ZEBREE ARCHEOLOGICAL PROJECT

EXCAVATION, DATA INTERPRETATION, AND REPORT ON THE ZEBREE HOMESTEAD SITE, MISSISSIPPI COUNTY, ARKANSAS

DAN F. MORSE and PHYLLIS A. MORSE, EDITORS
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ABSTRACT

The Zebree site is located on the edge of Big Lake in extreme north east Arkansas. Evidence has been recovered for at least five periods of occupation: late Woodland (Barnes), early Mississippian (Big Lake phase), late Mississippian (Lawhorn phase), pioneer historic (early 19th century), and late historic (1895-1940). Well planned, extensive excavations were conducted in 1975 by the Arkansas Archeological Survey under contract with the Memphis District of the Corps of Engineers. The early Mississippian, Big Lake phase, occupation is perhaps the most significant, since it bears upon the question of the origin of the Mississippian tradition in the area between Cahokia and the Cairo Lowlands in southern Missouri. Recovery techniques in the field were focused on answering a series of questions, not only concerning the technological and social behavior of the various occupants, but also on answering questions concerning the biases brought into archeological interpretations through various accepted recovery techniques.

Final salvage work at the site in 1976, when the drag lines put the new channel through the site, culminated 10 years of research on the problems of 25 centuries of human behavior in this area as witnessed by the archeological data in this site.

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PREFACE

The Zebree site is located in Mississippi County, Arkansas, immediately west of Big Lake and south of the Missouri state border. It is centered at latitude 35°59'04" and longitude 90°07'53" and is contained within the Big Lake National Wildlife Refuge (Fig. P-1). The Zebree site investigation, extending as it did from 1967 through 1977, represents a microcosm of the history of archeology in northeast Arkansas.

Neither the deposits nor the investigative approach are unique to archeology. The combination of these two factors, however, together with the temporal and spacial position of the site at the very beginning of the development and spread of intensive agriculture in the northern Mississippi Alluvial Valley has resulted in a tremendous amount of information. Virtually every aspect of archeological investigation practiced today exists in the following pages and there is something for almost everyone. Detailed descriptions of individual artifacts are sacrificed, on the basis of boredom in most cases, because we have more control over what those artifacts mean in terms of behavior. For example, kitchen utensils are discussed from the standpoint of manufacture, functional relationship to behavior, breakage, and post-depositional history. The sherd descriptions are referenced and the computer printout proveniences of specific types are available in a large data appendix.

The deposits themselves benefited the project from the standpoint of the excellent preservation of bone and shell and existence of a small area of natural stratigraphy. The approach was multifaceted. Basically every variety of excavation technique developed to this date was employed. Investigators with specific expertise in certain aspects of archeology were in the field to direct the collection of their data. Included were a ceramicist, an ethnobotanist, and a ethnozoologist. The laboratory processing took place in the nearby building and the laboratory crew was as large as the field crew (Fig. P-2).

We attempted an integrated approach in the field and during analysis. This report is an attempt at integration as well, to fuse individual contributions into a coordinated account. The time element has prevented some refinement of specific areas of the investigation, but this was meant to be a report of what was done in contrast to a prospectus of what might be done. The main regret is that the research team so hastily brought together in early July, 1975, could not have remained together during the long period of analysis. The high level of cross fertilization of ideas during that summer period is the best any of us has witnessed.

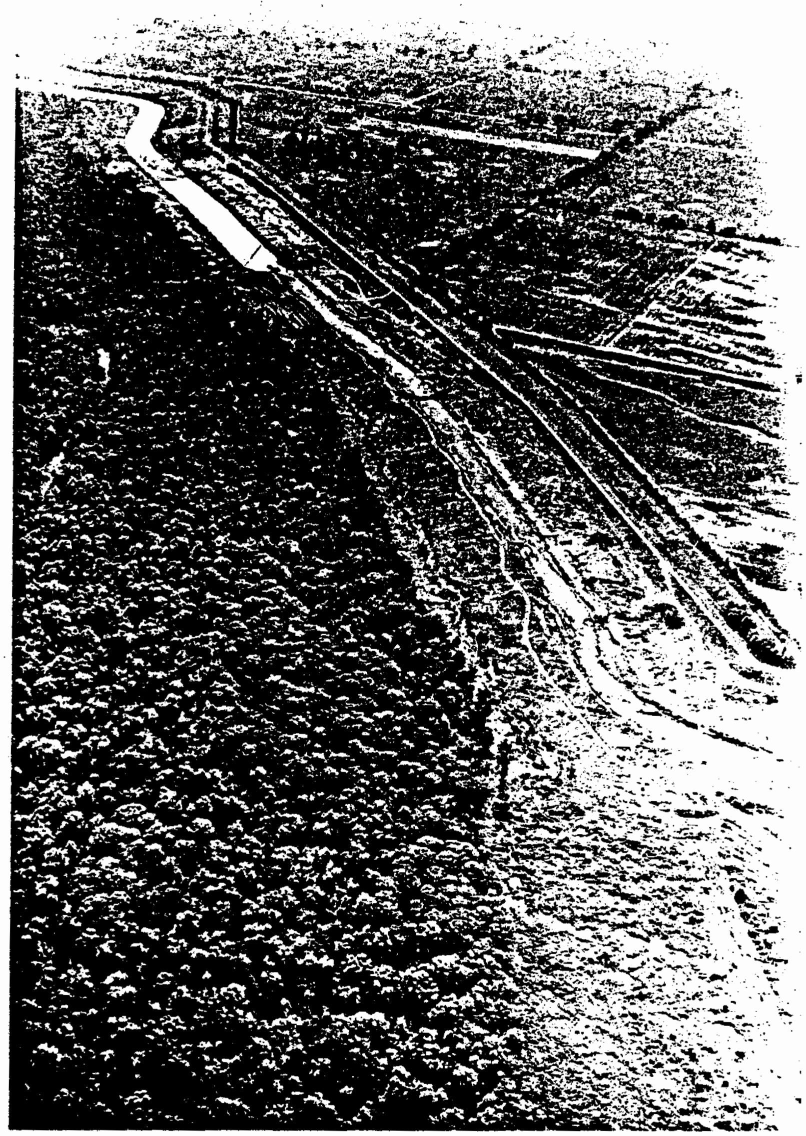

Figure P-1

Final day of the Zebree site. Dragline approaches site at the upper end of the picture.

Figure P-2

Crew of the 1975 Zebree Excavation. Upper row from left: R. Rockwell, O. Wood, D. Hurdlebrink, J. Sperber, J. Clayton, D. Bright, J. Newsom, T. Tucker, R. Brengard, T. Davis, P. Morse, D. Morse, J. Evans, R. Matthews, M. Raab, B. Elrod, M. Million, E. Roth, D. Anderson. Lower row from left: J. Priday, J. Chambliss, J. Cotton, C. Schrader, K. Tucker, R. Hurt, S. Harris with Fur Face, A. Bush, DD Million.

The 1975 field investigations were necessitated by the pending destruction of this National Register site by a Corps of Engineers channelization project. The Memorandum of Agreement and budget for the mitigation of adverse impact on the site have been published in the preliminary report on the 1975 work (Morse and Morse 1976). The contract (DACW66-76-C-0006) with the Memphis District of the Corps provided also for this integrated report on all the work at the site. However, the Arkansas Archeological Survey has provided considerable financial support for the project, in addition to that indicated in the budget (Morse and Morse 1976:108).

So many people and institutions were involved in the Zebree Archeological Project down through the years that we decided to make up a table listing them in alphabetical order (Table P-1). Special thanks need to be extended to Jerry Cohen of Cohen Construction Company, Blytheville, for his unselfish aid to us which allowed the 1976 salvage phase as the site was being destroyed. In addition, the computer services of Arkansas State University and particularly Drs. David R. Adams and Robert M. Babb are to be commended for aid considerably beyond normal expectation. If it had not been for the generous extension of credit by Roy Jolly of Barton Lumber Company of Jonesboro, the field portion of the 1975 project might never have begun. Last, but not least, the Survey administration, as the report period dragged on, choked with the usual delays and aborted contributions, has demonstrated admirable restraint.

Dan F. Morse
November 1977

Table P-1. Acknowledgment of individual help on the Zebree Archeological Project 1967-1977.

NAME	YEAR(S) ASSOCIATED	CONTRIBUTION
David R. Adams	1977	Computer aid.
David G. Anderson	1975-77	Field Assistant; author of chapters in report; compiled appendices.
Robert M. Babb	1977	Computer aid.
George A. Berger	1977	Dean, Agriculture Division, ASU.
Leonard W. Blake	1969-77	Ethnobotany and lithic procurement.
Bobby W. Brown	1968-69	Manager, Big Lake National Wildlife Refuge.
Terry Bremer	1975	Typist.
Richard Brengard	1975	Crew member.
Dixie Bright	1975	Crew member.
Abbie Bush	1975	Crew member.
Alan Bounds	1977	Computer aid.
Lynne J. Bowers	1975	Dendrochronology.
Julie Chambliss	1975	Crew member.
Ruby Chittenden	1975-77	Manuscript typing.
Jerry Clayton	1975	Crew member.
Jane Cotton	1975	Crew member.
John Cotton	1975	Crew member, field photographer.
Jerry Cohen	1976	Provided for 1976 salvage project.
M. L. Cude	1977	History.
Hugh Cutler	1969-77	Ethnobotany.
Joseph Darr	1975	Crew member.
Hester Davis	1967-77	State Archeologist (administrative).
Tony Davis	1975	Crew member.
Mike Deaton	1969	Crew member.
John Doebel	1975	Manager, Big Lake refuge.
Carol Dougan	1977	History, lab.
Tom Egan	1977	Computer aid.
Jimmy Ellis	1969	Crew member.
Barry Elrod	1975	Crew member.
Steve Erwin	1969	Crew member.
Jane Evans	1975	Crew member.
Jeff Flenniken	1969	Crew member.
Dick Furguson	1969-77	Soils, ceramic advice.

Albert C. Goodyear	1975	Sampling advice.
Jerry Gray	1975	Crew member.
Alice Greene	1975	Crew member.
Louis Gregoire	1969	Illustrator.
James B. Griffin	1967-77	Advice.
John Guilday	1969	Ethnozoology.
Herbert Haas	1977	Radiocarbon; chapter in report.
Dan Hamilton	1977	Computer aid.
Suzanne E. Harris	1975-77	Ethnobotany, history; chapter in report.
David Higgons	1977	Computer aid.
Patti Holifield	1969	Draft typing.
Debbie Hodge	1969	Lab.
Roy Horn	1969	Crew member.
Debbie House	1975	Crew member.
John House	1975	Sampling advice.
Douglas Hurdlebrink	1975	Crew member.
Richard Hurt	1975	Crew member.
Aleta Jamieson	1969	Draft typing.
Wanda Johnson	1977	Manuscript typing.
Sam Jones	1975	Provided GLO notes and maps.
Brenda Keech	1975-77	Illustration, clerical, administrative.
Jim King	1975	Palynology, lake coring; chapter in report.
Kathy Kirkland	1969	Draft typing.
Lisa Lamar	1977	Lab.
Karen Leach	1977	Keypunch Operator.
Col. A. H. Lehman	1975	District Engineer, US Corps, Memphis (administrative).
Evan Lindquist	1975	Ceramic advice.
Rufus W. Lyerly	1968-69	Crew member.
Charles R. McGimsey III	1967-77	Director, AAS (Administrative).
Chip McGimsey	1977	Environmental Reconstruction.
Inez McSwain	1975	Provided GLO notes and maps.
Don Martin	1975-77	US Corps, Memphis (Liaison).
Mary Martin	1969	Lab.
Bob Mathews	1975	Crew member, botony advice.
Larry Medford	1968-69	Crew member.
DD Dowden-Million	1975-77	Crew member, illustrator.
Michael G. Million	1975-77	Ceramicist, chapters in report,
Dan F. Morse	1967-77	Project Director.
Phyllis A. Morse	1967-77	Overall charge of lab; editor, history, administrative.
Jeffrey B. Newsom	1975	Field Assistant.
Jeffry D. Nicholson	1975-77	Spectographic analysis, chemistry.
Chester North	1969	Lab, salt manufacturing project.
Neshe North	1969	Lab, draft typing.

Arleen Olson	1976-77	Photographer.
Roy Parker	1969	Crew member.
Paul Parmalee	1969	Ethnozoology.
Christopher Peebles	1975-77	Reviewer.
Ella Pierce	1968, 1976	Volunteer fieldwork.
Howard Pierce	1968, 1976	Volunteer fieldwork.
Allen Posey	1977	Ecology advice.
Billy Porter	1969	Crew member.
Mary Lucas Powell	1975-77	Bio-archeology, chapter in report.
Tom Pozorsky	1969	Crew member.
Cindy Price	1975-77	History, advice.
Jim Price	1975-77	History, advice.
Dan Printup	1969-75	Photographer.
Mary Printup	1969-77	Editor.
Mark Raab	1975-77	Field supervisor.
Paul Raines	1977	Environmental reconstruction aid.
Richard Rockwell	1975-77	Crewmember, lab, mussel study.
Martha Rolingson	1969	Editor.
Eric A. Roth	1975-77	Ethnozoology, chapter in report.
Roger Saucier	1967-77	Geological advice.
Thomas Scheitlin	1976-77	Computer aid, developed program.
Sandra Scholtz	1975	Statistical advice.
Cindy Schrader	1975	Crew member.
Leonard Sebree	1977	History.
Paul Shipley	1975	Loan of equipment.
Mary Gay Shipley	1975	Hospitality.
Mickey Sierzchula	1976-77	Lithics aid, contribution to report.
Bruce Smith	1975-77	Reviewer.
Allan Solomon	1975	Palynology.
Jay Sperber	1975	Crew member, human osteology field lab.
Nan Stiles	1975	Crew member.
Brenda Stone	1967-69	Draft typing.
Robert Taylor	1969	Crew member.
A. Wayne Tennille	1968-1975	Soils advice.
Karin Tucker	1975-76	Crew member, lab.
Terry Tucker	1975-76	Crew member, lab.
Tom Watts	1975	Volunteer field work.
Iris Weaver	1975	Lab.
David White	1977	Lab, illustrator.
Stephen Williams	1967-77	Advice.
Gayland Wilson	1975	Backhoe operator.
Daniel Wolfman	1975	Archeomagnatism, chapter in report.
Ollie Wood	1975	Crew member.
Richard Yarnell	1977	Ethnobotany.

CHAPTER 1

ARCHEOLOGY IN THE NORTHERN MISSISSIPPI ALLUVIAL VALLEY

Dan F. Morse

The northern Mississippi Alluvial Valley extends from near Arkansas Post, Arkansas, northward about three and a half degrees latitude to Cape Girardeau, Missouri (Phillips, Ford, and Griffin 1951:506; Fig. 1). These north delta lowlands of the Mississippi River are bounded by high bluffs on the east in Illinois, Kentucky, Tennessee, and Mississippi and by the Ozark Escarpment of Arkansas and Missouri on the west. Over half of the area is in Arkansas, with Missouri including most of the remaining land surface. Mississippi contains somewhat more than one eighth of the remainder and other states are only marginally represented. Nearly 50,000 km^2 are represented in all.

Major Physiographic Divisions

The area is extremely complex geographically and this complexity must be recognized and accounted for in studies of human behavior. The two major divisions of these lowlands, western and eastern, are separated by Crowley's Ridge, an erosional remnant made up of Tertiary deposits capped by Pleistocene gravels, clay, sand, and wind-blown silt (Morse 1969a:14; Chapman 1975:4). Near Forrest City, Arkansas, are stratified deposits in the Ridge which include large oyster and other marine shells and shark teeth. There is evidence that major Quaternary paleontological remains are present in the Ridge as well, with *Mammut*, *Castoroides*, *Megalonyx jeffersoni* and *Equus* represented. No intensive paleontological investigation of this locality has been initiated to date and all these finds have been made accidentally by laymen. While older deposits outcrop along the escarpment bordering the lowlands on the west, the lowlands themselves are composed of a 30-meter deep mantle of Pleistocene deposits over the downwarped trough of Paleozoic strata comprising the base of the Mississippi Embayment. Most of these deposits are alluvial and due to glacial outwash. A significant amount, around 1025 km^2, are sand dunes (Saucier 1978), and virtually all of the surface soils have been modified by wind action. While there has never been a detailed geomorphological investigation made of this area (Saucier 1978), there is still a considerable amount of information available; much more, in fact, than will be related here.

Each lowland reflects the history of a major drainage system shifting away from Crowley's Ridge. In the Western Lowlands, there are four distinct surfaces, each slightly lower than the one immediately to the east. Each consists of a separate modern drainage system complicated by relict braided and later meandering stream channels. Alluvial fan formation near the Arkansas-Missouri border has further complicated matters, causing some major shifts in drainage possible as late as a few millenniums after the end of the Pleistocene. Deposits in the Western Lowlands date to the waning of the early Pleistocene (Saucier 1978) and most surfaces date to at least 30,000 BP except for more modern modifications as described above (Saucier 1974, 1978).

Similar surfaces have been recognized east of Crowley's Ridge which also are parallel with the Ridge and with the Mississippi River. Deposits in this lowland were laid down during the later phases of the late Pleistocene (Saucier 1977) and the surface has been considerably modified by relict braided and later meandering stream channels. The westernmost surface is distinct, being bordered by a 5 meter high ridge upon which are concentrated most of the fluted points found in the Eastern Lowlands. South of the southwest corner of the Missouri bootheel, the St. Francis River flows increasingly east of this escarpment to Marked Tree where it is joined by both the Right Hand Chute and the Left Hand Chute of Little River. The Left Hand Chute of Little River flows within a broad floodplain relict of a recent crevasse channel of the Mississippi River (Saucier 1970). This floodplain borders the Right Hand Chute of Little River south of Big Lake; northward this chute is involved in the drainage of Pemiscot Bayou in Missouri and the west (Right Hand) chute drains a large area of the central portion of southeast Missouri. In fact, 5 inches of rain in southeast Missouri in 1969 caused almost all of the Zebree site to be flooded despite the complete absence of rainfall in Arkansas.

The natural areas in the northern Mississippi Alluvial Valley consist primarily of drainage basins (Fig. 1.1). The Western Lowlands contain two areas in Missouri (St. Francis River Drainage and Advance Lowland), two in Arkansas and Missouri (Little Black River Drainage and Upper Black River Drainage), and four in Arkansas (White River, Black River including Village Creek, Cache River including Bayou de View, and the L'Anguille Drainage), not counting the separate Ozark streams which flow into the lowlands. Crowley's Ridge is an effective barrier or boundary. The three braided surfaces immediately to the east constitute together a major subdivision of the Eastern Lowlands, the Malden Plain (Fig. 1-2; Surfaces A-C). A second major subdivision, the Little River Lowland, is mostly made up of recent

Key to Figure 1: Geographical divisions of the northern Mississippi Alluvial Valley.

1. Cairo Lowland (Williams 1954:129)
   a. St. James Bayou Drainage (Davis 1972:13)
   b. St. Johns Bayou Drainage (Davis 1972:12)

2. Sikeston Ridge (Williams 1954:150). Included within 1-b by Davis (1972:12).

3. Morehouse Lowland (Williams 1954:166). Included in Castor River Drainage and Little River Lowland by Davis (1972:11).

4. Malden Plain (Williams 1954:168)
   a. Braided Surface C
   b. Braided Surface A & B

5. Crowley's Ridge (Williams 1954:194)

6. Advance Lowland (Williams 1954:194). Included within Castor River Drainage by Davis (1972:11).

7. St. Francis River Drainage (Williams 1954:196)

8. Little River Lowland (Williams 1954:184)
   a. Right Hand Chute (Morse 1975b)
   b. Left Hand Chute (Morse 1975b)
   c. Pemiscot Bayou Drainage (Davis 1972:15)
   d. Portage Open Bay Drainage (Davis 1972:15)
   e. Tyronza Watershed (P. Morse 1976)
   f. St. Francis River between about Marked Tree and Parkin

9. Lower St. Francis Basin (Phillips, Ford, and Griffin 1951:Fig. 1)

10. Little Black River Drainage (Price and Price 1975)

11. Black River Drainage (Williams 1954:198)
    a. Upper Black River
    b. Lower Black River
    c. Village Creek (Klinger 1977)

12. White River (Phillips, Ford, and Griffin 1951:Fig. 1)
    a. White River Valley near Batesville
    b. Middle White River
    c. Lower White River

13. Cache River (Schiffer and House 1975)
    a. Cache River proper
    b. Bayou de View

14. L'Anguille Drainage (Morse 1973a)

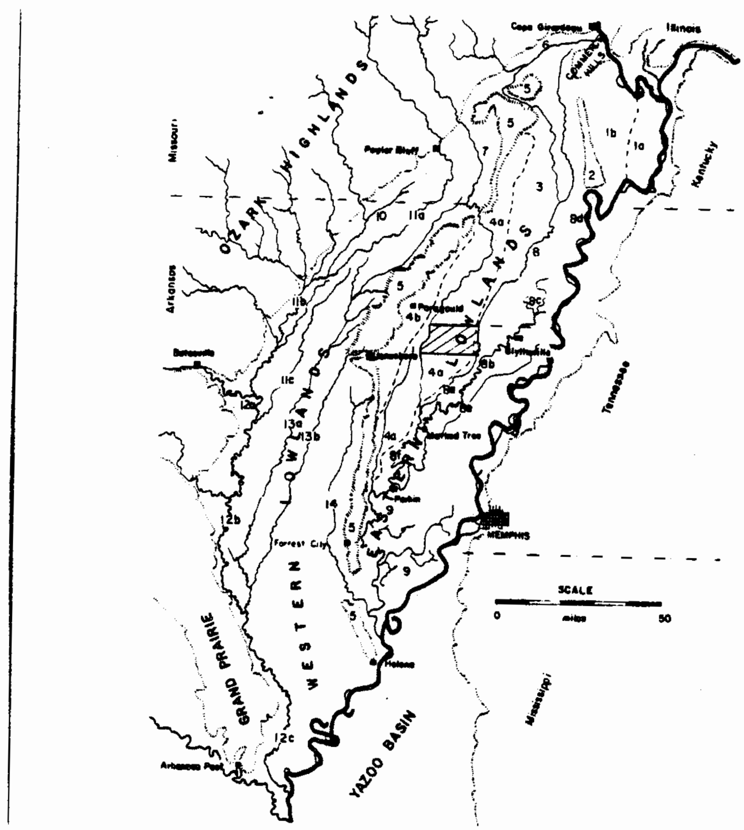

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Figure 1-1. Geographical divisions of the northern Mississippi Alluvial Valley. (see key)

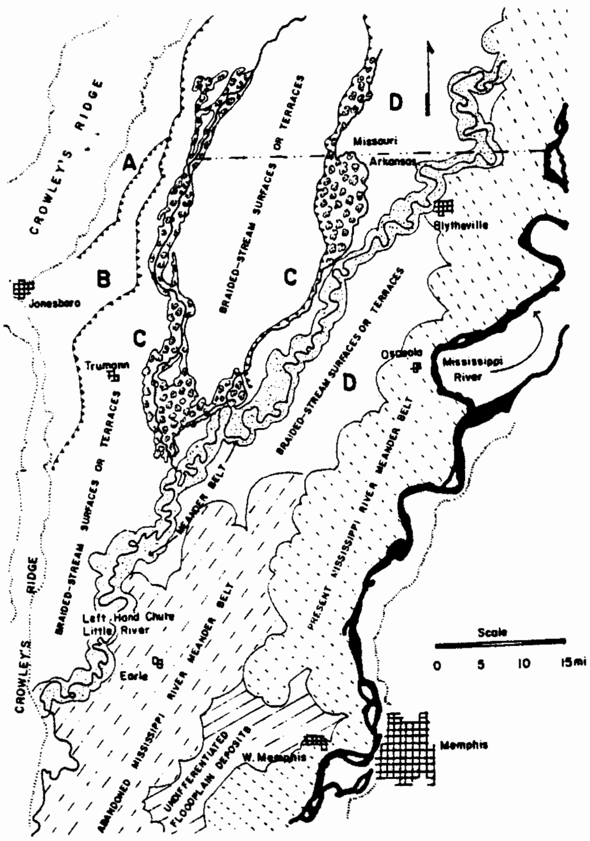

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Figure 1-2. Braided stream surfaces and meandering stream belts in the Eastern Lowlands of northeastern Arkansas (based on Saucier 1970, Fig. 2).

meandering stream deposits but there is an important relict braided strip drained by the Tyronza River in Arkansas (Fig. 1-2; Surface D), and relict braided surfaces in the Cairo Lowland. The Cairo Lowland is separated from the more western lowlands by Sikeston Ridge which, while only 10-20 feet high, is 3 miles wide and 28 miles long. The Cairo Lowland is adjacent to the confluence of the Ohio and Mississippi rivers and not far removed from the Missouri, Illinois, Tennessee and Cumberland River mouths. At the other end of the northern Mississippi Alluvial Valley, the lower St. Francis basin is a complex area of relict and modern meandering channels (Fig. 1-2). Late Archaic associations are with the relict channels and Mississippian remains with both the abandoned and modern channels. It is in this general geographical location, within the northern alluvial valley, where occur the densest accumulation of archeological remains to be found anywhere in the United States of America. Virtually every curio cabinet in the country, both professional and lay, includes artifacts, sometimes in considerable quantities, from this region.

History of Archeological Work

Arkansas did not become a state until 1836 and its northeastern corner remained a western frontier until the mid-19th century. Henry Roe Schoolcraft, who made a "Tour into the interior of Missouri and Arkansas in 1818 and 1819" (Park 1955), stated in his journal on November 5, 1818, at what is now Potosi, Missouri, "I begin my tour where other travellers have ended theirs, on the confines of the wilderness, and at the last village of white inhabitants, between the Mississippi River and the Pacific Ocean" (Park 1955:21). Since Schoolcraft was able to stay with pioneer settlers almost everywhere he traveled, the region into which he traveled was not all that uninhabited. He noted the location of several prehistoric sites in his journal.

The initial historic reference to exploration of the antiquities of the area under discussion is usually to the publication of the classic Squier and Davis volume in 1848 (Davis 1969). However, the closest these investigators came to the northern alluvial valley was a brief description of a mound site in Bolivar County, Mississippi (1848:116-117), and a reference to temple mounds of large size at New Madrid and St. Genevieve, Missouri (1848:175). Earlier pioneers such as Brackenridge (1814) and Atwater (1820) also were only peripherally concerned with the valley. During the 19th century a commonly held theory was that the Aztecs and others forced or voluntarily migrated down the Ohio and Mississippi rivers into Mexico and that earth monuments were built during this movement southward.

Later in the 19th century there were numerous publications on sites and artifacts such as those by Conant (1879), Potter (1880) and Evers (1880), and later by Beckwith (1911); but probably the most important works to appear were by Thomas (1894), Brown (1926), and Holmes (1886, 1919). The period of museum exploitation of the northern alluvial valley had begun in earnest. It reached its climax in terms of the numbers of pots extracted for museum display between 1870 and 1890. C. B. Moore (1910, 1911) carried on the practice, which continued into the early 1930s with the discoveries of the University of Arkansas Museum and the Alabama Museum of Natural History (Morse 1973d). The Academy of Science of St. Louis, the Davenport Museum and everyone else who wanted pots seemed to head for the southeast Missouri and northeast Arkansas area after 1870. Many private collections were also accumulated and the continuation of this activity persists among many laymen today (Hathcock 1976).

The date 1935 is an important one for the valley as well as the remainder of the eastern United States. A new approach to archeological data officially began. The Society for American Archaeology was founded. The Missouri Archaeological Society, one of the most scientific layman-oriented societies to exist in the mid-20th century, came into being. Professionally trained archeologists, such as M. R. Harrington at the University of Missouri, began teaching and working in the area. While Holmes' syntheses (1886-1919) represented an increased sophistication over his predecessors and peers (Griffin 1969), it was not until the early 1940s that an actual cultural-historical survey of the valley was successfully accomplished (Phillips, Ford, and Griffin 1951). The association of Phillips, Ford, and Griffin produced the classic pioneer work for the northern Mississippi Valley. This work is important from several standpoints. It established regions and a time scale, realizing the promise indicated by Holmes and taking advantage of the extraordinary archeological backgrounds of the three participants. The study was organized around a central problem not unlike that utilized as a basis for this report. The survey was well planned and executed. Dr. James Hampson, a knowledgeable amateur in Wilson, Arkansas, was able to help (Williams 1957b). The writing was self critical and honest. There was an unfortunate tie into the Fisk chronology (Fisk 1944), complicated by circular reasoning in deciding dates and channel sequences but this was the preradiocarbon period and there was no real alternative. In fact, the multi-disciplinary integration reflected in this report is still unachieved in some archeological projects. There was little direct evidence of the preceramic complexes, which were not recognized as being widespread in the eastern United States until after 1937. In brief, *Archaeological Survey in the Lower Mississippi*

Alluvial Valley, 1940-1947 is a high standard against which we may gauge our actual progress in understanding cultural processes in the northern Mississippi Alluvial Valley.

The development of university supported archeological programs financed a great deal of research in the area, especially in Missouri. In particular, Carl Chapman and his students conducted excavations such as that at the Hearnes site (Klippel 1969). The University of Michigan also began a research program in the Central Mississippi Valley (Griffin and Spaulding 1951). The more complex Mississippian occupations still were the major research focus, exemplified by Stephen Williams' dissertation (1954) on southeast Missouri, although the whole time scale was recognized by this time (S. Williams 1954:Table 2). Highway salvage operations produced reports on survey and excavation of several sites (Marshall 1965). The National Park Service sponsored a study of land leveling in southeast Missouri (R. Williams 1972). In Arkansas, two excavations were supported by the Gilcrease Foundation (Perino 1967). The Lawhorn site was excavated and described by John Moselage, an amateur archeologist, with the advice and help of Carl Chapman. A layman-professional cooperative effort produced the Campbell site report (Chapman and Anderson 1955), as well as the Ford-Redfield survey, the first concentrated effort to locate Dalton sites in the valley (Redfield 1971). Dr. James Ford of the American Museum of Natural History excavated the Helena Crossing site in 1960 (Ford 1963). The Arkansas Archeological Society sponsored several amateur digs in northeast Arkansas (Davis 1969). Across the river in Memphis, Nash excavated part of the Chucalissa site and it became the property of Memphis State University (Nash and Gates 1962).

Since the middle 1960s archeology in the northern Mississippi Alluvial Valley has tended to continue the cultural-historical approach perfected by Phillips, Ford, and Griffin and also to initiate the investigation of cultural-ecological systems. The Arkansas Archeological Survey was founded in 1967, and has placed in northeast Arkansas the only archeologist who has ever worked in the region full time. In southeast Missouri, the University of Michigan Powers Phase project, sponsored by the National Science Foundation, began an area wide study of an entire archeological phase (Price 1973). Using data provided by the General Land Office surveys, Lewis (1974) pioneered a study of the past ecology of the Cairo Lowlands region. Immediately to the south of the research region covered here, the Lower Yazoo basin (Phillips 1970) has been the subject of intensive study by the Harvard Peabody Museum. The introduction of new types of federal funds into archeology has led to the gathering of great amounts of data, such as that in this report, as well as to the need to decide how best to conduct probabilistic surveys and excavations.

Archeological Complexes

A rather complete archeological sequence is now known in the northern Mississippi Alluvial Valley. A total of approximately 11,500 years of human occupation is evident in a land which, for the most part, is now extensively cultivated and clear of vegetation. This easily allows us to examine the land surface for sites. At the same time this cultivation destroys sites at an alarming rate (Scholtz 1968; Medford 1972). There are an estimated 600,000 sites within the valley region under consideration. Less than 6000 have been recorded and fewer than 1000 of those by any kind of sophisticated sampling design. A "site" is technically any specific locus at which there is evidence of human behavior. The practical field definition, developed to manage the collections gathered at various geographical loci, has changed through the years in response to increasing sophistication in archeological methodology and interpretation.

The first sites to be noted were the large late prehistoric villages. Until the beginning of the Arkansas Archeological Survey in 1967, and most notably with the inception of the sophisticated drainage surveys in the early to mid-1970s (Schiffer and House 1975; Klinger 1977), the only sites recorded or used as a basis for analysis were those which produced a sizable sample of debris to analyze. The emphasis was more upon ceramic sequence (and later projectile point sequence) than upon settlement systems: ". . . the primary data were the pottery samples, not the sites from which they were collected" (Phillips 1970:241). The definition of "site" now not only includes large villages but any tool locus. Any locus which contains two or more artifacts within 10 meters of each other (Arkansas) or three artifacts or more at a "single locus" (Missouri; Price, Price, and Harris 1976:82-83) is recorded as a site. Such a definition is used only in cases of intensive and/or probabilistic surveys. In addition, any habitation or structure indicated on an original land survey map or other pre-1860 historic document is recorded as a site in Arkansas. Any locus of human activity from which data can be obtained using archeological extraction techniques technically is a "site." For practical reasons, post-Civil War sites are only recorded during intensive surveys or when they appear to be of community-wide importance; in other words, when specific research problems are known to need these data.

The following discussion is by period in the sense that each broad unit is the period of time during which a specific cultural stage is most representative in the northern Mississippi Alluvial Valley. Each is headed by a traditional eastern United States designation followed by the current dating as indicated by a combination of radiocarbon and stage designation. In many of the later headings, an additional period designation is marked by a single asterisk (*) in parentheses which follows Phillips (1970). Mississippian alternative periods marked by two asterisks within parentheses (**) follow Price (Price, Price, and Harris 1976) and are in common use in southeast Missouri.

Paleo-Indian (fluted points): 9,500-8,500 B.C.

While over 100 fluted points are known from the area, most with at least metric data recorded (Arkansas Archeological Survey files [AAS files]), no overall review has been accomplished. Two basic styles are present which may equate typologically with Clovis (9,500-9,000 B.C.) and Folsom (9,000-8,000 B.C.). The loci of these fluted points are old surfaces and associated for the most part with large riverine activity. There appears to be an excellent chance for buried deposits. There are two regional linear patterns of occurrence in Arkansas, each along the bank of a relict stream. In one situation there are points along both sides of the Cache River channel, a major relict stream which once combined the Cache, Black, and St. Francis rivers. Also, the eastern escarpment of braided surfaces A and B have produced several fluted points. In southeast Missouri, a tighter spacial concentration may occur. A complete fluted point is alleged to have been surface-collected on the levee of Ditch 81 immediately across the Arkansas-Missouri boundary 2 or so miles north of the Zebree site. This find, however, is unique for the region east of the braided stream A and B system. Prominent channels of the relict river immediately east of the escarpment as they became inactive during and immediately following the Paleo-Indian period interred *Mammut*, *Tapirus* and possibly *Megalonyx* within their deposits (Morse 1969a)

This period represents an initial occupation of the valley. It is also a time when the Pleistocene is in its final waning stages and when a full glacial vegetation, consisting of spruce and/or pine-dominated boreal forests (Saucier 1977:42) is giving way to a deciduous forest made up of mixed oaks on terraces and canebrakes on higher elevations bordering swamps (King and Allen 1977:17). The shift took place by at least 7000 B.C. (King and Allen 1977). There is some evidence from Arkansas that the shift may have occurred earlier, perhaps contemporaneously with the fluted point makers. A relict lake-swamp pollen sample collected south of Jonesboro was analyzed by Dr. Peter J. Mehringer, Jr., of Washington State University. The base represents a lake deposit which may have contained a young

Mammut and which seems to be contemporaneous with the transition of an active braided channel to an inactive one caused by a shift eastward of the braided pattern. This channel is immediately east of the major escarpment which has produced a number of fluted points to the north. A conservative guess date is anywhere between 6000 and 10,000 B.C. The lower lake deposits appear to be similar to Zone 1 at Old Field (King and Allen 1977), dated to 7000-6700 B.C. Mehringer (personal communication, 1974) thinks there is an excellent chance for sample contamination but this is in general agreement with Old Field. In the basal sand level *Quercus* (oak) was most prominent, followed in order of representation by *Carya* (hickory), and *Ulmus* (elm). *Pinus* (pine) is not prominent but is present.

Williams (1957a) has reported on the Island 35 mastodon which was in association with two bifaces. Neither biface is characteristic for this early period; one may be a broken stemmed or notched point. The deposits are probably secondary and the association accidental.

Dalton: 8,500 - 7,000 B.C.

Probably the earliest recognition of Dalton points was by Williams who included them as a trait for the "Bloomfield Ridge phase" on Crowley's Ridge (1954:35). There is little doubt that during the Dalton period there was a highly favorable environment present in the northern Mississippi Alluvial Valley. Dalton remains are plentiful and indicate a highly sophisticated and successful adaptation by hunters and gatherers. Indeed, the closest analogies are with the Upper Paleolithic of Europe. While we have only point loci for the fluted point makers, there has been a great deal of research on Dalton remains, such as settlement pattern, tool inventories, and general behavior. Hunting camps have been tested and excavated (Goodyear 1974), a cemetery completely excavated (Morse 1975a) and a base settlement tested (AAS files). Stable territories with permanent base settlements, with satellite cemeteries and hunting, gathering, and other extraction camps are indicated, although this is not a traditional interpretation of hunter and gatherer activity (Schiffer 1975; Morse 1977a). The major large mammal secured for concentrated protein almost certainly is the white-tailed deer. The true adz is present and probably used for house posts and dugout canoes. Although not as rich as the Upper Paleolithic in variety and concentration of tools, nevertheless the Dalton inventory is more complex than anything yet reported for the New World on this time level. Stone tools indicate a rich and varied bone tool inventory as well, although this is not preserved. Sparse Dalton hunting activity is indicated for the Big Lake Region located immediately west of the Zebree site. Very probably, this region was made up of a combination of relict and active braided channels and was not a secure locus for permanent habitation. Most Dalton activity was taking place west of the escarpment along braided surfaces A and B and in the western lowlands.

Early-Middle Archaic Hiatus: 7,000 - 3,000 B.C.

Post-Dalton artifacts range from rare to nonexistent during this period (Morse 1975c:190-191; Price and Price 1977:15-17; Chapman 1975:183). There seems to have been minimal human activity within the valley in contrast to a great deal of activity in the Ozark Highlands to the west, the Ouachita Mountains to the southwest and within the Tennessee uplands to the east. The contrast before and after about 7000 B.C. is so apparent that almost certainly there must have been population movement out of the northern valley. The contrast is even more remarkable when considering the evidence of abundant habitation of this area after about 3000 B.C. Assuming adequate samples, something drastic had to happen to cause such a population decrease and that something almost certainly must have been climatological. Vegetational shift to species supporting less animal life is probable. King and Allen at Old Field have recognized the Hypsithermal dating to around 6700 - 3000 B.C. This was a period of drier conditions, with a lowered water table in the low-lands and a corresponding shift from forests to grasslands. The Arkansas profile examined by Mehringer and discussed above also seems to indicate this same shift. Grasses, mostly *Gramineae*, constitute 84% and 65% of the total pollen in two samples. In addition, there is some evidence that relatively major drainage shifts took place at this time and that braided channels changed to a meandering Mississippi stream channel.

Late Archaic (Poverty Point Period*): 3,000 - 500 B.C.

This is a very little investigated period in the northern valley, somewhat surprising in view of the abundant remains available for study (Phillips 1970:869-871; Price, Price, and Harris 1976:38; House 1975:156-157). A basic settlement pattern reflecting a probable tribal organization in contrast to the earlier band system has been proposed: a small group moves within a single minor drainage so that the maximum environmental diversity in a short space is exploited by a pattern of seasonal habitations (House 1973).

How widespread this basic settlement system was or what kinds of alternative systems existed at this time is hard to determine.

Studies along the Ozark Escarpment allow us to postulate seasonal shifts from the lowlands up a narrow stream valley and back again. The same phenomenon seems to be present in and adjacent to Crowley's Ridge. Southward the lowlands widen and drainages multiply so that alternate systems of settlement might have been followed, although these areas were relatively sparsely inhabited at this time. Sometime, probably around 1500 B.C., there is an apparent shift in settlement pattern within the northern valley. Sites with Poverty Point-like artifacts concentrate along the Mississippi River, which at that time flowed near Blytheville and Parkin, Arkansas, while a secondary cluster occurs along the White River (Morse 1974b).

Some horticulture may be present during this period (Marquardt and Watson 1976) but basically these people remained hunters and gatherers. Late Archaic debris occurs sparingly within the Big Lake region and this area would seem to be peripheral to the main activity of this period. One difficulty in identifying site complexes is in recording lithic scatters, some of which involve only a few bits of debitage. These must be viewed as *nonceramic* and not necessarily *preceramic*. The relative lack of definitive late Archaic artifacts indicates that these lithic scatters probably are post-ceramic, but were created by activities which did not cause pots to be present or to break. At the same time, one has to realize that there is a possibility that a late Archaic pattern of small sites with less chance of the loss of definitive artifacts for archeologists to find could exist (Reid, Schiffer, and Neff 1975: 209). The later part of late Archaic, ofter referred to as terminal Archaic, evolves into early Woodland with little disruption in most regions of the eastern United States where a fairly complete archeological sequence is known. The northern alluvial valley presumably is no exception.

Early Woodland (Tchula Period*): 500 - 0 B.C.

The tendency toward the clustering of sites, noted in the latter half of the late Archaic period, increased during this period until much of the central portion of the northern alluvial valley was uninhabited. Much of the Eastern Lowlands of Missouri were inhabited and some areas south of Memphis are recognized as Tchula (Phillips 1970:Fig. 443). But much of northeast Arkansas apparently was uninhabited from around 500 B.C. until possibly as late as A.D. 400-500.

Unless our site survey data are greatly distorted, it appears that whatever happened to enable the development of Hopewell in Illinois, Ohio, Louisiana, and Florida, seems also to have continued to remove people from the central core of the northern Mississippi Alluvial Valley. Presumably there is a climatological and/or vegetational basis for this development, one which was not as conducive for hunting, gathering, or horticulture. Unfortunately, there are no pollen records for this and later prehistoric periods for this region.

Tribal organization during late Archaic and Woodland seems to allow for adaptation to variations in the physical environment. Tribes were small or large, cohesive or noncohesive, settled in compact villages or in neighborhoods, poorly developed or highly developed. In addition, groups may have had the ability to migrate out of or into different regions. Probably no more than a total of 500 to 1000 individuals would have been involved in any such demographic adjustments.

Middle Woodland or Hopewell (Marksville Period*): A.D. 0 - 500

A classic Hopewell site exists near Helena, Arkansas (Ford 1963); in fact, the report could be of an Illinois Hopewell discovery (Perino n.d.). South of Helena there are abundant Marksville remains (Phillips 1970:Fig. 444) which constitute the typical Hopewell of the southern Mississippi Alluvial Valley. Northward, Phillips' map is practically blank. The tentative Turnage phase in extreme northeast Arkansas is based solely on the presence of fabric-impressed, grog-tempered ceramics. No Hopewell marker types are yet recognized and these components may be early Woodland expressions extending north of Memphis and east of the Blytheville cluster of Poverty Point-like artifacts associated with the abandoned meandering stream channels, since the Mississippi River would have shifted to its present locus by this time.

There is at least one Marksville-like site located in Tennessee, the Twin Mounds component of the Pinson site in the upper reaches of the Forked Deer River (Morse and Polhemus 1963:21; 32). Within the northernmost portion of the alluvial valley, particularly the Cairo Lowland, there are fairly abundant Hopewell ceramic remains (Williams 1954:30; Phillips 1970:887; Griffin and Spaulding 1951: 76-77). These relate stylistically to the Twinhoeffel site located near Carbondale, Illinois, where grog-tempered fabric-impressed sherds occur together with Hopewell incised and stamped sherds. Some elements of Hopewell are reported (Marshall 1965:72), but for the most part they are absent (S. Williams 1954:33). Around Memphis and westward over to Brinkley and beyond to the White River there are sites producing grog-tempered Hopewell ceramics. Further west and north, related sites become rarer and possibly even later in time. The northernmost of this Brinkley cluster recognized to date (site 3PO158) contains grog-tempered ceramics and appears about as late as possible to be still regarded as Hopewell-related. Apparently the central core of the northern alluvial valley is filling with permanent settlement once again after around A.D. 300 - 500, a reasonable expectation given the widespread incidence of late Woodland sites.

Westward along the Ozarks, "No ceramics depicting major Hopewell influence have been found in the Little Black River area" (Price and Price 1975:50). However, a sand-tempered pottery tradition known as Barnes apparently develops near here (Price and Price 1975: 50): ". . . decorations are net impressing, fabric impressing, bossing (both interior and exterior), and zoning." A predominance of plain surface treatment at some sites indicates, together with the above, a time period equating with late Hopewell. A later expression is found near Cape Girardeau (Price and Price 1977: 18-19). Bossing, notched rims and cord-wrapped stick decoration are present. These characteristics are found on a very late Hopewell level and on an initial late Woodland level, particularly when zoning and fabric-impressed motifs are absent. A general absence of rim folds may reinforce a relatively early relationship to Barnes complexes found further south and discussed in the following subsection.

Late Woodland (Baytown Period*): A.D. 500 - 700

Phillips actually dates this period to between A.D. 300 and 700 (1970:Fig.450). However, radiocarbon dates seem to indicate that Baytown as a post-Marksville period begins at a later time (Phillips 1970:Table 18). There are, by this period, two distinct pottery pastes in the valley (Figs. 17-5 and 17-6). Except for the sand-tempered group in northwest Mississippi, which is related to the Miller complex (Jennings 1941:212) further east, sand-tempered pottery is concentrated tightly in adjacent portions of southeast Missouri and northeast Arkansas and is known as Barnes. Surrounding Barnes on the north, east, and south are grog-tempered complexes known collectively as Baytown (culture, not period). There is little room for doubt that two distinct traditions are present (Chapter 17). Probabilistic surveys in Arkansas are reinforcing the interpretation that both are moving toward each other into uninhabited territory and that at the end of the Baytown period Baytown culture is encroaching upon Barnes territory.

The late Woodland component at the Zebree site is Barnes. Most of the pottery is cord marked and radiocarbon supports the assigned late dating of the Zebree component (Chapters 10 and 11). There is little decorative variation beyond some check-stamped sherds and rim folds. Only a few Baytown sherds were present, probably representative of trade vessels. Data from the Zebree site and from a transect survey plotting sites in relationship to environmental zones have been interpreted as indicating a maximum population in a winter village made up of around four households, with fragmentation into sites containing individual households during the rest of the year. Barnes in apparent contrast to Baytown was not a strong politically structured society (Chapter 3). The Baytown and Coahoma phases further south are mostly known for their ceramics but mound sites are characteristic and sites are apparently large, stable, and relatively complex (Phillips 1970:903-907).

Initial (Developmental**) Mississippian (Coles Creek Period*): A.D. 700 - 1050

The development of intensive agriculture, in contrast with the earlier horticultural or hunting-gathering pattern, with concomitant increased population and development of a chiefdom social organization took place around A.D. 700 within the northern alluvial valley. The cultural processes associated with this change constitute a central focus of this study. The two basic issues of *in situ* development *versus* site intrusion are in print (Morse 1977b) and the Zebree Archeological Project is a modern test of the conflicting yet complementary hypotheses. Evidence supports the contention that at least in the Big Lake region, site intrusion occurred (Morse 1977b; Chapter 21).

The Big Lake phase as represented at the Zebree site is very similar to the Fairmount phase at Cahokia (Fowler 1969; 1975), to the Hoecake phase (?) in the Cairo Lowland (R. Williams 1974), and to the Hayti phase in the upper reaches of the Little River Lowland (Marshall 1965; n.d.). That Cahokia is primary is indicated by the large size of the site (1500 hectares), the local developmental cultural background, the vast concentrations of exotic raw materials and finished artifacts, and the extremely complex social-political behavior as exemplified by Mound 72 and the "woodhenges." The Big Lake phase, based on ceramics, probably is a segment of a population movement out of the Cairo Lowland into the Malden Plain via the Little River lowland.

Beyond the Malden Plain, acculturation of late Woodland groups in place within the Western Lowlands seems logical based on the nature of the reported data. Three phases possibly representative of a developmental sequence reflecting this change have been named in southeast Missouri (Price, Price, and Harris 1976:42-56): Buckskull, Scatters, and Naylor. In Arkansas, the Adams phase was proposed (Morse 1969a) near Newport on the White River; the surface-collected artifacts representative of this general time period along the Cache River have not been assigned to a named phase until more control can be exercised over them.

In the Cairo Lowland, the Beckwith phase was proposed for the Coles Creek period (Phillips 1970:912-913). The high percentage of plain grog-tempered ceramics indicates a dating early in the Baytown period (Chapter 10). The descriptions of grog-tempered O'Byam Incised and Matthews Incised together with a shell-tempered cord-marked pottery are puzzling since these motifs are horizon markers for middle period Mississippian sites. The grog-tempered "Bell Plain" also described as a characteristic of Beckwith is a horizon marker for post A.D. 1350 sites, particularly the Nodena phase. R. Williams (1974) redefined S. Williams' (1954) Hoecake phase to accommodate Hayti and Big Lake-like features at the Hoecake site. The concept of a Hoecake phase based on the early Mississippian component at the Hoecake site, but minus the Baytown ceramics, is the one adopted in this volume.

Further south the Black Bayou and the Walnut Bend phases are based on the assumption that check stamped pottery is a marker for the Coles Creek period (Phillips 1970:913-916). However, check stamping occurs in the Baytown period (Chapter 16), and Black Bayou is located where the Hayti phase and related sites are known to be present (Fig. 21-7). The Black Bayou phase is earlier than the Coles Creek period if the interpretations presented here are valid. The Walnut Bend phase dating by Phillips is also suspect, but is strengthened by the inclusion of Coles Creek-like sherds (Phillips 1970:915). The Toltec phase is undergoing investigation and refinement at the present time (Rolingson 1977), and any further comment would be premature except to say that it is related somehow to Coles Creek. Across the river to the east is the Peabody phase (Phillips 1970:917-918) which is described as "particularly vulnerable" and there is little more to state other than somehow it is related to Coles Creek.

