hundred meters paralleling Taylor Creek. Locus A showed a higher density of materials concentrated at the base of the hill. The materials collected in a controlled sample from there included 6 quartz Savannah River points, 6 biface fragments, 3 biface blanks, 2 flake cores, 5 flake tools, several quartz chunks, and approximately 100 flakes, half of which were biface thinning flakes. On the basis of the Savannah River points, the site was culturally assigned to the late Archaic period, circa 2500 B.C.

Prior to the field school excavation, the site boundaries had to be operationally defined. After the site was initially surveyed and sampled, the highway department had bulldozed the I-77 route and strung the right-of-way fence. Only the western periphery of Locus A was left intact. A portion on the eastern side of the right-of-way fence, subject to construction traffic, still exhibited surface lithic materials. A small flat clearing on the west side of the fence, though exhibiting little in the way of surface material - due in part to the grass cover - was essentially undisturbed. Permission from the South Carolina Highway Department and the landowner, Mr. C. Albert Johnson, enabled the college to test both areas.

Although the resulting excavation area was arbitrary, its arbitrariness was less than that which might be assumed from the spatially extensive nature of Archaic archaeological remains. From a model of Archaic piedmont exploitation derived from the I-77 research analysis, the Mt. Holly site was proposed as a possible low-intensity habitation site (House and Ballenger 1976:105-106), low-intensity indicating the possibility of a camp where greater energy was captured and processed than expended in domestic activities. This possibility raised expectations of uncovering subsurface materials in such a setting.

A habitation function was supported by the following site attributes: its close proximity to water; the presence of some flake tools and debitage indicating processing/maintenance activities; and the relatively high density of cultural material compared to similar sites found in the corridor. As can be seen, knowledge of the content and range of the upland camp sites is relative and scarce. Since most of the investigations of piedmont Archaic sites have focused on major riverine stratified deposits, House and Ballenger (1976:79-86; 112-120) had first to interpret the archaeological record found in the upland piedmont between the major riverine areas. They concluded that the inter-riverine zones were regularly exploited but minimally inhabited. In general, the limited expression of archaeological materials at sites with one or more habitation attributes may indicate that they were the seasonally occupied, exploitative camps of small groups or extended family units. Certainly this site contained no overt features of intensive habitation such as rock hearths, fire-cracked rock, or midden stains. In fact only one site in the survey sample fits a more intensive mode of occupation, and if not the result of sampling bias, represents the low incidence of intensive habitation in the uplands (House and Ballenger 1976:102). Mt. Holly was distinguished from the quarry-workshop type site by the content of the flaking debris. Two preliminary indices for discerning lithic activity developed by House (House and Ballenger 1976:96-100) appeared to bear out this distinction; a relatively high degree of biface discard, calculated by dividing the number of biface fragments by the number of other flakes, suggested a high degree of

biface tool use, exhaustion, and breakage, whereas a manufacturing or early stage reduction index, obtained by dividing the number of chunks plus other flakes by the number of thinning flakes, was low compared to other sites. However, evidence of manufacturing debris might be expected to occur at the site given the ubiquitous presence of quartz in the piedmont. Outcroppings of quartz veins had been noted in the adjacent I-77 roadbed.

The majority of sites located on the I-77 survey fell into the category of extractive sites. Although today the site area is covered by second growth cedar and pine, its natural oak-hickory vegetation cover would have provided an amenable setting for the exploitation of a variety of plants and animals. Like the more limited extractive site assemblages, this site's assemblage included flakes and tools that indicate resharpening, breakage, and discard waste from light-duty cutting activities (House and Ballenger 1976:96). Separating purely procurement from processing/maintenance lithic debris is not yet possible, although the biface thinning flake model proposed by Goodyear and House may point the direction of further analysis.

Given all the ambiguity or noise in the analysis, due in part to the low sampling population and to the beginning status of research on piedmont exploitation strategies, the hypothesis that the Mt. Holly site was a low-intensity habitation site was formulated. The artifact density and the unknown reliability of the surface collection for predicting the total range of tool classes were major influencing factors. The excavation was intended to test this hypothesis with subsurface data. The working research hypothesis was the null hypothesis that the site was not a low-intensity Archaic habitation site; the implication of which was that the site would not exhibit any habitation or domestic features such as midden stains, pits, fire-cracked rock hearths, or functionally diverse activity areas.

In order to test this statement adequately, the natural processes affecting this site must be considered. The extreme time range, the extreme susceptibility of surface sites to erosion, and the Southeastern soils' rapid acidic obliteration of organic matter combined to lessen the likelihood of finding non-artifactual materials. In addition, land modification, since the historic period, involving such land use activities as grazing, clearing, and firing, has affected the surface configuration while plowing has affected the subsurface context.

Even so, a preliminary review of the area suggested some potential sight integrity. A slight drainage swale between the base of the hill and the site area might have minimized colluvial deposition from the hill. The hill, at the same time, may have deflected extreme lateral sheet washing. A discussion with the landowner revealed that the area had not been plowed for 30 to 40 years, a fact supported by the vegetation growth. It was expected, however, that identification of intra-site artifact patterning would provide the major testing base, especially as a temporary camp could not be considered to be structurally represented by houses or storage pits.

The mid and late Archaic exploitation pattern has been characterized as a diffuse economy by Cleland (1966), that is, a variety of natural resources were procured and processed using an expanded set of tool forms or a multi-function tool set. A seasonal camp might be expected to exhibit this diversity in resource processing, as well as in domestic activities.

Maintenance and manufacturing, flaked-lithic activities associated with a diffuse technology might also be expected to occur in camp. (Wood working tools or ground stone were not recorded for any of the I-77 sites, which may suggest highly curated behavior with a low chance of waste or loss occurring at a temporary campsite.) Use of "rare" or imported flaked-lithic material might also be represented. Such patterns would contrast with specialized extractive patterns of a limited range of activities and their associated tools, which could have been shaped from local quartz for immediate use and subsequent discard.

Recognizing diverse activity areas requires extensive spatial sampling to encounter tools associated in working areas. Recovering biface thinning flakes, which should appear in a statistically higher proportion at camps (Goodyear 1975:208), in an effort to indicate the nature of the maintenance and manufacturing activities, requires an intensive screening process. Therefore, a procedure to sample randomly the site area in 2-meter square units and to sift the dirt through a 1/4 inch mesh screen to permit recovery equal to an intensive surface collection was implemented.

An initial 11% sample for discovering working floors has been proposed by Goodyear (1975:212) on the basis of results from similar research at the Brand site in Arkansas. At this sampling level, placement of a 4 meter-square grid over the 784 square meter site area would have necessitated excavating 20 sample units. Even though the site was considered shallow because of the prominent bedrock outcrops, there was some doubt that the field school could open 20 sample units. As the most important concern was to define the presence of activity areas, each crew was to sample until an activity area was tentatively identified and then expand excavations in that area. The archaeological definition of an activity area would be based on an increase in artifact density, proximity, and/or the occurrence of an arbitrarily designated number of tool forms (in this case, 5) in the same level.

It soon became apparent that we would not have the labor power to sample at a level that would test the occurrence of the alternative hypothesis. The field work was conducted by myself and two students, Mel Jenkins and Jeanette Anderson, with an occasional assist from John House. Working in the afternoons for three weeks we totalled approximately 200 person-hours. Despite the heat, the clay, and the interviewers and visitors who often outnumbered us by a ratio of four or five to one, we excavated 10 square meters or 1% of the site area. With this limited testing we hoped to clarify methodological problems dealing with vertical and horizontal patterns of artifact distribution, disturbance factors, and relationships between surface and subsurface materials that would apply to the testing of this hypothesis at other similar piedmont sites.

The following conclusions and discussion of the results are preliminary as no formal analysis has yet been undertaken. First, the artifacts recovered in archaeological context were not culturally in situ. This conclusion was reached after examination of the soil profiles with Gene Hardee of the U.S. Soil Conservation Service.

Excavation of the 2-meter squares was conducted by natural stratigraphic levels in 1-meter square provenience units. The northwest meter squares were

quickly dropped in the first two sample units in order to discover the patterning of artifact occurrence relative to the stratigraphy. The cessation of the lithic debitage coincided with the appearance of the clay subsoil, 55 cm in one unit and 30 cm in the other. As the initial two squares had aligned on a common grid line, the third unit was opened on the same grid line to obtain an extended profile which might resolve the depth discrepancy. Subsoil was reached at 20 cm in this third unit, a depth which had been originally expected. The depth of the B horizon appears to increase westward towards the drainage, although the present surface is level.

The soil profile exhibited the general A-B-C horizon developed from essentially gabbro bedrock containing prominent quartz veins, one of which appeared in a sample unit. The C or subsoil zone was not consistent. The Mecklenburg clays with their characteristic red color were heavily influenced by the greater plasticity of the Iredell clays in one unit and replaced with sandier Enon subsoil in the deepest test unit.

The soil profile is a truncated one, in other words, the occupation surface of the Archaic period has long since eroded. The A horizon is a fairly shallow 5 to 8 cm. Had the majority of artifacts been recovered in the A horizon (and there was a tendency toward this occurrence in the shallowest unit), this pattern would have been understandable in terms of artifacts settling as the soil washed away. But their consistent presence, with seemingly no weight bias, throughout the B zone in the deeper two units was puzzling.

Bits of glass, ceramics, some metal, etc. also appeared in the B horizon, leading to a suspicion that the soils were culturally disturbed, perhaps by plowing. But the soils showed no other evidence of plowing. Early plowing in this type of soil should not have affected more than the upper 10 cm which would not account for the cultural materials found at the greater depths.

A darker zone of soil appearing just above the subsoil in these units has been interpreted as probable leaching from the A horizon. The B horizon may experience a fair amount of illuviation, that is, material deposition from the A horizon. This process would be augmented through the action of tree roots and burrowing animals, affecting the downward displacement of artifacts as well as soil humus and minerals.

A rather specific type of disturbance phenomenon was isolated in the deepest unit. This phenomenon, identified as wind-throw or felled trees, would affect the vertical and horizontal distribution of artifacts and may have contributed to the depth of the B horizon in this sample unit. Because the types of soils present at the site do not permit adequate tree root development, there is a moderate hazard of windfall occurring during excessively wet periods or during high winds.

While the vertical effect on materials is obvious, determining horizontal displacement is more speculative. One of the closest parallel studies on the effect of tree uprooting on archaeological materials, conducted by Wylie (1974) for the U.S. Forest Service, concerned specifically the impacts of pinyon-juniper chaining in Utah. He found an average of a 17 cm displacement in the direction of the fall which he considered a minimal figure because of a 50% flake loss. As it is hard to control the dragging

factor, this figure may coincide with maximum windfall displacement. There are many problems of comparison here, beyond the difference of natural versus mechanical actions to differences in soil and tree species. The problem deserves further investigation.

Can activity areas continue to be inferred archaeologically subject to these horizontal and vertical disturbances? Although the original occupation surface is no longer present, if the majority of displacement is assumed to be vertical, the levels could perhaps be collapsed to identify areal concentrations. By controlling provenience in 1-meter squares, certain meters were identified as "hot spots" during the excavation. Later examination of the screened material enabled us to determine tool concentrations not identified in the field. In at least one provenience unit (B horizon), 5 tool forms were counted; 1 flake tool, 2 point tip fragments and 1 small biface fragment were recovered in addition to a Savannah River point which was recorded during excavation. Fire-cracked rock, 10 chunks, 26 other flakes, and 41 biface thinning flakes all of quartz completed the provenience unit, which exhibited a higher artifact density than the surrounding 1-meter squares in the sample unit.

Second, the surface materials closely approximated the subsurface materials. This conclusion was borne out in two ways. Two 2-meter squares were opened in the "undisturbed" area where little or no material appeared on the surface, and 1/2 of a 2-meter sample unit was opened in the "disturbed" area where flakes were still showing on the surface. The disturbed unit was the shallowest but contained a higher density of materials, especially a preponderance of biface thinning flakes. This disturbed area and the original Locus A location were almost isomorphic. Artifact material declined slightly in the next sample unit to the west, tapering off in the deepest and far western sample unit.

The subsurface assemblage closely paralleled the composition of the surface assemblage. In terms of the number of points, bifaces, and preforms or blanks recovered, the counts were almost identical. Two new tool classes were added after the identification of 1 core tool and 2 flake cores. A number of small pieces of fire-cracked quartz were also identified although limited comparative, experimental work makes their identification tenuous. Biface thinning flakes continued to be the most prominent lithic debris, 60% of about a 500 flake total. They were fairly small (ca. 2 cm) and uniform in appearance.

About 10% of the biface thinning flakes were of materials other than quartz. Almost all of the material has been identified as Carolina Slate with a couple of representatives each of argillite and a tuffaceous material. A few of the Carolina Slate flakes were long and narrow supporting the suggestion by House (House and Ballenger 1976:130-133) that this type of resharpening would maximize the use life of this non-local and more technically efficient lithic resource.

These preliminary findings suggest that for late Archaic piedmont surface sites, a survey with controlled surface sampling will produce analytical information equal to or at least representative of that from limited testing and that excavation, with a smaller return per the labor involved, should be conducted only in view of explicit analytical goals.

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THE AUVERGNE MOUND AND THE BLUEGRASS PROJECT

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The Bluegrass Project

It is my purpose here to discuss, in general, the scope of work of the Tulane University Bluegrass Project in the summers of 1975 and 1976 and make specific comments about one site which has been excavated, the Auvergne Mound. The Bluegrass Project was established in the spring of 1975 to coordinate my own interests in the prehistory of the Inner Bluegrass Region of Kentucky with those of students, in the form of an undergraduate field school in archaeological field techniques. This was conducted for two summers, 1975-6. The project is now finished and no more work will be done under it, although the work of analysis and publication continues.

My own interest in the Inner Bluegrass Region of Kentucky was stimulated by two general questions. First, the area is poorly known archaeologically despite the fact that, through the work of William S. Webb and his associates, it has contributed a number of monographs, which, in total, have been critical in the definition of Adena Culture. The remainder of the archaeological sequence, however, is imperfectly understood. Secondly, I have become interested in burial variation, not specifically within any one time period, or region, but in general in Southeastern prehistory. A graduate seminar at Tulane in the Spring of 1975 underscored for me that Woodland burial in Kentucky -- here primarily Adena mound burial -- indicates greater variation in burial attributes than I have encountered in any other archaeological culture. Thus, with respect to the Bluegrass Project, I am interested in the excavation of cemeteries.

These interests conditioned both survey and excavation. First, survey has now identified 22 sites within an area of approximately 4,000 acres in Bourbon County (Bb county designation); there is no dearth of archaeological sites in the Inner Bluegrass. These sites, largely surface collections of lithic tools and waste materials, indicate occupation from the early Archaic through the late prehistoric. The area with which I have been most concerned appears to have been most importantly used during the late Archaic and Woodland periods. Indeed, there is an interesting concatenation of sites from the two periods which suggests a similarity in settlement system organization in both. No Paleo-Indian materials were located; however, deeply buried bones of Pleistocene fauna (horse) have been reported from the focal area, near stone tools which I have been unable to examine. Interestingly, Fort Ancient materials are not important in survey collections (here materials such as ceramics) although Fort Ancient burial structures do exist. It is my impression that Fort Ancient settlements are lacking because it is primarily "upland," perhaps unsuitable for Fort Ancient farming. There are important Fort Ancient settlements near this area, the Buckner Site south about five miles, and the Larkin site north about ten, both of them in the floodplain of the South Fork of the Licking River and its tributaries.

Four sites, all of them cemeteries, have been excavated or tested in the course of two summers' field work. In brief they are as follows. 1) 15 Bb 21, The Norton Clay Site: The Norton Clay Site, reported upon below by Mr. Richard Beavers, is a unique stone burial cist, probably preceded by a brief occupation of the cist locus unrelated to the burial activity. It is my impression that the earlier occupation is late Woodland, the cist Fort Ancient. This is supported by a C-14 date of 855 +/- 65 B.P., 1095 A.D. (UGa-1267), which apparently immediately precedes cist construction. Fort Ancient triangular points and parts of three individuals were contained in the cist and scattered through the stone surrounding it. We are interpreting the bones as scattered remains from the exposure, not burial, of at least three individuals, hence the unique nature of this site and its importance to the interpretation of Fort Ancient burial practices.

2) 15 Bb 38, the Claude Dungan Site: The Claude Dungan Site, just across Stoner Creek from the Norton Clay Site, is probably also a Fort Ancient cemetery. It consists of a stone cist, somewhat plow damaged but at least similar in general construction to Bb21, dissimilar in that it probably contained four burials, not exposures as in the case of the former. The analysis of this site is currently underway. Neither of these sites has revealed any Fort Ancient pottery, and in both stone tools and waste materials are rare. They are cemetery loci, nothing more.

3) 15 Bb 23 (unnamed): Bb23, on a bluff overlooking Stoner Creek and near the two sites above, is a low earth mound approximately 10 meters wide and two meters high. There was no material on its surface and it was tested with a single trench in 1976 in an attempt to establish its prehistoric nature and dispel a competing explanation that it had been the location of a pioneer house. This test revealed fragmentary human bone in a confused context; thus I must conclude that it is a burial mound which awaits future excavation.

4) 15 Bb 16, The Auvergne Mound: Bb 16 is a conical earth mound approximately 12 meters in diameter and 60 centimeters high. It was completely excavated in the course of the two summers and is considered in greater detail than before.

The Auvergne Mound

The Auvergne Mound is a small mound cemetery covering a single, central interment. Associated with this burial, and with activities subsequent to burial, are lithic waste flakes, a few stone tools, and potsherds. It is hoped that floral material will be recovered from samples which have been taken from the burial pit and other parts of the mound. Charcoal from the mound has been dated at 2945 +/- 225 B.P., 995 B.C. (UGa-1239). This date is extraordinarily early.

Activities at the site may be recapitulated as follows: 1) Pre-Mound Occupation: There is no evidence that there was an occupation of this locus prior to construction of the mound. We did recover evidence of an ephemeral village occupation around the mound, some distance from the mound skirt. This took the form of sherds, waste flakes, and an occasional stone tool. We were unable to define this occupation satisfactorily or to identify features, even though, corroborating local oral tradition, it was clear that the

surrounding area has never been plowed. Further, in the final stage of mound construction, sherds were included in the earth fill, at least one of which (a rim sherd) matched with a sherd from the surrounding village area. These indications suggest a pre-burial occupation near this mound, although not on the exact spot of the subsequent burial.

2) Burial: A single individual, probably adult, was buried (extended head to the east, feet to the west) in a shallow pit below ground surface. Immediately south of this burial pit, adjacent to it, was placed a single post. The burial was badly decayed and represented only by tooth enamel and faint, granular indications of major long bones. There was a single artifact association with this burial, a tight cluster of 18 unworked flakes of Boyle chert (from perhaps as much as 30 miles away) which I have interpreted as the contents of a small bag laid on the chest of the individual. There were at least two small sherds of Adena Plain pottery in the fill of the burial pit.

3) Burial Closure and Post-Burial Activity: The burial pit was filled and a low mound, about 30 centimeters high, was constructed over the burial locus. On the surface of this mound a fire or series of fires was built north of the burial pit. This contributed charcoal to the surface of the mound, from which the date has been taken, potsherds on the surface of the mound, all Adena plain, a few stone tools, and a light scatter of burned animal bone, possibly concentrated on the margins of the mound.

4) Final Burial Construction: Subsequent to this activity a final mound was constructed over burial and activity area. It was formed of earth scraped up from the vicinity of the mound and included sherds from the surrounding settlement. A shallow depression, from which mound fill was taken, was apparent around the mound itself before excavation. The mound was a maximum of 60 centimeters in height. The construction of this mound terminated prehistoric activity at this locus.

Significance of the Auvergne Mound

The significance of the Auvergne Mound at this stage of analysis is as follows: first, and with some trepidation because I have obtained but a single C-14 date, I suggest that this may be the earliest mound burial recorded so far in the central Ohio Valley. This cemetery is distinguished by the fact that, in contrast to later mound cemeteries in central Kentucky, human activity followed burials in the same locus and this contributed midden elements -- notably potsherds -- in situ above the initial and only burial. The mound is also distinctive in that the cemetery contains only one individual, representing one act of burial; unlike most later mounds, the Auvergne Mound was not an accretional, multiple use burial structure.

Secondly, I hesitate to classify this mound structure as "Adena." I do not see this term as appropriate given the typological evidence discussed in brief below. It is my opinion that the time has come to develop new descriptive-integrative concepts for the central Kentucky Woodland sequence. This is underscored by the early date for the Auvergne Mound, if it is indeed a valid determination.

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The artifact sample from the Auvergne Mound makes neither a good "early" nor "late" Adena complex. Lacking are artifacts or fragments of mica or copper, a fact which might argue for the validity of its early C-14 date. Added to this, there is one crude, triangular sandstone palette, not unknown in Adena and even considered by some as an "early" trait. However, lacking are typically Adena projectile points, either of the type Adena Stemmed or the type Robbins Stemmed; the several, large, thick and generally crude projectile points which have been recovered lack well defined parallels in currently identified Adena, early or late.

The entire pottery sample of 306 sherds has been identified as Adena Plain. Implicit in that typological identification is a date probably post-400 B.C. by current approximations, possibly as late or later than the 150 B.C. date from the Morgan Stone Mound in adjoining Bath County. At this point it must be emphasized that the dating of, even the identification of, the ceramic type Adena Plain is not at all clear. The only closed association of date and pottery type comes from Morgan Stone -- 150 B.C. (Webb 1941). It is clear that the type is also considerably older than that date and that it persists, at least as defined, into the Christian era.

Despite these questions concerning the overall placement of Adena Plain, it is candidly admitted that there is a strong similarity between vessel shape in the Morgan Stone context and the Auvergne Mound as estimated from rim and basal sherds (Webb 1941:266, Fig. 17). If both the Auvergne and Morgan Stone dates are valid, it must also be allowed that certain attributes of ceramic production during the intervening period were remarkably conservative.

No Fayette Thick pottery has been recovered from Auvergne. It has been informally suggested that Fayette Thick should be earlier than Adena Plain. There are two questions concerning the temporal relationship between these types, one arising from the excavation of the Auvergne Mound, the other from reconsideration of the survey data on central Kentucky Adena. First, in the Auvergne Mound sample, thick basal sherds -- by their thickness and tempering (but lacking cord-marking) -- might be classified as Fayette Thick. Yet they join with sherds which are thinner and comfortably Adena Plain. The typological division between these types may be less clear than as it is presented. Secondly, no stratigraphic evidence exists from the Bluegrass to indicate a temporal sequence for the two types. Both occur in surface collections made from Peter and Grimes Villages (near the Mt. Horeb "ceremonial circle" complex in Fayette County) by William S. Webb and associates. Given these two sites alone, the frequencies of these types vary. This need not indicate, however, that they are sequential in time.

The question of the classification of the Auvergne Mound burial complex and its integration into what is already known of Bluegrass mound building aside, the work of the Tulane Bluegrass Project has been able to contribute little to a vexing problem which remains for the Woodland Period. The Auvergne Mound was located in a field which has never been plowed, this was apparent from the excavation of the mound and the sampling of the surrounding area. We were unable, however, to recover convincing evidence for the structure of the early Woodland settlement associated with this century. In

this instance we cannot plead that ephemeral evidence has been destroyed by the plow, certainly the case for many sites in central Kentucky. It is my hope that floral material will be recovered from the soil samples from the mound excavation. These, at least, will provide certain types of evidence for early Woodland settlement in the area which we have not had before.

The evidence for settlement around this mound consisted primarily of concentrations of potsherds away from the mound skirt. Associated with these were a few stone tools, some waste material. Faunal material was limited to a few scraps of deer teeth. The mound was built on a field of Maury Silt Loam, a deep, dark soil characteristic of many of the more level areas of the Inner Bluegrass. It was not possible to identify features such as postmolds in this soil, if they indeed existed. An attempt was made to strip a portion of the surrounding area which failed, principally because the machinery which was used was too light. Because all midden material was concentrated in the upper 10 centimeters of the soil profile, I doubt that stripping would have been particularly effective in locating site features, had it been possible. I remain at a loss to develop a strategy for the excavation of this and similar settlements and, lacking the evidence which it might produce, can offer no new information on the non-mortuary aspects of early Woodland occupation. It must be remarked, however, that lithic materials, including types identified in the Auvergne Mound, occur widely in surface collections from this portion of Bourbon County; potsherds generally do not. Occupation of this "upland" area was extensive if not intensive. Furthermore, the surface collections generally contain lithic materials from both Archaic and Woodland periods, from the same sites. A similarity in settlement pattern for the two periods seems indicated. Significantly, Fort Ancient materials are not important in these collections; the small triangular projectile point is indeed rare on these same sites. This fact might suggest that the significant changes in settlement pattern in the Bluegrass occurred at the end of the Woodland period, not at the beginning. They would, of course, be associated with the developing dependence upon imported cultigens, principally maize, which is only really apparent in the area in the late prehistoric.

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Bluegrass Project C-14 Dates

15 Bb 16, The Auvergne Mound UGa-1239 2945 +/- 225 B.P.: 995 B.C.

Kentucky

Bourbon County

Lat. 38°10'; Long. 84°13"

Portion of a larger sample (Field Spec. #55) from activity surface above central and only burial (extended inhumation in shallow pit). In close association with large sherds of Adena Plain pottery. Location in grid

site: 65.58 m. North x 51.35 m. East; El. 98.38 m. All pottery from the site is Adena Plain, other diagnostic early Adena artifacts occur. Date is somewhat earlier than expected.

15 Bb 21, The Norton Clay Site UGa-1267 855 +/- 65 B.P.: A.D. 1095

Kentucky
Bourbon County
Lat. 38°11'; Long. 84°11'

Charcoal sample (Field Spec. #50) from base of lowest rock level. Sample from interface between upper and lower component of the site, felt to be closely associated with upper component of the late Woodland occupation, possibly pre-dating the Ft. Ancient burial cist. Location in site grid: 47.70 m. North; 49.63 m. East; El. 102.32 m.

THE OWL HOLLOW ARCHAEOLOGICAL RESEARCH PROJECT: NEW DATA ON LATE
MIDDLE WOODLAND SUBSISTENCE AND SETTLEMENT IN LOWER MIDDLE TENNESSEE

James E. Cobb
University of Tennessee

The Owl Hollow Research Locality

The Owl Hollow Archaeological Research Project centers on the headwaters of the Elk and Duck rivers in Franklin, Bedford, and Coffee Counties in south central Tennessee (see Fig. 1). These counties are characterized physiographically by contrasting, dissected terrain formed by resistant cherty Mississippian limestones of the Eastern Highland Rim and erosion of less resistant Ordovician limestones of the Central or Nashville Basin. The drainage systems of the Elk and Duck Rivers -- agents responsible for reduction of the Eastern Highland Rim -- have formed relatively broad floodplains in the Central Basin which become more V-shaped as one approaches the headwaters of the main rivers and their major tributaries in the Eastern Highland Rim. The topography of the area has strongly influenced local environments by creating contrasting ecotones that are in relatively close proximity. Faulkner and McCollough (1973) have characterized this area as an ecotone which can be divided into four biogeographical zones: floodplain, older alluvial terraces, valley slopes and bluffs, and upland. In general, these four zones can be subsumed under two major vegetational zones: (1) a lowland vegetation zone with concomitant riverine floodplain and terrace plant and animal species and (2) an upland vegetation zone with inclusive forest, forest edge and grassland adapted plant and animal species. The diversity of the landscape and the range of plant and animal species prevalent in this ecotonal area have strongly influenced previous research designs for archaeological salvage in both the Tims Ford and Normandy reservoirs. Emphasis in recent years has been placed on the explanation of exploitative subsistence schemes and settlement systems and their articulation with the local environment. This ecological approach, although somewhat limited in the past by reservoir construction parameters and funding, has substantially increased our knowledge of complex regional adaptations during the late Middle Woodland period.

Owl Hollow Research

Salvage excavations began in south central Tennessee in 1966 in conjunction with the construction of the TVA Tims Ford Reservoir on the upper Elk River (Fig. 1, Tims Ford Locality). This work led to the identification of the Middle Woodland Brickyard and Owl Hollow archaeological phases (Faulkner, ed. 1968). The excavation of the Brickyard site in the reservoir proper produced data which defined the early Middle Woodland Brickyard phase. The Brickyard phase is now included in the early Middle Woodland

McFarland phase represented by numerous sites in the Normandy Reservoir (see below). The Owl Hollow site (4OFR7) -- dominated by a seven acre black, trash-filled midden ring and abundant cultural remains -- was located in the secondary impact area of the Tims Ford Reservoir and was not eligible for excavation in the 1966 project. The location of this site on a small tributary stream and the distinctive and heavily concentrated midden and cultural material found at this site led Faulkner (1968) to hypothesize a late Middle Woodland affiliation for these cultural remains. From the analysis of a surface collection from this site, Faulkner (1968) suggested the Owl Hollow phase had a temporal placement between the Brickyard (McFarland) and the Late Woodland Mason phases in the upper Elk River Valley. This placement was based in part on the presence of limestone-tempered plain and simple stamped pottery and especially a lanceolate "spike" projectile point.

In 1971, TVA began construction of the Normandy Dam on the upper Duck River (Fig. 1, Normandy Locality) near the town of Normandy, Tennessee, which is about 12 linear miles northwest of the Elk River and Tims Ford Reservoir. Unlike archaeological salvage in the Tims Ford Reservoir, TVA's Normandy Archaeological Project was well funded and provided for extensive survey, testing and excavation over a period of four years. In conjunction with the primary research design, Woodland sites chosen for testing and excavation were those considered relevant to explicate settlement and subsistence patterns of Middle Woodland groups that had inhabited the upper Duck River Valley from ca. 100 B.C. - A.D. 600. Two archaeological phases, termed McFarland and Owl Hollow, were defined for the Middle Woodland period in the Normandy Reservoir with a temporal placement ranging from 100 B.C. - A.D. 300 for the early Middle Woodland McFarland phase and A.D. 400-600 for the late Middle Woodland Owl Hollow phase (Faulkner and McCollough 1973; 1974). Testing and excavation of McFarland phase sites indicated that this phase was rather widespread throughout the upper Duck Valley while the later Owl Hollow phase sites only occurred in the lower reservoir zone which is marked by a broad riverine floodplain. Although there is good evidence for cultural continuity throughout the Middle Woodland period, by around A.D. 400 there is evidence of a major shift in settlement indicated by development of unique, concentrated community patterns in the upper Duck River lowlands. Archaeological evidence for this shift in settlement has been documented at three Middle Woodland sites in the Normandy Reservoir - 4OCF108, 4OCF111, and 4OCF32 - where density of occupation was delineated by dark, organically enriched midden areas with concentrated material remains such as lanceolate spike points, limestone-tempered pottery, and greenstone celt fragments occurring in the plowzone (Faulkner and McCollough 1973; 1974).

During extensive excavation, these three sites revealed large structures with a unique arrangement of two centrally-placed earth ovens between four rectangularly-placed central support posts, circumscribed by an oval arrangement of shallowly placed exterior posts. Four of these "double oven structures" were defined in the Normandy Reservoir and radiocarbon dated ca. A.D. 400-500 which places their construction in the late Middle Woodland or Middle Woodland II period. The double oven structures in the Normandy Reservoir have been assigned to the Owl Hollow phase on the basis of the tight series of radiocarbon dates and associated diagnostic material remains. Community patterning for Owl Hollow phase settlements in the lowland zone indicated the establishment of single or multiple houses on the

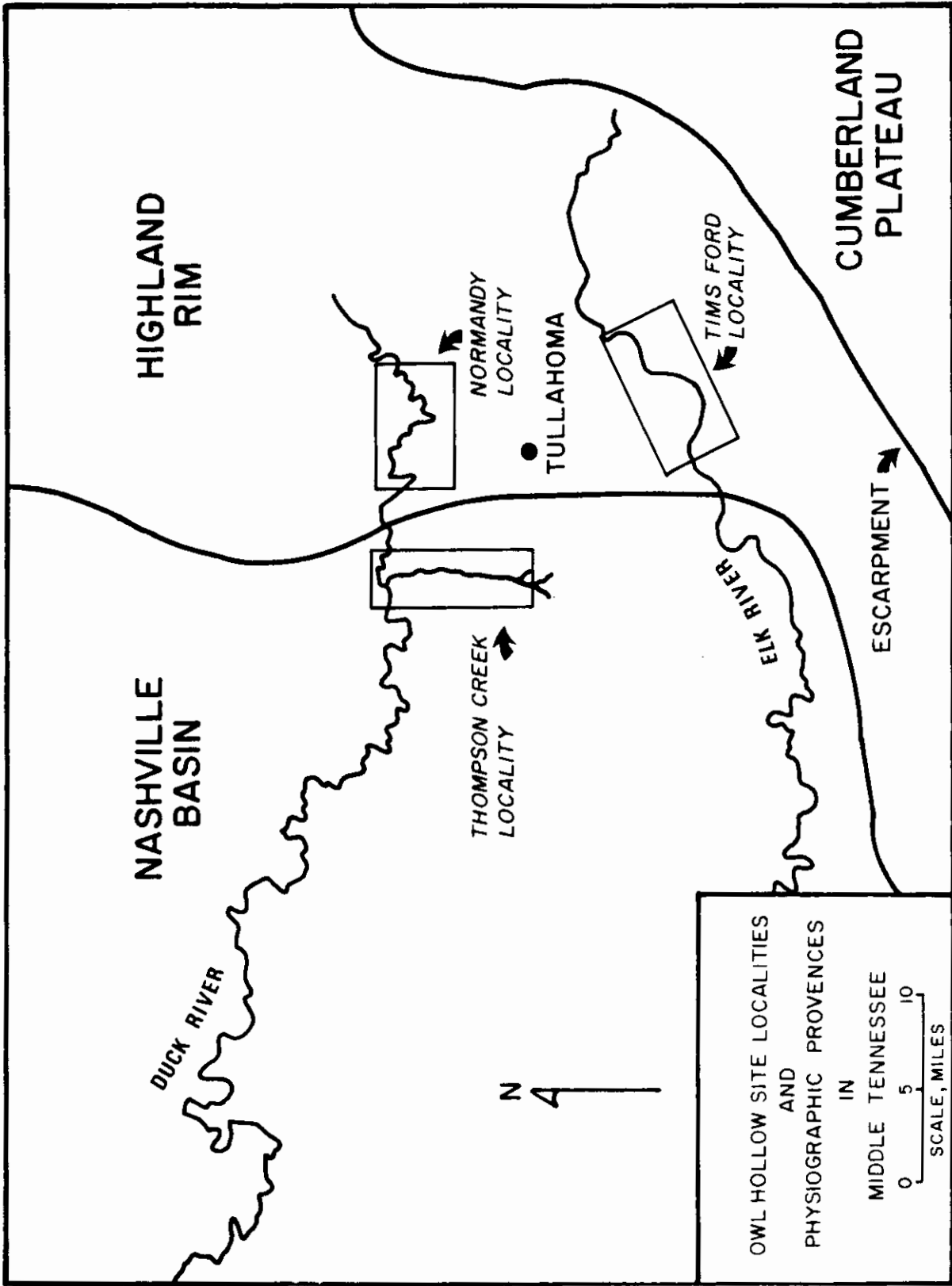


Figure 1. Owl Hollow localities and physiographic provinces in Middle Tennessee.

first terrace above broad floodplains. It is believed the double oven houses functioned as winter lodges due to their substantial construction and interior placement of large earth ovens. Adjacent to these winter lodges were smaller rectangular or oval structures lacking ovens as on site 40CF108 or clusters of postholes that suggested rebuilding of such structures on sites 40CF111 and 40CF32. These lighter built structures were considered to be summer houses (Faulkner and McCollough 1974).

Seasonal occupation of these settlements, however, could not be adequately demonstrated from the recovery and analysis of plant and animal remains. The possible summer structures produced no organic material on which to base seasonality. Recovery of faunal and charred botanical material from the double oven houses was limited either by preservation or sample bias. Although the earth ovens are large and impressive features -- averaging four and one half feet in diameter and one and one half feet deep -- the quantity and variety of identifiable plant and animal remains recovered have not been great (Faulkner et al. 1976:234). Water screening and flotation used on the fill from all structural excavations have recovered primarily charred wood and hickory nut shell. However, recent and complete analysis of the total floral sample from the earth ovens in Structure I on site 40CF111 provided the first evidence of a cultigen, squash (Cucurbita pepo), in a late Middle Woodland context in the Normandy locality. Herbaceous seeds of possible economic importance identified from the 40CF111 earth ovens include cleavers (Galium aparine L.) and chenopodium. Faunal remains from the Normandy earth ovens have generally been fragmentary and in poor condition due to soil acidity. Faunal analysis indicates the consumption of aquatic, lowland, and upland species, but this list is not inclusive. Evidence for deer and turkey is minimal while other small mammals generally considered food sources are missing from the analyzed sample. Based on available floral, faunal and structural evidence, a hypothetical settlement pattern for the Owl Hollow phase is year-round residence by at least part of the population on lowland (first terrace) habitation sites. Possible community patterning is suggested to be dual summer and winter dwellings built contiguously on these permanent village sites (Faulkner and McCollough 1974; Faulkner et al. 1976).

Concomitant with Normandy Project excavations, additional Owl Hollow phase sites were surveyed on the main channels of the Elk and Duck rivers outside the reservoirs, and numerous sites were recorded many miles up the major tributaries of these streams. Surface survey of these sites recorded heavy concentrations of material remains associated with dark, organic-rich middens. The marginal location of several of these sites -- in the uplands zone or bordering the Cumberland Plateau on small second and third order streams -- suggested a more complex settlement pattern than that observed in the lowland zone of the Normandy Reservoir. As additional Owl Hollow sites were recorded, it became obvious that problem-oriented work on selected sites would be required to further clarify the Owl Hollow phase subsistence and settlement patterns in the Eastern Highland Rim.

The Tennessee Valley Authority and the National Park Service funded all archaeological work in the reservoir construction areas. Although this work generated hypothetical settlement models about Middle Woodland settlement and

subsistence patterns in the Eastern Highland Rim, these hypothetical models could not be adequately tested due to restrictive funding beyond the reservoir precincts. Settlement patterns such as that hypothesized for the Owl Hollow phase were not confined to currently imposed, artificial reservoir areas. Therefore, in December 1975, a research proposal was submitted to the National Science Foundation for additional financial support for the excavation of these Owl Hollow phase sites outside the reservoirs. The goals of the proposal centered on the dating and definition of settlement types, identification of the subsistence base, and the recognition of seasonal scheduling. A grant (NSF BNS76-11266) was received from the National Science Foundation to fund the Owl Hollow Research Project for 16 months.

This project began in December, 1975, when certain Owl Hollow phase sites in the upper Elk and Duck river drainages were selected to test the hypotheses generated in the earlier reservoir salvage. Crucial questions to be considered included:

- (1) Were Owl Hollow sites permanent year around settlements with a seasonal shift from winter lodges to summer lodges, or
- (2) were these seasonal sites occupied in the winter with summer sites being found on the tributary streams or in adjacent river valleys?
- (3) Were the Owl Hollow type site (40FR7) in the upper Elk Valley and ancillary sites on tributary streams directly tied to seasonal settlements in the upper Duck Valley, or
- (4) were the Owl Hollow type site (40FR7) and ancillary sites independent entities and temporally separated from the Duck River sites, perhaps representing a late shift of Owl Hollow populations to tributary streams due to internal population pressures or external pressures from Late Woodland (?) groups?
- (5) Are the floral and faunal remains in the winter lodge earth ovens representative of a subsistence pattern based primarily on wild plant and animal foods, or
- (6) are these remains in the winter lodge earth ovens only representative of a seasonal cycle with food production being important during the warm season?
- (7) Was the apparent increase in population during the Owl Hollow phase caused by more intensive horticulture including possible introduction of maize, or
- (8) was this increase in population due to other cultural factors?

Phase I of the Owl Hollow Research Project involved testing late Middle Woodland sites 13 miles below the Normandy Reservoir on Thompson Creek - a first order tributary of the Duck River (Fig. 1, Thompson Creek Locality). Ten days were spent testing three major sites located along a 12 mile stretch of this stream. The Shofner site (40BD55) is located one mile above the confluence of Thompson Creek with the Duck River and overlooks a broad

floodplain; site 40BD51, the Bomar site, is located six miles up Thompson Creek along the narrowing first terrace of the creek; and the Raus site (40BD46) is located on the last expanse of creek terrace before the creek descends from the Eastern Highland Rim into the Nashville Basin. The choice of the Thompson Creek locality for testing was as much influenced by the intensive occupation of these sites as their geographical location relative to the Duck River floodplain and the Eastern Highland Rim. A primary objective was sampling undisturbed features for the radiocarbon dating of the Thompson Creek occupation and the recovery of settlement and subsistence data from the different econiches in which these three sites were found. The above objectives were accomplished on a limited scale at the Shofner and Raus sites.

Since there was only limited testing on the Shofner and Raus sites, numerous data were not recovered. Structural patterns were not encountered on either site. However, abundant subsistence data recovered was from the analysis of the contents of a large storage/refuse pit and a two foot thick midden on the Shofner and Raus sites, respectively. The storage facility on the Shofner site was radiocarbon dated at A.D. 565 +/- 60 (UGa-1341) while Level IV of the Raus midden had a date of A.D. 615 +/- 60 (UGA-1340). These dates are slightly later than the latest C-14 dates for the Owl Hollow phase in the Normandy Reservoir, but are within the estimated age range of the Owl Hollow phase.

The Shofner subsistence data suggest both warm-season exploitation of a riverine and floodplain habitat and cold-season exploitation of the surrounding uplands. The storage/refuse pit contained in excess of 300 lbs. of aquatic gastropod and pelecypod shells, several species of fish, aquatic turtles, snakes, egg shell from a large bird (turkey?), and beaver (Castor canadensis). Identified seeds of economic importance were maygrass (Phalaris caroliniana), chenopodium (Chenopodium sp.), amaranth (Amaranthus sp.), knotweed (Polygonum sp.), and purslane (Portulaca oleracea); maygrass is an annual that matures from May-July. Analysis also revealed the "possible" presence of maize (Zea mays), although the sample was judged too small and fragmentary for a positive identification (personal communication with Dr. Richard Yarnell). Inclusive in the large storage/refuse pit, however, were additional refuse remains which suggest fall-winter exploitation of an upland habitat. Predominant wood charcoal is from species of (1) hickory; (2) white oak and red oak groups; (3) black walnut; (4) chestnut; (5) hackberry; and (6) elm. Charred nut remains correspond to the primary wood species as hickory, acorn and walnuts are the most prevalent. Remains of fox squirrel (Sciurus niger), white-tailed deer (Odocoileus virginianus), eastern cottontail rabbit (Sylvilagus floridanus), and turkey (Meleagris gallopavo) suggest an upland habitat. Not only these material remains but also the presence of such a substantial and formal storage facility -- 1.35m x 1.29m x .5m deep -- suggest food storage activities over a prolonged period, perhaps fall-winter.

Determining the seasonality of the Shofner site occupation(s) is obviously limited from the available data; however, based on the analysis of the refuse from this large multipurpose feature, it is tempting to suggest year-round occupation of the site. This interpretation is based on evidence of refilling an empty fall-winter storage facility with refuse discarded from

spring-summer subsistence activities. Tentatively, it appears that the Shofner site was a year-round habitation locus (probably for several continuous years) situated in an optimal area for the hunting and collecting of riverine, lowland, and upland species of plants and animals as these became seasonally available and the practicing of incipient horticulture on the broad floodplain adjacent to the site.

Data from the analysis of the Raus site midden deposits indicate a sample not unlike that recovered from Shofner; however, a more predominant seasonal upland forest exploitation is suggested. Botanical samples from midden levels II-IV are predominantly acorn and hickory nut remains, although maygrass, chenopodium, amaranth, knotweed, purslane, and cleavers seeds occur in quantities that suggest economic importance. Additional remains include grape seeds, sumac seeds, and water lily pods. Upland and lowland species of hickory, oak, catalpa, and sycamore were identified from wood charcoal analysis. Faunal remains suggest both an upland and lowland habitat for such mammals as fox (*Urocyon cinereoargenteus* or *Vulpes fulva*), groundhog (*Marmota monax*), squirrel, cottontail rabbit, white-tailed deer, turkey, and raccoon (*Procyon lotor*) with a small sample of aquatic mammals and fish present, e.g. beaver, catfish and suckers. The faunal sample and identifiable species were generally consistent from midden levels II and IV, while Level III -- essentially deposited by clearing and dumping organic-enriched refuse from earth ovens -- contained predominantly plant remains; e.g. abundant acorn. Seasonality of the Raus site occupation(s) -- based on a selected sample from an accretional midden -- strongly suggests a fall and possibly winter occupation. However, this may be a biased sample since surface surveying has also revealed abundant and clustered gastropod and pelecypod remains at the site. Apparently, the Raus site was also an optimal location for hunting and collecting seasonally available foodstuffs from lowland and upland areas as well as aquatic species from adjacent Thompson Creek. The localized and extensive midden relates directly to earth oven activity associated with processing fall-winter foods. The extensive and localized aquatic shell concentrations suggest a warm season exploitation of the Thompson Creek resources. Both midden and shell concentrations are distributed non-randomly throughout the defined site area suggesting separate refuse discard (structure?) locations.

Following the extensive testing of these Owl Hollow sites in the Thompson Creek locality, emphasis was shifted from the upper Duck River drainage to the contiguous upper Elk River Valley in the vicinity of Winchester, Tennessee, for Phase II of the Owl Hollow Research Project. Full scale testing and excavation began June 23 and terminated August 19, 1976, on the Owl Hollow type site (40FR7; Fig. 1, Tims Ford Locality). Eight weeks were spent by the University of Tennessee archaeological field school on a small portion of this seven acre site enclosed by a black midden ring. Briefly, our excavation strategy involved transecting the site east-west and expanding north-south in four primary areas that had a midden deposit or significant clusters of postholes and features; the Western, Central, North Midden and Eastern Expansion areas (Fig. 2). The plowzone was removed by hand excavation from a total of 203 2 X 2 meter units revealing 150 features and 556 postholes. Recovery of subsistence and settlement data was extensive from three of the four primary areas under investigation. Two structural loci in the Central and Eastern Expansion areas were excavated and the North Midden deposit was extensively sampled.