In the northern portion of the valley, three early Mississippian expressions seem to occupy strategic positions in relation to upland resources, consisting of granites, basalts, cherts, sandstones, galena, red ocher, and other raw materials. The most prominent in terms of site size and number exist essentially along the Mississippi River and include the Hoecake and Hayti phases. The upland resources probably are located north of Cape Girardeau in Missouri. The Big Lake phase is located along the St. Francis River and has direct access to the same essential resources, but from another direction--the headwaters of the St. Francis. In addition, access to Cahokia and to the Crescent chert quarries is available via Big River which headwaters are near the headwaters of the St. Francis River. The Western Lowlands groups had to be content with Ozark stream exploitation of the uplands and most probably the White River provided primary access to a variety of basic lithic resources. There are no other major streams which would allow access to the kinds of lithic resources apparently so important to Mississippian society. However, in order to test any such hypotheses of Mississippian upland utilization, the specific identifications of the important raw resources and the delimitation of where they are available will be necessary.

Middle (Expansion**) Mississippian: A.D. 1050 - 1400

The later portion of Initial Mississippian and in particular the earlier portion of Middle Mississippian is obscure at this time. Investigations of deposits similar to the lowest levels at Rose Mound (Phillips, Ford, and Griffin 1951), and Crosno (S. Williams 1954), and to the Banks Mound 3 site (Perino 1967b) will help fill this hiatus, which is also apparently the period during which Mississippian spread throughout the Yazoo Basin (Phillips 1970: 558-560). During this middle period sites are found almost everywhere. Numerous smaller villages in Arkansas and Missouri and larger villages in the Cairo Lowland have been recorded (Fig. 25-4).

From the Powers phase data, there is little doubt that strong central social and political control of a society was exercised and that centrally directed labor to build villages within a short period of time was accomplished (Price 1973). The small sites may mostly represent farmsteads spaced throughout the environment to maximize production. The villages seem to be crowded with houses so, while basically ceremonial, based on the presence of mounds, they apparently served also as residential units. Where it is possible to tell, they are palisaded and, in the only extensive study to date, also divided into walled wards (Price 1973). The ceramics are not exotic and only recently with the astronomical rise in pottery prices have sites been systematically looted (Fig. 25-5). Strangely, very little participation in the "Southern Cult" was practiced in the northern alluvial valley (Phillips 1970; S. Williams 1975) although occasional "Cult" artifacts are discovered.

There are only a few middle period sites along the Mississippi River south of the Cairo Lowland. This may be Phillips' Pemiscot Bayou phase (1970:929). The earliest site is the Banks Mound 3 site (Perino 1967b). More typical, and similar to those along the St. Francis River, are 3MS16 and an early component at 3MS53. Up-river, however, particularly in and near the Cairo Lowland, is where the middle period sites exist as large, impressive fortified villages such as Lilbourn, Towasahgy, Crosno and a number of others. There is little doubt that this was the area of concentrated occupation along the Mississippi River. While sites do exist downriver, they are rare and considerably smaller.

Along the St. Francis River are several multiple mound sites, such as Shugtown, Lawhorn, McDuffee, Bay, and others, but apparently the fulcrum of occupations known collectively as the Lawhorn phase is still near the same basic locality as the Big Lake phase, but sites are now concentrated on both sides of the St. Francis and Little rivers. Larger sites may exist south of Marked Tree but these sites are multicomponent and it is difficult, without intensive investigations, to separate the middle and late period components. The Hazel site is a good example (Morse and Smith 1973). To the north is the Malden Plain phase (S. Williams 1954), but it is more restricted than Williams indicates (Fig. 25-4).

In the Western Lowlands two phases have been identified. The Powers phase in the Naylor area is well studied and constitutes a model for investigations of village make-up and settlement pattern in the rest of the northern alluvial valley (Price 1973). It is similar to the Lawhorn phase along the St. Francis River. The Wilson phase, located along the central Cache River, has produced little information other than that gained from surface survey and some testing (Schiffer and House 1975). No mounds are known. Hamlet satellites to villages are common and scattered linearly along the terraces bordering the Cache River floodplain. Ceramics and points are similar to other middle period sites in Arkansas and Missouri. Further south and east is the Cherry Valley phase which is known only from charnel house mounds on and adjacent to both sides of Crowley's Ridge (Perino 1967a). This phase does not appear to be the burial mound component for the Wilson phase but this has to be treated as a possibility. The burial ceramics are distinctive and include beakers. Cherry Valley may date slightly earlier than other neighboring middle period phases.

Late Mississippian (Climax**): A.D. 1400 - 1550

Around A.D. 1350 or so, occupation abruptly terminated for the Powers phase and for much of the Lawhorn phase north of Marked Tree and for the Wilson and Cherry Valley phases. This phenomenon also occurred in and near the Cairo Lowland (Price and Price 1977: 20). Williams (1977) even goes further and postulates that the central area of Mississippian development is vacated. One hypothesis is the collapse of the chiefdom system just before the origin of state organization (Wright 1977). At the same time that these regions in Missouri and Arkansas were abruptly depopulated, the extreme northeast corner of Arkansas, the St. Francis River downriver from Marked Tree, and the area around Batesville on the White River floodplain experience sudden population increases. Two patterns seem apparent. First, considerable consolidation of sites and behavior took place and, in fact, less land is being used to support more people. Second, there was a significant southward shift of population centers for all three phases at almost the same time. The Walls phase south of Memphis located on both sides of the Mississippi River may have fragmented from the Nodena phase or may be descendant from the Pemiscot Bayou phase, in turn descendant from the earlier Hayti phase. Nodena seems to be the paramount phase and exercised control of a portion of the Mississipi River. Walls phase may well have been vassal to the Nodena phase, if one interpretation (Morse 1969a) of the DeSoto accounts is valid.

The Parkin phase was centered more around Parkin than Marked Tree. The Greenbrier phase on the White River, although little investigated, has provided curios for cabinets in large numbers. Just as the Powers phase is similar to the Lawhorn, so Greenbrier is similar in terms of typical artifacts to the Parkin phase. Further to the south, the Kent phase, Parchman phase, and Hushpuckena-Oliver phases have been identified (Phillips 1970:938-942). Phillips discusses these phases although he is "far less enthusiastic" about cumulative graphs used to define them than formerly. The Humber site is an example of the richness of deposits and similarity to the Nodena phase at the southern extent of the northern alluvial valley (Tesar and Fichtner 1974).

In 1541 the DeSoto expedition must have seen the southern half of the northern alluvial valley at its population and developmental peak (Brain, Toth, and Rodriguez-Buckingham 1972). The expedition chroniclers may have been describing the Walls, Parkin, and Nodena phases of northeastern Arkansas when stating "In Aquixo and Casqui and Pacaha they saw the best villages seen up to that time" (Phillips, Ford, and Griffin 1951:356). The most accepted route, however, locates the expedition some 90 km to the south (Brain, Toth, and Rodriguez-Buckingham 1972). Since this expedition transversed the whole of the southeastern United States this statement is, as Phillips, Ford, and Griffin stress, a "pregnant" one. The DeSoto accounts clearly indicate a highly developed chiefdom organization. Interestingly, archeologically the usual trait characteristic of a chiefdom--elaborate status burials (Peebles and Kus 1977)--is lacking as far as we know. The geographical concentration of population is startling, but according to preliminary catchment basin studies of Nodena phase sites, the area immediately surrounding a village is sufficient to account for the agricultural support of the probable population of the village (Vin Steponitis, personal communication). In one case investigated (the Hazel site near Marked Tree) the Parkin phase reoccupied a Lawhorn phase site with apparent temporal discontinuity and leveled the older site before new construction took place.

Late Mississippian (Proto-historic Mississippian Decline**): A.D. 1550 - 1686

Possibly as early as A.D. 1500-1550, Mississippian society succumbed to one, or more likely a combination of causes such as European diseases, the aftermath of the DeSoto expedition's depletion of their food surpluses, social-political disruptions caused by the expedition's interference in political matters, a climatic period detrimental for farming, and even a possible critical imbalance between technology and environment. Warfare was characteristic at least during the period of the DeSoto expedition. In any event, Mississippian society underwent a dramatic change. The numerous large villages described by the DeSoto chroniclers were simply not present when Marquette and Jolliet descended the Mississippi River in 1673. The village of Mitchigamea (Thwaites 1890:151-2) was the first observed for a long distance on the river, and the Akansea were 8 to 10 leagues further downstream. These may both have been Quapaw villages (Phillips, Ford, and Griffin 1951:394-398). Goods such as hatchets, knives, and beads were received by these people from both eastern and western sources. These Indians did not yet have guns, although enemies to the South did (Thwaites 1890:155).

Archeological hints exist for this sometimes violent Euro-Indian trade contact, but almost all finds have been made by untrained digging. There is a human effigy pot known from a prominent village of the Greenbrier phase which depicts eye glasses (AAS files) and historic artifacts are reported from sites which could date to this period (Morse 1969a). Sites dating to between about A.D. 1700 and 1800 are very rare. One site which may post-date 1698 is located near Blytheville (Morse 1971d). During the last quarter of the 17th century French accounts described the Quapaw villages which were in existence at and near the mouth of the Arkansas River. During this period, a smallpox epidemic caused two villages to be abandoned and the resultant lesser population recombined into a new village which appears to have also included a third village (Phillips, Ford, and Griffin 1951:413). This apparently occurred within a decade. Realizing that the Delaware and other groups are purely an historical recombination of earlier societies, it is tempting to view the Quapaw as a purely historical recombination of major earlier phases which had been disrupted in various ways by historical intrusion by the Spanish. The Caborn-Welborn phase near the Ohio River has been interpreted as a site intrusion possibility from northeast Arkansas at this approximate time (S. Williams 1977). The description by the French of trade goods and chickens and peaches indicates the distinct possibility that the Quapaw location near the mouth of the Arkansas River is related to the access to European goods. Already, the Indians of the alluvial valley seem to have shifted toward an economic dependence upon the European intruders, both French and Spanish.

French-Indian: A.D. 1686 - 1803

With the establishment of Arkansas Post in 1686, trade with the Indians was a permanent phenomena. Trappers and traders were prominent and mostly French. French settlements in the northern part of the valley consist of tight clusters of fields and houses. Additional detail in particular portions of the northern part of the alluvial valley are in Price and Price (1975); Price and Price (1977); and, Price, Price, and Harris (1976).

Machinations of the French, Spanish, British, and later the United States caused great disruption in the location of Indian groups. Many Kaskaskia moved down to Arkansas Post in 1775 (Faye 1945:94). In 1786, 200 Delaware warriors conducted their winter hunt on the St. Francis River, trading with Arkansas Post (then Fort Carlos III) (Faye 1945). They soon settled on the White River, welcomed by the remaining Quapaw. American traders illegally occupied the third Chickasaw Bluff (Memphis) and attracted trade from Louisiana Territory.

In Missouri, occupation by the French on the western side of the Mississippi was sparse in the 18th century. In 1760, only one permanent settlement was established in Missouri and no one settled the Missouri interior until 1790, when mines were exploited (Gerlach 1976:10). The French settled along river and creek bottoms, whereas Americans preferred uplands (Gerlach 1976:17).

The Delaware and Shawnee occupied land near Cape Girardeau in 1793 and were soon scattered in villages in southeast Missouri. Two villages were located near Jonesboro. In 1775, Cherokees were already occupying Louisiana Territory and in 1795 were on the St. Francis River (Starr 1921:38; Lankford 1977). An unknown number of these Indians became amalgamated within the Euro-American pioneer society.

The Cherokee moved from the St. Francis River area after the New Madrid earthquake in 1811-1812 to a new location between the Arkansas and White Rivers. They held no legal title to land there until 1817 (Starr 1921:39). At that time Cherokees were permitted to trade land in Arkansas for that to the east; they were finally moved out of Arkansas in 1828.

Euro-American Pioneer: A.D. 1803-1836

Between the time of the Louisiana Purchase and the statehood of Arkansas there was a period of pioneer homesteading. The time period is a central, restrictive one. Pioneer settlement probably occurred slightly earlier in Missouri (1790 according to Price and Price 1977: 26). Bounty warrants given after the war of 1812 encouraged settlement and two kinds of settlement patterns were developed. One was the "Shelbyville Square" town plan (Smith and Davidson 1973). There was a central public square with equal-sized blocks oriented around the center. The other type was a dispersed neighborhood series of fields either contiguous or separated, each with one or more structures within the clearing. Each family lived within its clearing and was relatively self-sufficient although, luckily for archeologists, they used distinctive imported English ceramics. This period is receiving considerable research emphasis within the northern alluvial valley and adjacent uplands (see Chapter 26).

American Settlement: A.D. 1836-1890

After Arkansas statehood and until the coming of the railroad, the northern valley was characterized by the arrival of larger numbers of people, many of whom claimed to be initial settlers thus creating a documentary break with the actual pioneers. This is the Victorian-factory period of the Industrial East and while there are homesteaders in neighborhoods, increasingly the wage worker-executive division widens and more specialists appear while manufactured goods over-balance home grown and made goods. This period may be divided into pre-Civil War (or mid-19th century) and post-Civil War (or late 19th century), with 1860 the approximate dividing year.

Railroad--Land Drainage: A.D. 1890-1940

With the railroads came land clearing for lumber and the harvest of ducks which were packed in ice for eastern resturants. This was followed by land draining for agriculture which increasingly opened acreage for intensive exploitation. A pattern of local hunting and fishing continued with new conflicts created by increasing governmental control, such as arrests for federal wildlife refuge poaching, out of season hunting or use of the illegal log net, all traditional 19th century practices. This is the major period of the large plantation. Increasing settlement in 80-acre tracts away from plantation areas took place after World War I.

Contemporary: A.D. 1940:

A profusion of plastics and broken pop bottles makes the archeology of this period relatively uninviting. Specialized knowledge of a large variety of artifacts is necessary. Little research has been accomplished except for recording sites in intensive surveys.

Remarks

The approximately 50,000 km^2 making up the northern Mississippi Alluvial Valley constitutes a major study region. To that end, the Central Lowland Archeological Seminar and Society (CLASS), made up of investigators active in the study of this part of the eastern United States, was formed as an informal research group in February, 1975. All of these people have been given a chance to participate in the Zebree Archeological Project on whatever level they thought appropriate in terms of their research interests and time. All have been kept up to date on events leading up to and following the excavation of the Zebree site and many took advantage of a CLASS meeting at the site during excavations. All have been sent a copy of this (and other) chapters and many have commented upon them. In some cases, comments are incorporated in the chapters. No one individual investigates, much less writes the archeology of such a vast region. I hope that this is clearly understood by any who read these pages.

CHAPTER 2

HISTORY OF THE INVESTIGATIONS

David G. Anderson

There were four periods of excavation at Zebree, one each in 1968, 1969, 1975, and 1976. The first season, in 1968, consisted of two test pits to determine the archeological significance and potential of the site to provide a basis for planning future excavations. The next two seasons, in 1969 and 1975, were large scale excavations directed towards maximum information recovery. Both were thought at the time to be terminal excavations, the last the site would see before destruction, and were conducted accordingly. The final field operation at Zebree took place in 1976, immediately prior to and while the site was being destroyed, and was purely salvage in orientation--the recovery by any means of information that would otherwise be irretrievably lost.

Discovery of the Site

The Arkansas Archeological Survey was created in 1967 with the passage of Act 39 by the State legislature (McGimsey 1972:66). The enabling legislation included provisions for the establishment of research stations at state supported universities and colleges. Three stations were established during the first year of the Survey's operations, and Dr. Dan F. Morse was hired to fill the position of Survey Archeologist at Arkansas State University in Jonesboro. Almost immediately he became involved in a wide range of salvage operations, necessitated by the tremendous amount of site destruction ongoing in the area (e.g., Medford 1972). In October, 1967, a local collector, Rufus W. Lyerly, Jr. of Jonesboro, told Morse about several sites endangered by planned ditching operations near the Big Lake National Wildlife Refuge in Mississippi County (Fig. 2-1).

On October 21, 1967, Morse and Lyerly visited the Big Lake area, and one of three sites that they examined was Zebree. Although the site was densely overgrown, a number of potholes were apparent, and a collection of artifacts (mostly sherds) was obtained from the backdirt piles. Several of the potholes were at the north end of the site and there was a large pothole to the south on a low rise that Morse felt may have been a prehistoric house mound. Zebree and a neighboring site at Buckeye Landing were recorded in the Survey site files at this time as 3MS20 and 3MS19.

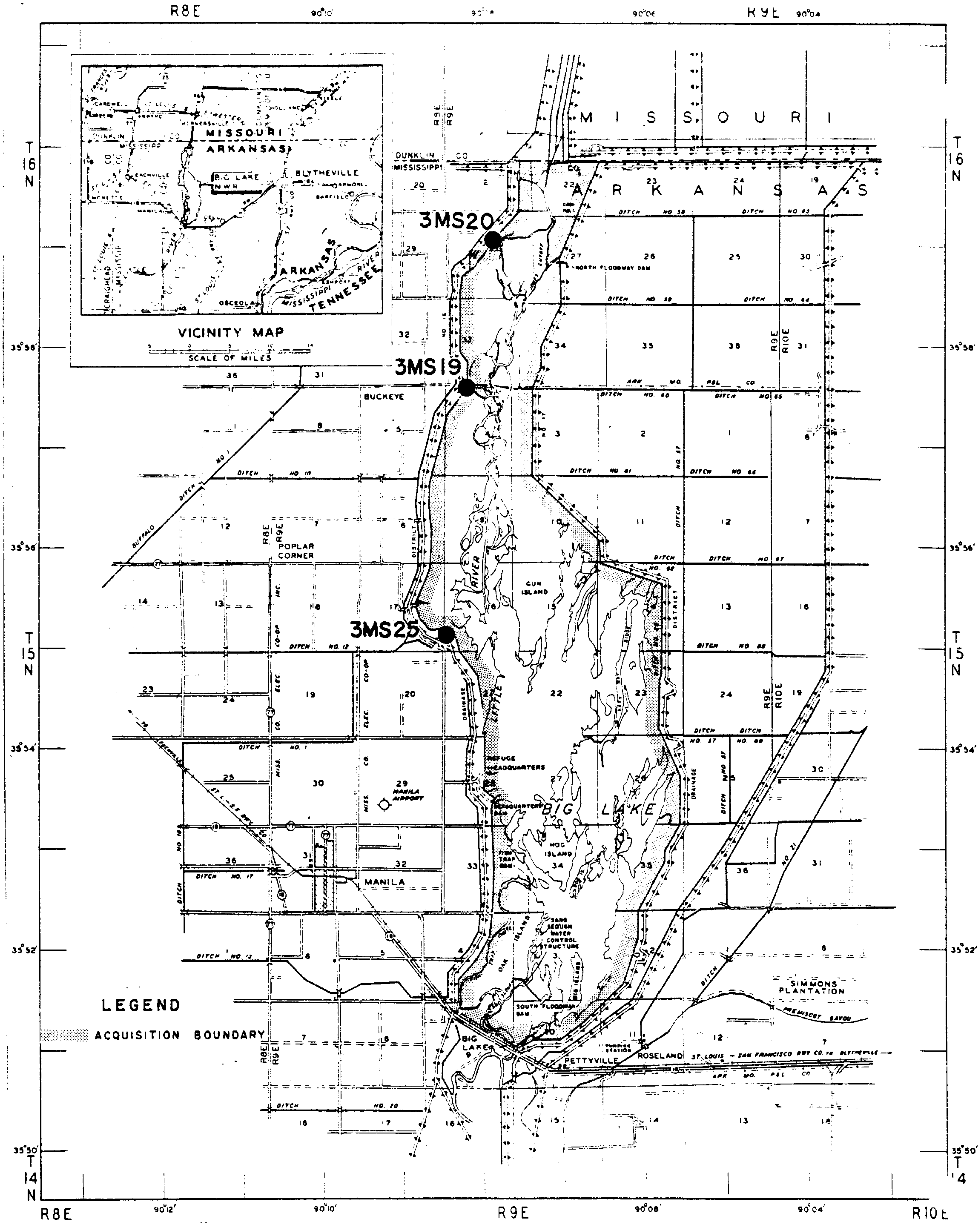

Figure 2-1. Big Lake National Wildlife Refuge.

The artifacts recovered from the surface of the site included sand-tempered Barnes Cord Marked (Williams 1954:204) and shell-tempered plain and red filmed sherds, and formed an assemblage previously unreported for northeast Arkansas. By a rather unusual coincidence, Morse was at the 24th Southeastern Archaeological Conference in Macon three weeks after visiting Zebree, and at the meeting Richard A. Marshall described some of the artifacts associated with sites he had been excavating near Hayti, Missouri, some 40 miles to the northeast (Marshall 1965, 1967). The ceramics reported were virtually identical to those found at Zebree and Buckeye Landing. Near Hayti the assemblage was considered to be early Mississippi in age. The Big Lake assemblages, if related, represented the earliest probable Mississippian materials known for northeast Arkansas.

On November 18, Morse and Lyerly revisited Buckeye Landing (3MS19) and a third site, previously unreported, that was located on land owned by the Manila School District. Several potholes were in evidence, and apparent Hayti phase artifacts were noted in the spoil dirt. Morse cleaned up one of the larger potholes, revealing the remains of an extended burial, and recovered a small slate celt. This site was reported as 3MS25, and was named Rice Landing.

All three sites (3MS19, 3MS20, and 3MS25) appeared to contain early Mississippian Hayti phase artifacts, and all were threatened with complete or partial destruction if a proposed ditching project was undertaken in the area. In late November, Morse wrote the Manila School District asking permission to test 3MS25 if necessary. At the same time he wrote the manager of the Big Lake National Wildlife Refuge, asking about the proposed ditching operations, and to obtain permission to map the two sites (3MS19, 3MS20) that were on federal (Refuge) property.

Through the cooperation of Bobby Brown, the manager of the Refuge, in December permission was obtained to map the Zebree and Buckeye Landing sites. Mr. Brown also saw to it that these sites were posted, to help deter future pothunting activities. Permission to test 3MS25 was also obtained about the same time from the Manila School Superintendent's office. On January 18, 1968, Morse and Lyerly revisited Zebree, accompanied by John Ellis, the refuge game warden. The site was extremely overgrown in spite of the cold weather (Fig. 2-2), and it was possible to produce only a rough sketch map of it at that time.

Although ditching was planned, little certainty existed as to the nature of the project or when it would be carried out. In January 1968, the State Archeologist, Hester Davis, contacted the Memphis District Office of the Army Corps of Engineers, asking for details on the project, and appraising them of the existence of

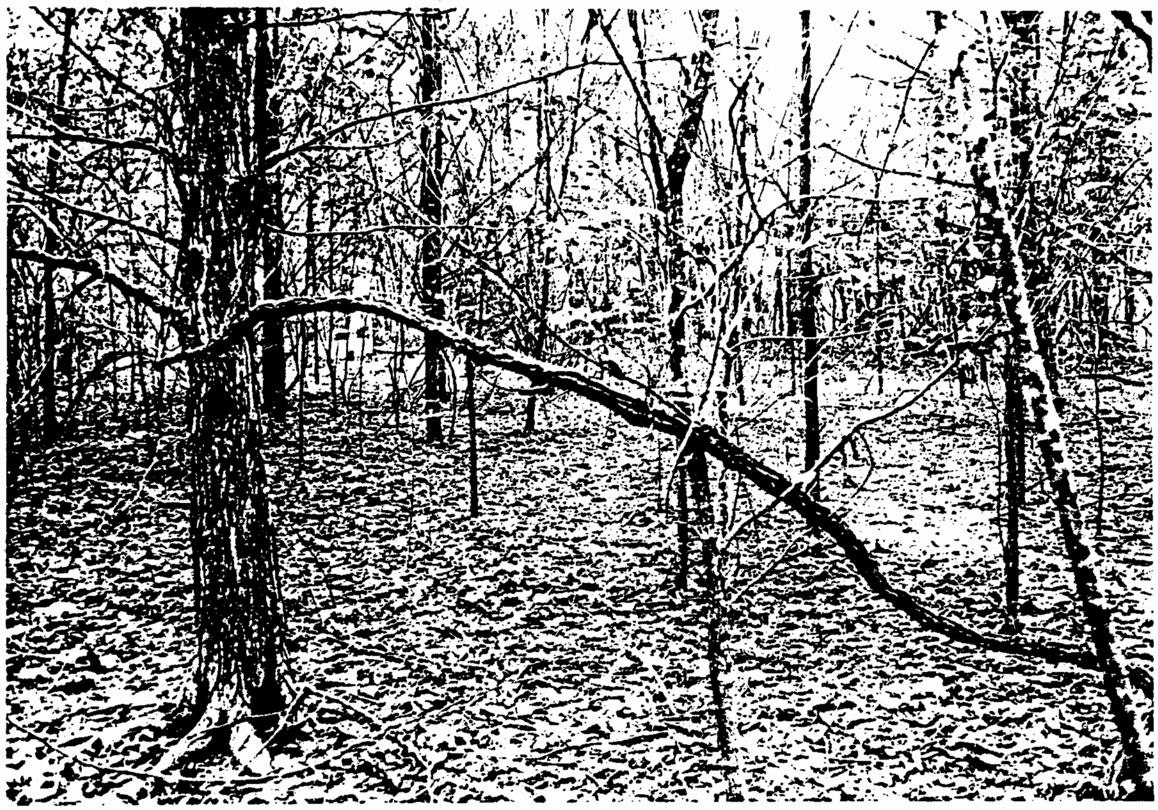

Figure 2.2. Area B in 1968, prior to the start of the initial testing operations. A crew member is standing in the background (slightly to the left of center), by the location of Test Pit 1. (Negative 682977).

three archeological sites in the probable impact zone. Plans delimiting the area of construction were sent to the State Archeologist's office in early February. Although uncertain as to when the ditching would actually begin, a completion deadline of "no later than calendar year 1972" was indicated (Michaels, letter to Hester Davis, 2 February 1968).

Since site destruction seemed inevitable, the Survey decided to initiate salvage operations. A testing program was considered essential to assess the archeological significance of each site, and for planning subsequent full-scale salvage operations. A formal proposal delimiting the purpose, methods, and requirements of a testing program was prepared, and was submitted to the Department of the Interior on April 24, 1968 (Morse and McGimsey 1968). Under the terms of this proposal the Arkansas Archeological Survey agreed to fund the entire cost of the operation. The proposal was accepted, and on June 14 an Antiquities permit sanctioning the testing was issued, under the provisions of the Antiquities Act of 1906. The actual field operations occurred from August 5 through 30, under the direction of Morse.

The early Mississippian character of the sites was recognized, and both the cultural-historical and processual research potential of the situation was delimited. In particular it was noted:

> These sites are important for understanding the history of this immediate area, for interpreting the chain of events and forces involved in the Mississippi Valley at this time and their effects on the remainder of the Eastern United States in the next few centuries, and for gathering information on the process of acculturation from one culture to another (Morse and McGimsey 1968:1-2).

The sites, in 1968, represented the only distinct early Mississippian occupation known in Arkansas, and were regarded as reflecting the initial spread of the complex into the region from the north.

The 1968 Test Excavations

A total of 18½ days were spent in the field during 1968 with 2½ days lost to rain. Testing occupied six days at 3MS25, four and a half at 3MS19, and eight days at Zebree, the last site examined. (A summary of the field procedures employed during this and subsequent seasons at the site is in Chapter 5.)

Rice Landing

At Rice Landing (3MS25) five test pits were opened, only two of which produced subplowzone features in the form of deep pits. A large number of sand- and shell-tempered sherds were recovered, together with animal bone, sherd abraders, a single point and a few flakes of local chert, a bone gouge, two ceramic bottle stoppers, a polishing pebble, and several miscellaneous items. The site deposits were extensively disturbed by recent historic activity, including the construction and later removal of a levee, the placement of several buildings in the area earlier in the century, and the depredations of a number of recent pothunters. Where prehistoric artifacts were found, however, they resembled those found at Zebree and on the Hayti phase sites to the northeast.

Buckeye Landing

The second week of the testing operation was spent at 3MS19, the Buckeye Landing site. Two test pits were opened, and subplowzone features were found in each, although few artifactual remains were encountered. Both sand- and shell-tempered ceramics were recovered, including fragments of at least two hooded bottles, and again a close similarity with the Hayti phase materials was evident. At both the Rice Landing and Buckeye Landing sites, Barnes Cord Marked, Varney Red Filmed, and Neeley's Ferry Plain were the predominant ceramics recovered, with only incidental occurrences of other wares observed. Buckeye Landing, like Rice Landing, had been under cultivation for a number of years, and had also had historic buildings on it dating from earlier in the century. At both sites the deposits were relatively shallow and devoid of artifacts, or else had been largely removed by past historic activity.

Zebree

The Zebree site covers approximately 1.24 hectares, approximately one acre of which was destroyed in the 1920s by the construction of a drainage ditch along the western edge of the site. A 0.1 meter contour map of the site indicates that the ditch (or other water source prior to the ditch) must have overflowed at times across the site toward the abandoned channel of Little River which borders the site (a swampy area now) on the east. This caused an east-west stretch of the southcentral part of the site to become badly eroded, leaving high areas on either side as two erosional remnants. The northern section is called Area A, and the southern Area B. The whole site when discovered, was covered by jungle-like secondary growth.

A total of eight days were spent at Zebree, and the fieldwork consisted of the excavation of two test pits intuitively placed on the two high areas within the site, to the south and west (Fig. 2-3).

A rich material assemblage was recovered from the test pits. Except for the early historic occupation detected only during the final salvage in 1976, all major site components were recognized by this test. Late Woodland and early Mississippian artifacts were noted in both units, and evidence for a slightly later middle Mississippian occupation was noted in Test Pit 2. Test Pit 1 produced a meter of stratified deposits, with pure late Woodland (Barnes) materials separated from early Mississippi midden by a distinctive and relatively artifact-free layer. Evidence for a comparatively recent historic occupation was noted in the upper 20 cm of the deposits in this pit, and was interpreted as reflecting the late 19th-early 20th century Sebree homestead occupation. Later investigations did, in fact, demonstrate this to have been the location of the house structure. Both pits exposed complex patterns of features. In the base of one of the features in Test Pit 2, several microlithic tools and cores were found, associated with fragments of both worked and unworked conch and mussel shell. Two reconstructable Barnes vessels were found in the Test Pit 1. A total of 15 features and 14 postmolds, were found in both units.

The results of the 1968 testing operations near Big Lake were summarized in a report submitted to the Department of the Interior in November of that year (Morse 1968). Included in that report were general descriptions of excavation procedures, site artifact and feature contents, evaluations of significance, and recommendations for future salvage operations. Detailed analysis and description was deferred in the anticipation that more extensive work would be undertaken on each site, giving a more viable interpretive perspective. The similarity of the early Mississippian material to Marshall's (1965, 1967) Hayti phase materials in Missouri was recognized. A separate Big Lake phase was proposed, however, for the early Mississippian occupations at the three sites tested (Morse 1968:20).

The additional work recommended was:

> Three weeks work each at 3MS25 and 3MS19 should be sufficient to provide an adequate sample of the material which remains at these two sites. The importance and potential of the Zebree site (3MS20) is such that intensive, prolonged excavation there is highly recommended. In order to recover the data which remains, two 3-month field seasons might well be necessary, with a crew of

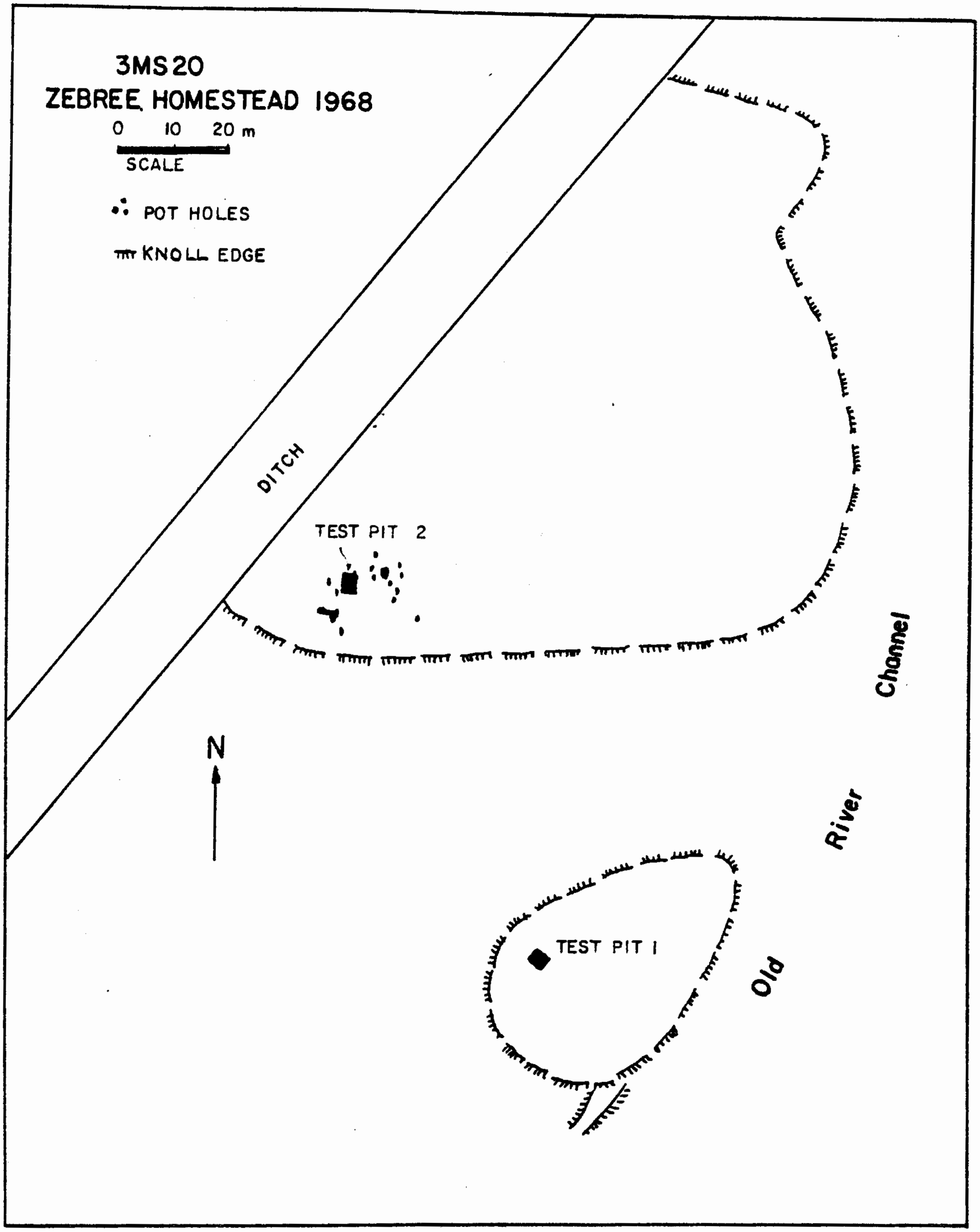

Figure 2-3. Zebree as conceived in 1968. Dense underbrush precluded the development of a detailed site map at this time (after Morse 1968:13).

> at least 10, plus others for processing the large quantity of material which will be recovered. The importance of salvaging the information contained in this site cannot be stressed too greatly (Morse 1968:21).

The emphasis on additional work at Zebree reflected that site's rich and stratigraphically distinct late Woodland and early Mississippian components. Further excavations at the site could:

> . . . provide valuable if not unique information on (1) the end of the Woodland occupation in the area, (2) an initial acculturation to Mississippian, and (3) a stronger and possibly more direct relationship to a major center of Mississippian development, the Cahokia site near St. Louis (Morse 1968:16).

The use of flotation and the collection of pollen samples was recommended, to help probe the relationship of agriculture to the spread of Mississippian. The uses to which particular features or artifact classes were put by the site occupants were also suggested as problem areas to consider in future investigations.

The Big Lake Sites in Perspective

The investigations near Big Lake in 1967 and 1968 were only a small part of the research, survey, and testing activity ongoing in northeast Arkansas at that time. One of Morse's primary research plans upon arriving in northeast Arkansas was to record as many sites as possible and to obtain collections from as wide a spatial and temporal span as possible. The purpose of this activity was to provide some measure of control in subsequent interpretations of prehistoric occupation in the general area (Morse 1969a). Previous research (Chapter 1) had tended to focus on the later Mississippian occupations, with their prominent mound groups, and a real need existed to determine the nature of both earlier and more prosaic assemblages. Accordingly, at almost every opportunity fieldwork, largely of a salvage nature, was undertaken during this period. During the same months that the initial reconnaissance near Big Lake was undertaken, the late fall and winter of 1967-1968, Morse was also involved in an extended salvage operation of another early Mississippi complex near Weona, where a series of knolls on the Hyneman property were being leveled. The testing of 3MS19 at Big Lake was even interrupted for one day to permit the salvage of some information from the leveling of the large pyramidal mound at the Hazel site (Morse 1973b).

The results of the 1968 testing were used to help plan later excavations. At the same time, the information recovered from the Big Lake sites was incorporated, in conjunction with information from other sites in the vicinity into tentative models about the emergence of Mississippian in the area (Morse 1969a). In late 1968 Morse (1969a) completed a summary of northeast Arkansas prehistory, as it was viewed on the basis of information collected to that date. Late Woodland sites were noted as common in the region, in contrast to an extreme dearth of early and middle Woodland sites. The occurrence of sand-tempered (Barnes) and grog-tempered (Baytown) ceramics on many sites was noted.

At least three phases of initial Mississippian were recognized in northeast Arkansas at this time, all the result of work during the previous two years (Morse 1969a:20-22). One site near Newport along the White River (3JA16) was designated as the Adams phase, two sites near Weona along a remnant of a former Mississippi River channel were put into the Hyneman phase, and five sites along the Little River (including the three tested in 1968) were placed in the Big Lake phase. All three early Mississippian phases were tentatively dated to between AD 900 and 1100, and a close cultural relationship with the late Woodland complexes in the same areas was inferred. Rapid changes in ceramics and possibly cooking and subsistence patterns were indicated, although burial and hunting patterns appeared to be relatively stable, continuing the Woodland tradition. The Hyneman phase sites were recognized as similar to those near Big Lake, and both phases were recognized as similar to the Hayti phase in southeastern Missouri (Marshall 1965). The Adams phase materials were considerably different, resembling more a developed Baytown, with little shell tempering evident, and a mostly plain or cord marked grog-tempered ceramic assemblage.

The Big Lake phase sites in late 1968 were being viewed as part of a larger pattern of emerging Mississippian in the central Mississippi Valley. A primary research concern was that of tying down local (northeast Arkansas/southeast Missouri) manifestations of this emergence. Rapid acculturation rather than direct colonization was suggested as a probable mechanism, although a definite change in settlement pattern and subsistence economy was indicated (Morse 1969a:22). A clear sense of problem orientation regarding the origins of Mississippian in the area had, however, developed by late 1968. It was suggested that research efforts focus not only on the known initial Mississippian sites, but also on some of the larger, later sites for evidence of earlier occupations and for change over time (Morse 1969a:21).

The 1969 Excavations

In April, 1969, a formal proposal was submitted to the National Park Service for extensive salvage operations at the Zebree site (Morse and McGimsey 1969). Although all three of the Big Lake phase sites tested the year before were regarded as containing significant information, attention focused on Zebree because of the unusual nature of the deposits and artifacts found there. Funding was requested for eight weeks of fieldwork by an archeologist and a crew of seven, and for a similar period of laboratory processing by a crew of three. The level of the operations was considerably below that originally suggested by Morse. In retrospect, Morse's call for at least two three-month field seasons at Zebree after the completion of the 1968 testing (Morse 1968:21) appears to have been an accurate, if not somewhat conservative appraisal of needed research. At the time of the planning for the 1969 excavations, however, proposing and implementing such an effort on the basis of only two test pits was more or less untenable. It was also assumed that if important discoveries were made during the field operations, then additional excavations at the site might be possible.

The major goal of the 1969 excavation was to recover as much information about the site and its contents as possible. Under the terms of the Antiquities Act permit, the proposal submitted to the National Park Service indicated this goal, as well as enumerating provision for the processing, analysis, and storage of the artifacts and other remains encountered. Two conditions of the proposal were that a preliminary report of the excavations findings was to be submitted within six weeks of leaving the field, with a final report due one year after the completion of fieldwork.

Planning for the excavation proceeded during the spring of 1969, both up to and after the submission of the proposal at the end of April. Equipment was assembled and a crew hired, and provisions made for camping on the site. The proposal was quickly reviewed, and the budget, for $8,900, accepted. Towards the end of May, 1969, Bobby Brown, the Manager of the Big Lake National Wildlife Refuge, had a crew open up a field road through the woods on the eastern side of the ditch. This road, connecting with a logging bridge across the ditch a mile and a half below the site, permitted the transportation of heavy equipment and supplies right to the site.

Trees and underbrush were cleared away from Areas A and B, and a campsite was established between them close to Area B at the south end of the site. Both cleared and surrounding areas were periodically sprayed with insecticide to reduce the numbers of gnats and mosquitos. A boat was kept at the site, and provided the only sure access for much of the dig, when the road was flooded or choked with mud. A well was established and a gas generator was set up to provide for fans, lights, and other amenities.

On June 11, an Antiquities Permit sanctioning the excavations was issued, and actual fieldwork began on the 16th. A total of nine weeks were spent in excavation, from June 16 to August 16. The crew consisted of Morse, a field assistant, and from four to eight laborers, usually averaging five. Two large block units, intuitively placed on the high areas, were excavated (Figs. 2.4 and 2.5). Scattered test pits and auger holes were also employed, in an effort to delimit the site boundaries. By the end of the excavation period, Morse had interpreted Zebree as the major site for the Big Lake phase (Morse 1969:1).

As in most archeological excavations, trees and backdirt piles occasionally were located over areas it became important to examine. The second week of the excavation there was a bad rain and hail storm. Little time was actually lost due to rain (since it was made up on weekends), but the damp weather made screening operations difficult. When the river and ditch water levels rose the water table was reached in a number of units while still in artifact-rich deposits, and these units had to either dry or the muck was pressed through the screen. Temperatures were generally over 90° during the daytime, and for one nine day stretch were over 100°. Humidity was near 90% during the daytime, and the stadia rod warped, cloth bags rotted, and mildew was universal. The last three weeks the weather was pleasant, but the excavations were finally closed down in mid August when Hurricane Camille came upriver and the resulting rain completely flooded the site.

In spite of these problems, crew morale was good, a great deal of work was accomplished. The laboratory crew in Jonesboro was so effective that by the close of the excavations all but the last two weeks of materials had been washed, cataloged, and temporarily stored. In all, a total of 153 features were recorded, including over 100 pits, 8 human and 2 dog burials, all or parts of 8 structures, several natural disturbances, and a number of concentrations of lithic, ceramic, and shell artifacts.

The 1969 Zebree excavations were not the only field activity conducted in northeast Arkansas that year. Two weeks prior to the start of the Zebree dig, Morse (1970) had spent several days recovering fragments of a mastodon and tapir that had been exposed by drainage ditch construction near Weona. Less than three days after the close of the Zebree dig, Morse found himself involved in nine days of

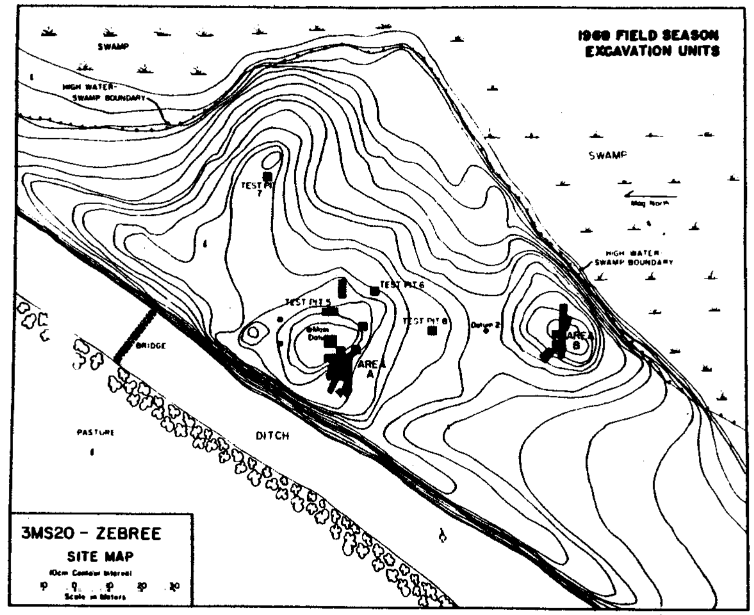

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Figure 2-4. The 1969 excavation units and site map. The full extent of the site was still not completely recognized, with the solotary test to the northeast thought to be at the periphery.

Figure 2-5. Beginning block unit excavations, Area A, June, 1969. (Negative 692365)

emergency salvage at the Floodway site (3PO46) near Marked Tree, a multiacre site with six mounds, all of which were leveled. In addition, the University of Arkansas field school was being conducted at the Hazel site (3PO6), a major Mississippian mound group bisected by the construction of Arkansas Route 308 later that year. The six week field school and subsequent four week Survey and Highway Department-sponsored salvage overlapped the Zebree and Floodway excavations. In addition, the Arkansas Archeological Society's annual training program was held at Hazel, in an effort to maximize information from the areas soon to be destroyed (Davis 1973). When the actual highway construction at Hazel began in late October, 1969, Morse spent 11 straight days at the site mapping and removing features as they were exposed by the heavy machinery (Morse and Smith 1973). All of this work accomplished during the 1969 season was directly relevant to the Zebree investigation, besides demonstrating the increased pace of site destruction in northeast Arkansas. The megafauna discovery allowed better temporal control on environment. The Hazel and Floodway excavations allowed for a firmer classification of Mississippian and emphasized the uniqueness of Zebree.

Analysis of the 1969 Excavations

Once out of the field processing continued and by the end of 1969 all washing, cataloging, and permanent storage had been completed. A 26 page preliminary report outlining the 1969 excavations was completed by late September and submitted to the Park Service in accordance with the terms of the Antiquity Act permit. In this report a number of preliminary conclusions about the site and its importance were put forth, indicating an elaboration of and in some cases a shift in former views. In particular, the similarities with Cahokia were emphasized, notably the microlithic tool industry and the presence of bone harpoons. The absence of Ramey Incised pottery was taken to imply a pre-1100 time-depth, and similarities with the AD 900-1100 materials at Cahokia were noted (Morse 1969b:21-24).

Perhaps the most significant result of the excavations was the light shed on the relationship of the late Woodland to the early Mississippian occupations. In Area B, a deep ditch or borrow pit had been excavated by the initial Mississippian occupants, and the fill thrown over a rich late Woodland (Barnes) midden. No early Mississippian artifacts (other than in obvious disturbances) were recovered in the capped deposits, and Mississippian artifacts were found immediately above and on the cap in large quantities. In Morse's words:

> Rather than a gradual shift in artifacts, the stratigraphy clearly revealed a sudden change from Woodland to Mississippi. We are able to infer two different peoples rather than one people changing their culture. In addition, we can contrast two cultural stages which are temporally close (Morse 1969b:22).

The delimitation of this stratigraphic/temporal relationship and the implications that arise from it are of considerable importance, for they run directly counter to the notion that a relatively gradual change occurred between late Woodland and early Mississippian in the immediate area. Previous interpretations of the Barnes/Big Lake or Barnes/Hayti interactions, as proposed by Morse (1968), Marshall (1965, 1967), and others for the Woodland/Mississippi transition in the region in general, had viewed the process as gradual, involving acculturation rather than colonization or direct replacement of groups. At the least, the Zebree evidence suggested that interpretations of gradual cultural change based on sherd frequencies in mixed deposits needed to be re-examined.

The discovery of large numbers of Varney pan fragments in the deposits suggested the possibility of on-site salt manufacture as something to test for, following the work of Keslin (1964), and the relationship of the microliths and shell beads was suggested as another potentially fruitful area (Morse 1969b:24). Soil samples were prepared for flotation. Additionally, shell and animal bone was separated and planned analyses included species identification and butchering techniques, with a view towards environmental and subsistence reconstruction. Examination of the shellfish was specifically oriented towards determining the nature of the Little River environment at the time of prehistoric occupation (Morse 1976b: 7), although specific hypotheses about the possible nature of this environment remained unstated. Finally, sources of lithic raw materials were tentatively proposed as well as possible mechanisms by which they could have been brought onto the site. In particular, cherts noted from Illinois and Cahokia (Mill Creek and Dupo or Crescent Quarry) were recognized at Zebree, and long distance trade in salt, shell beads, and lithic raw materials suggested as a possible avenue for future research (Morse 1969b:23).

The amount of material recovered during the 1969 Zebree excavations was far greater than had been anticipated, and preparation of the final report took four years. Processing, analyses of various kinds, and extensive writing and rewriting occurred, and in addition the ordinary demands of maintaining the Survey station continued. Almost all of the faunal remains recovered in the excavation were sent to John Guilday and Paul Parmalee, of the Carnegie Museum and the Illinois State Museum, respectively, for identification (Guilday and Parmalee 1975). Their analysis, the results of which were in hand by September of 1970, indicated a strong aquatic orientation of site subsistence patterns. Additionally, remains of prairie chicken and the 13-lined ground squirrel were identified, indicating the existence of an open, prairie environment and the exploitation of the same, somewhere near the site (Guilday and Parmalee 1971).

Processing and artifact analysis continued during 1970, and early in the year two probable additional houses were "discovered" in the 1969 block units when individual artifacts were plotted by depth. While a tentative draft of the site artifact assemblage was largely completed by mid-summer, this early formulation was extensively revised due to subsequent analyses. Once initial inspection gave way to extended examination, the site assemblage was found to be far more complex than initially suspected. The microlithic tool industry was found to be complex and diversified, and attention focused on both replication of the manufacturing technology and the uses to which the finished tools were put (Morse 1975b:124-145). Morse and Bobby Brown, the Refuge Manager, collected samples of American lotus (*Nelumbo lutea*) from the waters of Big Lake during the summer and Chester North, Morse's lab assistant, ran atomic absorption tests on the ashes, after burning, to test for the presence of salt (North 1975). The results of the test supported the possibility of prehistoric salt manufacture at Zebree by means of the burning and leaching of lake plants, and additionally prompted investigation of the pan and funnel vessel forms for their possible role in such a process.

One of the more significant events influencing the ongoing analysis of the Zebree assemblage was the re-evaluation of the origin of the Big Lake and St. Francis sunk lands (Saucier 1970). Partially influenced by the strong aquatic orientation indicated at Zebree, Saucier advanced the hypothesis that the formation of these low areas may have occurred a thousand or more years ago and not, as generally assumed (by Fuller 1912), during the New Madrid earthquake of 1811-1812. The presence of a lake environment along sections of the Little River during early Mississippian or earlier Woodland times may have provided additional incentive to settlement, over and above those offered by the more prosaic riverine/backswamp resources common along streams in the area. Attempts to test this "Big Lake formation hypothesis," as it came to be called, through the examination of site shellfish, were frustrated for a variety of reasons. Through examination and specific identification of shell fish recovered in dated archeological deposits it was hoped that the nature of the aquatic environment exploited by the site's occupants might be determined. Finding a specialist on freshwater shellfish of the general Arkansas region proved difficult, although the effort was initiated in 1970.

Analysis and writing continued through 1971 and 1972, and by spring of 1973 the manuscript was completed and sent to the Survey Coordinating Office for editing and publication preparation. The intervening years between the 1969 excavation and the completion of the manuscript were busy, with several projects other than Zebree ongoing. For a while after the 1969 dig, the possibility of a later season at the site was discussed, and Morse developed plans for the use of heavy equipment (a backhoe or bulldozer) to delimit the palisade ditch and locate features. These plans were abandoned when it became apparent that additional funding would not be immediately forthcoming. Morse continued to maintain close contact with Bobby Brown, however, keeping him posted about the analysis, and in turn Brown relayed what information he knew about the planned ditching, as well as detailed environmental data concerning the wildlife refuge itself. In addition, Brown began to enlist local support to help preserve the site.

Field Activity During Zebree Analysis

During the summer of 1970, extensive excavations were conducted at the Brand site, a relatively pristine early Archaic Dalton hunting/butchering station (Goodyear 1974), and research on local Dalton assemblages proceeded over the next several years (Morse 1971a, 1971b, 1973a, Morse and Goodyear 1973). Attention also focused on the complete range of Mississippian settlement in the area. This research focused on the Nodena phase (Williams 1954, Phillips 1970:933-934), delimited by a series of mound groups near and along the Mississippi River to the east and southeast of Blytheville. During 1970 and 1971, Morse assembled a detailed history of previous investigations at Nodena phase sites, particularly at Upper Nodena (3MS4) (Morse 1973d). In the same volume he summarized available information on the phase and proposed hypothetical models for settlement patterning, subsistence orientation, and social organization (Morse 1973d). These models were used to structure field and laboratory analyses during later field investigations at Zebree.

Excavations were conducted at the Upper Nodena site from late June through mid-August, 1973, as part of a combined University of Arkansas-Arkansas State University field school. During the same period, the mound at Armorel (3MS23) was tested and a brief reconnaissance of the local area initiated to locate other probable Nodena phase sites (Morse 1973e). The excavations at Upper Nodena were directed towards the testing of the plan of the site Morse had recreated based on Dr. Hampson's field notes from the 1930s (Morse 1973d:66), and towards recovering information related to house size and orientation, tool use, and subsistence. The test at Armorel was directed towards determining site stratigraphy, and in particular to see if intact pre-Mississippian Woodland deposits existed below the mound. A lab was established near the site, and methods of artifact processing and analysis under field conditions were developed.

A zooarcheologist was employed, and both flotation and water-screening experiments (with a variety of mesh sizes) were undertaken and then routinely employed.

The following year, extensive excavations were conducted at the Armorel site, again as part of a combined University of Arkansas-Arkansas State University field school. Excavations were conducted on the site during June and July of 1974 with a four-week program of site survey and testing in July (P. Morse 1974). Excavations at Armorel tested, among other things, whether or not the site was Nodena phase, to investigate subsistence preferences, to check possible craft specialization as reflected in lithic materials, to examine kitchen pottery and the manufacturing technology behind it, and to determine whether pre-Mississippian Tchula deposits were intact within the midden (Morse 1974b). In addition a field survey was undertaken to examine Nodena phase settlement pattern, and testing at the Nodena phase Knappenberger mound was undertaken to discover undisturbed middle Mississippi remains (Klinger 1974a).

In addition to generating a tremendous amount of new information on the nature of middle and late Mississippian in northeast Arkansas, the two field seasons of Nodena phase investigation provided the necessary experimental and practical background experience used to set up and run the 1975 Zebree excavation. Many of the field and laboratory procedures quickly initiated at Zebree in 1975 such as concomitant lab and field operations, varied recovery procedures, and specialists handling specific areas of the investigation were all previously developed during the Nodena research.

Zebree analysis was always a consideration during these years, and a considerable amount of both time and energy was devoted to the interpretation of the 1968 and 1969 assemblages. In late July, 1971, the Mid-South Archeological Conference was hosted in Jonesboro, and over 70 people attended, including most of the archeologists working on Mississippian in the central valley at the time. The station collections were examined, particularly the materials from Zebree, and comments on the materials and Morse's interpretations exchanged. Early in January, 1972, Morse tested the Hinklin site in Missouri, where a large Varney jar had been found the year before by a collector. The tests indicated a Mississippian occupation, although probably somewhat later in date than Zebree or the other Big Lake sites known at that time. An average of two to three hundred new sites were recorded in northeast Arkansas each year during the late sixties and early seventies with surface collections or minor testing operations made at a sizable fraction of this total.

Early in 1973, Michael Million became Morse's laboratory assistant and almost immediately began a program of ceramic replication experimentation. Early research along these lines included investigation of the Armorel site kitchen assemblages (Million 1974), and preliminary examination of the Zebree ceramics. Part of the latter research helped to shape Morse's (1975b) descriptive formulation of the Zebree wares. The Zebree manuscript itself remained in Fayetteville for over a year before it was returned late in 1974, for final commentary prior to publication. In the meantime, Morse continued with a detailed examination of the microlith industry found at the site, and specialized papers of the subject were subsequently released (Morse 1974a; Morse and Tesar 1974). Over the same period, Million began ceramic replication experiments on the Zebree assemblage itself. In addition to the Armorel excavation, the Cache River Archeological Project (Schiffer and House 1975) was underway at this time, with extensive field survey and testing in the spring of 1974 and write-up throughout the remainder of the year. During March and April, 1974, Morse spent 32 straight days excavating at the Sloan site, a probable Dalton cemetery discovered during the Cache survey (Morse 1975a).

The final document on the 1969 excavations at Zebree was printed in March of 1975 (Morse 1975b), minus a major interpretive section that had been edited out by the Coordinating Office to make the report descriptive in orientation. This section, dealing with possible mechanisms behind the emergence and spread of Mississippian as viewed from northeast Arkansas was subsequently released elsewhere (Morse 1977b).

Preparation of 1975 Excavation

The excavations that were ultimately undertaken at Zebree in 1975 and again in 1976 were made possible largely through the efforts of Bobby Brown, the Refuge Manager, to preserve the site. Late in 1973, Brown began steps necessary to place the Zebree site on the National Register of Historic Places. By mid-1974, it was becoming apparent that the long-delayed ditching operations at Big Lake, while still in the planning stage, would be initiated at some time in the near future. Accordingly, thoughts began to turn to the possibility of mitigative operations and their requirements. In late 1974 the Corps of Engineers notified the Arkansas Archeological Survey that the proposed ditching had been funded and that the contract for the final ditching would be let in January of 1975 If not for

Brown's nomination (of which the Corps was unaware) little probably could have been done to delay the destruction or at least partially mitigate it. Without the National Register nomination, it is almost certain that the ditching would have occurred with little or no funding or provision for archeological salvage and the additional possibility that archeologists would not have been notified even of the probable final schedule. (The other two Big Lake phase sites in the direct impact zone, 3MS19 and 3MS25 were, in fact, ditched away without any notice to the Survey.) Fortunately, through Brown's foresight, an additional season of work at Zebree was achieved.

The nomination of Zebree to the National Register (which was approved early in 1975) necessitated a re-evaluation by the Army Corps of Engineers of their ditching operations. Under the provisions of the Historic Preservation Act (PL 89-665), particularly Section 106, the Corps were required to

> take into account the effect of the undertaking on any district, site, building structure, or object that is included in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under title II of this Act a reasonable opportunity to comment with regard to such an undertaking (PL 89-665. Sec. 106; in McGimsey 1972:244).

Furthermore, under the provisions of the then-recently passed Archeological and Historic Conservation Act of 1974 (PL 93-291) the Corps had authorization to meet the cost of mitigating the destruction. Accordingly, the Corps immediately suspended planned ditching operations in the vicinity of the Zebree site to provide time for the planning, initiation, and completion of salvage measures. This action occurred in January of 1975, and a period of one year was tentatively set for completion of the mitigation, prior to resuming ditching operations near the site.

Virtually all of the planning and preparation for what resulted in the 1975 season of excavations at Zebree occurred from January through June of that year. During this period, Dan F. Morse was on an official leave-of-absence from the Survey, with the intent of devoting full time to the completion of the report on excavations at the Sloan site conducted the previous year. Phyllis A. Morse assumed responsibility for the running of the Jonesboro station. In actuality, Morse was in his office every day, and much of his leave-of-absence was spent in preparation for the work at Zebree.

The magnitude of this effort and the ensuing fieldwork, laboratory analysis, and write-up, have combined to delay completion of Sloan until after the Zebree project is completed.

Much of January and February, 1975, was spent in estimating the effort needed to mitigate effectively the destruction of the site, in the time allotted (one year). A proposal and budget for $243,794 was prepared, an amount considered adequate for both field and laboratory operations in the time remaining prior to site destruction. This was then discussed informally with the Corps (with whom close contact had been maintained), for their use in meeting the requirements of the Advisory Council on Historic Preservation. During this period, the research and logistical planning was conducted in Jonesboro, while contact with the Corps of Engineers was maintained through Survey headquarters in Fayetteville. Final preparation of Morse's proposal and budgetary estimates, and negotiations with Corps personnel, were undertaken by Hester A. Davis, Arkansas State Archeologist, and Dr. Charles R. McGimsey III, Survey Director, a task requiring innumerable phone calls, letters, and several face-to-face meetings during the first half of 1975.

After the submission of the quarter-million dollar budget, there followed a period of considerable uncertainty. The Corps considered the possibility of by-passing the site (and thus avoiding both destruction and the need for excavation). The size of the proposed budget was also challenged as being beyond the 1% of total project cost limit authorized by the provisions of the Archeological and Historic Conservation Act of 1974 (Sec. 7). One percent of the proposed ditching operations along this particular section of Big Lake was roughly $102,000, and this was the amount the Corps, in April, indicated it would be able to commit. Thus, while under the conditions of the Historic Preservation Act and Executive Order 11593 effective mitigation should have been possible, adoption of the most restrictive interpretation (but hardly the spirit) of the Archeological and Historic Conservation Act by the Washington office of the Corps made necessary less-than-adequate mitigation funding. Faced with the choice of a protracted legal review process before the Advisory Council and possibly elsewhere, or accepting the Corps figure, the Survey felt it had little choice but to accept. Any delays would mean missing the summer excavation period, when both student crew and specialist help would be readily available. Although a final decision on whether or not the site would be ditched had yet to be made, beginning in late April, Survey personnel began replanning and budgeting for operations that would be within the new (lower) dollar figure.

By late May of 1975, a revised budget was completed, conforming to the $102,000 funding limit. On May 27th, at a meeting with Corps personnel in Memphis, the decision to ditch rather than by-pass the site was announced, and a formal request for a suitable mitigation budget issued. The cost of by-passing the site, it had been found, would have been far more than the monies available to mitigate it, and even shifting the ditch channel would not preclude eventual lateral erosion into the deposits. Under the direction of Hester A. Davis, the Arkansas Archeological Survey accordingly submitted a revised proposal and budget for $101,945.00 (Morse and Morse 1976: 108) and applied for an Antiquities Permit during the first week in June. In a covering letter accompanying the proposal, Davis indicated that should the Corps interpretation of the 1% funding limitation be overturned, the Survey would reopen negotiations towards achieving more adequate mitigation measures.

The $101,945 revised budget included two months funding for a field crew of 12 and a lab crew of 8, and for the field director, two field assistants, the lab director, and three lab specialists (ceramic, zooarcheological, and ethnobotanical) for the same period. Per diem, laboratory headquarters and equipment rental, mileage, and miscellaneous supplies were encompassed, as well as funding for subsequent analyses, report preparation, and publication. The Survey contributed the salaries of the project director and a graduate assistant, as well as a number of other material benefits. While hardly a shoestring operation, the revised budget was considerably below the level felt necessary to mitigate the site adequately, and a number of compromises had to be made. The field period was shortened from three to two months, and the number of personnel was cut almost in half. Funding for analyses by the three laboratory specialists was greatly reduced and encompassed only the field period. Plans for a fourth specialist (lithics) were dropped, and a site survey team abandoned. Finally, post-excavation analyses were greatly reduced from levels conceived in the original budget, although every effort was made to insure completion of all phases of project research.

Until the end of May, it was uncertain as to whether excavations would be conducted at Zebree in 1975. Under the terms of the revised proposal fieldwork was slated to begin July 1st and run for two months, giving exactly one month to gear up. While a considerable amount of planning had been accomplished prior to this time, until the official go-ahead was issued little could be done. Morse had been contacting people all spring about the possibility of working on the Zebree project that summer, but formal offers could not be made until funding was assured. An even worse situation logistically was that funding for the purchase of supplies and equipment was unavailable until after the proposal had been formally approved, an event which did not occur until early July. Essential materials had to be obtained in advance of this date, however, and the Survey (or in many cases, Morse himself) had to provide funding or obtain credit.

Once the revised proposal was submitted in early June, the pace of activity quickly accelerated. Job offers were made to a number of people, purchases of equipment and supplies began, and a search for housing in the Big Lake area was initiated. The site was visited and conditions assessed, and contact was made with the construction company responsible for the ditching operations, which were already in progress on the reaches below the site. Morse and Million had previously visited Zebree in mid-February and again in May, and on the former occasion had noted extensive recent pothunting. The site was posted after the Refuge authorities were contacted, and little additional damage occurred prior to the summer excavations. By late June, the project rapidly acquired shape and organization. Mark Raab, the new Survey Archeologist for northwest Arkansas, arrived at this time to serve as the field supervisor, and by the end of the month, all of the project specialists were present. Besides Dan F. Morse (project director), Phyllis A. Morse (lab director) and Mark Raab (field supervisor), these included Suzanne Harris (ethnobotanical analysis), Michael Million (ceramic technology), Eric Roth (zooarcheological analysis), and David G. Anderson and Jeffery Newsom (field assistants).

Finding adequate housing for the project specialists and crew--some 30 people--proved exceedingly troublesome. There was virtually no available housing in any of the small towns near the site, and structures that were offered as possibilities by local entrepreneurs combined astronomical rents with substandard or nonexistent plumbing, electricity, or even safe construction. The Morse's house in Jonesboro became something of a Zebree crash pad throughout late June, with ultimately up to nine people sleeping in the living room, den , and anywhere else floor space was available. This permitted extended (and often spirited) discussion in the evenings about research goals, field procedures, equipment purchases, and plans for the ensuing days work. Many of the field and laboratory procedures used during the ensuing excavation were refined during these evening sessions. The last day in June, housing was finally located. People were scattered over a large area, and about one quarter of the field crew camped at the site itself each day.

1975 Field Excavations

The Zebree site in June, 1975, seemed to be a mosquito-infested wilderness. All traces of Morse's 1969 clearing activity had disappeared, and dense underbrush covered the entire area under the hardwood canopy. Advance clearing operations at Survey expense began on June 23 and continued every day for two weeks under the direction of Michael Million. Most of this work was accomplished by Million, Raab, Anderson, Doug Hurdelbrink, and Barry Elrod, all of whom came down with poison ivy in varying degrees of severity. Underbrush was hacked away with sickles, bush knives, and axes, with chain saws used to remove larger growths. Phyllis Morse consulted with an entomologist about mosquito control, and a half-gallon container of malathion was acquired. This insecticide, which was approved by the Refuge authorities, is nontoxic to birds and other warm blooded animals (and, as was sometime cynically suspected, to mosquitos as well). Every morning a mosquito squad would liberally spary 10 to 20 gallons of the diluted (roughly 1:250) insecticide over and around the site area and, except for a few resurgences, the effort was largely successful. Crew members arriving on the site after the first week in July could have but little appreciation of the site's original conditions.

Under the direction of Raab, a steel cable swinging bridge was suspended over the drainage ditch to the site (Fig. 2-6). (This effort, it should be noted, received as much attention and praise from visitors over the course of the field season as did the excavations themselves.) The bridge provided direct and convenient access for most supplies and equipment and for the crew each day. The logging bridge to the south of the site was still intact, and the road to the site blazed in 1969 was re-opened, permitting access to heavy equipment and vehicles during periods of low water or dry weather. Two well points were established near where the bridge adjoined the site, and washing and wet-screening racks were placed in the same area, draining into the ditch. The Corps of Engineers gave approval to use the ditch for water screening. A storage shed was built for equipment right on the site (Fig. 2-7) and an outhouse placed across the ditch (and downwind).

All of the preparations described above were undertaken before a single shovelfull of earth had been dug. Additionally, before the excavations began, the site terrain was being mapped to 10 cm contour intervals (Fig. 2-8); a historic metal detector survey of the same area was conducted by Jim and Cindy Price; and a fully functional laboratory and headquarters station had been set up in a building at the Big Lake National Wildlife Refuge Headquarters. While this was in part due to the efficiency of the project organization, it was

Figure 2-6. The steel cable suspension bridge over the ditch to the site, 1975 field season. (Negative 752551)

Figure 2-7. Random square excavations proceeding in the vicinity of the equipment storage shed, at the northern end of the site. (Negative).

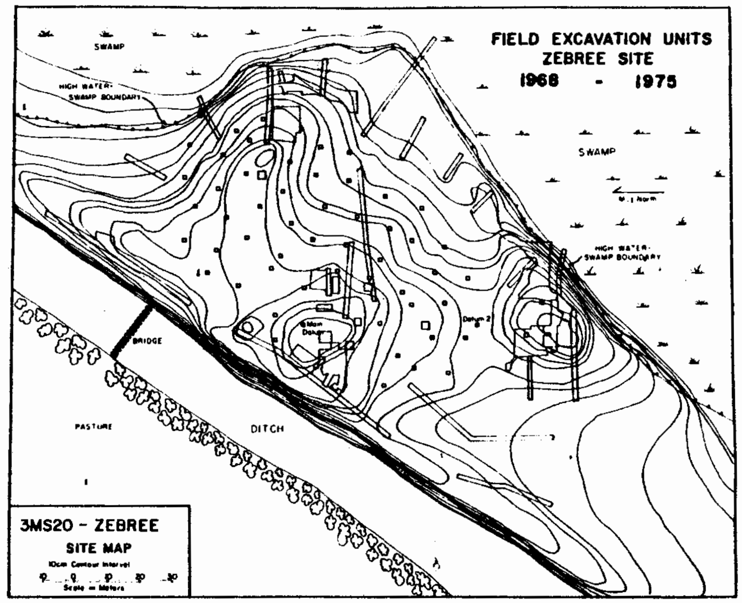

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Figure 2-8. The Zebree site as delimited in 1975 (10 cm contour intervals), including all excavations units from the 1968, 1969, and 1975 seasons.

also due to a frustrating series of delays in obtaining government approval to initiate excavations. The proposal and budget for the project submitted in early June had to be approved by the Corps, the Advisory Council on Historic Preservation, and the State Historic Preservation Officer before excavations could begin. This meant that the proposal and budget had to be converted into a formal Memorandum of Agreement, which then had to be mailed back and forth between all concerned parties for approval and signatures. A normally slow procedure, the agreement was quickly passed from hand to hand in a spirit of cooperation. Unfortunately, it got lost in the mail for eight days during the final step--the return of the completed agreement to the Advisory Council for approval. The actual excavations began on July 8, when verbal confirmation of the final signing of the agreement reached the Refuge Headquarters. While some of the eight days lost were spent in final clearing, settling-in, and last minute preparations, at least several days of valuable field time were lost.

During the first week of the excavations, everyone worked in the field until enough of an artifact backlog had developed to justify full-time laboratory operations. Processing and analyses of materials proceeded throughout the excavations at the field laboratory under the direction of Phyllis Morse. In addition to cleaning, sorting, and cataloging artifacts from the field, analysis of ceramics, ethnobotanical remains, and zooarcheological data proceeded on a full-time basis under the direction of Million, Harris, and Roth, respectively, each assisted by one or two students. Each of these three specialists, it should be noted, also managed to spend a considerable amount of time at the site, pursuing specific data-recovery strategies. In addition to the normal daytime activities many of the field personnel worked in the evenings completing records, assisting in specialized analyses, discussing the project to date, and so on. Informal meetings of all supervisory personnel were held on the average of once a week (no small trick considering they were housed over an area 50 miles in diameter), and problems, modifications in field or lab procedures, records checks, and general briefings on the state of individual analysis or activity were discussed. These meetings, and the regular flow of people from the lab to the field, provided for relatively rapid information flow and feedback, and procedures in either area could be modified to meet new circumstances in the other.

The first two weeks in July, the water level in the swamp to the east of the site rose alarmingly, and a number of the random sample square locations were flooded. The extent and detail of the site contour map made at this time was limited by this flooding, although fortunately the major areas of the site were never completely inundated. Some two weeks of field time were lost to rain, however; and many excavation units were at least temporarily flooded. This proved disasterous along profiles, which quickly undercut and collapsed (Fig. 2-9), although block units were little affected and required only the removal of slumpage or mud prior to resuming excavation. Smaller units were bailed by hand when they became water filled, while larger units were drained, where possible, via backhoe trenches.

During the field season, a number of archeologists with research interests in the region or in problems related to late Woodland or Mississippian visited the site and provided useful commentary and criticism. An informal research organization exists within the Central Mississippi Valley known as CLASS (Central Lowland Archeological Seminar and Symposium), whose members are attempting to pool their knowledge, research designs, and information about ongoing research in a natural area encompassing portions of seven states. The 1975 CLASS meeting was held at the lab headquarters on August 2, with several hours spent at the site. This enabled many of the primary investigators in the central Mississippi area to view the field and laboratory operations firsthand and provided a forum for commentary and suggestions about both the procedures and interpretations that were being developed at the time. As part of a formal peer review, two scholars with extensive research experience and commitments in southeastern U. S. archeology, Dr. Christopher Peebles of the University Museum at the University of Michigan, and Dr. Bruce Smith from the University of Georgia, visited the site for the purpose of evaluating the project (Peebles 1976; Smith 1976), and provided useful input into the ongoing effort.

During the course of the summer, a number of specialists in various disciplines visited the site and participated in the project. The metal detector survey of the site area, made under the direction of Jim and Cindy Price of the University of Missouri's Southeast Missouri Archaeological Research Facility immediately prior to the start of the excavations, located sensitive areas which were flagged. The pattern of metallic debris indicated a single dump area on and adjacent to the site of the Sebree homestead in Area B (Chapter 27). Dr. Jim King of the Illinois State Museum's Quaternary Studies Center visited the area in late August and collected several cores from Big Lake for palynological investigation and to aid in the reconstruction of the prehistoric aquatic and surrounding terrestrial environment (Chapter 14). This effort necessitated the construction of a pontoon-based raft on which two days were spent paddling about the upper reaches of the lake and coring. Dr. Dan

Figure 2.9. Flooding and undercutting of backhoe cut profile brought about by heavy rainfall and rising waters, 1975 excavation season. (Negative 752834).

Wolfman, Arkansas Archeological Survey regional archeologist at Russellville, also visited the site in August and collected several fired clay samples for possible archeomagnetic dating (Chapter 12). Lynne Bowers, from Shelby State College, collected increment cores and chain saw sections of bald cypress from the immediate site area, as part of an ongoing program of dendrochronological investigation in the general northeast Arkansas region (Bowers 1973, 1976).

The excavations and analyses continued at Zebree throughout July and August and into early September. A full crew was maintained until the last week in August, when most of the students had to return to their various campuses.

The crew total dropped from near 30 to under 10 although excavations were continued at the site until the 8th of September, largely by Dan Morse, Michael Million, and Dan's son, Danny. The final activity consisted largely of the rapid excavation of promising pit features still unexcavated in exposed profiles and in the use of the backhoe around the site's eastern perimeter to locate several sections of the ditch system. All of the equipment from the site had to be removed at this time, and the lab headquarters had to be cleaned out, with all equipment and artifacts transferred to the Survey station in Jonesboro. Dan Morse assumed charge of the final excavation, backfilling, and equipment removal from the site area, while the transfer of the lab equipment and artifacts to Jonesboro proceeded under Phyllis Morse's direction. Much of the dismantling was accomplished by these two, assisted by Suzanne Harris, Brenda Keech, and several ASU students who were available on a part time base. Only one Survey vehicle was operational at this time, and a large number of trips were necessary to transport all the material from the Big Lake area to Jonesboro.

Setting up the laboratory in Jonesboro took the remainder of September. Under Phyllis' direction, artifact sorting and processing continued, much as in the field laboratory, and by late fall, all but the fine-screened materials (artifacts recovered through flotation or in screens under 1/4" mesh size) had been processed and cataloged. Suzanne Harris was hired for an additional three weeks to continue her analysis of site ethnobotanical remains and actually stayed beyond that. Anderson and Newsom, graduate assistants charged with major artifactual and environmental analyses, respectively, were by this time in Fayetteville in graduate school and it was necessary to relay project notes, maps, artifacts, and other information to them for their research. Additionally, a general policy of the Survey was to maintain duplicate records of all field notes and maps in Fayetteville to prevent accidental loss. In late September, Dan Morse organized all of the Zebree records and took them to Fayetteville where they were copied. The routine of sorting the tremendous quantities of fine screened and floated material was established in Jonesboro continuing the effort begun in the field lab, and this activity continued unabated over the next year and a half.

Preliminary Analyses

The focus of project activity during the fall and early winter of 1975 was the preparation of a preliminary report indicating the history, methods, and preliminary findings of the 1975 excavations, as well as future research and analytical goals. A symposium on "The Zebree Project: New Approaches to Contract Archeology" was presented at the 32nd Annual Southeastern Archaeological Conference in Gainesville, Florida on November 8th, with papers by Morse, Anderson, Harris, Newsom, Roth, and Raab, with commentary by Dr. Bruce Smith of the University of Georgia and Dr. Stephen Williams of Harvard University. Under the direction of Dan and Phyllis Morse, these papers were assembled and edited, together with additional documents by Bowers, Million, and Peebles, and sent to Fayetteville for release through the Survey. The manuscript was submitted in mid-November 1975 and published in late March 1976 (Morse and Morse 1976).

Much of the activity during the fall of 1975 focused on either laboratory organization and processing or the preparation of the preliminary report. Morse did revisit the Zebree site several times during the months immediately following the dig to check on conditions. By early October, only one month after the close of the fieldwork, the bridge had been badly vandalized and the site potted in several areas. During one visit, Morse scared off a carload of pothunters approaching the site from the old logging road which was still passable. Other than notifying the Refuge authorities, there was little that could be done to stop the looting short of continual on-site inspection. Fortunately, this form of activity rarely lasted more than a day or two, at least for any one party, since the site deposits were relatively devoid of marketable antiquities (i.e., whole pots). Usually an afternoon or two of digging with little more than the recovery of large sherds hit by the probe was enough to discourage most of the visitors.

Early in October, Morse returned a well pump, cots, and other equipment to Jim Price, who had loaned them to the project earlier in the year. This form of cooperation, it should be noted, is common among investigators in the area who frequently assist other projects when possible, both materially through the loan of equipment and in the research effort itself. Reports on the 1975 activities at

Zebree were presented by Morse to the membership of the Mississippi Archaeological Society in October and to the Arkansas Archeological Society in November.

The processing and sorting of Zebree artifacts continued throughout the spring, employing both paid and volunteer labor. Iris Weaver of Paragould spent over 500 hours sorting fine-screened materials during 1975 and 1976, and at least three times this number of hours were put in over the same period by others at the ASU lab. The work was extremely hard on the eyes and could only be done for a few hours each day. Students in Morse's two anthropology classes were required to put in ten hours over the course of the semester on a special project, and artifact processing was one of the alternatives offered. The bulk of sorting was completed by early summer, at least from the features and random square levels. Only about half of the bucket and flotation samples remained unsorted at this time. The sorting of the contents from the 1975 fine-screened features, was over.

Prior to 1976, there had been no formal survey of the Big Lake area. The complete route of the ditch itself had never been surveyed due to lack of funding, and the only knowledge of site location in the area was intuitively derived and largely the result of leads provided by local informants. A survey of the Zebree area and the immediate region had been incorporated into the original budgetary proposal early in 1975, but this had to be abandoned when funding was cut. The need for some kind of a comparative data base from the area, against which to place the Zebree occupations was therefore pressing, Accordingly, Morse developed plans for a survey in the Big Lake area to be accomplished largely through volunteer help.

A variety of surveying and sampling schemes were considered (Morse 1976b), and the method selected involved the complete field survey of a 1/4 mile wide transect that extended for 15 miles across the Big Lake region from Big Lake to the St. Francis River. The transect, originating at Big Lake near the town of Manila, was selected since it was on line with the transect House and Schiffer (1975:47) had surveyed across the northern portion of the Cache Basin, and that Klinger (1977) was continuing across Village Creek Basin at this time. The transect was also situated so as to cut across all of the major environmental zones in the Big Lake Highlands, the focus of the ongoing environmental reconstruction. All prehistoric and historic sites found within the transect were recorded, including single finds. Over 100 sites and a large number of isolated artifact finds were plotted. The fieldwork itself was accomplished during the last two weeks in March, over a period of six days, with two additional days spent in the lab checking records and in initial processing of artifacts. The project, although directed by Morse, was conducted by over 20 volunteers, including students at ASU, members of Morse's immediate family, and anyone else who could be cajoled into spending a day in the country. By the end of April, the site forms and artifact processing from the Big Lake Transect had been completed except for one section.

In addition to the ongoing artifact processing and the planning and implementation of the Big Lake Transect survey, a number of other projects and activities were underway in northeast Arkansas during the winter and spring of 1976. Under the direction of Timothy C. Klinger, an extensive field survey of portions of the Village Creek Basin was undertaken for the Soil Conservation Service from late 1975 to mid-1976, in a project comparable in scope and direction to the Cache survey of two years before. Some 525 archeological sites were located during this Village Creek survey. Also at this time, Tom Padgett (1977) was conducting a series of survey and testing operations along Crowley's Ridge, as part of an extended contract with the Soil Conservation Service. Morse himself continued to visit newly reported or endangered archeological sites in the region; and in early March, spent a day at the Floodway site (3MS2) where a Big Lake phase component was discovered in the eroding midden. The Alabama Museum of Natural History had excavated here in 1933; and based on a photograph of a large jar in place deep in the deposits and seen in the files at Moundsville, Alabama, the existence of Big Lake phase remains below the later Mississippian midden was suspected by Morse as early as 1971. Pothunters and a ditch running by the site had been slowly and continuously eroding the deposits, but Big Lake phase materials were discovered in this cut below those of the more extensive Nodena phase surface occupation.

In early April, Morse visited the Manila area and discovered that the Buckeye Landing and Rice Landing sites had been ditched through. The Rice Landing site was completely destroyed, while at Buckeye Landing much of the prehistoric component was covered by the levee. The historic component, including an early 19th century house site indicated on the GLO maps, was apparently completely destroyed. The ditching had stopped about a quarter of a mile below Zebree. It was learned that the final contract for the last section of the ditch would be let in May 1976 with construction to begin by mid-June. Accordingly, Morse began to make plans for a possible salvage effort at the site that summer and also initiated contacts with a number of local people to help keep track of the ditching.

Early in May, Mickey Sierzchula, a graduate student at Fayetteville interested in lithic technology and flintknapping, visited Jonesboro and examined the microlithic assemblage recovered at Zebree. Sierzchula attended the Crabtree/Flenniken flintknapping school in Washington that summer, and one of the subjects he pursued was the replication of the Zebree microliths. Shortly after returning from the flintknapping school, he decided to pursue the replication as the topic for his master's thesis at Fayetteville. About the same time, the late summer of 1976, another University of Arkansas graduate student, Mary Lucas Powell, decided to incorporate study of the Zebree human skeleton remains into her master's thesis, which examined bioarcheological excavation sampling requirements, focusing specifically on the Zebree project as a case in point (Powell 1977, Chapter 23). Powell's effort was largely voluntary, while the Survey contributed nine months of Sierzchula's time as a half-time Survey Assistant for work on Zebree. Both were unexpected yet welcome additions to the ongoing analysis.

The student working on the environmental reconstruction left Arkansas in May 1976 and it was essential to find someone to assume responsibility for the paleo-environmental reconstruction. Suzanne Harris, the project ethnobotanist, had prepared similar environmental analyses during surveys conducted in Missouri (e.g., Price and Price 1975, Price, Price, and Harris 1976), and accordingly she was hired. Harris was in Jonesboro from June through early September 1976 working on both the ethnobotanical analysis and the environmental reconstruction, and during this time provided a great deal of input on all aspects of the ongoing research. Anderson was also in Jonesboro during July and August working on the organization and initial analysis of portions of the 1975 artifact assemblage, and in addition spent a great deal of time in computer-assisted analysis of Harris' General Land Office tree species data for the paleoenvironmental reconstruction.

The 1976 Excavation at Zebree

On May 13, 1976, the bids for the final section of Ditch 81 were opened, and the contract was awarded to the S. J. Cohen Construction Company of Blytheville, Arkansas. The ditching was scheduled to begin at the end of June or early July with Zebree in all probability to be destroyed during the second or third week of operations. Morse contacted Jerry Cohen, the head of the construction company, about the possibility of conducting salvage operations at the site during the ditching, and a pledge of full cooperation was received. On July 6th, Morse and Anderson visited the Zebree area where they met Cohen and his field supervisors. At that meeting, Cohen again pledged his full support and told his supervisors to provide all possible assistance to the archeologists during the salvage operations.

The last week in July the ditching began, and for the next three weeks, all activity focused on the salvage at the site. The 1976 field operations were funded wholly by the Survey and were under the direction of Dan Morse, assisted by David Anderson. Twenty straight days were spent at the site. On a number of days, the work force was expanded with volunteers from the Arkansas Archeological Society, students from Arkansas State University, members of the construction crew, and interested people from the area. Arleen Olson, Survey photographer, spent almost two weeks at the site documenting the destruction, photographing features, and doing a great deal of digging. Other Survey personnel who visited the site for one or a few days and helped out included Mark Raab, Mickey Sierzchula, David Stahle, and Dan Wolfman.

Field conditions during the 1976 season were considerably different than in previous seasons. Prior to the ditching, the site had been cleared, and instead of a lush green jungle, the area was a desolate tree and branch strewn swath of brownish gray (Fig. 2-10). Bulldozers and log skidders were constantly at work in the zone ahead of the draglines, pushing the downed vegetation into brush piles or hauling it away for lumber sales. The brush piles were ignited with fuel oil and were usually burning or smoking all around the site. The last few days of the salvage, when the draglines were within a couple hundred feet of the site, it was possible to feel the impact of the 12,000 pound bucket each time it hit--a most disturbing sensation if one was in the bottom of a pit at the time.

Access to the site during the 1976 salvage was obtained by a variety of methods. Cohen saw to it that earthen dams were periodically thrown across the ditch, above where the draglines were working, to permit trucks and other heavy equipment access to the eastern side. These temporary structures rarely lasted an entire day and were of necessity frequently repaired or replaced. The water level in the ditch, accordingly, rose and fell rapidly, depending on whether the dam was holding or had just broken. A boat was used to ferry back and forth over the ditch during periods of high water, especially when the dam was on the verge of or actually washing out. Once these temporary dams were broken, the water level in the ditch quickly dropped 5 to 8 feet, and it was possible to wade the remaining 1-2 foot stream.

As the water level rose and fell, it exposed most of the long submerged bed of the ditch to the west of the site. Unfortunately, no aboriginal remains were detected, although these may have been

Figure 2-10. David Anderson directing bulldozer trenching operations at the eastern edge of the site, August 1976. The former jungle-like environment has been converted into a torn and desolate wasteland. (Negative 763684).

deeply buried. One elaborate and illegal catfish wicker trap was found, along with a number of whiskey bottles. A large number of mussels were collected for use in comparative examination and identification of site shellfish remains (Chapters 17 and 22). Even a cache of 1930s soft drink bottles was found buried during a break in ditch construction. When the water level was low, it was possible to set up wet-screening operations in the ditch bed, which was done to help process the fill of a 19th century well that was detected. Morse and Anderson were forced to wade the ditch about 1000 feet below the site one day, and in the process, found an extensive Big Lake and Barnes sherd scatter in an eroded gully off the ditch. The next day, when they returned with collection equipment, this gully had been bulldozed over to permit the dragline to advance over it and only a few sherds were recovered.

The discovery of a Big Lake phase site in close proximity to the Zebree site was disconcerting, although there had been virtually no time to conduct a survey in the area. As noted, the ditch route itself was never surveyed, which appears in retrospect to be unfortunate. The dragline operators recounted stories of extensive artifact scatters along the course of the ditch, including what appears to have been a major site near the old Wildlife Refuge Headquarters that "everyone" knew about (except the archeologists). The additional knowledge would have undoubtedly brought additional frustration, though, for little probably could have been done to recover much information from these sites--and all available effort was needed to recover part of the Zebree record.

The area opened during the 1976 salvage, approximately 2500 square meters, was roughly three times the total area examined in all of the previous seasons combined. A total of 136 features were investigated, including ten fragmentary human burials (Fig. 2-11), a large number of pits, several earthquake disturbances, and the historic well. Additional segments of the early Mississippian palisade ditch were uncovered at the north end of the site, although as during previous seasons, the feature proved disjointed and difficult to follow. One human skull which exhibited marked cranial deformation was encased in surgical plaster prior to removal to prevent crumbling (Fig. 2-11). Through inspection of the bulldozer cut floors and profiles, it was possible to obtain rough ideas about the depth of artifact-bearing deposits and the extent of earthquake disturbances in several areas of the site.

In terms of increasing the artifact inventory associated with each prehistoric component, a primary goal of the salvage, the excavations were quite successful. Several new artifact categories

Figure 2-11. Excavation of Burial 23 (F391). (Negative 763695) August, 1976.

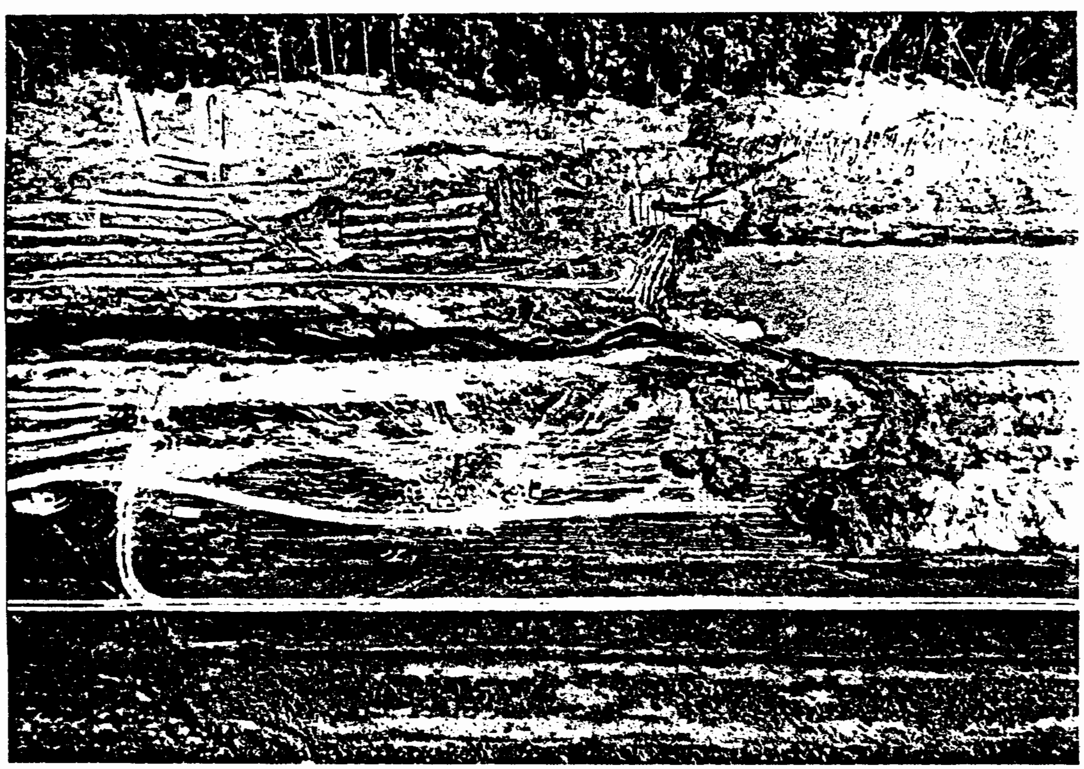

Figure 2-12. Draglines advancing on Zebree, August 1976. The site is in the upper left hand corner, with truck as north arrow. (Negative 763788)

were recovered, including pottery ladles and bowls in the Big Lake component. One Big Lake pit produced a sphere of hematite, and reconstructable vessels were found in over a dozen pits. A middle Mississippian infant burial was recovered with a buffalo fish effigy bowl in association. Typically, this burial was at the base of one of the balks between two grader cuts and was detected only through Morse's enthusiasm to leave no potentially productive area unchecked. As is also typical of operations of this nature, the last few days yielded the richest returns. The last day and a half, 21 features were opened, including one with four and another with two reconstructable vessels plus several single vessel finds. Considering that only one intact Big Lake vessel had been found during the 1975 excavations, the salvage was an exciting period and one that the investigators wished could have been extended.

Much that was accomplished in this frantic three weeks was due to helpfullness and interest of Jerry Cohen and the ditching crew. During the actual excavations, a bulldozer and operator were made available each day; the construction crew helped in the digging when possible; and even a small plane was provided to photograph the site. The degree of cooperation was unprecedented in Morse's experience and S. J. Cohen Construction Agency was later awarded one of the two environmental honorable mentions given to private contractors in the Corps of Engineers first annual Environmental Awards for 1976.

One major accomplishment of the 1976 season was the testing of the western side of the ditch, an area previously unexamined. Some 200 meters of bulldozer cuts were opened to subsoil, but no intact or even disturbed deposits were found. Except for a few Barnes sherds and one possible pit at the extreme north end of one cut, only recent historic remains were detected. The remaining area appeared to have been extensively disturbed, to a depth of several feet, by the previous ditching activity.

A second high point of the excavation was the discovery and removal of an early 19th century cypress-lined well in Area A (Chapter 26). The feature had been detected by Morse in 1969, who assumed it was an outhouse pit, but it had remained unexcavated then. The last few days of the excavation, Morse decided to check this feature, in part because a number of early 19th century ceramics were turning up in the grader cuts around Area A. A second reason for the test was the greatly increased sense of appreciation for historic archeological remains by both Morse and much of the archeological community since the 1969 excavations.

With the use first of bulldozers and later, when the hole became too deep, the dragline bucket, the fill surrounding the well was removed to permit safe excavation. A log skidder was used to pull up boards and shoring beams, and eventually the feature was completely removed to a depth of roughly 4 meters. Fill from inside the well was scooped into 5 gallon oil buckets provided by the contractor, and about 80 gallons were removed to the Jonesboro lab for the fine-screening. Danny Morse set up a water-screening operation in the ditch channel beside the site through which much of the remaining fill was processed.

Much of the fieldwork that took place during the 1976 season could be described as opportunistic, with any and all available equipment employed to help in the data recovery. The construction crew working the dragline cooperated fully and even got to the point that they could spot rich features as they were exposed by the bucket. If these had not been completely carried away, the ditching was momentarily directed elsewhere to enable the archeologists to dash in and check the deposits. Several of the last features found on the site were detected in this fashion.

The dragline reached the site on August 13, 1976, and had completely gone through it four days later, effectively terminating the excavations (Fig. 2-12). While much of the site was ditched away or buried under the new levee placed near the swamp edge, traces of the past occupations still remain. The section of the levee by the site is especially rich in artifactual debris, and along the ditch the midden is continually being undercut and eroded by the rising and falling waters, and as expected, is being continuously pothunted.

The Final Analyses

With the close of these 1976 field excavations attention shifted back to the laboratory in Jonesboro. Some 10,000 sherds had been recovered, in addition to a large number of other artifacts, and until the fieldwork ended, all the available lab help were working at the site on a part-time basis. The station typist-technician, Brenda Keech, who was running the office while everyone else was in the field, managed to keep things in order and get a good deal of the initial processing done. By the end of September, all of the material had been washed and boxed up, although cataloging and analysis had yet to begin.

At the end of August, Anderson returned to Fayetteville for a final semester of graduate classes; and shortly after this, Harris returned to Missouri. The Morses left for Europe in late September where Dan gave a paper on Dalton culture in the central Mississippi Valley at the IX Congres de Union Internationale des Sciences Prehistoriques et Protohistoriques in Nice, as part of a symposium on the Holocene in North America. Zebree continued to dominate the Morse's lives, however. Sherds from the 19th century well were taken with them and identified by personnel from the Victoria and Albert Museum in London. In late August, the Morses visited Little Rock to look for records about the historic occupations at the site. About all they were able to discover was that the further removed a settlement was from a court or any kind of government seat, the less likely the occupants were to pay taxes. In early September, a large quantity of the cypress timbers from the well were given to Lynne Bowers for use in her dendrochronological studies. At the same time, pollen samples taken from behind and between the well shoring timbers were sent to James King, who shortly thereafter sent word that no grains had been preserved. Also, in late September, an article with accompanying cover picture recounting the 1976 salvage appeared in *Construction News*, a regional trade journal. The article described both the excavations and Jerry Cohen's cooperation that had made them possible, and included an extensive photo-spread picturing the work at the site.

Early in November, Morse and Anderson (1976) gave a brief presentation on the current state of the Zebree project at the SEAC in Tuscaloosa, Alabama, as part of a symposium on "Approaches to Anthropological Archaeology Under Contract." Over the course of the fall, Morse gathered together all of the Zebree material from all four field seasons and set aside half of a large classroom/laboratory for storage and analysis space. One of the more fortunate circumstances of the year occurred in late October, when Michael and DD Million returned from a stay in Europe where they had been since the close of the 1975 field season. The archeological assistant's position, which Million had held formerly, was open at this time, and it was immediately offered to him. Early in November, Million began work again at the Jonesboro station and assumed a major responsibility for the ongoing Zebree analysis and reporting.

Under Million's direction, the final sorting and cataloging of the 1976 excavation sample was completed by early January 1977. At the same time, Million began to check the results of the Big Lake Transect survey. Over the next six months, he spot checked all questionable site locations and completed the surveying in areas missed due to crop conditions during the original fieldwork. The final work on the transect was completed with all sections examined by late spring of 1977. In the analysis of the 1976 Zebree assemblage, all reconstructable vessels, lithics, and unusual artifacts were separated from the mass of the material, and all sherds were identified as to component, to permit feature identification. At the same time, Million began working on technological/replication studies of the Big Lake and Barnes ceramic assemblages. All of these tasks were performed over and above his normal station duties, which included running the lab, checking site leads, and maintaining the site files in good order.

In mid-February of 1977, Anderson moved to Jonesboro from Fayetteville and was able to devote his full attention to Zebree. With the help of student "volunteers" from Morse's Indians of Arkansas class, each of whom was required to put in 24 hours time on some kind of lab or field project, the final sorting of the remaining bucket and flotation samples was accomplished over the next two months. In addition, the laborious task of transferring the results of half a dozen specialists investigations from data sheets onto computer cards was accomplished, primarily by Anderson, David White, and Lisa Lamar, two laboratory assistants. Over the same period, Million completed all analyses of the 1975 and 1976 ceramics, and it became possible to identify site features and levels by specific component. Descriptions of all features for both field seasons were generated. These descriptions, coupled with computer lisings of contents, provided a basis for more detailed studies of pit form and function.

Early in February, a dozen radiocarbon samples had been selected from the over 200 available and were submitted to Dr. Herbert Haas, Director of the Radiocarbon Laboratory at Southern Methodist University (Chapter 11).

Throughout the course of the spring and into the summer, the pace of the investigations quickened as the deadline for completion of the draft in early October approached. On February 22 and 23, a meeting of Zebree project investigators was held in Jonesboro with Anderson, Harris, DD and Michael Million, Dan and Phyllis Morse, Mary Lucas Powell, and Mickey Sierzchula present. A tentative outline for the final report was prepared with reporting resonsibilities allocated and various deadlines set for analysis completion and chapter drafts. The status of various lines of research was discussed, and individual investigator requirements such as drafting and specific computer work made known. The results of the meeting were then disseminated to all other project participants and to interested researchers in the general region as an issue of the CLASS Newsletter (Morse, ed., 1977).

Early in March, Morse spent a week in Illinois and Missouri tracking down possible sources for extralocal cherts found on the

Zebree site. With Leonard Blake of the Missouri Botanical Gardens, he visited the Crescent Quarries near St. Louis (Ives 1975) and collected a number of chert samples for Sierzchula's replication experiments. Based on this visit, Morse realized that what he had been previously calling "Dupo" chert was actually Crescent Quarry chert. Together with John Kelley, an archeologist in charge of highway salvage operations near Cahokia, Blake and Morse visited the town of Dupo, Illinois, where only a very poor grade of chert was found outcropping.

By late spring, various aspects of the analysis were rapidly shaping up. Powell completed her M.A. thesis research on the Zebree human skeletal assemblage, while Sierzchula was well along in his replication experiments. Anderson's thesis, involving the evaluation of field procedures over each season, gained momentum as final data from the last two seasons was organized. Richard Rockwell identified shellfish remains from a number of Big Lake and Barnes features, employing a comparative collection that he had assembled himself with the help of Paul Parmalee (Rockwell 1977, Chapter 17). Suzanne Harris came down from Missouri and spent a month in Jonesboro from early April to mid-May and worked on the environmental reconstruction and on identifying flotation sample remains. DD Million was hired as artist and began to draw final maps and figures. Project specialists further removed, contributed data and progress reports, including Eric Roth (zooarcheological), James King (palynological/Big Lake coring results), and Dan Wolfman (archeomagnetic dating).