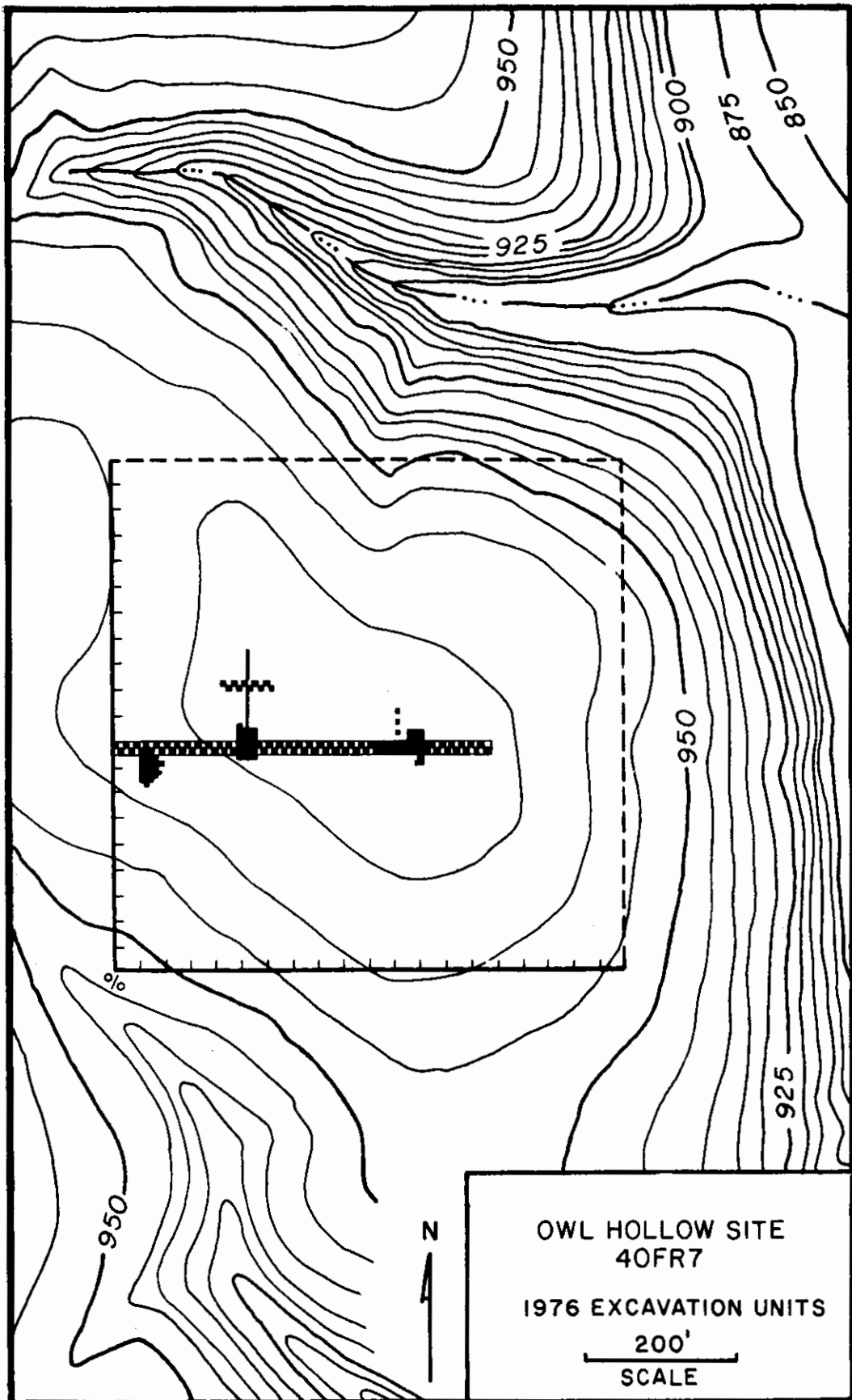


Figure 2. Owl Hollow site, 40FR7, 1976 excavation units.

A tentative circular-to-oval structure ca. 5 meters in diameter was defined in the Central Expansion area (Fig. 3). This structural area, which had witnessed several superimposed rebuilding phases, had numerous features and postholes but none could be directly assigned to a specific structure. Apparently all rebuilding phases represent a light-framed warm weather house type. There was no evidence of interior ovens in association with this structure locus or any refuse accumulation from earth ovens in the surrounding area. Floral and faunal remains from the pits and post-holes have not been analyzed from the Central Expansion Area. However, field observation of fauna from the structure locus suggests a predominant warm weather exploitation of aquatic snails and mussels and several species of large fish. Based on tentative field observation, seasonality is suggested to be spring-summer for Structure Locus I in the Central Expansion Area due to evidence of: (1) a small, circular structure type; (2) absence of interior features, especially earth ovens; (3) absence of large storage facilities and (4) presence of prolific aquatic fauna.

Adjacent to the Central Expansion Area and oriented east-west was a crescent shaped light brown midden deposit. The homogeneous brown midden layer -- at a maximum, 30 cm. deep -- was excavated in arbitrary levels with all fill processed by waterscreening and/or flotation. Based on field observation, a prolific number of aquatic snails and mussels were recovered from all midden levels. Fine water screening revealed quantities of fish scales, fish bone, frog bones, snake vertebra, and small mammal remains. Large mammal bones were present throughout the midden but were not abundant. Botanical material consisted primarily of wood charcoal and charred hickory nut shell. Midden content suggests this refuse accumulated during a warm weather occupation of the site. The closely adjacent structures in the Central Expansion Area and the substantial midden accumulation are probably directly correlated. Due to the depth and areal extent of the midden deposit, additional structures probably occurred at intervals paralleling the crescent-shaped midden.

Fifty-six meters east of this probable warm weather habitation area, Structure Locus II was uncovered in the Eastern Expansion Area (Fig. 4). Structure definition is based on the arrangement of paired earth ovens in association with four central support posts. Total dimensions of the structure have not been determined since only a partial exterior wall alignment along the southeast edge of the excavation area was defined. Adjacent to this defined wall were two cylindrical-shaped storage/refuse pits that were 78 and 98 cm. deep. Botanical and faunal remains from the storage facilities and the earth ovens have been partially analyzed and indicate a different inventory from that recovered in Structure Locus I. There is an almost total absence of fish and aquatic snails, mussels and turtles from all of the features. The ovens and storage facilities contain predominantly large mammal remains such as white-tailed deer and a large sample of charred hickory nuts. A winter occupation of this double oven structure is tentatively based on: (1) projected structure type; (2) lack of aquatic species; and (3) presence of large, formal storage facilities. From the available evidence, inhabitants of the Owl Hollow site were exploiting several econiches in close proximity to the site including riverine and lowland resources from the Elk River on a seasonal basis. Recently received radiocarbon dates of A.D. 535 +/- 60 (UGa-1426) and A.D. 565 +/- 85 (UGa-1427) place this marginal upland site in the latter range of the



Figure 3. 40FR7, Central Expansion -- warm weather habitation and activity area.

temporal span for the Owl Hollow phase in the upper Duck River Valley. These dates are entirely consistent with the two dates from the Thompson Creek locality.

In brief summary, the settlement pattern of the Owl Hollow phase in the upper Elk and Duck River drainages is characterized by the establishment of permanent base camps which date from A.D. 400-500 in the lowland zone of the major river valleys and A.D. 500-600 on small streams in the marginal uplands. Faulkner (n.d.) has recently suggested a population increase, the competition for arable land, and the need for collective protection to account for this late phase shift to the uplands.

Intra-site community patterning indicates use of large, formal double oven winter lodges during the cold season and a shift to an adjacent smaller structure in the warmer months. The pattern of winter-summer occupation of dual house types recognized in the Southeast for certain historic tribes may have originated in the Interior Low Plateaus in the Owl Hollow phase during the late Middle Woodland period (Faulkner n.d.). The subsistence pattern of this phase was based primarily on intensive hunting and collecting of seasonally available foodstuffs from varied ecotones. White-tailed deer, acorn, hickory nuts and maygrass were relied on heavily. The presence of cultigens has now been documented with the possible identification of maize from at least one Owl Hollow site. Continued work will be required to assess

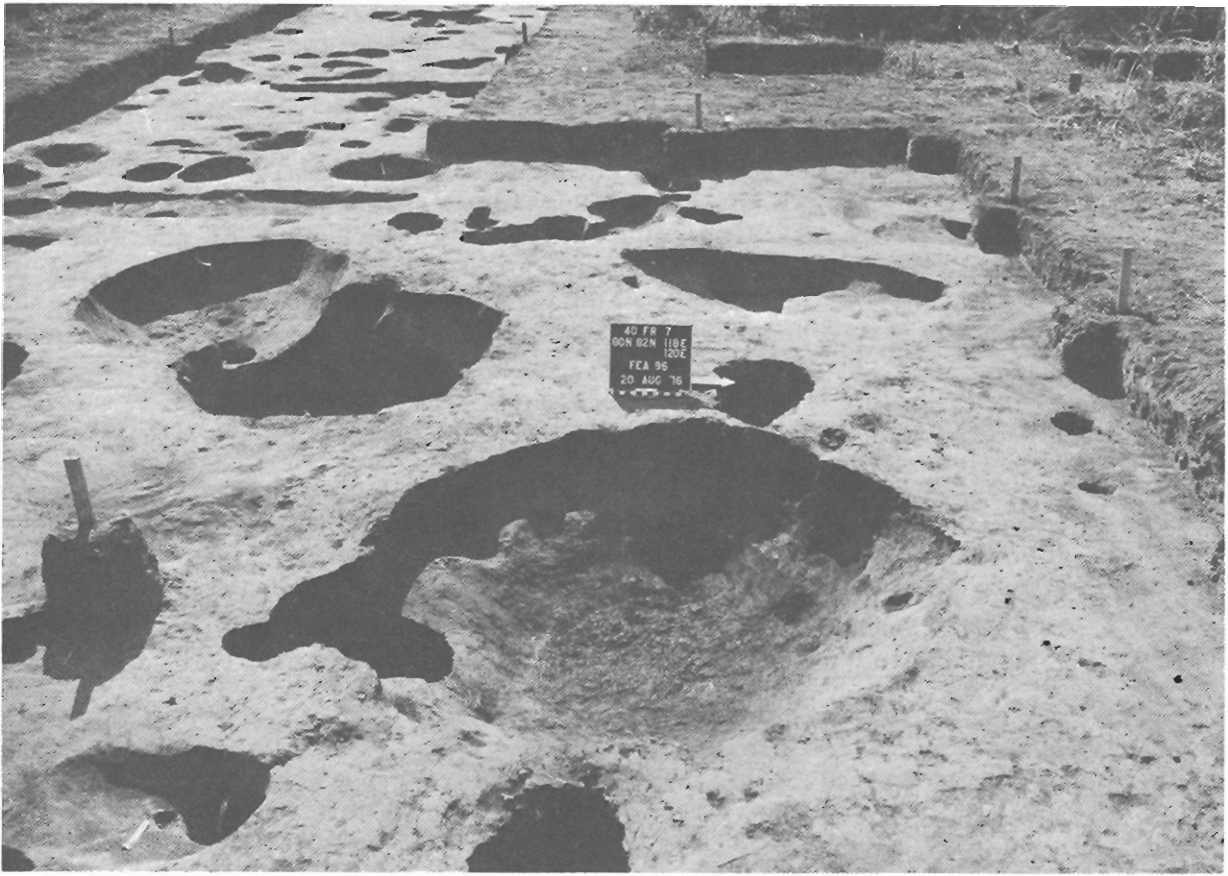


Figure 4. 40FR7, Eastern Expansion -- winter habitation and activity area.

the importance of these cultigens in the Owl Hollow economic system and to substantiate further this hypothesized pattern of subsistence and settlement.

Phase III of the Owl Hollow Research Project will begin in Spring, 1977, with intensive testing of one Elk River lowland site and two additional marginal upland sites in the Elk River drainage.

Acknowledgments

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ALKYL HALIDE FLOTATION: AN EFFECTIVE SEPARATION OF SHELL MIDDEN
COMPONENTS BY THEIR VARIOUS DENSITIES

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As modern archeological studies turn more toward the delineation of subsistence patterns in prehistoric cultures, the need for more precise bioanalytic methods becomes evident.

Various aqueous flotation methods have been devised in the past decade for separating preserved organic matter from soil samples representative of various archeological features. Although these techniques have proved effective in isolating floral and faunal material for species identification, they demonstrate a quantitative ineffectiveness that is inherently related to the flotation medium density (Struever 1968; Schneider and Noakes 1970).

While heavier organics may be suspended momentarily in an aqueous system, the ultimate result is sinking of all matter with a density greater than one gram/cm³. Consequently, recovery of heavier organic matter in aqueous systems rarely approaches the quantitative values necessary to implement statistical evaluation of the ecological data that are preserved in many archeological sites.

Screening can sometimes increase the yield of heavier organics but the particle size of the matrix becomes an additional limiting factor, especially for the recovery of microscopic organic matter.

Because the preservation of bone is especially good in calcareous soils, coastal shell midden sites offer a wealth of ecological information. While the presence of shell is desirable from a preservational standpoint, it also acts as a diluent of the valuable organic matter that it preserves. Conventional flotation and screening techniques can concentrate organic remains, but the ultimate separation of small shell fragments must still be accomplished manually. Considering the usual size and frequency of sampling, this hand sorting is time consuming and precludes efficient quantitative evaluation of the biological fraction.

Various heavy chemical water solutions such as zinc chloride have been used by some archeologists to increase the density of the flotation medium, thereby increasing the yield of organic matter recovered. These methods have not proved entirely suitable for today's analytical needs due to the corrosive nature of the solutions and the resulting damage that is inflicted on delicate organic matter.

In an attempt to locate a more suitable medium for high density flotation, the physical and chemical properties of a number of neutral organic compounds were reviewed (Weast 1968). Two alkyl halides were selected and tested as high density flotation media with excellent results. Organic materials having densities in excess of 2 g/cm³ were differentially floated from sand and shell matrices with no distinguishable damage to even the most delicate plant parts. Gentle mixing accomplished separation of the various constituents without the harsh hydraulic activity usually associated with flotation.

The primary flotation medium used was 1,1,2,2 tetrabromoethane (density 3.0g/cm³), while tetrachloromethane (carbon tetrachloride, density 1.6g/cm³) was used for a density reducing or diluting solvent.

Two techniques were used in the flotation of coastal Georgia oyster shell midden samples: (1) Predetermined density flotation (standard procedure), (2) Progressive dilution flotation (alternate procedure). The first method uses the predetermined density of each type of organic matter to formulate a flotation medium that will float the specified item(s). Table 1 shows the relative quantities of each alkyl halide required to prepare solutions of prescribed density. The second method merely uses pure tetrabromoethane to float the entire sample mass. Subsequent progressive dilution with carbon tetrachloride allows differential floating or sinking of each type of organic matter.

The techniques and apparatus used with the alkyl halide medium are simpler than those used with most conventional aqueous systems. Several glass beakers with pouring lips and a crescent shaped copper mesh skimmer constitute the flotation assemblage. A fine grade filter paper and a glass or plastic funnel are used to remove any floated or suspended microorganisms. If shell midden samples are being analyzed, a series of screens are desirable to allow separation of the larger fragments before floating, thereby reducing the size of the flotation system needed.

During development of the procedure, one to two kilogram samples of shell midden were screened free of large shell fragments (8mm screen) and sand (.8mm screen, Tyler, ASTM #20) and slurried in a 250 ml system using a 50%-50% alkyl halide mixture to float bone and charred organic matter. The sand fraction was slurried in 500 ml of pure carbon tetrachloride to float the lighter organic matter. The resulting analysis of a typical sample is given in Tables 2 and 3.

Table 1. Alkyl Halide Flotation, Medium Formulation

Desired Density (g/cm ³)	Weight % CCl ₄	Weight % C ₂ H ₂ Br ₄
1.6	100	0
1.9	75	25
2.3	50	50
2.6	25	75
3.0	0	100

Table 2. Oyster Shell Midden Analysis (Standard Procedure)

Sample number and description	Sample Size	Retained on 8mm Screen	Hand Sort	Light Organic Float (carbon)	Heavy Organic Float (bone)	Shell Frag. Residue	Sand Residue
N15E11-1, oyster shell midden, shell core, 9Gn-51	1 liter 1725.5g	798.9g	23.9g (4 sherds)	15.1g	27.6g	117.5g	742.5g

Table 3. Floral and Faunal Remains

Sample Number	Analytical Category	Species	Common Name	Min. No.	Approx. Size
N15E11-1	Retained on 8 mm Screen	<u>Crassostrea virginica</u>	Atlantic Oyster	18	Small (8cm ³)
	"	<u>Mercenaria mercenaria</u>	Quahog Clam	2	----
	"	<u>Modiolus demissus</u>	Ribbed Mussel	1	----
	"	<u>Triodopsis hopetonensis</u>	Land Snail	1	10mm
	Heavy Organic Float	<u>Cynoscion nebulosus</u>	Seatrout	1	50g
	"	<u>Galeichthys felis</u>	Sea Catfish	1	75g
	"	<u>Micropogon undulatus</u>	Atlantic Croaker	1	50g
	"	<u>Paralichthys lethostigma</u>	Southern Flounder	1	200g
	"	<u>Pogonia cromis</u>	Black Drum	1	600g
	"	<u>Sciaenops ocellata</u>	Red Drum	1	1000g
	"	<u>Gastrocopta rupicola</u>	Land Snail	1	1mm
	"	<u>Gallium</u> sp.	Bedstraw	not counted	1mm
	Light Organic Float	<u>Acalypha virginica</u>	Virginia Three-Seeded Mercury	1	1mm
	"	<u>Gallium</u> sp.	Bedstraw	not counted	1mm

Identification by: Burch 1962; Fernold 1950; Martin and Barkley 1973; U.S.D.A. 1961; and University of Georgia archaeology lab floral and faunal collection.

The laboratory tests achieved a separation of bone and vegetal organic matter from shell fragments that approached 95% effectiveness. With the tests showing an almost complete separation of organic matter from shell scrap, the value of this procedure as a qualitative and quantitative method is obvious. Analytical weight percentages or counts coupled with uniform wide scale site sampling could provide concrete ecological information. Alkyl halide flotation seems particularly compatible with the coring techniques that are growing in popularity.

An unexpected advantage of the alkyl-halide system was realized when fish otoliths were floated from shell matrices using a solution with a density of 2.7 g/cm³. Fish otoliths, which have been used extensively by biologists to study the development of fishes, provide an excellent record of species, size and age.

While the alkyl halide solution has its main advantages in separation of worthwhile organic matter from oyster or other shell midden, it shows promising advantage over aqueous systems for other soil types. Comparative analyses run on samples of organically stained sand recovered from the east borrow pit at 9Gn-51 show that the recovery of microorganics was 22% higher with the alkyl halide system than with conventional aqueous flotation. The subsequent charred seed count was 28% higher with the alkyl halide process (Table 4).

Table 4. Sand Midden Analysis (CCl₄ Flotation)

Sample Number & Description	ASTM Screen Analysis (U.S.D.A.; 1960)	Sample Size	Analytical Method	Macro Organic Ret. ASTM #20	Organic Float	Seed Count (Seeds/cm ³)
N16E55-1 sandy fill, east borrow pit, 9Gn-51 Munsell _____ 10YR3/4	#20, .1 #40, 1.4 #60, 8.6 #200, 88.1 pan, 1.8	50g	Aqueous flotation	130mg	365mg	3.4
	"	"	Alkyl Halide Flotation	140mg	470mg	4.7

While the experimental results demonstrated that the flotation solution is completely harmless to even the most fragile preserved organic matter, it should be handled with extreme care by the laboratory technician. The fumes of both liquids are toxic and should only be used with the assistance of a negative draft fume hood.

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APPENDIX

Alkyl Halide Flotation: A Proposed Procedure

Reagents: Tetrachloromethane (CCl₄, Carbon Tetrachloride), 1,1,2,2 Tetrabromoethane (Br₂CHCHBr₂, Acetylene Tetrabromide).¹

Apparatus: Large pyrex beakers or other suitable glass containers equipped with pouring spouts. The volume of the beakers should be three times the volume of the chosen sample size. Glass funnels, skimmers, etc. should be selected to suit the type of midden sample being processed.

Procedure:

1. Air dry midden sample.
2. Screen midden sample through 8mm screen. Hand sort large bones, sherds, etc. from retained material (oversize). Save material that passes 8mm screen (undersize) for step 3 (standard or alternate procedure).

3. (Standard Procedure - Predetermined Density Flotation) Screen undersize from step 2 through an .8 mm (Tyler or ASTM #20). Retain undersize for flotation of small organic particles. Retain oversize for flotation of heavier organic matter.

4. Add each volume of undersize collected in step 3 to three volumes of 100% CCl_4 . Skim floated organic matter from the surface. Air dry float.²

5. Add oversize collected in step 3 to an equal volume of 10%-90% CCl_4 - $\text{Br}_2\text{CHCHBr}_2$. Skim float and retain for step 6. Decant alkyl halide mixture to a second vessel. Wash any material that sinks in CCl_4 . Air dry and sort for otoliths.³

6. Dilute 10%-90% alkyl halide mixture from part 5 to 50%-50% with CCl_4 , and add float from part 5. Skim organic matter from surface. Shell fragments will sink. Wash float in CCl_4 and air dry.

3. (Alternate Procedure - Progressive Dilution Flotation) Add undersize from part 2 to an equal volume of 100% $\text{Br}_2\text{CHCHBr}_2$.

4. Add CCl_4 slowly with constant stirring to allow progressive dilution and subsequent sinking of each midden component.

5. Separate and wash each component in CCl_4 and air dry.

Notes

¹These reagents are volatile liquids that are hazardous to handle. Their vapors are toxic and a fume hood should be used throughout the procedure.

²A stratum of organic matter may form above the sand sediment. It may be removed by decanting the CCl_4 to another beaker.

³This part may be omitted if separation of otoliths is not required.

PRELIMINARY INVESTIGATIONS AT SOAPSTONE RIDGE, DEKALB COUNTY, GEORGIA*

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Linda R. Carnes

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Introduction

During the past three years, Georgia State University's Laboratory of Archaeology has conducted extensive surveys on Soapstone Ridge near Atlanta. The Ridge is noted for its numerous aboriginal quarry and workshop sites (Kelly 1950:156; Wauchope 1966:394). In this paper, we will attempt to bring to your attention some of the preliminary findings of the surveys, and to delineate some directions for future problem-oriented research.

Soapstone Ridge is located in south DeKalb County and extreme north Clayton County, about 8 miles southeast of Atlanta (Fig. 1). The Ridge is oval in shape and covers about 16 square miles, with its long axis running east-west. Although the Ridge is in close proximity to a large urban settlement, it has remained relatively undeveloped because of its rugged topography and highly erodable subsoils. The highest elevations on the Ridge are about 1050 feet, with the average elevation about 800 feet.

Soapstone Ridge represents the largest intrusion of mafic-ultramafic rock on the Georgia Piedmont (Fig. 1), and possibly the largest in the entire Southern Piedmont Region (Duffe n.d.2). The formation is broken throughout by small faults and shear zones containing large amounts of schistose material, indicating substantial deformation and movement during or after emplacement (Pickering 1975:2).

The Ridge is dissected by dendritic stream erosion, leaving what was once a dome-shaped body of rock as an irregular series of rounded, boulder-strewn knolls with intervening stream valleys and steep ravines (Fig. 2). South River forms the northern border of the Ridge, Conley Creek flows along the southern border, and Blue Creek flows across the Ridge and empties into South River. There are several natural springs on the Ridge.

The term soapstone, sometimes used synonymously with steatite, refers to all talcose massive rocks. "Typical" soapstone is composed of about 10 percent talc, with the remaining 90 percent being chlorite, amphibolite, pyroxene, mica, calcite, dolomite, or other minerals. The rocks on Soapstone

*In the seven years since this paper was written, much new information has been obtained on Soapstone Ridge, as well as on quarry-site archaeology in general. We have made no revisions, however, as we feel that the article should be published as originally written. R.S.D. and L.R.C., 7/20/83.

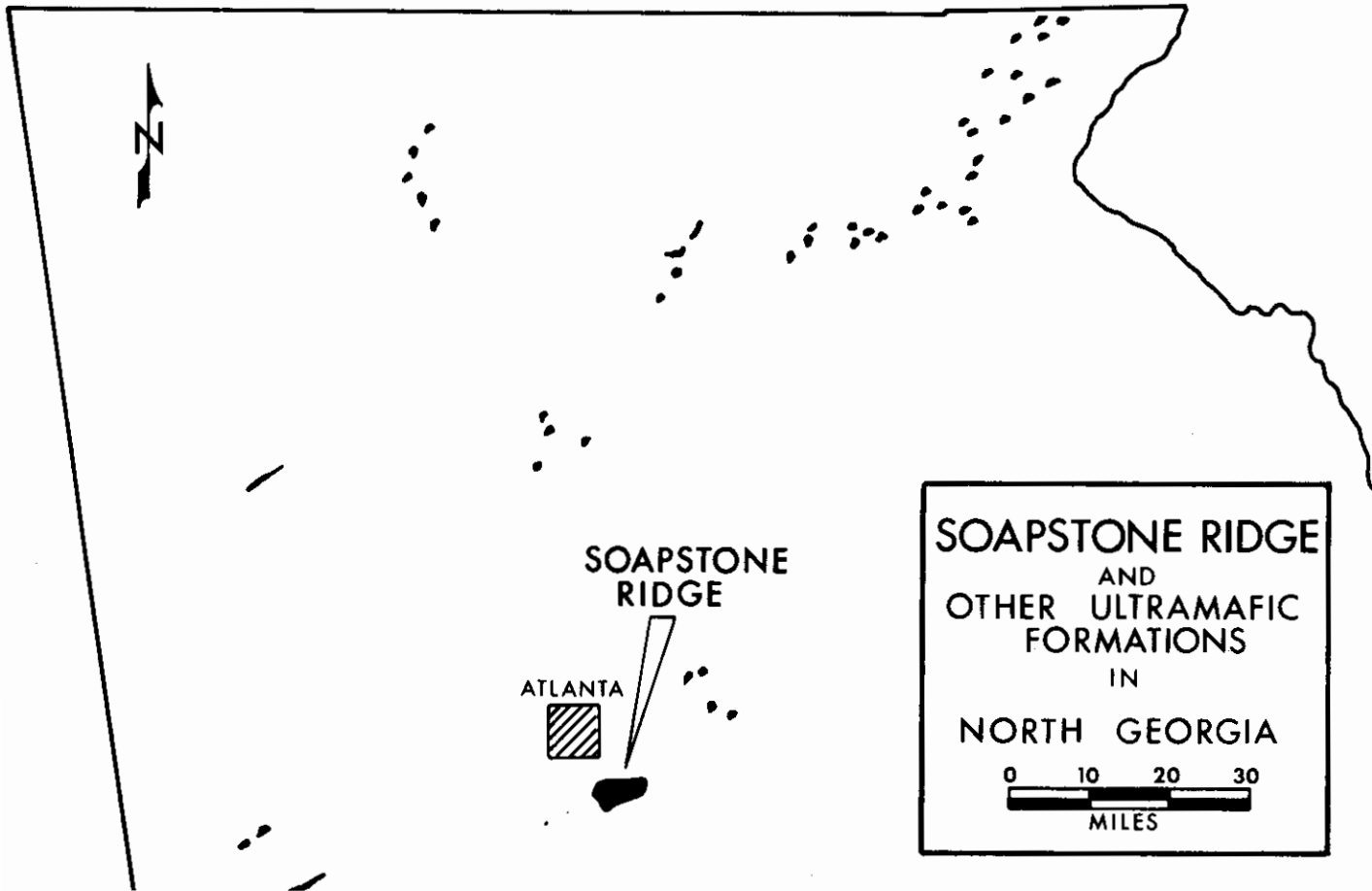


Figure 1: Map of north Georgia, showing Soapstone Ridge and other ultramafic formations.

Ridge are usually classified by geologists as metapyroxenite (Pickering 1975:3). The materials quarried aboriginally range from fine-grained rock, of the type normally referred to as steatite, to more coarse-grained varieties.

Vegetation on the Ridge consists predominantly of mixed stands of hardwoods and pines, although because much of the area has never been cleared for cultivation there are some climax or near-climax hardwood stands. Existing on the Ridge today are some unique plants, including a type of Western Blue Grass that grows only on soils derived from mafic rocks. In spite of the Ridge's close proximity to the city, there is abundant fauna with some rare species such as the barn owl and bobcat, and a large mollusk population in Blue Creek.

The Surveys

The Georgia State University surveys were carried out as part of an environmental impact study prepared by the Georgia Department of Transportation for a proposed interstate expressway connector that would bisect the Ridge (Dickens and Carnes n.d.). In addition, we have participated in a cooperative effort with state and county agencies, and local residents, to establish a program for the protection and preservation of the Ridge as a unique natural and cultural resource. In fact, Soapstone Ridge recently has been considered for nomination as an "archaeological district" for the National Register of Historic Places.

To date, 62 aboriginal sites have been found on the Ridge. These consist of 17 quarry sites, 23 workshop sites, and 22 habitation sites (Fig. 3). Thus far, all of the work has consisted of systematic surface reconnaissance, with no excavations. Definition of site "types," therefore, has been based entirely on surface observations.

A quarry is defined as an exposure of soapstone, usually boulders, that exhibits quarry scars (Fig. 4). The site may have only a single boulder with a few scars, or it may have numerous boulders or groups of boulders covering several acres. A workshop is defined as an area where broken or unfinished vessels litter the surface, but where there is no evidence of above-ground quarry activities (Fig. 5). Some workshops may prove to be quarry sites if further investigations reveal subsurface quarry remains. Such remains already are suggested by localized depressions recorded on several sites. It has been demonstrated that soapstone weathers rapidly and that freshly exposed material is softer and more easily worked (Sheldon n.d.). It is also possible that naturally-fractured rubble may have been utilized at locations where it was available, or that some sites labeled as "workshops" represent caches or stockpiles of bowl blanks. Habitation sites on the Ridge were represented by 16 camp sites, all of the Archaic period, and 6 village sites on which there were both Woodland and Archaic components.

Several techniques were used to locate sites, including some useful information provided by local residents. Since the Ridge has remained a rather isolated rural community, it is rich in folklore and was the locale of several of Atlanta's first large plantations. Some examples of the information obtained from local residents are references to several mineral



Figure 2: A typical boulder-strewn knoll on the summit of Soapstone Ridge. The boulders in this picture are a coarse-grained metapyroxenite.

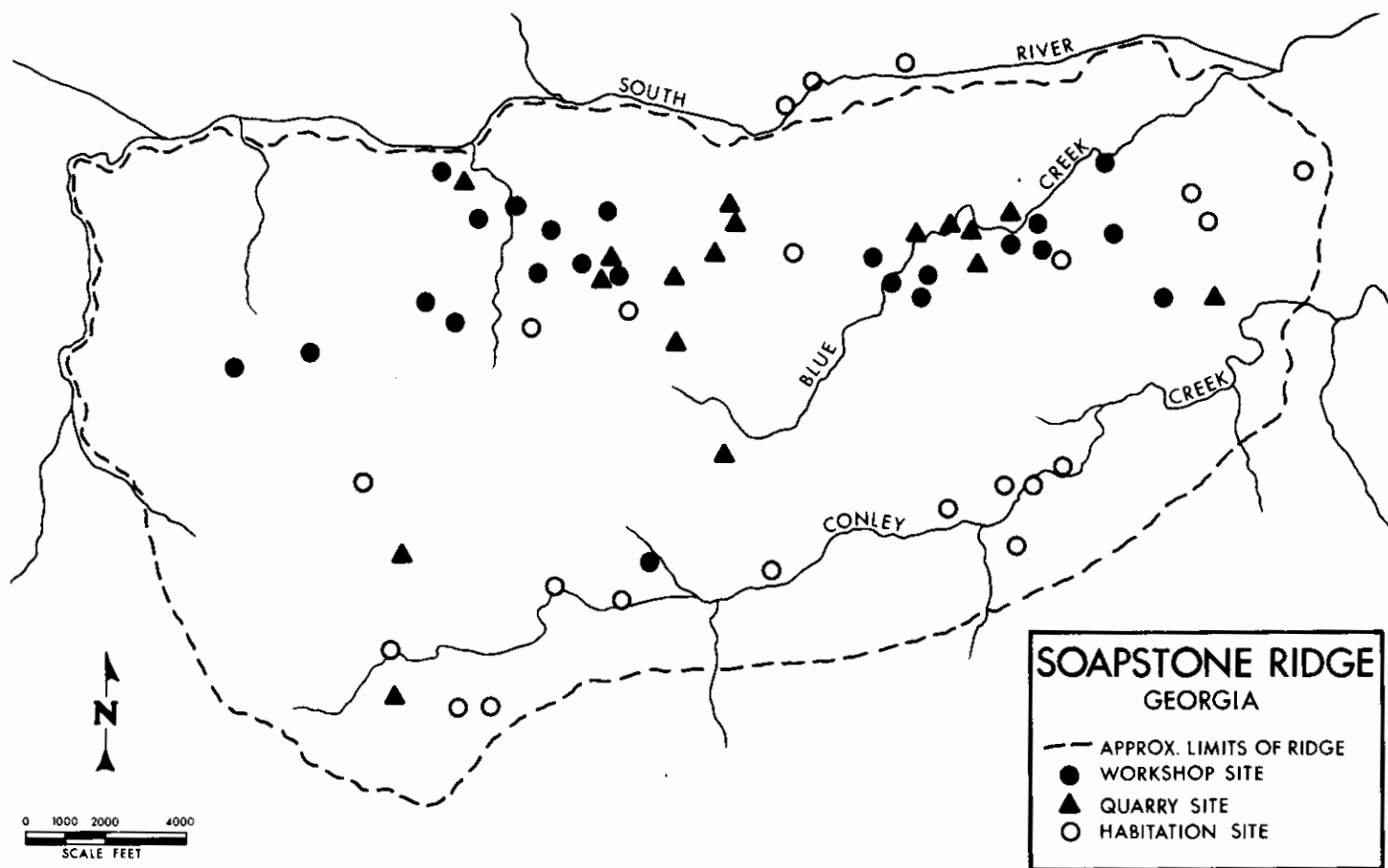


Figure 3: Map of Soapstone Ridge, showing the locations of workshop, quarry, and habitation sites.

springs on the Ridge where caches of stone bowls were reported to have been uncovered in the 1920s and 1930s. Since these springs have been greatly altered or destroyed, the local stories along with some early photographs (Fig. 6) are important. Additional information has come from bowl collections made by residents, and from groups of bowls incorporated into rock walls or used as building material (Fig. 7).

The distribution of site types has been found to be related to drainage, topography, and vegetation. Steep wooded slopes with soapstone outcrops were predictable locations of quarry and workshop sites. Steep-sided ravines, which were usually caused by drainage from springs (existing or extinct), frequently yielded quarry tools, bowl fragments, and bowl blanks. Quarry and workshop sites were most numerous on the rugged northern and central portions of the Ridge, whereas habitation sites were found mostly in the stream valleys bordering the Ridge (Fig. 3).

Sites with extensive boulder quarrying were mapped at scales of 1:10, 1:40, or 1:50 to record the distribution and limits of the archaeological remains. One such site, the McGarity-Etheridge Site (GSU 9Da 17), has been listed on the National Register of Historic Places. This site covers approximately 52 acres and exists today as one of the largest and best preserved aboriginal soapstone quarries in the Southeast (Fig. 8). Here, over 200 quarry-scarred boulders were recorded, as well as several large boulders that apparently were not quarried. Mapping revealed that large boulders were most numerous on the steeper southern slopes of the site. One



Figure 4: Typical quarry site on the Ridge. The boulder in this photograph exhibits several quarry scars.



Figure 5: Typical workshop site on the Ridge. Many of the pieces lying on the surface have been partly worked into bowl preforms, or constitute fragments of broken, unfinished bowls.

group of boulders at the northern end of the site has only a few quarry scars that may represent experimental attempts. Another group of unquarried boulders protrudes from the southern crest of the hill. Quarried boulders are scattered over the entire southern slope, with several clusters of intensively carved specimens being found in the southeastern part of the site.

Other important features on this site are 12 shallow depressions distributed along the upper slopes. The depressions are all roughly circular, ranging from 6 to 20 feet in diameter and from 3 to 3.5 feet in depth. Two of the depressions encompass a quarried boulder, and several others are located immediately adjacent to quarried boulders. At sites in Tallapoosa County, Alabama, it has been found that similar depressions were the result of aboriginal excavations to obtain fresh unweathered rock (Wright 1971). It is probable that the depressions on the McGarity-Etheridge Site also represent aboriginal activity, and careful excavations in these features may reveal the remains of that activity.

The McGarity-Etheridge Site contains evidence of all stages in the acquisition and shaping of bowl preforms (Fig. 9). The basic technique was to isolate a natural protuberance on the boulder, or a protuberance created by previous quarrying, with an encircling groove (Fig. 10). This groove was enlarged outward, and deepened, until a bulbous piece of desired size was obtained (Fig. 11). This piece was then undercut until there was only a narrow "neck" connecting it to the boulder (Fig. 12). The preform was then pried loose from the boulder, probably by use of wedges or levers.

After detachment, the preform was refined on the exterior, with enough material being cut away to obtain the basic vessel form and usually to leave two opposing lug handles near the rim. Finally, the preform was inverted, and the surface that had been previously attached to the boulder was carefully hollowed out to complete the bowl. Some boulders at the site show evidence of more than one bowl preform having been worked at the same time (Fig. 13). There are several examples of double preforms, and others with three or more grooves that apparently were carved in concert.

A few crude chipped-stone implements of amphibolite have been found on the surface of the McGarity-Etheridge Site (Fig. 14). These tools vary in size and shape. Some have a flat bit, others are more pick-shaped, and some have notches for hafting. Such tools would have been suitable for the initial shaping of a preform, or for excavating dirt and rubble from around the boulders. No tools suitable for thinning and hollowing out the interiors of vessels have been recovered. However, marks on sherds from finished bowls indicate that single and multiple-toothed chisels were used (Fig. 15). Through preliminary experiments in shaping bowls, we have determined that these tools probably were made from deer antler. More than adequate work can be done with a kit consisting of several antler chisels of varying size and shape, a wooden mallet, a flint knife, and a sandstone abrader.

The finished vessels were of different sizes and shapes (Fig. 16 A, B, and C). Three basic forms have been identified: (1) a hemispherical form; (2) a conical form (with either pointed or flat bottom); and (3) an elongated form (with either rounded or squared ends) usually having lug handles at the ends. Some of the quarry and workshop sites have a predominance of one form. For example, a round form is prevalent at the McGarity-Etheridge Site.

Many of the bowls, bowl fragments, and preforms encountered in the surveys, because of their size and weight and because we believe that the

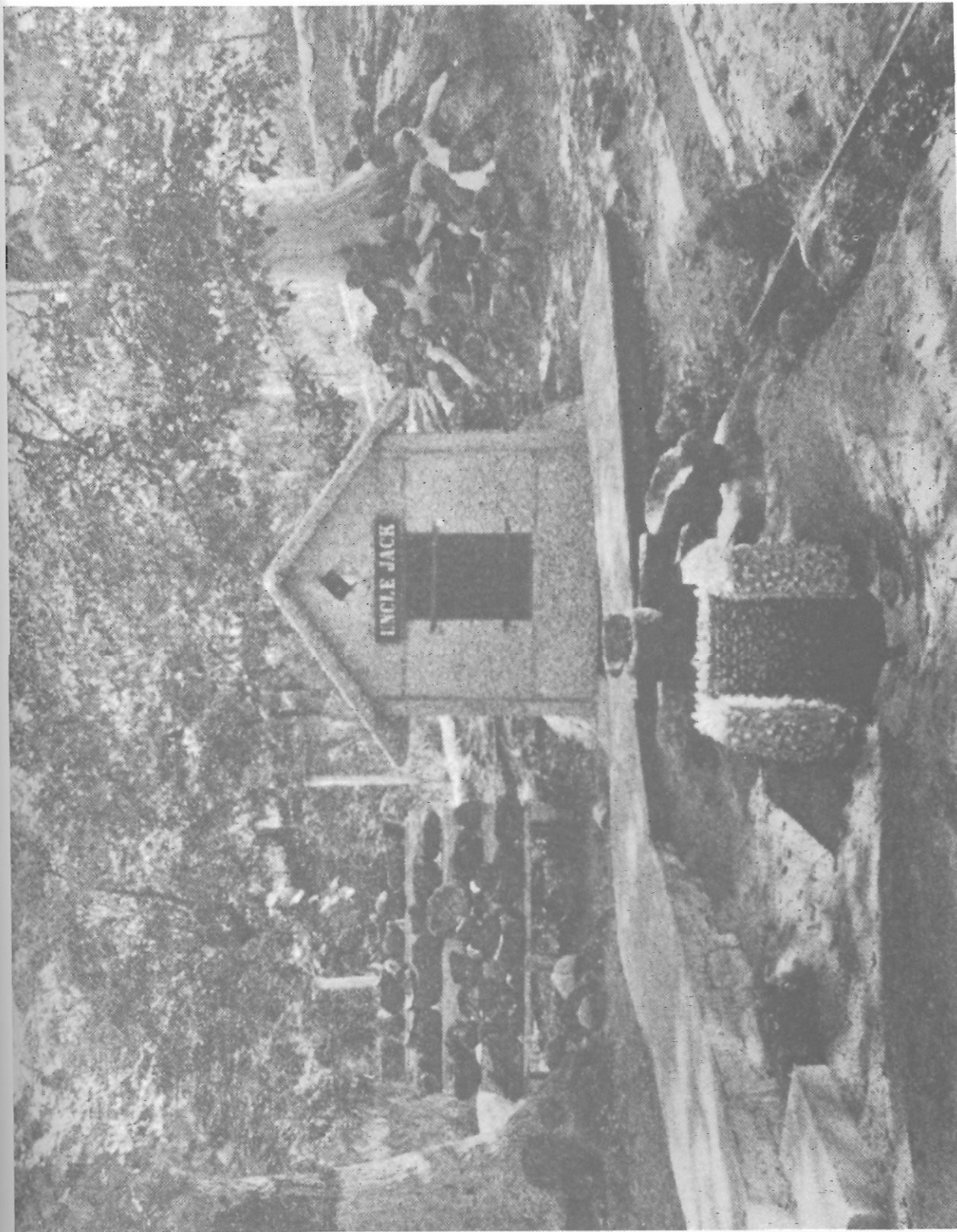


Figure 6: Photograph from a 1929 advertisement for mineral waters from "Uncle Jack Spring." Note the numerous bowl preforms (mostly whole) stacked on either side and in front of the spring house.



Figure 7: Unfinished and broken bowls collected by a resident of Soapstone Ridge.

sites should remain as undisturbed as possible, were photographed, measured, and mapped, and left in their original positions. Measurements taken on the bowls included wall thickness, inside diameter, overall diameter, inside depth, and overall depth. Other characteristics were noted, such as shape, appendages, and any unusual carving marks or peculiarities of the rock. Field sketches were also made of each piece.

Information on the desirable characteristics of soapstone for cooking utensils has come from local folk usages as well as from some modern domestic and industrial usages. For example, we learned that soapstone will hold and radiate heat well without breaking under heat stress by observing that soapstone slabs had been used to line hearths in the chimneys of old houses on and around the Ridge. We also learned that some early residents of the area had used, and in some cases were still using, homemade soapstone griddles and bread pans (Fig. 16D) when they wanted "grease-free, non-stick cooking." We have also seen soapstone irons, bed warmers, buggy warmers, and pot rests.

Suggested Research Problems

In conclusion, we would like to suggest some potential research problems for future work on Soapstone Ridge, as well as some questions that might be asked of the data already acquired.

(1) Was there differential use of the raw material and of quarry/workshop techniques through time? The acquisition of temporal data might allow us to reconstruct the evolution of soapstone technology during the Late Archaic period. This problem could be explored by excavations at key sites, with an effort to define the tool assemblages in use at each site and to obtain absolute dates for each. Possible association of specific quarry techniques and bowl forms has already been noted in the surveys.

(2) Was there differential use of the raw material and of quarry/workshop techniques by various contemporaneous groups? This problem is especially important in light of the accumulating evidence from Late Archaic habitation sites for scheduled use of resources in a seasonal round and within specified territories (Caldwell 1958:6-18). Investigation of this problem, again, would require the delineation of artifact assemblages associated with specific sites, the acquisition of absolute dates from key

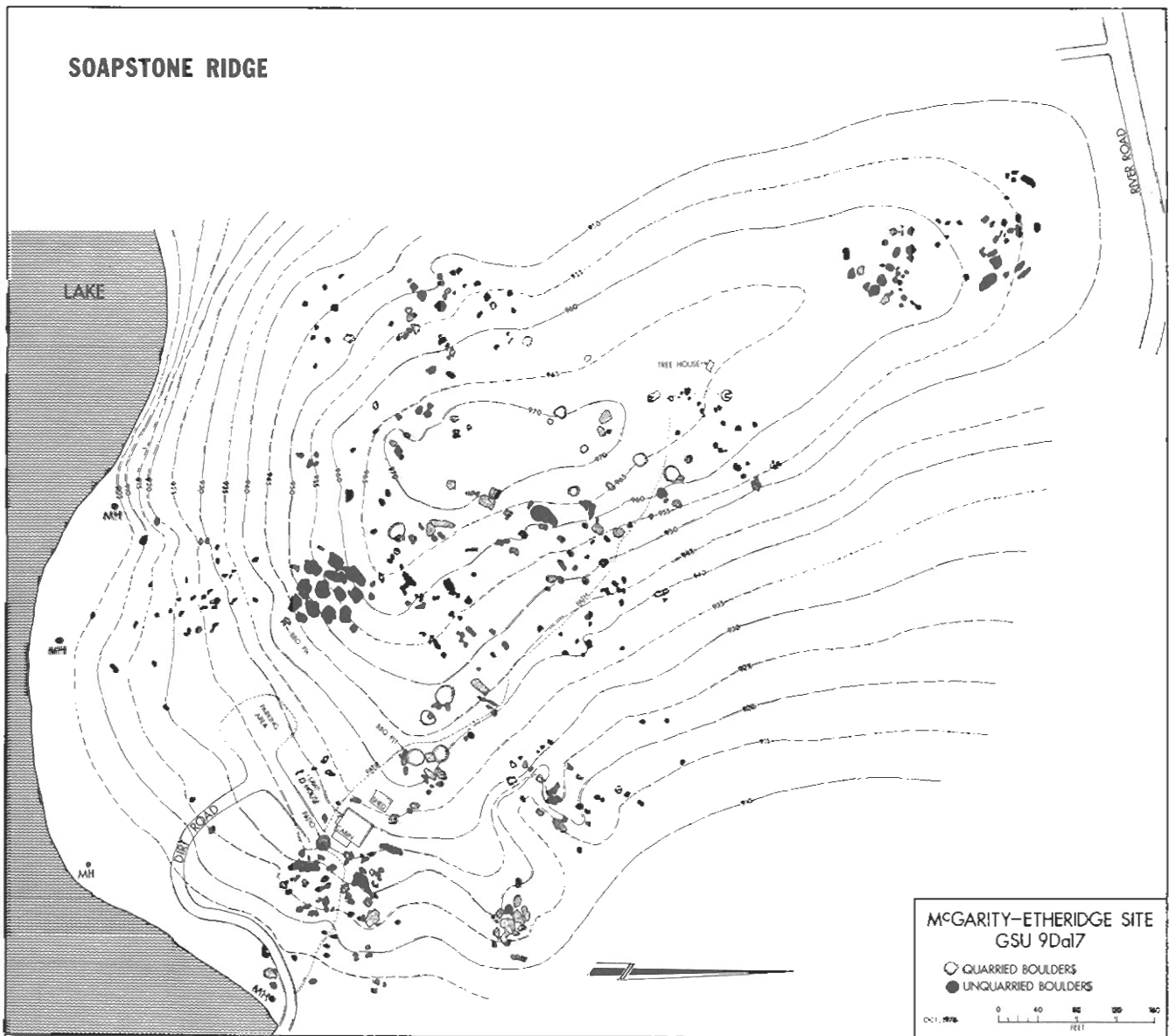


Figure 8: Topographic and archaeological map of the McGarity-Etheridge Site.

1



2



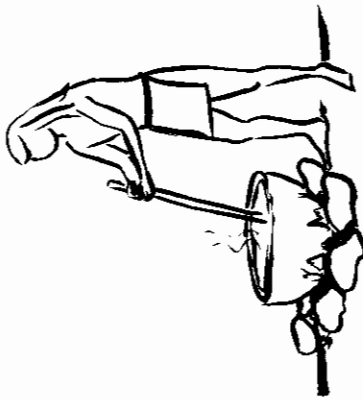
3



4



5



Sequence of quarrying and shaping a soapstone bowl.

Figure 9: Hypothesized steps in the preparation and removal of a bowl preform, based on examples from the McGarity-Etheridge Site.

sites, a study of the distribution of cached implements and bowl preforms, and a comparison of the macro and micro compositions of the raw material from various parts of the Ridge with the compositions of finished soapstone artifacts from habitation sites in various areas surrounding the ridge.

(3) In what directions and in what amounts was the material from Soapstone Ridge traded or otherwise distributed to distant areas? This type of information would be useful in determining the extent of interaction between groups indigenous to the central Georgia Piedmont with groups in the Ridge and Valley, Blue Ridge, and Coastal Plain provinces, and with groups in more distant parts of the Piedmont itself. Studies of the macro and micro compositions of the raw material from Soapstone Ridge and from other quarry sites on the Piedmont might allow for the recognition of compositions specific to each area. It would then be possible to define the source quarries for artifacts from habitation sites in distant areas. Studies of this type, utilizing different concentrations of rare earth elements defined by neutron activation, have been successfully employed on soapstone from quarries in Virginia (Luckenbach, Holland, and Allen 1975:57-58).

(4) What was the technology, or technologies, used in working the soapstone? Excavations at the quarry and workshop sites should produce an assemblage of these tools, assuming conditions favorable to preservation. Some preliminary experimentation in carving small bowls from soapstone obtained at the McGarity-Etheridge Site has shown that single-toothed and multiple-toothed chisels made from deer antler are adequate for working even the coarser-grained rock.



Figure 10: Shallow groove on the surface of a boulder, illustrating the initial stage in the preparation of a bowl preform.

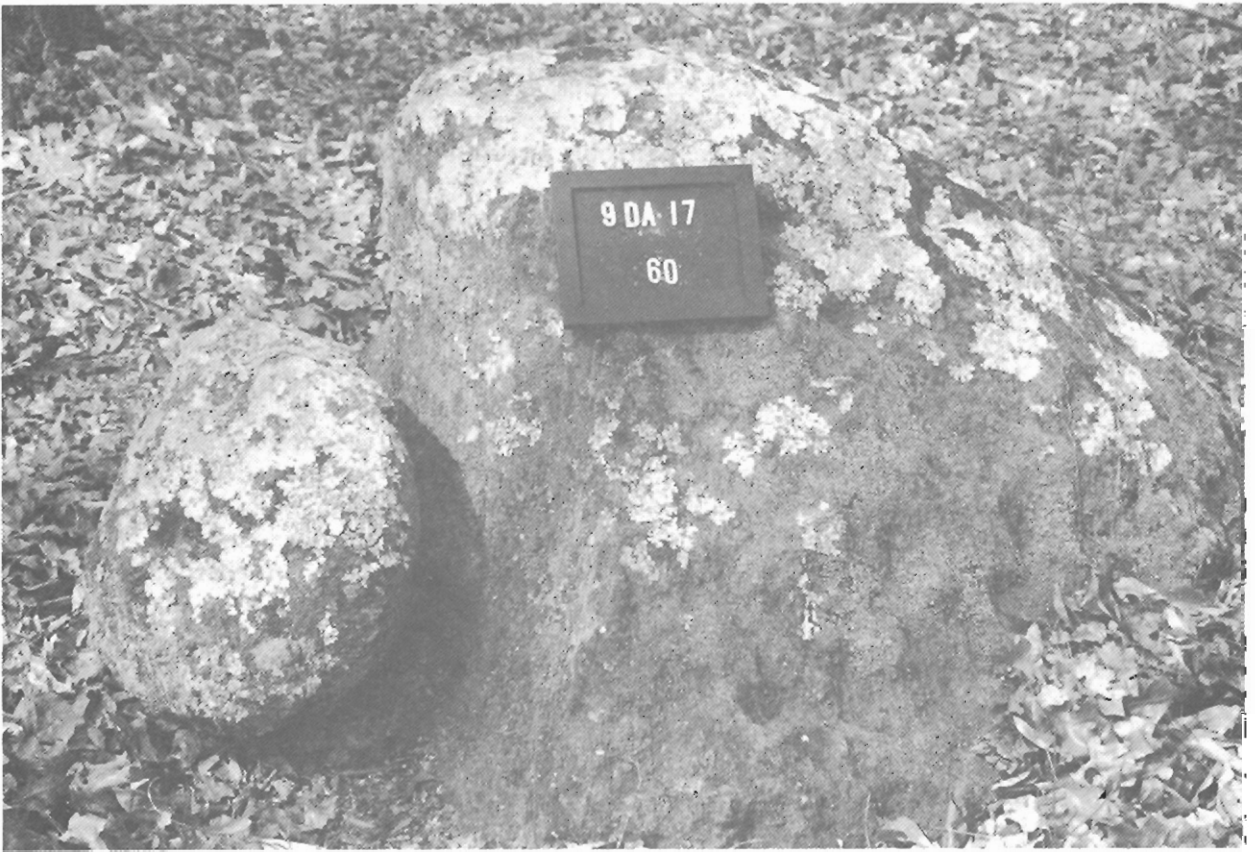


Figure 11: A bowl preform ready to be snapped from the side of a boulder.



Figure 12: Residual "neck", where a bowl preform has been removed. Another cavity caused by preform removal can be seen on the left side of the boulder.



Figure 13: A boulder that has been grooved to obtain three bowl preforms at one time.

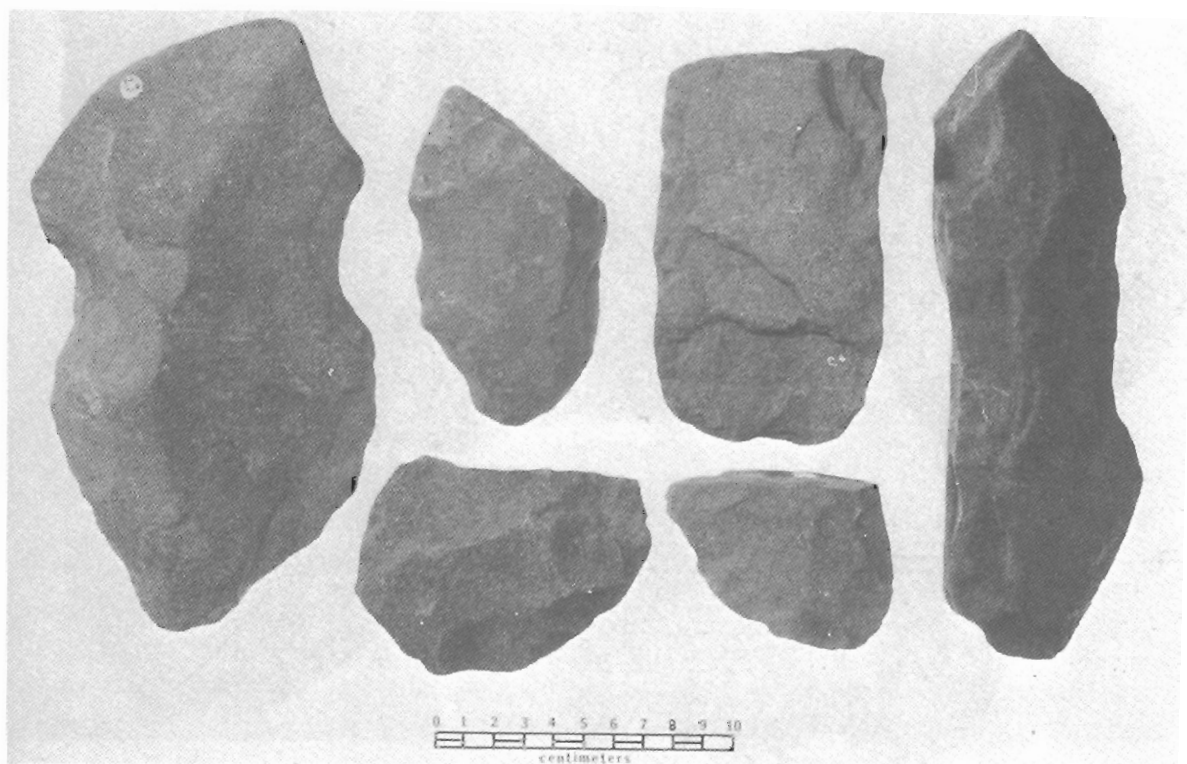


Figure 14: Tools of amphibolite from the McGarity-Etheridge Site. These tools probably were used in the initial quarry work and in digging around boulders to obtain unweathered rock.

(5) Why do some of the boulders at a single quarry, such as the McGarity-Etheridge Site, show evidence of having been worked whereas other nearby boulders are untouched? Answers to this question would help in defining, specifically, the properties that were most desired by the aboriginal stone masons and by the users of the finished bowls. Again, studies of the macro and micro structures of the different rocks would be useful, as would experiments in duplicating and using various types of bowls. We have already obtained some important information on various properties of soapstone from its folk usages as well as from its usages in modern contexts.

(6) How was the overall environment of Soapstone Ridge utilized by the cultures under consideration? Recent studies of the soils, hydrology, botany, zoology, and modern human settlement of the Ridge have shown that the area, even today, has considerable environmental and cultural integrity (DeKalb County Planning Department 1976). Research specifically aimed at defining the paleoenvironment of the Ridge should be undertaken in conjunction with any further archaeological investigations.

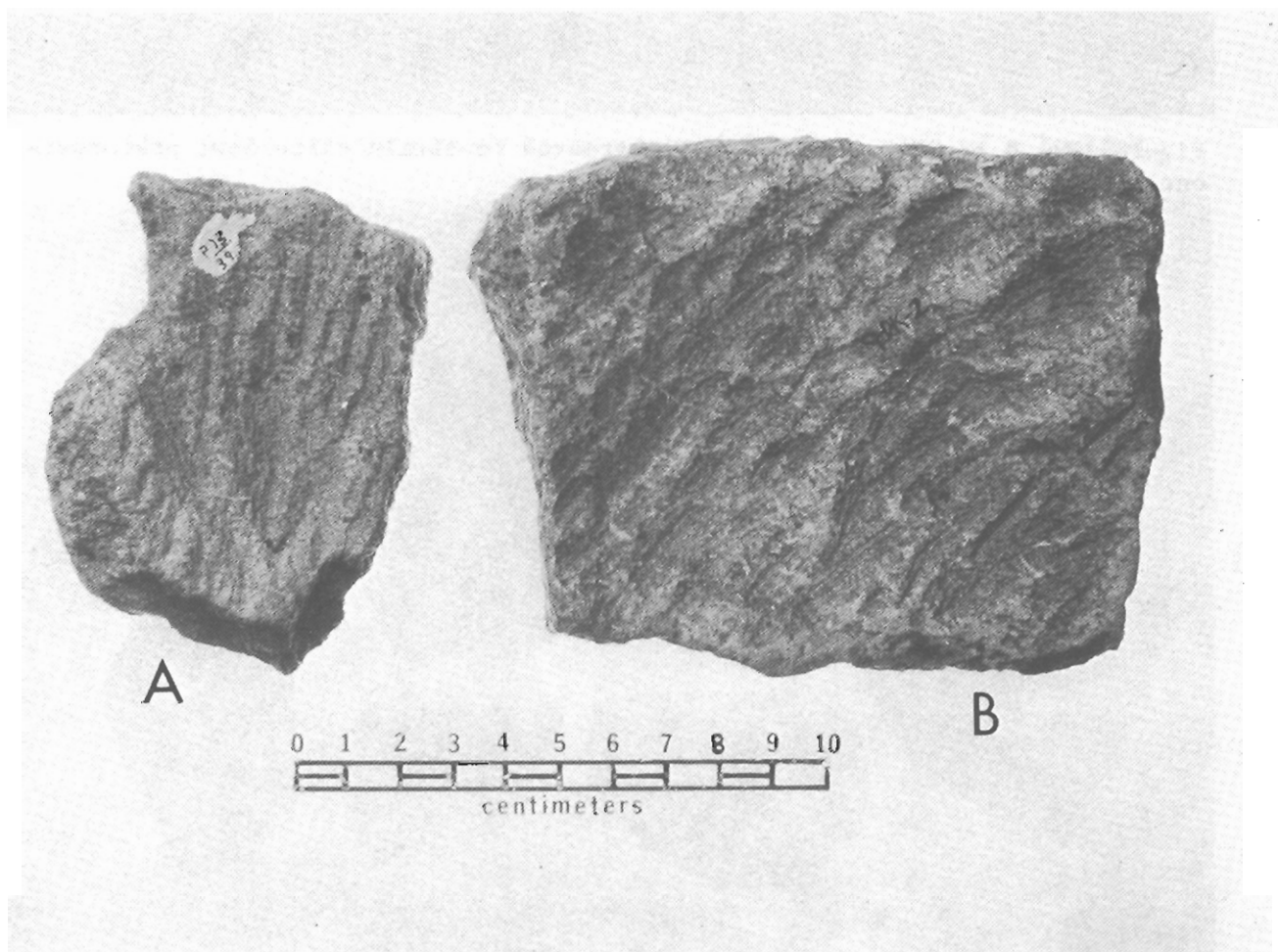


Figure 15: Soapstone sherds showing thinning marks on the interior sides. A, marks from a single-toothed chisel; B, marks from a multiple-toothed chisel.

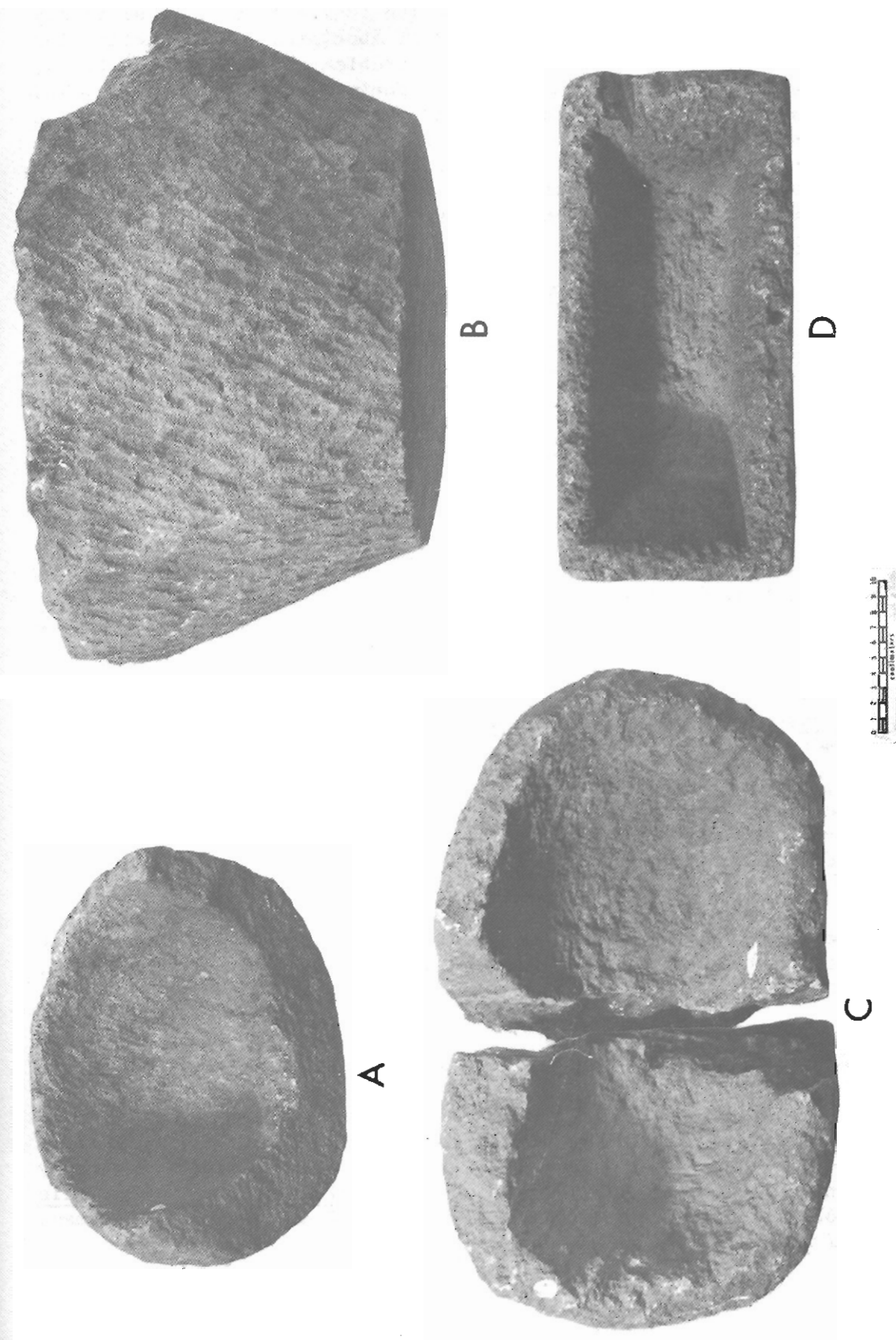


Figure 16: Soapstone vessels. A, hemispherical form; B, conical form; C, elongated form; D, modern bread cooker with a loaf-shaped depression on the facing side and four corn stick-shaped depressions on the opposite side.

Conclusions

We have attempted to summarize information obtained from preliminary surveys at Soapstone Ridge, an important area of aboriginal quarry activities in the Southern Piedmont. Further surveys, problem-oriented excavations, mineralogical and trace-element analyses, experimental stoneworking, and paleoenvironmental studies at the numerous and well-preserved sites on the Ridge should expand considerably our knowledge of Late Archaic adaptations to the Southern Piedmont Region. It must be emphasized, however, that these studies will be possible only if some of the sites are preserved and if the basic characteristics of the Ridge environment are perpetuated.

Acknowledgments

The authors express their appreciation to James McKinley for drafting Figure 8, and to Joan Rupp for Figure 9.

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EXAMINATION OF PREHISTORIC INTRA-SITE VARIABILITY ON THE
TEXAS COAST: PALMETTO BEND RESERVOIR

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Palmetto Bend Reservoir, currently under construction by the Bureau of Reclamation, when completed will flood approximately 10,000 acres. Palmetto Bend is located on the Navidad River just inland from Matagorda Bay, or about 100 miles southwest of Houston.

In conjunction with the reservoir construction, the Texas Archeological Survey of the University of Texas at Austin has been conducting archaeological investigations for the last four years. I shall discuss our current work, concentrating on 41 JK 178 or the Olsovsky site which we are presently excavating.

Prehistoric site investigations during the earlier testing phase were designed to, first, examine an ethnohistorical model predicting settlement-subsistence organization; and, secondly, to evaluate the present context of refuse and post-occupational disturbance. Results from this research allowed the accurate planning of the current research.

We found that approximately 20 scattered mechanical or hand test pits would yield an "adequate" sample of 100 or more artifacts for inter-site comparisons and for the testing of the ethnohistorical model. Water screening with superimposed 1/4" and 1/16" mesh-wire allowed the recovery of the excellently preserved faunal remains. All soil from the excavations was water screened; and all residue bagged. Results from the implementation of these procedures were adequate for the preliminary evaluation of the ethnohistorical model, but were not totally satisfactory.

On deeper archeological sites, which represented longer spans of time, stratigraphy was often more complex and natural levels far from horizontal. Lack of surface exposure prevented our obtaining information on spatial organization. Isolated one-meter pits often could not be stratigraphically correlated and, due to the low artifact densities, were not reliable for statistical spatial analysis.

The amount of residue recovered from the fine screening was staggering. A picking laboratory crew, made up largely of volunteers, sorted a 10% sample of the residue for almost a year. Manual sorting or picking was used when both chemical and wind separation techniques failed.

We also discovered that large areas of sites were disturbed by rodents, and previous erosional events. This caused our increased concern with site formation-transformation processes and how to measure and correct for them. We designed the final intensive excavations with these problems in mind, so as to minimize them and to explore the spatial organization within sites. Based on the ethnohistorical model we realized that one site would not reflect all of the variability present in the local archaeological record.

Seven sites, dispersed along the Navidad River and its tributaries, were selected. We will show the excavation strategy at 41 JK 178, which the other site excavations will parallel.

41 JK 178: The Olsovsky Site

The Olsovsky site is located on a ridge within the Blufftop Forest dominated by oaks. This ridge protrudes into the Floodplain Forest, dominated by elms, along Mustang Creek. Testing of the site during Spring 1976 permitted the accurate establishment of the site boundaries and the determination of two distinct occupations.

The first occupation contains contracting stem arrowpoints, bone-tempered pottery, and steeply retouched flakes. It is believed to date from A.D. 1000 to 1500. The second occupation occurred late in the 19th century or early in the 20th century and is probably associated with a barbeque pit located just off the site. Stratigraphy at the site is simple, but we have been unable to separate the historic occupation from the prehistoric.

The first step in the excavation was to isolate an eight-meter square block with backhoe trenches. This block was located on the basis of the previous tests so that it was centered in the site and located where post-occupational disturbance was minimal. The trenches were then cleaned and profiled. Next a one-meter grid was superimposed over the area and the elevations at the stakes measured. Hand excavation was begun in one corner of the block and proceeded in such a way that two faces or profiles were always available for examination on each square.

In order to reduce the amount of residue recovered, all the fill was screened through 1/4" wire screen with the exception of a systematic 10% volumetric sample taken from the southwest corner of each one meter square. These columns were water screened through 1/4" and 1/16" hardware cloth and the residue bagged separately.

As material was water screened, the coarse residue from each square was laid out to dry. Rough sortings into shell, bone, charcoal, concretion/pebble, historic debris, prehistoric sherds, and lithic categories were then made. Frequency counts for each category per square were plotted each night onto a number of transparent overlays. Field cataloging and the rapid plotting of results allowed us to modify our field collection techniques quickly so that various hypotheses about site formation and artifact distribution could be investigated.

Figure 1 displays the distribution of prehistoric and historic artifacts and debris. For the moment let us concern ourselves only with the prehistoric refuse distribution map. The mean density is approximately 28.4 items per square. If you shade in the areas with values greater than the mean, you would end up shading in the northeast or upper right hand corner. Based on this distribution we could hypothesize that this concentration was the result of either primary refuse activities in which artifacts were discarded where they were used, or that this concentration was the result of

N 18 E 10				N 18 E 18			
6	1	0	7	5	1	2	3
10	1	0	5	13	0	5	1
1	2	3	3	5	3	5	3
8	11	3	1	2	2	1	3
4	32	5	0	2	1	2	1
1	0	1	0	0	1	0	0
1	2	0	0	0	1	0	2
0	0	0	1	1	1	0	0
N 10 E 10				N 10 E 18			

A) HISTORIC ARTIFACTS

N 18 E 10				N 18 E 18			
7	9	32	70	30	53	33	37
1	34	21	67	62	51	57	48
18	14	12	71	41	31	49	76
16	140	35	7	28	44	77	36
3	38	16	18	14	10	6	13
23	7	12	6	5	2	7	23
15	17	13	24	7	18	12	6
6	14	7	24	14	10	7	11
N 10 E 10				N 10 E 18			

B) PREHISTORIC REFUSE

Figure 1. 41JK178, Palmetto Bend Project, Jackson County Texas. 1/4 inch water screen residue, general fill, raw count.



secondary refuse activities -- dumping. We could also assign various functional "tags" depending on the makeup of the assemblage.

Now look at the historic refuse distribution map. The mean density for this map is approximately 2.4. Once again the high density association of these two occupations in terms of space is quite clear. When chi-square was calculated, it resulted in a value of 10.32 with one degree of freedom, and a probability of occurring at random of 0.002. An obvious explanation for this correspondence is that some common natural or cultural process resulted in the removal or truncation of deposits in the southern portion of the site. No such event was obvious during the earlier examination of the profile along the backhoe trench.

At the same time that this close association was noted, excavation revealed the presence of a raised hump of calcium carbonate concretion gravels. In the same vicinity a depression had been noted on the surface prior to excavation. Water screening of the soil from this area resulted in the recovery of a higher density of wood charcoal than in adjacent units. The charcoal appeared to be quite recent and contained numerous bark fragments. We have, on the basis of the above observations, proposed the following hypothesis. Recent 20th century uprooting of trees has resulted in the removal and dispersal of cultural refuse from its original archeological context. We also believe that artifacts can be dispersed by roots radiating out from large trees, although this has not been demonstrated by any sort of systematic experiment.

Conclusion

We are therefore left with a quarter of the site which may have been intact for a fairly long period of time. Observations based on excavations at 41 JK 178 have demonstrated the difficulty in interpreting stratigraphy and our frequent inability to understand the archaeological context of refuse through limited testing. Our investigations at the Olsovsky site once again serve as a cautionary reminder for those of us who quickly assume that we can accurately assign meaning to spatial scatters of refuse -- particularly when little concern has been placed on the cultural and natural processes by which the scatter was created or transformed.

COPPER: ITS PROCUREMENT AND USE BY THE INDIANS OF THE
SOUTHEASTERN UNITED STATES

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The presence of large numbers of copper artifacts in the prehistoric eastern United States has given rise to several hypotheses concerning the origin and dispersal of these artifacts. Little attention has been directed toward the location and identification of the aboriginal quarry sites which produced the raw materials necessary for the manufacture of these artifacts. The purpose of this paper is to identify native copper deposits in the eastern United States, to discuss the quarrying of copper within these areas, and to suggest the possibility of the exploitation of indigenous copper ore sources by the Indians of the southeastern United States.

The term "mine" has been misapplied to the collection and processing of native copper ores. Geologically, "mining" is restricted to the excavation of minerals by the use of subterranean workings such as shafts (American Geological Institute 1974:322). The term "quarry" more aptly applies to the collection of native copper ores as it refers to open or shallow subsurface workings seldom extending more than 10 or 12 feet below the surface (American Geological Institute 1974:408). Aboriginal copper quarries, particularly those in the Great Lakes area, do not consist of subterranean shafts, but are generally shallow pits averaging 10 feet in depth. In other cases, large nuggets of native copper occur on the surface and can be easily separated from their rock matrix or simply picked up off the ground.

Copper is a mineral occurring in both uncombined and combined states. Uncombined copper, commonly referred to as native copper, contains 95-99 percent copper and is produced by the exposure and weathering of copper bearing sulfide veins. Copper in its combined state includes large quantities of impurities. Combined copper minerals, such as chalcocite and chalcopyrite, require refining and smelting for the extraction of usable quantities of copper. As these copper extraction processes were unknown to the eastern Indians, the only copper sources available for aboriginal exploitation were those containing native copper ore either as exposed outcroppings or as easily accessible subsurface deposits.

Native copper deposits are found in association with older, weathered landforms or in glacial tills, the most extensive deposits occurring in the Lake Superior/Isle Royale area (Fig. 1). These deposits, formed during the Precambrian Era, were exposed and weathered by glacial action. Other deposits in this area are in Wisconsin and the glacial deposits of Michigan and Illinois. In the southeast, native ores are distributed throughout the Appalachian Piedmont from Anniston, Alabama, to Frederick, Maryland. Within this area large deposits occur in Fannin and White Counties, Georgia; Ducktown, Polk County, Tennessee; Ashe and Person Counties, North Carolina; and in Madison and Fairfax Counties, Virginia. These deposits, formed during the Ordovician, have been exposed by erosion and weathering. Additional small outcroppings occur in Arizona and New Mexico, however, it is unlikely these deposits were exploited by the eastern Indians.

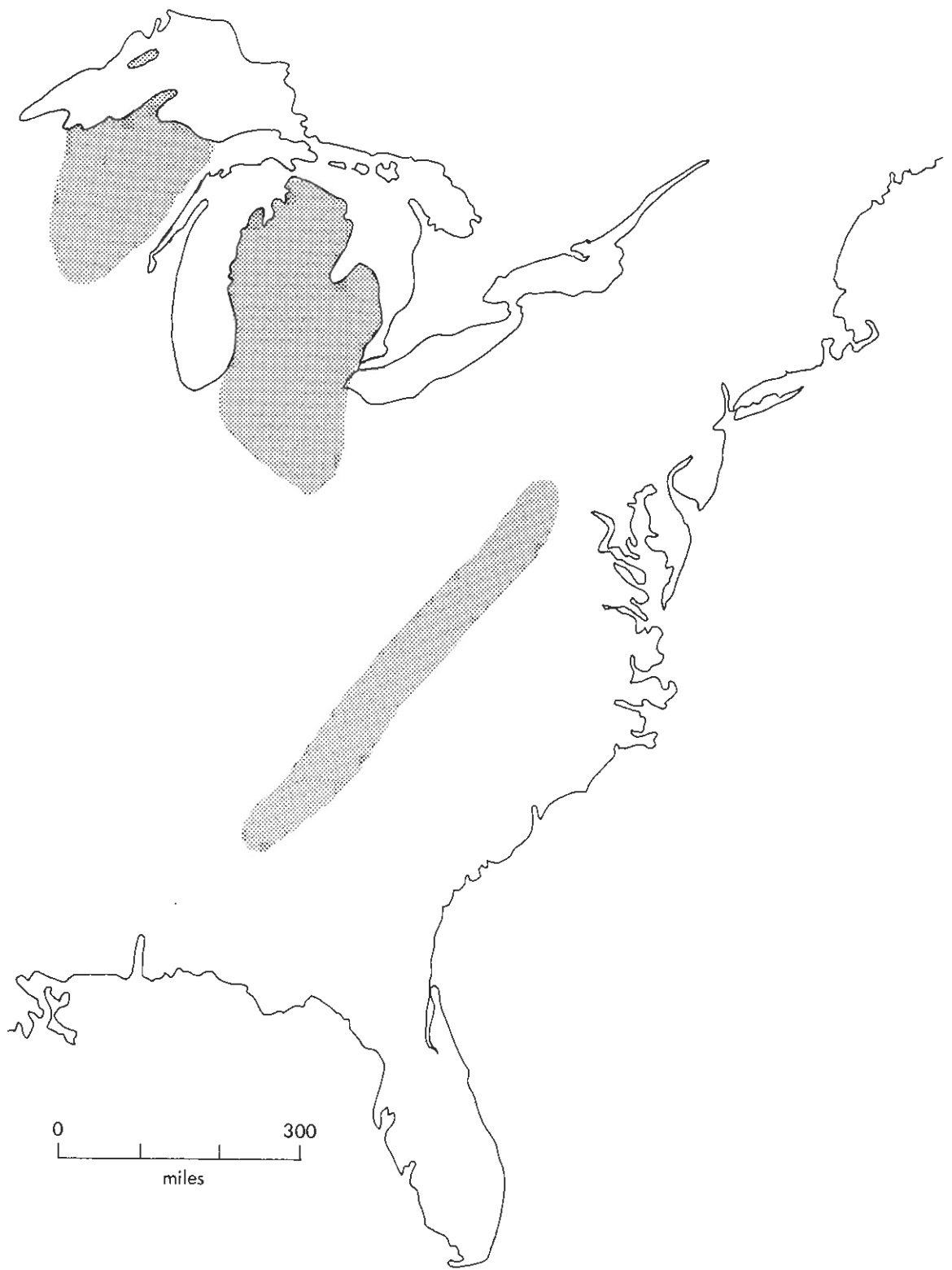


Figure 1. Native Copper Ore Sources.

Aboriginal copper quarries have been reported from the Isle Royale/Lake Superior area. These quarry sites were described by Winchell as:

Rude, irregularly disposed, shallow pits in the general surface, which on being cleared of rubbish, are found rarely to exceed the depth of ten feet but in some instances reach the depth of twenty. They seem to have been located by the accidental outcroppings of native copper, over large areas the rock being entirely bare. In other cases, the mining seems to have been systematically prosecuted along the strike of a known copper bearing belt of rock. In this case it is a rock of marked lithological characters, being of a red color, and, when once its trend was established by a series of pits, it was followed under the drift-materials, that were thrown off into heaps, in which are found, mingled with charred wood and other relics, a great many stone hammers (Winchell 1911:601).

Stone hammers and chisels found discarded in these pits suggest that copper was separated from its matrix by the very simplest and most laborious methods, probably accompanied by the application of heat and by repeated blows to the rock in which the copper was embedded (Griffin 1961:22). Winchell reported that:

Some of the masses found, being too large for removal from the pits, show the marks of long continued pounding and about them in the pits are a great many small, thin chips of metallic copper, of irregular shapes, with concavo-convex surfaces, exactly such as would be produced by battering a small nugget of copper into a thin layer by pounding it continuously (Winchell 1911:602).

Once recovered from the quarry, copper nuggets appear to have been partially or wholly processed at the quarry site. Drier (1961) described a quarry site in Houghton County, Michigan 14 feet in depth and containing evidence of quarrying activities. About 20 feet from this pit there was an area of broken rock indicating that this location was an area where the prehistoric miners crushed the rock they removed from the pits. Numerous small pieces of free copper were found in this crushed rock. One of these copper fragments 1/3 by 1 inch was flattened on both sides, and one edge had breaks in it as though it had been hammered. The hammerstones found at this site were smaller than those found in the copper quarry and had apparently been used in processing the copper after its removal from the quarry. Other sites contiguous to the quarry area contained nuggets of unprocessed ore and hammerstones similar to those described by Drier (Griffin and Quimby 1961:77-88).

Aboriginal quarry sites resembling those found in Michigan are unknown or unrecognized in the Southeast. That quarrying techniques were known to the southeastern Indians is evidenced by the presence of aboriginal mica quarries in North Carolina (North Carolina Mineral Museum). This apparent lack of copper quarry sites may be attributed to the destruction of these sites by modern commercial mining operations rather than to their absence from the area. Early historic accounts contain numerous references to the quarrying and working of native copper by southeastern Indians. These accounts ranging from Ponce de Leon in 1513 to those of the English on Roanoke Island and Jamestown, which, in 1612, record the presence of copper artifacts and their manufacturing techniques (Hakluyt 1953; Sauer 1971).

While the early Spanish accounts contain vague references to copper bearing deposits laying to the north of Florida; the de Soto chroniclers are specific in their identification of the province of Chisca as the area where copper was quarried by the southeastern Indians. Both Garcilaso (1951) and the Gentleman of Elvas (1968) describe this province as sparsely populated and mountainous but containing large deposits of native copper. Exploratory parties sent out from Cofitachique to this province returned in eleven days bringing with them large nuggets of unworked copper surface collected in Chisca.

The English or Roanoke Colony provide detailed descriptions of copper quarries in southwestern Virginia and North Carolina. These quarries, near the headwaters of the Roanoke River, furnished copper to the inhabitants of the Middle Atlantic coast. Strachey (1953) reported that survivors of the Roanoke colony had been found in southwestern Virginia where they served as forced labor, beating and processing copper for the chief of the village in which they had sought refuge. Lane (Hakluyt 1953) described the aboriginal method for the recovery of copper ores. A large bowl, partially covered with skin, was dipped into a stream at the base of a copper deposit. After a short time the bowl was filled with sand, rocks and copper nuggets that had been dislodged from the deposit upstream. These nuggets could easily be distinguished from other stones and removed for processing. This method of copper panning is historically documented; examples may be cited from the literature of both Georgia and North Carolina (Lawson 1967).

Lane (Hakluyt 1953) noted that the copper recovered from panning was thrown into a fire, heated and separated from its matrix, yielding two parts ore to three parts rock. This heating process removed any matrix material adhering to the nuggets and reduced the oxidation layers. The copper was then pounded into shape and exchanged to Indian groups along the coastal plain.

Other accounts record the presence of aboriginal mines and quarrying shafts in Georgia and North Carolina. Mooney (1975) reported the presence of aboriginal quarries in North Carolina and attributed these workings to the Spanish. C.C. Jones (1873) noted the presence of shafts in Fanin and White Counties, Georgia, giving a date to these quarries of at least 200 years. Lederer (1958), in 1669, wrote that a number of old mines were present in the North Carolina Piedmont. Lawson (1967) said that he had been told of an aboriginal copper mine in western North Carolina but had not visited the site. Hariot (1946) in his description of the natural resources of North Carolina lists copper and goes on to explain that the English knew of no copper mines in the area as the Indians were reluctant to disclose their source for the metal. In a later account he states that he and a group of Englishmen were shown a mine by an Indian from Roanoke Colony, but he does not give a location or description of this quarry.

Assuming that the early historic accounts were correct in their identification of the loci of copper deposits, it should be possible to identify by chemical analyses those deposits that served as aboriginal quarries.

The technique of Optical Emission Spectroscopy has been successfully employed in the identification of trace elements in native copper ores and artifacts. The specific techniques used have been described elsewhere and will not be dealt with by this paper (Goad 1974, 1976).

In order to test the hypothesis of indigenous copper quarrying by the southeastern Indians twenty ore samples from major native ore sources in the eastern and southwestern copper artifacts were selected for analysis. The artifacts chosen for analysis were single rivet copper earspools from two Middle Woodland sites and one Early Mississippian site in Georgia. The specific sites are Tunachunnee, a Middle Woodland site in Dade County; Mandeville, a Woodland site in Clay County; and Kolomoki, an Early Mississippian site in Early County (Tables 1 and 2; Fig. 2).

The results of this analysis indicates that there is a significant and recognizable difference in the trace element composition of these samples (Table 1, 2). In order to group the samples based on the similarities and differences in their trace element composition an objective grouping technique was employed.

The general kind of statistical technique considered appropriate for grouping is cluster analysis. The method used is Ward's Method. A computer program, HCLUS, was used to perform the analysis. HCLUS was developed by John Wood of Northern Arizona University and modified by Donald Graybill of the University of Georgia (Graybill 1974, Wood 1974).

Briefly, what any cluster analysis attempts is to group units or variables (in this case copper samples) into clusters so that there is a higher degree of association within clusters than between clusters. Ward's Method is a hierarchical agglomerative clustering technique in which clustering proceeds by progressive fusion beginning with the individual cases, i.e. copper samples, and ending with the total population (Anderberg 1973:142-145).

Table 1

Sample No.	State	Iron	Manganese	Cobalt
8	AZ	.00017	.00065	.00090
9	VA	.00034	.00075	.00083
14	VA	.00011	.00078	.00085
15	VA	.00014	.00042	.00087
17	MI	.00025	.00003	.00000
18	WI	.00030	.00000	.00000
19	MI	.00009	.00007	.00000
21	TN	.00019	.00120	.00032
22	GA	.00023	.00115	.00029
23	GA	.00020	.00110	.00035
24	NC	.00024	.00100	.00031
25	MI	.00010	.00009	.00000
26	NM	.00013	.00056	.00086
27	NC	.00022	.00111	.00028
28	MI	.00009	.00010	.00000
29	WI	.00029	.00000	.00000
30	TN	.00017	.00115	.00032
31	AZ	.00016	.00060	.00088
32	NM	.00020	.00062	.00089
34	TN	.00021	.00120	.00037

Table 2

Sample No.	State	Iron	Manganese	Cobalt
F30L	GA	.00014	.00190	.00030
F30R	GA	.00017	.00222	.00027
K#12	GA	.00018	.00110	.00036
F33	GA	.00015	.00115	.00026
M#1	GA	.00020	.00111	.00032

(F30 1, R, and F33, Tunachunnee; K#12, Kolomoki; M#1, Mandeville.)

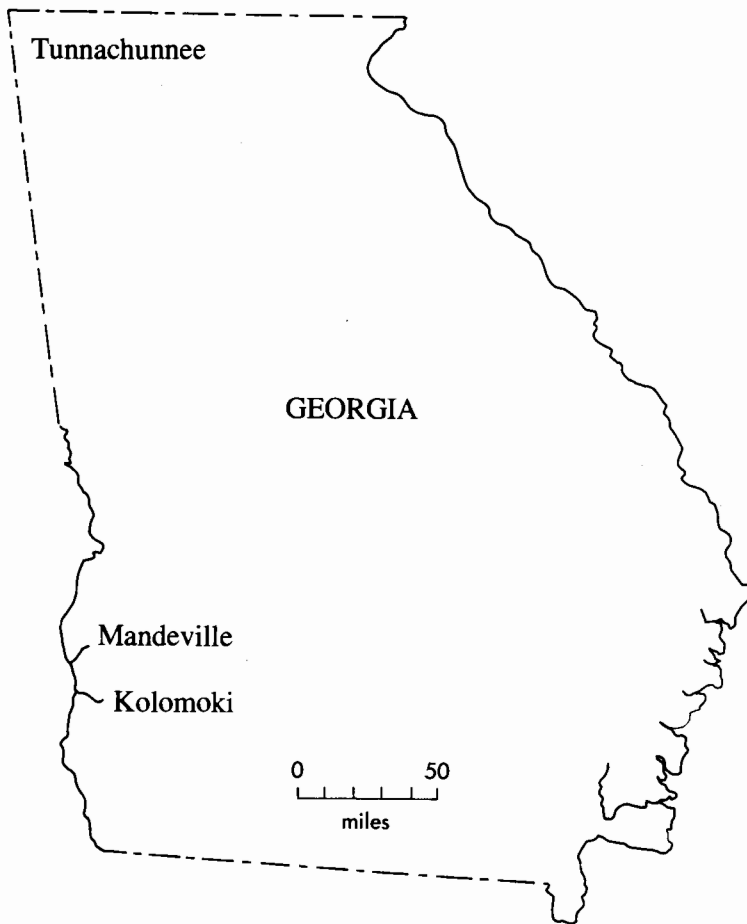


Figure 2. Map of Sites.

Figure 3 presents a dendrogram of the hierarchical set of junctions for the entire cluster analysis. The 25 nodes along the bottom of the dendrogram represent the individual copper samples. The scale on the left side of the dendrogram is the actual measure of the inter-cluster distance developed during the analysis.

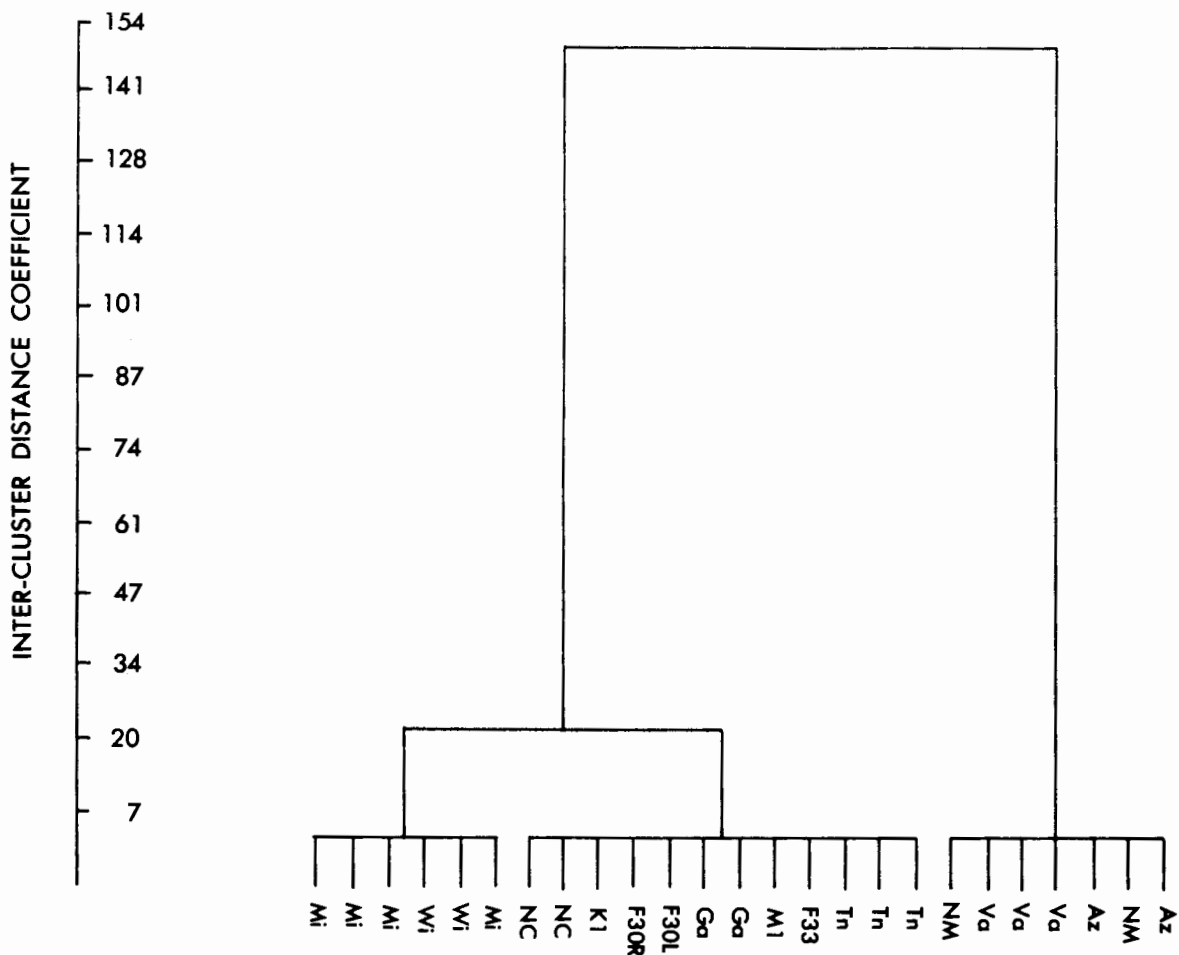


Figure 3. Dendrogram of Complete Linkages.