In late April, a second Zebree project symposium was held in Jonesboro will all of the original participants attending, as well as Hester Davis, Paddie Patterson, and Mark Raab, from Fayetteville. Unlike the previous meeting, which was primarily organizational, this second meeting focused more on the state of the various analyses underway and consisted largely of progress reports and discussion of specific research avenues to follow for the final report. Logistical problems such as the amount of drafting, photography, computer analysis, typing, and editing that were likely to be necessary were also discussed and tentative plans and schedules made to handle this burden.

By July, all of the artifact sorting, processing, and analyses were completed with all pertinent information transferred to computer cards. Extensive analysis of this data base was underway, including the preparation of numerous artifact distribution maps based on the random square analysis data. These latter were prepared in Fayetteville (due to a lack of computer-graphic facilities at Arkansas State), using a program adapted by Thomas Scheitlin (Chapter 9). In addition to these maps, a wide range of other data presentation and manipulation options were at last possible, and ideas were tested against the data set within one to a few days after they were conceived. Most of the final computer analyses were conducted at the Arkansas State University's Data Processing Lab, run under the direction of Drs. Adams and Babb of the School of Business, who provided their complete cooperation and more than a little advice.

The months of June through August saw the project operating at its most feverish pitch, with periods of near round-the-clock writing and anlysis. Much of the analyses presented here were completed and written up during these three months, as two year's thought achieved fruition. Early in June, the first radiocarbon dates came in and suggested a very early date for the Big Lake phase; as the summer wore on and more early dates continued to roll in, the excitement increased. While the present analysis can hardly lay claim to being completely definitive or exhaustive, during these three summer months, it seemed as if more and more pieces in the picture were falling into place.

This report reflects ten years of investigation at one site, and not just the results of two months of fieldwork during the summer of 1975. Over this time, a wide range of analyses were contemplated and many were actually undertaken. Investigations at the site, with site materials, and in placing the site in a regional perspective, grew more sophisticated over this time, and the number of investigators rose from essentially one to several dozen. Many of the ideas about the site that were first conceived in 1967 have since been tested, some unfortunately can never be. Many of the specific field and analytical procedures reported here did not occur spontaneously, but grew and were refined through an extended period of contemplation, trial, and error. Throughout the course of the project, every effort was made to maximize available resources; and a watchful eye kept open for new opportunities to follow up on one or more lines of inquiry. Much of the effort reported here was voluntary or goes far beyond the bounds funded by the National Park Service, the Corps of Engineers, or the Arkansas Archeological Survey.

CHAPTER 3

CULTURAL PROBLEMS

Dan F. Morse

As outlined in Chapter 2, there have been ten years of excavation and analyses of artifacts from the Zebree site. The culmination of those years took place with the excavation of mid-1975 and the final analysis of 1977. There was no single research plan but rather the recognition of a series of questions concerning archeological problem areas. These questions developed over the years (Morse 1975b, 1976b; Raab 1976a, b; Smith 1976; Peebles 1976) and we were acutely aware of them by the beginning of the 1975 excavation period so that whenever possible recovery strategies could be oriented toward obtaining answers (Chapters 5-9).

Related to all of these questions is the basic question of how the archeological record can best be sampled. The recovery strategies at Zebree included all known approaches appropriate to an archeological excavation given the time and money limitations involved and the research questions being posed. Both probabilistic and judgmental samples were collected. Experiments concerning the recovery of items through different screen sizes were conducted to discern what was being lost and to identify optimal screen sizes for different classes of artifacts. Pollen and flotation samples were gathered routinely to test different environments of the site for preservation. Sherds were both counted and weighed to give an index to compare different categories. Post-depositional modifications were examined in detail to control site environmental factors affecting the data. Bucket samples were collected from each probabilistic level to test this usefulness for future short period salvage projects.

The following discussion is in terms of research questions. This chapter covers those questions called "cultural," while Chapter 4 includes those called "environmental." In some cases, the questions revolve around specific site information such as the dating of a particular component. In other cases, regional cultural-historical information such as the relationship of two contemporaneous late Woodland traditions are explored. On a higher anthropological level, questions pertaining to the transmission of a Neolithic way of life from one region to another are developed. Even further afield from the site-specific queries include investigation of the role of population magnitude in the development of Mississippian culture from a Woodland base.

Obviously the excavation of a single site is not going to provide definitive answers to a large number, perhaps not even any of the questions covered. All answers are in terms of a sliding scale of probability, the appropriateness of each of which must be judged by the reader. There are disagreements with the answers accepted here (see Chapter 29). The discipline of archeology cannot progress without disagreement.

The main purpose of these two chapters is to provide an introduction to the sections which follow. Research orientation can best be provided here by giving away the plots of the various chapters. In some cases, judgmental statements are made as to the success of answering any particular research question. The main points of the volume are provided to give the reader generalities by which to read and criticize the succeeding chapters. We provide our concept of the forest here and it is then up to the reader to look at the trees in the next chapters and judge the forest reconstruction accordingly.

Research Question 1: What is the spacial distribution and the temporal span of each of the Zebree site components?

There are five recognized components at Zebree: Barnes (Baytown period), Big Lake (Initial Mississippian period), Lawhorn (Middle Mississippian period), Euro-American Pioneer, and the Sebree occupation (Railroad-Land Drainage period). Delimiting their respective spacial and temporal dimensions has been fairly successful.

All components have been dated by several methods. Period identification is based on seriation (Chapter 10). Dating relative to each other was accomplished by use of the principles of stratigraphy (Chapter 10). The Barnes and Big Lake components were dated, in addition, by the application of the radiocarbon technique (Chapter 11). The uncorrected dates seem to cluster around AD 700-800 for Barnes and AD 800-950 for Big Lake at the Zebree site with considerable overlap of the standard deviations for both components. A total of nine radiocarbon dates for the Big Lake phase are amongst the earliest yet obtained for Mississippian culture. They range from AD 718-990. The Lawhorn phase was dated by utilization of the archeomagnetic technique to a single hearth (Chapter 12). The resulting date of around AD 1200 is in accord with the general dating of the Lawhorn phase elsewhere by radiocarbon.

Excavation units were placed to sample virtually every portion of the site and where possible backhoe and bulldozer trenches were extended beyond the apparent site area (Chapter 5). A 1% stratified unaligned sample was obtained in the middle half of the site to provide ideas on intensity of occupation. A metal detector survey was accomplished to pinpoint the extent of the main Zebree occupation area. The spacial distribution of each component was different. Barnes was the widest spread in terms of feature and artifact distribution.

Density maps indicate up to four to five concentrations, possibly representative of separate households in what may be a winter village. Big Lake was almost as widespread as Barnes but limited to a roughly rectangular area thought to be bordered by a ditch and constructed around a possible central post pit. Possibly as many as seven concentrations of artifacts and features within the ditch-enclosed village are interpreted as areas made up with clusters of houses. Lawhorn was a hamlet, possibly a farmstead, consisting of three structures within a restricted area of refuse. The Euro-American Pioneer period is represented only by a well and a few artifacts on the nearby surface. The Sebree occupation is concentrated on the knoll where the house was placed and possibly also is represented by historic artifacts scattered throughout the site area which constituted the yard and garden.

Research Question 2: What cultural variability is represented in each of the assemblages?

Cultural variability is necessarily related to the level of socio-cultural integration represented by a particular assemblage. The artifacts recovered from a regional center will differ in variability from those recovered from a farmstead. In addition, the artifacts and features discovered in a site representative of a segmentary tribe will differ from those recovered from within the context of a chiefdom.

Tribal organization varies considerably. Barnes seems to be at one pole and the two Mississippian components at or near the opposite end. Based on surface survey data gathered in conjunction with the Zebree investigation and upon the Zebree site excavations, Barnes appears to be made up of small local autonomous groups each of which lives within and exploits a territory of a very few hundred km^2 (Chapter 17). Decentralization is the key characteristic. These local groups are probably lineages or local kindred within a tribe. They are probably loosely held together as a tribe by virtue of marriage outside the local group and perhaps by a pan-tribal clan system. There does not seem to be any basis upon which to propose well-defined higher levels of sociocultural integration. We do not know these facets of Barnes existence but merely suspect them on the basis of archeological investigation and a best fit with concepts of the segmentary tribe (Sahlins 1968:20-23). The Zebree site is a possible example of a compact Barnes village but surface survey within the Big Lake Region indicates the co-existence of an open community of houses or hamlets scattered within the territory. The two possible such territories sampled are similar to each other environmentally. The coexistence of of open community and the compact village has been interpreted as reflecting seasonal variation, with the compact village in existence during the winter and the open community pattern in existence during the remainder of the year.

In the Barnes Zebree site assemblage, debris concentrations seem to be made up of a circular or oval house pattern with related storage pits and burial pits. Artifacts recovered primarily are ceramic--cooking jars and individual food bowls--with little lithic activity indicated other than reworking points into other cutting and scraping tools. Working bone and antler into awls and points is also indicated at Zebree, but the Barnes inventory is small. Evidence of possible trade is limited to chert from Crowley's Ridge and possibly the Ozark Highlands.

The contrast between Big Lake and Barnes at the Zebree site emphasizes the polarity within the classification, tribal organization. Zebree might be the regional center of the Big Lake phase, probably a strongly structured chiefdom. It is interpreted as the regional center despite an estimated population of only 140-150 at any one time (Chapter 21) based on the presence of all traits representative of what is known of the phase and on the site being the largest recorded to date for this particular phase. It is also centrally located geographically for known sites of this phase. Smaller sites just beyond Zebree may be part of a community of sites and Zebree may be but the central focus of a regional community.

Evidence for a complex, probably chiefdom, type of tribal organization during the Big Lake phase is considerable. For instance, the village seems to be organized and possibly was built quickly. It appears to have been palisaded. Rectangular houses, the ditching system, and evidence of land fill reflect a much greater degree of central control over labor than is in evidence during the Barnes occupation. The Zebree site is part of a trade network probably involving Cahokia but certainly involving items derived from the Gulf Coast and southern Illinois. Chert quarries near St. Louis and lithic resources near Farmington may have been exploited directly by the Big Lake phase. Debris concentrations within the site seem to be made up of clusters of houses, with associated storage pits, burials, and, possibly, outside hearths. One area of the site is richer than the others in terms of artifacts, particulary the number of exotic artifacts. In addition, this same area is shown by density maps to include the greatest concentration of mammal bone, mainly the white-tailed deer. However, this area does not include all exotic artifacts and is outnumbered, for instance, by another area in terms of *Anculosa* beads and mussel shells to be made into beads. We think that ranking and the corresponding nonegalitarianism of population implied by the conical clan system is present. But it does not seem as definite in the sense of a concentration of exotic artifacts at the Zebree site as is present at later regional centers such as Moundville (Peebles and Kus 1977). It may be that the small population represented at the Zebree site in effect mostly constitutes the ranking lineage.

The material culture inventory for the Big Lake phase is enormous (Chapter 18-20). For instance, there is evidence for specialized microlithic production and possibly the manufacture of salt. The ceramic inventory alone is considerably larger than that during the Barnes occupation and besides food bowls and cooking jars included several sizes of serving bowls, seed storage bottles, salt pans, funnels, ladles, and jars measuring over 50 liters in capacity. Arrow points and retouch chips from large stone hoes are included in the inventory. Even bone and antler harpoons are present.

The Lawhorn expression at Zebree probably is a farmstead, a satellite of a larger village. In addition, the Lawhorn component seems to have been a short-lived occupation, based on the lack of evidence for rebuilding any of the three structures. The length of occupation possibly was around 25 years or so. Structures, burial pits, and possible irregular pits are in association. The artifact inventory is slight compared to the previous occupation and basically consists of kitchen utensils, hunting-butchering equipment, and burial furniture.

The Euro-American Pioneer settlement probably consisted of a house and outbuildings but only a well was found. The cypress boards lining the well were sawed with a ciruclar saw and appear to have been recycled from a structure. The well contents indicated that a whole family, not just a male trapper, was present and that there was an orchard and cultivated fields. In fact, there is an indication that specialization in the cooper trade was characteristic of at least one of the family members.

The Sebree occupation is known to be that of the family of a hunting guide and a commercial hunter and fisherman. Artifacts representatve of such a situation were recovered, but of course are more easily interpreted because of personal interviews, particularly with Leonard Sebree.

The 1% probabilistic sample is assumed to be representative of at least half of the site. This sample formed the basis for stating that representative artifacts and features are known for the various components. The judgmental sample provided rich inventories, particularly the 1976 salvage of pit features filled with refuse, to supplement the 1% sample. This and the earlier judgmental sampling accomplished in 1969 and 1975 allowed us to investigate the rarer features such as house patterns and the Big Lake ditching system and to recover whole feature contents.

Research Question 3: What are the relationships between these temporally ordered components?

Barnes is not only the earliest recognized component at the Zebree site, it is also representative of the earliest Woodland occupation of the Big Lake region. To date, there are only a very few Archaic loci known for the area and no evidence of early or middle Woodland has come to light. There can be little disputing the hypothesis that Barnes represents a migration into an uninhabited region. Barnes,furthermore, appears to date late within the Baytown period, based on seriation, particularly of ceramics, and reinforced by the three radiocarbon dates which range from AD 664 to AD 816.

Radiocarbon dates for the Big Lake phase overlap with those for Barnes and these dates reinforce the interpretation that Big Lake almost immediately follows the Barnes occupation at the Zebree site. However, the stratigraphic relationship indicates a disconformity. The interruption is characterized by soil deposited directly on the unweathered Barnes midden in one part of the site. The two components are distinct in time and material culture and there is no evidence whatsoever at the Zebree site of a developmental sequence leading from Barnes into Big Lake. It is true that both components ate ducks, fish, deer, and raccoon, made pots, knapped chert, and stored food in pits; but there the similarity ceases. The technological superiority of almost every aspect of Big Lake life as seen in the material culture and inferred behavior is striking. Barnes is not typical late Woodland in lifestyle but more like Archaic, particularly in settlement pattern. Barnes and Big Lake seem to occupy the two polar extremes of the definition of tribal organization. We hasten to add that the Big Lake phase, while exotic, probably is not completely at the one extreme; certainly it is not identical to the Cahokia Mound 72 situation or to Etowah, Spiro, or Moundville. But it does seem to fall within the classification of chiefdom (Sahlins 1968:23-27), which polarizes it in reference to the decentralized segmentary tribal classification apparently the most appropriate categorization of Barnes.

Cultural transmutation to the Big Lake phase

The term "cultural transmission" means "the process by which individuals learn to be members of their culture" (Tindall 1976:195) so it is not appropriate to our needs in examing cultural change. As long as "cultural evolutionism" is defined as "an attempt to understand human cultural diversity as the result of a historical process of adaptation" (Greenwood and Stinil 1977:409) it is a theoretical viewpoint and not a statement of change. A concept, then, of "cultural transmutation" would seem to be suited to our purposes. That is, we wish to look at the kind of change involved and then examine possible theories to explain those changes.

No one disagrees that there is change through time represented at the Zebree site and in the Big Lake region from the Baytown period into Mississippian periods. But there is a disagreement, essentially unpublished, over the nature of the transmutation. First, is the transmutation one of degree or kind? Second, was the change an *in situ* evolution, one of diffusion and acculturation, or one of migration and amalgamation?

The contrast between Barnes and Big Lake is startling, despite the similarities of tribal organization, and are in accord with the difference between a decentralized segmentary lineage and that of a centralized chiefdom. There is such a wide gulf between the two expressions of human behavior that it is very difficult indeed to postulate an evolutionary change from one into the other, given the very short period of elapsed time indicated at the Zebree site. Also, there is no evidence of a developmental phase within the surveyed portions of the Big Lake region. Transmutation almost certainly was caused by an outside source, whether diffusion or migration, with rapid consequences.

Change may take place so rapidly in reference to archeological time periods that it appears to have occurred over a wide area simultaneously. Or it may progress at a slow enough pace that its approximate origin may be pinpointed and its geographical spread through time mapped. Change may involve the interdigitations of different neighboring societies so that in effect it does take place over a limited area simultaneously. Transmutation in cultural behavior is at the same time the very essence of anthropology while perhaps the one of least understood aspects of human behavior.

The basis for cultural transmutation to Mississippian is the "law of cultural dominance" (Sahlins 1968:2). This states simply:

> . . .that cultural dominance goes to technical predominance: the cultural type that develops more power and resources in a given environmental space will spread there at the expense of indigenous and competing cultures.

To the northeast, almost continuously into the Cairo Lowland are a series of sites which contain features and artifacts similar to that associated with the Big Lake phase at Zebree (Chapter 21; Fig. 2-7). These all relate to the Fairmount phase at Cahokia (Fowler 1968) but have a distinctive Cairo Lowland ceramic cast. They all belong to the same period and probably are somehow related. The Big Lake phase is the furthest recognized southwestern extension of this culture and the only expression not in a Baytown cultural area. Cahokia could not possibly have contributed sufficient populations to occupy the northern alluvial valley as well as populate all of the areas elsewhere postulated for it. The brief amount of time now apparently involved, perhaps at most 100 years, for the development of a full-blown Mississippian chiefdom similar to the Big Lake phase in the Cairo Lowland may mean that the development may have come into being simultaneously with, or very quickly as a result of, a development in the American Bottoms near St. Louis. Although our control over developments within this time period has not developed sufficiently to be firm, we can say that this region does seem to constitute the heartland of Mississippian. The relationship of Mississippian to Baytown culture in the Cairo Lowland probably was quite different than that between Barnes and Mississippian; for one thing the level of sociocultural integration may not be so nearly distinct.

In other words, transmutation had to involve indigenous populations to a greater or lesser extent. The decentralization of Barnes indicates to us a high probability that migration with subsequent amalgamation of the small Barnes population is the cause of transmutation within the Big Lake Region. On the other hand, the Hoecake phase could be a result of diffusion from and acculturation to the proto-Fairmount phase, but as yet there is no evidence either way. In fact, there is a feeling that Fairmount itself could have been a response to developments within the northern extreme of the alluvial valley (John Kelley, personal communication). To date, the Cahokia area is the only really socially complex region known immediately prior to the emergence of Mississippian.

Migration into an area of decentralization is perhaps easier to accept than into an area of centralization. Sahlins (1961) has hypothesized that even a strongly structured segmentary tribe is no match when in competition with an expanding chiefdom and we cannot assume that Baytown culture was able to acculturate before a migration took place (Willey 1953). The situation discussed in Chapter 1 with reference to the Mississippian transmutation in the Western Lowlands fits Willey's model fairly closely in terms of the final expression.

Advocating migration is tricky. We see site unit intrusion at Zebree and conclude, based on our survey data, that the apparent intrusion is from outside the Big Lake Region, probably from the northeast and possibly from as far away as the Cairo Lowland. First, was the Big Lake phase occupation at Zebree the only intruding population or were other Big Lake phase sites involved as well? The population increase from Barnes to Big Lake in the area could have been from 150 (or less) to 1000 or more and the invading population probably was at least 140 and perhaps constituted as many as nearly 500. These figures are guesses based on inadequate survey data but represent the only guess we currently have. At the least, then, the migration apparently would have equaled the maximum indigenous Barnes population.

The chiefdom form of tribal organization is based on individual rank by virtue of primogeniture. The "conical clan" is composed of a group of lineages ranked according to the birth of the oldest male. They are "conical" since few are high ranked and many are low ranked. One lineage and one male is paramount. The chiefly postions are political and the paramount chief is chief of the district. He is in direct control of surplus goods and even can conscript labor for public works. The highest ranking lineage seems to enjoy the not inconsiderable fruits of the others' labor (Peebles and Kus 1977).

Sahlins (1968:24) states that:

> It may be that the tribe as such is constituted as a single clan-chiefdom, but more often it is divided into several independent chiefdoms, fighting over who is finest in the jungle.

This provides a mechanism for lesser ranked lineages to move into new, less competitive niches where they would be the highest ranked lineages. The Hoecake site may be as large as 80 hectares in extent and include a large number of mounds (Chapter 21). However, the specific house clusters are very similar to those at Zebree, apparently even being the same approximate size, and almost identical artifacts and features exist at both sites. The only difference on a household or even house cluster level is the large percentage of Mulberry Creek Cord Marked sherds at Hoecake which predate the Mississippian material. The Hoecake site is not being transported to the Big Lake shores; rather, the Hoecake phase lesser ranked lineages are proposed as possible cultural and biological sources for the formation of the Big Lake phase. Actually the Hoecake site could well date as late or even later than the Zebree site and the large number of mounds and the possibly large size of the community may even be post Zebree habitation developments. It is now clear that the developed Fairmount phase at Cahokia probably almost entirely postdates the Zebree expression.

<u>Transmutation into the Lawhorn phase</u>

The Lawhorn phase represents a substantial population increase in the general region but at the Zebree site itself, the Lawhorn component consists of three structures. Differences with Big Lake involve larger houses with interior hearths, probably above ground storage with the development of daub sealing for silo-type structures, and stylistic changes in ceramics and lithics. There are more similarites than differences with Big Lake and what takes place is an intensification of what is considered Mississippian, seen at some villages in the form of pyramidal mounds, for instance. The Lawhorn phase is a local development and there is more than ample time to explain the changes recorded archeologically.

Cultural transmutation in the historic periods

The Euro-American Pioneer occupation at Zebree could be Indian but more probably is white. If Indian, it would probably consist of a group passing through Arkansas on its way eventually to Oklahoma. However, the well evidence suggests an Anglo-based family homesteading at the Zebree site. This is part of the migration of Euro-Americans and others into the western frontier in the early 19th century.

The Sebrees themselves during a later period are known to have migrated here from Kentucky (Leonard Sebree, personal communication). They were part of a general migration which took place after the Civil War disruption and with the beginnings of lumbering and the railroad. There was apparently little conscious cultural continuity from the Euro-American Pioneer period into this period represented by the Sebree occupation.

Research Question 4: What were the relationships between each of the components and contemporary socio-cultural systems?

Barnes

Hopgood, in speaking of "the Barnes-Baytown problem in pottery classification", offers the following hypothesis (1969:68-69):

> Hypothetically the variability in quantity of sand in Baytown Tradition pottery can be accounted for by such natural factors as the amount of sand in the clay sources available to the potters. Therefore, the division of the pottery into a Barnes (sand-tempered) and a Baytown (clay-tempered) series is not useful for cultural historical interpretation.

One test implication of this hypothesis is that temper should relate to environment in terms of sandiness. Barnes ceramics are distributed over several physiographical subdivisions (Phillips 1970:903). This does not support an environmental hypothesis for sandy textured pottery.

A second test implication is that sand is a constitutent of the clay collected to manufacture into pottery and it is the varying amounts of this sand which create Barnes or Baytown ceramics. However, the pottery clay collected for manufacture is backswamp clay and is relatively free of sand inclusions. Sand was added to the paste deliberately for technological reasons (Chapter 16). Furthermore, the sand included in the Zebree sherds has been modified considerably by wind erosion, indicating that it was collected from a different place than the clay. This second test implication is also negated.

The hypothesis that Barnes and Baytown are two separate and distinct traditions is supported by the previous discussions concerning the two test implications. In addition, Barnes ceramics occur on contiguous sites within a restricted geographical region. Baytown ceramic sites also follow this pattern (Chapter 17). Overlap of Barnes and Baytown areas (Fig. 17-5) is interpreted as fluctuation in culture area borders through time. This hypothesis best explains the patterning of sites with Barnes and Baytown ceramics.

Three additional hypotheses developed by Sahlins (1961) concerning cultural expansion and confrontation of the Tiv, Dinka, and Nuer have been applied to the Barnes-Baytown situation (Morse 1977b). Their application basically has been from the standpoint of testing the usefulness of these hypotheses in explaining patterns of archeological remains and at the same time providing some specific aspect of those remains to investigate. The main difficulty with late Woodland investigation is that the traditional avenues of analyses are not very exciting; *i.e.*, the ceramics and lithics are generally unimpressive with minimal variability. The application of the Sahlins' hypotheses, however, allows us to investigate some potentially exciting aspects of human behavior; at the least, it should organize our concept of Barnes and Baytown.

All tribal societies grow by segmentation along kinship lines. The first hypothesis is that a tribe moving into an uncontested or uninhabited territory will grow by segmentation but the resulting segments will tend to become autonomous. In other words, the maximum effective level of socio-cultural integration will not exceed the lineage or village. The tribe or subtribe cannot operate as an integrated unit.

First, the apparent presence of uninhabited territory ready to be occupied seems to fit the Big Lake Region situation at the beginning of the Barnes occupation. Earlier Barnes sites and Baytown sites are not present according to current site survey data. Sites located in survey and the excavation of the Zebree site indicate that the village, possibly a lineage made up of four separate extended family households, represents a maximum seasonal expression of integration. The more typical site is small, possibly only a single household, and seems to form part of an open community settlement pattern. No mound sites are known. Barnes seems to be an example of decentralization almost to an extreme, as suggested by the first Sahlins hypothesis.

The second Sahlins hypothesis possibly pertains to Baytown. In essence, it states that a tribe growing by segmentation and expanding or attemping to expand its territory into areas where it is challenged tends to be more cohesive at higher levels of socio-cultural integration. There are Baytown mound sites and exotic artifacts possibly suggestive of pan-tribal or pan-subtribal ceremonial activity. While villages may be basic autonomous units within the loosely integrated tribe, these villages may include more than one lineage and there may be a potential, possibly rarely realized, for the subtribe to act as a cohesive unit. Baytown also apparently is expanding into uninhabited territory but this expansion may involve two or more tribes (or subtribes) in competition for the same territory, thus it would not be "uncontested territory." The possibility of subdivisions within Baytown must be researched with the attempt to test this hypothesis in reference to Baytown remains. Competition may be an important ingredient leading toward tribal centralization. The ultimate, of course, in tribal centralization is a chiefdom form of organization wherein a sociopolitical hierarchy is based upon and justified by kinship relationships.

The third Sahlins hypothesis is basically that when these two different kinds of tribal organizations come into contact with each other and begin to compete for territory, their respective degrees of sociocultural integration remain the same. The Barnes cultural adaptation to expansion into uncontested territory is not expected to change adequately in order to confront competition from the more highly integrated Baytown, according to this hypothesis. Such a change does not seem to have occurred, as predicted, but considerably more survey data are needed and good excavation information is necessary from sites existing in the region where both Baytown and Barnes ceramics are found.

A fourth hypothesis is that given such a confrontation the tribe organized into cohesive units on a higher level of socio-cultural integration will conquer and absorb its competition. The local expectation based on this hypothesis is that Baytown will expand its territory at the expense of Barnes after the two come into direct contact with each other. Sahlins' hypothesis also indicates that territorial encroachment is accomplished by "leap frogging" or by continuous pushing. Test implications are that there should be overlapping at the common borders of the two major ceramic traditions and that in every case of overlapping the Barnes expressions should be earlier than the Baytown expressions. Furthermore, there can be rare examples of Baytown sites just beyond the overlap region within Barnes territory.

That an overlap exists between these two traditions is indicated by Figure 17-5 and the nature of the overlap in Arkansas is also demonstrated by that Figure based on the Village Creek survey data (Klinger 1977). In the Village Creek Watershed, 20% of the 177 Woodland sites discovered contained both Barnes and Baytown ceramics (Stewart 1977:199). The other 80% contained either only Barnes or only Baytown ceramics. As Stewart indicates in one of two alternate second generation hypotheses, the mutual exclusiveness of site ceramics within the same general area indicates a temporal ordering of Baytown and Barnes.

Baytown was found on 71% of the sites, 83% of which were located toward the south of the area under consideration. Barnes was found on 29% of the sites, 32% of which were located toward the north of the sampled area. Since approximately 38% of the sampling accomplished in the first three stages is north of the line chosen by Stewart (Transect 107; Klinger 1977:99-132) then Barnes sites are fairly equally distributed to the south and north while Baytown sites are more concentrated in the south. This concentration of Baytown to the south indicates that Baytown possibly is conquering and absorbing Barnes in a push up the Western Lowlands toward Missouri.

The same sort of overlapping seems to be true in the Cairo Lowland and west of Sikeston Ridge (Fig. 17-5). At site 23NM269 at the edge of the Cairo Lowland, Baytown pottery seems to replace Barnes pottery in the stratigraphy (R. Williams 1972:46). The situation is not completely clear, however, and better stratigraphic control is needed to test this prediction of the fourth hypothesis as it relates to the relationship of Barnes and Baytown.

The possibility of Barnes Plain being replaced by Mulberry Creek Cord Marked within much of the overlap area needs to be investigated. An indication of this possibility is at site 23NM169 (R. Williams 1968:40-43), but this is very weak data for testing this test implication of the hypothesis. The predominant surface treatment of Barnes ceramics in the eastern part of the exclusive Barnes area is cord marking. Plain surface treatment occurs to the west where probably earlier Barnes components are prevalent and within portions of the overlap zone where possibly slightly earlier Barnes components were absorbed by Baytown. In the Village Creek Watershed, the reported Barnes Plain may include a large percentage of eroded surface sherds; wherever only a few sherds are found on the surface or in disturbed deposits, the erosion of the exterior surface of small sherds is going to be a factor potentially altering the data.

In the Barnes occupation at Zebree, a few Baytown sherds indicate the possibility of occasional trade vessels being obtained from Baytown neighbors probably located across the Little River. Zebree is located within the east center of the Barnes distribution and may have felt the pressure of the hypothesized Baytown expansion. If the sherds do represent trade vessels, then knowledge of the Baytown presence is represented. This may be important if our investigation ever gets to the point of trying to examine the possible methods of absorption by Baytown if that indeed continues to be a probability.

Big Lake

As mentioned earlier in this chapter, the Big Lake phase probably is contemporaneous with the Fairmount phase at Cahokia, with Hoecake and Hayti phases along the Mississippi River, and with the emerging Mississippian in the Western Lowlands. This latter situation is doubly interesting since it seems doubtful, if Barnes is as decentralized as we have indicated, that it could have acculturated into Mississippian. The presence of the flat-based "Baytown-like" pot in the initial Mississippian expression in the Western Lowlands may provide an answer. It suggests that Baytown may have absorbed the Barnes expression in the Little Black Drainage immediately before the acculturation to Mississippian.

Also contemporaneous with the Big Lake phase is Coles Creek culture to the south if the dating of the Coles Creek period is correct. The nearest expression of Coles Creek-related traditions centers near Little Rock and Brinkley. The Little Rock expression currently is under intensive investigation by Rolingson (1977).

Farther afield but dating to the same general time level as the emergence of Mississippian are the beginnings of developmental Pueblo. This apparent coincidence needs to be investigated, but not in the present report.

Lawhorn

The Lawhorn phase or group of phases is part of a northern alluvial valley pattern of very similar appearing complexes which are widely scattered and possibly represent smaller independent chiefdoms with higher ranking chiefdoms located in crucial environmental regions. Later, these condense into three major phases in the northern portion of the alluvial valley with uninhabited buffer zones between them. The patterns are only just becoming apparent; the systems behind them are still obscure.

Historic

The historic Euro-American component at Zebree is still little understood in relationship to contemporary social systems. There was an early-middle 19th century dispersed farmstead at Zebree with imported English ceramics as the common tableware. Socio-economic relationships to other farmsteads, to New Orleans and St. Louis, and the nearby towns are just beginning to fit into a pattern. These people have been unknown, since technically they squatted on goverment land, did not pay taxes, and did not build on a section line (and were thereby ignored by the original land surveyors, if indeed they still lived there when the section lines were laid out).

The Sebree occupation is more easily related to contemporary social systems, although the new ditch literally destroyed even that basic bit of historic archeology, as the landings and points from which Big Lake was exploited more than 30 years before the lake became a national refuge are now gone.

Research Question 5: The role of population magnitude in the shift from Woodland to Mississippian

It is fairly certain that there was a substantial population increase with the emergence of Mississippian. Our hedging is due to the fact that most Mississippian phases described in the literature post-date Zebree, (generally around AD 1150), leaving a 450 year time period over which we as yet exercise little control. Within the American Bottoms near St. Louis where some control over AD 1150 phases does exist, there is an apparent 150%

increase in the number of village and camp sites during and to around 100 years beyond the late Woodland period (Munson and Harn 1971:9-14, 30-36). The population increase from middle Woodland to Mississippian is particularly impressive there (Munson and Harn 1971:Figs. 28 and 32). Much of this population may be derived from the loess-covered bluffs surrounding the American Bottoms in Illinois, but the general expectation is that significant biological unit increases beginning around AD 700 soon will be adequately documented.

Documentation of this increase is trickling into the current literature. Evidence of possible human sacrifice, particularly of a large number of females in one burial pit, in the deposits of Mound 72 at Cahokia (Fowler, personal communication), implies a surplus of adults in the Fairmount phase. The expansion into uninhabited or sparsely inhabited environmental niches around the beginning of the Coles Creek time period by Baytown and Barnes also implies biological increase. The hypothesis of Mississippian site unit intrusion in the Big Lake Region implies biological increase to allow segmentation and subsequent movement. While the increase in site size is due to an unknown degree to the integration of indigenous autonomous Woodland groups by whatever means into a new social order (the chiefdom), the population estimations now appearing for post AD 1150 sites (Chapter 25) implies significant biological increases.

Mississippian probably involves a social organization which could accommodate significantly more people than Woodland apparently was able to accommodate. If true, population magnitude was an important variable in the shift from Woodland to Mississippian. However, whether it is a cause of, or due to the emergence of Mississippian is very much a disputed point. Meyers' (1971) concept of population pressure as a causative factor in the origin of domestication in Mesoamerica is pertinent here, although we are not as much concerned with *the* origin of domestication as with the wide spread shift to intensive agriculture from an earlier period of alternative interactions with a variety of environments. The possibility of population pressures in and around the American Bottoms and within the Cairo Lowland will have to be investigated from the standpoint of Meyers' ideas.

The domestication of crops may have had a long history in the eastern United States prior to the crystallization of Mississippian. Adoption of horticulture seems to be part of the alternatives of some groups to accommodate themselves within specific, sometimes changing environments. Population increase within specific regions may have occurred in response to, or possibly was the cause of domestication. Until Mississippian emergence, however, there is no general agreement by archeologists about chiefdom organization; in fact, all cultural expressions, including Poverty Point and Hopewell, prior to Mississippian can be reconstructed within current understandings of segmentary tribal organization. If population pressure is critical to Mississippian emergence, there needs to be an explanation of why it became critical at the particular point in time and not earlier.

The more important agriculture became through time, the more population increase would be at a selective advantage. If White (1959:47) is correct in his argument that agriculture represents an increase in the production of goods per unit of human energy expended in contrast to collecting wild foods, it follows that the more units of human energy (people), the greater will be the production over that needed to feed and clothe those people. To maximize the production of surplus goods, then, an increase in population is beneficial to the system.

There are other things which indicate that a growing importance of agriculture may have induced population increase. The population increase seen with the advent of the Neolithic is apparently explicable in terms of healthier females and births (Hassan 1973), a decreased age of menarche in the female, possibly due to dietary changes with the advent of agriculture (Sengel 1973), and the relaxation of birth control methods (Hassan 1973). Birth control and infanticide are known to be practiced in modern hunters and gatherers and have been postulated to explain how population was kept to a very low annual growth rate during most of the period of human history (Hassan 1973). Child spacing probably is the same amongst hunters and gatherers and in agriculturalists due to deterioration in health and the increased possibility of early death of the female if spacing is too close (Hassan 1973). The statistics are not all that definite, but in the Archaic, adult female deaths appear to be occurring during expected periods of child bearing beginning around 16-17 with few females surviving beyond around 28-30 (Morse 1967:286-289; Webb 1946). The late Archaic seems to be just reproducing itself. In Illinois Hopewell, (a late Hopewell) population sample indicates that the average age at death for adult males was 44.3 and for adult femates 42.8 (Morse 1963). Relative to the male, the female may not be as healthy but is longer lived than previously and could produce babies sufficient for population increase even with a 60% mortality rate. At Zebree, females were seemingly tall and healthy and may have outlived males (Chapter 23; Appendix): repectively, the average age at death was calculated as 40.5 and 37, but with overlapping standard deviation. The Big Lake female apparently was capable of producing more healthy children than a female could during the Archaic period and possibly during the Woodland period as well.

While population magnitude may or may not be a causative variable in the origin of Mississippian, it appears to function in an important supportative role in the continuation and spread of the Mississippian system. In the case of the site unit intrusion into the Big Lake Region as represented by the Big Lake phase at the Zebree site, a well-organized population which seemingly budded off from somewhere to the northeast was able,apparently, to quickly and efficiently build the site. The increased population in the Cairo Lowland, if indeed that is where the Big Lake phase originated, should not have caused demographic pressures for such a migration, since there is no evidence anywhere in the northern alluvial valley for the human carrying capacity to be approached, but such migrations, no matter how small the intruding population numbers may be, are a direct result of population increase. Such migrations, or their potentiality, appear to be a prime cause in the spread of Mississippian culture beyond the heartland.

Population estimations were attempted in reference to the three prehistoric components at the Zebree site. Midden concentration maps based on artifact density in the 1% sample were constructed for Barnes and Big Lake. Each concentration was interpreted in terms of number of houses estimated for a typical midden concentration and in terms of the apparent household size, based primarily on cooking jar capacities.

The maximum population for Barnes at Zebree would seem to be around 40-50 and that for Big Lake around 140-150. A figure for Lawhorn was around 15 since this was a three structure hamlet rather than a village. Fitting the Zebree site into a regional settlement pattern suggests regional populations for Big Lake at three to six times that of Barnes and for Lawhorn three or more times that of Big Lake. There seems to be a significant increase through time from the beginnings of Mississippian occupation.

Research Question 6: The role of subsistence energy in the shift from Woodland to Mississippian

Ford hypothesizes that "on the bottom lands of the major rivers in the Midwest the trend toward dependence upon agriculture resulted in a new, more complex social structure" (1974:405). Most archeologists would probably agree that Mississippian is based on intensive agriculture, is, in fact, dependent upon agriculture. Hunting and fishing and probably the gathering of wild plant foods continue to be important, as indicated by the Zebree fauna and flora lists for the Big Lake phase (Chapters 21 and 22). Also at the Zebree site in association with the Big Lake deposits there is ample evidence of corn and the possible storage of corn in large storage pits and the curation of seed in special pottery vessels (Chapter 21). No corn or any definite cultigen for that matter was found associated with Barnes but Smith's (1976) criticisms of this research question in terms of preservation or seasonality of occupation or sample size suitability makes us very cautious in interpreting only from these data. The Mississippian material culture inventory at Zebree, in contrast to Barnes, includes chips from large stone hoes and fragments of heavy cutting implements capable of clearing forest growth. In addition, both the Big Lake and Lawhorn components appear to be permanent year-round occupations in contrast to the possible seasonality of the Barnes village. Also, in contrast to Barnes sites, Mississippian sites in the Big Lake Region are concentrated on the best available land for crops (Fig. 17-4 and AAS files). The implication of all this is that Mississippian in the Big Lake Region was probably dependent upon agriculture whereas Barnes probably was not.

The Big Lake phase at the Zebree site is affiliated with the Hoecake phase of the Cairo Lowland, located adjacent to the Mississippi River, the largest river in the Midwest. By virtue of the possibility of site intrusion, the Zebree data suggest that the Cairo Lowland may represent the southernmost possible part of the Midwest where Mississippian originated. The role of *subsistence energy* as a causative variable, however, remains pretty much on the same level of theoretical perspective as existed before the Zebree investigation. If White's ideas on the primacy of technology are correct (1959) subsistence energy has to be an important variable. It is difficult to view the social complexity reflected by the artifacts and features at Zebree during the Big Lake phase as being derived from a Barnes subsistence base. At Zebree, we simply were not able to quantify energy beyond apparent yield as reflected by storage pit size but were able to demonstrate technological superiority over Barnes in almost every aspect of Big Lake technology. This, in turn, implies but does not prove superiority in subsistence energy. This implication is strengthened by the data at Cahokia during the Fairmount phase, a culture affiliated with the Big Lake phase.

Research Question 7: The role of social differentiation in the shift from Woodland to Mississippian

At Cahokia, there is considerable documentation being gathered together for interpreting a complex system of social stratification (Fowler 1969; Fowler and Hall 1975; Jerry Rose, personal communication). The stratification apparent at such sites as Moundville is in accord with the chiefdom system of tribal organization (Peebles and Kus 1977). As Peebles predicted (1976) the limitation of time and money and the absence of a burial population to use as a basis for interpretations of interpersonal relationship caused this to not be as fruitful an enterprise as the other research questions.

One burial group at Zebree, Burial 3, was a "best" candidate for an elite ranking lineage within the Big Lake phase village. It was made apparently within a charnel house in contrast to other burials, and was located within the suspected house cluster area of an elite (Area A). However, there was no burial furniture and nothing else to differentiate this burial from the others on the basis of status. Other burials within the suspected area of the elite portion of the Big Lake population were similar to burials found elsewhere.

Trace element analysis was conducted to compare with Mound 72 skeletons. In contrast to Mound 72 skeletons, the Zebree skeletons reflected the significant lack of a red meat diet the year preceeding death. The presence of fish and duck bones at the site demonstrate that high protein values were obtainable from nonred meat sources. The importance of the whitetailed deer within Mississippian as the major source of red meat is well documented (Smith 1975a). Mammal bone, caught by the ¼" screen in contrast to the equal distribution of other major classes of bone, does concentrate at the suspected elitist Area A and the identified ¼" screened mammal bone at the site is largely made up of whitetailed deer, with raccoon a close second. This is a possible indication that whitetailed deer are mostly consumed by a privileged portion of the Zebree population.

Other tests of artifact distribution to support Area A as the site of an elite portion of the population (in control and consuming of exotic goods, as suggested) for chiefdom by Peebles and Kus (1977), were generally inconclusive. This area is rich in terms of artifacts, particularly those tending to be complete and exotic. But a plotting of *Anculosa* beads for instance demonstrated that Area B produced a larger number of beads and bead blanks than Area A. In addition the three-barbed harpoon was found in Area B while the other three, single-barbed harpoons were recovered in and near Area A. The only stone discoidal found at the site was in Area B. Paint stones and the only fragment of mica from the site were recovered from Area A but other artifacts were shared by these two areas.

Zebree seems to be somewhat more egalitarian than expected based on the results of analysis of material at the later larger centers. It was suggested earlier that the whole site population may be made up of similar ranking lineages. The position of Area A is more in accord with the expected location of the highest ranking lineage overlooking an open plaza area toward the lake (Chapter 21). If each house cluster (midden concentration) is a lineage, then at Zebree two of them seem to be of somewhat similar rank based on artifact distribution. Other known Big Lake phase sites in this region are smaller in extent and contain less of a variety of material goods, particularly lacking the microlithic industry (with the exception of a site adjacent to Zebree which may be a specialized microlithic manufacturing locus). No real hierarchy of sites with Zebree at the head has been worked out; in fact, such a hierarchy would be difficult to do at any time period within the Mississippian of the northern alluvial valley with the exception of the Powers phase (Price 1974).

Research Question 8: The role of labor specialization in the shift from Woodland to Mississippian

The hypothesis "a shift from family-based labor to communal labor organizations may be an important factor in the development of the Mississippian" was proposed by Raab (1976a:25). Household economy is an important facet of both Woodland and Mississippian since it is important in both segmentary tribes and in chiefdoms (Sahlins 1968).

Communal labor is labor beyond the household, incorporating two or more households. This is not necessarily characteristic of the chiefdom organization and may be found in virtually all levels of tribal organization. However, as higher levels of socio-cultural integration are involved in a cohesive venture incorporating and directing labor forces beyond the household, the more complex the tribal organization must be.

Labor specialization involves the removal of someone from basic household economics to a position of being supported by surplus from household production units in a society. It is generally conceded that priests and especially chiefs in a chiefdom are specialists of this kind. They are supported by the society's surplus production and it is the role of the chief (or hierarchy of chiefs) to encourage surplus production, direct its production, see to its storage and distribution. It is also the chief's role to organize and direct the construction and upkeep of public works, to do what is necessary for security and diplomacy, and to regulate internal affairs--to keep the peace even if it conflicts with traditional household practices. At Zebree, indirect evidence of such behavior is possibly inferred from the palisade system around the site and the landfill in Area B. It is possible that the construction of Mississippian rectangular houses is an activity beyond the reach of the household and has to be accomplished by a communal work force. No indication of this kind of behavior was found associated with Barnes.

At the Zebree site in the Big Lake phase there is evidence of over-production beyond local need. Storage pits average 2 metric tons and range up to 4 metric tons in capacity. One metric ton is sufficient for a household for one year (Flannery 1976). A population of dogs is present, perhaps averging around 20, This is unusual for Mississippian (Smith 1975a). The human skeletons reflect a healthy biological population. This is unusual for Mississippian in the Midwest because of suspected dietary deficiencies (Jerry Rose, personal communication). Preliminary trace element analysis indicates that red meat is not being eaten in significant quantities yet the infections indicative of protein deficiencies are not prelavent (Chapter 23; Jerry Rose, personal communication). The indication is that there seems to be more than enough nutritious food.

Microliths associated with the Big Lake phase occur in large numbers; puzzling since they do not seem to wear out once made correctly (Chapter 19). They occur with byproduct debitage with each of the midden concentrations and hence probably at least one male in each lineage knaps microliths, and possibly every male is capable of accomplishing this feat. But, there are probably not enough microliths at the site to account for all males continuously making microliths, so presumably there is some sort of a limitation to those who are better knappers. The same seems to be true for the manufacture of adzes and celts, and other items of material culture. Pottery vessels seem to have been made and possibly fired in communal areas near each of the midden concentrations but this is interpreted as an indication of working together rather than specialization by any one person (Chapter 21). The acquisition of raw materials from the Crescent Quarries and from the Ozarks might be limited to only a few males, but there is no possible way to show specialization. Trade presumably would be restricted pretty much to the ranking lineage but this is not based on any evidence from the Zebree site. The best candidate for labor specialization is the manufacture of salt in an area adjacent to Area A low in most artifact classes, except for Wickliffe funnel fragments.

Mississippian society probably is based on the ability to command large populations under central control for overproduction and for special projects. Barnes does not seem to be operating beyond the lineage level of socio-cultural integration. The Big Lake phase at the Zebree site is apparently operating at least at the village level and possibly at a tribal level based on a very limited knowledge of other sites. There is no definite evidence of labor specialization in the sense of manufactured goods such as microliths and adzes, beyond the household level. Technological superiority of crafts manufacture is evident but this does not by itself imply supra-household manufacture. The microlithic site adjacent to Zebree and the Zebree site itself may indicate a site or community specialization in the manufacture of microliths or perhaps the bone and shell artifacts thought to be the end results of this specialization. Not enough is known of other sites to test whether, as apparently is the case in the Nodena phase, there is site or sub-tribe specialization in the manufacture of basalt and granite artifacts.

CHAPTER 4

ENVIRONMENTAL PROBLEMS

Dan. F. Morse

This chapter is a continuation of the previous chapter. It is difficult to separate cultural and biophysical problems since they are interwoven. Probably the main purpose of this separation is to emphasize the need for environmental archeology in the Southeast, for it seems to be lagging behind behavioral archeology.

Research Question 9: What was the Adaptive Niche of Each of the Components?

The Barnes occupation pattern evidently was a seasonal shift. Winter villages were established on high ground and may have constituted a maximum social fusion. At Zebree, apparently no more than about 50 individuals and as low as 10 lived in a winter village. Any use as a summer village or as a temporary extraction camp was not recognized but such use might be masked. There is an indication that smaller sites existed within the region, ranging from small lithic scatters, presumably hunting camps, to ceramic scatters, presumably short-lived summer house sites, to combination larger lithic and ceramic sites which might be winter or summer villages. Scheduling of resource exploitation probably involved hunting, fishing, and gathering of wild plants plus an unknown degree of horticulture. The environmental reconstruction indicates that the Big Lake region may not have been very attractive. The lake probably was not present and the fauna consisted basically of small mammals and rodents (Paul Raines, personal communication). Ample fish, however, would have been in the streams and this was a major duck and goose flyway. The white tailed deer population was probably low. For small shifting populations the environment was adequate.

A basic consideration of our research was to pinpoint, if possible, just what attracted Mississippian culture to the Big Lake area. Specifically, the question was asked whether the creation of a new habitat, an open lake, by geologic mechanisms might have attracted a developmental Mississippian group of people into the area. In a very general sense, these late Woodland and developmental Mississippian groups can be considered integral components of their ecosystems. Thus, an understanding of the environment(s) in which they were operating is essential for any explication of the nature of their culture.

The reconstruction of the prehistoric environment, therefore, was basic to our research goals.

The environmental reconstruction was based on middle 19th century land survey notes in relationship to modern topography and soil types. A pollen profile from Big Lake itself begins slightly earlier than the reconstruction but has not been integrated with the reconstruction mainly because there are conflicts due to size of pollen, strength of winds, water borne pollen intrusion, and other factors. The dendrochronology data has been collected but not analyzed so it cannot be integrated at this time. Site pollen was insufficient for comparisons with the lake pollen to test whether the same essential environment existed back in time as we think it did. Animal species have not been plugged into the reconstruction as fully as we would like because we lack control on too many variables.

One continuing problem in Mississippian studies is just what constitutes intensive agriculture. Mississippian society is based on intensive agriculture but large amounts of fauna and wild flora remains still occur in the typical midden. There continued to be a dependence on wild food because it was economical and provided variety. Ducks and fish are collectable in large numbers at certain seasons. Deer represent a lot of meat even on a single specimen. Deer products other than meat also are important for clothing and tools. At Zebree there would appear to be sufficient grain to subsist on that alone, yet a great deal of bone refuse is mixed in the midden deposits.

A related problem developed as to just what was the meaning of the word "midden", and could different middens be compared to each other or was some sort of adjustment necessary in our approach to the different components. Primarily, how midden deposits related to human behavior became an important question.

The Lawhorn component was a farmstead consisting of three structures, probably all residential. Its location on the west edge of the site may indicate that Big Lake itself is not as important as the fertile soils and the villages to the west. This is true also of the early historic component location but the later historic component is as close to the lake as possible presumably because the lake constituted the basic source of livelihood for the Sebrees.

Research Question 10: What was the Big Lake Phase District?

Earlier reference in Zebree reports were to the "Big Lake Highlands" (Morse 1975b, 1977b). Actually the term "Big Lake Highlands" taken from Figure 73 in Williams (1954) refers to a narrow highland strip which runs from north of Manila into Missouri and upon which the road to Grand Prairie was located. At the insistence of the historic-oriented individuals on the project (Suzanne Harris and Phyllis Morse), a new name, the Big Lake region, was coined to refer to that area between Big Lake and the St. Francis River north of the confluence of those streams near Marked Tree. This is basically the Braided Surface C portion in Arkansas except for the southern tip west of the St. Francis River. A more detailed description of the physical and vegetational attributes is given in Chapter 13.

We do not know whether this region is the actual territory of the Big Lake phase or not. Logically it should be and historically this area, often referred to as "Buffalo Island", does have social-cultural reality. Today and in the historic past, there were social ties into Missouri as well, and we would expect this to be valid in the prehistoric and early historic period when Missouri did not exist as a political unit.

The environmental reconstruction was accomplished with the assumption that the area north of Marked Tree and between the Little and St. Francis Rivers and south of the St. Francis River gap in Crowley's Ridge was or at least included the territory of the Big Lake phase. A number of sites exist within this region which exhibit obvious relationships to the Big Lake phase. The Zebree site, thought to be the regional center, is located midway between the north-south extremes just discussed and immediately west of Big Lake on high ground bordering the eastern portion of the region.

Research Question 11: When Did Big Lake Come Into Existence?

Two conflicting hypotheses exist in print concerning the origin of Big Lake. One (Fuller 1912) states that there was land subsidence during the New Madrid Earthquake of 1811-1812. This was later modified by Saucier to state that bank collapse and mud flow dammed up relict braided channels during the earthquake period causing the lake (1970). Saucier, however, proposed a conflicting alternate hypothesis as well, that the lake was caused by the alluvial drowning of relict braided channels by the construction of natural levees acting as dams when a crevasse channel of the Mississippi River attempted to divert the flow of the aggrading Mississippi River. The crevasse channel is now occupied by the Left Hand Chute of Little River and would have provided a buffer zone between the Big Lake phase and the Hayti phase.

The New Madrid earthquake hypothesis

A series of severe shocks took place within southeast Missouri, northeast Arkansas, western Kentucky and western Tennesse from December 16, 1811, into March, 1812, (Saucier 1970). Three of the eight violent shocks "had intensities of XIII (Modified Mercalli Intensity Scale of 1931) and probable magnitudes of 8.5 (Richter scale)" (Saucier 1970:2947-2849). Associated with these shocks were probably earth waving, fissuring, sand blows, stream bank collapse, and landslides. The Tiptonville dome south of New Madrid is hypothesized to have been uplifted at this time and an area in Tennessee is hypothesized to have subsided to cause Reelfoot Lake. In addition, the "sunk lands" within which occur Lake St. Francis and Big Lake are also hypothesized as being due to land subsidence during these three months. There may have been some faulting near New Madrid (Saucier 1970: 2849) itself, but for the most part faulting is not considered a characteristic of earthquake activity in alluvial soils.

Minor tremors are felt at least every year or two today. But during those three months thousands of minor shocks were felt in addition to eight violent and ten severe shocks. Original land records indicate "sunk lands" and fissures occasionally as possible earthquake-related phenomena. Archeologists have discovered sand-filled cracks apparently due to the movement of an area of higher ground toward lower ground (such as a slough bank) with a quicksand-like soil filling the crack instantly from beneath. Sand flowing out onto the surface become "sand blows". Some subsidence of topsoil will take place as the soil slumps into the crack at the same time the crack is filling with sand. A classic example of this was trenched in 1973 at the upper Nodena site and a lesser example was excavated at Zebree in 1969 (Morse 1975b, Fig. 8b). Very occasionally, displacement will occur as dramatically shown in a photograph of a burial interrupted by an earthquake crack at the Campbell site in southeast Missouri (Chapman and Anderson 1955:78). Almost every levee or point bar site excavated within the seismic risk zone if excavated intensively will upon close examination, reveal sand-filled cracks from a centimeter to over a meter.

At the Zebree site there occurred what appeared to be a complex picture of cracking with some localized subsidence. Some of the random squares penetrated into mixed "midden" and white sand layers due to this phenomenon. In the northeastern portion of the site, this was dramatically shown when bulldozer trenches revealed patches of mixed soils in 1976. Presumably these cracks and disturbances would have been associated with slumping of the higher knoll area of the site toward the lower swamp to the east. Undisturbed midden would have been displaced very little if at all. Wave action of the earthquake apparently would have lifted topsoil and replaced it exactly as before without movement or cracking. In support of this, undisturbed buried midden did appear intact. Features were symmetrical and clearly recognizable (not blurred at the edges). Bones in the burials, both dog and human, were articulated. Pottery vessels were found unharmed. This is the normal or usual situation with site deposits within the seismic risk zone and we assume that no significant displacement or disruption took place unless it can be recognized in the field by observation of the soil involved. There appears to have been only a minimum amount of damage to archeological resources within the seismic risk zone.

The folklore surrounding the New Madrid Earthquake is instructive to a certain extent. How reflective it is of actual events is questionable. Fuller's 1912 account includes much of this folklore uncritically. To date, a specialist in folklore has not examined this from the standpoint of separating out what is usual in tales concerning a natural disaster years after the disaster took place. Some events reported by Fuller seem extremely improbable, others unlikely and some, such as ascribing Crowley's Ridge to an earthquake, completely impossible. The hypothesis that the New Madrid Earthquake caused the land to subside to cause Big Lake is improbable for, as Saucier pointed out (1970), the water-filled depressions are relict braided stream channels. To have the whole section of land gently subside, preserving the original contours, is an improbable expectation. Saucier thinks (personal communication) that the possibility that bank collapse and mud flow could have dammed the relict channels causing them to fill with water is more probable. This explanation would allow the lake to originate with the New Madrid Earthquake.

The alluvial drowning hypothesis

Saucier proposed an alternate hypothesis which would have the lake come into being perhaps 1100 years earlier by virtue of a normal phenomenon of alluvial drowning due to damming by the levee construction of a crevasse channel of the Mississippi River now occupied by the Left Hand Chute of Little River. This would explain the strange parallel course of Right Hand Chute of Little River with Left Hand Chute between Big Lake and Marked Tree and the wide floodplain for Left Hand Chute of Little River (Fig. 1-2).

A meandering stream aggrades. It deposits detritus within its bed, reducing its gradient. At some point, the river will attempt to divert to a new course with a steeper gradient. The attempt may or may not be successful, but during the attempt, the crevasse channel may intercept tributary drainages of the river. Rapid alluviation involving the building of levees will cause the alluvial drowning of the intercepted drainages. There is a reduction in gradient and increased aggradation of the flood plain of the intercepted drainage. The southern (and lowest in elevation) portion will be drowned. Characteristics of drowning are standing dead timber and swamp or open-water appearance.

The Mississippi River began aggrading its bed when it changed from a braided to a meandering stream, approximately 6000 years ago (Saucier 1974:21). There is evidence of several abortive attempts of the Mississippi River to change its course to the lower elevated region halfway between the Tennessee uplands and Crowley's Ridge after aggradation had elevated the channel substantially. A series of relict channels exist immediately east of the Left Hand Chute of Little River, probably the latest and best preserved of the attempts. A reasonable time estimate for this latest event seems to be between 1000 and 1500 years ago. Both the St. Francis and Right Hand Chute of Little River would have been intercepted. The rapid construction of levees would have caused the alluvial drowning of the southern portions of both drainages and diverted the course of the Right Hand Chute as far as the St. Francis River. Big Lake and Lake St. Francis essentially consist of ponded relict channels of an earlier braided stage of the Mississippi River. Only near the crevasse channel do these lakes extend beyond the relict braided channels.

To date no large sites have been discovered within the specific loci proposed as lowered by earthquake activity. In addition, the observed settlement pattern of Mississippian sites makes sense in terms of the two lakes. An associated levee at the Hazel site does not contain earlier Mississippian artifacts, possibly indicating that the levee was being formed during that period (Morse and Smith 1973:76).

Research Question 12: Was Big Lake Important to the Big Lake Phase?

The alluvial drowning hypothesis would allow Big Lake to originate about the time that the Big Lake component migration took place. This would make the lake's importance pertinent to our understanding of the phase since there would be the possibility that it was instrumental in attracting the migration. As Smith states (1975a:167) "oxbow lake areas . . . . represented newly available, prime environmental locations for Middle Mississippi groups to settle". We might extend this to embrace all large lakes and emphasize the lake fauna as well as the natural levees which would provide easily tillable land (Morse 1973d:78; Smith 1975a: 167).

In any alluvial situation with a meandering stream, lakes are frequent. This is especially true of a low elevation region where backswamps abound and floods are widespread. There is no disputing that lakes and, most probably, lake exploitation existed. What is in doubt is whether Big Lake was in existence and whether we could test this as a hypothesis. A direct test was to obtain lake cores. An indirect test was to look at the nature of aboriginal environmental exploitation and see whether a large or small lake was indicated.

Lake coring was expected to help accomplish two objectives. One was to see what the environment looked like through the counting of pollen. A lake or swamp environment is best for pollen preservation and although there is the difficulty of relating pollen changes directly to cultural behavior, since the site context is not involved, this approach would allow us to make some meaningful checks on our environmental reconstruction based on other data. A second objective was to obtain a radiocarbon date which would indicated whether the pollen core and presumably the lake deposit predated or completely postdated the 1811-1812 date line. The cores did postdate the New Madrid Earthquake, but this did not completely disprove that the lake existed only after that time period. Indeed, the earthquake could have caused the deposition of a sandy lens through which the coring apparatus could not penetrate or, less probably, caused the older deposits to be washed out of the lake basin.

There are several indicators that the lake did exist and was important during the Big Lake phase. The clay base of the lake could be a source of pottery clay superior to the pottery clay available from backswamp deposits. Natural levitation has produced a fine and relatively clean clay. Freshwater mussel shells were collected for use as temper in pottery manufacturing. Serviceable shells are procurable from sandbars in rivers but a thinner-shelled and larger variety of shell populate lakes in contrast to rivers and would be an easier shell to process. Although the same species of mussels inhabit rivers and lakes, there are subtle differences in size and proportion and species preference which indicate a lake.

The same species of fish tend to inhabit both stream and lake, especially since lakes in a lowland environment are fed by the flooding of streams. Channel catfish (*Ictalurus punctatus* [Rafinesque]), for instance, inhabit both environments but in streams "rarely exceed five pounds," while "some lakes produce much larger fish"(Cross 1967: 206). In addition, certain species such as the largemouth bass prefer or are most common in lakes rather than streams (Cross 1967:253) and most particularly in lakes with clear water. Ducks prefer open water in good weather. Presumably, the more available open water, the more possibility of duck exploitation. However, the corresponding flooding of backswamp and other areas occur which creates considerable open water.

The presence of salt pans in large numbers at the Zebree site indicates that salt is being processed consistently at this locus. There is no evidence of natural salt occurring where salt processors at the site could obtain it. There is evidence of salt being present in soils near West Memphis but this would be difficult to extract given our knowledge of Zebree Site technology (Dick Furguson, personal communication). One hypothesis for salt procurement is the possibility of its extraction from a plant, specifically *Nelumbo lutea*, the American Lotus, which is common to Big Lake today. If true, this could be another indirect indication of the presence of a large lake.

Preliminary faunal interpretations at the Zebree site have indicated that mammals constituted the bulk of the meat diet and that the lake was not as important as the land environs, at least as concerns bulk weight. However, the tables used for weight calculations at Zebree have been questioned by Smith (1975a:33-36). Smith investigating the white-tailed deer demonstrated that these tables do not take into effect the sex and age of the individuals counted nor do they take into account regional variability. His figures indicated that the bulk weight of deer meat is prone to be overestimated significantly. This is confirmed in part by the trace element analysis which, though only preliminary, indicates that red meat was not a significant part of the diet, at least of the recovered Big Lake phase skeletons during the last year of life (Jerry Rose, personal communication). Red meat can be translated into mammals and beyond this to deer and raccoon, the two major mammals recovered at the site. Fish and fowl are not red meat and their abundant remains at the site in all midden areas attest to their importance to the diet. Fish in particular were important and represented by large numbers of specimens, but as a result of standard weight tables are underrepresented in the fauna interpretation. It is abundantly clear that considerable regional work along the lines of Smith's work (1975a) needs to be accomplished. However, we could not determine with any assurance of accuracy the age and sex of the Zebree deer, nor could we reliably estimate the specific weight of each fish.

A catchment basin analysis has not been made but approximately three times as much fertile crop land is available within a short distance of the site as is apparently needed based on the best population estimate and probable low yields of corn. Almost half of any of any catchment basin reconstruction would include the lake and associated swamp. Also included would be gathering channels and other potential natural fish traps.

The lake is associated with a meandering stream which flows through it and the bordering Big Lake highlands. These represent a safe refuge portion of the Mississippi frontier. East and north are Mississippian groups while to the west and south are the indigenous Woodland groups which presently are amalgamating or retreating.

Research Question 13: How Important was Prairie Exploitation to the Big Lake Phase?

Maumelle Prairie exists south of Lake City immediately west of the St. Francis River (15' Leachville Quadrangle) and Grand Prairie is located north in Missouri west of the Right Hand Chute of Little River. Local tradition indicates that these two prairies merged together within the Big Lake Region. However, this may be based on the widespread presence of Johnson grass, introduced by Dr. Kinsolving of Hornersville around 1909 (M.L. Cude, personal communication). The necessity for deep plowing to dig up roots first reported to Morse in 1967 might be due to this introduced species rather than to a deep rooted indigenous prairie grass. The hypothesis that a prairie was located immediately adjacent to the Zebree site was tested with negative results by reference to the original land survey maps and field notes. Since prairie exploitation did occur, based on the finding of prairie species in 1969 at the Zebree site, it is important to know how far away the closest known prairie was located. Grand Prairie is to date the nearest known prairie. While prairie exploitation does not seem crucial to Mississippian behavior, it does occur in the Cairo Lowland (S. William 1954) and may constitute part of the microecological variation important to at least some Mississippian phase district locations.

Research Question 14: How Important Were Upland Resources to the Big Lake Phase?

The biotic and nonbiotic resources available to the inhabitants of the Zebree site are outlined in Chapter 15. There is a great deal available in the lowlands; for instance, salt scraping tools and beads were made of clay. The microlithic industry appeared to be geared toward maximizing bone and antler provided as a resource.

Yet, there is a limit to what the lowlands can provide to a low energy system. Stone and mineral resources are for all practical reasons absent. There are occasional small gravels in the local soils, possibly present from ice-rafting during the winter months (Vance Haynes, personal communication) but these probably are most often collected by the archeologist with small mesh screens. The uplands surrounding all but the southern boundary of the northern alluvial valley contain numerous stone outcroppings suitable for quarrying. In addition, the central upland erosional remnant, Crowley's Ridge, contains stone suitable for use.

There is no doubt that stone stock had to be obtained. What we do not really know is which specific stone was involved and how it was obtained; i.e., through direct visitation or trade. Before any studies on stone procurement can be seriously pursued, we must have a means of identifying specific stone through some spectographic technique. At the present time we are limited to an intuitive identification based on matching an unknown stone with those in a type collection gathered from suspected quarry locations.

Chapter 15 includes a listing of the kinds of stone available within the alluvial valley including the bordering escarpment. In addition, it outlines lithic resources beyond the valley since it is fairly certain that quarries near St. Louis and north of Cairo were being exploited. The only west Tennessee area to be examined in this light is the area of quarries within the Cumberland River valley just south of the Kentucky border with Tennessee.

A hypothesis has been developed that upland stone resources were crucial to the existence of and were directly exploited by the Big Lake phase. In particular, sandstones for abraders, and granites and basalts for heavy cutting tools may have been absolutely necessary to a group involved in the extensive cutting of large and small trees for the construction of villages and other wooden items such as canoes. The thrust into the Big Lake region may have been initiated by the realization that the St. Francis River gave direct uncontested (by another chiefdom) access to the very same basic resources which were vital to the Hoecake phase and which outcrop immediately north of the Cairo Lowland. The St. Francis River flows past the same formations but west of the Mississippi River access. These uplands also contain hematite, copper, lead, cherts of various kinds, turkey, and deer, among other resources. In addition, near these outcroppings is the headwaters of Big River which flows into the Meramac at the very locus of the Crescent Quarries where the basic material for microliths was obtained. This also allowed access to Cahokia for trade and prevented a dependence upon communitites of the Hoecake phase. This orientation could explain the location of the Zebree site and of the other Big Lake phase sites. Unfortunately, we do not know where the St. Francis River was flowing in relationship to Zebree but presumably the site's location on the lake was for exploitation and because this was the western edge of the Mississippian frontier.

Crowley's Ridge was also being exploited for stone resources. The most striking example is an orthoquartzite which outcrops on the western edge of the ridge almost due east of the Zebree site. Apparently this stone was utilized to manufacture backed knives but it is not known how techologically important this was to the Big Lake phase.

Research Question 15: How Important are the Deer, Raccoon, Turkey, and Dog to Mississippian Society as Food Resources?

It already has been pointed out in an earlier section of this chapter that the use of standard weight tables may be distorting interpretations concerning the relative importance of certain species. At Zebree there is evidence that deer and raccoon are not as important as at other Mississippian sites (Smith 1975a). In addition, turkey is virtually absent. The reason for this is thought to be the importance of lake resources, particularly fish, and ducks which made up for the relative lack of mammals in the environment. A concentration of mammal and hence deer bone in Area A indicates the relative importance of deer and possibly raccoon since they may have been consumed by the elite portion of the population significantly more than by others. The distribution is not a mutually exclusive one but is impressive nevertheless. The mammal distribution is based on the 1% sample taken over half of the site and indicates a general lack of mammals at the site as a whole and a concentration in one midden deposit area.

The dog is not generally regarded as an important animal to Mississippian society in the sense of being held in high esteem (Smith 1975a). At Zebree there was deliberate burial of dogs and evidence for a fairly sizable population of dogs. We suspect that there was considerable food waste at Zebree and this higher population would be in accord with Smith's ideas on what conditions population (1975a:11). However, rather than merely living on the margin of the village as postulated by Smith, the Zebree dogs probably were inside the walls. Value as sentinels would have proven most advantageous, particularly in a frontier situation.

Research Question 16: Did Mississippian Technological Innovation Maximize the Environmental Potential?

Mississippian ceramics are superior to Woodland ceramics by almost any scale one wishes to apply, yet the same pottery backswamp clay was probably used. Mississippian potters discovered that when calcium carbonate, resulting from burning mussel shell was added to clay, the final product was vastly superior. Burning mussel shell also allows it to be crushed more easily; furthermore, if it is not burned, it will explode causing harm to the vessel. But this still does not fully explain how the discovery of shell tempering came about. The discovery of thermal treatment of chert might have been due to accident but the discovery of shell tempering, when clay resources are being exploited at their fullest, is extraordinary. The scientific observations involved must have been considerable. There are rare examples of shell-tempered pottery in Hopewell (Morse 1963) but only in Mississippi did it become useful knowledge.

The possibility of manufacturing salt from freshwater plants is theoretically valid but has not been proven. Nor has a test been developed to check whether the Big Lake phase actually did make salt in this fashion. Circumstantial evidence, particularly funnels and salt pans, and a lack of known salt deposits, indicate that this innovation did occur. Furthermore, the process of leaching is well known to many low energy systems, particularly in reference to acorns or manioc.

The ability to store large amounts of grain in an induced carbon dioxide atmosphere seems to have been demonstrated at Zebree in the large number of pits and other data. It is quite possible that even Barnes culture practiced the same storage mechanisms only on a smaller scale. More efficient cutting tools are evident in the Big Lake phase, from microliths to adzes. There are a greater variety of stone abraders, not just in shape but in abrasion characteristics.

Maximization of environmental potential within a given prehistoric technology is often not fully appreciated. This aspect of human behavior has been emphasized in the Zebree report as much to show how little we actually understand about primitive or stone age science as to hypothesize sophisticated knowledge and control for the Zebree inhabitants. Nowhere do we want the reader to believe we are proposing unique achievements for Zebree or the Mississippi Valley. Anything seemingly new or innovative mostly underscores our ignorance of the biophysical sphere of kinship-based cultures.

Remarks

These then constitute 16 of the major areas of concern for the Zebree Archeological Project, eight behavioral and eight biophysical. Both are tightly interlinked with each other and it is difficult and perhaps misleading to examine them separately. But this gives us a chance to investigate the location of weaknesses in our arguments. We are not attempting to solve the problems of the beginnings of the Formative or Neolithic and the intensification into Urbanization or State Organization. However, we expect that much of what we have to say will bear at least a little upon those problems for all of us hold to a basic assumption that humans respond to similar stimuli in similar ways, no matter where or when the particular expression exists.

CHAPTER 5

FIELD STRATEGIES

David G. Anderson

Field procedures at Zebree were selected and employed each season subject to constraints imposed by the interplay of the project research goals and the resources available to meet them. Ideally, field strategies should ensure maximum data recovery under the conditions imposed by available time, money, equipment, and personnel. They should strive towards productive results, information which is representative, reliable, and relevant to project goals and hypotheses. Archeological fieldwork cannot be conducted in a vacuum. Proper excavation strategies are not techniques derived solely from sound muscular coordination and long experience, but rather are the methods of data collection by which project research goals are to be met. This linkage of goals and procedures is crucial, for unless the right kinds of data are collected the project will founder, no matter how meticulous the test pits. In the present section, background information on each season, such as research goals, available resources, and research results are only briefly reported, to illustrate how they gave rise to the selection of various specific field procedures in that and subsequent seasons.

1968 Testing Operations

In August, 1968, archeological testing operations were conducted at Zebree and at two other sites within the Big Lake National Wildlife Refuge, Buckeye Landing (3MS19), and Rice Landing (3MS25). All three sites were endangered by the planned drainage project, and testing was undertaken to help assess the significance of each site and to aid in the planning of full-scale salvage operations, if these were found to be necessary.

A total of eight days were spent at Zebree during the testing and two pits were opened. Fieldwork was conducted by Morse and a crew of two, assisted on occasion by one or a few local volunteers. The site was accessible only by boat, necessitating the daily ferrying of equipment and personnel across the old drainage ditch. At the time, Zebree was densely overgrown, and preparation of a detailed site map was impossible. Some 20 potholes were evident, concentrated for the most part in Areas A and B. Temporary datums were established near each of these rises--prominent trees in the immediate area were blazed--and these were tied into a Wildlife Refuge boundary marker on the northwest corner of the site, near the ditch.

Test Pit 1, at the southern end of the site, consisted of squaring up a large pothole and then expanding it. Test Pit 2, located on the northwestern rise, was placed among a large cluster of potholes (see Fig. 2-3). All fill from both units was shoveled or troweled out and artifacts were hand-picked from the loose dirt. Arbitrary levels were used where natural stratigraphy was not apparent, and the fill of all features or disturbances encountered was kept separate. Because additional work on the site was anticipated, portions of features extending beyond each unit were left unexcavated. Charcoal and other samples were taken as warranted, and unusual or delicate artifacts were separated and safeguarded.

Arkansas Archeological Survey excavation unit level sheets were used throughout to record basic information during the excavations. Graph paper was used to draw all final profiles, floorplans, and maps of the immediate test localities. Black and white and color slide record photographs were taken, with identifying notes accompanying each shot. A separate field record book was also kept, complementing the level sheets and generally detailing the excavation activity. All artifacts and samples were assigned temporary catalog numbers in the field; these numbers were then checked when permanent catalogue numbers were assigned in the laboratory. Both pits were backfilled at the close of the excavations, and temporary (wooden) datum stakes were left in place by each. Routine artifact processing operations of washing, numbering, and storage were conducted at the Jonesboro Survey lab, both during and after the completion of fieldwork.

Some time prior to the 1968 excavations, and probably during the summer of the preceeding year, a large oval-shaped pothole had been opened at the south end of the site. Oriented NE-SW and measuring 140 x 190 cm, this pothole was relatively isolated, being by itself and away from the cluster of 19 potholes on the northern rise. A myriad of probe holes and a tunneling excavation procedure, caving in the walls from the base upwards, indicated an experienced digger. The scar was advantageously placed on one of the rises, and the backdirt was rich in artifacts, and for these reasons Morse decided to excavate around it rather than completely remove a unit nearby. Test Pit 1, excavated around an old pothole, was roughly rectangular in shape upon completion, and measured 3.2 x 2.3 meters.

From the field notes, it is apparent that the pothole was squared off to "(1) see the extent of damage, (2) to get some control of the sherds thrown out, and (3) to get a quick profile of this part of the site." The pothole was first cleaned up, and all artifacts found within the loose spoil were assigned to a general provenience. Upon encountering undisturbed deposits, features and artifact clusters were exposed and then removed separately. As the testing proceeded, stratification in the deposits became increasingly obvious. Two 2 x 0.5 meter extensions were then removed to subsoil, one to the NW and the other to the SE, to examine the stratigraphy in more detail. Each extension was taken out in 10 or 15 cm arbitrary levels, following within natural strata where this was observed. Any features encountered were removed separately.

The second test was initially a 2 x 2 meter pit opened amongst a large number of potholes on the western rise. As with Test pit 1, a half meter extension was later opened to the south to further clarify the stratigraphy. The first 30 cm was recognized as plow zone and was removed as a unit. Below this two arbitrary levels (30-44 cm, 44-58 cm) were removed before subsoil was encountered. No recognizable cultural stratification was detected. Upon reaching subsoil the outlines of a number of features were recognized; these were removed separately. The completed unit measured 2.5 x 2 meters (Fig. 5.1).

1969 Intuitive Block Units

The year 1969 saw extensive and what at the time were thought terminal excavations at the Zebree site. The major goals of the 1969 excavations have been variously recounted (Morse and McGimsey 1969:1-2; Morse 1969b; 1975b:4; 1976a:8) and essentially consist of the recovery of as much diverse information about the site and its contents as possible prior to destruction. Morse has summarized some of the more specific goals as

> to confirm the 1968 tests, to collect sufficiently large assemblages of artifacts in good cultural context to provide an adequate and representative sample of all occupations, to relate the two areas of the site to each other, to expose house patterns and at least hints of community plans for each occupation and to obtain sufficient samples to investigate more fully the nature of the Zebree microlith industry (1976a:8).

The early Mississippian occupation received the focus of attention. Excavations were undertaken to better delimit it in relation to earlier and later occupations on the site and, if possible, to recover

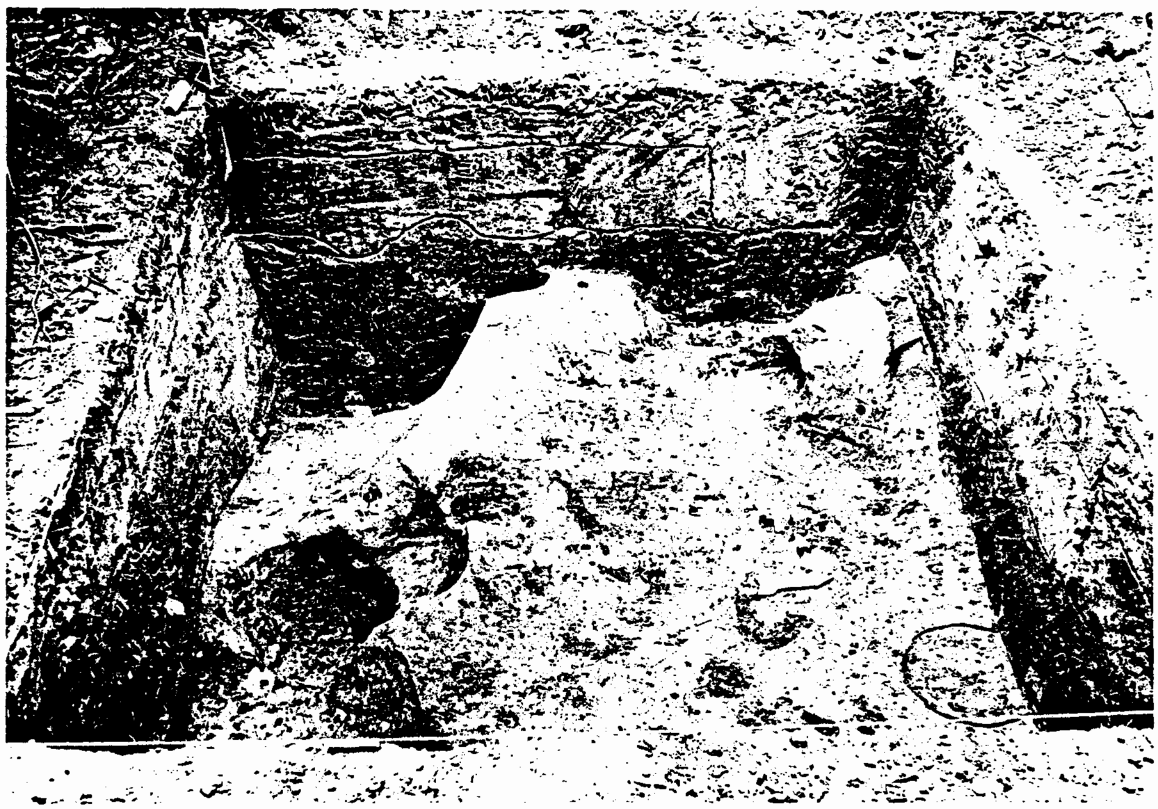

Figure 5.1. Test pit 2, 1968, after removal of midden and features.
(Negative 682955)

information relating it to other centers of initial Mississippian development, notably to the north in the Hayti/Cairo Lowlands area and with Cahokia.

The 1969 field activity at Zebree was conducted over a period of nine weeks (a total of about 350 man-days). The excavations themselves consisted of the removal of two large block units intuitively placed on the high areas, and the use of scattered test pits and auger holes.

Once Areas A and B had been cleared, the immediate vicinity of the 1968 test units was gridded into 2 m squares with a transit, stadia, and tape. A finite grid was established, with a point southwest of Area B selected as the origin and the Y axis, or site meridian, oriented along magnetic north-south. Locations within the site were determined first in distance along the meridian and then to the left or right of it. The center of the 1968 Test pit 1 in Area B, for example, was 17.5R11, while that Test pit 2 was 80R7. The grid was set up so that as much of the site as possible would be within a single quadrant. Permanent datums were established along a line within Areas A and B and at a point roughly between them, at 88R18, 8R18, and 34R18.2, respectively. The point in Area A (88R18) was selected as site Main Datum and a 5 foot length of zinc-based pipe was driven into the ground; the other two datums were marked with 3 foot lengths of wrought iron. Wooden stakes were used to mark temporary points, and the entire grid was tied into a bench mark on the far side of the levee across the ditch to the west.

Initial excavation consisted of cleaning out and squaring up seven old pothole scars near 1968 Test Pit 2 in Area A to see why they were dug and to get a look at the stratigraphy. Most of the potholes apparently were dug as the result of a probe hitting one or more large sherds. With the pothole strata serving as a guide excavations then proceeded with the removal of contiguous 2 meter squares in Area A, around the 1968 test unit. After two weeks a second block was begun, in Area B immediately to the east of the 1968 test pit.

A total of 180 square meters were opened during 1969, 92 from a block in Area A, 54 from the block in Area B, and the remaining 34 from a series of test pits of varying size placed near and to the east of Area A.

Squares were excavated in arbitrary 20 cm levels unless natural strata existed, in which case these were followed and removed in total. A thin plow zone 20-30 cm deep extended over all of the areas tested; in Area A this was screened, while in Area B it was discarded to speed excavation. Arbitrary levels were shoveled out, unless features appeared, and the fill was sifted through 1/4" mesh in shaker screens. Features and the stratigraphic zones in Area B were troweled out and the fill hand picked. Attempts to fine screen feature and natural strata fill were frustrated by the damp soil; rainfall occurred at least briefly on most days, and when the adjacent ditch filled the water table on the site was only a foot or two below the surface in most areas.

Every effort was made to excavate features completely when these were encountered. Adjacent (unexcavated) squares were frequently intruded or undercut to remove fill, and even tunneling procedures were employed on one occasion to delimit a house floor in Area B that had been disturbed by a large tree. The presence of numerous pothunters in the area meant that features or units could not be left partially exposed on nonexcavation days. (During the first weekend of the dig, the site was vandalized and some equipment was stolen.) As in 1968, Survey unit level sheets were used throughout, with supplementary sheets used to record features and additional information where necessary. Floorplans were drawn at the base of each level, and concentrations of artifacts and single distinctive artifacts at any depth were exposed (Fig. 5-2), drawn in, and plotted on the record sheets. All final profiles as well as many floor plans were drawn on graph paper. Pencils were used throughout, and a Munsell chart was employed to maintain soil color control. Over 100 black and white photographs and color slides were taken, one backing up the other, and notes were kept recording each shot.

Soil, carbon, and flotation samples were taken from a number of features and strata, and fragile artifacts were wrapped separately. A zone of burned clay encountered in Area A was covered over, to preserve the deposit for possible archeomagnetic dating. The effort proved unsuccessful, however, due to the poorly fired nature of the clay.

A 3-inch auger was used to help determine both the nature of the soil matrix and the midden depth. A series of 28 auger tests, one every 2 meters, were placed along the north-south line beginning at the Main Datum and running towards the datum in Area B (see Fig. 2-4). Several other locations were augered up to 2 meters or more in depth to determine natural stratigraphy.

Nine test pits of varying size were opened in an attempt to delimit the nature and extent of deposits better, and to locate additional features or houses if these were to be found. Most were

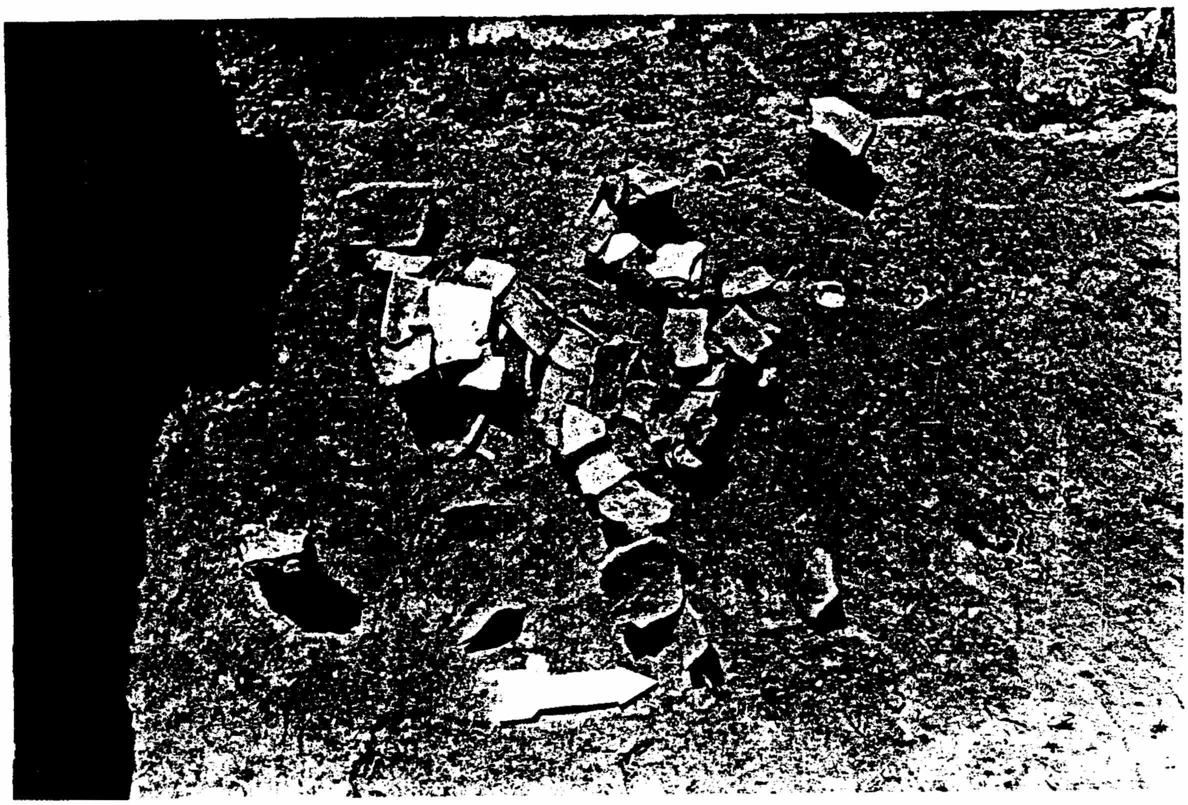

Figure 5.2. Cluster of Mississippian sherds in F57, Area A, exposed as a unit in the bottom of a poorly defined pit. (negative 692736)

located close to Area A although one 2 meter unit (Test Pit 8) was placed roughly over 50 meters to the northeast of Area A, near what was then thought to be the site periphery (see Fig. 2-4). Two 1 meter pits, four 2 meter pits, and two 2 x 4 meter units were opened. The final unit, a 0.5 x 0.4 test slot, was opened west of Area A near the ditch edge, to determine the effects of the construction on the deposits.

During the excavations level contents and field specimens were assigned temporary catalog numbers based on the excavation unit or grid coordinate at hand. All materials were removed to the Jonesboro station for processing, where final numbers were assigned. While the excavations were in process a transit and stadia rod were used to shoot 140 points, most near Areas A and B, for incorporation into a site contour map. Upon completion of the excavations all open units were backfilled using a bulldozer, and all materials except for the three primary datum stakes were removed. The resulting data base has been summarized by Morse (1975b), and served as a guide to prepare for and help interpret work on the site in 1975 and 1976.

1975 Multistage Operations

Field operations in 1975 began on June 23 (see Chapter 2). Two gasoline generators were established near the well points, and provided power to run water pumps, fans, lights, and other electrical equipment as needed. With both generators running it was possible to have three hoses in use simultaneously at the wet screen rack, and large quantities of midden and feature fill were processed in this manner. Wheelbarrows were employed to transport feature fill from excavation units to the wet screening area. Most artifacts were washed in the field at this rack prior to removal to the lab, and the screen frames were placed in the sun on sheets of plastic to dry.

As recounted in Chapter 2, laboratory work continued simultaneously with the excavations after the first week of digging. Current and rapid information flow between the lab and field was maintained. Field personnel were aware of the nature and quantities of material they were recovering, and could modify their strategies to suit the needs of project specialists.

Under the direction of Gayland Wilson, of Paragould, a backhoe was available each day to place test trenches or transects in various parts of the site. It was quickly found that one or two hours a day with the backhoe created enough work to keep several people busy for one or more days. Over the course of the excavation, the backhoe was used to open a large number of transects across the site, speed up the random square operations through slot profile trenches, open block units, or remove overburden. In addition to these somewhat prosaic activities, the backhoe was also used to uproot trees, dig drainage ditches when the site flooded, clear underbrush, pound in the well points (with the bucket as a hammer head) and move backdirt piles which frequently were located over areas where further excavation was desired. Towards the end of the dig, the backhoe was also used to backfill units (including all of the random square holes).

Once the site had been cleared, some 250 points for a detailed 10 cm contour map of the site were shot in with a transit and stadia rod, and Morse's 1969 grid system and excavations relocated. As new units were opened during the course of the excavations they were mapped, a necessity to visualize the nature of the coverage on a site this large and overgrown. To map in units and shoot contour points adequately it was necessary to establish the transit over a number of carefully set datums about the site, including those placed in 1969. Even with the underbrush removed there were so many trees that line-of-sight readings were difficult over more than 30 or 40 meters.

Three major excavation strategies were used in 1975: (1) the removal of a randomly selected 1% sample of certain areas in the site using 1 meter test pits, (2) the use of arbitrarily and randomly placed backhoe transects and slots across the site, and (3) wide area block unit excavations at locations which previous excavations or the results of methods 1 and 2 had demonstrated to be of significance to the project's goals. For the first several days, fieldwork concentrated on opening and completing as many random squares as possible, primarily in areas of the site previously unexamined. Field procedures diversified after this time with roughly 1/3 of the crew working random squares, 1/3 in block unit excavations, and 1/3 involved in specialized activities such as mapping, photography, profiling, burial removal, water screening and artifact washing operations, or record keeping. After the first week, about ten people a day remained in the lab while roughly 15 worked at the site. The actual numbers varied somewhat from week to week as crew members arrived from or left for school or when rain precluded operations at the site.

Random Excavation Sample

A 1% excavation sample was obtained from a large area of the site through the use of a dispersed probability sample (Anderson 1976) (Fig. 5-3). The method employed made use of a stratified systematic unaligned sampling strategy. Directions for utilizing this strategy have been clearly presented by Haggett (1966:196-198), and examples of its utilization on archeological sites have been discussed by Redman and Watson (1970). A particular goal of this sampling procedure was to secure information on the nature and rate of midden accumulation.

The 1% sample was obtained using a table of random numbers, by selecting a 1-meter sample square from within a grid system employing units 10 meters on a side. Each 10 meter grid block, therefore, contained 100 1-meter squares, one of which was chosen for excavation using a stratified systematic unaligned selection procedure. Once in the field, the location of each square was determined using a transit and steel tape, shooting from the fixed datum points. In this way, sample squares were selected in a manner which assured maximum dispersion over the site. A total of 55 1-meter units were excavated using this strategy, from the central and northeastern portions of the site within a roughly "L" shaped area. These areas on the site had been only briefly tested, or not tested at all by Morse in 1969.

The units were excavated in natural levels and arbitrary 20 cm levels within natural levels. If no natural stratigraphy could be determined arbitrary 20 cm levels were utilized throughout the unit. The first 27 pits were excavated in this fashion. In some of the squares first excavated deep midden or features were encountered. A different strategy suggested by Goodyear and House (personal communications) was therefore adopted for the remaining sample squares. A backhoe trench a meter and a half long and a meter or more deep was placed along the north face of each of the remaining 1-meter units. From this backhoe trench the stratigraphy within the unit could be readily determined and in many cases features such as pit outlines were noted and could be removed separately. A total of 28 units were removed using this trenching procedure.

In the excavation of each random square a consistent collection procedure was employed. From each level a 1 gallon flotation sample was collected, taken from the center of each unit. These samples were removed to the laboratory each day for processing and analysis by the ethnobotanist. In addition to these flotation samples, a

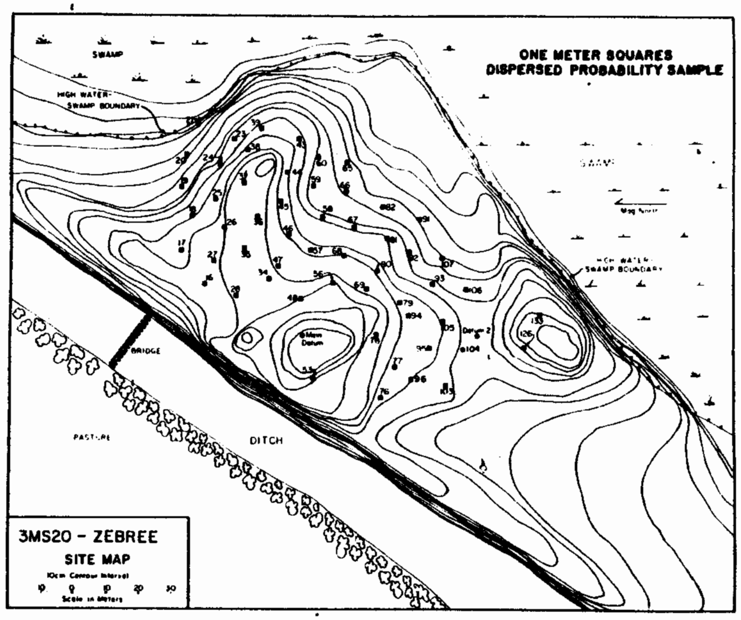

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Figure 5-3. The 1% random excavation sample, 1975 field season.

"bucket sample," consisting of 2 gallons of earth, was removed from each level for fine screening. This sample was then weighed and wet-screened through 1/8 or 1/16 inch mesh at the site. The remainder of every level was passed through 1/4 inch screen, employing either the wet screening racks if the hoses were free, or dry screens suspended from frames made from swing sets or lashed poles. In addition to the flotation and bucket samples, pollen, soil, and carbon samples were taken from within units when considered appropriate. Field notes were taken on each square, with records kept by level, and profiles were drawn upon completion of the unit. Features encountered were removed separately. As in previous seasons, Survey level sheets were employed, with supplementary feature record and field catalog sheets as needed. Graph paper was used for final profiles, and record photographs taken as needed. Crews working a particular square routinely filled out temporary field catalog forms, took all notes, and labeled samples and artifacts. This led to some variation in the quality of the notes, and field spot checks were used to catch potential errors. Finally, each pit crew also washed the artifacts recovered from 1/4" screening upon completion of the unit.

Backhoe Transects

The second major field strategy utilized at Zebree involved the use of a backhoe to place test trenches and transects across the site in both randomly and arbitrarily determined locations. During the field operations a backhoe and operator were on the site each day and were utilized extensively. The responsible use of the backhoe was a challenge, since there was sometimes a temptation to open more area than could effectively be worked and recorded.

Backhoe cuts were placed within the site, on the site perimeter, and outside the site to recover several kinds of information. Transects 1 meter wide, running north-south and east-west, were opened across the site to delimit the extent of midden. As noted, short trenches were opened along the north face of a number of 1 meter probability sample units. Additional trenches were placed across the site, with variable orientation and extent, to locate or delimit features such as the palisade, geological stratigraphy, or profiles for the gathering of soil and pollen samples. A total of 20 long transects and trenches (Fig. 4) and 28 short trenches were opened using this strategy. The combined length of these trenches was approximately 490 meters.

Backhoe trenches were excavated in 10-15 cm cuts under the supervision of one of the field directors. Earth was removed to

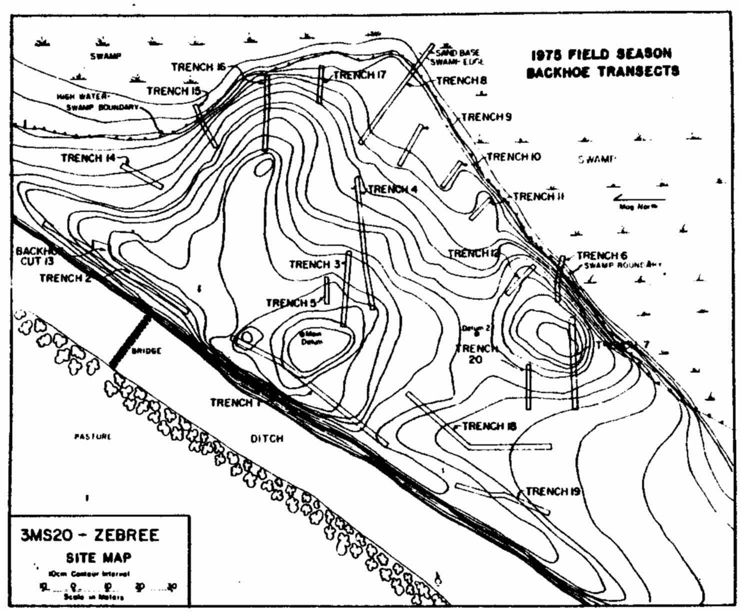

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Figure 5-4. Backhoe long transects excavated in 1975.

subsoil or until unusual features or materials were observed. Walls and floors were cleaned and profiles drawn, with soil and pollen samples removed as appropriate. Features encountered were drawn on the profiles and removed separately, if time permitted (Fig. 5-5). To some extent the placement of backhoe cuts on the site was limited by conditions of topography, drainage, and vegetation. Care also had to be taken to leave gaps in the trenches, where necessary, to provide for the efficient movement of people and vehicles across the site.

Block Unit Excavations

The third major excavation strategy utilized consisted of excavation of relatively large "block" units. Excavations conducted in this fashion consisted of units from 5 to 10 meters on a side, placed in areas of potential significance to project research goals (Fig. 5-6 and 5-7). The previous excavations on the site and the sampling and transect procedures of the 1975 field season formed the basis of decisions concerning block unit locations. Five block units were excavated in 1975, encompassing an area of approximately 240 square meters. In addition, two other large areas on the site's eastern perimeter were opened to subsoil during operations designed to locate and follow the palisade. These somewhat irregularly shaped units extended over approximately another 240 square meters.

Block units were excavated two ways. In the first procedure the backhoe was used to remove overburden to immediately above the desired levels, at which point finer recovery techniques were used. In the second procedure contiguous 1 x 2 or 2 x 2 meter squares were removed following natural stratigraphy, or in arbitrary 20 cm levels if no stratigraphy was apparent. This procedure saw only limited use, with only 14 square meters, all in Area B, opened in this fashion. In both procedures the units were removed to subsoil, with pollen, soil, and flotation samples collected as appropriate. Features encountered were mapped and removed separately.

Feature Removal

In each of the major excavation procedures outlined a wide range of features were encountered. These included pits, burials, postmolds, and burned clay areas. When these were found the procedures utilized that led to the feature discovery were abandoned, and procedures more directly relevant to the recovery of feature data were adopted.

Figure 5-5. Dan F. Morse examines Features 206/210 intersected by Backhoe Trench 3, 1975 season. (Negative 752777)

Figure 5-6. Block Unit 4 excavations near Area B, 1975 season.

All features were mapped, and in all cases material from defined feature areas was kept separate from other material. In unusual situations relevant specialists were called in to remove the features. Separate feature records were maintained, containing appropriate notes, field catalog numbers, and profiles or plan drawings. Again, photographs were taken as appropriate. A majority of the feature fill was water-screened through 1/8 inch mesh, with the volume of the fill recorded in gallons for a number of the units. Finer or coarser screening procedures were occasionally used; screen size was commonly recorded along with the volume of material. Flotation samples were removed from a majority of the features, and pollen and soil samples from a number of them, particularly if unusual soil conditions were apparent. Carbon and archeomagnetic dating samples were secured where conditions warranted. Every effort was made to remove completely all features encountered in the block units. Features encountered in trench profiles, or extending beyond the boundaries of the random squares, were removed only if the shape or contents indicated a promising return on recovery time. Particular attention was focused on the larger or richer shell, or clay lined or bell shaped pits, or on burials.

A total of 158 features were recovered, some 250 flotation and 220 bucket samples were taken, and over 50 samples each of soil, pollen, and carbon were collected. Over 100,000 artifacts were ultimately collected and processed.

1976 Field Salvage

Due to various delays the final ditching operations in the vicinity of Zebree did not begin until the end of July, 1976. While another field season at the site could have been possible, and indeed desirable, to complement the results of the previous seasons, there was no available funding.