Using the dendrogram, the next procedure was to determine the optimum acceptable number of clusters to be included in the analysis. Figure 4 presents a graph of the percent of change in information in relation to the number of clusters produced. As can be seen from Figure 4, a reasonable cluster solution, for the particular problem at hand, is that of three clusters. This point falls at a point of major transition of information and resolution.

The three cluster solution was chosen. Cluster I is composed of the southwestern ores, including New Mexico and Arizona. Ores from Virginia are also included in this group. Ore deposits from Georgia, North Carolina and Tennessee in addition to the five copper earspools are included in Cluster II. Cluster III is a grouping of all ores from Michigan and Wisconsin.

The results of this cluster analysis suggest that the copper used in the manufacture of the Georgia artifacts analyzed was quarried in the Southeast. This suggests a number of hypotheses which may be examined with the analysis of additional ores and artifacts. For the Georgia area a series of exchange networks may be developed originating at source areas in North Carolina and Tennessee.

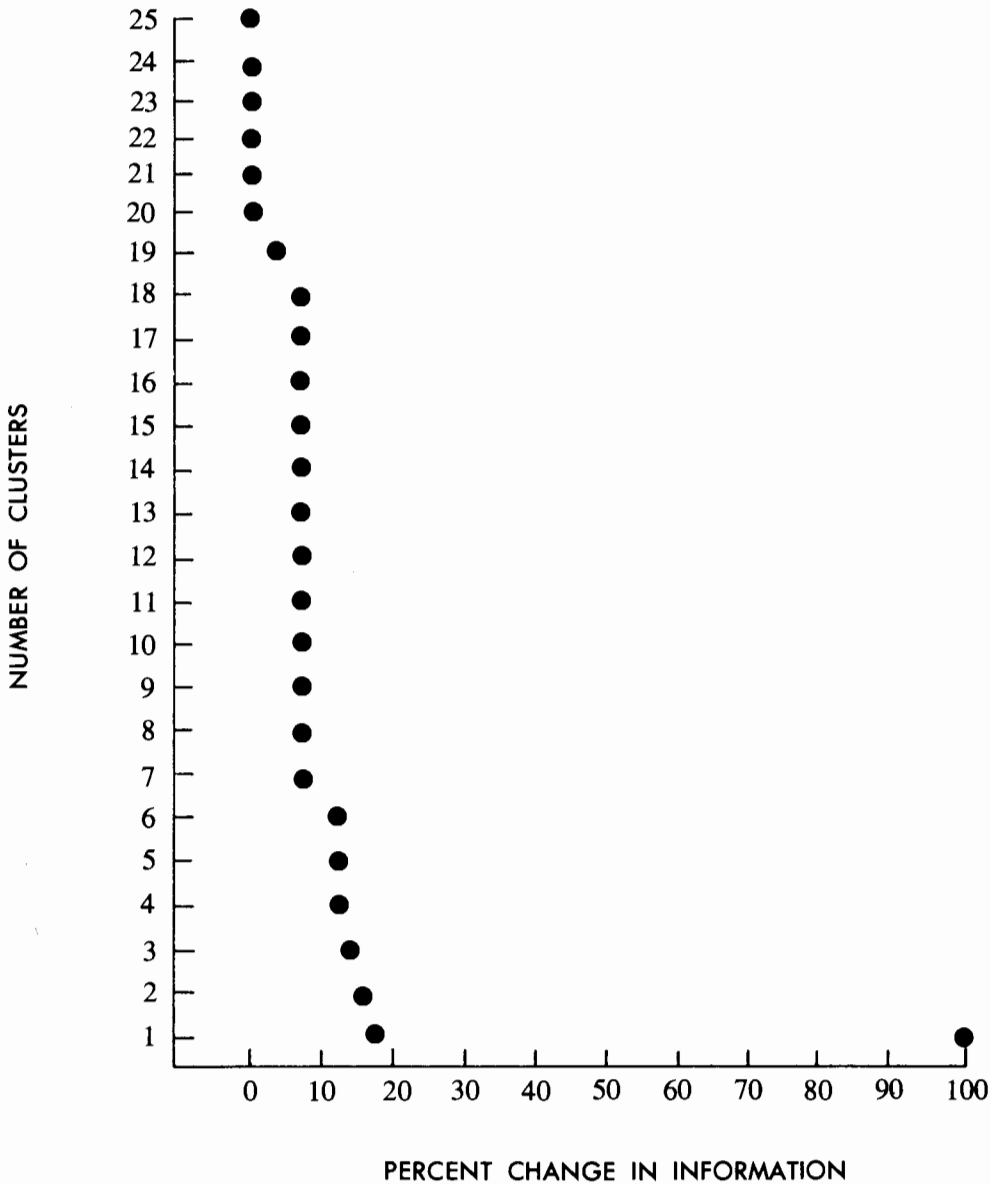


Figure 4. Number of Clusters.

All of the artifacts analyzed were copper earspools of the single rivet style averaging 3 cm in diameter. The inner and outer cymbal discs were held in place by a thin copper rivet hammered through the two discs. It is suggested that the similarity of the artifacts in both style, method of copper manufacture, and size suggests that they were manufactured at or near the quarry site and exchanged to other points in the Southeast. Ethnohistorical references, particularly those of Elvas (1968) and Lane, record the presence of similar copper exchange routes; and it is possible that a similar form of exchange existed at an earlier date. Garcilaso (1951) and the Gentleman of Elvas (1968) report that, while in Florida, de Soto captured several young boys who had been apprenticed to itinerant traders. One of these boys told de Soto that these traders regularly visited Chisca

and Cofitachique where they exchanged pearls and other goods for copper artifacts. These artifacts were traded to other points throughout Georgia and Florida for shell and other items. Lane (Hakluyt 1953) reports that the Mangoaks, a tribe living on the North Carolina mainland, maintained trading contacts with the groups living in the quarry areas of North Carolina. The Mangoaks secured copper artifacts from these groups and passed on a portion of their copper to coastal groups in exchange for pearls.

In summary, it has been suggested that copper was quarried throughout the eastern United States wherever there were sufficient outcroppings to warrant exploitation. Although quarries have not been identified in the Southeast, this lack of sites may be attributed to modern mining operations which have destroyed large surface areas where aboriginal shafts and pits might have existed. In order to test the hypothesis concerning aboriginal quarry operations in the Southeast, a number of ethnohistorical accounts have been presented along with a spectrochemical analysis of southeastern geological copper sources and artifacts. This analysis has shown these artifacts were manufactured from ores indigenous to the Southeast, and it is suggested that the lack of known quarry sites from which these ores were taken is due, in part, to the failure on the part of the archaeologists to look for these sites during field survey.

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EXCAVATION AND RECOVERY OF BIOLOGICAL REMAINS FROM TWO
ARCHAIC SHELL MIDDENS IN WESTERN KENTUCKY

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and

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Introduction

The Shell Mound Archaeological Project was conceived in 1971. Marquardt had become interested in the well known western Kentucky shell mound sites in the context of an extensive survey of the prehistory of the Western Coal Field physiographic region of Kentucky completed while he was a M.A. candidate at the University of Kentucky. He had found that although the shell mound sites figured prominently in many interpretations of the prehistory and physical anthropology of the eastern United States (e.g., Byers 1959; Caldwell 1958; Dragoo 1958, 1975; Fowler 1959; Griffin 1952, 1967; Howells 1960; Johnston and Snow 1961; Leigh 1925; Lewis and Kneberg 1959; Neumann 1952; Rolingson 1967; Webb and DeJarnette 1942; Winters 1968, 1974), little was known in detail about the subsistence activities of their prehistoric inhabitants at this important horizon. Meanwhile, eight years of subsurface and surface work by Watson in Mammoth Cave National Park had delineated the activities of native North American horticulturists and cave miners in this part of west central Kentucky during the Late Archaic/Early Woodland time period (ca. 1500 B.C. - A.D. 20). As a result of archaeological investigations in dry caves of Mammoth Cave National Park, she and her colleagues had been able to define in some detail the plant and animal resources used by these aboriginal cave explorers and miners (Watson et al. 1969; Watson (ed.) 1974). Paleo-ethnobotanical analyses by Bryant, Cutler, Schoenwetter, Stewart, and Yarnell indicate that plant use included cultivation of squash and gourd as well as sunflower, possibly sumpweed (marsh elder), and perhaps chenopod. Maize was not used. Because there is some evidence from excavations in Salts Cave Vestibule that the earliest occupants did not cultivate the tropical species but were using the native North American ones, Watson and her co-workers had become very interested in recovering comparable information from the immediately antecedent time period (Middle to Late Archaic). However, initial attempts to locate related surface sites near the entrance to Salts Cave had failed. Thus, Marquardt's and Watson's research interests coincided, and when Marquardt came to Washington University in the fall of 1971, he and Watson undertook a reconnaissance of the Green River shell mounds in Butler and Ohio counties.

These sites were first described by Clarence B. Moore, who visited several Green River shell mounds, hiring local laborers to dig in some of them. A wealthy man, Moore financed publications that included full color photographs of some of the artifacts (Moore 1916). In the 1930s and the early 1940s several large sites on or near the river were extensively

explored by Works Progress Administration laborers under the general supervision of William S. Webb (Webb 1946, 1950a, 1950b; Webb and Haag 1939, 1940, 1947).

When we arrived in the Fall of 1971, we found the area looking much the same as it must have appeared to Webb in 1935 (see map, Fig. 1). With the exception of Indian Knoll (Oh 2) and Chiggerville (Oh 1), currently threatened by strip mining activity, the shell mounds have not been seriously disturbed. Many of the residents in the Big Bend in Butler County remember well the extensive excavations when hundreds of workers were mobilized for archaeological excavation under the WPA. In fact, some of the people still living in the area worked on the WPA crews. The generosity and kindness shown us by the residents of the Big Bend make working there a genuine pleasure.

A twelve day sounding at the Carlston Annis site (Bt 5) in late March and early April of 1972 by a small crew from Washington University re-initiated archaeological work on the Green River shell mounds (Marquardt 1972a, 1972b). We obtained a complete profile of the deposits in one one-by-one meter square from surface to sterile clay, a stratigraphic series of pollen samples, and of flotation samples, and two C-14 determinations. Our dates compare favorably with one of the series obtained by Webb on antler fragments from Indian Knoll and Carlston Annis (Table 1). However, the accuracy of the antler dates is questionable because the dates were obtained by the solid carbon method on materials of unknown reliability and context.

Having learned the depth of the deposit, its approximate age, and the nature of floral and faunal material at the site, we planned a second season's work at Carlston Annis, and at one or more of the other nearby shell mounds. During the 1974 spring break period we also mapped, but did no further work at, the Bt 11 shell mound.

Our second shell mound excavation effort began May 17 and continued until July 18, 1974, with the primary focus of attention once again being Bt 5. We also dug a one-by-one meter pit to the bottom of the Bowles site at the present site of Rochester, Kentucky, 15 miles west of Morgantown. A small part of Oh 13 had been excavated by the WPA but, according to the field notes, when the landowner and the archaeologist could not agree upon a price for damages to a potato crop, the excavations were terminated. Results of the work were not published, but the notes are on file at the University of Kentucky.

Shell Mound Archaeological Project
1974 Season: Field Operations

Top priority data desired from Bt 5 and Oh 13 in 1974 were botanical, hence we were particularly concerned with flotation. Because of difficulties experienced in floating the alluvial deposits (so different from the sandy sediments of Salts Cave) of the excavation in 1972, we refined our flotation set-up along lines suggested by Bill Robertson who had floated all the Salts Cave sediments. After some adjustments, the new rig (Watson 1976) worked quite well and we floated approximately 800 10-12 lb. bags of dirt from Bt 5 and Oh 13.

At Bt 5 (Fig. 2) we laid out a 4x4 meter area (Operation C) in a part of the site undisturbed by the WPA. This 4x4 was then subdivided into four 2x2 meter squares, each of which contained four 1x1 meter squares (Fig. 3). The northwest 2x2 (squares 1, 2, 3, 4) and the southeast 2x2 (squares 13, 14, 15, 16) were excavated; in each of the quadrants one 1x1 meter square (C1 and C13 respectively) was a float square, one was a mussel shell square (C2 and C14) and two were stratigraphic pits (C3, C4, C15, and C16). All excavation was by trowel and all deposits in the float squares below the plow zone were bagged for flotation (i.e., a total of about 4.5 cubic meters of dirt). The primary objective in the shell squares was to recover all shell as intact as possible in order to get a stratigraphic series of identifiable specimens. The stratigraphic pits were meant, of course, to furnish a profile of the deposit.

Table 1

Radiocarbon Dates From Kentucky Shell Mounds

<u>Lab. No.</u>	<u>Site</u>	<u>Provenience</u>	<u>Depth</u>	<u>Age (Libby half-life; uncorrected)</u>	<u>Material</u>
UCLA 1845B	Bt 5	AI, lvl. 8	105-120 cm.	4040 +/- 180 B.P.	charcoal
UCLA 1845A	Bt 5	AI, lvl. 10	135-150 cm.	4250 +/- 80 B.P.	charcoal
C-116*	Bt 5		6.5 ft.	5149 +/- 300 B.P.	shell
C-180*	Bt 5		3.0 ft.	7374 +/- 500 B.P.	shell
C-251*	Bt 5		6.5 ft.	4900 +/- 250 B.P.	antler
C-254*	Oh 2		1.0 ft.	5709 +/- 350 B.P.	antler
C-254*	Oh 2		1.0 ft.	4894 +/- 560 B.P.	antler
C-738**	Bt 5		1.5-2.5 ft.	4289 +/- 300 B.P.	antler
C-739***	Bt 5		5.5-7.0 ft.	4333 +/- 450 B.P.	antler
C-740***	Oh 2		1.0 ft.	4282 +/- 250 B.P.	antler
C-741***	Oh 2		4.5 ft.	3963 +/- 350 B.P.	antler

*Johnson 1951:6-8; Webb 1951

**Libby 1952:675-676

***Libby 1952:676

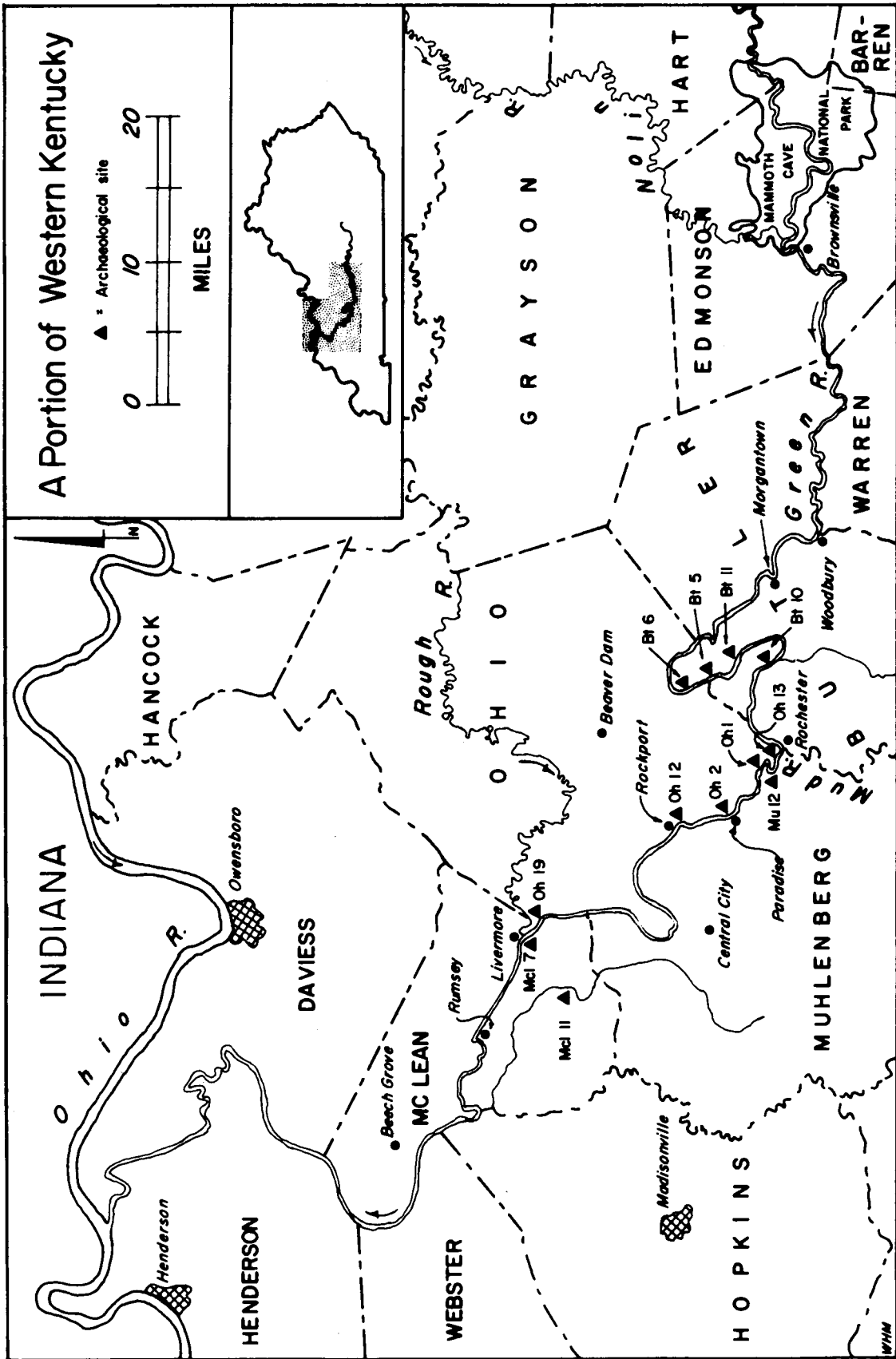


Fig. 1. A portion of western Kentucky, showing locations of certain shell mound sites.

At Oh 13 (Fig. 4), after some initial difficulty in locating deposits undisturbed by modern barn construction, we dug a 1x1 meter pit to sterile soil (2.46 meters below surface) with 50% of the dirt being bagged and floated.

Some Observations

Before summarizing preliminary results of the botanical and zoological analyses, we would like to make a few comments about the composition of the Kentucky shell middens.

There seems to be much variation in density of mussel shell and other debris from place to place. Often there will be dramatic increases or decreases within a vertical distance of less than 10 centimeters. Also, there can be as much horizontal as vertical contrast in shell, artifact, and bone density. It is probably the alkaline quality of mussel shell that gives the middens their characteristically favorable conditions for bone preservation (and characteristically unfavorable conditions for pollen preservation). Perhaps an implication of the contrasts in shell density are concomitant contrasts in preservative qualities.

Differences from site to site may be a possibility. More than 1200 skeletons are known from the Indian Knoll site (Oh 2), most of them well preserved (Moore 1916; Webb 1946). Although nearly all the burials excavated in our limited testing of the Carlston Annis site were also well preserved, Webb (1950a:273-274) reports that the 390 skeletons excavated at the same site by WPA crews in 1939-1941 were "poorly preserved." Another interesting contrast is that Webb reports clay floors at Indian Knoll (1946:129) and Carlston Annis (1950a:272), but no such "floors" have been recognized by us even though our excavation is done entirely by troweling. Finally, pottery is known to occur in the uppermost levels of shell middens (e.g., Webb and Haag 1939:59; Webb 1950a:343-344; Webb 1946:354-362), yet we have found no ceramic items in or on top of the mounds we have investigated.

Probably few archaeologists would doubt the value of detailed biological investigations of this sort, but we will probably all agree that we have a sampling problem as well. Before we can begin to investigate continuities and changes in Archaic exploitation patterns we must first be able to place our deposits accurately in time. Before we can do that, we must know something about the process of shell midden formation. The middens are large, complex, and inconsistent, and there seems to be a pressing need for the development of better strategies and techniques for the investigation of shell midden stratigraphy.

As an example, suppose we hypothesize that the Kentucky shell middens were built up gradually by a deviation amplification process in which there was horizontal as well as vertical stratigraphic accumulation. If this is true, then we may expect as much temporal variation horizontally as vertically. Radiocarbon dating is of undoubted utility but it may be helpful to augment our radiocarbon dates with dates obtained by some other technique which is less expensive and more responsive to small differences in time of soil deposition. As one possibility, we suggest that thermoluminescence (TL) (Ralph and Han 1971) may be used to date deposits relative to one another, either by directly dating fire cracked rock, fired earth, or artifacts

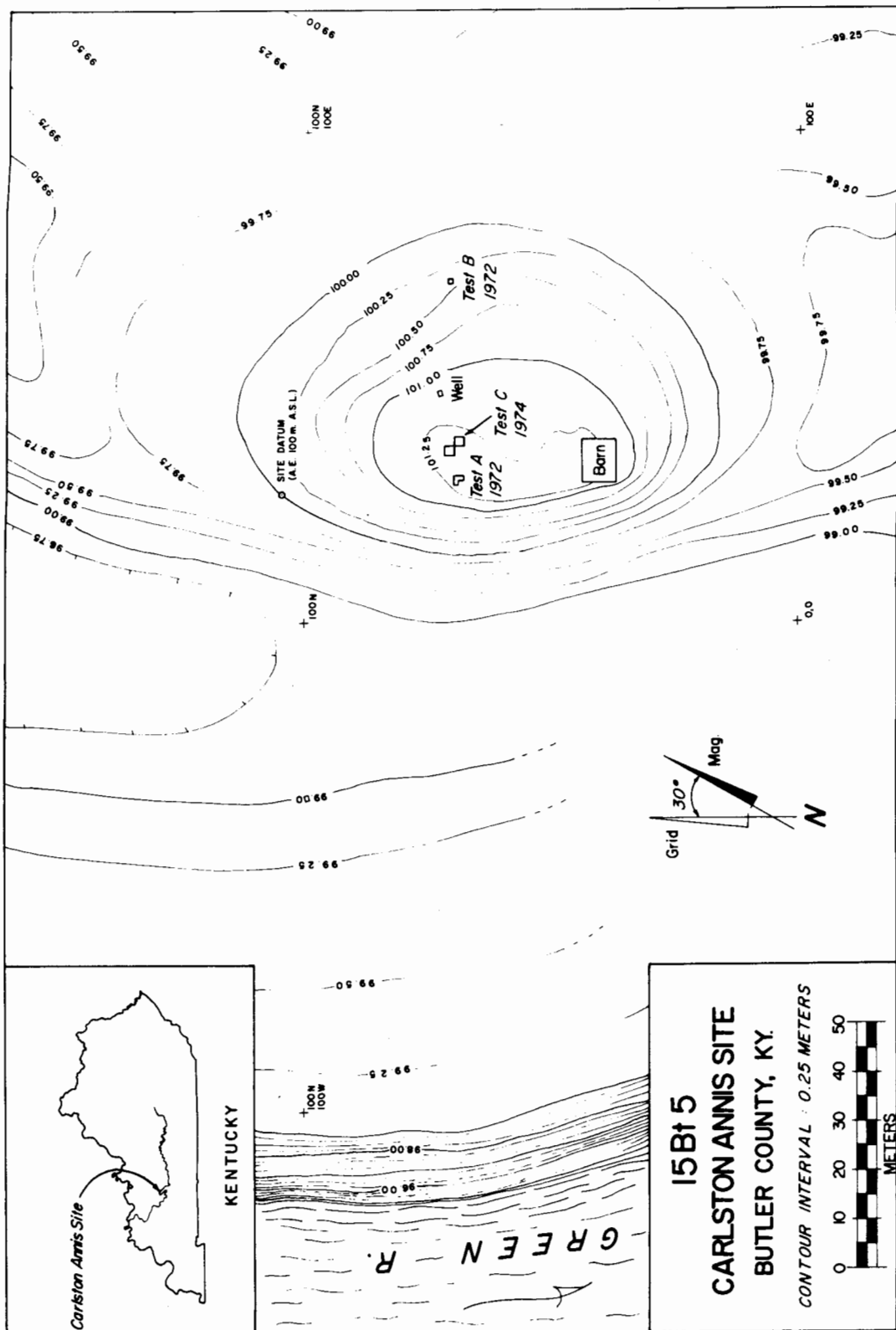


Fig. 2. Map of site Bt 5, the Carlston Annis mound, showing areas of 1972 and 1974 excavations.

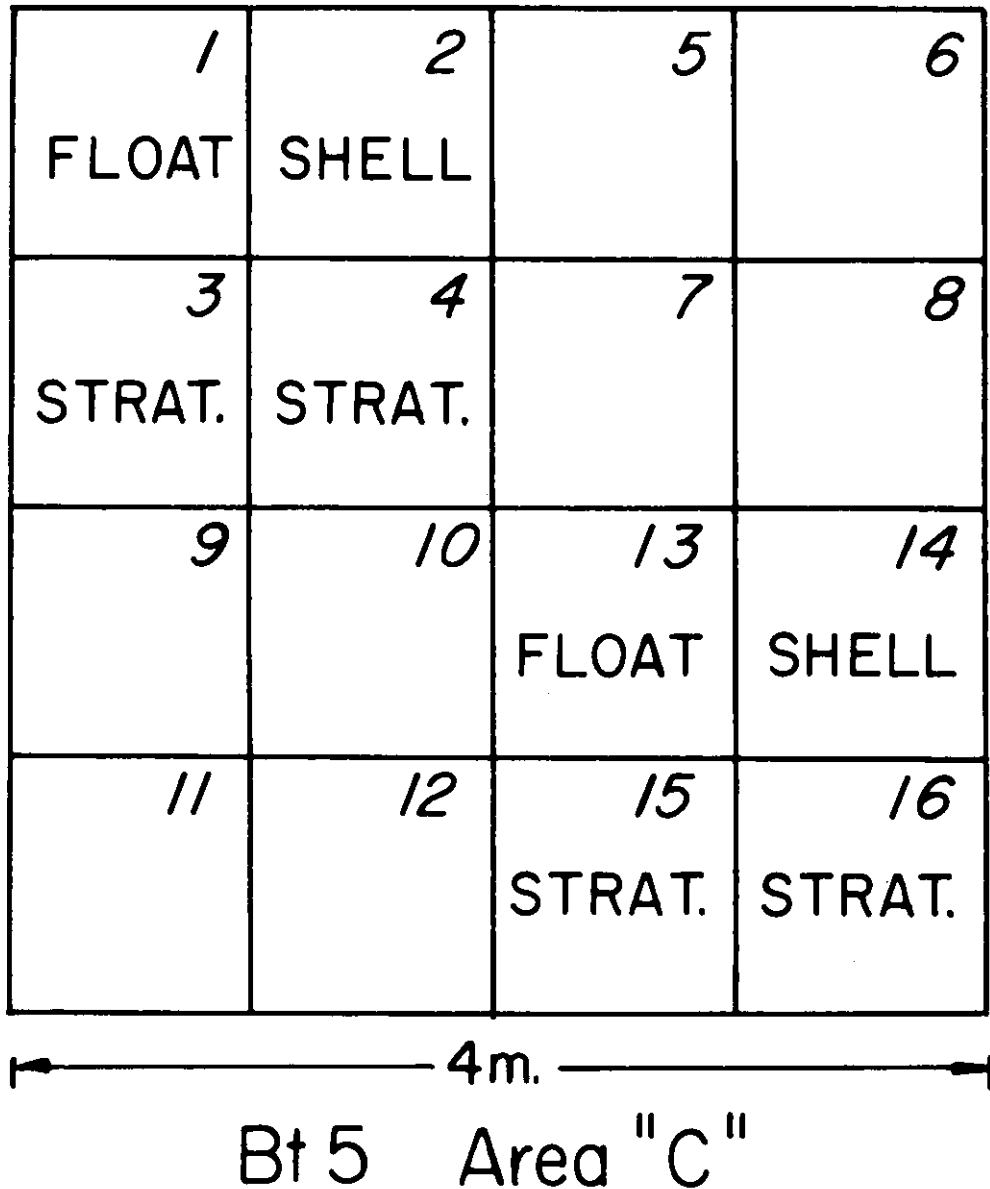


Figure 3. Arrangement of special-purpose excavation units at the Carlston Annis site in 1974.

(ceramics, heat treated cherts; Rowlett, Mandeville, and Zeller 1974), or by directly dating the soil matrix. In the latter case, standard dosimeters can be buried at different places in the deposit and allowed to absorb radiation. When irradiated, the dosimeters give up TL in proportion to the amount of radiation contained within the soil. Differences in radiation content might be indicative of differences in time of deposition. Alpha recoil dating is another promising technique that has been used successfully to date daub from different levels of the Hazel mound in northeast Arkansas (Garrison 1976; Garrison, Zinke, and McGimsey, in press). These techniques may eventually be shown inappropriate for the kinds of questions we are asking, but we think that they and other techniques for the investigation of the processes of shell midden accumulation warrant our serious consideration.

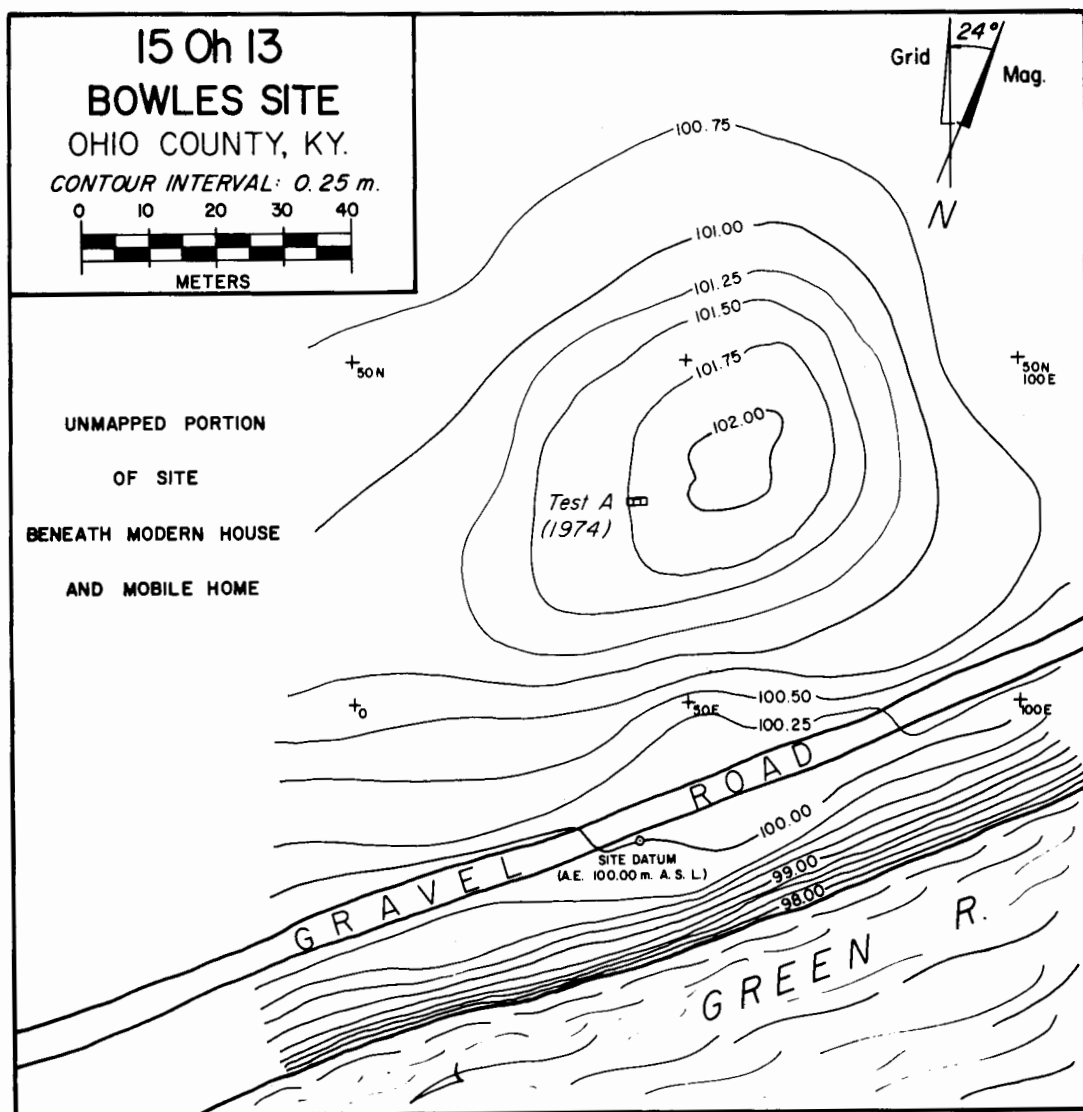


Fig. 4. Map of site Oh 13, the Bowles site, showing area of 1974 excavation.

We have been sufficiently impressed, even in our limited soundings to date, with the necessity for a detailed understanding of shell mound depositional processes and stratigraphy that we are currently seeking a geomorphologist to collaborate with us on these problems.

Preliminary Results

Biological materials presently being analyzed include human bone, animal bone, mussel shell, and botanical remains. In addition to the five burials recovered from our excavations at the Bowles site, and the six burials found at the Carlston Annis site, Louise Robbins (University of North Carolina-Greensboro) is analyzing the 390 human burials taken from the Carlston Annis site by the WPA excavations. These burials have not been previously described or reported. The skeletons analyzed thus far are mainly of adoles-

cents and adults; few child and infant burials were saved during the excavations of the site. There is a minimal amount of sexual dimorphism between males and females which, at least in part, must result from participation in similar kinds of strenuous physical activities. There is a higher incidence of skeletal pathology (in addition to arthritic cases) in the series than is usually found in series from the Archaic cultural period. The range and severity of dental and bone pathologies are surprising, especially in light of the diverse dietary debris that has been recovered from the site. Some factor or factors in the diet, in the environment, or both adversely affected the normal function of vascular systems of the people, which in turn upset the balance of normal growth and maintenance of skeletal bone. These maladaptive factors have not yet been identified. In addition to the morphological and paleopathological examination being carried out by Robbins, Steven C. Ward (Washington University) is carrying out research on dental pathologies and wear patterns as well. The animal bone from our excavations is being examined by Lathel Duffield (University of Kentucky). When these analyses are completed we will compare the findings with what we know of human and animal remains at other shell mounds in the Big Bend, shell middens elsewhere, and other Archaic sites in the eastern United States.

The analysis of mussel shell from unit C-2, Carlston Annis mound, has now been completed by Diana C. Patch (Ohio State University). Although there are substantial differences in the amounts of shell -- both unionids and gastropods -- from level to level (see Fig. 5), the five most frequently identified species of unionid are always the same for levels 4-18 (levels 1-3 constitute the plow zone, while levels 19 and 20 are transitional to sterile, sandy clay). By far the most prevalent species is Epioblasma torulosa rangiana*, a riffle species preferring shallow water, very strong currents, and a substrate of stable sand. Elliptio dilatatus, while tolerant of many environments, can be found in riffle/run areas, as can Ptychobranthus fasciolaris. Obovaria retusa* and Cyprogenia stegaria were also frequently found in the Bt 5 levels: these are "large river" species requiring shallow water, a swift current, and a gravel to sand/gravel substrate. Individuals of the genus Pleurobema were also found. Because most malacologists believe that Pleurobema inhabits deeper water and is buried, one is led to wonder whether the Indians made a special effort to find individuals of this genus; however, David H. Stansbery (Ohio State University, Museum of Zoology) has observed Pleurobema partially buried in the shallow water of riffles. Also present in the Bt 5 levels were Quadrula pustulosa, Elliptio crassidens crassidens, Cyclonaias tubercula, Actinonaias ligmentina carinata, Quadrula cylindrica cylindrica, Fusconaia subrotunda subrotunda, Plagiola lineolata, Lampsilis ovata, Ligumia recta, Obliquaria reflexa, Quadrula metanerva, Amblema plicata plicata, Epioblasma triquetria, Obovaria olivaria, and Plethobasus cyphrus. There are no Anodontines found in the Bt 5 levels, perhaps suggesting the absence of a deep, pond-like area near the river that would have the mud substrate favored by this sub-family of Unionids.

In sum, the Unionid analysis suggests that the Green River near Bt 5 must have been large but shallow. There may have been a gravel bar where Bt 5 is located, allowing easy access to a riffle and a run with strong currents in a sand/gravel substrate (Patch 1976:35-52).

* Both E. torulosa rangiana and O. retusa are today rare and endangered species in this area. The gastropod O. canaliculatum is also endangered.

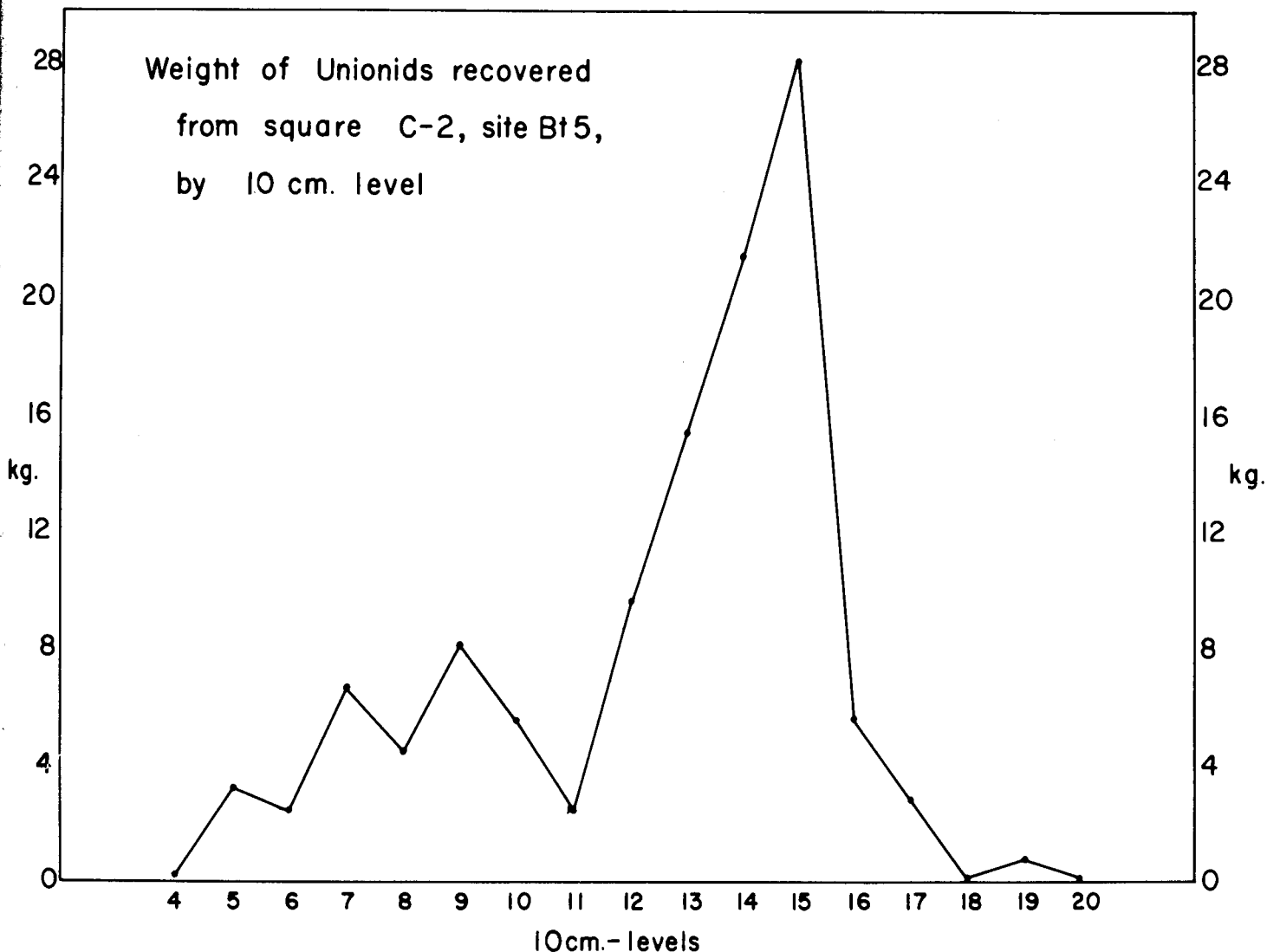


Fig. 5. Weight of Unionids recovered from Square C-2.

Patch also identified five species of aquatic gastropods in the Bt 5 shell midden deposit. In the uppermost levels (4 and 5) were individuals of the genera Elipstoma and Anculosa, but in the lower levels (6-20), Oxytrema canaliculatum is much more common (Fig. 6). A few Campeloma crassula individuals are found, mostly in levels 5, 6, 7, 12, 13, and 15.

The genus Oxytrema is a river form found on rocks near a swift current, and Anculosa inhabits rocks and gravel bars in swift streams as well (see Baker 1928: 181-182; Goodrich 1922:5; Patch 1976:55). Thus, the identified species of aquatic gastropods would seem to confirm the hypothesis that the Green River was large, with riffle/run habitats (Patch 1976:53-58). The riffle/run situation is one in which human shell-fishers can most easily make such collections by wading and hunting the Unionids by sight, by touch with the feet and hands, or by the use of nets, scoops, or other tools.

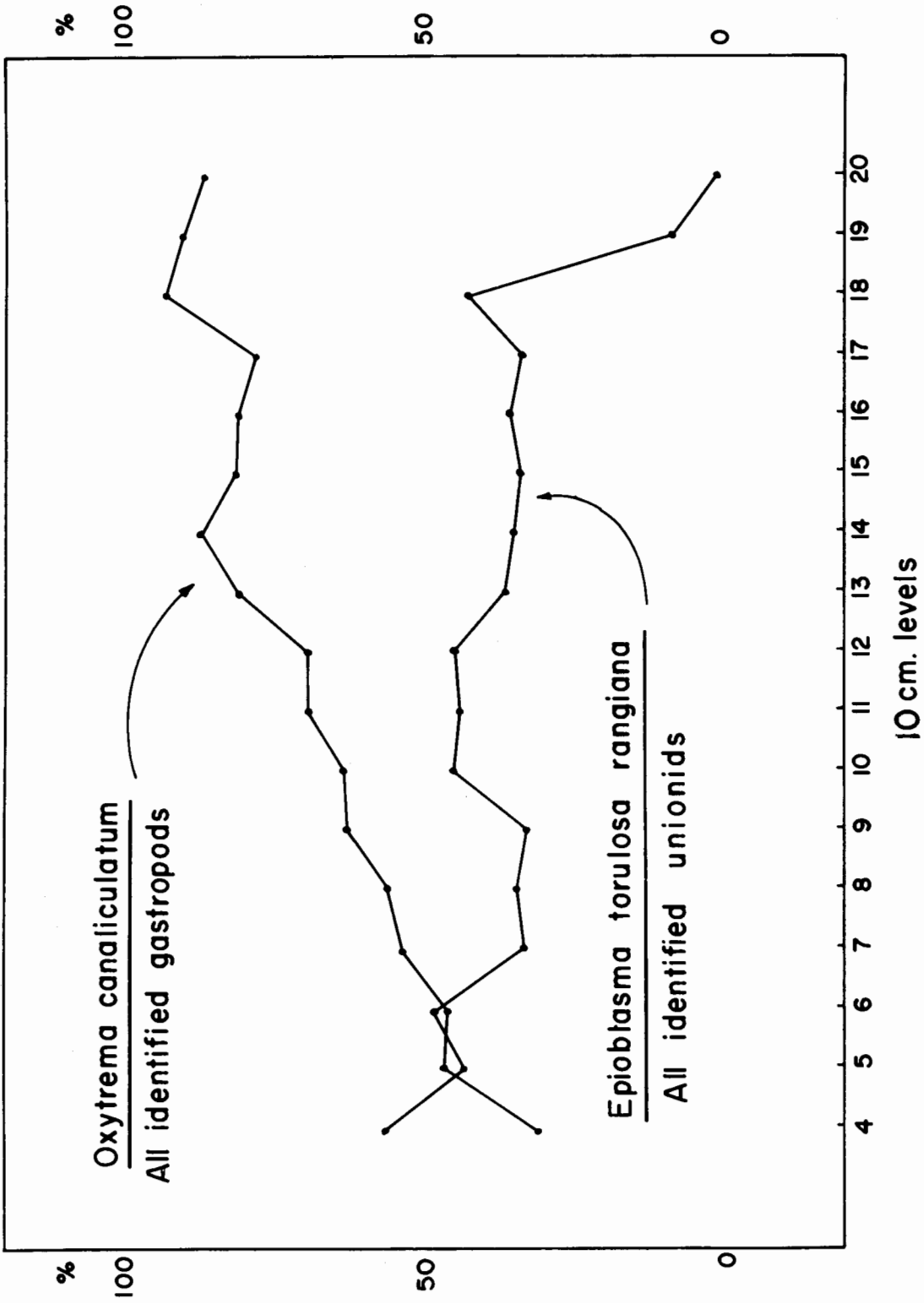


Fig. 6. Percentages by arbitrary level of Oxytrema canaliculatum and Epioblasma torulosa rangiana.

The percentage of shell that is burned or calcined is very small, suggesting that the method of cooking may have been steaming or boiling involving the use of heated sandstone fragments (Patch 1976:60; Parmalee and Klippel 1974:421).