The 1976 season was an emergency salvage, and was conducted in the best tradition of such excavations. Each day a bulldozer was available for use some 3 to 5 hours, and with it a series of 3 meter wide cuts were made across the site to subsoil (Figs. 5-8 and 5-9). A total of 2,500 meters was exposed in this fashion, primarily in those portions of the site slated to be ditched away. Once the dark overburden had been removed, the stains of features extending into the subsoil were easily recognized, marked, and then quickly excavated. Pit contents were removed using trowels and small shovels, and the fill hand picked. Screening proved far

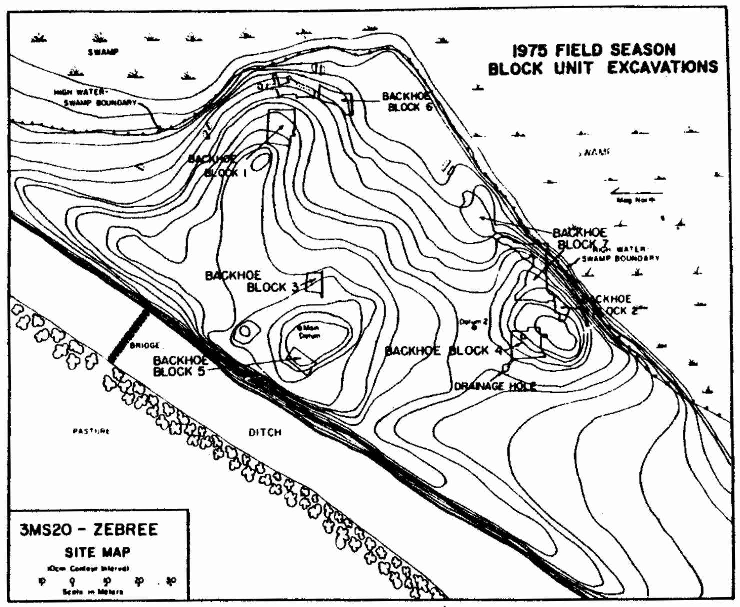

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Figure 5-7. Block unit excavations, 1975 season.

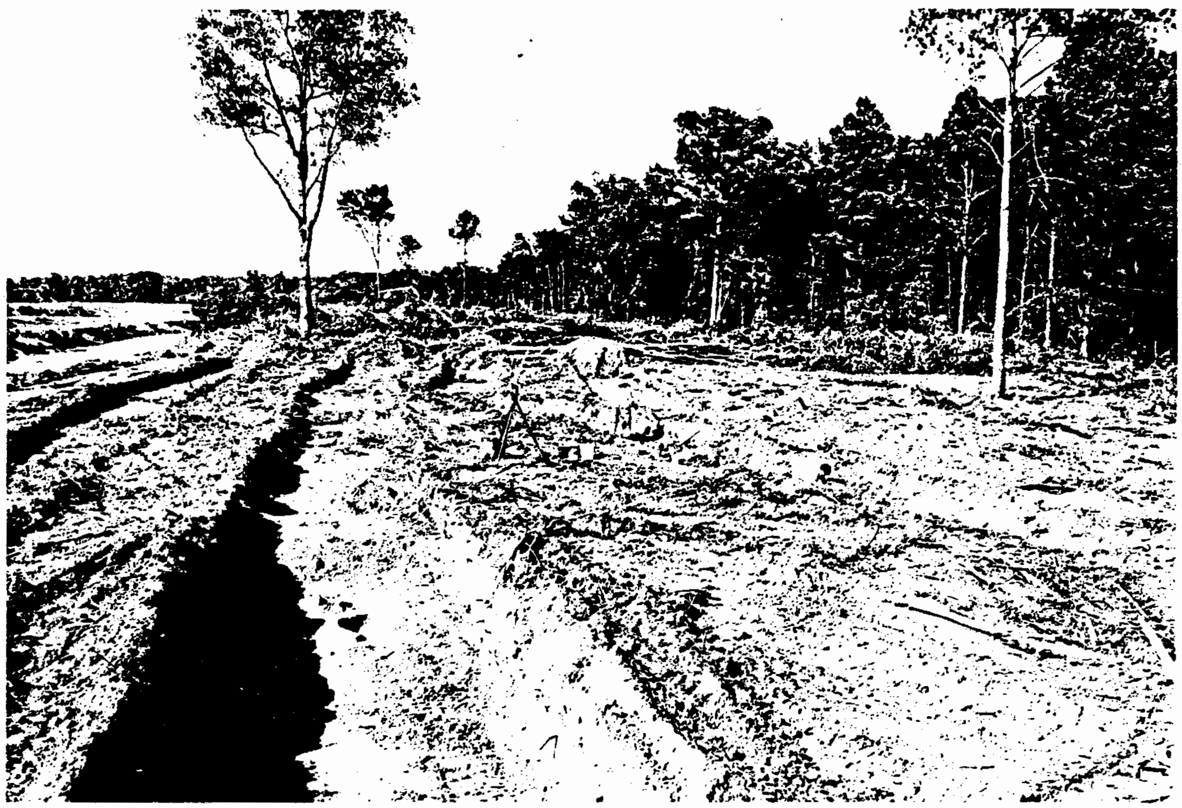

Figure 5-8. Bulldozer cuts across the Zebree site, looking north 1976. Transit (in center of photograph) is established over the main datum. (Negative 763659)

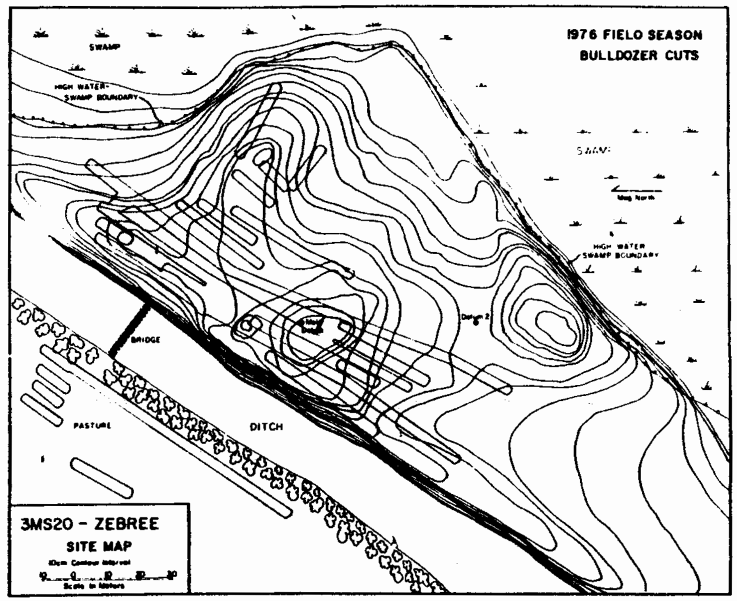

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Figure 5-9. Bulldozer cut locations, 1976 field season.

too time-consuming, and was only used to process fill from a few of the features that were removed to the Jonesboro lab. All field records were kept by Anderson, who also ran the transit and plotted in newly dug or exposed features each evening. This mapping proved to be essential to avoid the very real if somewhat comical possibility of reexcavating backfilled test pits and features from earlier seasons.

Approximately 200 meters of trenches were opened on the west side of the drainage ditch in a test of this previously unexamined area. With the help of first bulldozers and during the last few days of the dig, the 12,000 pound dragline bucket, it was possible to excavate the fill of an early historic well in entirety (Chapter 26). Damage caused by preliminary clearing and heavy equipment maneuvering was noted and photographed, and the extent of the new ditch and levee system was mapped in relation to site deposits and features.

A major focus of the 1976 excavations was to augment the artifact inventory assignable to specific components. With the capability to open large areas of the site, it was possible to excavate clearly recognizable features. By removing as many of these as possible and learning the component to which each belonged, it was hoped to greatly increase the range of recovered artifacts, and to provide additional information about component locations within the deposits. In all 136 features were found, and over 70 pits were completely excavated. All artifacts were removed to the Jonesboro lab each evening, where processing was initiated.

Conclusions

The four field seasons at Zebree saw the use of a wide variety of field recovery procedures (Fig. 5-10). In each case, however, the strategies employed were largely preformulated and designed to recover information relevant to project goals. A flexible outlook was maintained however; if a particular technique didn't work, or didn't work as well as originally hoped, it was modified accordingly. In no case were excavations restricted to iron-clad unit sizes: if features or other areas of interest extended beyond a particular excavation unit, they were followed out. While each season after 1968 was conducted in the ignorance that later work would be possible, the results of the previous work were used to shape strategies. Every possible or conceivable method of data recovery in use or standard practice in American archeology today was employed or considered at one time or another during the excavations, and a number of highly novel approaches were used as well. For example, features were removed with bamboo picks, trowels, shovels, by hand, and in

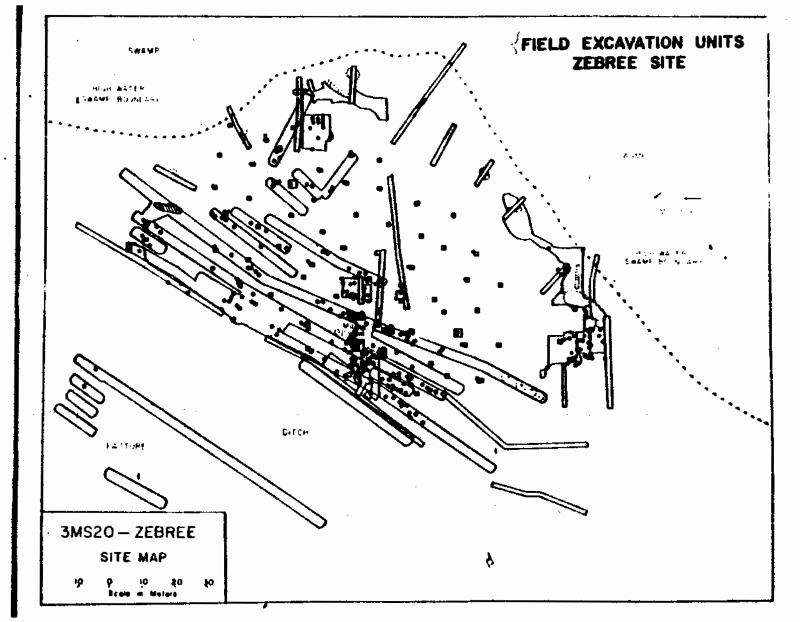

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Figure 5-10. All excavation units and features at Zebree, 1968-1976 field seasons.

the case of the well, with a dragline. In many cases, the diversity of procedures was a mixture of circumstance and necessity; in all cases the goal and the result was maximum information recovery.

CHAPTER 6

COLLECTION OF ENVIRONMENTAL AND SUBSISTENCE DATA

Dan F. Morse, Suzanne E. Harris, Alan Solomon, Lynne J. Bowers and Eric A. Roth

One major problem in reconstructing an environment within the central Mississippi Valley is that the modern environment is so different from any previous environments because of total land clearing. Furthermore, there was a significant earthquake in the early 19th century with unknown effects upon the landscape. The Indians of the 10th through 16th centuries were intensive agriculturalists and must have influenced the pristine environment to a great degree. Even their predecessors were at least horticulturalists and before them there was land clearing for villages or camps and even possibly fired woods for animal drives. To reconstruct an environment here is to attempt to reconstruct the earliest historically known environment, the early to mid-19th century, and to try to work back from this base. The methodology and justifications are covered in Chapter 13. Data was collected from the original land survey maps, contemporary accounts, topographic maps, interviews with a variety of scientists and agriculture experts, botanical transects made during the period of excavation, results of pollen analysis, and the plant remains and animal bones recovered during excavation.

Probably the most significant aspect of the Zebree archeological project in relation to environmental studies was the presence of personnel who were to analyze the data during the period of their recovery. Suzanne Harris and Eric Roth both had input into the recovery strategies immediately before and throughout the excavation period. They were available to make field observations when potentially important finds were found. Since they were processing animal and plant remains during the excavation, they were able to recommend field priority shifts; for example, to suggest strongly that more Barnes data was necessary. Alan Solomon was contacted before the excavation began and was in touch with Suzanne Harris throughout the excavations.

Experiments with screen mesh sizes suggested during the first week the appropriateness of the 1/8 inch mesh for the recovery of identifiable animal bones, and abundant floral remains were also recovered. Preservation was almost optimal, with fragile bird bones and fish scales represented in large numbers.

Two approaches were pursued concerning the 1975 Zebree remains: stratigraphically controlled pottery analysis was undertaken by Michael Million which enabled positive component identification of certain archeological excavation levels and features, and faunal and floral remains from all excavation levels were counted, weighed, and recorded from each excavation level and/or unit. Together with the pottery analysis such information was used by David G. Anderson and Thomas Scheitlin to generate the computer density maps.

All in all 13,839 faunal elements and fragments were examined from the 1975 excavation. Of these, 1,842 elements were identified down to generic and/or specific levels, and can be associated with specific archeological components. The sample represents a total of 231 individual animals who in turn represent 44 species. The number of skeletal elements assigned to each genus/species, the minimum number of individuals present as determined by recurring body elements and the estimated meat yield for genus/species are based upon White (1953), Cleland (1966), Smith (1975a), and Ziegler (1973).

Zoologically the sample contains two noteworthy features. The first is that the sample is essentially a modern one. Of the 44 species identified, only one, the passenger pigeon (*Ectopistes migratorius*) is now extinct, while only one also, the sandhill crane (*Grus canadensis*) is now extirpated from the Mississippi Valley. Because of this phenomenon ethological attributes and microenvironmental requirements determined from modern wildlife studies can confidently be applied to the study sample. This is also true for botanical remains.

The second noteworthy feature of the zoological sample is that it is highly oriented toward aquatic habitats, a notion strengthened by the large proportion of fish and migratory waterfowl elements present, plus the aquatic habitat orientation of several of the small mammals (e.g., muskrat, raccoon, swamp and marsh rabbit). This observation was made following the 1969 Zebree faunal analysis (Guilday and Parmalee 1975:227), an intensive analysis based on over 9,000 recovered and 6,000 identified specimens.

Bucket samples and feature fill were passed through 1/8 inch screens. All other material was screened through 1/4 inch screens, the more traditional size. Rather than pound the remains through the wire screens, all soil was water screened. This was faster and minimized breakage as well as protecting fingers from fish spines.

A bucket sample was obtained from every level of every random square to function as a control over the 1/4 inch screened material. This was deemed particularly important in reference to animal bone and lithic debris. In addition, following the example of Struever (1968a), a standardized volume of fill from each level of each random square was collected for flotation.

The heavy element from flotation samples provides an important 1/16 inch mesh screen recovery to check on the bucket samples.

A one-gallon sample was obtained from the center of each level before the excavation of that level commenced and extended to 20 cm, the usual thickness of a level. Samples also were taken from each feature encountered in the random squares.

Botanical samples were taken from the majority of features encountered in the test trenches and block excavations; these were usually 2 gallon (using buckets of the bucket samples), although sometimes larger samples were taken at the discretion of the excavators, in which case the volumes were noted on the container. These samples were likewise processed by water flotation. Finally, some botanical material was recovered from the water screening and fine screening of general fill of the 1 m squares and the test trench and block excavation features.

Samples for water flotation were transported from the field to the lab for processing. The water flotation was conducted using a wash tub and a 55 gallon drum. The light fraction floating on the water surface was skimmed off with cloth paddles. One, coarsely woven, was used to remove larger pieces rapidly and a second tightly woven one of India gauze was used to remove small seeds. In samples containing numerous seeds, primarily features, these seeds were kept separate from the other botanical materials; in samples where only a few or no seeds were visible it was deemed more efficient to recombine and process them with the rest of the light fraction.

In order to recover all adhering material, both paddles were rinsed with a high pressure hose and their contents strained through India gauze, the same fabric as the finer woven paddle. The rectangle of fabric used as a strainer was then wrapped around the light fraction to form a packet. This packet was then stapled to the newspaper lining of a cardboard box in which the heavy fraction of the same sample was dried.

An average of 20 flotation samples per day were processed. Generally, fresh water was used for every third sample, and for every sample for the features from the block excavations. Approximately 191 samples from random square levels, 38 samples from features within random squares, and 54 samples from features in test trenches and block excavations were recovered and processed by water flotation.

The light fractions of the flotation samples were rough sorted in the lab for charred botanical material and bone; the heavy fraction was sorted for these categories also (which rarely occurred) and for small flakes which might be indicative of microlith manufacture. The most abundant botanical remains were charcoal. Nut fragments were the next most abundant, due no doubt to their ability to survive, and seeds were least abundant due to their inability to survive.

Many pollen samples were collected. In the central Mississippi Valley, pollen in sufficient amounts to be statistically meaningful has not been recovered from archeological sites (Schoenwetter 1975, Bryant 1975). Noting the experiences of King, Klippel, and Duffield (1975) in obtaining pollen from a restricted favorable environment, we decided to experiment by collecting from as many different environments as possible.

Our pollen research strategy was a fairly simple one. We wished to sample many environments in and near the site with the view of both testing these environments for pollen preservation and gaining information about the natural and disturbed environments as well as about subsistence. Table 6-1 summarizes this strategy.

Table 6-1. Pollen collection environments

Samples	Potential Interpetive Data: Natural Environment	Human-Disturbed Environment	Human Subsistence
Lake core	X	X	
Swamp-site interface	X	X	
Outside site column	X	X	
Just within site		X	X
Base of palisade trench		X	X
Random squares		X	X
Natural zones, Area B		X	X
Pit features		X	X

Ten samples were submitted to Allen Solomon (Table 6-2) with disappointing results. More pollen was recovered than in earlier attempts, but with one exception (Table 6-3) adjacent to a vessel rim, no samples were considered statistically significant enough to count. An eleventh sample from a cypress board recovered from the historic well dating around 1820-1840 was submitted to James King who could not find any pollen grains. This latter was surprising in view of the fact that the cypress had to have been beneath the water table since the manufacture of the well.

A tree-ring study based on the bald cypress (*Taxodium distichum L Rich.*) was initiated and primary data collected during the excavation period. The study was interrupted by Lynn Bowers's Ph.D. program at Louisiana State University. Two primary aims of the study can be satisfactorily completed based on the material collected. Primarily we wished to gather data to aid in the

Table 6-2. Results of experiments with pollen potentiality of site environments. Identification by Alan Solomon

Catalog Number	Provenience	Est. Pollen Grains (gm)*	Counted	Environment	Major Pollen Types	Age
4265	18R18	590	-	Base of Zone B	*Ambrosia*, Chenopodiaceae, *Cornus*-type	Big Lake
4228	18R18	150	-	Base of Zone C	*Ambrosia*, *Helianthus*-type	Big Lake
4229	18R18	500	-	Top of Zone D	*Ambrosia*, *Helianthus*-type Chenopodiacea, Cyperaceae, *Carya*, Gramineae	Barnes
4159	Feature 270	375	-	Pit Fill	*Ambrosia*, *Helianthus*-type Monolete fern spore, *Liquidambar*	Barnes
4162	Feature 288	360	-	Between two Shell Layers	*Ambrosia*, *Polygonum persicaria*-type, *Cornus*-type	Barnes
4166	Feature 257	2490	Yes	Outer Rim of Vessel	See Table _	Big Lake
4198	Feature 210	820	-	Clay of clay-lined pit	*Ambrosia*, Graminaea *Ulmus*	Big Lake
4224	Pollen Profile #1, outside site	185	-	140 cm BS	*Ambrosia*, *Helianthus*-type Chenopodiaceae, Cyperaceae	Holocene
4163	Historic Deposit near Sebree House in swamp nearby	2780	- (Poor Preser-vation)		*Carya*, *Pinus*, *Salix*	Historic (Sebree)
4173	Beneath Iron Bed Part in Swamp Nearby	750	-	Between and and Iron	*Salix*, *Liquidambar*	Historic (Sebree)

Table 6-3. Pollen count for sample 4166, from outer rim of a Big Lake vessel, Zebree Archeological Site, northeast Arkansas. Identification by Alan Solomon.

Pollen Type	Number	Percentage
Pinus	1	0.4
Carya	2	0.8
Quercus	1	0.4
Acer	1	0.4
Abrosia-type	38	14.5
Chenopodiaceae-Amaranthus	5	1.9
Gramineae	2	0.4
Unknown B	201	77.9
Others	9	3.1
Total Pollen	258	100.0

environmental reconstruction; in particular, we wished to obtain climatic information and to see if the trees reflected any trauma associated with increased flooding during the 20th century. We also wished to see if any trauma was reflected in the rings during the period of the New Madrid Earthquake. A second aim was to add to the master tree-ring dating chart if at all possible (Bowers 1973).

Specific tree species are adapted for survival in specific habitats. The bald cypress, which is very common at Big Lake, occurs naturally (more than 90% of natural stands) at elevations of less than 100 feet above sea level and is usually restricted to very wet soils (Fowells 1965). Dickson (1968) found that bald cypress grows best in water-saturated, aerated soil. However, the seeds do not germinate while the site is submerged (Applequist 1959). In order for a bald cypress to become established in an area, the seed must sprout during a time when the water has receded and the seedling must grow tall enough the first year to stay above the floods except for short periods (Langdon 1958). Seedlings often reach heights of 8 to 10 inches during the first season and 16 to 20 inches by the second year (Mattoon 1916).

The growth rings of the bald cypress at Big Lake should be able to add the following to the reconstruction of environmental conditions:

1) An even aged site (i.e., a uniform age is determined for trees throughout the stand) could indicate the time at which the site was inundated. The seedlings would have established themselves at a time when the site was not flooded.

2) The age dynamics of a mixed site (i.e., trees of varying ages) could indicate intermittent periods of flooding.
3) Growth responses indicated by either wide or narrow tree rings and the nature and degree of fluctuation for any period along the ring record can yield information as to site disturbances at a particular time. It is hoped that this information can be interpreted and related to specific environmental changes using what is now known about the growth requirements of bald cypress (Dickson 1968) and data collected previously from a wide range of "site types" throughout the area (Bowers 1973).

A major drawback of the study is that to be useful for the environmental reconstruction comtemplated by this project, the trees will have to date back to the early 19th century. The oldest sample taken to date from a bald cypress growing near the area (Bowers 1973) showed 263 years in 1972. Of course, samples of this type would be adequate. The oldest sample previously obtained at Big Lake, though, only extends back to 1882. However, the probability of finding older trees at Big Lake appears high.

The collection and processing methods which were followed primarily are those of Stokes and Smiley (1968). Collections of both living and dead specimens were made from two areas within the boundaries of Big Lake National Wildlife Refuge. Thirty-five samples were collected from a recently cut area located approximately 805 meters northwest of the Zebree site known as Area D of the diversion channel area, Ditch 81 structures. Samples were also taken from 10 living trees on the place known as Katy Ray Ridge, 8.5 km southeast of the Zebree site.

Field notes were kept as to the exact location of the site of collection, depth of water at base of tree, soil characteristics, associated species, relationship to other trees and physical features of the tree, such as stem diameter at breast height and crown type when available. A Swedish increment borer was used to remove a core 5 mm in diameter from living specimen . Precautions were taken to eliminate the risk of fungal attack at the spot of coring by inserting wooden plugs in the tree after sampling. The borer was rinsed with isopropyl alcohol before insertion into a new tree. A chain saw was used to take wedge-shaped sections from stumps in the area which had previously been cut. Samples were numbered to distinguish the specific site of collection, tree, and core. For example, core 3-5-2 would be Core 2 from the fifth tree on Site 3. The core number indicates the side of the tree from which the sample was taken, i.e., 1, north; 2, east; 3, south; and 4, west.

Each specimen was numbered and the size, type of sample, and condition of sample recorded with the field notes on individual file cards. The cores were allowed to air dry for a few days and then mounted. Cores and cross sections were surfaced by sanding with progressively finer grades of aluminum oxide sand paper. When the sanding was finished, cell walls became visible and ring details were quite prominent.

The ring width for each sample was measured with the aid of a dissecting microscope and an Ames Dial indicator to the nearest .001 mm. After a graph of raw ring widths was constructed for each sample, they were compared. When all specimens were aligned, a time period common to all specimens was observed and the specimens dated relative to each other.

This process aided in the detection of missing rings or double rings since the chance of abnormality occurring in all the specimens during the same year is small. If a specimen did not cross date with the others, it was eliminated from further study. A chronology was constructed by averaging the values for each year for all the samples.

After preliminary cross dating and elimination of errors is made visually, the FORTRAN computer program written by Baillie and Pilcher (1973) will be used to make the following comparisons: between radii of the sample; between samples; between the samples and the chronology constructed previously by Bowers (1973); and between the two chronologies.

Briefly, Baillie and Pilcher's (1973) program is designed to establish the highest correlation between the ring patterns of two different samples. Raw ring widths are first standardized by conversion to a percentage of the mean of the five ring widths of which it is the center value. Then, the data is normalized by taking the log to base e of the percentage figures. The output is in the form of $\underline{t}$ values to indicate the probability of the obtained correlations.

CHAPTER 7

EXPERIMENTS WITH SCREEN SIZES

Eric Roth, David Anderson, Michael Sierzchula,
and Dan F. Morse

The use of the half or quarter inch screen to filter out small artifacts has been one method of a professional excavation for the last 20 to 30 years. One of the first published descriptions of the use of ½ inch screens is in Phillips, Ford, and Griffin (1951:24) in their discussion of excavation methods. This field research took place from 1940 to 1947. Some archeological contracts written with governmental agencies today still specify that screens will be used. One way to casually sort out the interested amateur archeologist from the average grave robber or treasure seeker in the Southeast is to observe whether screens are being used.

Morse had already tested the idea of using small screen sizes to recover data in other test excavations in northeast Arkansas. In the planning of the Zebree 1975 excavations, ¼ inch mesh was specified as the standard screen, with 1/8 and 1/16 inch used as alternates for various sampling designs. Not only was much more useful data recovered, but the use of water with the screening cleaned artifacts far more quickly and with much less damage.

Actual theories about potential data loss were tested by screen size experiments during and after the excavations. In this section, Roth tests for faunal recovery, Anderson discusses the practicality of using a two gallon fine screened bucket sample to reflect artifact distributions across the site and percentages of artifacts recovered by varying screen sizes, and Morse and Sierzchula discuss the loss of lithic manufacturing data as shown through controlled replication experiments.

Faunal Recovery

The faunal recovery methodology of Thomas (1969) was applied to three features located within the Zebree Site during the 1975 excavation. This method consisted of passing archeologically derived fill through successively smaller screen mesh sizes (in this case 1/4, 1/8, and 1/16 inch), with the objective of quantifying the amount of faunal skeletal element loss inherent in the use of differing screen mesh sizes.

Thomas was concerned with the underrepresentation of small-sized bone elements at two Great Basin sites and he accordingly grouped his skeletal assemblage into five classes, based on ascending live weight estimates. For each such class he calculated the percentage of bone loss for each screen size, plus a correction factor which was designed to yield a constant value representative of bone number loss for each of his faunal classes which he termed the "constant of recovery."

With regard to the former factor, the percentage of loss for the 1/4 inch screen size is calculated as follows:

$$\text{Percentage lost through 1/4" screen} = \frac{100\ (\text{bones in 1/8" + 1/16"})}{\text{bones in 1/4" + 1/8" + 1/16"}}$$

while for the percentage of bones lost in an 1/8" screen the calculation is:

$$\text{Percentage lost through 1/8" screen} = \frac{100\ (\text{bones in 1/16"})}{\text{bones in 1/4" + 1/8" + 1/16"}}$$

Similarly the calculation for the constant of recovery is:

$$\text{constant of recovery} = \frac{\text{total bones}}{\text{bones recovered per screen gradient}}$$

While Thomas's basic method was retained, the Zebree zooarcheological sample necessitated some changes in the overall approach to the quantitative assessment of skeletal element loss. For example, Thomas (1969:395) stated that his Great Basin samples contained less than 1% of bird, fish, and reptile remains, therefore he concerned himself only with the mammalian remains recovered. At Zebree, fish and bird remains were abundant, with reptilian and amphibian remains also being present, although not to so great an extent. Because of this the Zebree sample has been grouped into zoological taxonomic classes (Mammalia, Aves, Reptilia, Amphibia, and Osteichthyes) rather than size classes. Thus, while emphasis still remains on examination of small bone element loss we also are interested in how such loss may affect our interpretation of the overall distribution of different faunal classes recovered archeologically.

We also wished to investigate the problem of how bone loss would affect the various methods of calculating the relative abundance of differing faunal species/classes. As reviewed by Chapin (1971) there are at present three distinct methods of calculating the relative abundance of species/class in wide use among faunal analysts: 1) by determining the weight of the recorded sample (Reed 1963), 2) by quantification of the number of bone and/or bone fragments recovered (Zeigler 1973) and, 3) by tallying the minimum number of individuals recovered based on the most commonly occurring body element (Flannery 1967). At Zebree all three methods of ascertaining species/class abundance were investigated for each class recovered from each screen size, along with the calculation of percentage of bone lost and constants of recovery for bone weight, number, and minimum number of individuals.

A third methodological change involved the analysis of feature fill, rather than the level-by-level approach undertaken by Thomas, a change necessitated by time shortage. Finally, a "hand-picked" unit of recovery was used for the purpose of investigating faunal loss when no screening apparatus is utilized, and hence only large and/or clearly visible faunal remains are retrieved.

Three features (249, 238 and 155) were analyzed involving 9405 bones and/or bone fragments. Total bone weight was recorded at 1507.2 grams, and the sample contained a minimum number of 182 individuals representing 44 species/genera. Of this overall sample 8327 bones were identifiable to at least the level of taxonomic class with a total weight of 1254.8 grams.

Tables 7-1, 2, and 3 present the results of the analysis based on the three most abundant taxonomic classes represented in the Zebree sample: Mammalia, Aves, and Osteichthyes. The introduction of the concept of minimum number of individuals in Table 7-3 requires a short word of explanation. In the other two approaches to the calculation of relative faunal abundance the percentage lost and the constant of recovery for each screen gradient were arrived at cumulatively, as per Thomas (1969). Thus, for example, the percentage of loss for the number of mammalian elements in Table 7-2 for the 1/8" screen mesh is:

$$\frac{100(139)}{1047} = 13.276$$

similarly, the constant of recovery for the same class and screen size is:

$$\frac{1047}{(121 + 255 + 532)} = 1.153$$

However, for the calculation of minimum number of individuals a slight modification is called for, reflecting the fact that each screen size must now be treated separately rather than cumulatively. For example, Table 7-3 reveals that a minimum total of 38 mammalian individuals were recorded in the 1/8 inch screen size, and a minimum total of 38 were discerned in the 1/16 inch screen size also. These figures do not mean that an additional 38 individuals were discovered in the 1/16 inch screen; rather, they reflect that no additional individuals were detected. Thus the percentage lost in this instance is recorded as:

$$\frac{100\ (0)}{38} = 0.00$$

while the constant of recovery is:

$$\frac{38}{38} = 1.00$$

Table 7-1. Weight in grams of recovered faunal sample per unit of recovery along with percentage of loss (%) and constant of recovery (c.r.)

Recovery Category	Faunal Class: Mammal	Bird	Fish	Totals
H.P.	395.50	87.80	75.70	559.00
%	35.90	40.48	84.56	55.45
c.r.	1.56	1.68	6.48	2.25
1/4"	180.70	36.90	223.00	440.60
%	6.61	15.46	39.08	20.34
c.r.	1.07	1.18	1.64	1.26
1/8"	28.60	21.50	175.30	225.40
%	1.98	.88	3.32	2.38
c.r.	1.02	1.01	1.03	1.02
1/16"	12.20	1.30	16.30	29.80
Totals	617.00	147.50	490.30	1254.80

Table 7-2. Number of elements per unit of recovery along with percentage of loss and constant of recovery.

Recovery Category	Faunal Class: Mammal	Bird	Fish	Totals
H.P.	121.00	66.00	142.00	329.00
%	88.44	91.90	97.80	96.05
c.r.	8.65	12.35	45.53	25.31
1/4"	255.00	391.00	1821.00	2467.00
%	64.09	43.93	69.64	66.42
c.r.	2.79	1.78	3.29	2.98
1/8"	532.00	340.00	3127.00	3999.00
%	13.28	2.21	21.27	18.40
c.r.	1.15	1.02	1.27	1.23
1/16"	139.00	18.00	1375.00	1532.00
Totals	1047.00	815.00	6465.00	8327.00

Table 7-3. Minimum number of individuals per unit of recovery along with percentage of loss and constant of recovery.

Recovery Category	Faunal Class			
	Mammal	Bird	Fish	Totals
H.P.	15.00	12.00	7.00	34.00
%	60.53	73.91	92.86	81.32
c.r.	2.53	3.83	14.00	5.36
1/4"	29.00	27.00	52.00	117.00
%	23.68	41.30	46.94	35.71
c.r.	1.31	1.70	1.89	1.56
1/8"	38.00	46.00	62.00	146.00
%	0.00	0.00	36.74	19.78
c.r.	1.00	1.00	1.58	1.25
1/16"	38.00	46.00	98.00	182.00
Totals	38.00	46.00	98.00	182.00

Figures 7-1, 2 and 3 illustrate in percentages what proportion of each taxonomic class was recorded per unit of recovery for each of the three methodological approaches. As can be observed, a uniform pattern exists throughout all three graphs, with Mammalia being the best represented, Aves intermediate, and Osteichthyes consistently being the most underrepresented. The 1/4 inch screen mesh is the unit of recovery utilized for most excavations. If it were the only mesh size used at Zebree, distortions would have resulted in calculations of the relative abundance of species/genera. With regard to weight (Fig. 7-1), the recovered faunal sample using 1/4 inch screen mesh would have constituted 93% of all mammalian bone weight recovered, 84% of all bird, and only 61% of the fish remains. Turning to the category of number of bone elements, Figure 7-2 reveals that this screen size accounted for merely 36% of the total mammalian sample, 56% of the bird remains, while representing 30% of the total fish assemblage. Turning to the concept of minimum number of individuals the 1/4 inch screen yielded 76% of all mammalian individuals, 56% of the total bird sample recovered, and 53% of the fish.

The pattern of taxonomic class distortion is logical and predictable, especially when consideration is given to the intuitive images anyone familiar with faunal analysis would form concerning overall skeletal element size and the three taxonomic classes involved. However,

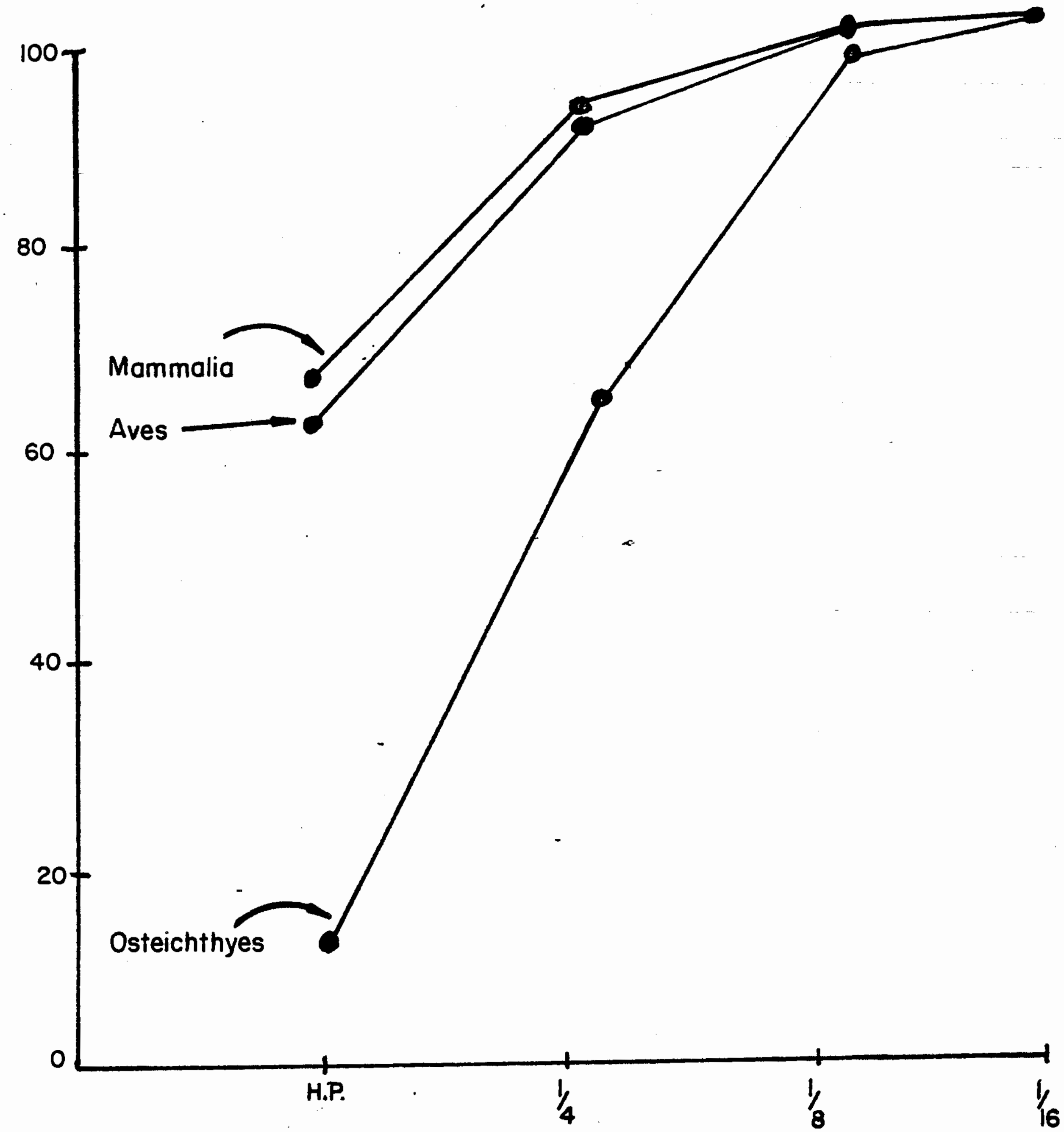

Figure 7-1: Percentages per unit of recovery recorded for total weight of the Zebree faunal sample.

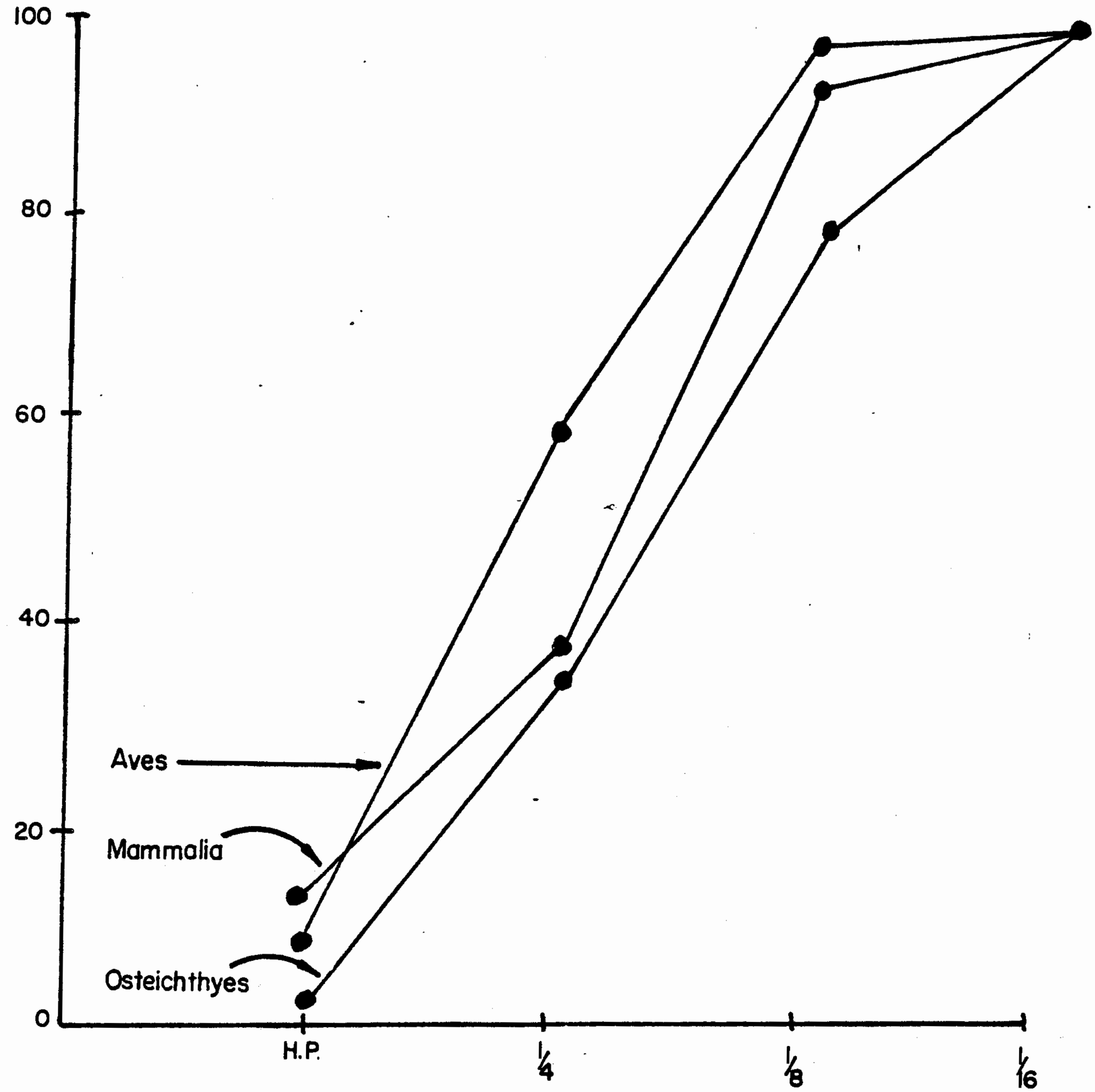

Figure 7-2. Percentages per unit of recovery for total skeletal elements of the Zebree faunal sample.

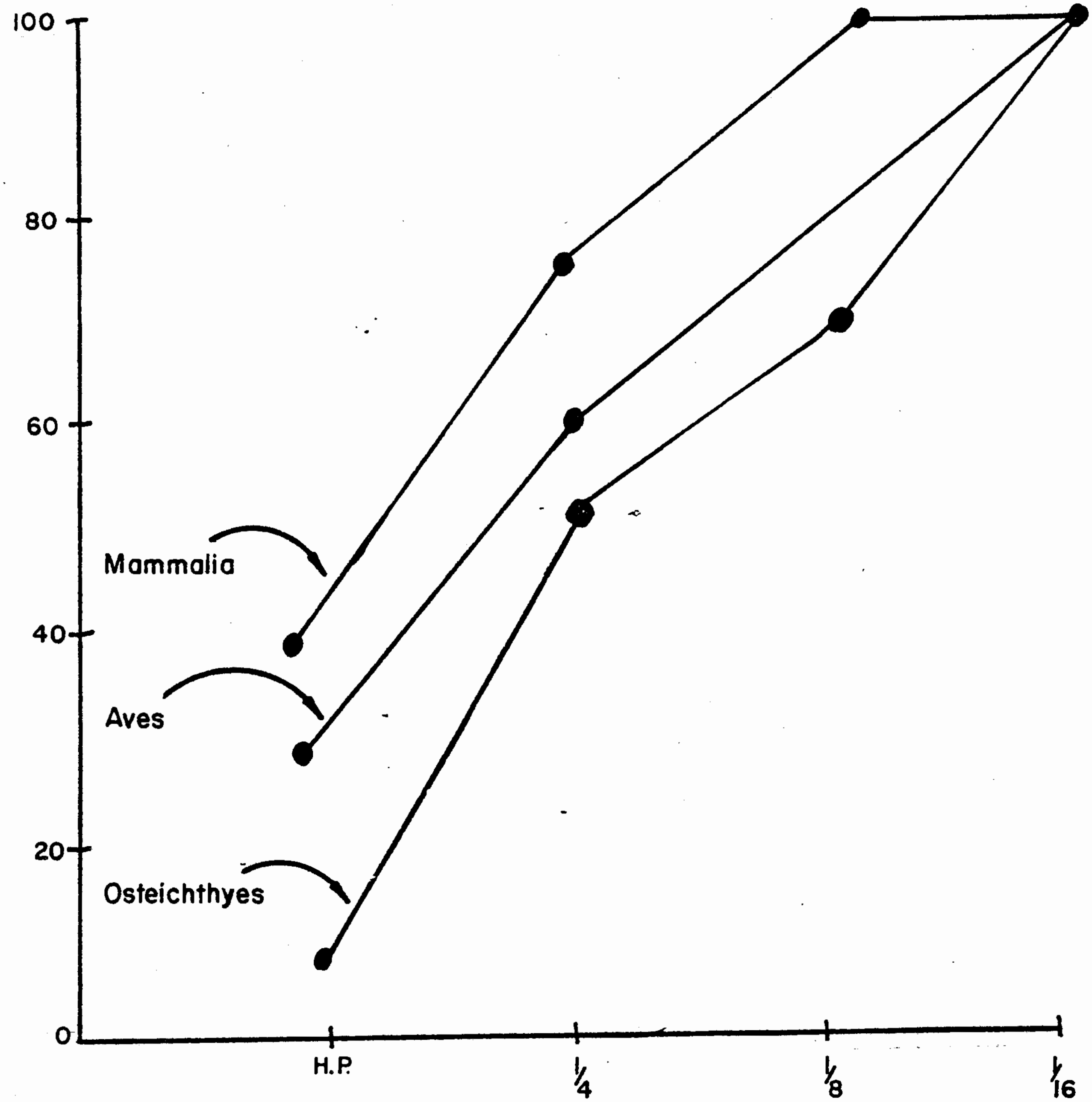

Figure 7-3: Percentages per unit of recovery for total minimum number of individuals from the Zebree faunal sample.

such a pattern, though intuitively appealing, is not meant to be considered a far-flung or all-encompassing model for zooarcheological findings because there exists a broad group of both physical and cultural mitigating factors which can alter such a pattern. Briefly some of these factors are: 1) differential depositional site history, e.g., primary versus secondary deposition, 2) changing soil conditions resulting in varying preservation conditions which may be either beneficial or deleterious to zooarcheological remains, 3) differential periods of burial under constant soil conditions which may result in an underrepresentation of earlier buried faunal elements and 4) differential cultural patterns, e.g., butchering and/or waste disposal. As such, the pattern revealed in Figures 7-1, 2 and 3 reflect the findings for only one archeological, geographical, and temporal locus, i.e., the Zebree site.

The true importance of such findings challenges the reliability of popular models frequently employed in archeological faunal analysis. Olson (1971) rightfully criticized early efforts in the field of zooarcheology for consisting of mere "laundry lists" appended to archeological reports. Olson feels (1971:1): "Interpretation, rather than identification, should be stressed as the final goal of bone examination." The majority of faunal analysts today would be in agreement with Olson, and accordingly they have delved into ethnological, ecological, ethological, and zoological sources to construct models to aid in the interpretation of zooarcheological areas of interest such as: 1) butchering patterns (White 1955; Wheat 1967), 2) seasonality of archeological site utilization (Gruhn 1961; Clark 1972), 3) food gathering patterns (Wing 1963, Flannery 1967), and 4) estimation of the dietary importance of faunal species (White 1953; Cleland 1966).

Essential as such models are to the growth of faunal analysis it must be stressed that all models are of necessity only as valid as their data base. Underrepresentation and distortion of faunal skeletal elements due to their small size is but one example of how such a data base may be biased, yet it is often an overlooked factor in the construction of excavation and in interpretive strategies.

Bias may be introduced through underrepresentation of small faunal elements. Figures 7-1, 2 and 3 show that in none of the approaches to the calculation of relative faunal abundance does the 1/4 inch screen account for as much as 2/3 of the total recovered fish sample. Such a loss is important to the construction of interpretive models. As reviewed by Casteel (1972) fish remains can yield useful information such as: 1) seasonal determination of site utilization, 2) environmental reconstruction, and 3) ecological zone utilization analysis. Such information is crucial for the construction of reliable interpretive models.

Thus the main thrust of our efforts at Zebree with regard to faunal recovery methodology was to point out that faunal analysts in their desire to reach the interpretive state of zooarcheological research cannot, and must not, ignore basic recovery techniques. Such a desire to be rid of confining technical aspects of analysis are understandable, for to quote Reed (1963:204):"With interpretation, one leaves technique behind, and zooarcheology becomes a fascinating maze of intermixed art and science." While we would agree with Olson concerning the importance of interpretation in faunal analysis the fact that such interpretation is dependent on basic recovery and identification procedures is as true today as it was in the past and will be in the future.

The experiments which took place at the beginning of the 1975 excavation at the Zebree site indicated that the 1/8 inch mesh screen was the most appropriate at this site. The 1/4 inch mesh screen lost too much of the sample and the 1/16 inch mesh screen recovered significantly more bone fragments without adding interpretive data. Whenever practical, 1/8 inch mesh screen was used for the recovery of fauna in features during 1975.

Bucket Sample Analysis

A total of 191 2-gallon "bucket samples" of fill were collected from the 1975 excavation units, primarily from the random squares. The weight of each was recorded in the field and the contents then screened through 1/8 inch mesh. The collection and fine screening of a standard volume of fill from the excavation units followed from the research interest in midden formation and content and to serve as a control to delimit the nature of data loss when larger mesh sizes were used.

Each sample was obtained by periodically dumping a shovel of fill into a bucket during the excavation of a level or feature. Fill was tapped down and the 2-gallon volume collected represents approximately 4% of a 20 cm level from a 1 m square. Weights were recorded in an effort to further standardize the quantity of fill, but these values are considered to be of little value due to differing moisture contents. Samples collected soon after a heavy rain invariably weighed more than those taken during relatively dry periods.

Several problems occurred during the collection and analysis of the bucket samples that reduce their analytical value. During field collection fill was often collected by shovel skimming, reducing the probability that large objects would be included. Highly visible artifacts were, indeed, often hand picked from the fill, although all excavators were instructed to leave them in the bucket sample collections. In some cases the samples were forgotten or else were collected from near the bottom of the level. Originally all of the samples were to have been screened through 1/16 inch mesh, but due to field error most (131 out of 191) were actually screened through 1/8 inch mesh. The remainder were rescreened in the lab to convert all to 1/8 inch screened samples.

In the laboratory the screened samples were sorted into identifiable artifact categories and counts or weights recorded for each. Weights were recorded for ceramics, fired red clay, other clay, charcoal, shell, bone, and fish scales, while for lithics both count and weight were noted. Counts of presence/absence data for a wide range of other artifact categories were also noted, such as for human bone, mud dauber nests, hematite, anculosa beads, and so on. The total weight of identifiable ceramics was recorded for each sample, and slightly over half of these (N= 103) were further sorted by type. The ceramics collected in the 60 1/16 inch mesh samples were further sorted through 1/2, 1/4, and 1/8 inch mesh. Summary statistics for these analyses are presented in Tables 7-4 and 7-5; individual measurements are recorded for each sample in the Appendixes package.

Table 7-4 compares the average weight of artifacts caught in the bucket samples with those in the random square levels. The values for the random squares reflect the average weight or count of artifacts caught by 1/4 inch mesh from a 1 m x 1 m x 20 cm level (including the volume of fill removed by the bucket and flotation samples). The 2-gallon bucket samples, in contrast, equal only about 4% of this volume. If the effect of 1/8 as opposed to 1/4 inch screening is minimal, then the average value of the artifacts recovered from the bucket samples should correspondingly be roughly 4% of that for the random square levels. It is apparent from inspection of Table 7-4 that this is true only in some cases. Lithics, charcoal, seeds, and other clay artifacts are considerably overrepresented within the bucket samples, and the quantitites of shell and fired red clay are slightly larger than expected. Only the various ceramic and bone artifact values are in approximate agreement.

The figures in Table 7-4 suggest that for most categories of artifacts (excepting only ceramics and identifiable bone) considerable proportions of the assemblages are lost when 1/4 inch mesh is used. Use of 1/8 inch screen would (apparently) result in the collection of roughly 1½ times as much shell, twice as much fired red clay, 9 times as many lithic artifacts, and 12½ times as much charcoal. Many of the artifacts that are underrepresented in the 1/4 inch sample are those that tend to be either small or relatively perishable. Few if any seeds, for example, would be expected in 1/4 inch mesh, since most are much smaller than this in diameter. The tremendous increase in the number of lithics noted between 1/4 inch and the 1/8 inch mesh is in close agreement with the pattern noted in Sierzchula's replication experiment. The smaller screen mesh permits the recovery of flakes from later stages of tool manufacture,

Table 7-4. Comparison of artifacts recovered in the random square levels with those in the bucket samples: average count or weight per case. The volume of the bucket sample fill collected was approximately 4% of the random square level.

Artifact Category	Random Square Levels (1/4")	Bucket Samples (1/8")	Bucket Sample $\bar{X}$/Random Square Level $\bar{X}$ (%)
Ceramics**	$\bar{X}$ = 518.78 N = 207	$\bar{X}$ = 23.01 N = 173	4.4%
Fired Red Clay	$\bar{X}$ = 50.29 N = 139	$\bar{X}$ = 4.48 N = 159	8.9%
Other Clay	$\bar{X}$ = 52.09 N = 151	$\bar{X}$ = 15.45 N = 160	29.7%
Shell	$\bar{X}$ = 54.93 N = 49	$\bar{X}$ = 3.55 N = 58	6.5%
Bone*	$\bar{X}$ = 42.03 N = 101	$\bar{X}$ = 1.67 N = 144	4.0%
Charcoal	$\bar{X}$ = 1.51 N = 91	$\bar{X}$ = 0.753 N = 114	49.9%
Lithics (count)	$\bar{X}$ = 7.63 N = 135	$\bar{X}$ = 2.747 N = 91	36.0%
Barnes** Ceramics	$\bar{X}$ = 276.11 N = 205	$\bar{X}$ = 14.11 N = 74	5.1%
Neeley's Ferry** Plain Ceramics	$\bar{X}$ = 123.31 N = 189	$\bar{X}$ = 5.85 N = 64	4.7%
Varney Red** Filmed Ceramics	$\bar{X}$ = 152.68 N = 176	$\bar{X}$ = 5.08 N = 42	3.3%
Seeds	$\bar{X}$ = 0.11 N = 5	$\bar{X}$ = 0.13 N = 5	118.2%

*Bone from random square levels (¼ inch) includes only fragments identifiable by taxonomic class

**Ceramics from random square levels (¼ inch) refers only to sherds caught by ½ inch mesh in laboratory presorting.

where large numbers of small flakes are produced. Charcoal, shell, fired red clay, and other clay are all relatively fragile artifacts, highly susceptible to decomposition and reduction, and show under-representation when coarse screens are used.

Table 7-4 suggests that little significant difference obtains in the amount of ceramic and bone artifacts recovered in 1/4 as opposed to 1/8 inch screen. Since only identifiable bone fragments are considered in the 1/4 inch totals, however, the bucket samples may actually underrepresent the amount of bone recovered. This may be due to the care taken with bone when encountered in the field. Larger fragments were carefully troweled out upon detection to avoid breakage. The laboratory ceramic identifications, from which the 1/4 inch averages are drawn, it should be noted, made use only of ceramics larger than 1/2 inch, even though 1/4 inch screen was used in the field. This would further suggest that there is little difference between the use of either 1/2 or 1/8 inch mesh as far as the recovery of identifiable ceramics at Zebree are concerned.

The 60 bucket samples field-screened through 1/16 inch mesh offered the opportunity to check artifact losses through 1/8 inch mesh. In order to examine further the question of ceramic information loss, all identifiable sherds were also passed through 1/2 and 1/4 inch mesh. Table 7-5 records the total count or weight of artifacts caught by each screen size over the 60 samples. The figures under "1/16" Mesh" therefore refer to the quantity of material passing through 1/8 inch mesh yet caught by 1/16, and so on. Only ceramics, however, were screened through all four mesh sizes. The values listed under "1/8" Mesh" for all other artifact categories refer to the quantity of remains caught by 1/8 inch mesh, under 1/16 that were passing through the 1/8 inch mesh and caught in the finer mesh.

The information reported in Table 7-5 is in close agreement with the patterning suggested by Table 7-4. Relatively few identifiable ceramic artifacts, for example, passed through either 1/4 or 1/8 inch mesh, although the figures do indicate that fairly considerable quantities occur between 1/2 and 1/4 inches in size. For most other classes of artifacts it is evident that a substantial proportion of the total site assemblage not only passes through 1/4 inch mesh (Table 7-5), but also through 1/8. In particular for lithics, charcoal, and other clay almost as much or more material passes through 1/8 inch mesh as is caught by it. The figures for shell, bone, and fired red clay show a similar, although less pronounced pattern, with 26%, 20% and 37% of the sample totals respectively, passing through the 1/8 inch mesh.

The ceramic data recorded in Table 7-4 indicates that at least a moderate proportion of the site's ceramic assemblage is under 1/2 inch in size, although little of this is smaller than 1/4 inch.

Table 7-5. Comparison of artifacts caught by differing screen sizes, employing the 60 bucket samples screened through 1/16 inch mesh. Ceramics were additionally passed through 1/2 and 1/4 inch mesh.

Artifact Category	1/2" Mesh	1/4" Mesh	1/8" Mesh	1/16" Mesh	Total
Barnes Ceramics	243.47 N= 21	69.78 N= 20	5.28 N= 11	0.11 N= 1	318.64 N= 23
Neeley's Ferry Plain Ceramics	38.60 N= 10	30.26 N= 17	4.13 N= 14	0.17 N= 1	73.16 N= 18
Varney Red Filmed	72.98 N= 7	16.39 N= 10	1.73 N= 8	0.46 N= 2	91.56 N= 13
All Ceramics	402.54 N= 27	156.57 N= 27	13.77 N= 22	7.18 N= 16	580.06 N= 28
Red Clay	-	-	214.01 N= 43	53.72 N= 37	267.73 N= 44
Other Clay	-	-	741.52 N= 52	698.14 N= 51	1439.66 N= 52
Shell	-	-	61.76 N= 12	21.62 N= 13	83.38 N= 13
Bone	-	-	92.64 N= 30	55.39 N= 29	148.03 N= 30
Charcoal	-	-	4.37 N= 6	18.49 N= 6	22.86 N= 6
Fish Scales	-	-	0.43 N= 3	0.08 N= 2	0.51 N= 3
Lithics (count)	-	-	85 N= 26	120 N= 27	205 N= 27

Total N refers to the number of levels with artifacts present, while the subtotals refer to the number within the total having remains caught by the particular screen mesh size examined. All totals except lithics refer to weight in grams.

The figures refer to identifiable sherds, furthermore, few of which could be typed even with careful examination below 1/4 inch. Totals for screen sizes less than this, however, probably give a fairly accurate picture of relative sherd proportions in each size category. For none of the categories, either by type or overall, is the weight of the ceramics under 1/4 inch much more than 10% of the total for sherds over this size yet under 1/2 inch.

Because of the problems with the greater than 1/2 inch totals, it is difficult to say precisely how much information was lost using 1/2 inch screen in the laboratory sorting of ceramics. If these values are accurate (as is suggested by Table 7-5), then anywhere from roughly 20% to 40% of the ceramics in the site deposits are lost using 1/2 inch screen. From the figures in Table 7-5, it appears that roughly 24% of the Barnes, 47% of the Neeley's Ferry Plain, and 20% of the Varney ceramics are under 1/2 inch in size. This would imply that the Neeley's Ferry Plain sherds are the most susceptible to breakage into small fragments, followed by the Barnes, with the Varney sherds the most durable. This data reinforces Million's idea that red filming strengthens the Varney sherds. This is a somewhat surprising conclusion considering the friability of the sand-tempered Barnes wares, but one that is supported by an independent form of analysis. In the chapter investigating postdepositional processes within the site, the average sherd weight was computed for all three of these wares in the plow zone, midden, and feature levels of the random squares (Chapter 8, Table 8-4). In every depositional environment examined the average sherd weight follows the pattern suggested here: Varney sherds are the largest, followed by Barnes, with Neeley's Ferry Plain sherds consistently the smallest. While this patterning probably has less to do with friability than exposure to mechanical reduction agencies, it does indicate that significant and totally unexpected information loss can and in all probability does occur with the use of large screen mesh sizes in ceramic analysis. Unless independent checks are run, and this loss recognized and to some extent controlled, estimates for ceramic and other artifact categories may be in considerable error.

Artifact density/distribution maps were prepared for site plow zone and midden levels using the bucket sample information in much the same manner that maps were prepared using the 1/4 inch level data sets. Using the bucket sample data, plow zone and midden distributions were prepared for all identifiable ceramics (unsorted), fired red clay, other clay, shell, all bone (unsorted), lithics, charcoal, and fish scales. These were then compared with the maps produced employing the materials caught by 1/4 inch screen from the entire level, to see whether gross patterning was reflected in both. Surprisingly, for most classes of artifacts the bucket sample distributions were in close agreement with the maps from the larger (although more coarsely

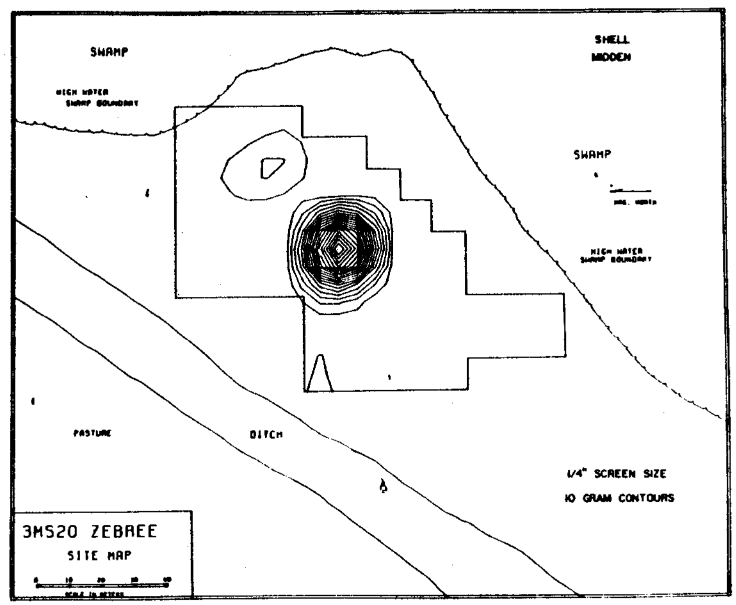

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Figure 7-4. Site density map of shell in midden, using 1 m square samples.

screened) sample. Discernible differences appear to be due primarily to factors of preservation and reduction, and if these are controlled for, then the smaller samples appear to be as useful as the larger for delimiting intrasite distributional patterning.

Figures 7-4 and 7-5 illustrate the distribution of shell within the random square midden levels as indicated by first the 1/4 inch screened levels and second by the 1/8 inch screened bucket samples. It can be readily seen that there is little difference in the two distributions; if anything, the bucket sample map provides more detail. This may be due to the greater sensitivity of the 1/8 inch mesh to shell: considerably more is likely to be recovered than if 1/4 inch mesh is used. Other distributions reflect similar patternings. The bucket sample distributions for ceramics and for bone, although unsorted, are in general agreement when compared with the 1/4 inch distributions of particular types or taxa. The midden bone distribution, for example, most closely resembles that for identifiable mammalian fragments, which might be expected since these are among the largest and most represented of the osteological remains. The combined ceramic distribution within the midden detected the three primary hot spots (Areas A, B, and the low area due east of A), and the low density area between them, in surprisingly close agreement to the distributions noted when ceramics from the entire level were employed.

The distributions for red clay, other clay, and lithics are in somewhat less agreement, something almost certainly related to the factors of size, preservation, and reduction noted previously. The fired red clay distributions are in closest agreement, which may be due to the relatively low quantities of this artifact passing through 1/4 inch mesh. The maps produced delimiting other clay and lithic distributions give only fair to poor agreement; as indicated in Table 7-4 appreciable quantities of these artifacts are under 1/4 inch in size. In the case of the lithics, fine manufacturing debris appears to be represented, while for other clay extensive reduction appears probable. In the case of either small or easily reducible artifact categories the fine screened samples appear to provide a more accurate representation of deposit contents than the 1/4 inch distributions. In the cases of fish scales, for example, no comparison between the two samples was possible, since virtually no remains were recovered by 1/4 inch screen.

The bucket samples illustrate two uses for fine screened artifact samples: control for loss effects of screen mesh size, and relatively accurate delimitation of distributional patterning within the site deposits. The various distribution maps indicate that small, fine-screened artifact samples may be as effective as larger, more coarsely screened samples. Future analysis of site midden may,

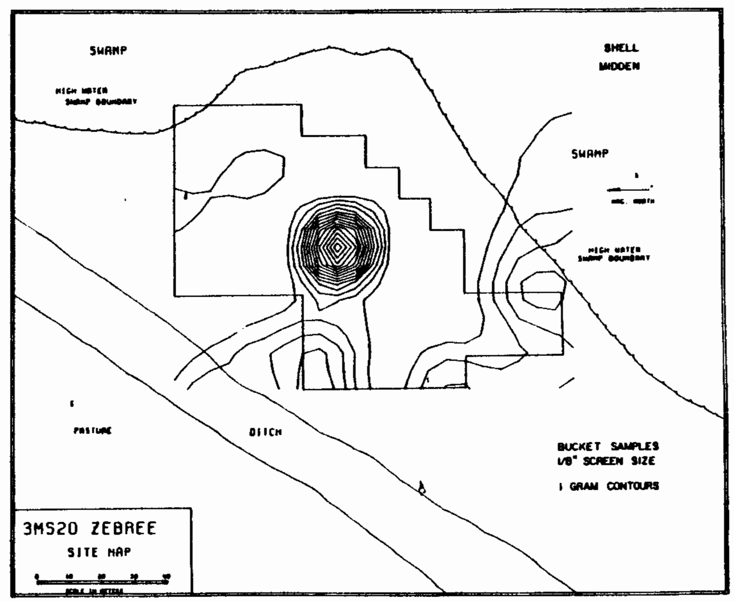

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Figure 7-5. Site density map of shell in midden, using bucket samples.

therefore, find it more profitable to employ smaller units than the 1 meter squares used at Zebree if exploration of midden contents is of primary concern. In terms of fieldwork this would prove much more efficient, particularly if accurate column samples could be obtained using augers, post hole diggers, or small test blocks. Where difficulty would exist is in the laboratory--fine screened samples take long periods of time to sort, and the trade-off must be recognized. If flotation samples are consistently taken these should prove an effective substitute for deliberate fine-screened samples: if the heavy fraction is saved it in effect represents a 1/16 inch sample. At Zebree the 1 gallon flotation samples can thus serve as a backup to the 2-gallon bucket samples, and in fact did so in the case of the lithic artifacts, which were pulled and examined along with other fine screened lithic collections (Chapter 24). The procedure used to collect the flotation samples at Zebree--a 1-gallon sample removed from the center of each excavation level--is also more free of bias than the procedure used to collect the 2-gallon bucket samples. Unfortunately time and financial constraints precluded the complete sorting of both sets of information for comparison.

Lithic Recovery

Flenniken (1975:26-31) conducted replication experiments to investigate the possibility of using the results as a scale to measure against recovered debitage for estimations of numbers of artifacts produced at a given site and to pinpoint more exactly what portions of the manufacturing process were represented. He used a 5 mm mesh screen which is approximately 1 mm smaller than the traditional 1/4 inch screen used in the Midwest and Southeast. He discovered that the loss during recovery based on number of flakes was 98.1% (3520 of 3588 flakes) for a preform; 99.6% (3486 of 3500 flakes) for two dart points made from preforms; and, 100% (1500 of 1500 flakes) for two arrowpoints made from flakes.

In view of the problems at the Zebree site of small lithic artifacts and questions concerning the presence and locations of manufacturing activities, we decided to experiment similarly. This was especially important because we had used a variety of screen mesh sizes for recovery and felt that the data had great potential importance if a scale could be established as control. Two preforms, a side-notched projectile point, and eight microlith tools were made by Sierzchula. The point was made on a flake and the preforms and microlithic cores were prepared from fragments of Crescent Quarry chert gathered from a road cut near the quarries.

Table 7-9 summarizes the debitage categorized by screen sizes by individual count and by weight in grams. The less than 1/16 inch category consists of abrasion powder and extremely small shattered flakes. No attempt was made to count the number of flakes in this smallest category. Counts and weights were both made for the larger categories to use as a guide to interpret lithics recovered in the random square levels.

Table 7-6. Lithic experiment showing screen sizes and amount of debitage for point, biface, and microlith. The weights for the point, two bifaces, and the microliths are not included.

Debitage from Lithic Experiments

Screen	Point		Biface 1		Biface 2		Microlith		Total	
Size	No.	Wt(gr)	No.	Wt(gr)	No.	Wt(gr)	No.	Wt(gr)	No.	Wt(gr)
1/2	0	0	54	718.75	78	478.40	9	73.04	141	1270.19
1/2-1/4	0	0	120	40.71	221	71.60	44	34.08	385	146.39
1/4-1/8	21	0.60	206	9.03	434	18.15	100	6.44	761	34.22
1/8-1/16	275	0.84	869	3.41	2154	10.30	587	2.60	3885	17.15
1/16	NC*	0.60	NC	1.72	NC	5.30	NC	0.74	NC	8.26
Total	296	2.04	1249	773.62	2887	583.65	740	116.90	5172	1476.21

*Not Counted

The projectile point weighs 2.5 grams and measures 32 x 18 x 3 mm. It is side-notched and is made from a flake. It makes up 55% by weight of the combined tool and its debitage. All debitage passed through the 1/4 inch mesh screen and only a very few flakes (7% by number and 29% by weight) were even retained by the 1/8 inch screen. Larger flakes tend to be the initial flakes such as the bulb of force and platform as the point preform is formed preparatory to finishing and notching. If this initial step is accomplished away from the site, these figures would be decreased considerably. Crucial to the identification of arrowhead manufacture both from the standpoint of presence and locus are the recovery of samples caught by both 1/8 and 1/16 inch mesh screens. In particular, there must be 1/16 inch screened lithic artifacts in the collections to be analyzed. Lunate flakes produced during notching of projectile points rarely can be caught by 1/8 inch screen. At the Zebree site, we do have the heavy element from flotation samples derived from the random squares which can be analyzed in this fashion.

Two bifaces were manufactured for this experiment. Interestingly, one involved over twice as much debitage as the other. This is due to Biface No. 1 being manufactured from a blocky piece of chert and Biface No. 2 being made from a tabular piece of chert. The second biface was rechipped as it was thinned, while the first biface was roughed out quickly and nearer to its final shape and size. More platform preparation to make sinuous edges was necessary in Biface No. 2. Almost 200 grams more was involved in Biface No. 1 debitage in contrast to the debitage of Biface No. 2. Based on this experiment, there are definite hints that screening through various meshes and weighing the debitage may give us considerable information concerning quarry activity and the onsite activity. The continual use of 1/4 inch mesh screen will tend to mask the activities we are supposedly investigating; even limiting ourselves to 1/8 inch screening as we tended to do at the Zebree site will still mask much of the data we need for more precise interpretations.

Biface No. 1 weighs 128.88 grams and measures 93.5 x 69.5 x 15 mm thick. By count, 86% of the debitage passed through a 1/4 inch mesh screen. By weight only 1.8% passed through but much of the 718.75 grams greater than 1/2 inch mesh would be left at the quarry site or used as points, cores, and other preforms in most instances so the weights are deceptive. By count, 70% of the debitage passed through the 1/8 inch screen and was caught by the 1/16 inch screen.

Biface No. 2 weighs 152.43 grams and measures 101 x 76 x 15 mm thick. By count, the loss through a 1/4 inch mesh screen was 90%. A total of 75% was lost through the 1/8 inch screen by count. By weight, the 1/4 inch screen loss was only 5.8% but again much of the 478.40 grams in the greater than 1/2 inch screen category probably would be left at the quarry site or used as preforms for points and smaller tools. If no more than 100 grams (probably too conservative) is to be represented in the largest category, then the loss by weight would be around 16%; if 0, then the loss would be around 32%. Similar computed figures for Biface No. 1 result in around 9% and 26% loss through the 1/4 inch mesh screen.

A total of eight microlith tools were made for this experiment. Two were caught by the 1/4 inch mesh screen. One is an expanded based type and the other broke while initial retouching was going on. The other six are fairly typical cylindrical microliths. Measurements and weights are as follows:

Screen Size	Cat. No	Length	Width	Thickness	Weight
1/4 inch	A	21.5	10	4	
	B	12	7	4	1 gram

Screen Size	Cat. No.	Length	Width	Thickness	Weight
1/8 inch	A	19.5	4	3	
	B	17	5.5	5	
	C	17	3.5	2.5	
	D	15	4	3	
	E	11.5	3.5	3	1.48 grams
	F	10	4	3	
	G	15.5	3	2.5	

Two cores, weighing 49.31 grams and measuring, respectively, 40 x 32 x 22.5 mm and 33 x 25 x 20.5 gm were caught by the 1/2 inch mesh screen. Almost all of the blades were caught by the 1/4 and 1/8 inch mesh screens. By count, 93% of the microlithic debitage passed through the 1/4 inch mesh screen and 79% went through the 1/8 inch mesh screen. By weight, only 8.5% fell through the 1/4 inch screen. The 10 blades which passed through (11 blades did not) may have been retained in the field by a 1/4 inch screen if the soil was not agitated sufficiently.

A basic question is what kinds of data should be recovered. These experiments on lithics demonstrate that the continued use of a 1/4 inch screen, no matter how customary, is inadequate. At the Zebree site, the field investigators felt that the 1/8 inch screen would probably be more than adequate but our experiments even cast doubt upon that conclusion. Additional experiments of this sort must be performed quickly, if we are to be able to use the data we are accumulating. Lithic manufacturing areas could be more readily located using 1/16 mesh data as well as information on the nature of the raw material as it is brought to the site. Most modern sampling designs include the systematic collection of flotation samples which in turn involve a heavy fraction made up of lithics and other debris captured by the 1/16 inch mesh screen. These samples are probably the best currently being collected in American archeology and now emerge as the basic lithic sample for making realistic interpretations concerning lithic manufacturing activities at a given site. The sorting and counting difficulties encountered in the laboratory processing might be alleviated by weighing and computing mass ratios. The experiments described here although limited do indicate that such investigative activities will result in useful data.

CHAPTER 8

POSTDEPOSITIONAL MODIFICATION OF THE ZEBREE BEHAVIORAL RECORD

David G. Anderson

Introduction

A primary assumption in archeological analysis is that human behavior is both adaptive and patterned, and that this behavior may leave material remains useful to the reconstruction of the cultural systems of which they were a part (Binford 1962, 1968). Much of modern archeological research might be characterized as the study of material remains--their physical and locational attributes--towards the resolution and interpretation of past adaptive systems. As a number of investigators have emphasized, however, the relationship between archeological remains and the adaptive systems that generated them is not direct. Where artifacts are found and the condition in which they are found may, or may not, accurately reflect past human behavior. Intervening cultural and natural processes physically and locationally transform remains, and the effects of these processes must be accounted for in any archeological reconstruction (Schiffer 1972, 1976b; Schiffer and Rathje 1973; Reid, Schiffer and Neff 1975; Collins 1975).

Evidence for five major periods of occupation during the past 1500 years have been recovered at Zebree, two historic and three prehistoric in age. A major focus of the Zebree project has been the question of midden formation--how the record of these components, as encountered by the archeologists, came into being (Chapter 4, Morse 1976a, Raab 1976b. That is, how (behaviorally) were the deposits formed, and what were their contents at the time of original deposition. While oral tradition and historic documents provide some detail for the later occupations, the primary record for each of these five components consists of the material remains and features encountered during the excavations. This record is not a mirror image of the Zebree occupations, but as Schiffer (1976b:12) has put it, is only a "distorted reflection," blurred and marred by postdepositional agents.

Although the formation of the Zebree deposits is a complex and multifaceted phenomena, within these deposits only four primary environments may be discerned. These are (1) a plow zone some 20-30 cm deep and extending over much of the site; (2) an underlying zone of both churned and built-up midden; (3) a large number of pit features occurring in most areas of the site; and (4) high and low elevational areas within the site itself (see also Chapter 11). The analysis here focuses on a comparison of the materials recovered in these differing depositional environments, in an effort to recognize and account for patterns of preservation, reduction, and spreading. It must be stated on the onset that total illumination, or control for postdepositional modification factors is not possible nor intended. What is hoped for, however, is that some of the more significant factors which blurred and marred the behavioral image might be delimited.

Site Depositional Environment: Modification Agents

A number of both natural and cultural factors have affected the archeological deposits at Zebree. Regional environmental conditions influencing long term patterns of physical and chemical weathering have been recounted in Chapter 14, and the body of the report concerns the nature of the various cultural manifestations at the site. Specific natural factors affecting preservation and postdepositional arrangement include soil texture and acidity, vegetation cover, elevational differences, and the water table level. Soil acidity is important in relation to preservation of artifacts such as bone or fabric, while texture (influencing drainage, aeration, and erosional patterns) is related to both preservation and postdepositional movement of the remains. Vegetational cover may check soil erosion but results in some churning due to root action and the nature of animal populations it attracts. Elevational differences are unquestionably important in relation to site flooding, erosional patterns, and the water table level. Flooding, in particular, appears to have strongly influenced settlement (house site) location towards higher areas, especially during the historic period, while the ground water level plays an important role in preservation.

The area of the artifact-bearing deposits at Zebree is not uniform in elevation, with about 2 meters of relief overall. Any microtopographic variation within an archeological site must be viewed in relation to postdepositional modification processes. Erosion and transport of site deposits (and the artifact within them) from high areas to low areas could be predicted, for example, with greatest effects on slopes or to larger artifacts (Rick 1976). Low-lying areas, subject to frequent flooding and flushing, would be expected to exhibit somewhat poorer preservation, although if the deposits were permanently saturated excellent preservation of perishable items might occur. Higher site areas would in all probability be repeatedly occupied with both the greatest amount of remains and the greatest disturbance (through trampling and churning) to these remains.

The soil over most of the site is Dundee silt loam, with a small area of Steele silty clay loam on the eastern border near the swamp/high water margin (Ferguson and Gray 1971:12,20). The Dundee soil is poorly drained and moderately to very strongly acidic; the Steele soil is moderately well drained and slightly acidic to mildly alkaline. Preservation of bone would be expected to be poor in the former soils and somewhat better in the latter, other factors being constant. Both soils are relatively fine grained and compact, and on moderately level slopes. Extensive erosion or transport is therefore unlikely; if anything, some deposition by aeolian or alluvial agencies would be expected over time.

The natural vegetational cover in the site area is presently a mixed hardwood forest, with prominent species including sycamore, pin oak, sweetgum, pecan, and white and black oaks, as well as some cypress on the swamp margin (U.S. Department of Interior 1976:14; Chapter 14). Some disturbance of the deposits in the form of churning and downward movement appears as an inevitable consequence of root action and the occasional toppling of trees in storms or due to age. A large opening in the Zone C cap in Block 4, and an interruption in a short trench in Block 6 both appear to have been caused by treefalls. The vegetational cover, particularly the nut-producing trees, attracted a number of species of animals, encouraging at least some burrowing activity within the deposits. During the 1975 excavations, voles (along with great numbers of frogs and toads) were found trapped each morning within the test pits. Other, more unusual evidence for burrowing disturbance included cicada nests found at varying depths (Chapters 4, 11) and, near the swamp edge, crayfish holes and raccoon diggings.

In recent years the site has been subject to repeated, almost annual flooding of varying duration and extent. While occasional flooding could be expected during the prehistoric and historic era due to the proximity of the Little River, the modern fluctuations appear to be unusual. Increased land clearing and drainage projects along the upper reaches of the Little River in Missouri in recent years have served to funnel waters and sediment into the Big Lake area, causing severe environmental dislocation (U.S. Department of Interior 1976:12ff). This activity has had a pronounced effect on the site deposits, and our ability to interpret them. During the period from 1969 to 1975, for example, between the second and third seasons of excavation at the site, up to 10 cm of fine clay sediments accumulated over the deposits. The greatest accumulations were in the lower, more frequently flooded areas, although even the highest points had up to a centimeter or two of the deposit.

The erratic river and lake level fluctuations have influenced the local water table to some extent. The water table level is directly related to the amount of moisture in the deposits, and is an important variable to consider both artifact and feature preservation. Although this is uncertain, it appears that the ground water table in the past (pre-20th century) was somewhat lower than at the present. The depth of the early historic well (Chapter 26), some 4 meters, and the depth within it below which excellent preservation occurred, some 2 meters, suggests an early historic water table some 1-2 meters lower than at present. This is a crucial point in the interpretation of the site's prehistoric occupations. Unless the water table and general water level were lower than at the present, most if not all of the pits on the site (even in high areas) would be flooded almost on an annual basis. This is something that is definitely not indicated. None of the features exhibit slumping or water erosion, and evidence for quick use and filling over only one season to avoid water damage is also not apparent.

A final significant natural modification agency at Zebree has been earthquakes. The central Mississippi Valley is one of the most unstable areas in the United States tectonically, with a long history of earthquake activity (Eppley 1965). While the recent (and best documented) activity has been relatively insignificant, the epicenter for the 1811-1812 New Madrid earthquake was only some 50 miles north of Big Lake. This earthquake, unquestionably the greatest recorded within the continental United States appears to have had a considerable effect on at least portions of the site deposits, excluding indirect effects caused by water table alteration (see also Chapters 4, 14). Sand-filled cracks, presumably of earthquake origin, cut through a number of features (Fig. 8-1), and in several areas artifact bearing deposits appear to have dropped one or more meters down cracks. In random square 96 the midden was excavated to well over a meter before earthquake slumping became apparent. Several random squares in the northeast corner of the site that indicated deep deposits when excavated in 1975, were found in 1976 to be in a zone of relatively massive earthquake disturbance. Most of these disturbances are readily distinguishable, either by the presence of cracks or coarse sandy fill, or were revealed during the 1976 stripping operations. Of some geologic interest, it should be noted that although these disturbances cannot be definitely attributed to the New Madrid incident, no features were observed intruding earthquake disturbances. The shocks may, therefore, be a somewhat isolated incident during recent millennia. Minimally, it suggests that archeology may prove as useful for dating earthquakes as it has for dating river channels (Fisk 1944, Saucier 1974) or shoreline accumulations (Butzer 1971, DePratter 1976).

Human agencies have also played a major role in shaping the site depositional environment. Repeated occupation during both the prehistoric and historic periods is unquestionably a major factor. All three of the prehistoric occupations dug pits of various sizes and shapes, churning and mixing the deposits. Repeatedly (or

Figure 8-1. Earthquake crack in Test pit 5, Area A, paralleling the edge of F84 (circular pit) and F127 (aboriginal post/ditch). (Negative 692742)

intensively) occupied areas exhibit the largest quantities of both artifacts and features and simultaneously the greatest amount of disturbance to these remains by later occupations. These occupations also undoubtedly produced changes in soil conditions in the immediate area, through both plant clearing operations and the discard of large quantities of atypical material (i.e., shell, bone, excrement, charcoal, ash, etc.). An examination of pH values from a number of locations within the site (Table 8-1) reveals a neutral and even slightly alkaline environment, rather than the moderately acidic conditions expected of Dundee soils.

Table 8-1. Comparison of soil pH values from differing depositional environments at the Zebree site.

Plow Zone	Midden	Barnes	Big Lake	Total
N=1 ph=6.4	N=11 range=6.2-7.8 =7.08	N=6 range=6.3-7.8 =7.08	N=9 range=6.3-7.8 =7.31	N=16 range=6.3-7.9 =7.19

The historic (c. 1890-1940) Sebree house site was located on the low rise in Area B, and an earlier historic occupation on or near Area A also appears probable (Chapter 27). Both resulted in considerable disturbance to the earlier prehistoric occupational debris. The early historic well, for example, was dug right through a Middle Mississippian burial (Morse 1975b). One consequence of these historic occupations was the removal of much of the immediate forest cover for timber and farming. The plow zone over much of the site area can be attributed to these occupations, although the length of time during which cultivation occurred remains unknown. The depth of the plow zone was nowhere more than 30 cm, however, and no recognizable subsoil (chisel) plow scars were detected, suggesting relatively minor disturbance. Plowing activity does result in horizontal artifact spreading, particularly from higher to lower areas. In addition, it brings remains to the surface, where they lie exposed and subject to collection and/or disintegration. The churning action increases soil aeration and permeability, accelerating chemical weathering and the reduction of perishable items. Finally, the plow blade itself may scar or break artifacts, possibly adding "retouch" to stone tools and reducing the size of ceramics. It should be noted in passing that no evidence for aboriginal cultivation has been detected within the site, although possible physical traces such as rows or hillocks may have been long erased by erosion or the modern plowing itself.

The upper 20 to 30 cm of deposits in Area B (the Sebree house site) although apparently unplowed, were especially churned, which has been attributed by Morse (1975b:15) to dog diggings under and around the house as well as to the presence of the house itself. A recent interview with Leonard Sebree, who lived as a boy in this structure, indicates that this interpretation is probably correct (Chapter 27). Mr. Sebree recalled seeing numerous artifacts in exposed areas of the site, but could recall little of his collecting activity other than remembering occasionally picking up an arrowhead or two. One highly interesting modification of the site assemblage was the use of a number of early Mississippian microliths as gizzard stones by Sebree chickens, creating an unusual degree of smoothing not observed on specimens recovered in lower deposits (Morse 1975b:15). These, to the unwary, might appear to exhibit extensive use-wear.

The historic structures on the site were all eventually torn down, a process that may have resulted in as much or more damage to the site as their construction. In particular, heavy machinery was used to tear down the Sebree house in the late 1930s, during the construction of the original ditch and levee system, and this may have removed or disturbed some of the deposits in Area B. The 1939 ditch and levee construction itself engendered considerable destruction to the deposits although even the general extent of this damage remains unknown.

Although the Sebrees abandoned the site in the late 1930s, a recent historic activity--pothunting--has modified the deposits somewhat. Some 30 to 40 holes half a meter or more in diameter and at least as deep were opened at the site from the mid-1960s through 1976. This activity churned the deposits and created (once backfilled and weathered) potentially disturbing "pit features", although fortunately most potholes are far cruder and less symmetrical in shape than aboriginal excavations. The latest (1976) ditch and levee construction has exposed a lengthy and eroding profile right through the center of the deposits, which unfortunately has served to attract a number of vandals or, less frequently, well meaning but ignorant collectors. The extent of earlier (pre 1960s) collecting or pothunting on the site is unknown, although it appears virtually certain that while the site was being plowed some artifacts were removed.

Analytical Procedures

An extensive and varied excavation sample is available from Zebree to aid in the delimitation of postdepositional modification effects. Artifacts were recovered from a number of contexts by flotation, wet and dry screening with mesh of differing size, and handpicking. Specific data sets include the random and nonrandom 1 and 2 meter square levels, feature fill, the bucket and flotation samples, and block unit and trench fill. In addition a number of pollen and soil samples were taken, including several from deep test cores or trenches. The following analysis focuses on a comparison of artifacts recovered from the four primary depositional environments noted previously: the plow zone, midden, features, and high and low areas within the site. Specific methods include the use of artifact density maps and bivariate statistical analyses. The 1975 random 1 m excavation units form the primary analytical base, and some cautionary remarks must be made about the use of this sample.

First, while the levels and features within the random squares form the sampling frame, it is the artifacts within this frame that are examined. The artifacts themselves represent a cluster, and not an element sample (cf. Kish 1965, Mueller 1975, Thomas 1975). Measurements refer to averages or totals within or between units, and not to elements or single artifacts. Statistical procedures based on the assumption of simple random element samples, as opposed to stratified cluster sampling (the present data base) are therefore not strictly applicable. Nonetheless, simple random sample-based formulas for correlation, regression, and t-tests are used. As a partial rationale for the use of these formulas, it is argued that if the sample coefficient of variation (standard deviation divided by the mean) is relatively low, the number of cases greater than 20 or 30, and normality assumptions met or closely approximated, then the results have at least some credibility and are not to be dismissed outright (Kish 1965:183-187). Complete faith in the results, however, particularly the significance values, should be avoided.

A second problem is that within the primary sampling frame (the 1 m squares) the units (level and feature volumes) are not strictly comparable. Excavation levels within random squares are generally but not always the same volume; they vary somewhat, especially in the case of the plow zone which was frequently removed as a unit. In some squares the plow zone level might be only 15 cm deep, while in others 25 or even up to 30 cm deep. If subsoil was reached in the middle of a level, then the volume of fill removed would be less than in a normal (complete) level. Features from the random squares vary considerably in volume. In all cases using the random square data, however, only materials within the sampled locations are employed. Remains in portions of features extending beyond a sample unit are not included in the analysis, and were in fact excavated separately in the field. Given these problems, the analyses that follow admittedly may be subject to some suspicion. The results, however, appear to be both intuitively meaningful and generally in agreement with those obtained when data from other excavation samples within the site are examined.

Patterns of Artifact Spreading

The random excavation sample includes plow zone and subplow zone remains from across a substantial portion of the Zebree site. Through the use of computer mapping procedures density/distribution maps were prepared for a wide range of artifact categories recovered from this area. Separate maps were run for plow zone and midden levels, "midden" being defined as subplow zone artifact-bearing deposits not discernably disturbed by either features (i.e., pits or pit bases) or other disturbances (i.e., earthquake cracks). Maps were prepared delimiting plow zone and midden distributions of the following artifact categories (recovered by ¼ inch mesh): Barnes, Neeley's Ferry Plain, Varney Red Filmed and Wickliffe ceramics, identifiable faunal remains by taxonomic class, charcoal and nut fragments, shell, fired red clay, other clay, ceramics under ½ inch, and lithics. Similar maps were prepared employing the bucket samples for both the plow zone and midden levels for all ceramics (unsorted by type), fired red clay, other clay, charcoal, fish scales, bone fragments (again unsorted) shell, and lithics (see also Chapter 7). For many of the categories plots of both count and weight were obtained, creating an extensive data base from which to compare plow zone midden distributions. Although it is impractical to reproduce all of these maps within the text proper, all are in the Appendixes package which may be obtained from the Arkansas Archeological Survey. In addition to these distributions, the locations of all features identified by component (and in total) are reported in Chapters 19, 24, and 30, and provide another base for comparison of midden and features.

A number of recent investigators have explored the relationship of surface to subsurface artifact distributions and the related problem of plow induced movement of archeological materials. Redman and Watson (1970:280, 290), working with materials from the tells of Cayonu and Girik-i-Haciyan in southeastern Turkey, suggest that even thousands of plowings of a site are unlikely to result in much lateral displacement over 5 meters, and further that collections from plowed surfaces may be highly reliable indicators of subsurface (subplow zone) remains. The principal objective of this study was to test the effectiveness of surface materials as a guide for subsequent subsurface investigations; the results were highly optimistic. Binford and others (1970:70-71, 88), pursuing a similar program of investigation at the Woodland/Mississippian Hatchery West site in Illinois, were somewhat more cautious in their conclusions. Although comparison of surface artifact density and subsurface feature location showed a general correlation, an inescapable conclusion of this study was that:

> data collection prosecuted without a prior knowledge of the culture history of the site or a program of stratified sampling cannot proceed by using densities of cultural items

> as a guide with any realistic expectation of obtaining an adequate and representative sample of features. In addition, in selecting sites for excavation without a program of stratified sampling, high densities of cultural items cannot be used as a guide to selection without biasing the results. (Binford *et al* 1970:88)

Binford *et al* (1970:70-71) and subsequently Schiffer (1972:162ff) have formalized these relationships, particularly focusing on the relationship of activity/feature location and artifactual concomitants, and an extensive literature on the subject has arisen, largely pioneered by these two.

The Cayonu/Girik-i-Haciyan and Hatchery West examples offer somewhat contradictory conclusions and subsequent literature on the problem of surface/subsurface relationships has done little other than to highlight the complexity of the situation. Reid, Schiffer and Neff's (1975) investigations at the Joint site (a Pueblo III ruin in the Hay Hollow Valley of north-central Arizona) indicate that surface distributions are relatively poor predictors of subsurface remains, and that surface distributions can only be understood in conjunction with detailed knowledge of site topography and erosional patterns and a knowledge of the refuse disposal patterns of the original inhabitants. Roper (1976:374), in spite of the conclusions of Binford at the nearby Hatchery West site, argues from collections made at the Airport site in Springfield, Illinois, that:

> archaeologists working in areas of intensive agricultural activity, such as the Midwest, should be able to use surface scatter as a reliable indicator of subsurface distributions. This of course assumes that other forces such as downhill transport, cultural disturbance other than agriculture, and alluviation are at a minimum.

The evidence from the literature suggests that the problem is a complex one and until the results of extended explorations on a variety of sites under a variety of conditions are reported (e.g., Goodyear 1976:8) it would appear that for the present the most judicious approach would be a cautious one, treating each site as a special case.

For these reasons careful investigation of plow zone and subplow zone artifact distributions at Zebree, as well as examination of other attributes such as size and preservation in differing deposits, were conducted prior to further analysis. From inspection of the various distribution maps it must be concluded that the plow zone to midden relationship at Zebree is a highly complex situation, but that generally, the plow zone artifact distribution is at best only a fair predictor of the underlying midden artifact distribution. For most classes of artifacts knowledge of plow zone distribution, even when coupled with a general awareness of spreading patterns within the site, does not permit effective prediction of midden distributions. This circumstance varies considerably, depending on the category of artifacts examined, but the pattern was pronounced over enough categories of artifacts to preclude combining plow zone and subplow zone levels in further distributional studies. Investigations of artifact-feature distributions by component that are discussed throughout the latter portion of this report (particularly in Chapters 19, 24, and 30), therefore, incorporate only artifacts recovered from midden levels.

One pattern noted over a large number of the categories examined at Zebree was the shifting, in the plow zone, of artifacts from higher to lower elevations. Such downslope movement is both logical and to some extent predictable (Reid, Schiffer and Neff 1975:221, Rick 1976). This pattern was somewhat nonsystematic, however; it did not occur over all classes of artifacts. Although larger artifacts would be predictably the most affected by such a trend (Rick 1976: 142), this was not generally noted. The analysis proceeded category by category and not by individual artifact. It appears that artifact displacement was greatest on slopes within the site, particularly in the vicinity of rich midden deposits. Where displacement appeared to be patterned, it was generally on the order of from 5-15 meters from underlying midden deposits. While hot spots tended to get spread about, the effect was greatest if a depression was nearby. Extremely rich midden deposits tended to show up in overlying or nearby plow zone areas regardless of slope conditions but for most classes of artifacts much of the distributional variability (within the midden) was either lost or severely distorted. Figure 8-2 presents a generalized picture of spreading patterns across the sampled area based on inspection of the various maps. It is apparent that most of the recognizable trends reflect downslope movement of artifacts from higher areas into the lower depressions between these areas and toward the swamp edge.

Among the categories of artifacts recovered by ¼ inch mesh, only fired red clay and mammalian osteological remains exhibited general overall agreement between plow zone and midden distributions, and even in these cases "hot spots" tended to be spread 10 meters or more beyond their midden limits. The bucket sample distributions of all bone (unsorted as to taxonomic class) yielded similar, surprisingly close agreement between the plow zone and the midden, although one major midden hot spot for bone, around Area B, was completely missed in the plow zone samples. This may, of course, reflect the extensive disturbance of the upper deposits in this area brought about by the

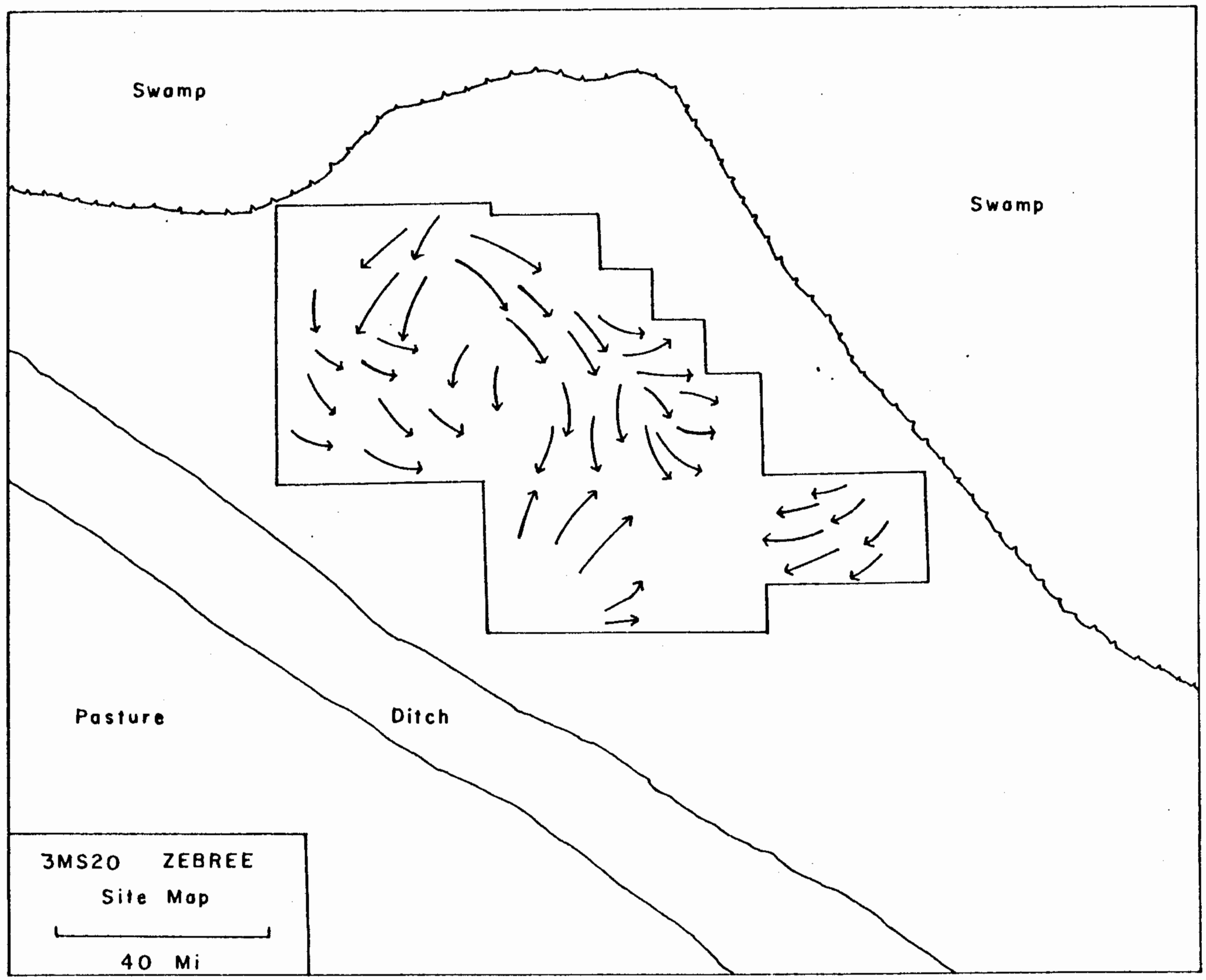

Figure 8-2. Hypothesized movement of artifacts from high to low areas of the site.

construction, presence, and then removal of the Sebree house. Additionally, the use of heavy equipment in the backfilling of the 1969 excavation block in this area may have disturbed these deposits somewhat, as suggested by close scrutiny of the field contour maps produced in 1969 and 1975.

Among identifiable ceramics recovered in the ¼ inch mesh, the Barnes, Neeley's Ferry Plain, and Varney Red Filmed distributions generally show the most consistent patterns of spreading from plow zone to midden levels, supporting the inference of a 10-15 meter spread, particularly downslope. Unfortunately only the very richest of midden sherd accumulations tended to show up in the plow zone, with most of the lesser (although still quite rich) centers missed completely. The Wickliffe distributions are largely incompatible with any picture of spreading, although this is probably due to the low counts involved. The bucket sample distributions of all ceramics (unsorted) yield results similar to those for the ¼ inch screen. Most minor concentrations are missed, with only the richest concentrations detected (again exhibiting a 10-15 meter downslope displacement in the plow zone level). The plow zone distributions of Varney Red Filmed ceramics (by weight) are presented in Figures 8-3 and 8-4 to provide a better picture of the plow zone/midden similarities (or lack thereof) and spreading patterns.