Although the sorting and identification of 1974 flotation samples being undertaken by Richard Yarnell, Gary Crawford, and others (University of North Carolina, Chapel Hill) is not yet complete, some interesting data can be reported. The original hypothesis of our shell mound work was that we would find evidence in the shell mounds of early domestication of native North American plants -- e.g., sunflower, sumpweed, chenopod -- for which evidence is so frequently found in the Mammoth Cave area (Watson et al., 1969; Watson, ed. 1974). The data obtained thus far from the Bowles (Oh 13) and Carlston Annis (Bt 5) middens tend to disconfirm this hypothesis. The majority of the material recovered by flotation is hickory nutshell, acorn shell, and acorn meat, walnut shell, and a wide variety of wild plant seeds: knotweeds, partridge pea, grape, blackberry, elderberry, persimmon, honey locust, bedstraw, and wild grasses. Perhaps the most surprising occurrence in the flotation samples was the identification of curcubit rind, probably Curcubita pepo, in levels 4, 12, and 15 at the Bowles site, and in levels 3, 6, and 20 at Carlston Annis in test pit C1. Radiocarbon dates from our 1972 excavation from levels 8 and 10 of test pit A1 (2090 B.C. +/- 180 and 2300 B.C. +/- 80, respectively; Libby half-life, uncorrected) almost surely postdate the curcubit found in level 20 of pit C1, suggesting that if the C-14 dates are accurate, we may conjecture that squash was present in western Kentucky by the third millennium B.C. It has been widely thought that squash first came to the eastern United States through an overland route from the Southwest, but the early dates for squash in western Kentucky may argue for some other route of diffusion from Mexico (Yarnell 1975, 1976). The only dates of comparable antiquity of which we have knowledge are those reported by Chomko (1976) for the Phillips Spring site in the Ozark Highlands of western Missouri: Chomko describes squash seeds from a feature dated to about 2300 B.C. (4310 +/- 70 B.P. - SMU-98 and 4240 +/- 80 B.P. - SMU-102).

With the exception of squash, there is thus far a conspicuous absence of evidence suggesting horticulture during the third millennium B.C. in western Kentucky shell middens.

Needless to say, our investigations by no means constitute an adequate sample from which to generalize. We have investigated only two shell middens, and excavations at each have been limited. It is possible that evidence confirming the original hypothesis of incipient horticulture will be found with further analysis of botanical materials reclaimed by flotation or with further excavation at these and other shell middens. Based on current evidence, however, the hypothesis seems to have little credibility.

We suspect that these preliminary results from Bt 5 and Oh 13 are probably representative. This suspicion is strengthened by Chapman and Criddlebaugh's account (1976) of very similar plant assemblages (but lacking squash) from the Early and Middle Archaic components at the Rose Island and Icehouse Bottom sites in Tennessee.

Settlement and Subsistence in the Western Kentucky Archaic

It has become practically axiomatic to consider settlement and subsistence patterns as closely related phenomena. There have been compelling

arguments in favor of Archaic seasonal settlement/subsistence strategies for the exploitation of forest, lacustrine, riverine, and coastal food resources. In an effort to test this generalization for our area -- the Western Coal Field physiographic region of Kentucky -- we have intensively surveyed areas near the Green River, areas next to smaller tributary streams, and areas in the sandstone-capped, forested highlands that overlook the Green River and the smaller streams. We have found rock shelters containing evidence of human activities or occupation, but so far none of the shelters we have either surface collected or excavated has yielded artifacts indicating contemporaneity with the third millennium B.C. - dated shell middens. We searched for rock shelters in the spring of 1975, excavating test pits in several of them in the summer of 1975. Thus far the best candidate for a shelter which overlaps in time with the shell midden occupations is a large shelter locally called "Peter Cave," which is located near the northern border of Butler County, some 18 miles from the Carlston Annis mound. Here we found a cultural deposit about one meter in depth, from which we collected soil for flotation in order to compare these materials with those recovered from the shell middens. We will also compare the Peter Cave material with that from cave and rock shelter sites in Mammoth Cave National Park.

Unfortunately a great deal of destruction has been done to the upper levels of the Peter Cave deposit by ill-advised amateur archaeologists and curious campers. This brings up another serious sampling problem: first, except for very small shelters which probably could have served only as short-term camps for prehistoric people, undisturbed rock shelters are rare in this area. The large shelters likely to have seen long-term or large-scale aboriginal occupation are the shelters most likely to suffer significant modern disturbance. Second, on the regional level, western Kentucky landforms have been seriously altered by large-scale strip mining activities. This massive earth movement has transformed vast regions of western Kentucky into eroded wastelands, further vitiating the archaeologist's ability to make general statements about Archaic settlement and subsistence.

One advantage of working within the boundaries of Mammoth Cave National Park is government protection of the land. Surveys in the Park have led to the discovery of several rock shelter sites. Again, most of them seem later, but a few appear to be as early as the shell middens to the west. The surface work of Kenneth C. Carstens (Northern Kentucky State University) in Mammoth Cave National Park is fully coordinated with our continuing survey and excavation efforts west of the park (Carstens 1974, 1975, 1976).

Conclusions

We believe our limited investigations of the Green River shell middens have been productive; in fact, so many data have been recovered that they are almost too productive. We believe that we now have a fairly clear, basic understanding of the subsistence activities of the Archaic shell midden inhabitants, augmenting the detailed technological studies provided by earlier workers. Yet our study has raised many questions at both methodological and processual levels:

What are the processes of midden formation?

What was the total pattern of human subsistence?

Why are the botanical assemblages at Bt 5 and Oh 13 so different from those of the people who utilized Salts Cave and Mammoth Cave 50 to 100 years later?

Was squash an important part of the diet of Middle to Late Archaic people in Missouri, Kentucky, and elsewhere?

Why do we find no evidence in the Green River middens of incipient cultivation of native North American plants?

Two factors lead us to be optimistic about finding answers to these kinds of questions in the future. First, many individuals are now using water-separation techniques to recover botanical materials from well-controlled stratigraphic excavations. Although such techniques have now been in use for over a generation, they have only recently been adopted on a large scale. The widespread pursuit of prehistoric subsistence data, coupled with increased sophistication in the study of geomorphological processes of site formation, will enhance our ability to make comparisons within and between certain regions.

The second reason for optimism is that we believe archaeologists are making real progress in formulating models of prehistoric human interaction. The distinction between Archaic and Woodland becomes increasingly blurred with each new investigation of prehistoric subsistence. We no longer interpret the beginning of pottery manufacture in a given region as a revolutionary leap forward. Woodland horizon subsistence is now known to have remarkable continuities with that of Archaic horizons, and the communication routes over which Middle and Late Woodland ideas and items travelled are known to have venerable Archaic antecedents. We are beginning to see regional distinctions in Archaic subsistence, and this should not surprise us. In fact, we conjecture that distinct Archaic adaptations will be defined with increasing certainty as our exploitation of the archaeological record becomes increasingly more efficient.

Acknowledgments

Since our initial contact with the people of the Big Bend in the Spring of 1972, we have been advised and helped by them in innumerable ways. We are especially grateful to the landowners of the two shell middens, Mr. Waldemar Annis (Bt 5) and Mr. Shelton Brown (Oh 13), for permission to work on their land and for their unfailing courtesy and hospitality. We also owe heartfelt thanks to Mr. John L. Thomas, manager of the Logansport General Store, who has counseled us on a multitude of matters, large and small, over the past four years. Our work at the Bowles site was facilitated by the courtesy of the Lockmaster of the Rochester Dam, Mr. Randall Lytle and his family. Mr. Lytle also kindly allowed us to photograph his collection of surface materials from Oh 13. The Shell Mound Archaeological Project has been supported in part by the National Geographic Society and by Washington University. This funding is gratefully acknowledged.

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EXCAVATIONS OF A TIMUCUAN VILLAGE IN NORTHEAST FLORIDA

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During the Florida State University Field School in the summer of 1976, a Timucuan village site was excavated in the Fountain of Youth Park in St. Augustine, Florida. The project was under the principal direction of Dr. Kathleen Deagan and the data will be presented in final form as a Masters thesis. The following is a preliminary report of the research. The goals of the project were threefold: to refine further the culture history of the northern St. Johns culture area, to explore the domestic and village life of the Timucua Indians, and to provide a baseline aboriginal cultural assemblage by which to gauge acculturative processes after contact in St. Augustine.

In the early 1950s John Goggin performed stratigraphic excavations in the northern St. Johns region in order to determine the sequence of cultures and traditions in the region. He delineated the Paleo-Indian, Archaic, St. Johns, and Spanish-Indian traditions; however, his research did not elucidate the relationship between the traditions nor the transitions between the various periods. The Fountain of Youth Park site (8-SJ-31) was used in his tests, and it was found to contain strata from the Archaic through contact and Spanish-Indian times. Thus the site could provide specific information on the cultural evolution of the region if excavated for that problem.

Goggin also provided a summary of Timucua archaeology at the Southeastern Archaeological Conference in 1953 which revealed that most of the information we had retrieved was from mound sites. Although village areas have been excavated since that time in the adjacent western Timucua region, this has not been the case in the eastern region. Because intrusive burials in cemeteries are found at 8-SJ-31 and a village area had been noted in earlier research, the site could serve as a source for the needed domestic data.

Finally, in the on-going research of the Florida State University in St. Augustine, the northern half of the city was surveyed during the spring field school of 1976. After soil auger testing of the Park, three test pits revealed that the site also contained a significant late St. Johns period and contact component which could provide the link to prehistory necessary to apply the direct historical approach to the prehistory of the region as well as providing a starting point to study culture change in Spanish colonial St. Augustine.

The Fountain of Youth Park has entertained an interesting cultural and archaeological history. The first occupants of the site heavily tapped the resources of the coastal and marsh environment building large deposits of shell in two areas. These shell heaps are seen today as slight rises in ground elevation. The next major occupation of the site is that of the later

St. Johns tradition culture which we first learn about in the early Spanish documents from the area. The contact period is represented by the Timucuan town of Seloy. In 1565 it was the cacique, or chief, Seloy who offered his house to Pedro Menendez de Aviles to serve as the first fort and Spanish stronghold in what was later to become la Florida. Seloy's village was to have been located on the mainland with a clear view of the harbor and an abundance of freshwater springs; all of which are satisfied at 8-SJ-31. It was also found in the survey that this was the only area that yielded the appropriate datable artifacts for this period. Later in this area the first Spanish mission, Nombre de Dios, was established, and some Indians relocated around it. By the early 1700s the Timucua tribes became extinct primarily as a result of Governor Moore's raids on St. Augustine and the surrounding Indian populations.

The first continuous European contact with the Timucua began, however, in 1564 when the French Huguenot colony established Fort Caroline. Rene Laudonniere, Jean Ribault, and Jacques LeMoyne left accounts and drawings of the Saturiwa tribe of the Eastern Timucua. The Saturiwa occupied the east coast of Florida from below St. Augustine north to the mouth of the St. Mary's River and west to the St. Johns River. Since Seloy's Town falls within this area, we are able to use the accounts of the French to shed some historical light on the life of the Timucua at contact. It is from the documents of the French, the Spanish priests and other migrant Spaniards that we are able to piece together the following picture of the Timucua.

The villages consisted of many houses surrounded by a stockade. The houses were round or square and made of wattle and daub. The cacique usually maintained a rectangular house in the center of the village. This was the building Menendez fortified in the village of Seloy. Sentry stations were small, round features at the opening of the stockade and were manned continuously. Around the village were the fields, and fish weirs were in nearby streams and marsh.

Subsistence was based on exploitation of both coastal and hinterland resources, possibly at different times of the year. Bow and arrow hunting, fish weir trapping, and plant gathering were all techniques of subsistence used by the Timucua. Cultivation of maize, squash, beans, and pumpkins was practiced but was not their primary food source. The LeMoyne sketches point out effectively how the Saturiwa used all food resources available to them; however, this variety was not reflected in the faunal remains from the excavations this summer.

The social organization of the Saturiwa was based on matrilineal, ranked clans featuring a royal lineage from which the caciques came. The members of the other clans were commoners. The caciques administered all social occasions, controlled marriage, led in warfare, and redistributed communal food. They also demanded respect in daily life, exacting labor, punishment, and tribute from transgressing commoners.

A division of labor was evident in many activities. Men tilled the gardens while women sowed and harvested the crops, as well as gathered wild foods. Men did the hunting and served in war. Caciques were usually male;

however, women caciques were reported and their role became even more important in relationships with the Spanish. Later many Timucuan women married Spaniards, opening new links of communication and alliance. This also resulted in the women replacing men as the principal leaders which was to cause some social unrest and disharmony. The Saturiwa were also known to have institutionalized the berdache who, although a male, performed the labors of a female while dressed in female attire.

For the next 200 years there was little, if any, occupation of the site. By the turn of the present century, the trend was to acquire and use the land in much the same way as it is used today. The twenty-one acre Fountain of Youth Park serves as a memorial to the landing of Ponce de Leon in Florida in 1513. In 1934, the owner of the Park discovered burials on the property which were eventually observed by M. W. Stirling of the Smithsonian Institution and excavated by Ray Dickson of the University of Chicago. Both men agreed that the burials were intrusive, undisturbed, and Indian. The seventy-four documented burials included three bundle burials, two flexed, and the remainder extended with feet to the east. Some of the extended burials also had their arms crossed over the chest. The artifacts associated with the burials included St. Johns plain and check-stamped pottery, Majolica, olive jar sherds, and shell and glass beads indicating a date in the late 16th century. Vernon Lamme, State Archeologist of Florida, excavated some areas of the site around the burials, discovering in his words "a typical Kitchen midden" that was occupied by Timucua Indians. And in 1951 Goggin did his stratigraphic testing in the park. The only summary of all this work is in a manuscript by Lillian Seaberg.

The FSU excavations this past summer concentrated on the eastern portion of the property away from the burials. A total of ten 1.5 x 3 meter pits were excavated testing two shell middens and an intervening village area. All the pits were along a line running parallel with and thirty meters west of the marsh. While cultural material is found all over the Park, the primary habitation areas are thought to be centered in this area. In Seabergs' report of the 1951 excavations, she notes that the beach of the marsh also yielded artifacts indicating that the occupation area extended into the water for an undetermined distance. Changes in sea level and marsh streams as well as human modification of the area could easily have impounded some, if not much, of the site.

The shell midden areas lie north and south of the centrally located village area. Both are similar in composition and assemblage. The shell is composed of mostly oyster with small amounts of various other shellfish. It begins immediately below the sod and is broken for the first 20 centimeters at which time it yields to whole shell and continues for 25 centimeters. Within the whole shell the soil lightens to brown and continues brown below the shell, then abruptly turns yellow. The yellow sand is the sterile layer overlaying the ancient white beach sand deposits.

The artifacts found in the shell included St. Johns series ceramics in the upper levels and fiber-tempered ceramics in the lower levels. The differences between the north and south middens were that the south midden did contain Majolica, San Marcos, and other grit-tempered wares whereas the north midden lacked these and did not have the same abundance of St. Johns

ceramics. This indicates that the south midden saw heavier use in later times. The north midden contained more fiber-tempered ceramics in the lower levels. Thus the occupation of the site seems to have moved slightly south through time.

Features within the pits were predominantly post holes with one partial circular pattern being exposed in a six-meter trench in the south midden. This pattern occurred below the shell and it could not be extended laterally because of time limitations. The post holes all appeared at the same level and averaged twelve centimeters in diameter. They contained shell but no artifacts. The extrapolated diameter of the pattern is 2.6 meters. Because the post holes were only about 5 centimeters deep, it is likely that they intruded from somewhere in the shell; however, it was impossible to determine where that might be.

More frequently occurring than artifacts were the faunal remains. The faunal remains from the site have so far been identified within proveniences. Minimum number of individuals and other analyses are forthcoming. The south shell midden area yielded fifteen identifiable species of which 66% were marine including fish and crab. The remainder included mostly mammals with fewer reptiles and some unidentified birds. While the fish were the most frequently found faunal remains, there seemed to be an even distribution of all types of fauna in all proveniences. The fauna found included deer, rabbit, rodents, turtles, birds, catfish, black drum, croaker, shark, trout, grouper, gar, perch, bowfin, and blue crab. The north midden area is represented by the same even distribution over the proveniences; however, fish are seen only in three species. While the fish do occur in more proveniences, they do not occur as frequently. The fauna are the same as in the south midden except that the only fish present are catfish, black drum, and shark. If the occupation of the site did move south through time, it was the later occupations that exploited a greater variety of fish. The earlier possibly made greater use of shellfish. The oyster shell deposits on the south were deeper than the north, but this only indicates a longer occupation in the south at a later time.

The village area which lies between the shell middens was discovered with the first test pit placed in the lower elevations on the site. The uncovering of features and post holes led to the extension of the original pit to a composite size of 7.5 x 3 meters. Unlike the shell middens these pits contained no strata of shell. Rather, the strata were indistinct bands of sand which grew lighter in color and sandier in texture from top to bottom. The top soil in Zone 1 was, as on the rest of the site, pleasingly lacking major disturbance. The entire composite square yielded only four sherds of pearlware and only one other modern sherd thus indicating the lack of later occupations and the current protected state of the site. The major component was revealed in Zone 2 which contained the bulk of the artifacts and the features. Zone 3 was, again, sterile light yellow sand overlying white beach sand.

While some San Marcos pottery was found in the upper levels, St. Johns series ceramics constitute 77% of all ceramics found in the village area. Notably rare are the fiber-tempered ceramics of which only eighteen sherds or less than 1% were recovered. Sherd-tempered sherds accounted for 5% of the

total sherds and were almost entirely found in an ash pit. Spanish Majolica and olive jar occurred consistently throughout the area and depths representing 4% of the total sherds.

The most significant feature of the village area was the house pattern shown by a half circle of post holes. Inside the pattern were two interior hearths filled with ash, one concentrated area of black dirt with many sherds, and a shell refuse pit outside the circle. The post holes were 20 centimeters in diameter and formed a circle estimated to be 4 meters in diameter. The larger ash pit was 1.5 meters in diameter and was centrally located with the smaller ash pit being .8 meters and located to the south next to the wall. The feature containing the black earth and 154 St. Johns sherds was .7 meters in diameter and only twenty centimeters deep. The interior of the structure was clean except for the material in the features. The outside of the structure was sparsely littered with artifacts and a refuse pit was located immediately to the northwest of the structure. The post holes, ash pits, and black dirt area were all closed contexts containing predominantly St. Johns check-stamped with lesser amounts of St. Johns plain, and olive jar. These all suggest a contact period settlement. The St. Johns vessels were predominantly shallow, globular and straight-sided bowls. Evidence of charring on the interior of St. Johns check-stamped sherds may indicate its use as cooking vessels while the lack of charring on St. Johns plain sherds could indicate their use as storage containers.

In a small test pit south of the village area pits, a feature was uncovered that may represent a palisade line. The feature was 60 centimeters wide and ran across the square. There were two areas within the feature which could represent post holes. These areas contained a St. Johns sherd, a San Marcos sherd and numerous wood fragments. The pit was at such a low elevation that ground water was encountered at 40 centimeters which made excavation, observation and control of features difficult. Excavation was soon abandoned after the completion of the feature. Wood fragments were found all along the feature and the artifacts included St. Johns ceramics, San Marcos ceramics, olive jar sherds, metal and glass.

The faunal remains from the village are very similar to those found in the shell middens. A total of fourteen species was identified with 50% of those being fish. Again, they were found evenly distributed throughout the proveniences with the fish, however, occurring just as frequently as the mammals. The variety of fish was somewhat diminished as well as the frequency of their occurrence.

Goggin characterizes St. Johns II period with intrusive burials, a host of ornamental and ceremonial artifacts and St. Johns plain and check-stamped ceramics. Intrusive burials are found in the cemetery of the site. The ceremonial objects would, of course, be absent in a village site. Goggin also mentions the association of St. Johns II sites with extensive shell middens. Thus the site seems to fit the characterization of a St. Johns II site. The evidence for contact is primarily reflected by the artifacts. The artifacts of the village component include St. Johns plain and check-stamped, San Marcos and other grit-tempered wares, olive jar, Majolica, some lead-glazed earthenwares, metal, and beads. All these can be accounted for by contact with the Spanish and the neighboring Indian groups who soon were to gather around St. Augustine.

Overall, the Fountain of Youth Park site, 8SJ-31, represents a long and varied and possibly intermittent occupation spanning from at least late Orange Period to Spanish contact. The shell midden areas move from fiber-tempered ceramics through St. Johns plain with little check-stamping. This may, upon closer analysis, shed light on that transition period. The village area represents the St. Johns IIc period through contact, although predominantly the contact period.

The finding of the house will be significant in domestic studies and will substantiate the historical documents. The refuse distribution and faunal data now indicate differential usage of fish as a food resource through time. Pollen and flotation samples are now being processed from features and strata.

Finally, the documentation of an eastern coastal Timucuan assemblage at contact is now available for comparison with later assemblages. When more comparisons are made, it will be possible to delineate the facts and processes of change as they occurred in this region of active culture contact and complex social intercourse.

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ZEBREE: AN EXAMPLE OF PROBLEM-ORIENTED CONTRACT RESEARCH
IN NORTHEAST ARKANSAS

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Just over nine years ago the Arkansas Archeological Survey program began in northeast Arkansas. The fifth site examined was the Zebree site, located near Big Lake in Mississippi County (Morse 1968, 1975a; Morse and Morse 1976; Morse and Anderson 1976). Until the final destruction of the site by the U.S. Army Corps of Engineers in August 1976, it was a major focus of contract research during all of those nine years. A history of our work at the Zebree site is essentially a microcosm of contract archaeology in northeast Arkansas.

In 1967, there were rumors that a ditch was to be dug along the west side of Big Lake which would be considerably larger than the then existing ditch. A local informant knew of three sites which would probably be disturbed or destroyed and these were mapped. The most impressive site was Zebree. Several potholes were in evidence even though the site was in the woods of the Big Lake National Wildlife Refuge. One recent pothole had pottery piled near it that was unlike any described for the recognized Mississippi complexes in northeast Arkansas. Representative sherds were taken to the Southeastern Archaeological Conference in 1967 and identified by Dick Marshall as similar to his Hayti phase at the Kersey site in southeast Missouri.

In 1968 more information was obtained concerning the ditch. Based on the fact that ditching would completely destroy all three sites, a three week testing program was financed by the Survey to test the three sites for research potential and to help plan more extensive excavations, if such were necessary. At no time was a survey for additional sites accomplished. Two of the three sites were found to have been largely destroyed by previous activity. Two test pits at the Zebree site indicated a very high potential research return, and National Park Service funds were requested for a more extensive test in 1969. The reasons for further testing included the presence of a new ceramic Mississippi complex; the recognition of the Cahokia-type microlith industry for the first time outside of the site of Cahokia; excellent bone preservation; pits with concentrations of debris common in the site; and stratification of the Woodland and Mississippi deposits in one part of the site within distinctive soil zones. Major problems developed during the 1968 tests were the identification of a possible new Mississippi complex and the relation of this complex to other Mississippi and Woodland complexes.

Excavation strategy was developed during the year between the 1968 and 1969 tests. In 1969 the two test pits were expanded into two large block excavations in an effort to increase the artifact inventory and to see relatively large sections of the village including possible features on an intuitive basis. Other test pits were spotted about the site. Another

problem was to determine how each of the three prehistoric and one known historic complexes known at the site related to each other stratigraphically and spatially. The emphasis was on the site and its contents. There was a feeling that the site would probably be destroyed soon after the 1969 excavation, heightened by a lack of communication channels with the Corps. There was a budget of \$8900 for the excavation, with no provision for processing what developed to be an enormous collection of artifacts, many of which fit classes not adequately described in the literature, if described at all. Not only were there new pottery types and lithic categories besides the micro-lithic debris, but also exotic artifacts new to this area such as barbed bone harpoons. During the four years it took to process the material, we developed a series of hypotheses relating the site to phases and regions; to areal development; and to ideas of initial Mississippi development and ecological interrelationships (Morse 1975b).

Fortunately the planning for the proposed ditch was delayed. In 1973 the site was nominated to the National Register by the manager of the wildlife refuge, based on information gained from the 1969 excavations. In late 1974 and early 1975, when the Corps of Engineers decided to go ahead with the project, the presence of the site on the National Register prompted extensive mitigation funding. Ditching in the immediate vicinity of Zebree was delayed, and \$101,945 in federal funds (under the provisions of PL 93-291) was allocated for the mitigation effort.

The 1975 Zebree work was planned to supplement the previous work and to include considerable work beyond the site and proposed ditch-levee boundary. This time we were no longer looking at the site, but at phases (Barnes, Big Lake, Lawhorn) and regions. In addition, funding was requested for artifact processing to and including publication costs. The Zebree site was now viewed as part of a community of sites. Excavation strategy emphasized the use of randomly placed squares, large block unit excavations, and a systematic backhoe-trenching search for the palisade system. Once again the excavations were thought to be the last the site would see.

Due to the various delays the actual ditching operations in the vicinity of Zebree did not begin until the end of July 1976. During late July and August a final 18 day salvage was conducted. A series of bulldozer cuts were made across the site to subsoil depth to expose pits, postholes, and other features for excavation. Objectives were to check predictions made from density maps projected by the 1975 random squares (Anderson 1976); to check the palisade system; to locate an expected cemetery (negative); to expand artifact inventories (ladles and red ocher spheres in the Big Lake phase); and to allow a comparison of the Corps-suggested recovery technique to the previous three excavation approaches to the site.

Detailed analysis of the site materials recovered during the 1975 and 1976 field seasons is currently underway. A number of specialists are involved, many of whom were present during the 1975 excavations. Three MA theses (Anderson, Powell, and Sierzchula) involve Zebree research, and are being completed at the University of Arkansas, Fayetteville. It should be noted that prior to the initiation of the 1975 excavations, research hypotheses and field procedures necessary to their investigation were formulated, based on Morse's previous work and the input of the entire research team.

Thus, the project zooarchaeologist, ethnobotanist, and ceramicist, for example, were all able to design and carry out data collection procedures relevant to their specific research concerns.

Two principal research areas form the focus for the current Zebree investigations: biophysical and behavioral (Morse 1976, Raab 1976). The former concerns the nature of the early historic and prehistoric environment in the site area, and the relationships of the site occupants to that environment. The behavioral analysis focuses on the nature of each component and comparisons between components (especially the Late Woodland and Early Mississippi, to investigate the origin of Mississippi in northeast Arkansas).

Under the direction of Suzanne Harris (1975a), considerable effort is being expended to reconstruct the early historic natural environment and, from this base, the natural environment in the site area at the time of the Late Woodland and Mississippi occupations. The reconstruction employs General Land Office witness tree data, pollen cores from Big Lake, dendro-chronological records, and the results of modern environmental studies, combined with site artifactual data (pollen, zooarchaeological, and ethnobotanical remains) from both the historic and prehistoric components. The reconstruction of the Late Woodland-Mississippi environment is a principal concern, but knowledge of the early 19th century environment is also important, particularly in relation to the early historic occupation of the site.

Harris (1976b) is also directing the analysis of botanical materials recovered from site deposits by fine screening and flotation recovery techniques. Plant materials from both prehistoric and historic components are being investigated to determine subsistence patterns and preferences, and for use in the paleoenvironmental reconstruction. The nature and extent of botanical remains in the site midden are also being investigated, as part of a general investigation of midden formation and preservation processes.

Analysis of the site vertebrate faunal remains is proceeding under the direction of Eric Roth (1976). The effects of varying screen mesh sizes on the nature of the faunal assemblages recovered is being investigated. Additionally, remains in the general midden and in component-specific cache pits are being examined. Minimum number of individuals (based on recurring element counts), and estimated meat yield for both individual species and taxonomic class are being calculated. These data are then being used in an attempt to delimit microenvironmental exploitation patterns and preferences for each component. Human osteological remains from the Zebree site are being investigated by Mary Lucas Powell. The analysis focuses on the relationship of the Zebree inhabitants to other local populations. Discrete (nonmetric) traits are being examined to test the in-situ development versus migration (from the Cahokia-Cairo Lowlands area) hypothesis for the origin of the Early Mississippi component.

Previous work by Morse (1975a) demonstrated the presence of a microlithic tool industry at Zebree in the Early Mississippi component similar to the industry at the Cahokia site. Experimental replication of the manufacturing technology, including investigation of the probable use to which the finished tools were put, is being conducted by Michael Sierzchula.

A primary goal of this analysis is the comparison of the Zebree and Cahokia industries to determine possible relationships. Thermal alteration experiments, tests of debitage loss due to varying screen sizes (Flenniken 1976), and source analyses of site lithic raw materials are also underway.

The Zebree prehistoric ceramic assemblages are being investigated by Michael G. Million. Site artifactual data (clay caches, pottery squeezes, firing pits) and replication experiments (Million 1975) are being employed in an attempt to reconstruct manufacturing technologies. Vessel form and function are also being examined. Ceramics, lithics, and other artifacts and features are being examined to delimit the extent and nature of each component (historic and prehistoric) on the site. The discovery of an early nineteenth century well in the site area during the 1976 salvage, for example, has prompted a complete re-evaluation of the historic occupation, which had previously been thought to extend back only to the 1890s.

An extensive series of radiocarbon samples has been submitted to help determine the age and temporal extent of the Late Woodland and Mississippi components (archaeomagnetic determinations proved disappointing due to extensive earthquake disturbance in the site area). The relationship of Zebree to surrounding sites is also under investigation; in 1976 a transect survey was conducted between Big Lake and the St. Francis River, and efforts are being made to locate other Big Lake and Barnes (Late Woodland) phase sites in the general northeast Arkansas-southeast Missouri area. Finally, the excavation strategies used over the four separate field seasons at Zebree are being evaluated by David G. Anderson for their relevance to project goals and for their usefulness to archaeological research in general. Advantages and disadvantages of the various procedures will be equally stressed, and suggestions for improvement or refinement proposed where necessary.

In terms of the mitigation contract, a final report on the excavations conducted at the Zebree site will be submitted to the Army Corps of Engineers at the end of 1977. The report will encompass the results of all four field seasons, and will be the final report on the Zebree project. Following the policy of the Survey, the report will be subject to peer review. All comments, favorable or otherwise, will be included in the final publication, which will be released through the Arkansas Archeological Survey in 1978.

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SEASONALITY IN COASTAL GEORGIA:
THE USE OF THE QUAHOG CLAM AS A SEASONAL INDICATOR*

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The periodic movement of many prehistoric populations for the purpose of the exploitation of specific resources has long posed a problem for archaeologists. A knowledge of the duration and season of occupation of sites is certainly a prerequisite to any attempt to define the parameters and interrelationships among prehistoric social systems. It seems evident that the development of analytical techniques for determining the seasonal occupation of sites is essential for the production and testing of hypotheses concerning many facets of prehistoric cultural systems. Such techniques, however, are few, and statements concerning seasonal occupation are often speculative or weakly supported. Recent research has indicated that the growth characteristics of certain bivalve molluscs may prove useful as a means of determining seasonality in archaeological contexts (Coutts 1970, Coutts and Higham 1971). The purpose of this paper is to present the principles and workings of a technique which allows for the analysis of the growth dynamics of one salt water bivalve, the Quahog or hard clam, Mercenaria mercenaria. The technique is then applied to a late prehistoric site on Ossabaw Island, Georgia.

The late prehistoric period of concern is the Irene phase dating from approximately A.D. 1350 to A.D. 1550 (Caldwell 1970). Even though a good deal of research has been directed toward analyzing Irene phase material culture, settlement patterning, etc. (Caldwell and McCann 1941, Pearson 1977), no reliable estimates of season of site occupation have been forthcoming. Archaeological evidence indicates that the Irene phase populations of the Georgia coast were heavily oriented toward the exploitation of tidal marsh-estuary resources. One common species utilized was Mercenaria. The numerous Irene phase shell middens on Ossabaw Island offer a means of developing a seasonal dating technique using Mercenaria as well as for ascertaining aspects of Irene phase seasonality.

Several recent studies have shown that the shells of many bivalves clearly demonstrate periodic growth which reflects certain environmental factors including seasonal variations in temperature, tidal fluctuations, and differences in daylight and darkness (Berry and Barker 1968, House and Farrow 1968, Ingle and Dawson 1952, Pannella and MacClintock 1968). All of these growth phenomena may be seen in cross sections of shell as alternating dark and light bands or rings. These bands are the result of growth by the accretion of calcium carbonate at varying rates. Light colored bands reflect

*This paper reports on an initial and preliminary effort conducted over six years ago. Since its writing, more sophisticated analyses of the seasonal growth patterns of quahog clams from coastal Georgia have been undertaken. The findings of this recent work (Clark 1979), in part, conflict with the results presented here. C.E.P. 6/27/82

periods of rapid growth such as would occur during daylight or during periods of warm weather. The dark bands reflect periods of minimum growth such as would occur at night or during colder months. Mercenaria has been shown to display both daily and seasonal banding (Pannella and MacClintock 1968). Banding based upon daily growth phenomena is often called micro-structure while banding which is reflective of seasonal growth patterns is often referred to as macro-structure. Seasonal banding, or macro-structure, is actually due to variations in the thickness of the daily growth increments. Although daily growth rings (micro-structure) can be and have been used in archaeological studies to estimate the seasonal occupation of sites (Cloutts and Higham 1971), it is the macro-structure or seasonal growth patterns which are of concern here.

For Mercenaria, the major controlling factor of seasonal growth has been shown to be water temperature (Godwin 1974, Pannella and MacClintock 1968, Pratt and Campbell 1956) such that the period of slowest growth occurs during the winter months. In shell cross-sections this period of minimum growth appears as a wide dark band. Figure 1 presents an idealized drawing of a cross-sectioned clam. The individual dark lines represent daily growth patterns (Micro-structure) reflective of nightly versus daily growth, while the wider bands (macro-structure) formed by the bunching of the daily bands represent periods of slow growth reflective of periods of cold weather. It should be noted that there is a gradual decrease in daily growth until minimum growth is reached, and then there is a rapid increase in growth. This growth pattern results in a sharp and easily distinguishable break between the period of minimum growth, the winter, and the beginning of a new growth period, the spring.

In addition to being able to distinguish winter growth from summer growth, it is necessary to determine which actual months of the year are represented by each of the seasonal bands. This requires a knowledge of the seasonal growth characteristics of a control clam population. Recent studies by the Georgia Game and Fish Commission (Godwin 1974) on planted clam populations in St. Simons Sound on the Georgia coast provide pertinent information on the average monthly growth of clams which permits determination of seasonal growth.

Figure 2 presents a graph of the percent of growth per month based on the St. Simons Sound samples. It should be mentioned that St. Simons Sound is only 40 miles from Ossabaw Island and presents the same types of growing conditions for clams as are found around Ossabaw. Nor is there evidence that growing conditions of today are significantly different from those of 500 years ago. For this reason the growth data from St. Simons Sound is considered applicable to the Ossabaw Island area.

As can be seen in Figure 2, growth does not stop completely but is slowest during the months of January, February and March. These, then, are the months represented by the dark or winter seasonal bands. There is a rapid spurt of growth during April. It is this very rapid increase in growth which produces the very sharp demarcation between the end of the winter growth period and the beginning of the spring growth period shown in the previous figure. The measurement from the end of one dark band to the end of the next band represents a year of growth - from April through March.

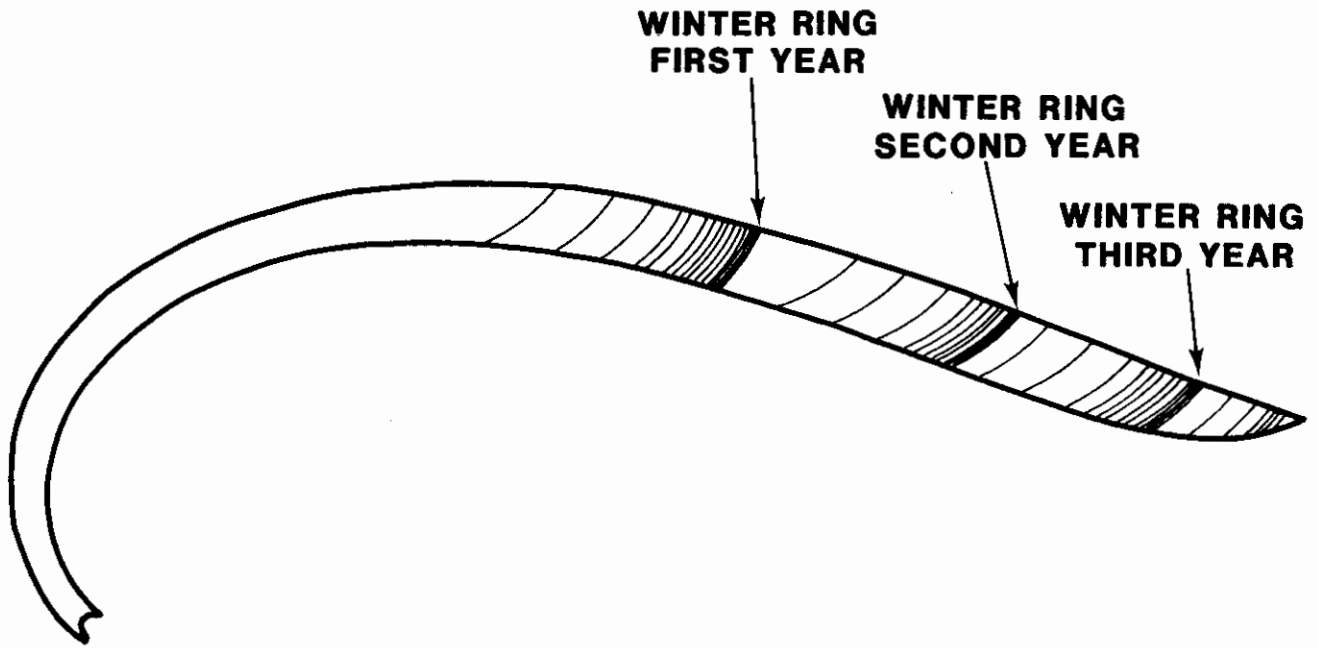


Figure 1. Shell cross-section.

Two growth periods are indicated, one in the spring and one in the fall. The slowdown in the growth during July and August is due mainly to water temperatures which are too high (above 25°C) for optimum growth and to the fact that spawning occurs during this time which seems to inhibit growth.

This basic information on growth characteristics permits the determination of the average yearly growth for each year of a clam's life. Once this is established, the measurement from the end of the last winter ring to the lip of the shell can be used to estimate the time of the year in which the clam was collected.

The clam shells used to develop the average yearly growth measurements were obtained from two Irene phase shell middens on Ossabaw Island. The middens are located at the same site (9Ch158) and are approximately 30 meters apart. Both middens are circular; one, designated Trash Midden 2, is 6 m in diameter and 45 cm high, the other, Trash Midden 3, has a diameter of 8 meters and a height of 60 cm.

A 1x1 m test unit was excavated in 15 cm levels in the center of each midden. Although oyster shell (*Crassostrea virginica*) comprised the bulk of the midden composition, a number of clam shells were considered usable: 36 from Trash Midden 2 and 30 from Trash Midden 3.

All shells were cross-sectioned using a diamond saw. The cut was made along the axis of the shell from the umbo or hinge to the lip. After slicing, the ring structure was plainly visible on most of the specimens. Several cracked during the cutting process and had to be discarded.

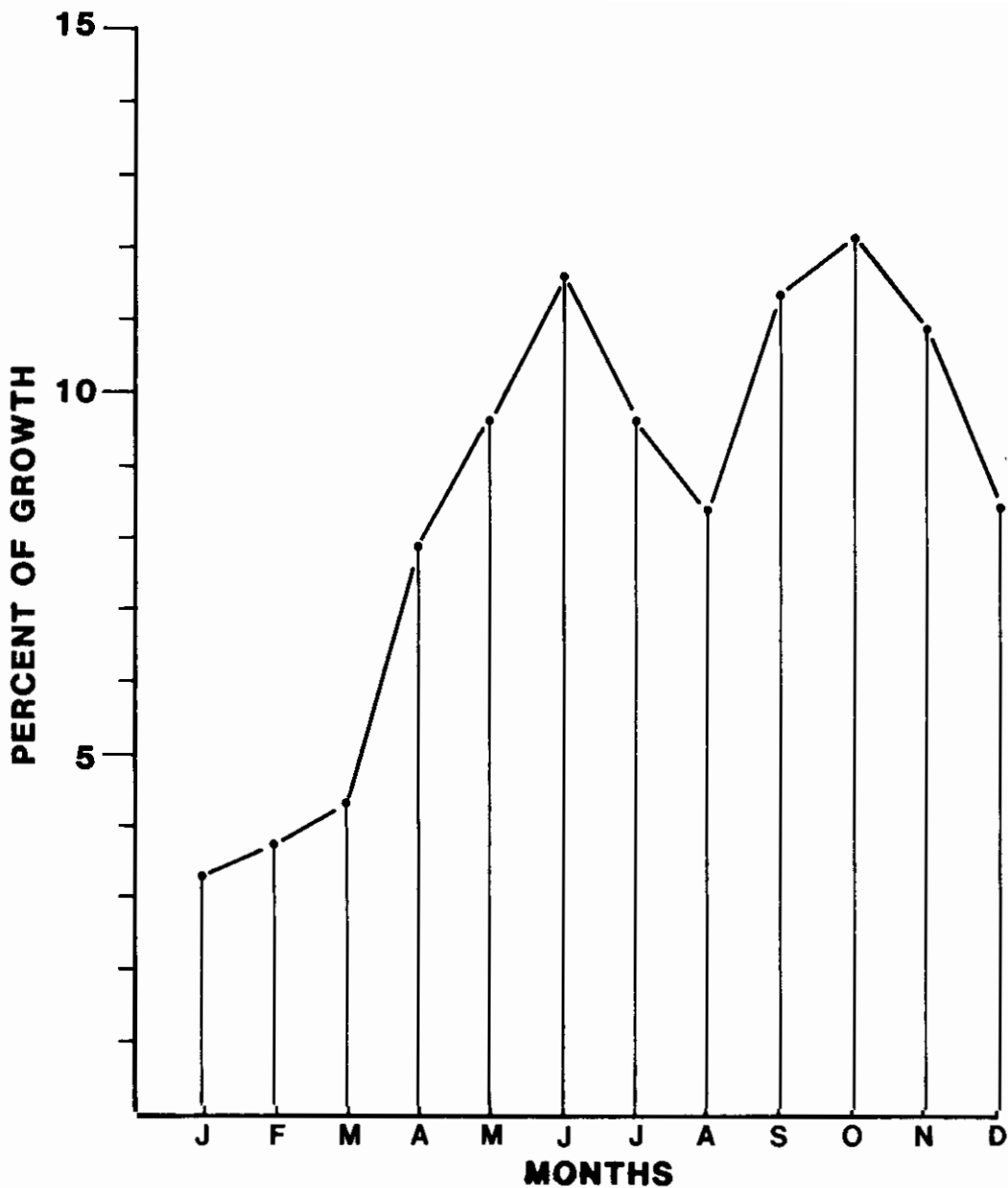


Figure 2. Monthly growth of clams in St. Simons Sound (after Godwin 1974).

The measurements used to develop the base line information on yearly growth are presented in Figure 3. Measurements were made with calipers to the nearest tenth of a millimeter. D1 measures the first year of growth and was made from the umbo of the shell to the end of the first winter growth band (it should be noted that this first measurement represents a period from spawning, i.e. mid to late summer, through March and not a total year's growth from April through March as is reflected in all other measurements). The amount of growth occurring during the second year was determined by measuring from the end of the first winter growth ring to the end of the second winter growth ring. This measurement is indicated by D2 in the figure. Measurements for remaining years were made in the same manner as D2 and are represented by D3, D4, and D5 in Figure 3.

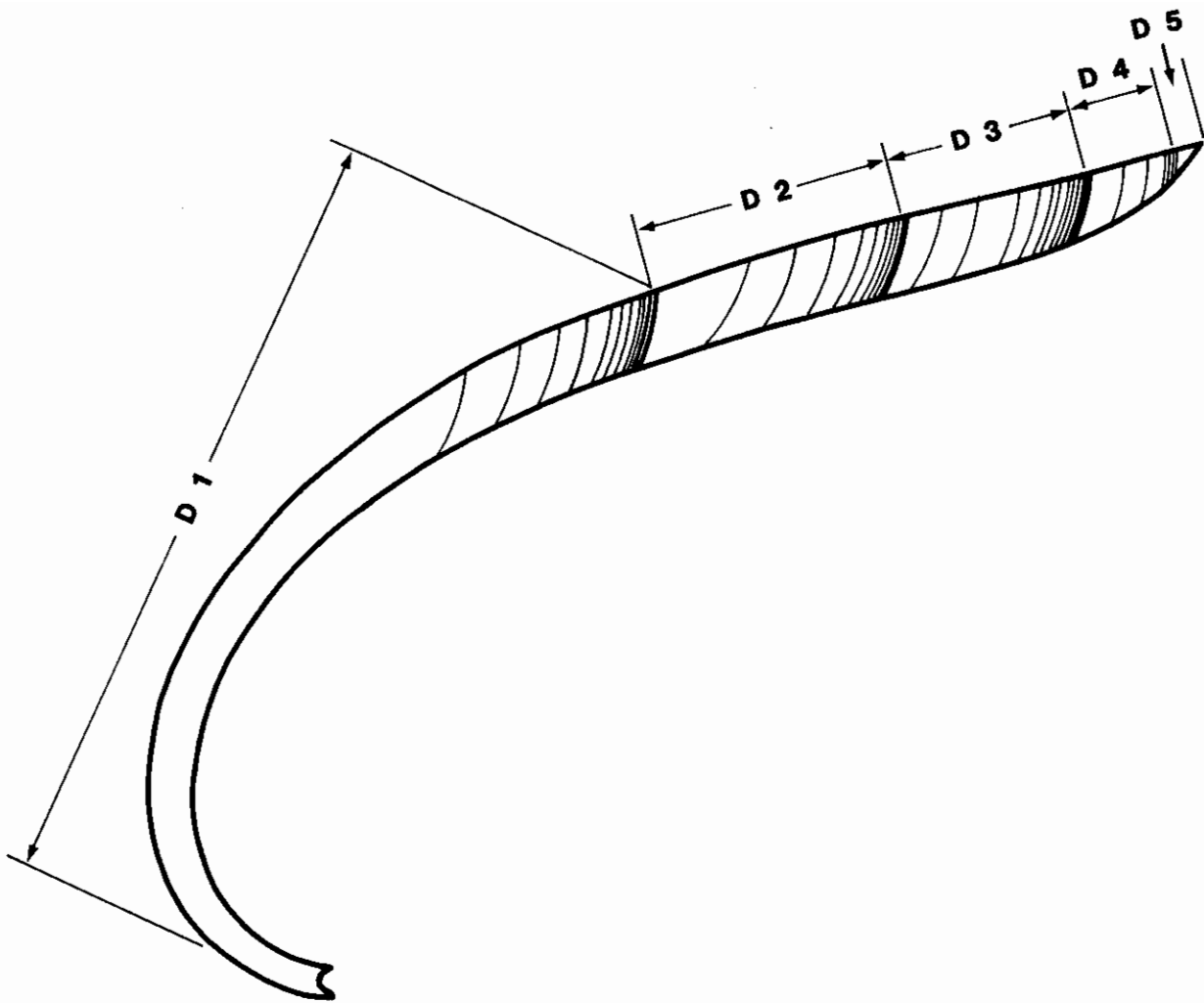


Figure 3. Measurements used for obtaining mean yearly growth.

These measurements were made on all shells and were used to determine mean growth per year. An important characteristic of the growth of Mercenaria and many other bivalves is demonstrated by these measurements. As can be seen in Figure 3, as the clam ages growth appears to slow down such that D1 is greater than D2, D2 is greater than D3, and so on. This decrease is only in part due to an actual slowdown in growth. Much of the apparent decrease is due to the fact that as the clam gets larger an equal amount of volumetric growth is spread over a wider area, and there is less actual growth along the axis of the shell. This apparent slowdown in growth is almost geometric in that the second growth ring is approximately one-half the width of the first, the third is one-half the width of the second and so on. Actual growth does, however, decrease as the clam gets older so that after 5 or 6 years the growth rings become extremely narrow. The result is that it becomes very difficult to accurately measure variations in these older growth

rings. For this reason clams over 5 years of age had to be discarded from the analysis.

Several of the clams did not demonstrate this regular geometric growth pattern. Irregular patterning has been shown to occur in clams that are growing under conditions of stress or in environmentally marginal or rapidly changing situations (Godwin 1974, Pratt and Campbell 1956). Clams demonstrating such irregularities were also discarded. After removing all unusable shells for the various reasons discussed, 57 remained from which reliable measurements could be taken.

The mean amounts of growth per year obtained from these 57 shells are as follows: for the first year, 39.3 mm; for the second year, 12.9 mm; for the third year, 8.9 mm; for the fourth year, 4.7 mm; and for the fifth year, 2.5 mm. The ranges and standard deviations of the measurements for each year were small. An analysis of variance conducted across all yearly measurements indicated that the growth for all clams for each year was significantly different from the growth of any other year. This means that, in most cases, if only a portion of a clam were available for dating, it would be possible to determine its age (and thus estimate its season of collection) by fitting it into the developed growth curve.

It should be mentioned that the amount of yearly growth demonstrated by these clams was similar to that of clams of similar age in the St. Simons Sound experiment. This suggests that there is little difference in the growing conditions of today and 500 years ago.

With a knowledge of the mean amount of growth expected for each year, it is possible to use the amount of growth from the last winter ring to the lip of the shell as an indicator of the percentage of growth occurring during the last year before collection. Correlating the percentage of growth occurring during this last year of life with the known percentage of growth per month allows for the estimation of the month of collection. As mentioned earlier, it is considered that growth begins in April and that the last month represented by the winter ring is March.

Although growth estimates can be made to the nearest month, the amount of error resulting from inaccurate measurements, variability in yearly growth, etc. would seem, at this time, to prohibit such accurate dating. For this reason only the season of collection is used. It seems reasonable that with larger samples and more accurate measuring techniques the actual month of collection can be determined.

Figure 4 presents data on the estimated season of collection for the shells from Trash Midden 2. Seasons of the year are listed across the bottom and the number of specimens along the side. It should be noted that only 26 shells are represented. Several were discarded due to factors mentioned above; i.e., they displayed irregular growth patterning or were over 5 years old. This small sample size is not seen as an invalidation of the results nor of the technique used.

Although all seasons of the year are represented, the majority (56%) of the clams appear to have been collected during the spring. If a shell midden represents a year-round deposition or deposition resulting from reoccupation

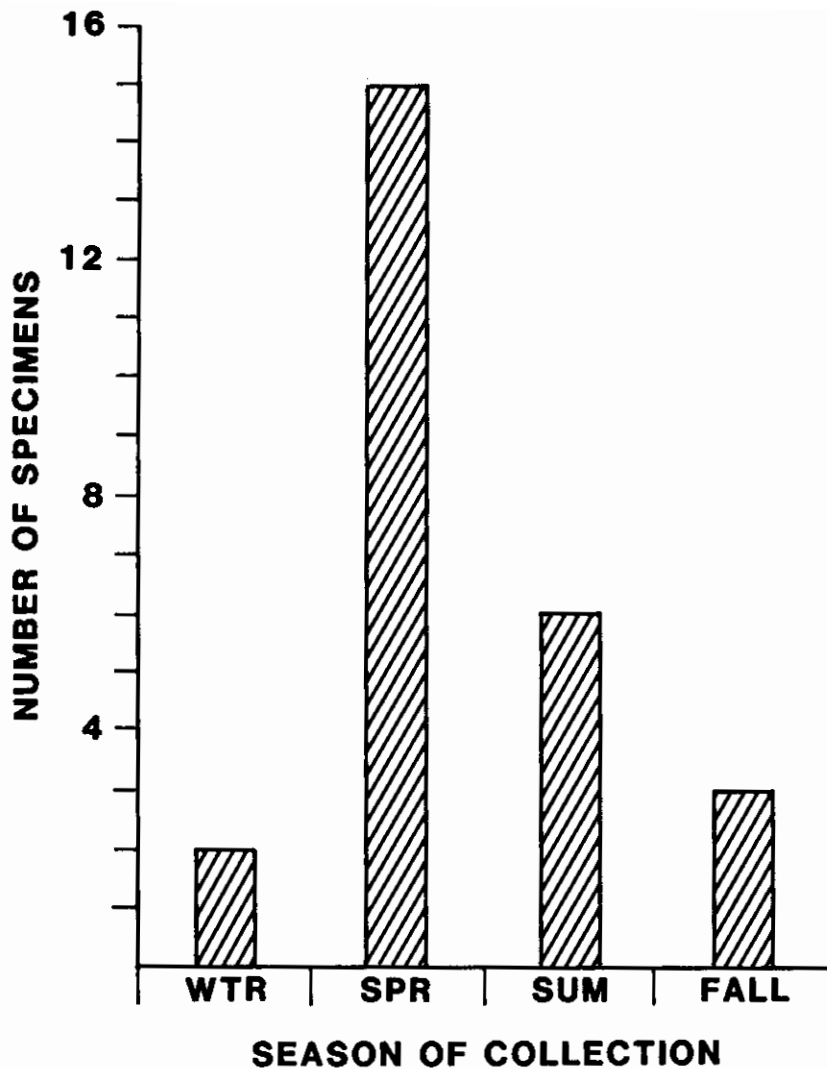


Figure 4. Total collection of shells from Trash Midden 2.

at different seasons of the year, then all seasons of the year would be represented. This would appear to be the situation with Trash Midden 2. However, an initial assumption in this study is that both of the middens used in the analysis represent rather brief periods of deposition probably on the order of several months. This assumption is based upon the small size of the middens and the homogeneity of the midden fill in which there is no stratigraphic evidence of midden abandonment and later reutilization.

A useful means of viewing the process of midden deposition is to look at the estimated season of collection for clams from each 15 cm level of the midden. Figure 5 presents this information. Only the spring and summer are represented in the bottom 15 cm level, all four seasons in the central level, and spring through fall in the top 15 cm. If it were not for the two shells producing the winter date, midden deposition could be easily interpreted as having begun in the spring and continued through the summer and into the

fall. This interpretation would be acceptable based upon the previously mentioned assumptions about the length of midden accumulation. For the present, I would argue that the two shells are anomalous and are the result of inaccurate measurements or represent cases of extreme variability in growth patterns.

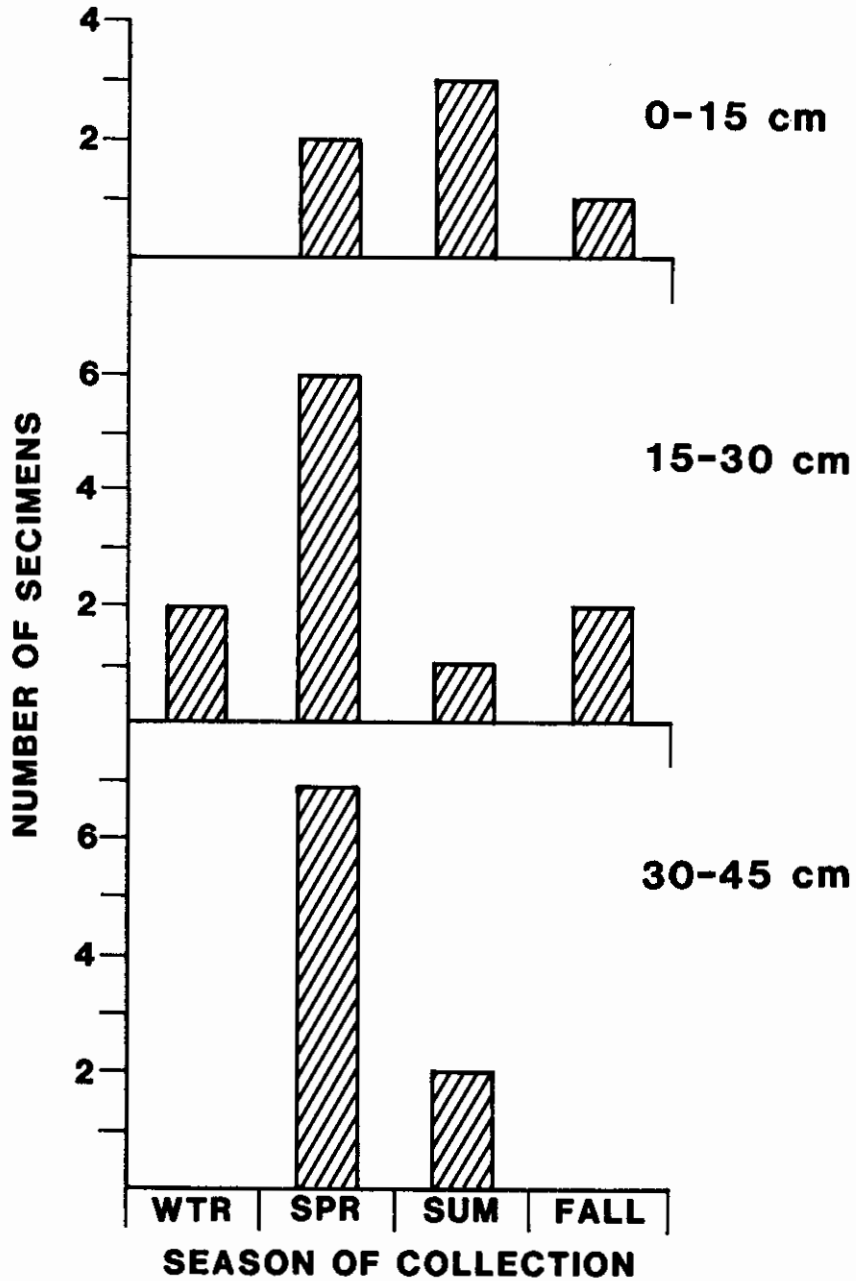


Figure 5. Shells from Trash Midden 2, 15 cm levels.

Data from the other trash midden are presented in Figure 6. Again the majority (67%) of the clams appear to have been taken in the spring with only a few taken during the summer and fall. If we look at clams from each 15 cm

level of the trash midden, a deposition pattern very much like that proposed for Trash Midden 2 is evident. The bottom 30 cm of the midden produced clams with spring dates; the 15-30 cm level has clams producing dates from spring through fall, and the top level produced clams collected during the summer and fall. The majority of the midden appears to have been deposited within a relatively short time during the spring. The summer and fall deposition near the top may represent continuous accumulation or simply extraneous material thrown on top of the midden after its initial and major period of use.

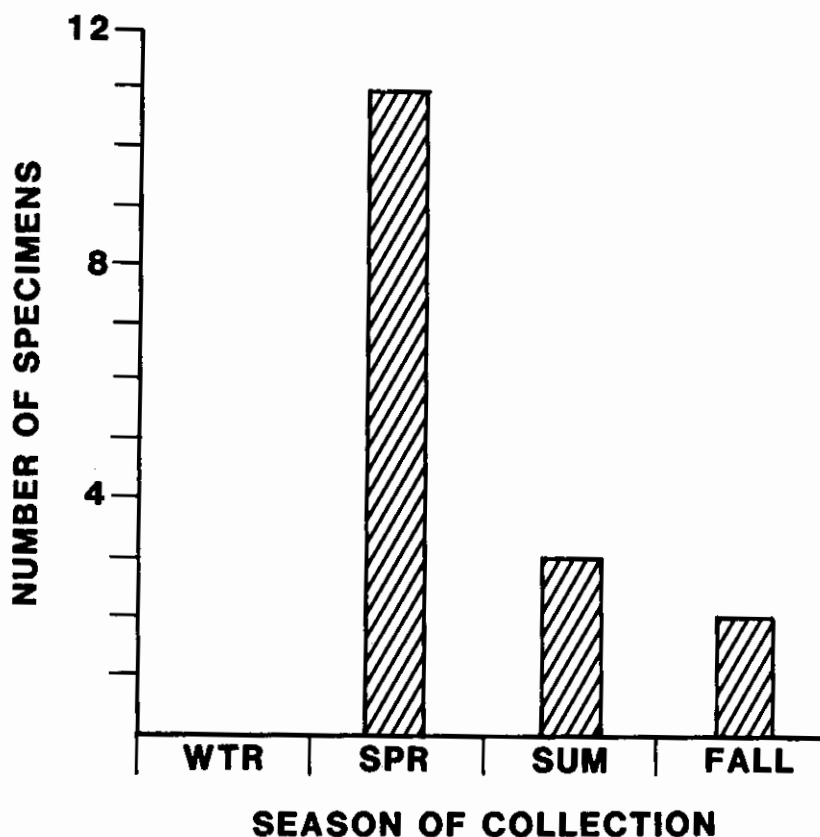


Figure 6. Total collection of shells from Trash Midden 3.

Faunal remains recovered from these middens include white-tailed deer (*Odocoileus virginianus*), diamondback terrapin (*Malaclemys terrapin*), and blue crab (*Callinectes sapidus*). None of these species would seem to be inconsistent with the suggested season of deposition indicated by the clams.

The season of deposition obtained for these 2 middens does not necessarily mean that the site was occupied only for the brief period of time suggested. There are numerous Irene phase shell middens at this site and the possibility exists that others will yield different seasons of deposition. This matter is currently being explored.

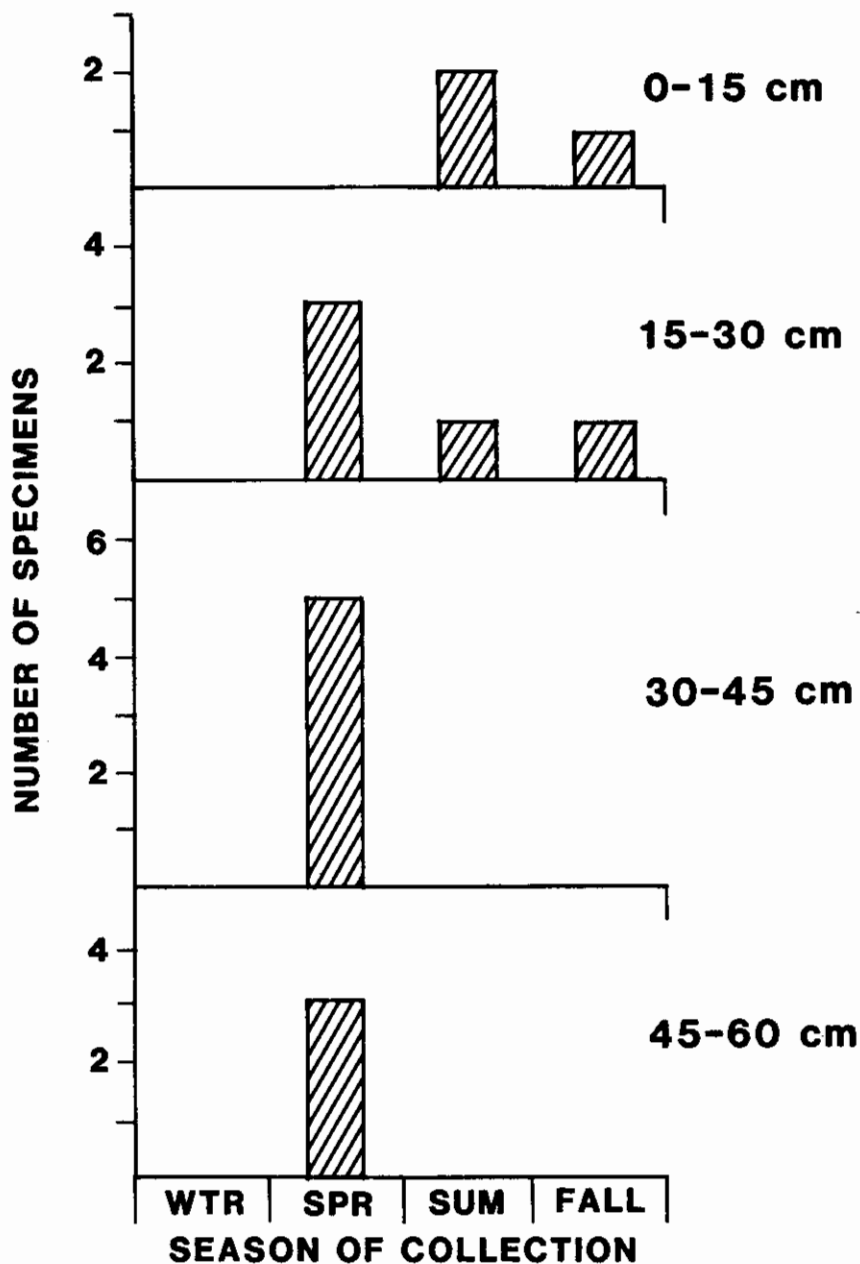


Figure 7. Shells from Trash Midden 3, 15 cm levels.

Certain sources of error are evident or possible in the technique and its application as presented here. Most obvious are small sample size and possible measuring error. These, however, can be overcome and the initial indications are that this technique will prove extremely useful in approaching the question of seasonality in coastal Georgia.

Acknowledgments

I wish to thank the Geochronology Laboratory of the University of Georgia for providing the equipment needed to process the shells and Fred C. Cook for his comments and suggestions concerning the analysis.

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UNDERSTANDING MAN'S CHANGING ROLE IN THE NATURAL ENVIRONMENT OF THE OZARK
BORDER, AN EXAMPLE OF REGIONAL APPROACHES IN ARCHAEOLOGICAL RESEARCH

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Cynthia R. Price
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The history of archaeological research in southeast Missouri has passed through several stages beginning with the queries of the gentlemen-scholars into the Moundbuilder origins, to whistle stop surveys by northern and eastern institutions in the 1940s and 1950s, to the landleveling salvage archaeology of the 1960s. Although southeast Missouri has witnessed several non-salvage research endeavors in the late 1960s and early 1970s, such as the Powers Phase Project and the Lilbourn and Towosaghy Projects, there has been no long-term continuity in research goals and standardization of method. Salvage projects have rushed from site to site excavating portions of Mississippian structures here, an Archaic burial there, and some Baytown refuse pits in yet another area.

Five years ago, a researcher could count on his fingers and toes all the research projects which had collected data in the "bootheel" of Missouri and adjacent Ozark Highlands. The coming of the era of contract archaeology has brought a rash of data generating projects stemming from both large and small cultural resource assessments for federal agencies, towns and private land-owners. When we were hired by the University of Missouri and assigned to southeast Missouri it soon became apparent that systematic order must be imposed on data generated by past projects and in the rapidly increasing number of contract projects arising in that region.

To further the research goals of the University of Missouri American Archaeology Division in Southeast Missouri, the Southeast Missouri Archaeological Research facility was formed to administer archaeological research in 18 counties of southeast Missouri (Fig. 1). These counties are roughly divided between the Mississippi Valley and the eastern Ozarks. The area is composed of diverse physiographic provinces ranging from the Salem Plateau, to the rugged Ozarks, to the swamps of the Mississippi Delta and is a region exceptionally well suited for both prehistoric and historic human ecology studies.

Since we are advocates of regional approaches in archaeological research it is only natural that we establish broad research designs for systematic collection of data. The all-inclusive research design adopted for southeast Missouri is "understanding man's changing role in the natural environment of the Ozark Border." Ancillary research designs developed on each new project tend to deal with specific details of past culture process on the Ozark Border in elucidation of the major research design.

In setting up a regional research program we immediately did away with some outdated concepts. First, no distinction in research approach is made between research funded by contracts and those funded by federal granting

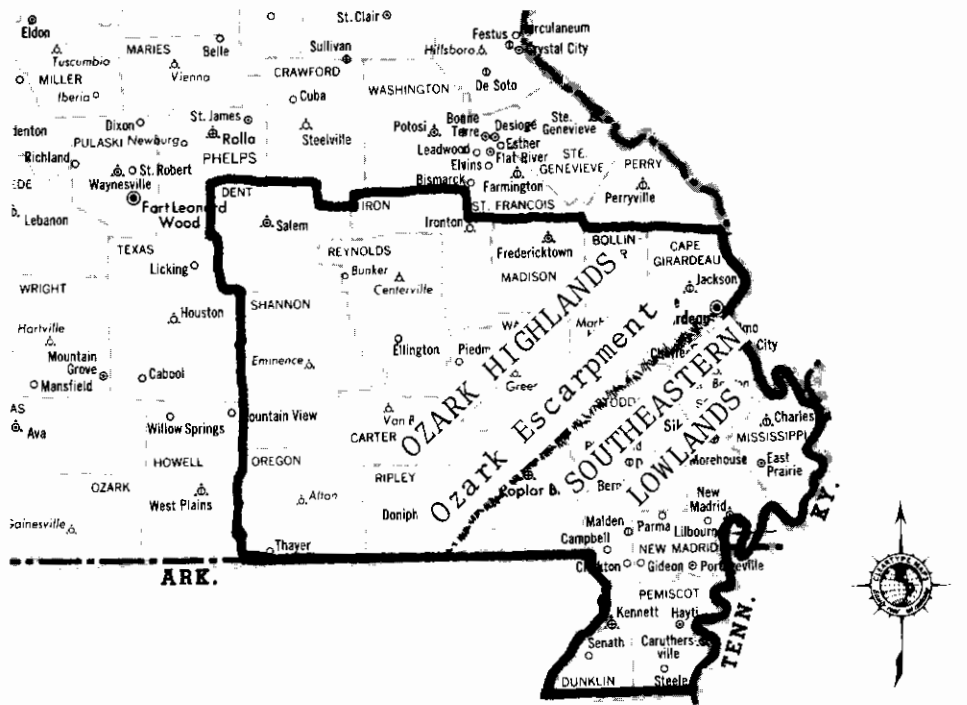


Figure 1. The Southeast Missouri Archaeological Research Facility Study Region.

agencies such as NEH or NSF. All projects are dealt with as "pure research" in which substantive data are collected and anthropological questions are asked of them.

Second, one kind of archaeology is not considered "better" than another. It is high time that archaeologists view both prehistoric and historical archaeology as means to a common end: explanation of past culture process. We make no distinction between historic and prehistoric archaeology except that historical documentation is employed in one. In studying culture process of the past 12,000 years on the Ozark Border, we have been investigating sites ranging from Early Man occupation, throughout the gamut of pre-history, through the early pioneer settlement, the Civil War, the logging industry, and the moonshining and sharecropping era. Only through such a broad temporal and cultural perception can we construct explanatory models of man's changing use of the Ozark Border and adjacent areas.

Recent projects administered through the facility have considerably expanded the data base for southeast Missouri and several ancillary research designs have been formulated and partially tested.

The Little Black River Watershed Project partially tested hypotheses on prehistoric settlement strategy. Barnes intersite variability, Developmental Mississippian settlement patterns, and Powers Phase settlement pattern were incorporated into research designs dealing with changing settlement-subsistence strategies on the Ozark Border. This was also applied to the historic era in explanation of historic site locational principles. These research designs were also employed in the Fourche Creek Watershed Project.

In addition to these research designs, another dealing with Late Archaic settlement-subsistence strategies was formulated and an explanatory model constructed. Historic site locational principles were again considered and a model of early pioneer settlement proposed. Both the Little Black and Fourche Creek projects were cultural resource assessments performed for the USDA Soil Conservation Service.

In contract archaeology as well as research financed by federal granting agencies we are dealing with anthropological problems that archaeologists have traditionally ignored because they seem trite or of marginal interest due to the fact that they deal with cultural phenomena in the not too distant past. For instance we have been dealing with settlement patterns of the common early settler on the frontier, the role of the logging industry in the changing social, economic, and settlement patterns of the Ozark Border, ethnoarchaeological approaches to the illicit alcohol industry on the Ozark Border, and settlement patterns on the sharecropper-tenant farmer era. We feel that all of these cultural expressions are of equal importance in understanding man's changing role in the natural environment of the Ozark Border.

Recently we have combined efforts with the Southwestern Missouri State University Ozark Studies Team which is composed of an historian, a geographer, a geologist, a linguist, an ethnologist, and several archaeologists. The primary objective of the Ozark Studies Team is to study man's experience of the Ozarks throughout his occupation there utilizing a multidisciplinary approach. It is our objective as participants in the study group to develop predictive models of man's changing social, economic, and technological use of the Ozark Border - to study continuity and change in the cultural systems of the Ozarks.

Thus the utility of contract archaeology in long term problem oriented research is obvious. All research projects channeled through the Southeast Missouri Archaeological Research Facility are treated equally. Such a research strategy is regional in approach and systemic in concept. All archaeological research projects executed through the Facility in the eastern Ozarks and Mississippi Alluvial Valley are consistent in goal definition and relevant data collected.

A MODEL OF PREHISTORIC DEER HUNTING IN THE OZARKS:
AN EXAMPLE OF PROBLEM ORIENTATION IN CONTRACT ARCHAEOLOGY

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Arkansas Archeological Survey

The following discussion is based on the results of the Pine Mountain Project (Raab et al. 1976). This project, a program of site survey, test excavations, laboratory analysis, and research design, was conducted by the Arkansas Archeological Survey in the western Ozark highlands of Arkansas between September and December of 1975. At the request of the U. S. Army Corps of Engineers, the Arkansas Archeological Survey surveyed and tested the valley of Lee Creek near Natural Dam, Arkansas, an area of 3600 acres, selected as a locality for a dam and reservoir. The purpose of the archaeological studies was to inventory the archaeological resources within the project area, determine the significance of potentially affected resources and recommend alternative resource management options - in all, a fairly familiar type of research. My comments below are derived from a published account of the project, Arkansas Archeological Survey, Research Report 7, on sale from the Arkansas Archeological Survey. Interested persons are urged to consult the complete report.

Two Problems in Contract Archaeology

The present discussion focuses on the investigation of only one research problem in the Pine Mountain report, prehistoric deer hunting in the Ozarks. It should be emphasized, however, that the problem of prehistoric deer hunting, although intrinsically interesting perhaps, has greater merit in that it illustrates an attempt to solve two related problems currently plaguing research in contract archaeology. Specifically, these two problems are (1) inadequate scientific goals and (2) lack of explanatory models and hypotheses with which to manage archaeological research.

(1) The continuing belief, in varying degrees of explicitness, that archaeology under contract cannot be expected to produce the quality of research we associate with the best of so-called "academic" or "pure" research is a serious problem because it is a self-fulfilling prophecy. Many contract archaeologists, and contract archaeologists already account for a sizable proportion of the archeological establishment, continue to operate as if they were bound to a "salvage" ethic, i.e., as if they had little or no control over the conditions of their work and gathering any kind of information is better than none. This view is seriously misguided for a number of reasons.

There is serious question whether a passive salvage approach really satisfies the requirements of the very environmental protection laws which have brought modern contract archaeology into existence. As Klinger indicates in the symposium paper by Raab and Klinger (n.d.), proper management of archaeological resources is absolutely dependent on the most up-to-date,

theoretically and methodologically informed scientific standards which contemporary archaeologists possess. From this perspective, a scientifically sound, problem-oriented approach to contract research is not a luxury but a necessity. As the papers in this symposium point out, this approach is not a utopian goal but an established working principle.

(2) The lack of explanatory approaches to archaeological research is a problem endemic to archaeological research generally, including contract studies. By explanatory approaches I mean research explicitly directed toward solution of important current anthropological problems in archaeology. In its most useful form, this type of research will include well-developed research designs, including specific, testable hypotheses. It should be obvious that this problem is related to, perhaps largely derived from, a salvage-oriented approach to archaeological research. I might point out parenthetically that this judgement is not a condemnation of the many real benefits brought to archaeology by some of the now-classical salvage programs of the 1930s, 1940s and 1950s. The lack of problem-oriented research, planning and publication that one associates with past salvage work is understandable in view of the state of method and theory and the relatively poor statutory and fiscal support of archaeology in former decades. The point is that former standards of research performance under contract are no longer appropriate because contract archaeologists of the 1970's have the responsibility and the academic, statutory and fiscal resources to meet high contemporary standards or research performance. Failure to set and meet high research standards in contract archaeology is increasingly difficult to blame on anyone but archaeologists themselves.

The Pine Mountain Research

We felt at the outset of the Pine Mountain research that many of the problems related to contract archaeology, including the two discussed above, could be resolved to a significant degree by formulation of specific problem-oriented research goals. This conviction led us to the formulation of a theoretical model with which to guide the archaeological research. In essence, we asked ourselves what kinds of important scientific questions could we hope to answer as a result of studying the resources in the Pine Mountain locality. Based partly on the theoretical interests of the research team, and partly on previously collected information from the project area, we decided to address the general question of how human settlement in the valley of Lee Creek was affected by subsistence practices, in both the historic and prehistoric eras. Specifically, we wanted to know how three settlement variables, seasonality, spatial distribution and technological variation, were influenced by subsistence activities. These goals presented us with two immediate research prospects. We needed to know what the range of variability actually was with regard to site seasonality, spatial distribution and technological variation in the project area. This need prompted a field program designed to record and test archaeological sites with a view toward getting a picture of inter- and intrasite variability. We also needed specific models of subsistence activities to begin the process of explaining the archaeological data. The model of prehistoric deer hunting was developed along with other subsistence models for this latter purpose.

Several facts pointed to a potential usefulness of the deer hunting model. A master's thesis by Charles Cleland (1960) on faunal remains from Arkansas bluffshelters indicated that the bones of white-tailed deer (*Odocoileus virginianus*) accounted for 85% or more of the faunal remains recovered from bluffshelters. Furthermore, archaeologists have emphasized (Scholtz 1969) an Archaic-stage type of hunting and gathering economy which seems to have characterized the Ozarks until late in prehistoric times (ca. A.D. 1000-1200). By any account, deer hunting appears to have been an economic mainstay in the prehistoric Ozarks. At the same time, a fairly large literature on the modern ecology of deer in the Ozarks and surrounding regions has recently been summarized and worked into a useful model of prehistoric deer hunting by Smith (1975). Smith's model emphasized the relatively great availability of deer during the late fall and early winter within certain vegetation zones of the Ozarks. He also discussed a method for dating the season of deer kills based on the examination of growth rings in deer molar teeth.

This model had a number of impacts on the organization of our research. We endeavored to identify sites which were occupied in the fall and winter for deer hunting. We were able to identify certain small shelter areas that represent short-term occupation with direct evidence of deer hunting. We were also able to demonstrate that sites varied considerably in their ratio of projectile points and biface retouching flakes to other artifact classes. A high ratio of projectile point/knives and small resharpening flakes was taken as a rough indicator of hunting activities.

Based on an analysis presented in two chapters (six and seven) of the Pine Mountain report (Raab et al. 1976), we hypothesized that seasonal exploitation of deer peaked in the late fall and early winter. Hunting probably also occurred within 2-5 km. of major sites and animals were generally brought back to camp whole, not butchered in the field. Most likely, hunting stations were maximally dispersed throughout a territory around base camps, with a fall-winter concentration of kill sites within oak-hickory vegetation communities of north and east-facing slopes and ridges. Small sites were probably used as short-term hunting stations, and were located in small tributary stream valleys, or near or within vegetation zones of optimal deer browse. This hypothetical composite picture of prehistoric deer hunting, summarized only briefly here, was constructed from published literature on plant ecology, deer ecology, and previous archaeological research. This model in turn allowed the following hypotheses to be proposed (Raab et al. 1976:87-91).

Hypothesis 1. If projectile point/knives and debitage from manufacturing and resharpening PP/K's reflect deer hunting, the sites utilized for deer hunting should evidence high relative proportions of these artifacts.

Test Implications

- (1) High relative frequencies of deer in faunal assemblages should show a high positive correlation with high relative frequencies of PP/K's and other stone artifacts related to manufacture and repair of hunting implements.
- (2) Sites whose artifact assemblages are constituted largely or exclusively of hunting-related stone artifacts should tend to be located in resource zones most favorable to deer hunting.

Analytical Methods

- (1) Development of concentration ratios of deer bone in relation to other faunal remains. Development of concentration ratios of PP/K's and their related debitage to total lithic assemblages. Linear regression analysis of concentration ratios of deer and stone tools on an intrasite basis. Analysis of variance tests of concentration ratios of intersite basis.
- (2) Development of concentration ratios of PP/K's-debitage to total stone artifacts within sites located within suspected deer hunting zones. Development of quantitative samples of vegetation within suspected deer hunting zones. Linear regression of PP/K-debitage concentration ratios with quantitative measures of deer browse species along sampling transects; increase in PP/K-debitage to total stone tool ratios by elevation should show high positive correlation with increase in preferred deer habitat by altitude.
- (3) Experimental recreation of living floor where PP/K manufacture and repair are carried out. All "artifacts" produced can be collected, classified and concentration ratios worked up. The results of this experiment would serve as a basis for making more reliable assumptions about patterning in hunting-related stone tool assemblages.

Hypothesis 2. If deer hunting reached a seasonal peak in the late fall and early winter, then deer found in archaeological sites in the project area should manifest an age distribution indicative of a peak in mortality in the fall and winter.

Test Implications.

- (1) Studies of the growth rings in deer teeth recovered from archaeological sites should show a pattern of mortality which peaks in the fall and winter.
- (2) Conversely, sites occupied in the spring and summer could be identified by the presence of spring-and-summer-killed deer.

Analytical Methods.

- (1) Prehistoric deer teeth recovered in 1934 and in future studies could be studied in relation to their growth rings (Dental cementum). This is a laboratory procedure which involves cross-sectioning teeth and microscopic examination of growth rings.

Hypothesis 3. If the deer are a stable, predictable food resource, kill sites, or primary exploitation sites, should form a maximally-dispersed pattern.

Test Implications.

- (1) Site distribution (of sites identified by hypothesis 1) within zones of resource exploitation (e.g., fall hunting - upland hardwood forest) should form a maximally-dispersed pattern.

Analytical Methods.

- (1) Application of spatial statistics, e.g., 1st nearest neighbor technique, to site distribution.

It is important to indicate that these hypotheses are just that, propositions offered for testing. The hypotheses, although based on the best available information, are in no sense to be thought of as established conclusions. Furthermore, these hypotheses were proposed at the end of the first stage of contract studies at Pine Mountain. The hypotheses are intended, with others, to guide any future, mitigation stage studies, should these be required.

In current practice, one all too rarely sees the development of specific, testable hypotheses during the initial stage of contract research (or at any stage of research). More typically, early stages of survey and testing are restricted to gathering only a few facts related to culture historical questions; e.g., inventories of ceramic and projectile point types, estimates of site size and other basic matters. Final stages of research are typically devoted to gathering bigger and better quantities of the same things that were collected during survey and testing, and final reports present more detailed documentation of what was known at the end of the first stage of research. Seldom is there any sense of anything really being tested or real evidence of the many advances made in archaeological method and theory during the last two decades. Performances of this kind are conspicuously deficient pieces of scientific research to an increasing number of people in science, government, and the public. The recent editorial by Schindles (1976) in Science on the "Impact Statement Boondoggle" should serve as a warning about poor research performance.

Returning to the two problems with contract archaeological studies enumerated at the beginning of this discussion, lack of adequate scientific goals and lack of theoretical models and hypotheses with which to guide research, it should be stressed that the deer-hunting hypotheses provided several tangible benefits. First, the hypotheses, as well as others, presented an explicit statement of the significance of archaeological resources in scientific terms. The significance of the resources resides in their potential to answer important scientific questions. Second, the specific hypotheses served to guide field and laboratory research. The problems set forth in the hypotheses indicated the kinds of data that needed to be collected and the kinds of analyses required to evaluate these data. Third, the hypotheses offered an unambiguous indication to the sponsoring agency why we felt that certain studies needed to be done and why certain resources were required to effect these ends. Our experience has suggested that specific, problem-oriented research proposals are met with far more understanding by sponsoring agencies than purely descriptive data and endless calls for more testing, and vague-sounding concepts such as "Archaic occupations," "Woodland peoples," "cultural influences," and the like. Fourth, a hypothesis-testing approach offers the advantage of tested information from which to create and test new, more specific hypotheses during sequent stages of research.

The major point of this discussion is that a problem-oriented approach, based on hypothesis testing and begun during the first stage of research is most efficient means of conducting archaeological research. Both management and goals are best met by this approach. My characterizations of current

contract research may have offered some but this seems a small risk in return for more critical thinking in this important area of American archeology.

I believe there are several positive steps that could be taken to improve the quality of contract archeological research:

(1) All archeological research, under contract or otherwise, should attempt to meet high contemporary standards of research. This would include development of explicit research designs which incorporate current theoretical and methodological concepts and attempt to measure research variables and test relationships between variables.

(2) Peer review of research designs and research results should be common practice. Without effective peer review, contract studies will remain largely beyond adequate evaluation and there will be little incentive to improve poor research performance.

(3) Finally, prompt publication and distribution of research results is essential. Certainly the results of the major research projects should be published and distributed so that they reach a reasonably large audience. The situation in which a research report is reproduced in 25 copies and never sees the outside of a bureaucrat's filing cabinet is unacceptable by any meaningful scientific standards. Again, there is little reason to improve research performance if research results are shunted into oblivion once they are accepted by the sponsoring agency.

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FORESTS AND FLOODS: CLUES TO THE MISSISSIPPI VALLEY FLOODPLAIN
ENVIRONMENT IN SOUTHEASTERN ARKANSAS AND SIGNIFICANCE
FOR PREHISTORIC SETTLEMENT

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The Mississippi Valley environmental reconstruction discussed here is a part of research on the Bartholomew phase in southeastern Arkansas during the Mississippi period (Rolingson 1972, 1976). The Bartholomew phase locality is the meander belt ridge of Bayou Bartholomew on the western edge of the Boeuf basin of the Mississippi Alluvial Plain adjacent to the Pleistocene terrace. The distribution of Bartholomew phase sites indicates a clear preference for the Bartholomew ridge in the bottomlands rather than the higher terrace less than five miles away, suggesting that the bottomland environment was more desirable.

Early 19th century travelers, such as Thomas Nuttall (Thwaites 1905) and Timothy Flint (1833), described the entire area west of the Mississippi and south of the Arkansas rivers as one vast, horrid cypress swamp. Phytogeographers of the 20th century classed the vegetation of this area as cypress swamp or as cypress-tupelo-red gum bottomland forest (Kroeber 1953). Within the 20th century the land has been cleared and is today a vast tract of highly productive cotton and soybean fields. There are few surviving evidences of what the environment of the Bartholomew locality may have actually been like before clearing took place, and I have found no vegetation or environmental studies that specifically describe the southeastern Arkansas area.

The research strategy, then, has been to search for a range of clues indicative of the natural environment prior to modern clearing, including the history of the Arkansas River, the physiography and flood conditions, scattered historic documents, and vegetation records from the General Land Office township surveys. The objective is to reconstruct environmental patterns present in the Bartholomew locality. The archaeological survey of the Bartholomew locality encompassed an area 27 miles north-south and 18 miles east-west, a total of 378 square miles in 10-1/2 townships. The environmental study has, however, of necessity used data from all of southeastern Arkansas.

Geologically, southeastern Arkansas is part of the Arkansas alluvial fan and the Boeuf basin (Fig. 1). Each of a series of streams flowing south now occupies an ancestral channel of the Arkansas River. Geologist Roger Saucier (1974) made a hypothetical reconstruction of seven stages in which the Boeuf River occupies the ancestral stage 3 Arkansas River channel, estimated to date 8000 to 6000 years ago, and Bayou Bartholomew occupies the stage 6 channel, dated 3000 to 1000 years ago. The present channel has been active only during the past 1000 years. This means that the 19th and 20th century records for the Bartholomew locality are applicable only for the past 1000 years. Any effort at reconstructing the environment when the Arkansas River was active in the Bartholomew channel, between 1000 B.C. and A.D. 1000, will require geological and palynological studies.

Although most of the land between the Pleistocene Prairie Terrace and Macon Ridge appears to be flat, there is considerable change in elevation. On a cross section of southeastern Arkansas, the elevation of the Mississippi River is 112 feet above m.s.l.; Macon Ridge peaks at 150 feet; the land then drops to 90 feet at the Boeuf River and rises to 120 feet on the Bayou Bartholomew ridge. The stream level of the Bartholomew is 95 feet. The Prairie Terrace rises as an abrupt escarpment above the ridge to 165 feet. It is evident that floods flowing through the Boeuf basin must reach a depth of 25 feet in order to encroach upon the higher surface of the Bartholomew ridge.

U. S. Weather Bureau recordings of stream levels did not begin until 1925, and records are biased by increasingly controlled conditions of dredged channels and construction of artificial levees. The bayou has crested the ridge only seven times during 43 years of record keeping (Patterson 1971:B-186). The threat of flood in the past has come from the east with flood waters normally entering the Boeuf basin at two locations. One is from the Arkansas River below Pine Bluff. The second is from the Mississippi River through the Cypress Creek gap at the mouth of Cypress and Amos bayous, which was closed by the Corps of Engineers in 1920. Both sources flow into the Boeuf basin.

The flood of 1927 was the second greatest flood recorded in southeast Arkansas (Frankenfield 1927), when the Arkansas River levee broke in three places below Pine Bluff. Despite the massive inundation, there were some 1500 acres of the Bartholomew ridge in the vicinity of Portland that did not flood, and several communities had only a few days of minor flooding (Arkansas Gazette 1927). At the Little Rock gaging station the 1927 flood recorded 1.6 feet lower than the greatest flood on record, that of June 1833 (Frankenfield 1927). Unfortunately, there was nobody in the Bartholomew locality in 1833 that left records. Other major floods of southeastern Arkansas were of less extent than those of 1833 and 1927 and have not threatened the inhabitants on the Bartholomew ridge (Frankenfield 1923:12-13; Vanatta et al 1914:7; Moore 1909:111).

The flood and elevation data indicate that major inundation threats to the Bartholomew locality probably came from the east in the Boeuf drainage and that the 30 feet of elevation difference offered considerable buffer against annual flooding. The Bayou Bartholomew meander belt ridge was subject to fewer incidents of annual flooding than any other portion of southeastern Arkansas except Macon Ridge. In fact, all known Bartholomew phase sites are located on or above the 115 foot contour, some 25 feet above the level of the Boeuf River.

Another indicator of the environmental condition is the vegetation. Historic documents were searched for information on the vegetation of the Bartholomew locality. The data discussed here is that of the surveyors' notes from the General Land Office township surveys made between 1827 and 1843. The first step was to plot the trees in the GLO notes on an overlay of the 15-minute topographic maps. It was evident from this that the crest of the ridge and the backslopes sported a mixed hardwood forest of oaks, hickories, sweetgums, ash, and elm. Densities of tree species were computed for the zones delineated by the contours. What is evident in the vegetation

pattern is a shift of species correlating with elevation. White oak, red oak, and hickories are more common on the higher elevations, while ash, hackberry, and elm are more common on the lower elevations. Two micro-environments within the ridge area were also identified, the oxbow lakes with cypress the dominant vegetation and the bayou bankline with sweetgum and pecan dominant. The forest on the Prairie Terrace is a pine-oak forest.

The next step was to overlay soil association areas. These roughly parallel the elevation contours used in the preliminary analysis. At this point seven environmental zones were established based on a number of factors including the vegetation patterns drawn from the preliminary mapping, descriptions by botanists of the habitat for the various species (Moore 1969; Putnam and Bull 1932; Maisenhelder 1958), soil associations mapped by the Soil Conservation Service, and local topography. The seven environmental zones are the Boeuf backswamp with clay soils, the Bartholomew ridge with sandy loam soils and containing two micro-environments - oxbow lakes and the Bartholomew bankline, the Overflow backswamp with clay soils, the terrace forest with loess soil, and a small prairie on the terrace (Fig. 2). All of the tree data were then put into the computer including specific location of each tree on a grid of section lines, the environmental zone in which the tree was located, the species, and the diameter of the tree. The zone, species, and diameter data were used to compute the importance value of each species in each zone. This importance value (Cottam and Curtis 1956; Curtis 1959) is based on three computations - the frequency of each species relative to the number of recording points in the zone, the density of each species relative to all trees within the zone, and the dominance or average basal area of the species relative to the basal area of all species in the zone. The importance value (IV) is the mean of these three figures. With the importance value data organized by environmental zones, some distinct patterns of vegetation are clear.

One factor that stands out is the similarity of species present from zone to zone. An index of similarity computed for all pairs of zones show 71% to 85% similarity for the trees of the five bottomland zones. The distinctiveness of the zones is in the dominance of species.

The Bartholomew ridge zone, with silt loams and fine sandy loams, supported a sweetgum (IV 21), white oak (IV 16), red oak (IV 12), hickory (IV 11), and black oak (IV 11) forest. These five dominants are 55% of the density of the the total trees, although 29 species are present. Variability in terrain is reflected in the presence of minor numbers of species tolerant of poorly drained conditions. The understory vegetation of cane, vines, and briars apparently varied in density with some areas reported as relatively clear of undergrowth, while in other areas cane formed an impenetrable mass.

On the bayou bankline, the dominant trees are sweetgum (IV 29), pecan (IV 19), and overcup oak (IV 15). The oxbow lakes and swamps are dominated by cypress (IV 51) and sweetgum (IV 14).

In the Boeuf backswamp no species is really dominant, and this is much more a mixed forest than any of the other zones. The five species totaling 50% density of all trees are ash (IV 14), white oak (IV 11), hackberry (IV 11), sweetgum (IV 10), and elm (IV 10), all but the white oak being species

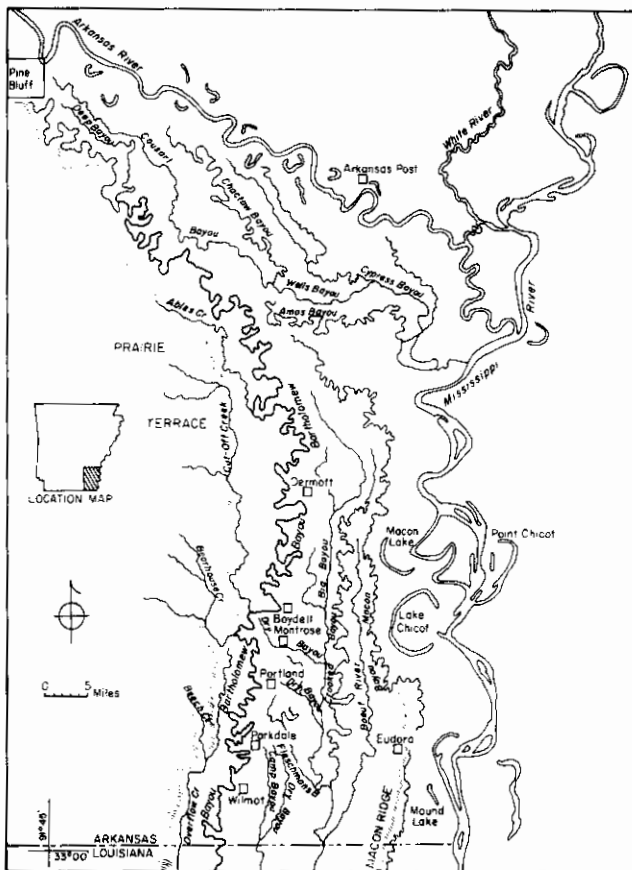


Figure 1. Major Streams and Physiographic Features of Southeastern Arkansas.

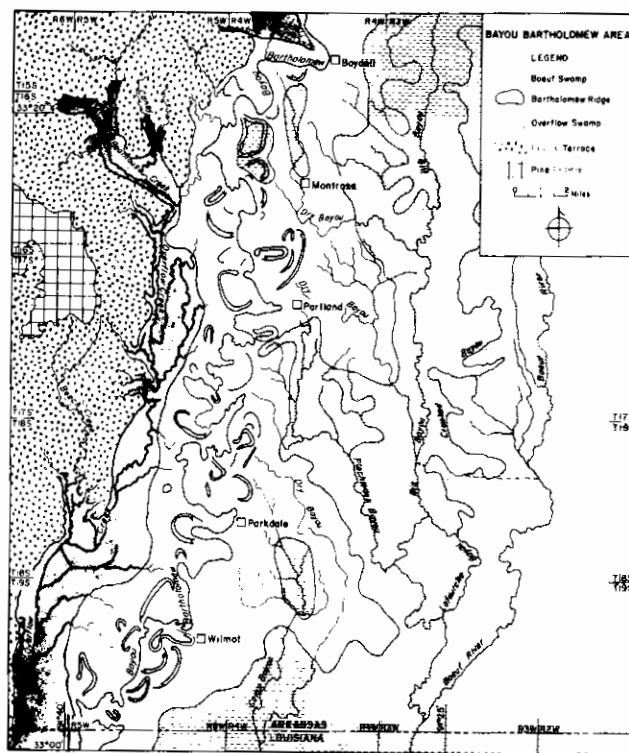


Figure 2. Bayou Bartholomew Environmental Zones.

favoring poorly drained clay flats. In fact, this zone has more diversity of terrain than the others. Small streams draining the eastern backslope are paralleled by loamy soils rather than clays. The streams themselves today have cypress growing in them, a fact never reported by the 19th century surveyors. Undergrowth varies as well, including both cane stands and wet areas of mixed briars and palmetto.

The Overflow backswamp, a rather level clay flat, is homogenous in vegetation. The dominant trees are pin oak (IV 24), hickory (IV 21), white oak (IV 16), and black oak (IV 14) for 63% density of the total range of trees. The undergrowth is predominantly cane.

The forest on the Prairie Terrace is dominated by black oak (IV 40) and pine (IV 33) with 68% density of the trees present. The small prairie on the terrace has only four tree species present and is dominated by pine (IV 50).

A surface mapping program that makes contour maps based on density of a species is in the process of being developed. These maps will provide a somewhat different view of the distribution of species that is blurred by creating zones. Higher densities of pin oak cluster in the southern portions of Overflow swamp, and higher densities of hackberry cluster in the northern portions of the Boeuf swamp.

The Bartholomew phase sites are primarily located in the Bartholomew ridge zone within one mile of both the Bayou Bartholomew bank and an oxbow lake. Locations of secondary importance are where sandy loam soils line the backslope streams. Twelve percent of the sites are in the Boeuf backswamp zone, but always located on pockets of sandy loam soil and only one site has been found in the Overflow backswamp.

From each of the kinds of data investigated, it is evident that the Bartholomew ridge was a high, generally dry locality within the often flooded swamplands of southeastern Arkansas. With a well-drained sandy loam for domesticated crops and easy access to varied natural resources, it provided a rich environment for the Bartholomew phase inhabitants.

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PREDICTIVE SETTLEMENT ANALYSIS IN CENTRAL GEORGIA

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The research presented in this paper is one aspect of a larger research program on materials recovered from the Georgia Power Plant Scherer project in Monroe County, central Georgia (Fish, Fish, and Jefferies 1978). The plant covers approximately 12,000 acres of upland piedmont ridges and small drainage valleys. The largest water course within the plant boundaries is Rum Creek which flows into the Ocmulgee River. Only very limited areas of the study area are within 4000 feet of this river.

An important aspect of present research has been to develop a predictive model of site location based on a variety of environmental variables. The first step in accomplishing this goal was to divide the plant site area into grids measuring 2000 feet on a side. The coordinate system used is the Georgia plane coordinate system.

Initial formulation of this model was accomplished by means of 2 cluster analyses; one grouping the grids mentioned above and the other classifying sites into groups.

Grid Analysis

Physical characteristics used as variables in the model are: 1) percent of grid in ridge top; 2) percent of grid in bottom land; 3) range in elevation within grid; 4) distance to nearest permanent water source; 5) distance to Rum Creek; 6) distance to the Ocmulgee River; 7) distance to the nearest shoals on the Ocmulgee River. Each variable was selected because it could be measured on at least an ordinal level of scaling and because it was thought that the variable could have had an important influence on aboriginal utilization of the plant site area.

The grids were grouped based on the above variables by the cluster analysis utilizing Ward's Method as written by Anderberg (1973). Ward's Method creates discrete groups by attempting to minimize variance within a cluster while attempting to maximize variance among clusters (Anderberg 1973).

No objective criteria exist for checking upon the number of clusters produced or discovered by a cluster analysis. The solution to this problem varies with the expectations of each research problem. To achieve maximum resolution among clusters generated was the crucial task in dividing the contract area into similar environmental zones. The program used in this analysis aids in this determination by means of a graph of percent of change in "information" versus the number of clusters created. This graph allows the selection of a number of clusters which contain the highest levels of information possible and the greatest intercluster resolution. Five clusters were deemed to be the optimum solution. Table 1 presents means and standard deviations on each of the 7 variables for the five clusters.

Cluster		Ridge	Bottom	Elevation Range	Distance Water	Distance Ocm.	Distance Shoals	Distance Rum
I.	Mean	27.3	26.7	75.9	606.7	4511.7	7080.0	11373.3
	S.D.	9.3	24.6	8.8	484.7	2773.9	2552.4	2908.3
II.	Mean	54.9	8.3	90.1	1195.5	14715.9	15202.3	6355.7
	S.D.	13.1	6.1	12.4	416.0	6048.1	6146.8	3434.4
III.	Mean	34.7	32.5	86.6	428.2	20529.0	21157.9	2695.2
	S.D.	14.6	14.1	15.2	285.6	4880.4	4794.4	1874.8
IV.	Mean	39.6	23.2	98.5	302.0	9838.0	10559.5	3322.0
	S.D.	13.1	10.5	18.1	271.3	3718.2	3665.8	2740.8
V.	Mean	28.4	12.4	137.2	936.1	28805.5	29833.3	4594.4
	S.D.	9.3	7.3	22.8	448.8	2283.7	2462.6	3033.0

Table 1. Physical characteristics of grids.

Stone Tool Analysis

The second cluster analysis classified prehistoric sites into groups based on the relative presence or absence of specific chipped stone tool types. From each collection, all retouched pieces were removed and were classified into 11 discrete categories as shown in Table 2.

Projectile Points	Denticulates	Cutting Implements
Endscrapers	Beaked Implements ¹	Sidescrapers
Bifaces	Gravers	Planes
Notches	Truncated pieces ²	

Table 2. Stone tool categories used in the analysis.

A weakness in the data collected during this survey, small sample size, required the coding of artifacts on a presence/absence basis only. Uncertainty exists over the effect small samples have on the associations discovered by cluster analysis in that the groups created may reflect more sample area than actual similarity (Graybill 1975). Coding the data in binary fashion does not totally rid the analysis of sample error, however, this partial solution must suffice until more appropriate statistical measures are devised for small samples.

The stone tool types mentioned above were placed into a cluster analysis to consider groupings of sites based on the relative presence of tools. The

specific technique of clustering was that of Ward's Method as found in Program Hierar of the Clustan Package (Wishart 1969). Program Result, also of the Clustan Package, was executed to determine which variables significantly contributed to each individual cluster. This significance is determined by the Binary Frequencies Ratio which is defined as the percentage of the artifact in a cluster divided by the overall percentage of that artifact. An artifact was considered to have significantly contributed to the formation of the cluster if it was present in at least two sites in the cluster and had a Binary Frequencies Ratio of 2.0 or more (Wishart 1969, Peebles 1972). Table 3 presents cluster content and variables significant in the formation of the clusters.

Other Artifactual Information

The cluster analysis presented in Table 3 was based solely on stone tools. Activities produce and/or require more than chipped stone tools alone. Various kinds of activities may produce more unretouched flakes or may require ground stone tools. These data were tabulated and compared against the stone tool clusters (Table 4).

Table 3. Stone tool cluster analysis results.

Cluster 1 N=22

Case numbers:

1, 3, 13, 20, 34, 41, 49, 53, 64, 79, 81, 120, 123, 126, 134, 140, 149, 161, 243, 271, 301

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Cutting implements	22	100.0	4.30

Cluster 2 N=15

Case numbers:

2, 37, 42, 70, 73, 88, 101, 103, 136, 148, 170, 196, 246, 283

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Planes	4	26.7	3.62
Truncated pieces	15	100.0	3.26

Cluster 3 N=22

Case numbers:

5, 28, 55, 74, 75, 80, 90, 92, 104, 107, 109, 113, 115, 118, 147, 173, 177, 187, 209, 232, 282, 284

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Notches	9	41.0	3.28
Truncated pieces	18	81.9	2.67

Cluster 4 N=15

Case numbers:

6, 7, 9, 66, 76, 89, 94, 119, 141, 145, 147, 192, 195, 200, 239

Table 3. (Continued)

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Beaked implements	5	33.4	7.34
Denticulates	4	53.4	4.70
Endscrapers	10	66.7	4.34
Notches	8	53.4	4.27
Cutting implements	14	93.4	4.01

Cluster 4 N=15

Case numbers:

6, 7, 9, 66, 76, 89, 94, 119, 141, 145, 147, 192, 195, 200, 239

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Gravers	14	93.4	4.01
Sidescrapers	7	46.7	3.16
Bifaces	15	100.0	2.80
Truncated pieces	12	80.0	2.61
Projectile points	14	93.4	2.03

Cluster 5 N=12

Case numbers:

10, 14, 15, 52, 65, 87, 91, 114, 132, 144, 171, 274

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Gravers	12	100.0	4.30

Cluster 6 N=21

Case numbers:

11, 12, 46, 54, 56, 68, 106, 108, 112, 122, 150, 184, 186, 189, 203, 236, 242, 265, 277, 285, 303

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Denticulates	5	23.9	4.20
Endscrapers	10	47.7	3.11
Planes	4	19.1	2.58
Beaked implements	2	9.6	2.10

Cluster 7 N=34

Case numbers:

16, 19, 24, 39, 43, 44, 47, 48, 67, 71, 93, 98, 110, 116, 143, 153, 193, 204, 207, 210, 212, 241, 244, 261, 268, 269, 276, 286, 294, 298, 305, 307, 309, 310

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Projectile points	34	100.0	2.18

Cluster 8 N=22

Case numbers:

18, 58, 60, 61, 77, 78, 99, 125, 129, 135, 137, 139, 155, 156, 206, 233, 240, 247, 251, 253, 266, 288

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Bifaces	22	100.0	2.80

Table 3. (Continued)

Cluster 9 N=13

Case numbers:

22, 51, 63, 72, 82, 127, 128, 146, 175, 194, 208,, 275, 278

<u>Significant artifacts</u>	<u>Number in cluster</u>	<u>% in cluster</u>	<u>BF Ratio</u>
Sidescrapers	13	100.0	6.77

Table 4. Sherd, ground stone, flake, tool, and artifact means per cluster.

Cluster	Mean sherds	Mean ground stone	Mean flake	Mean tool	Artifact mean
I.	4.00	0.00	3.90	1.82	9.73
II.	38.67	0.80	22.30	6.33	68.00
III.	5.41	0.14	9.68	2.14	17.36
IV.	24.93	0.33	76.27	14.93	116.53
V.	5.25	0.00	6.75	1.67	13.67
VI.	1.23	0.05	5.05	1.86	8.19
VII.	16.35	0.09	5.44	1.56	23.44
VIII.	5.09	0.00	5.73	1.64	12.45
IX.	10.92	0.23	8.08	2.23	21.31
X.	1.84	0.08	2.71	0.00	4.62

Two general statements may be made from these observations; mean flake count per cluster is associated with mean tool count per cluster and mean ceramic count per cluster is associated with mean count of ground stone tools per cluster. This association dissolves at the lower end of the table, i.e., those clusters with small sample size, a phenomena most probably due to sample error.

Results

To provide specific content to the model, the environmental cluster analysis was observed vis-à-vis the chipped stone tool analysis and other artifactual information. Other analytical techniques were considered, however problems associated with sample size and lack of contextual information limit our discussion to speculation.

Cluster 1

Cluster 1 is physically characterized by:

- 1) Large distance to the major creek, Rum Creek
- 2) low percent of grid in ridge top
- 3) small distance to the Ocmulgee River
- 4) small distance to the nearest shoals on the Ocmulgee River.

Artificially, grid cluster 1 is characterized by tools probably used for a wide range of activities. Chipped stone tool clusters 3, 6, and 8 are present. Cluster 10 composed of those sites without stone tools is present in each of the five grid clusters and will not be considered in this discussion. Proposed activities for grid cluster 1 are:

- 1) Cutting (denticulates)
- 2) scraping (endscrapers, notches, planes)
- 3) perforation (truncated pieces, beaked implements).

Both the physical characteristics and the artifactual content of this cluster seem to indicate that many of the sites present within this cluster were probably larger, more permanent settlements than the more interior grid clusters.

A mean of 3.4 sites per grid were located within this grid cluster.

Cluster 2

Grid cluster 2 is physically characterized by:

- 1) Highest percent of grid in ridge top
- 2) largest distance to water
- 3) lowest percent of grid in bottom land.

Stone tool cluster 7, significantly composed only of projectile points, is the only stone tool group represented in grid cluster 2. As many of these sites are projectile point isolates, hunting is proposed as the major activity which occurred in this cluster. Few or no habitation sites would be expected.

A mean of 1.72 sites per grid were located within this grid cluster.

Cluster 3

Grid cluster 3 is physically characterized by:

- 1) Highest percent of grid in bottom land
- 2) lowest distance to the major creek, Rum Creek.

Artificially, grid cluster 3 contains representatives of stone clusters 7, 8 and 9. The following activities are proposed:

- 1) Cutting (bifaces)
- 2) scraping (sidescrapers)
- 3) hunting (projectile points).

A mean of 3.2 sites per grid were located within this grid cluster.

Cluster 4

Grid cluster 4 is physically characterized by:

- 1) Nearest distance to water
- 2) high range in elevation
- 3) low percent of grid in ridge top
- 4) low distance to the major creek, Rum Creek
- 5) low distance to the Ocmulgee River
- 6) low distance to the nearest shoals on the Ocmulgee River.

On the basis of significant stone tools present (stone tool clusters 1, 2, 3, and 7) the following activities are proposed for grid cluster 4:

- 1) Cutting (cutting implements)
- 2) scraping (planes, notches)
- 3) perforation (truncated pieces)
- 4) hunting (projectile points).

A mean of 6.9 sites per grid were located within this grid cluster.

Cluster 5

Grid cluster 5 is physically characterized by:

- 1) Highest range in elevation
- 2) largest distance to the Ocmulgee River
- 3) largest distance to the nearest shoals on the Ocmulgee River
- 4) low percent of grid in bottom land.

Due to land purchase patterns GPC had not purchased any grids of Cluster 5 at the time of initial survey. Therefore no comparison could be made with the stone tool cluster analysis. However, on surveying one grid of this cluster, 2 stone tools were later found suggesting the presence of the following activities:

- 1) Cutting (biface)
- 2) scraping (sidescraper).

Three sites were found in the one grid surveyed within this grid cluster.

Table 5. Model expectations vs. results.

Cluster number	Model	Resurvey
1	Denticulate Notches Endscrapers Truncated pieces Planes Beaked implements	Truncated pieces Beaked implements Projectile points Gravers
2	Projectile points	Bifaces
3	Sidescrapers Bifaces Projectile points	Only stone mounds found
4	Cutting implements Planes Notches Truncated pieces Projectile points	Projectile points
5	Not visited during initial survey	Biface Sidescraper

Prediction

These observations show, on an inductive level, that artifact sets, which perhaps represent different kinds of activities, do covary with the environmental characteristics of the area. If the model thus formulated is a close reflection of reality, then similar artifact sets should be in evidence in those grids not yet visited within a cluster. To evaluate this statement the field crew returned to the plant site to check at least one unvisited grid from each cluster. Table 5 presents the correspondence between the expectations and the results of the resurvey.

While it is obvious the predictive portion of the survey was not highly efficient, the results are not contradictory to a degree which demands present modification of this settlement model for the central Lower Piedmont of Georgia. More strenuous evaluation of this model is yet to be made with the excavation of numerous sites which will provide contextual data for the elucidation of the kinds of activities present in each of the grid clusters.

Table 6. Environmental and cultural content of grid clusters.

<u>Cluster</u>	<u>Environmental characteristics</u>	<u>Activities</u>
1	Large distance to Rum Creek Low percentage ridge top Near Ocmulgee River and shoals	Scraping Cutting Perforation
2	High percentage ridge top Large distance to water	Hunting
3	High percentage bottom land Near Rum Creek	Cutting Scraping Hunting
4	Near all water Near shoals High range in elevation Low percentage ridge top	Cutting Scraping Perforation Hunting
5	High range in elevation Large distance from Ocmulgee River Large distance from shoals Low percentage bottom land	Cutting Scraping

Summary

Although this analysis has not identified the variables which could be used to fully explain the various processes for determining sites location it has shown that various activities are distributed in a non-random fashion over the upland Piedmont landscape.

The cluster analysis produced five clusters of physical areas based on several variables previously discussed. These clusters are not discrete but may be further grouped into 2 major environmental areas. Clusters 1, 3, and 4 are roughly characterized by low percentage of ridge top and/or a higher percentage of bottom, proximity to major water. The second major group, composed of clusters 2 and 5, are characterized by ridge tops or low percentage bottom and distance from water.

The analysis of the collections has shown that a much wider range of activities occurred in the environmental areas comprising Group 1 than in the higher and more distant from water areas of Group 2. Our speculations are then that continued research in the Group 1 areas will contribute information on the full spectrum of technomic activities while research in the Group 2 areas will provide data perhaps restricted to hunting and gathering activities.

Notes

1. Beaked implements as used here is defined in Seckinger and Graybill (1976:43,47). Due to the general unavailability of this report the definition is cited below:

Technologically these all appear to be made on relatively thick flakes of quartz or on angular fragments of the same material. The beaked shape usually appears to have been created by retouch directed from the inner (bulbar) surface of flakes toward the outer surface, and located a few millimeters from the end of the flake that is distal to the striking platform. On angular fragments the retouch was again near one end of the item and directed from the flatter side of the piece toward the more angular side. In some cases only one side of a piece had purposeful retouch directed toward isolation of the "beak," natural fissures or angularity on an opposing side providing a complementary concavity.

2. Items included in this analysis called truncated pieces were, during fieldwork and initial analysis, thought to be burin like tools. Further examination and fieldwork demonstrated, beyond reasonable doubt, that these artifacts were directly associated with logging activity. They appear to have been flakes of bifacial retouch of an approximate mean length of 45 mm which had been run over by logging truck, creating the edge.

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CULTURAL RESOURCES MANAGEMENT IN THE NASHVILLE DISTRICT,
U. S. ARMY CORPS OF ENGINEERS

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Historically, the responsibility for managing cultural resources at the Federal level has been primarily with the National Park Service. Through the defunct Inter-Agency Archaeological Salvage Program and the regional offices of the National Park Service, vast numbers of Federal projects were assessed for their impacts on cultural resources, a multitude of archaeological sites were discovered through professional surveys, and many significant sites were excavated.

Prior to 1966, the primary responsibility for actions pertaining to cultural resources associated with Federal programs and projects was delegated by legislation to the National Park Service. With the enactment of the National Historic Preservation Act in 1966 and following legislative and administrative actions, a major portion of this responsibility was shifted to the Federal agencies having jurisdiction or control over actions affecting these resources. As a result it is now necessary that the Corps of Engineers and other Federal agencies coordinate and conduct all such activities with the advice and consultation of the National Park Service, the Advisory Council on Historic Preservation and the State Historical Preservation Officer.

With the passage of Presidential Executive Order 11593 in 1971 and the Moss-Bennett Act (the Archeological Conservation Act of 1974), Federal agencies are directed to develop their own programs of cultural resources management and assessment, whether through "in-house" contract administration and field work or through a transfer of funds to the National Park Service. Through the Executive Order, authorization is given for each Federal agency to inventory all archaeological and historic sites and resources under Federal jurisdiction or control, and to assess their significance based on eligibility criteria established for the National Register of Historic Places. Unfortunately, specific funding appropriations were not established with the Executive Order, thereby not providing a mechanism for its systematic implementation by all Federal agencies.

The Moss-Bennett Act, enacted 24 May 1974, is directed to the preservation of archaeological, architectural, and historic data and sites that would otherwise be lost as a result of Federal construction or other federally licensed or aided activities. With the Moss-Bennett Act came the specific funding authority for expenditures relative to the mitigation of impacts to significant cultural resources.

In response to the requirements of all of the pertinent Federal cultural resources management legislation, many Federal, state, and local agencies have begun to employ cultural resources managers. These duties are presently

performed by planners, foresters, archaeologists, historians, geographers, sociologists, cultural anthropologists, architects, landscape architects, outdoor recreation planners, and members of other disciplines.

A partial inventory of the agencies include the following: Army Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, Forest Service, Bureau of Land Management, Bureau of Outdoor Recreation, state historical commissions, state archaeologist offices, state highway departments, and state, regional, and local planning offices. These positions are primarily for the management of cultural resources and for archeological contract administration, although some of these agencies (especially the Forest Service and the Bureau of Land Management in the Western United States) have become increasingly involved in conducting "in-house" cultural resources field investigations.

To assist in the implementation of Moss-Bennett and other Federal cultural resources legislation, the Corps of Engineers has recently increased its staff to include 21 archaeologists in 18 district and division offices, one cultural anthropologist, and one historian. Cultural resources studies are undertaken primarily within means of staff expertise, or through contracts directly, with qualified investigators, rather than through transfers of funds to the National Park Service. In general, this method provides for a better control of reports, recommendations, and publications related to proposed project effects on cultural resources, as well as being more economical.

The Nashville District has accelerated its program of Cultural Resources Management through expanded programs of in-house cultural resources contract administration and field research. The District has in-house expertise with myself as archaeologist, an architect (assisting in architectural history and historical matters), a geologist (who has an undergraduate minor in anthropology, assisting in field surveys of small-scale project areas), and a biologist, an ecologist, two landscape architects and an outdoor recreation planner who are involved with historic preservation and archaeological planning on an individual project basis. Presently, an additional archaeological position is being proposed, based on the increasing demands of archaeological and historic studies, contract administration, and in-house field investigations.

Since the beginning of Fiscal Year 1976 on July 1, 1975, the Nashville District office has initiated compliance efforts for NEPA (the National Environmental Policy Act), Executive Order 11593 and the Moss-Bennett Act for a number of construction, planning, and real estate projects on Corps lands. "In-house" field investigations have included a cultural resources reconnaissance of a real estate easement of a power line crossing at Cordell Hull Reservoir, Tennessee, a real estate easement for a water line crossing at Wolf Creek-Lake Cumberland, Kentucky, land disposal to the Lyon County Port Authority in Lake Barkley, Kentucky, and an architectural/historical/historical archaeological reconnaissance at the Bay Springs Damsite for the Tennessee-Tombigbee Waterway Project in Tishomingo County, Mississippi. No significant sites were discovered for the previously mentioned real estate projects. An interesting complex of circa 1850 structures were observed at the Bay Springs project area. Although the remains within the area cannot be judged architecturally significant, the area is historically significant in the development of industry and commerce in pre-Civil War Mississippi and

exhibits some possible historic archaeological potential.

An archaeological survey was conducted at the Gainsboro Port Authority project lands at Cordell Hull Reservoir by the office of the Tennessee State Archeologist. Five definable prehistoric sites were discovered and were tested in a contract study by Middle Tennessee State University. As a result of test excavations, two of these sites have been evaluated as significant. One (40JK27) is a multi-component Archaic/Woodland site; the other (40JK30) is possibly a small single-component Mississippian village with some possible evidences of a structural unit. A program for the mitigation of impacts to these sites is currently in preparation.

An archaeological survey and test excavation of the Salt Lick Recreation Area in Cordell Hull Reservoir was contracted with the University of Tennessee at Knoxville. Eight prehistoric sites were discovered. Although the laboratory analysis and report-writing are still underway, early Archaic through Mississippian cultural materials were discovered in the project area. Some archaeological features of Woodland cultural affiliation (including five hearths, trash pits, and evidence of a house) were discovered through horizontal stripping of excavation units.

The District has also become involved with architectural and historic studies and restoration at Mill Springs Mill at Wolf Creek-Lake Cumberland, Kentucky. Mill Springs Mill is a grist mill structure on the National Register of Historic Places which played a significant role in the commercial trade and industrial growth in south central Kentucky. The building and machinery also provide an excellent example of unique 19th century engineering. Through Congressional action in 1974 the District initiated a plan to restore and maintain the mill fully due to its unique historical, architectural, and recreational qualities.

A program of cultural resource studies at the Tennessee-Tombigbee Waterway in Mississippi has been established by the District through transfer of funds to the National Park Service and by in-house contract administration. National Park Service contracts include a survey of the Divide-Cut Section by the University of Mississippi and a survey of Bay Springs Lake by the University of Alabama. Nashville District contracts to date have included a contract with Mississippi State University for the excavation of the L. A. Strickland Site and a contract with the University of Mississippi for excavation of eleven significant prehistoric sites. Further archaeological excavations at minimally twelve additional prehistoric sites in the Divide Cut are anticipated. However, further coordination with the State Historic Preservation Office, National Park Service, and the Advisory Council on Historic Preservation will be necessary prior to additional field investigations.

The needs for additional cultural resources studies at three other Nashville District projects currently under construction are being assessed. They are Smithland (in Illinois and Kentucky), and Laurel and Martins Fork (both in Kentucky). Cultural resource investigations will be conducted at all nine operating District projects where an action may disturb cultural resources or sites. Our ultimate objective is to have an adequate cultural resources survey accomplished on all District lands to input into all levels of the planning process and to provide a comprehensive program of cultural resources management for the Nashville District.

MISSISSIPPIAN SOCIO-POLITICAL ORGANIZATION:
AN ALTERNATIVE APPROACH

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Introduction

Most discussions of Early and Middle Mississippian socio-political organization do not define models in terms of a general theoretical approach. The purpose of this paper is to demonstrate how Vogt's (1968) model may be adapted to Early and Middle Mississippian and its application tested by empirical data in order to derive a general theoretical approach to Mississippian socio-political organization.

Theoretical Basis

The theoretical basis of this paper will be essentially the hypothetico-deductive approach as described by Fritz and Plog (1970:410). An hypothesis with deductively derived test implications which may be tested against empirical data is proposed. Although the hypothesis cannot be confirmed definitively, current data which lend themselves to this study will be examined in light of the test implications proposed. The purpose of this paper is not to test the hypothesis but to assess its utility as an explanatory model to be tested at a later time.

Models

The Sears Model

The generalized models proposed by Sears (1968) for Mississippian socio-political organization are that of the "Priest State" and "Militaristic State." These models appear to fit into the view that archaeologists generally have when discussing attributes of Mississippian socio-political organization. Briefly, the "Priest State" consists of communities similar in type and size except for the ceremonial center. The center is larger in size except for the seat of a rigidly interpreted religion and ceremonialism. Located in the ceremonial center are a core of priests who, as leaders of the state cult, control cultural and ritual patterns. The cult's representatives are also present on the village level where they control cultural and ritual patterns (Sears 1968:140).

The "Militaristic State" is distinguished from the "Priest State" by two characteristics:

- (1) An urban ceremonial center, physically readily distinguishable from other ceremonial centers within the boundaries of the state because of its greater size and complexity and possibly greater population.

(2) Fortifications, particularly of the urban center, with the incorporating variant (incorporating type of conquest state); of the frontier towns or cities, with the replacing type (replacement type of conquest state) (Sears 1968:148).

The Vogt Mayan Model

Evon Z. Vogt (1968), in his article on Zinacantan settlement patterns, examined the use by the modern Maya of the religious system of cargo. "The cargos that are the principal concern of this study are, . . . all religious positions. That is, they are offices devoted to the performance of ritual" (Cancian 1965:22). As Cancian has observed, economic expansion has had an adverse effect upon the original intent of cargo: to act as a religious system of rotating offices whose main purpose is to unify the urban center with the outlying villages economically, politically, and ceremonially. Hereafter when we refer to the cargo system, it will be to an ideal nineteenth century model present before industrial expansion. Vogt's purpose was to draw possible parallels between the modern use of cargo by the Maya of Zinacantan and the ancient Maya. Research on the cargo system suggests that individuals from certain lineages came in from outlying village centers to serve in a rotational office (priestly ranks) of some kind. Initiation into the rotational office was in the hands of a permanent core of ritual specialists. In return for the ritual specialists' guidance in various details of ceremonial procedure, the cargo holders furnish the specialists with food and liquor.

Vogt adds that the cargo holders possess more formal power than the ritual specialists, but the ritual specialists who continually serve in the same ritual roles have marked control of specific ritual knowledge. After those in a position of cargo have served a specific amount of time and expended their economic surpluses in ceremonial activity, the cargo holder would return to corn-farming while awaiting the next position of rank.

There is a definite advantage in using cargo as a possible explanatory model for Early and Middle Mississippian. As Vogt (1968:167) suggests for the Maya, cargo serves as an integrative mechanism. It is a means for inducing the village centers to bring not only food into the ceremonial center but also labor for its support and maintenance. This would mean that the gulf between farmer and priest would be reduced, allowing rotation between farmer and priest.

Vogt (1968:169) raises a question pertaining to the Maya which has important implications for the Mississippian period and will influence the rest of this paper. The question is how the individuals serving in the cargo system of social roles were selected - whether, for example, they were lineage heads or represented lineages, and if the ritual specialists, or the individuals serving in the cargo system of social roles were buried with ceremonial pomp in the pyramids.

To accommodate our study we can restate Vogt's hypothesis: if individuals within Mississippian society were active participants in a cargo system, then this system accorded the individual certain rights and privileges during life and upon death.

The system involved possible lineage heads of outlying villages going into the associated ceremonial center and serving within the priestly hierarchy for a period of time. Initiation into the cargo system (priestly ranks) was in the hands of a permanent core of ritual specialists. During the period of time the lineage head served his cargo position, economic surpluses from his village would be expended at the ceremonial center. Upon completion of the cargo position, the lineage head would return to his village for a prescribed period, or until enough economic surplus could be accumulated. This would allow him to advance to the next position of cargo. If death occurred during or after completion of the cargo, the holder was buried within the ceremonial center with the rights and privileges accorded to his rank.

Techniques

1. To evaluate our hypothesis and its forthcoming test implications, we must consult previous analyses. One of the methods at our disposal is that of biological distance.

Cranial Non-Metric Variants (which are basically genetic in character, but may be influenced by environmental variables) can yield data on biological relationships within and between populations. A statistic used to define these relationships is the Mean Measure of Divergence. As described by Suchy (1975:69) the Mean Measure of Divergence " . . . does not produce a distance measurement in the mathematical sense; this statistic produces a measure of biological difference."

It is not within the scope of this paper to elaborate further on the use of non-metric variants. A more detailed description of the technique may be found in a number of reports (e.g., Berry and Berry 1967; Ossenberg 1969; Rees 1969; Lane and Sublett 1972; Corruccini 1972, 1974; Buikstra 1973, 1975; Suchy 1975; and Green and Suchy 1976).

2. As discussed by Brown (1973), bone strontium content will express in quantitative terms (mg/kg) differential amounts of animal protein intake within and between populations. The levels obtained from atomic absorption spectroscopy appear inversely proportional to the amount of animal protein intake.

Those individuals who have a higher intake of animal protein will have a lower ratio (mg/kg) level of strontium. Those individuals who have a lower intake of animal protein will have a higher ratio (mg/kg) level of strontium.

3. Supra-local and local burial goods can be used as indicators of differential status within society. Peebles (1971:69) defines supra-local goods as artifacts of distinction (e.g., copper gorgets, effigy pipes, ceremonial celts) which have cut across the boundaries of many distinct cultures. Local symbols are those which have " . . . far more restricted distribution than the supra-local symbols. These local symbols usually take the form of animal effigy vessels or parts of animals such as canines, claws, and shells."

The above types of data may be useful in defining a facet of Mississippian socio-political organization not yet considered. Because these three types of empirical data are not available for testing on any one Mississippian settlement system, previously published data will be examined from various sources in order to arrive at conclusions which may be helpful for future use.

Test Implications

Test Implication I

If the cargo system is in operation in Mississippian society (with individuals from associated villages being buried at the ceremonial center), homogeneity between the ceremonial center populations and the associated village populations should be reflected through measures of biological affinity (Mean Measure of Divergence).

The test can be accomplished by taking the ceremonial center population and dividing it into groups reflecting status and rank. The groups may then be compared to each other by the Mean Measure of Divergence for each possible pair to determine biological affinity between groups. Then each village population that is associated with the ceremonial center may be compared by the Mean Measure of Divergence to each ceremonial center group, for each possible pair, to determine biological affinity between the groups.

According to the resulting data, if the ceremonial center groups can be shown to be distinct through the Mean Measure of Divergence from the village populations, then the hypothesis may be rejected. If the ceremonial center groups can be shown to be related to the village populations through the Mean Measure of Divergence, then the hypothesis may be accepted.

Evaluation of Test Implication I

Unfortunately, we are lacking comprehensive regional and local bioanthropology studies for Early and Middle Mississippian skeletal populations according to settlement systems. We must therefore use data which we have at our disposal.

Work done by Buikstra (1973) in the Lower Illinois Valley may prove significant to our hypothesis if we take the view stated by Raab (1975) that Mississippian society may reflect growth out of Woodland socio-political organization. Raab (1975:15) suggests that agricultural land use in the Woodland period was a family-based endeavor, while in the Mississippian period it was a community-based undertaking. As the shift from family-based production to community-based production occurred, so did an increase in economic productivity and social complexity. In concurrence with this idea, Raab (1975:16-17) suggests that ". . . Mississippian was part of a behavioral system which was set in motion during the Woodland period and if we want to understand the Mississippian we are going to have to look at Woodland sites, too."

Buikstra (1973), working with Illinois Hopewell skeletal populations, theorized that "central feature" burials (due to distinct morphological characters) represented a distinct genetic stock. A series of eleven non-metric characters scored from the Gibson and Klunk skeletal series divided into burial groupings (e.g., central features and associated burials, sub-floor pits, residual intra-mound burials) were used to test the theory.

If the burial groupings are significantly different, an argument for inherited status would be strengthened. However, . . . none of the chi-squares developed through two-way comparisons are significant. Although these data may not be sensitive enough to pick up on subtle variations, this comparison would not support the argument for inherited status determining access to the relatively inaccessible central features (Buikstra 1973:29).

Test Implication II

If the cargo system is in operation in Mississippian society, no significant differences in animal protein intake between the ceremonial center groups and the associated village populations should be reflected through measures of bone strontium.

The ceremonial center population is divided into groups reflecting status and rank. The groups may then be compared to each other by bone strontium levels derived by atomic absorption spectroscopy for each possible pair to determine similarity/dissimilarity between the groups.

According to the resulting data, if the ceremonial center groups can be shown to be distinct through bone strontium levels from the village populations, then the hypothesis may be rejected. If the ceremonial center groups can be shown to be similar to the village population through bone strontium levels, then the hypothesis may be accepted.

Evaluation of Test Implication II

Based on test implication II, Brown's (1973) analysis of bone strontium levels from Gibson central feature burials, and the remainder of the series, indicated no significant difference between the two groups' dietary treatment during their lives. Brown (1973:30) states that, "Differences in diet within populations should be discernible. High-status segments of society such as traders or leaders might have access to more meat than the majority of the populations and this would be reflected in lower bone strontium for those high status individuals." Brown (1973:58) found that individuals occupying the central features and those in peripheral positions had similar ratio values of bone strontium. Due to the similarity in ratio values, the hypothesis that individuals in the central feature areas were consuming more animal protein than those in peripheral positions was not supported.

Brown's analysis lends further viability to Buikstra's (1973) finding mentioned previously that each mound group represents a homogeneous population. Thus, Brown's analysis implies that community-related individuals are participating in the status system which may support test implication II.

If we assume that Early and Middle Mississippian reflect patterns set forth in the Woodland period, the data presented by Buikstra (1973) and Brown (1973) appear to support our hypothesis. There appear to be few distinctions between the status groups and the general population. This may support the existence of a cargo system of social roles.

Test Implication III

If the cargo system is in operation in Mississippian society, then a very low incidence of supra-local burial goods would be expected within the associated village cemeteries.

This test implication appears to be the most subjective of the three proposed. The implication is difficult to compute for significant differences for we do not know what would constitute a significant difference. We do know, however, that Mississippian villages were organized structurally on some division of status (Price 1973, 1974).

If these internal village structural divisions were indicative of status, as Price (1973, 1974) argues, then we would expect high status burials with supra-local goods to occur within village cemeteries. This finding would then reject the hypothesis. If, however, status burials represented a very small fraction of the overall village population, we might assume a system such as cargo may have been in operation.

Evaluation of Test Implication III

Due to our lack of adequate regional and local studies of Early and Middle Mississippian, we must turn again to available data. Although chronicles such as those of the Hernando de Soto mission (Bourne 1904) do not indicate that a cargo system of social roles was present in the late prehistoric era, we shall observe that cargo may have played some part in its socio-political organization.

Peebles (1971), in his study of differential distribution of mortuary artifacts from major site units at Moundville and the Pickwick Reservoir in Northern Alabama, has argued that the Bessemer site, located 90 miles south-southeast of Moundville, was in an alliance with Moundville rather than part of its settlement system. Peebles feels that, "At present there is no reason to believe that the difference between 2 sub-sets of sites is a manifestation of anything except 2 cultural systems. Both sub-sets of sites are most probably, within limits, contemporary, and, at Moundville, the 2 sets spatially overlap" (Peebles 1971:87).

This hypothesis is based primarily on an analysis of differential burial treatment at Moundville and Bessemer. According to Peebles (1971:81) most individuals in Moundville irrespective of age, sex, and status were buried whereas at Bessemer being buried on the site was itself a mark of distinction. Status differentiation at Moundville was determined by grave goods and burial locality. At Bessemer there are few ways to distinguish between burials. Most burials possess plain pottery; a few have decorated

pottery. Even fewer burials have shell beads or copper ornaments. Due to these factors, distinctions are difficult to establish between burials at Bessemer.

The distinctive lack of supra-local goods appears to fit our third test implication of the alternative hypothesis and may in fact reflect a system such as cargo operating within the Bessemer and Moundville sub-sets, with those individuals achieving status being buried at Moundville.

Peebles demonstrated that close ties which existed between Moundville and Bessemer were due to a Bessemer-type mound within the Moundville complex and that economic resources which were essential to Moundville ceremonialism were probably a major tie between the two sites.

In relation to our hypothesis, we can state that expenditure of economic surpluses from Bessemer to Moundville would be an important factor in that expenditure would argue for more integration of the Bessemer sub-set within Moundville. Again, a system such as cargo would enable the economic surplus from Bessemer's ecotone to flow freely into the Moundville sub-set.

This would imply that each lineage could be expending its economic surplus at the ceremonial center, thereby assuring an influx of goods. The individual in a position of cargo would thus be maintaining a guarantee: that the communities' goods would continue to flow freely to the ceremonial center by a person in position of cargo going back to his lineage and continuing as a farmer while awaiting the next position of cargo.

According to our hypothesis, we may hypothesize that the difference between Bessemer and Moundville in relation to burial treatment could be due to a system such as cargo. The absence of high status burials at Bessemer may simply be a reflection of the cargo system. The cargo holders may be interred at the main ceremonial center, Moundville.

Conclusion

An alternative to the Sears (1968) approach to Mississippian socio-political organization is presented. The approach is based on a hypothesis developed by Vogt (1968) in his study of Zinacantan settlement patterns. The hypothesis was directed toward explaining integration of outlying village centers with those of the ceremonial centers of the ancient Maya by the ceremonial process of cargo. Certain data suggest that Early and Middle Mississippian peoples may have been involved in an integrative process such as cargo.

Test implications developed to test the hypothesis utilize (1) non-metric skeletal data as a measure of biological affinity between groups, (2) bone strontium as a quantitative measure of protein content in the diet of various groups, and (3) supra-local and local burial goods as an indicator of division between social groups. From the data presented, a process such as cargo may have taken place in Mississippian society, indicating that an actual test situation is warranted.

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THE TROYVILLE - COLES CREEK CERAMIC SEQUENCE
AT THE BRULY ST. MARTIN SITE, LOUISIANA

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The purpose of this paper is to summarize new evidence on the absolute and relative chronologies of the Troyville and Coles Creek periods and to present an empirical test of the validity of type frequency seriation for these periods.

The site to be analyzed is called Bruly St. Martin or Grand Bayou, and is numbered Iv-6 in the Louisiana State University catalog (see Springer 1973 for details). It is located about eight miles from both Bayou Lafourche and the Mississippi River, in the northern part of the Mississippi River Delta (Fig. 1). Iv-6 consists of a village and platform mound on the bank of an abandoned bayou.

Excavations consisted of my own ten-by-thirty foot trench and a five-foot test square excavated by Mr. Glen Fredlund, both in the village area. The test square contained dark midden soil and was excavated in six half-foot levels (labeled 1-6, beginning with the top). At the base of the sixth level occurred natural levee clay into which Mr. Fredlund did not excavate. The trench was excavated to a depth varying from 2.1 to 4.5 feet b.d. (below datum, datum being an arbitrary elevation about .5 feet above ground surface). The trench stratigraphy was based on a combination of natural and arbitrary levels, which may be summarized as follows:

Unit A (top). The plow zone. Dark silt.

Unit B. A shallow basin of midden immediately below the plow zone. Probably a house depression.

Unit C. A small pit in the upper part of the levee clay.

Unit D. The higher levels of yellow-green natural levee clay, down to about 2.0 feet b.d. Unit C originates near the top of this level and is incorporated within it.

Unit E. The lower levels of levee clay.

Units D and E, though composed basically of water-laid silt and clay, contained scattered sherds, bone and stone tools, shells, bones, and charcoal, which became sparser as one went deeper. Many small lenses of ash and midden occurred, usually two to three feet across. I interpret Units C, D, and E as the remains of seasonal occupations, while A and B suggest a permanent village.

In general, the conditions for stratigraphic excavation were excellent. The light yellow-green clay showed features easily and held straight walls. In two of the ten-foot squares comprising the trench, easily observable plow

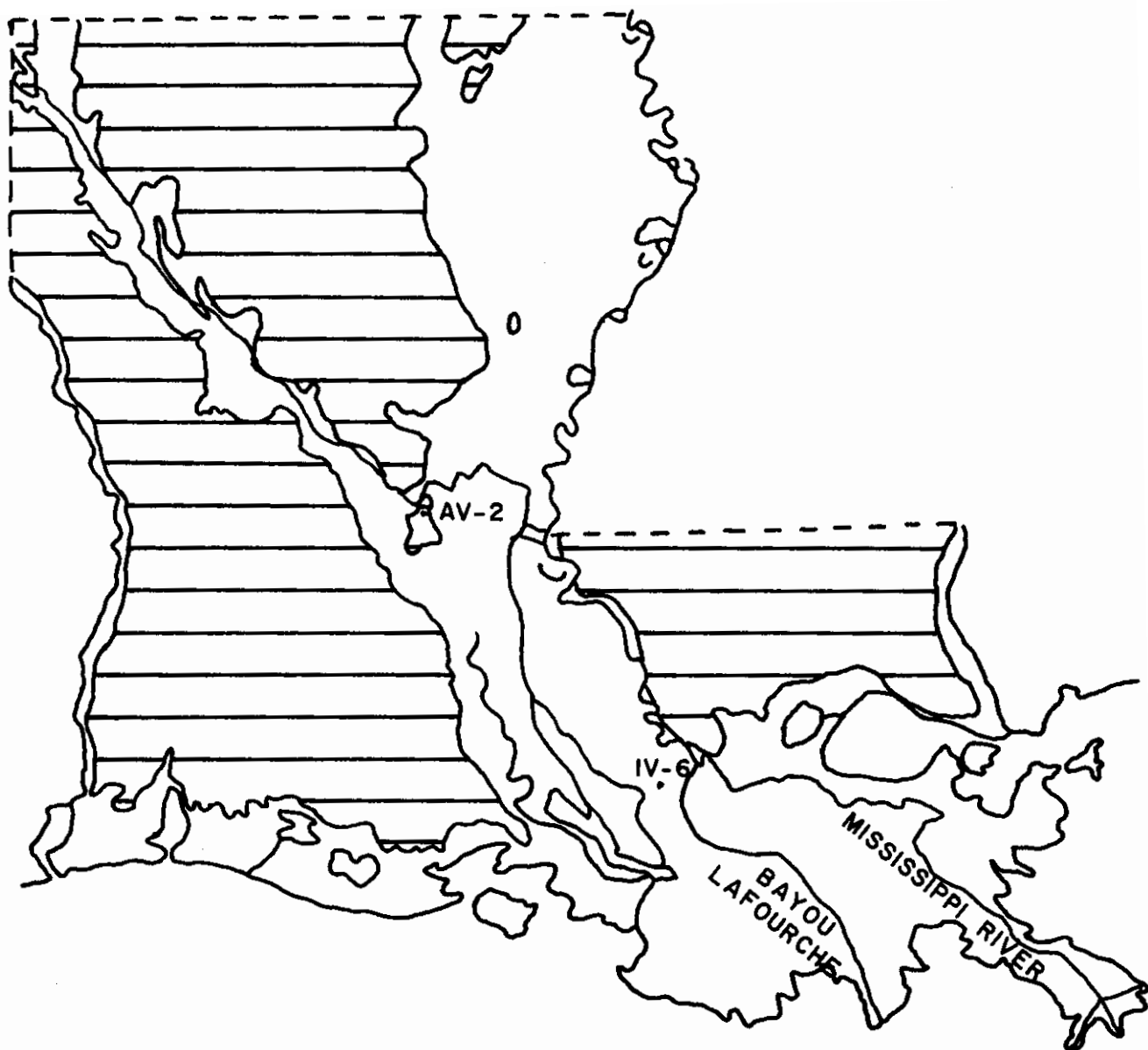


FIGURE I. GEOLOGIC MAP OF LOUISIANA

 TERTIARY AND PLEISTOCENE DEPOSITS

 RECENT DEPOSITS

 POLITICAL BOUNDARIES

0 50

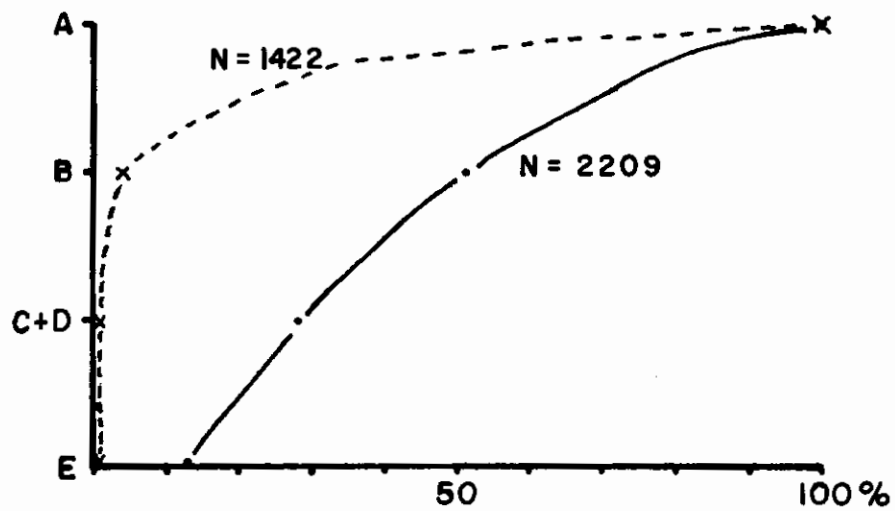
MILES

furrows extended into the top of the levee clay. Unit B, however, presented difficulties in that its dark blue-gray soil was difficult to separate by color from the overlying plow zone. Unit B contained features and well preserved shells and bones, showing that it was undisturbed midden, but it is almost certain that a few furrows and plow zone pockets intruded into its top.

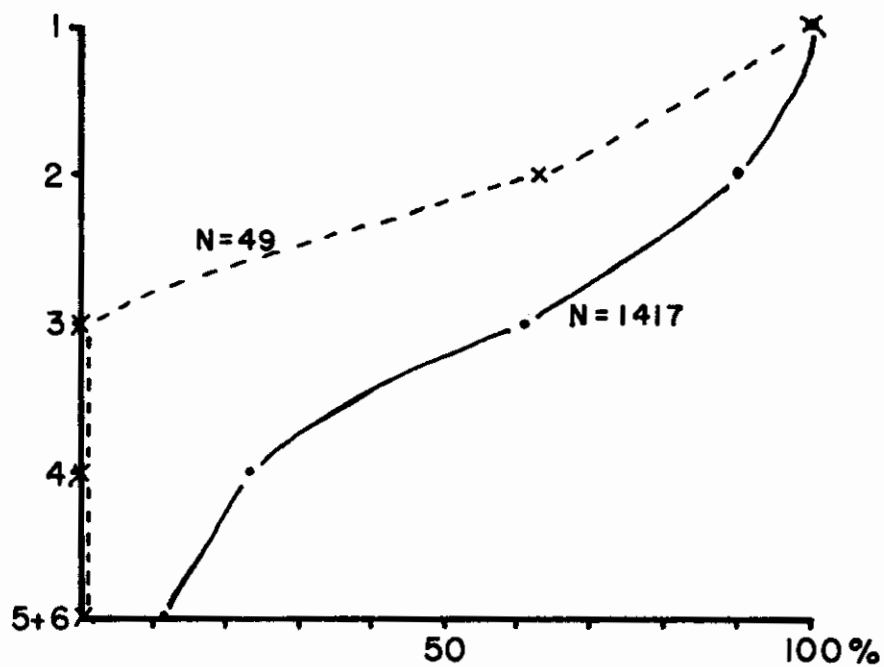
The pottery from Iv-6 is generally quite similar to that recovered from Greenhouse (Av-2; Ford 1951) and somewhat less similar to contemporary material produced by seriation from other parts of the Lower Mississippi Valley (Phillips 1970). The main differences from Greenhouse amount to a less skillful and less varied execution of motifs and designs. Incision and punctation are less precise, polished surfaces are rare, and only rarely are negative designs created on the undecorated surface of the pot. Such differences could be misleading, in that they might suggest incorrect chronological alignments if the general crudity of southern Louisiana pottery is not taken into account. Cord marking is rarer at Bruly St. Martin and check stamping more common, which is what one would expect from its location to the south of Greenhouse. Pottery frequencies indicate that the trench and Levels 5 and 6 of the pit may be assigned to the Troyville period and Levels 1 - 4 to Coles Creek. Four radiocarbon dates from the trench support an age of A.D. 600-700 for late Troyville.

The most widely used approach to chronology in the Lower Mississippi Valley has been type frequency seriation, but this approach has recently come under criticism (Phillips 1970; McNutt 1973). Most of the discussion pro and con has been heavily methodological, with few suggestions as to how one can tell in a particular case whether the proposed seriation and chronological placement of sites are valid. In general, the supporters of seriation claim that consistent results of unimodal curves have been produced and verified by stratigraphic excavations, while critics contend that the method is suspect on logical grounds and that stratigraphic mixture has vitiated the findings of the excavations. With the exception of Nance's (1976) recent proposal of a technique of attribute analysis to detect stratigraphic mixture, I know of no recent attempt to provide an empirical test of seriation.

The data from Iv-6 permit a critical examination of seriation in a number of ways. One way is to construct a chart of the occurrence of decorated sherds in the excavations and compare it with what seriation would lead us to expect. The results (Springer 1976) are quite close to the unimodal curves produced by seriation and provide support for that method. Another approach is to analyze an undeniable case of stratigraphic mixture to see if it might simulate the sort of continuity demanded by seriation. The upper levels of both excavations at Iv-6 contained large numbers of historic artifacts (nails, glass, etc.) derived from a nearby house. Within the trench, many such artifacts occurred in Unit A, as one would expect, but several also occurred in Unit B. As was mentioned earlier, the dark soil of Unit B made plow furrows impossible to detect, and some introduction of historic artifacts would be expected for that reason. A similar circumstance was present with the arbitrary excavation levels of the test pit. Under these conditions, the question arises whether the naturally included materials can be distinguished from the intrusive ones. An affirmative answer would tend to support the validity of Iv-6's stratigraphy as a test of seriation, while a negative one would suggest that stratigraphic mixture can so confuse the vertical distribution of sherds that a true test of seriation



A. THE TRENCH



B. THE TEST PIT

FIGURE 2. CUMULATIVE FREQUENCY CURVES
FOR DECORATED SHERDS AND HISTORIC

ARTIFACTS, IV-6.

•—• = DECORATED SHERDS

x---x = HISTORIC ARTIFACTS

is impossible. Figure 2 presents a set of cumulative frequency curves comparing the occurrence of decorated sherds with the intrusive historic artifacts. Units C and D and Levels 5 and 6, respectively, have been lumped to avoid low counts. In Figure 2a, it is clear that the two categories of artifacts have quite different distributions and that Unit A is almost certainly the point of origin for all historic artifacts. Figure 2b also shows distinctive curves for the two classes of artifacts, although the break in the occurrence of historic artifacts is less extreme. I believe that most researchers will agree that in both cases simple quantitative techniques, including type frequency seriation charts and cumulative frequency curves, will allow the detection of stratigraphic mixing and thereby open the way for a stratigraphic evaluation of seriation.

Acknowledgments

I am indebted to Joseph Vogel of the University of Alabama for the suggestion to use cumulative frequency curves as a device for detecting stratigraphic mixture.

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THE CHRONOLOGICAL IMPLICATIONS OF EARLY MARKSVILLE CERAMICS

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Primarily due to the efforts of state archaeological surveys in Mississippi and Louisiana, there has been during the past five years an explosion in the data base pertaining to early Marksville archaeology. Only nineteen early Marksville components (Fig. 1) were identified in the entire Lower Mississippi Valley when a review of the same subject was presented to the Society for American Archaeology in May of 1972 (Toth 1972). Today, there are at least eighty confirmed early Marksville components (Fig. 2) and many more sites with Marksville ceramics that are anticipated to yield the diagnostics necessary to put them into the confirmed column. The increase in data, combined with a careful application of the type-variety system of ceramic typology, has resulted in a series of tight ceramic phases that encompasses most of the Lower Valley (see Phillips 1970:886-901; Toth n.d.). These early Marksville phases are believed to represent roughly contemporary societies that existed and interacted for no more than 150 to 200 years.

There are a number of outstanding ceramic markers that, in specific combinations, can be used to identify early Marksville phases. Most of these diagnostics have close parallels in the Hopewell style pottery of the Illinois Valley. The types and varieties that distinguish early Marksville ceramics have been defined and illustrated in the report on collections from the Marksville site (Toth 1974). Even a cursory inspection of whole vessels demonstrates the unmistakable character of early Marksville ceramics and points out the striking similarity to certain Illinois Hopewell material. At the outset, it is important to emphasize that the diagnostic early Marksville motifs and decorative treatments are not limited to mortuary contexts. The known distribution of such pottery includes roughly a 50 per cent correlation with village contexts.

The most definitive product of early Marksville manufacture is a vessel (Fig. 3a) having three main attributes: a crosshatched rim, a raptorial or broad-billed bird motif, and background roughening by zoned dentate rocker stamping. Another example (Fig. 3b) of the raptorial bird motif, from Marksville Mound 8, has deep lip notching which is a common form of rim embellishment in early Marksville ceramics. Another diagnostic motif (Fig. 3c, d) is illustrated by two variations of vertically bisected circles on vessels from Crooks and Anderson Landing.

Philip Phillips (1970:886) aptly calls the crosshatched Marksville rim an "archaeologist-proof marker." Equally diagnostic, however, are other Marksville rim treatments such as the vertically incised rim (Fig. 3e), the dash-dot rim (Fig. 3f) - here with a zoned plain rocker stamped body decoration - the alternately slanted incised rim (Fig. 3g) and the slanted incised rim (Fig. 3h).

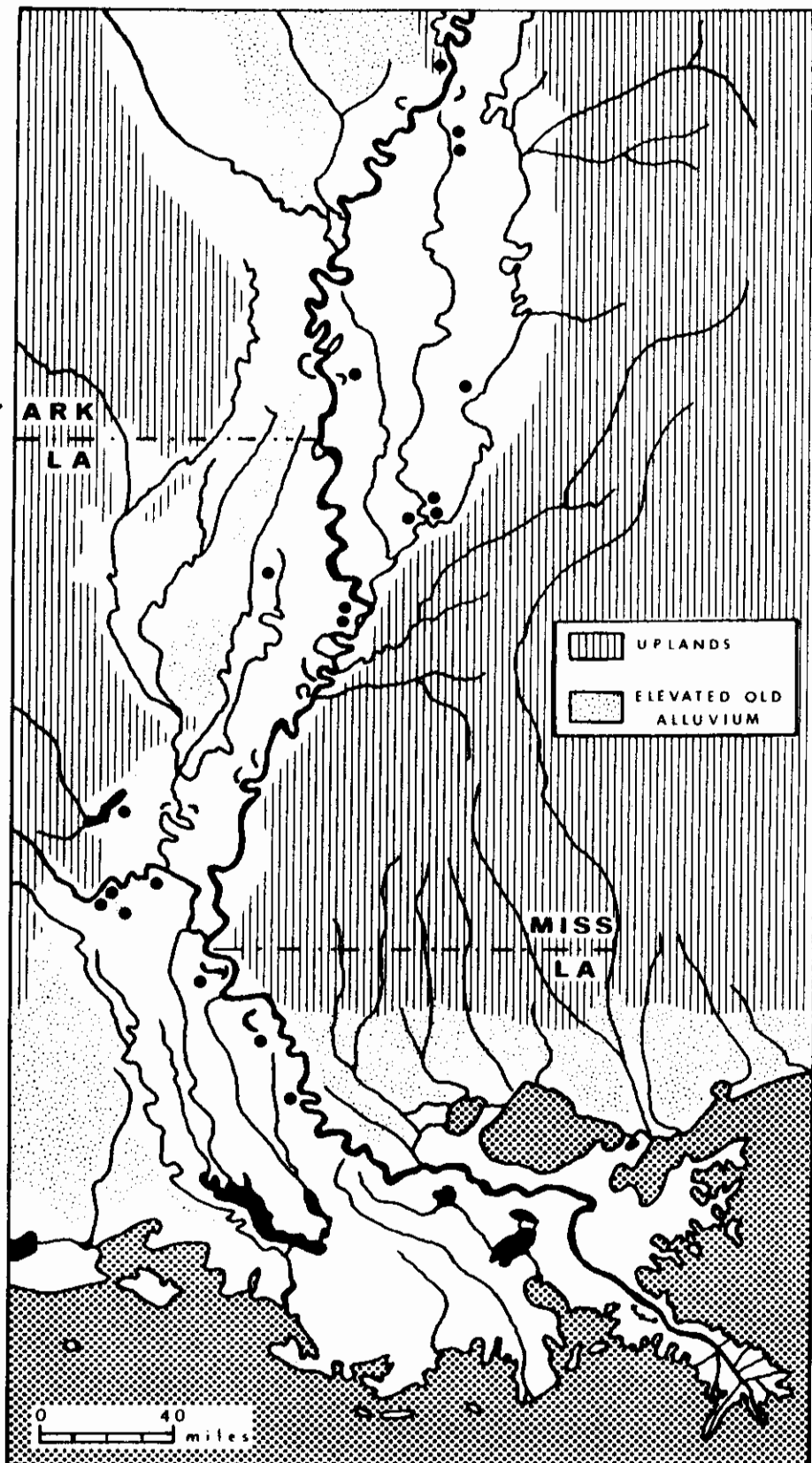


Figure 1. Confirmed Early Marksville Components (1972).

Close-spaced parallel incised lines (Fig. 3i) constitute a very popular treatment of Marksville Incised, var. Marksville in central Louisiana but one that is much less common in the Tensas and Yazoo basins. More likely to be found in these regions is a wide-spaced treatment (Fig. 4a) called var. Sunflower. The wide-spaced treatment is used in simple meandering designs and in more diagnostic motifs such as the broad-billed bird on a vessel from Crooks (Fig. 4b).

Several highly definitive early Marksville zoned decorations are now included as varieties of a new type, Mabin Stamped. While most of these decorative treatments can be found in the Havana ware of the Illinois Valley, at Marksville sites they are used in the Hopewell style. One variety (Fig. 4c), called var. Crooks, is defined by zoned scallop shell impressions and seems restricted to the southern half of the Lower Valley.

The two most common Mabin treatments involve zoned cord-wrapped stick impressions and zoned straight dentate impressions. Other related treatments, also varieties of Mabin Stamped, incorporate zoned individual cord, jab-and-drag, and curved dentate impressions. The cord-wrapped stick version (Fig. 4d, e) is called var. Mabin and the straight dentate variety is named Point Lake. A whole pot with zoned straight dentate decoration has not been recovered in the Lower Valley, but numerous potsherds have been found (Fig. 4f).

Turning to the subject of ceramic parallels with Illinois Hopewell, a vessel (Fig. 4g) from Mound 5 at the Gibson site in Calhoun County, Illinois, illustrates a zoned cord-wrapped stick decoration similar to the Lower Valley Mabin variety. The Gibson vessel is clearly in the Hopewell style and exhibits striking crosshatched rim and bird design similarities to Marksville vessels. Another vessel (Fig. 4h), from Brangenberg Mound 3 in Calhoun County, Illinois, parallels the vertically incised rim treatment and broad-billed bird motif as found in the Lower Valley. The bird motif is formed by wide-spaced broad incised lines similar to the Sunflower variety of Marksville Incised. Finally, one last vessel (Fig. 4i), from Mound 1 at the Utica site in the upper Illinois Valley, embodies the same three essential attributes as might be found on a classic early Marksville vessel: crosshatched rim, bird design, and zoned dentate rocker stamping.

Whole vessel comparisons from opposite ends of the Mississippi Valley involve too many specific duplications to be explained by anything other than a direct historical connection. Indeed, it is the Hopewellian connection in Marksville ceramics that allows the chronological insights and speculations on cultural dynamics to which the balance of this paper is directed.

The Illinois Valley sequence provides the best clues to early Marksville chronology. Ceramic parallels, such as those outlined above, document the fact that there was some contact between the Illinois and Lower Mississippi valleys. The first ties are with the Bedford, Ogden, and Utica phases in the lower, middle and upper Illinois Valley respectively, which are dated between A.D. 1 and 150 (Griffin, Flanders, and Titterington 1970:6-7). These Illinois phases are the ones associated with the fine Hopewell style ceramics

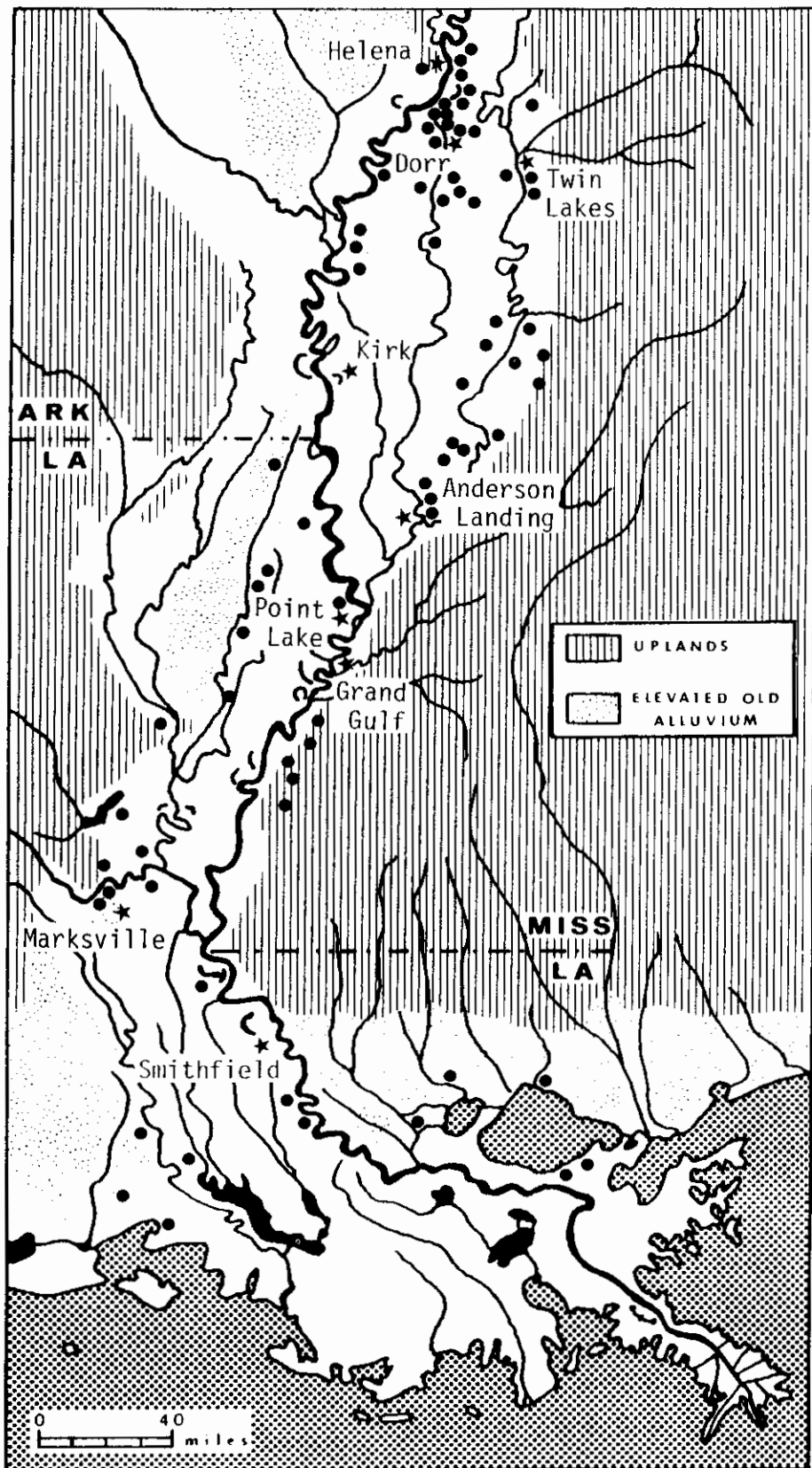


Figure 2. Confirmed Early Marksville Components (1976).

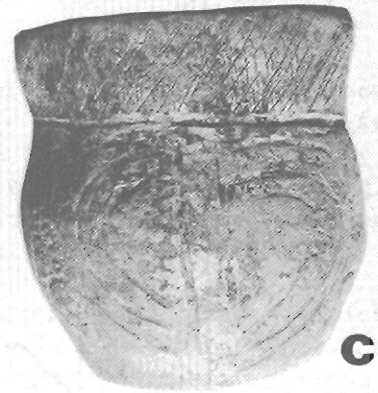
Figure 3



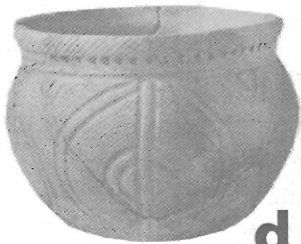
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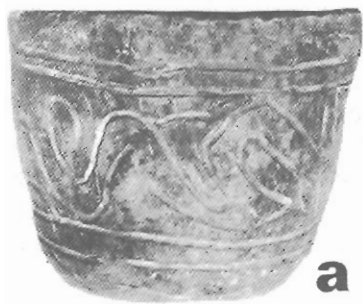
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Figure 4



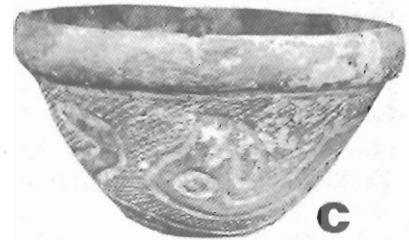
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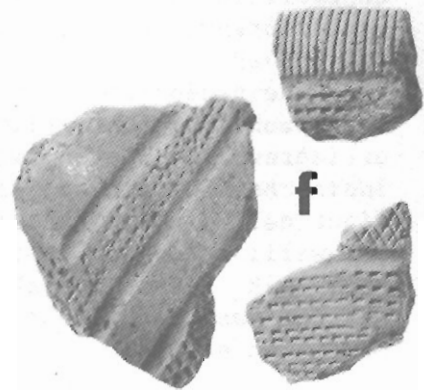
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that include bird designs, crosshatched rims, the bisected circle motif, and other diagnostics. One Bedford phase site, the Klunk Mound Group, has log burial crypts and other mound features that are very similar to those found by Ford at Helena Crossing (cf. Perino 1968; Ford 1963).

By A.D. 150 new pottery styles take control in the Illinois Valley. One of these decorations, unzoned plain rocker stamping covering the entire vessel body, is found in the Lower Valley as Indian Bay Stamped. An early variety of Evansville Punctated provides another Lower Valley parallel to the Baehr and Pike ceramic groups associated with the ceramic shift in the Illinois Valley. The Baehr and Pike ceramic groups are definitive of the Pike, Steuben, and LaPorte phases which date roughly A.D. 150 to 300 (Griffin, Flanders and Titterington 1970:8-9). These are the Illinois Valley phases most consistently associated with panpipes, figurines, and other items in the set of spectacular Hopewellian status-related artifacts.

The early Marksville phases of the Lower Valley seem to overlap two time divisions in the Illinois Valley: the Bedford-Ogden-Utica phases because of ceramic parallels including crosshatched rims, the bird design, and several decorative treatments in the Hopewell style; and the Pike-Steuben-LaPorte phases because of association with panpipes, figurines, and other Hopewellian status-related items. The years A.D. 100 to 200 overlap middle to late Hopewell in the Illinois Valley, and it is thus between these dates that most early Marksville activity in the Lower Valley probably can be ascribed.

The radiocarbon date of A.D. 170 (UGa 488) on charcoal from a pit at the Dickerson site near Friars Point, Mississippi, supports such a chronological estimate. The pit contained early Marksville pottery, particularly the type Indian Bay Stamped, and a beautiful, locally made, Hopewell style ceramic figurine. Similar radiocarbon dates from Tunacunnhee, Mandeville, and other Hopewellian horizon contexts across the Southeast can be used to infer that the peak intensity throughout the entire Hopewellian procurement network perhaps was reached during the same time span, the second century of the Christian era.

The following model can be postulated to tie together the chronological implications derived from the study of early Marksville ceramics and to speculate upon some cultural dynamics that may have been involved. During the first century of the Christian era, and probably not much before the year A.D. 50, small groups representing the contemporaneous Bedford, Ogden, and Utica phases of the Illinois Valley penetrated down the Mississippi River in search of raw materials, to trade, to explore, or for some still unestablished reason. The move was relatively rapid, so that for all practical purposes one can say that contact was made simultaneously here and there from Helena, Arkansas, south to at least Baton Rouge, Louisiana. Contact, of course, was with local Tchefuncte groups who adopted many ceramic and mortuary practices and then reinterpreted them to fit their own specific cultural needs.

The first contact sites were right along the then active channel of the Mississippi River or up major tributaries. Such sites share a mixture of Havana and classic Hopewell ceramic decorations - all in the Hopewell style - but have yielded few of the Hopewellian status-related items.

Contact continued between the Illinois and Lower Mississippi valleys during the time frame A.D. 100 to 200. Indeed, it probably peaked during this period. The Hopewellian status-related items arrived in these years too. Local groups incorporated and modified the newly introduced Hopewellian ideas. In doing so, they developed into purely local, Lower Valley, cultural equations which have been defined as phases. Considerable continuity with preceding Lower Valley traditions was maintained. The early Marksville phases were influenced by Illinois Hopewell peoples, probably very small numbers of them who appeared sporadically, but they by no means became Hopewellian. There is no evidence of a significant exchange of goods and services or sustained, regular interaction of any type.

Beyond the year A.D. 200, during the Late Marksville period, there is little indication of continued contact with the Illinois Valley. A very vigorous cultural system permeated throughout the Lower Valley during the period A.D. 200 to 400. The most famous example is the Issaquena phase defined by Phillips (1970). There obviously was widespread interaction within the Lower Valley during these years, and probably some contact in an east-west direction along the Gulf Coast. Influence from northern Hopewell, however, seems to have come to an end.

The chronological scheme just outlined is admittedly speculative and must be tested by excavation while a few early Marksville sites still can be found intact. The important point, however, is that such a model would hardly be possible were it not for the detailed study of early Marksville pottery using the type-variety system of ceramic typology. Moreover, though the dates may change as the result of future research, it is reasonable to hope that the ceramic phases themselves will remain valid cultural entities. If they do, they will provide a strong base on which to anchor the subsistence and settlement studies that are sure to be forthcoming.

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REPORT ON THE EXCAVATION OF A SOUTH CAROLINA SHELL RING

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During the transition from the Archaic to the Woodland period there developed along the coast of Georgia and South Carolina a particular florescence characterized by shellfish gathering, hunting, fine bone workmanship, and the manufacture of pottery with punctations (Thom's Creek and Stallings wares). Some of the associated shell middens are large, irregularly shaped heaps, while others are ring shaped with clear interiors. Unfortunately, little work has been done on these sites in South Carolina and few reports are available.

This paper reports on excavations conducted at the Lighthouse Point Shell Ring (SoCV141) by the Research Laboratories of Anthropology, University of North Carolina at Chapel Hill. The site is located a half mile south of Fort Johnson on James Island just a short distance from Charleston, South Carolina.

Lighthouse Point was first described by John Drayton at the beginning of the 19th century:

It is of a circular form: measuring around two hundred and forty paces. Its width at the top is ten paces; and at its base from sixteen to twenty; and its height is from eight to ten feet. . . . It is situated in the midst of cleared lands, on no uncommon residing; surrounding the dwelling house and offices of a gentleman who resides on the island. And the waters, which were driven by the hurricane of 1725, over much of the adjacent lands, are said to have been completely banked out by this work. This being observed by Mr. Rivers, he placed his dwelling house therein; which has been continued, either by repairs or new buildings, to the present day (Drayton 1802:56-57).

Later this site was used as a source of lime for the building of St. Michael's Church in Charleston and as late as 1960 as a source of road fill. In the spring of 1976 the site was bulldozed in preparation for building a civic center (Fig. 1). In no area has the scraping gone into the sand subsoil and about two feet of undisturbed midden remains in some areas. The central portion of the ring now has a shell overburden of about three feet.

Five 10-foot squares in the midden portion and two 5-foot squares in the interior were excavated. Because so few sites of this type have been excavated it may be useful to outline briefly the methods of excavation and analysis. Four natural levels were established for vertical control. Level 1 is characterized by quantities of historic material mixed with the aboriginal material. This level is the result of bulldozer activity and does not usually exceed .2 to .3 foot. The shell midden, level 2, has numerous pockets of shell and occasional sand lenses. The shell is banded and frequently crushed. Although no features were recorded in this level the



Figure 1. View of Lighthouse Point after being bulldozed. Looking toward the marsh (north).

numerous bands of a single species of shellfish probably represent a single meal or collection activity and as such could be considered a feature. Level 3, termed the pre-ring humus, seems to be a buried soil horizon. Potsherds are encountered, although their size and frequency decrease from level 2. The soil is brown and somewhat loamy. Level 4 is a sandy yellow soil with cultural material rapidly diminishing down to a depth of 3 feet below ground level, at which point the sand is culturally sterile.

Thirty features have been discovered - 29 from the midden area and 1 from the interior. Most of the midden features are pits, measuring from 2 to 5 feet in diameter and having depths ranging from 1 to 3 feet (Fig. 2). There are shallow basins which may represent larger pits that were not defined until cut down to level 3.

The features, although rich in animal bones and charcoal, are poor producers of artifacts and pottery. The general shape and internal composition suggests they were used as roasting pits. The features originated at different levels within the squares but were generally confined to the midden area. The one feature found in the interior had a homogeneous brown-black sandy fill with a number of associated sherds; the morphology of the pit is in contrast to those found in the midden area, which suggests a functional difference.

The predominant pottery recovered from the site is Thom's Creek Plain (83%, 2030 sherds), followed by Thom's Creek Finger Pinched (Fig. 3), Thom's Creek Reed Punctate, and Thom's Creek Shell Punctate (Fig. 4; Trinkley in press). Two percent of the total sherd collection showed evidence of being painted. Spectrographic analysis by the University of North Carolina Department of Geology indicates that the pigment used was not mineral in origin, but presumably was plant (Daniel Textoris, personal communication).

The lithic assemblage consists of two chert Savannah River Stemmed points (Coe 1964:44), 1 rhyolitic hafted hammerstone, and 15 flakes. All but two of these flakes resulted from resharpening existing tools. The remaining two flakes are blocky and may represent limited bi-polar flaking. All lithics came from the ring interior.

Recovered were a variety of shell tools, predominantly made from Busycon shells, either by removing the body whorl leaving the columella to serve as awls or by knocking round holes in the body whorl. One flat shell bead made from a ribbed mussel (Modiolus demissus) was found.

Worked bone was the most abundant artifact category after pottery, accounting for 57 pieces. This category can be broken into bone pins, modified antler, and modified bone. The largest category is that of worked bone pins - both plain and engraved. Four examples of unfinished pins and waste products were found. The process of bone pin manufacture has been replicated by James Michie (personal communication) using deer metacarpals.



Figure 2. Feature 7 after excavation, showing west profile of square 220R50.

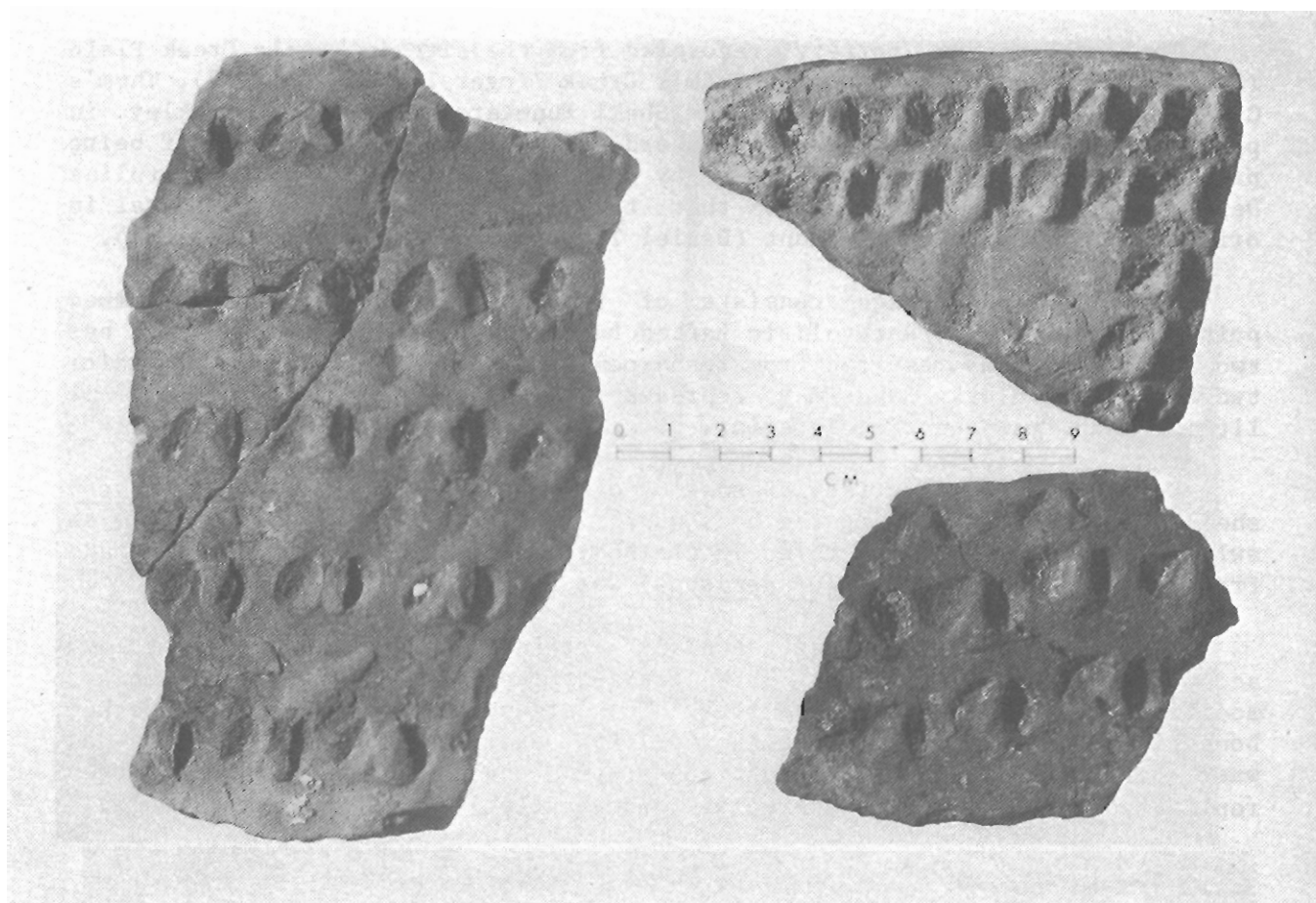


Figure 3. Thom's Creek Finger Pinched pottery recovered from Lighthouse Point.

The next most frequent bone modification involves deer antlers - predominantly socketed antler points (Fig. 5). Two examples of slightly curved antler tines over three inches in length were found. It seems doubtful that these were points for a projectile, although they may have been used in a thrusting spear or for hafting stone tools.

The faunal remains currently recognized for Lighthouse Point seem to parallel those identified for other Thom's Creek shell middens along the South Carolina coast and represent a wide span of possible collection times (Trinkley 1976). More detailed information on subsistence and seasonality will be available once the faunal and ethnobotanical analyses are completed.

Midden accumulation seems to have started on top of a developed humus level with a large number of sherds and shells being trampled into the soil during this first phase of occupation. The stratigraphy which remains suggests the gradual accumulation of shell and debris, occasionally covered by yellow sand turned out from a recently dug pit. The stratigraphy fails to note evidence that the site was left unoccupied for any length of time. The "numerous small piles of shell about seven or eight feet in diameter" which Calmes (1967) attributed to individual habitation sites at Ford's Skull Creek Shell Ring (SoCV253) were not observed during these excavations. However, more extensive excavations providing larger north-south and east-west profiles might provide an answer.

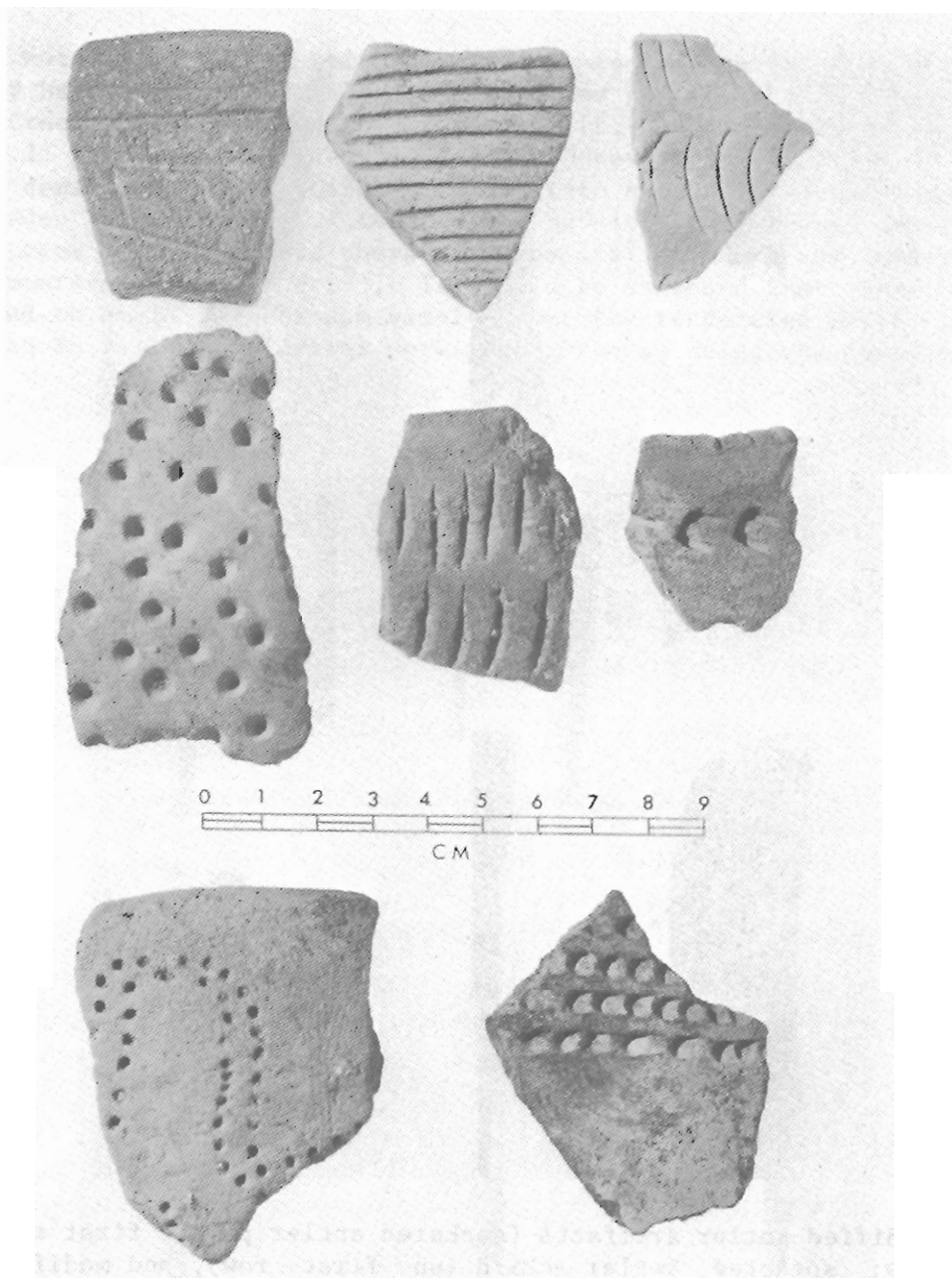


Figure 4. Thom's Creek Incised (first and second on first row), Thom's Creek Shell Punctate (third specimen on first row, first and second on second row), and Thom's Creek Reed Punctate (third specimen on second row and row three).

The pits found during the excavation are not the first features found at a Thom's Creek shell midden, although they seem to be the most thoroughly documented. Waring (Williams 1968:271) refers to several cooking pits found at Sapelo made up of a "cemented mass of shell, ashes and charcoal"; Calmes (1967) mentions a pit with "concretion-like material"; and Edwards (1969:14) found two pits at Sewee (SoCV47). The feature found in the interior of the Lighthouse Point ring documents the use of the inner portion of the site.

The features found in the midden are all similar in size, shape, and internal composition. Most, though not all, show signs of intense heat and



Figure 5. Modified antler artifacts (socketed antler points first and second on first row; socketed antler third on first row), and modified bone artifacts (bone awl and polished bird bone, second and third on second row).

were possibly used as steaming pits for shellfish. Others appear to have functioned as trash pits, but all are associated, in some way, with domestic activities. The one pit found in the interior had a brown sandy fill with no indication that it was used as a cooking or fire pit.

There are indications that definable activity areas occur within the site. All lithics found came from the interior while the sherd abraders were found only in the midden area. The sherd density is appreciably different from the interior to the midden area. The total sherd density for the two 5-foot squares in the interior is 318/100 ft.³ as compared to 202/100 ft.³ for the ten foot squares in the midden. The interior total is slightly higher due to the feature material which was combined with the

square material. With this in mind it is safe to say that the two areas probably have about the same amount of refuse per 100 ft.³. There were 5.2 Thom's Creek Finger Pinched sherds per 100 ft.³ in the interior as compared with 19.1 per 100 ft.³ in the midden. However, the interior of the ring has a density of Thom's Creek Reed Punctate sherds eight times as great as the midden (41.2/100 ft.³ compared to 5.0/100 ft.³) and a density of Thom's Creek Shell Punctate sherds 3 times as great as the midden (14.6/100 ft.³ compared to 5.0/100 ft.³). It should be stressed that these figures are based on small, non-random samples, but the tendencies shown provide data which can be tested by further work at Lighthouse Point and other sites.

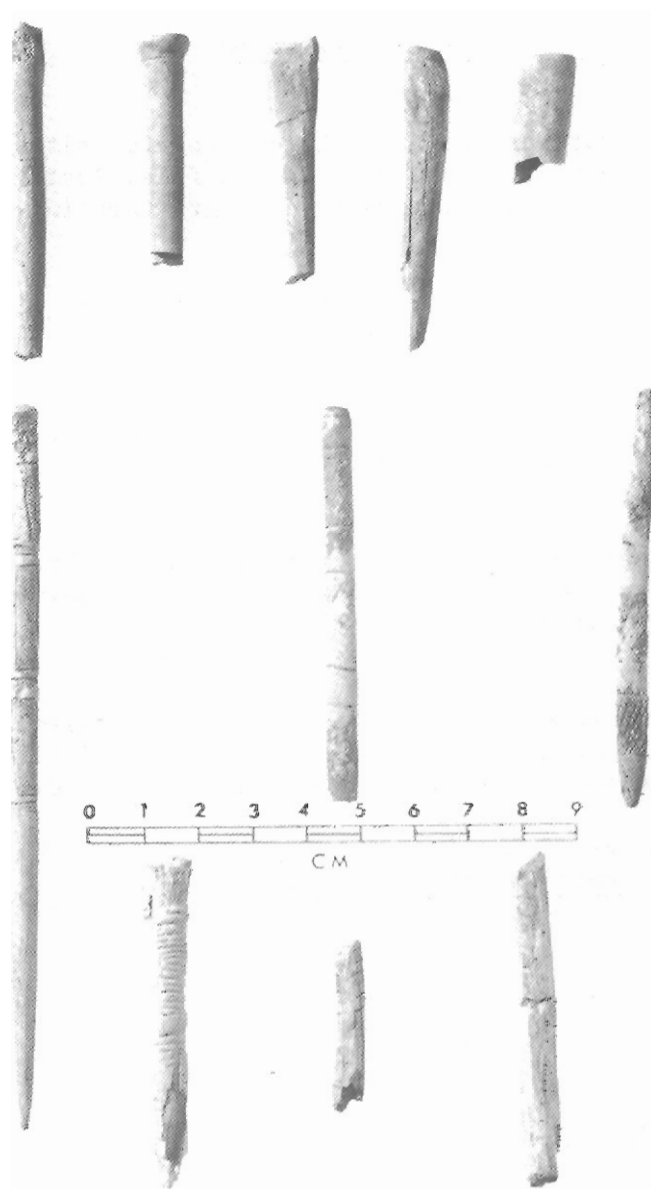


Figure 6. Worked bone pins recovered from Lighthouse Point.

It may be significant that no worked bone or antler, either complete or in some stage of manufacture, was found in the interior of the ring. The sherds found in the lower levels of the interior squares showed considerable wear and were very fragmented. There were 572.4 small sherds per 100 Ft.³ in the interior and only 266.2 small sherds per 100 ft.³ in the midden. All of this evidence suggests that different activities were taking place in the interior. Further work should shed more light on this question.

The differences in artifact distribution, feature morphology and ceramics between the ring midden and the interior are tentative, based on the available data, and are offered for testing by future work. Work at this site is still scheduled and artifact analysis is ongoing.

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