Most of the other categories of artifacts examined exhibit only fair to poor correspondence between plow zone and midden distributions, over both the bucket and ¼ inch screen samples. Among the ¼ inch screened remains, the plow zone shell distribution completely misses two out of three major midden hot spots, for fish three out of four, bird two out of three, and turtle one out of two. A similar pattern occurs in the bucket sample shell distributions, where two out of four midden hot spots have no apparent plow zone traces. In all of the cited cases some deterioration of bone or shell in the plow zone would be expected (see discussion below) and might be responsible for some of the observed discrepancies. Generally, for these and other classes of artifacts, however, only extremely rich midden deposits are likely to be reflected in the plow zone, and even then the locations may be considerably different or distorted due to spreading. The various maps appear to indicate that surface distributions at least at Zebree can be used only to approximate subsurface conditions and material. Furthermore, without some knowledge of spreading patterns even these distributions are of limited value.

Patterns of Artifact Preservation and Reduction

The primary depositional environments within the Zebree site have been subjected to differing patterns of physical and chemical weathering, as well as to different patterns of culturally derived

Zebree - VRF
25 gram cont
DGA/TES - 6/13/77
Plow zone PDM-Fig 2
8-3

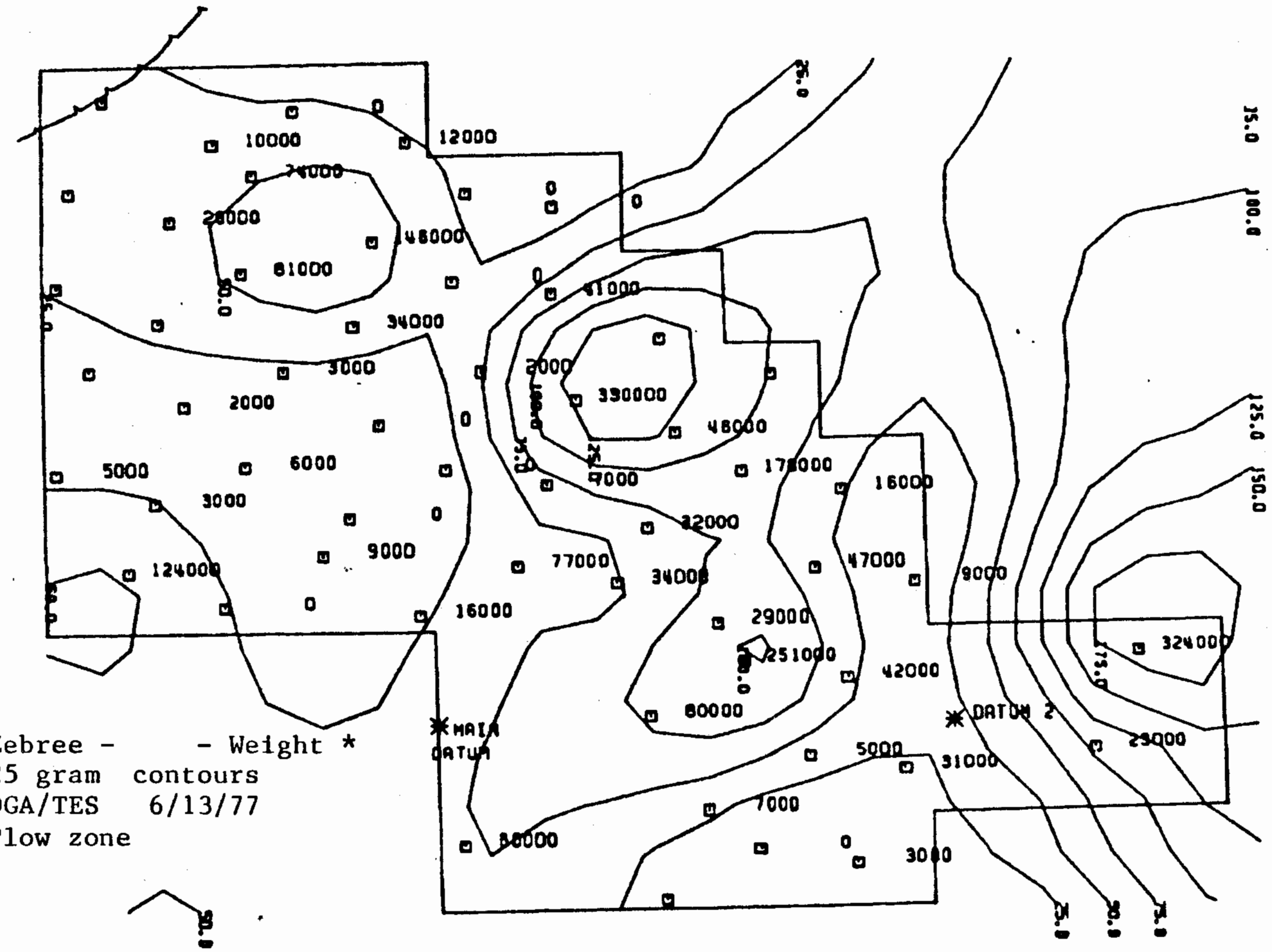

Figure 8-3. Site density map of Varney Red Filmed ceramics in the plow zone

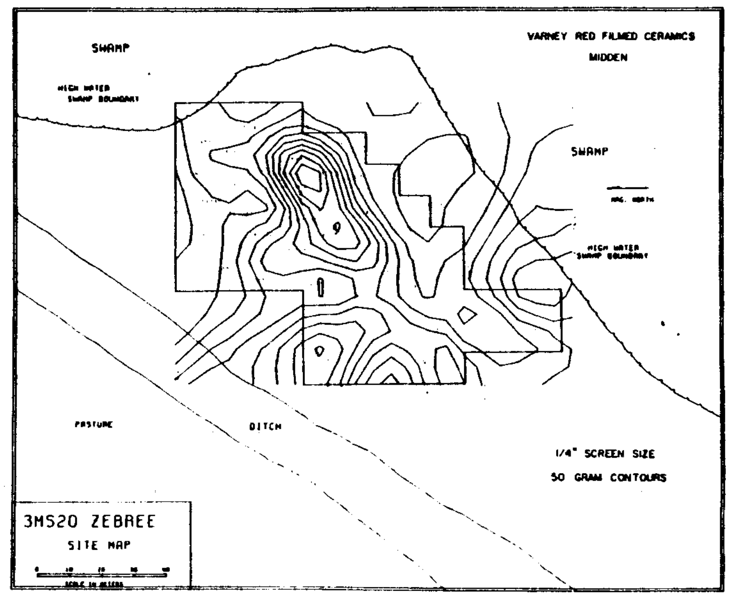

Figure 8-4. Site density map of Varney Red Filmed ceramics in the midden.

modifications. Artifacts in the upper plow zone layer of the deposits, for example, have been subject to considerable mechanical weathering from the repeated turning of the soil, and from contact with the plow share itself. Baker (1975:29ff), for example, has noted elsewhere that possible patterns of inadvertant modification or retouch on stone tools lying within plow zone levels, and Anderson (1976) has determined that consistent reduction patterns obtain in the size of potsherds exposed to plowing action. The increased aeration and permeability brought about by plowing may alter local soil chemistry somewhat; the pH value recorded from the Zebree plow zone is one of the most acidic reported from the site (Table 8-1), and suggest a highly unfavorable environment for the preservation of either shell or bone.

The other depositional environments within the site are expected to yield similar patterned modification of their artifactual contents. Within the midden intensively occupied areas are expected to contain large quantities of organic material, including shell and bone, reducing soil acidity and enhancing the preservation of these and other artifact categories. This same intensive occupation is also likely to mean that these deposits are extensively churned and mechanically abraded through pit excavation as well as by being trampled and kicked underfoot (McPherron 1967:254, Brose 1970:46). Artifacts found within pit features might be expected to be in the best condition, since presumably little postdepositional trampling would obtain. Additionally, the apparent use of pits as refuse disposal areas after abandonment would, through the accumulation of organic and other covering litter, provide both physical protection and a favorable soil chemistry for preservation. High and low areas within the site, demarcating both reoccupation and water level, would also be expected to exhibit differing patterns of artifact preservation and reduction, with the lower, less occupied areas possibly subject to more chemical but less physical (mechanical) weathering.

Generally the following major trends would logically be expected to occur within the Zebree deposits: (1) increasingly favorable physical and chemical preservational environments from the plow zone to midden to features, and (2) increasingly favorable chemical and decreasingly favorable mechanical preservational environments from low to high areas. Discussion here is restricted primarily to the first of these two points; the second receives extensive commentary in the various chapters relating to prehistoric occupation and midden formation. In these sections differing elevational environments are examined in relation to patterns of occupation, group size and the intensity, or duration of settlement. Both quantity and average size of artifacts between high and low areas are examined, particularly between suspected occupied and unoccupied zones, in a direct examination of the McPherron (1967) trampling index as well as for patterns of refuse disposal and preservation.

Tables 8-2 and 8-3 give the results of a comparison of the weight of shell and the average weight, by taxonomic class, of identifiable faunal remains within the random square plow zone, midden, and feature levels. The results are generally in agreement with those expected under point 1 above, that is, plow zone remains are on the average smaller (or fewer) than those in the midden, and at least in the case of the shell considerably fewer remains occur, again on the average, in the midden levels than in the features. The general pattern breaks down slightly in the case of the bone; identifiable fragments in the midden are class by class slightly larger than those recovered in features, although the results of the t-tests suggest that the difference may be due to sampling variation. In the case of both shell and all of the identifiable faunal remains, however, the difference between the plow zone and midden (and also feature) levels is marked: considerable reduction appears to have occurred. The chemical and physical depositional environment within the plow zone would appear to be highly unfavorable to the preservation of either shell or bone remains.

Table 8-2. Comparison of shell weight in differing depositional environments at the Zebree site. 1975 random square excavation sample: student's t (difference of means) test results.

Artifact Category	Provenience: Plow Zone (N=52)	Provenience: Midden (N=112)	Provenience: Features (N=37)
(4) Weight of Shell	N= 7 $\bar{X}$= 3.929 SD= 3.668	N= 25 $\bar{X}$= 36.262 SD= 82.926	N= 17 $\bar{X}$= 103.382 SD= 90.673

	t-Test Results*: Plow Zone/Midden	Midden/Features	Plow Zone/Features
(4) Weight of Shell	t= -1.94** df= 24.33 p= 0.032	t= -2.48 df= 40 p= 0.008	t= -4.51** df= 16.13 $p<$ 0.001

N= number of excavation levels
$\bar{X}$= average
SD= Standard deviation

*All probabilities are one-tailed.
**Separate variance estimate (Alpha for F= 0.05).

Table 8-3. Comparison of average identifiable faunal element weight, by taxonomic class, in differing depositional environments at the Zebree site. 1975 random square excavation sample: Student's t (difference of means) test results.

	Provenience		
	Plow Zone (N=18)	Midden (N=63)	Features (N=20)
(1) Average Wt. Mamalia Element	N= 17 $\bar{X}$= 0.357 SD= 0.176	N= 63 $\bar{X}$= 1.320 SD= 4.358	N= 19 $\bar{X}$= 1.042 SD= 1.164
(2) Average Wt. Ave Element	N= 5 $\bar{X}$= 0.177 SD= 0.050	N= 32 $\bar{X}$= 0.403 SD= 0.600	N= 16 $\bar{X}$= 0.247 SD= 0.161
(3) Average Wt. Pisces Element	N= 6 $\bar{X}$= 0.200 SD= 0.066	N= 25 $\bar{X}$= 0.229 SD= 0.145	N= 16 X= 0.215 SD= 0.087
(4) Average Wt. Chelonia Element	N= 4 $\bar{X}$= 0.325 SD= 0.386	N= 14 $\bar{X}$= 0.429 SD= 0.343	N= 10 $\bar{X}$= 0.394 SD= 0.316
(5) Average Wt. All Identifiable Elements	N= 18 $\bar{X}$= 0.309 SD= 0.037	N= 64 $\bar{X}$= 0.750 sD= 1.592	N= 19 $\bar{X}$= 0.591 SD= 0.432

	t-Test Results*		
	Plow Zone/Midden	Midden/Features	Plow Zone/Features
(1) Average Wt. Mamalia Element	t= -1.75** df= 62.74 p= 0.043	t= 0.46** df= 79.48 p= 0.325	t= -2.53* df= 18.92 p= 0.010
(2) Average Wt. Ave Element	t= -2.08** df= 33.34 p= 0.023	t= 1.37** df= 38.89 p= 0.090	t= -1.53** df= 18.91 p= 0.072
(3) Average Wt. Pisces Element	t= -0.47 df= 29 p= 0.322	t= 0.38** df= 38.89 p= 0.355	t= -0.38 df= 20 p= 0.304
(4) Average Wt. Chelonia Element	t= -0.52 df= 16 p= 0.305	t= 0.25 df= 22 p=0.400	t= -0.35 df= 12 p= 0.368
(5) Average Wt. All Identifiable Elements	t= -2.18** df= 67.23 p= 0.017	t= 0.71** df= 80.75 p= 0.239	t= -2.66** df= 23.01 p= 0.007

*All probabilities are one-tailed.
**Separate variance estimate (Alpha for F= 0.05).

A number of minor points within these tables deserve additional comment. Examination of the figures reported for both fish and turtle indicate that little difference occurs in the average weight of these elements regardless of the provenience. While the plow zone figures are slightly lower than those reported for either the midden or feature levels, the results of the various t-tests indicate that this difference is rather minimal. The reasons for this seeming discrepancy from that expected by point 1 above appear to be due to factors of preservation. Most of the fish identifications (at least on the class level) were made from vertebra fragments, which were usually recovered intact. The similarity of these figures may reflect the average size of recovered fish vertebrae rather than differing depositional environments. The similarity in size of the turtle fragments may reflect the relative resistance to weathering that seems to characterize these remains (Stoltman 1974:138), or it may reflect sampling bias due to the low number of these remains. The average size of identifiable remains recovered in features compared to those found in the midden (i.e., slightly smaller in the former case) may reflect differing refuse disposal patterns. Feature fill is likely to reflect materials dumped or swept in from around primary occupation areas, while midden remains derive from both intensely and marginally occupied areas. Remains in features may have undergone a period of extensive trampling prior to deposition, a fate less likely in peripheral areas. Finally, the number of dog remains recovered from pits suggests that scavenging of bones may well have been commonplace, and even the possibility that some dogs may have been confined (by choice or otherwise) to these features.

Table 8-4 presents the results of a comparison of average sherd weight, by type, in the random square plow zone, midden, and feature levels. Barnes, Neeley's Ferry Plain, and Varney Red Filmed ceramics were examined, primarily because these were the only types represented in any quantity from the excavation units. The results are in direct agreement with those expected: over all three categories average sherd weight increases from plow zone to midden to feature levels. The results of the t-tests, furthermore, suggest that significant differences are present in average sherd size between the different deposition environments. This has immediate and important consequences for ceramic analysis, since it indicates that sherd counts from differing deposits are not directly comparable. Sherds in features, for example (regardless of type), tend to be two to three times the average weight of those in the plow zone (Fig. 8-5), and one and a half to two times the average weight of sherds in the midden. Equating these counts in analysis (i.e., adding plow zone, midden, and feature sherd counts together), as in an attempt to estimate prebreakage vessel totals, would almost certainly yield meaningless results unless some measure of control was introduced.

Table 8-4. Comparison of average sherd weight, by type, in differing depositional environments at the Zebree site. 1975 random square excavation sample: Students t (difference of means) test results.

Artifact Categories	Provenience: Plow Zone (N=48)	Provenience: Midden (N=106)	Provenience: Features (N=49)
(1) Average Wt. of Barnes Sherds	N= 47 $\bar{X}$= 3.158 SD= 0.663	N= 106 $\bar{X}$= 4.322 SD= 3.496	N= 48 $\bar{X}$= 6.182 SD= 7.241
(2) Average Wt. of Neeley's Ferry Plain Sherds	N= 46 $\bar{X}$= 2.178 SD= 0.481	N= 100 $\bar{X}$= 3.131 SD= 1.646	N= 40 $\bar{X}$= 5.024 SD= 4.474
(3) Average Wt. of Varney Red Filmed Sherds	N= 39 $\bar{X}$= 3.621 SD= 2.280	N= 94 $\bar{X}$= 5.653 SD= 9.831	N= 39 $\bar{X}$= 9.830 SD= 9.683

	t-Test Results*: Plow Zone/Midden	t-Test Results*: Midden/Features	t-Test Results*: Plow Zone/Features
(1) Average Wt. of Barnes Sherds	t= -3.30** df= 120.92 p< 0.001	t= -1.69** df= 57.16 p= 0.048	t= -2.88** df= 47.81 p= 0.003
(2) Average Wt. of Neeley's Ferry Plain Sherds	t= -5.32** df= 129.36 p< 0.001	t= -2.61** df= 43.29 p= 0.007	t= -4.00** df= 39.78 p< 0.001
(3) Average Wt. of Varney Red Filmed Sherds	t= -1.89** df= 113.99 p= 0.031	t= -2.24 df= 131 p= 0.014	t= -3.90** df= 42.20 p< 0.001

*All probabilities are one-tailed.
**Separate variance estimate (Alpha for F= 0.05).

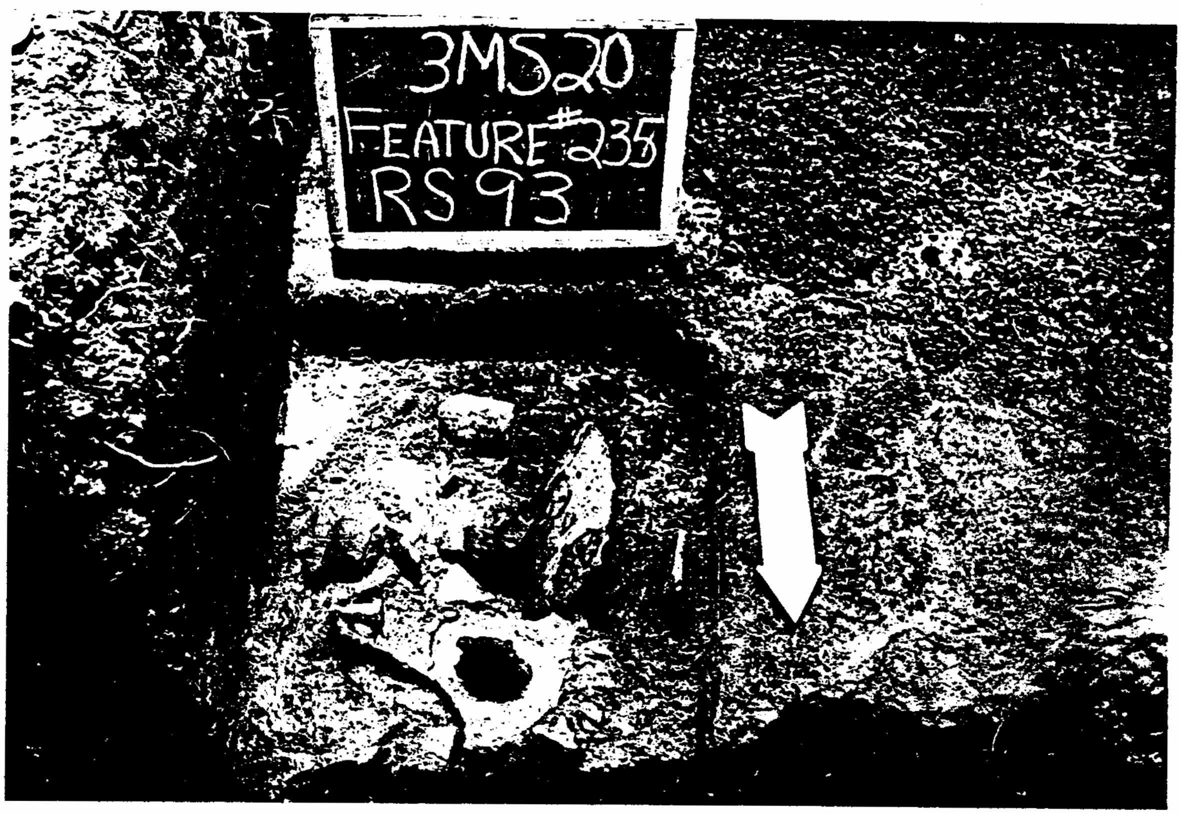

Figure 8-5. Cluster of large Mississippian sherds in the base of a small pit (F235) in Random Square 93. Large sherds and even reconstructable vessels were frequently found on pit bottoms. (Negative 752881)

Examination of the standard deviations and means associated with each sherd type and each depositional environment is also instructive. Plow zone means and standard deviations for average sherd weights tend to be the smallest, indicating both a small sherd size and relatively minor deviation from this size across the sampled area. This minimally suggests a consistent pattern of breakage by type by plow action. Varney Red Filmed sherds consistently exhibit the largest means and standard deviations within each depositional environment. This is almost certainly due to the inclusion of both jar and salt pan sherds under this type; the former are almost invariably thinner and tend to break into smaller pieces. High standard deviations relative to the mean within the midden and features indicate considerable variation in average sherd weight within these environments. In the midden itself this variation appears related to mechanical weathering (i.e., trampling). Small sherds are almost consistently associated with areas of intensive prehistoric occupation (Chapters 17, 22), and probably reflect breakage underfoot while larger sherds generally occur in less intensively occupied areas.

Sherd size variation within features appears to be a somewhat more complex phenomenon. The rather considerable variation observed among the Varney Red Filmed sherds again appears to be due in part to the lumping of different vessel forms. Some of this variation, for Barnes and Neeley's Ferry Plain as well as for Varney Red Filmed sherds, however, appears due also to particularistic circumstances: some pits included more or less intact vessels while others did not. The variation observed in both the midden and feature levels indicates that reduction patterns there are nowhere near as consistent, for any type, as those observed within the plow zone. The variation in average sherd weight for Barnes ceramics observed among the Zebree features, finally, appears to be due in part to the occurrence of these sherds in pits of both contemporary and later occupations, a point discussed in greater detail below.

Modification Effects from a Behavioral Perspective

The purpose in delimiting postdepositional modification processes is to be able to control for them in analysis. Once modification effects are recognized they can be incorporated into behavioral analyses, by providing for more realistic estimates of original deposit contents. The effects of collector behavior, for example, have been examined in efforts to determine original (precollector) assemblage contents (Morse 1963:48, 1973; House and Schiffer 1975:175-176; Anderson 1974:155-157, 1976). At Zebree, knowledge of artifact spreading and reduction patterns has permitted somewhat more reliable estimates and analyses than might have otherwise been possible although control is admittedly on a very low level.

Considerable variation in Barnes average sherd weight was noted within the Zebree features (Table 8-4), and was attributed in part to the presence of these ceramics in pits of both contemporary (late Woodland) age and from subsequent occupations (Chapter 10-9,10). To test this, average Barnes sherd weight was compared in Barnes as opposed to Big Lake component features over the entire 1975 excavation sample (Table 8-5). Only pits definitely assignable to one component or the other were used, with all questionable cases excluded. The results verified the original interpretation, and in addition produced information of surprising importance.

Table 8-5. Comparison of average sherd weight in Barnes and Big Lake phase features excavated at the Zebree site. 1975 Student's t (difference of means) test results.

Artifact Categories	Barnes Pits (N=18)	Big Lake Pits (N=76)	t-Test Results*
(1) Average Wt. of Barnes Sherds	N= 16 X= 13.657 SD= 11.442	N= 68 X= 5.006 SD= 3.798	t= 2.99** df= 15.79 p= 0.0045

*All probabilities are one-tailed.
**Separate variance estimate (Alpha for F= 0.05).

As may be seen from Table 8-5, the average weight of Barnes sherds in Barnes pits is considerably greater than in Big Lake pits. Furthermore, the respective standard deviations indicate that considerable variability in average sherd weight occurs in Barnes features, with only relatively minor variability indicated over the Big Lake feature assemblage. That is, Barnes sherds in Barnes pits tend to vary considerably in average weight, while in Big Lake pits they are relatively uniform. This immediately suggests a primary (contemporary) deposition for the Barnes sherds found in Barnes pits and a secondary (later) deposition for the Barnes sherds found in Big Lake pits. The sherds in the Barnes pits include a significant proportion of relatively large specimens, indicating little if any postbreakage modification. Many appear to have been tossed or swept into the feature immediately upon breakage (Fig. 8-6). The Barnes sherds in the Big Lake pits, however, are considerably smaller and relatively uniform, which suggests that they probably had been kicked underfoot for a while before winding up in the fill. The average weight of these sherds (5.006 grams), furthermore, is very close to the average weight of Barnes sherds recovered from the general site midden (4.322 grams).

Figure 8-6. Partially exposed Barnes sherd cluster, containing portions of one or two large jars, in the base of F221, Block Unit 3. The large size of the sherds suggests deliberate discard after breakage. (Negative 752852)

This patterning has important implications regarding the chronological and cultural relationships between the Barnes and Big Lake peoples (see Chapter 10). Minimally, it tends to indicate separate periods of occupation; contemporaneous Barnes/Big Lake ceramic manufacture on the site would be expected to produce at least a few Big Lake features with large Barnes sherds within the fill. Turning from Zebree itself, it is argued that consideration of average sherd size or weight may prove a highly useful tool in a great many circumstances where questions of single versus multicomponentcy need to be resolved. Within the southeast, for example, a great many sites have been reported with both late Woodland and Mississippian ceramic assemblages, a point used by many investigators to support a slow transition from the earlier complex to the later. If sherd reduction processes and other postdepositional effects are controlled, these arguments might be more convincing; at Zebree this same pattern, when modification effects are examined, supports the opposite conclusion.

Although minor when compared with the features, some variation in sherd weight may also be noted within the site midden, for all three principal ceramic types (Table 8-4). This, it was suspected, may have been related to postdepositional breakage caused by the trampling and churning of these sherds in intensely occupied areas of the site. A brief test for this possibility was undertaken employing the average weight of Barnes sherds taken from different areas within the site (Table 8-6). Sherds were examined from two artifact rich zones, and from two (comparatively) artifact poor zones within the midden. Areas of artifact concentration, it was assumed, reflected areas of intensive prehistoric occupation and low artifact density zones the reverse. It was predicted that sherds in the former zone would be smaller than those in the latter area, due to greater exposure to culturally generated mechanical reduction agents. Finally, the average weight of Barnes sherds under the Zone C cap in Area B was examined to provide some measure of control. These sherds, it was reasoned, reflected relatively pristine pre-Big Lake phase Barnes midden, since they were in effect sealed in place (apparently) early in the Mississippian occupation.

Table 8-6. Comparison of average Barnes sherd size in differing areas of the Zebree site midden. 1975 random square excavation sample.

Zone D	Concentration		Low Density Zone	
(Area B)	(S of Area C)	(N of Area C)	(Center Area C)	(Bet. Areas A,B)
N= 4	N= 18	N= 11	N= 15	N= 16
range= 4.635-5.545	range 2.703-6.772	range= 1.292-7.0	range= 2.70-9.277	range= 3.323-6.214
$\bar{X}$= 4.996	$\bar{X}$=3.966	$\bar{X}$= 3.452	$\bar{X}$= 4.243	$\bar{X}$= 4.299

The results generally conformed to expectations. Barnes sherds from the two concentrations were somewhat smaller than those from the low density areas. The sherds in Zone D, furthermore, were larger than those from either lower high density zones. The results were encouraging and prompted further analysis along these lines, incorporating data values from across the site midden. The contour maps reported in Chapters 19 and 24, delimiting average Barnes and Neeley's Ferry Plain sherd weight within the midden, are a direct spinoff of this analysis.

The differences in average sherd weight noted between the plow zone, midden, and feature levels within the 1975 random squares (Table 8-4) are such as to render direct comparison of sherd counts between these proveniences relatively meaningless. Unfortunately, for the 1968, 1969, and 1976 excavation seasons only sherd counts were recorded during the laboratory analysis. Using linear regression analysis, however, together with the count and weight data from the 1975 random excavation levels, it was possible to develop a series of predictive equations linking these two variables (Table 8-7). These equations, developed for individual as well as combined proveniences, render the data from these other seasons comparable to that from 1975, with both a high degree of accuracy and efficiency. That is, through examination of the values for variance explained (R^2), it is apparent that the equations will yield highly reliable results for sherd weight, without the necessity of actually weighing the complete excavation assemblages.

An intuitive appraisal of the relatively direct count-to-weight relationship implied by the correlation and regression analysis may be obtained by comparing the midden distribution of Varney Red Filmed ceramics by weight in this Chapter (Figs. 8-3 and 8-4) with the distribution by count in Chapter 24. Few differences can be observed in the two maps, supporting a fairly direct relationship. Given sherd count, it should be possible to arrive at an accurate estimate of weight. A similar set of maps illustrating this count-weight relationship for Barnes ceramics is to be found in Chapter 17. Additional maps delimiting both count and weight distributions for other ceramic types and other artifact categories, for both the plow zone and midden levels, are to be found in the Appendixes package. In almost every case the distributions are equivalent, suggesting widespread applicability for this form of analysis.

A second point to note about this close agreement between count and weight across the site is that it indicates fairly consistent reduction patterns within plow zone and midden environments. Count and weight distributions in marked disagreement with each other (for the same category of artifact) would imply a considerable variation in average artifact weight within the area investigated (average/ weight = weight/count). This would imply markedly different reduction or preservation patterns in differing areas. At Zebree these effects are not pronounced, although enough minor variation does exist within the midden to render effective trampling index oriented studies.

Table 8-7. Comparison of count and weight relationships of prehistoric ceramics, by type, in differing depositional environments at the Zebree site. 1975 random square excavation sample: regression and correlation analysis results.

Ceramic Category	All Units (N-203)	Plow Zone (N=48)	Midden (N=106)	Features (N=49)
(1) Barnes	N= 201 R^2= 0:816 $p<$ 0.001 wt= -47.5+ (ct)(5.28)	N= 47 R^2= 0.896 $p<$ 0.001 wt= -31.4+ (ct)(3.93)	N= 106 R^2= 0.914 $p<$ 0.001 wt= -58.7+ (ct)(5.14)	N= 48 R^2= 0.785 $p<$ 0.001 wt= 7.3 + (ct)(6.05)
(2) Neeley's Ferry Plain	N= 186 R^2= 0.828 $p<$ 0.001 wt= -10.7+ (ct)(3.46)	N= 46 R^2= 0.957 $p<$ 0.001 wt= -2.5+ (ct)(2.43)	N= 100 R^2= 0.836 $p<$ 0.001 wt= -22.8+ (ct)(3.73)	N= 40 R^2= 0.870 $p<$ 0.001 wt= 12.4+ (ct)(3.62)
(3) Varney Red Filmed	N= 172 R^2= 0.643 $p<$ 0.001 wt= 4.97+ (ct)(5.30)	N= 39 R^2= 0.903 $p<$ 0.001 wt= -2.02+ (ct)(4.29)	N= 94 R^2= 0.724 $p<$ 0.001 wt= -0.88+ (ct)(4.74)	N= 39 R^2= 0.585 $p<$ 0.001 wt= 46.3+ (ct)(6.30)

N = number of units examined
R^2= variance explained
p = significance
wt = weight of sherds
ct = count of sherds

Conclusions

Understanding postdepositional modification processes is an essential part of reconstructing the behavior that created the archeological deposits in the first place. As such, achieving control over the effects of natural and cultural modification agents should be pursued during every archeological analysis. Fieldwork should be directed towards the recovery of data not only from deposits, but about them--information that can later be used to control for preservation, reduction, spreading, collector behavior, or any of a number of distorting conditions. In all instances, however, the recognition of modification agents and effects should not be regarded as sufficient. Such information is valuable only insofar as it is used in interpretive analysis.

CHAPTER 9

CERTAIN LABORATORY AND ANALYTIC PROCEDURES

Phyllis A. Morse, David G. Anderson, Thomas E. Scheitlin
Michael G. Million, Mary Lucas Powell

The processing and analysis of archeological data recovered from the field requires a great range of specialized techniques, many of them borrowed from other fields of study. After the initial cataloging of specimens to insure the curating of data such as provenience, the specialist seeks specific attributes for study. This may necessitate the use of a comparative collection of bone such as that used by the zooarcheologist, or reference to illustrations in books, or to a comparative collection such as was done by the ethnobotanist. Rare or puzzling specimens such as passenger pigeon or smartweed were sent off to colleagues for further identification. Geometric principles were involved in determining the diameter, height, and volume of vessels by Million. Specific attributes were sought by Powell on the skeletal population. Efficient use of vast quantities of data was facilitated by the expertise of Anderson and Scheitlin in locating useful computer programs as well as coding and running the data. Anderson probably spent more time at the computer center than in recovering the primary data in the field. The appendix contains much of the computerized data.

The laboratory procedures detailed here include only those carried out during the 1975 field season or subsequently in the Survey labs in Jonesboro or Fayetteville. Some detailed procedures, such as for analysis of the fauna, were done by others under subcontract and are not covered in this report.

The Field and Post-Field Labs

One major decision made in the initial planning of the Zebree excavations was to operate a field laboratory near the site which would utilize as many people as were actually doing the field excavations. Personnel, particularly anthropology students, were to be rotated between field and lab work. The usual procedure of concentrating all funds and labor on the actual fieldwork has resulted in the past in rooms full of boxes of unwashed, uncataloged, and unreported materials which the archeologist will get around to coordinating some day. In the Southeast where it is possible to excavate all year around, that day seldom ever comes.

We were fortunate in being provided with a five room air-conditioned residence at the Big Lake National Widlife Refuge Headquarters to be used as a laboratory and office. The ideal situation would have been a laboratory located at the Zebree site itself for instant feedback from field to lab. Instead, communication several times a day by truck was usually necessary.

A basic processing laboratory was set up, as well as separate ceramics, zooarcheology, ethnobotany, and physical anthropology laboratories. A lithics specialist was not fundable during the actual excavation. Enough tables and portable shelves were supplied so each specialist could keep necessary type collections, references, and ongoing processing orderly.

The materials from the excavation were washed in the field. Two wells were driven near Ditch 81 on the edge of the site. Two artifact washing tables were constructed near the bridge and varying mesh-sized interchangeable screens were built (Fig. 9-1). Cleaning artifacts by high pressure hoses was much quicker than the usual hand washing in a dishpan of dirty water, and resulted in less breakage and damage to fragile specimens such as mussel shells. Artifacts were just as clean as if the usual hand washing had been used. Quarter inch screens were used for washing most random square levels. Eighth inch screens were used for most other samples. Sixteenth inch was used when deemed appropriate by the field situation or specialist. Flotation of ethnobotanical specimens was done separately at the laboratory. Specimens were dried in screens at the site, bagged in heavy duty plastic aquarium bags, marked with both tags and permanent felt markers, and brought to the laboratory at the end of the day. Fragile specimens were curated by the appropriate specialist, such as a dog burial excavated by the zooarcheologist.

Artifacts were sorted into basic categories of charcoal, bone, shell, lithics, and ceramics. Catalog numbers were assigned to the first four categories by Phyllis A. Morse. Ceramics were cataloged separatedly by pottery type under the direction of Michael G. Million. The categorization of lithics was done by Dan F. Morse and David G. Anderson in the evenings. Further sorting and identification of specimens by each specialist took place in the separate labs, with three persons sorting ceramics, two or three sorting ethnobotanical specimens, the zooarcheologist having occasional help, and an anthropology student, Jay Sperber, cleaning the human bone when a burial was discovered.

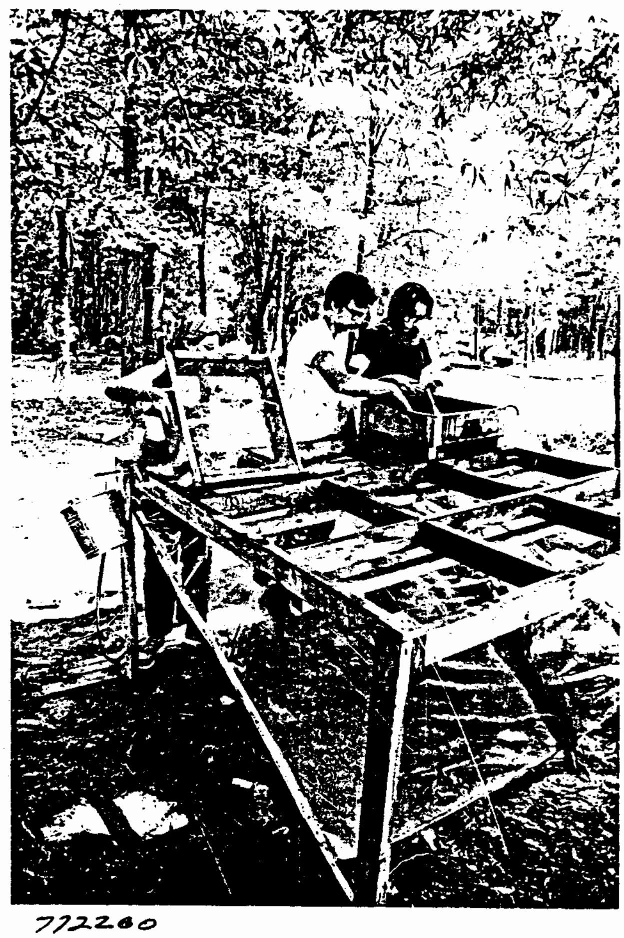

Figure 9.1. Water screening artifacts at the Zebree site using interchangeable screens.

By the second week enough material had been accumulated to set up all the laboratories and keep them going. On productive days, 60 or more separate bags of material came into the lab at the end of the day. The potential backlóg was cut down greatly by rainy weather, when all the field personnel could also be put to work sorting specimens in the lab. Sorting and cataloging of all random square material was given priority, so analysis could begin early in the fall using this data in various computer programs. Material from other excavation units was given equal priority with material from features. Sorting of this material continued until the summer of 1976. Three part-time persons worked on sorting the 1/8 inch screened features all winter. One feature was never wholly sorted; a measured proportion of it was. The picking out of small bits of shell, burned clay and ceramics under 1/4 inch in size was very tedious. The number of small bones, fish scales, charcoal specimens, and chert flakes recovered produced enough data to justify the use of 1/8 inch screens and the expense of sorting, but a method of chemical sorting should be set up if this kind of data recovery is done again. The two-gallon bucket samples were theoretically screened in 1/16 inch screens, and sorting these was also extremely time consuming. One person worked on these for over half a year, and David Anderson finally finished categorizing them in summer of 1976.

Materials from the random squares, features, and bucket samples were not only sorted, cataloged, and identified; they were weighed. They were then bagged in plastic bags or coin evenlopes and stored for further study. Materials such as ceramics under 1/2 inch in size were weighed and placed in dead storage.

Cleaning specimens by high pressure hosing in the field was an extremely efficient method, cutting down laboratory time by as much as half. Tedious hand sorting and writing numerous 3 x 5 cards for each excavation unit before further study by specialists remains as a great consumer of laboratory time. Hand sorting of excavated material continues to be one of the most time consuming and therefore costly procedures in archeology today.

Computer Applications

Computer systems were employed for three primary purposes in the Zebree analysis: 1) data storage and retrieval, 2) mathematical permutations and generalized statistical analyses, and 3) generation of site and artifact density maps. The first two procedures involved the transfer of field and laboratory analysis results into manageable data records, their interface with available computer storage and analysis systems, and their manipulation for the generation of tables, appendices, and statistical tests. Once laboratory analysis was completed by the relevant specialist(s) data sets were coded, keypunched, and stored, and tables and analyses prepared on demand. Computer files were created for most classes of data using a format amenable to manipulation by readily accessible programs, in particular Statistical Analysis System (Barr et al. 1976) and Statistical Package for the Social Sciences (Nie et al. 1975). The third primary use for the computer, the generation of site and artifact density maps, was accomplished by interfacing these data sets with a series of mapping programs available through the University of Arkansas Computing Center.

Data Coding and Storage

The route artifact data traveled going from initial observation in the ground to the computer involved a number of intermediate steps. In the lab, once the initial washing and sorting was completed, cataloging would begin, with each artifact or category of artifacts (usually separated by provenience) assigned a specific catalog number. The artifacts were then labeled with this number and a master catalog record kept consisting of the catalog number, the provenience, a brief description of the artifacts themselves, the recorder, and the date. To simplify the transfer of information for many categories of data, analysis results were incorporated into the brief descriptions entered into the master catalog. Thus count and/or weight was recorded for most items, and specific field recovery conditions were indicated (i.e., screen mesh size, whether the artifacts were from a special sample such as flotation, bucket, pollen, carbon, and so on). While this procedure could not hope to record all possible analytical desiderata, for many classes of artifacts it was possible to code final data sets directly from the catalog. In particular such categories as the weight of shell, fired clay, pottery squeezes, ceramics under 1/2 inch, or the count of a variety of lithic and ceramic artifacts were coded directly from the catalog, to give a few examples.

While inspection of some categories of site data essentially stopped once the cataloging procedure was completed, much of the assemblage was partioned among a number of specialists for further analysis. Many of the categories for which basic (e.g., count/weight) information had been recorded in the catalog later underwent considerably more detailed analysis. A second major effort, therefore, involved transforming the results of each specialist's analysis into a framework that could be coded, stored, and manipulated by the computer. In this process the demands of the specialist of necessity assumed priority over limitations of the data storage system. That is, analysis results were coded and stored so they could be used by members of the research team, and not merely for archival purposes. In many cases this required a fair degree of interaction among team members in the development of analysis record sheets, coding procedures, and planned and subsequent data manipulations.

Each specialist pursued his or her particular research interests, and the results were widely disparate. The handling of the data by the ethnobotanist was considerably different, for example, from that recorded by the ceramic or lithic specialists. In as many cases as possible these diverse analysis results were reported in a standardized format, however, to permit rapid transfer onto the computer. Analysis results were ordered by provenience, and for the most part on standardized record sheets. The ceramic analysis employed a standardized three page record sheet throughout (Million 1976:109-11), from which coding was relatively straightforward. In some cases keypunching proceeded straight from these analysis sheets, while in others the data values were first coded on standardized (FORTRAN) coding forms, and these used to guide the keypunch operator.

Because the overall project involved a number of widely scattered specialists and took place over a period of two years it was not possible to standardize either coding format or data storage completely. Data sets could not, quite simply, be transferred to the computer until the analyses generating them were completed. This occurred at varying times owing to the complexity of the project. Thus, while the random square ceramic analysis was essentially complete by September of 1975, the results of the zooarcheological and ethnobotanical analyses were not available until early summer of 1977. Even when data had been coded, alterations could and did occur--ceramic vessel count estimates were completely recalculated by Million in 1977, for example, some two years after the original analysis. This happened with other data sets as well, and reflected changes in analytical perspective that occurred during the lengthy interaction the investigators had with each other and with the data. All changes had to be accounted for among already existing computer data files, necessitating lengthy periods of card repunching and the erasing and reestablishing of affected tape and disk files.

Once a data set had been coded and keypunched, the cards were then checked against the coding sheets. If the intermediate step of coding had not been employed the cards were used to generate tables listing the contents of each data set, by provenience, for each item of information recorded. The format employed was identical to that used to generate the appendices, and, in fact, both sets of data were generated at the same time. These data-listing/appendices could then be compared against the original analysis sheets to check for coding or keypunch errors. This was done for each data set and demanded a great deal of time and patience. Errors detected during this step were corrected, and indeed during all subsequent phases of the analysis if any errors were discovered (in either the original analysis or previously undetected coding errors) they were corrected.

In all cases a card deck was prepared for each data set, and used as the primary record from which to place data on either computer tape or disk storage. One copy of each deck has been placed on file at the Survey stations in Fayetteville and Jonesboro, and additional copies are on tape. The latter (tape and disk) files are much easier to manipulate, since they obviate the step of feeding in data cards every time a separate analysis/manipulation run is desired. Specific data sets from the 1975 excavations existing on both card and tape, and duplicated in more interpretable form in the appendices, include the results of the ethnobotanical and zooarcheological analyses, analyzed contents of all random squares (including presence/absence data) and all features, and the analyzed contents of the bucket and flotation samples. The General Land Office witness tree data used in the environmental reconstruction was also coded and forms a separate record. These data sets were used, employing primarily SPSS and SAS procedures, to generate appendices, test hypotheses employing statistical/quantitative analyses, and generate density/distribution maps in conjunction with the GIPSY4 (Geographic Incremental Plotting System) and GIPTAB (GIPsy4 TABlet routine) procedures.

Data Manipulation and Computer Graphics

The production of tables and appendices, and the testing of hypotheses employing statistical methods, were conducted at both the University of Arkansas, Fayetteville campus, and at Arkansas State University in Jonesboro. Programs were entered through terminals located at both schools and connected to an IBM 370 at the University of Arkansas Computing Center. Much of the actual data manipulation was accomplished at Arkansas State University, employing the School of Business' Data Processing Lab's telephone-line linked terminal to Fayetteville.

Analyses and tables could be printed out on the Data Processing Lab's printer with a turn-around time as fast if not faster than in

Fayetteville. A card duplicator in the Arkansas State University Administration Building was used to prepare copies of all data sets, both for archival storage and for use by the project specialists.

While the computer facilities at Arkansas State were useful for most phases of the analysis, the computer graphics with the CalComp plotter had to be done in Fayetteville. It was possible to use the CalComp to plot various maps from Jonesboro, but the results had to be mailed, with a turn-around time of days instead of hours if one was working with the machine in Fayetteville. Additionally, if any errors--mechanical or otherwise--occurred, or if the finished product needed minor alterations (i.e., slightly altering density contour intervals to give a clearer interpretation), still more time would be lost. All computer graphics, therefore, were conducted at Fayetteville, with several trips of a few or more days necessary to transport data sets and personnel capable of interpreting and, if necessary, modifying output as it appeared.

The principal use of computer graphics was to illustrate the distribution of specific categories of artifacts over the site. Contour, or more accurately density maps for a wide range of artifacts were generated, using the random squares as the sampling frame. In such a procedure a contour-like map is generated, where intervals reflecting elevation are replaced by those representing the frequency or weight of an artifact category (Binford et al. 1970, Redman and Watson 1970). In all cases it should be remembered that the plotted contours are based only on the data from the sampling units, and represent an extrapolation, rather than a precise distributional statement. The accuracy of the extrapolation depends on the efficiency of the sample; that is, how well the sampled areas reflect the unsampled area around them (Asch 1974:182ff). The rationale for this use is that it provides at least an approximate vantage otherwise unavailable from which to view site contents, the assumption being that it is easier to perceive patterning on a visual surface than in a column or table of figures. However questionably derived, such patternings can then be checked against other forms of data and by other methods of analysis for validity.

Initial computer-graphics analysis of the 1975 Zebree data employed the STAMPEDE (Surface Techniques, Annotation, and Mapping Programs for Exploration, Development, and Engineering; Gussow et al. 1968) contouring program available in Fayetteville to produce density maps of specific categories of ceramics on both the printer and the CalComp plotter (Anderson 1976:40-43). This mapping program was somewhat unwieldy, and was abandoned in favor of the much more flexible GIPSY4/GIBTAB systems during the final analysis. While both programs produce essentially similar results, the latter is much more efficient time-wise, with the added advantage that the person who developed GIBTAB and debugged major portions of the GIPSY4 system (Scheitlin) was available to rectify routine errors arising through its application.

Artifact density maps appearing in this report and in the appendices were generated using the GIPSY4 program developed at the Pennsylvania and Arizona State Universities (Monmonier 1968, 1969) and adapted by Tom Scheitlin for use at the University of Arkansas, Fayetteville's IBM 370 computer. Comprehensive descriptions and documentation of this mapping program have been presented elsewhere (Schietlin 1977a, 1977b, 1977c). Basically, the contouring program interpolates nonorganized X and Y values into a regular grid, with the grid size internally discerned based on maximum and minimum X and Y coordinates. In the case of the random excavation sample (one unit in every 10 m-on-a-side block) this grid is composed of units almost exactly 10 m by 10 m, and would thus agree well with the sampling conditions. Once the grid is established, a Z value is calculated for each cell, based on (but *not* exactly representing) the input Z data values for that grid unit.

Each Z value (from which contours are drawn) may be thought of as a weighted average reflecting the values of the 10 nearest data points. Highest weights are assigned to closest data point values, while lowest weights correspond to the most distant values (Scheitlin 1977a). Because the Z values (and hence the contours) are based on a weighted average, the final map produced has extrapolated, rather than exact contours. The procedure is concerned with delimiting overall patterning within the data set, rather than small, localized fluctuations. What the program does, in effect, is to smooth the surface, to lower highs and heighten lows. A cell value will be higher than its nearest data point if the nine other data points are higher, and lower if they are lower. This does not by any means eliminate or even distort major distributional trends, but serves to emphasize them.

The GIPSY4 program guards against minor data fluctuations which make a surface difficult to interpret by providing a generalized or smoothed view of the data. The effect is similar to the use of a linear model in regression analysis to explain overall data relationships, rather than considering mild variations from the pattern on a case by case basis. To some extent the program serves to guard against abnormally high or low data values distorting general patterning (as might happen if a rich pit was incorporated into the midden levels upon which the density maps are based). The contour lines themselves are plotted based on the proportion of the difference in Z values to the distance between grid points. That is, the placement of the lines is based on a search of all Z values for the appropriate position, much as in hand drawn contours where intuition and estimation are substituted for calculated proportions.

A second program developed by Scheitlin (1977b), GIPTAB, was used to create a site base map on which to overlay GIPSY4 contouring results. GIPTAB is designed to operate in conjunction with the GIPSY4 mapping system. This program digitizes (determines X and Y values) any two dimensional representation within a coordinate system previously defined by the user. The procedure involves the use of an electronic tablet and pen, and is similar to tracing, the difference being that the recorded values are stored in the computer. Additional options provide for injection of labels and a variety of special symbols, and the entire package permits the quick and accurate generation of a base map which could be plotted much more quickly than drafted.

Artifact density maps generated using GIPSY4 and GIPTAB were initially produced on a CRT scope/terminal. This permitted the investigators to inspect a large number of maps quickly, and to copy each using an associated Xerox-type copier capable of reproducing images directly off the scope screen. This saved a great deal of time since contour values could be quickly adjusted, with the much more lengthy mechanical plotting reserved for publishable quality maps. Count and/or weight values for some 30 categories of artifacts were examined for both the plow zone and midden levels of the random squares, with approximately 150 separate maps created during the analysis. Finished maps for all categories in both depositional environments are to be found accompanying the text or in the appendix.

Ceramic Laboratory Techniques

All ceramics brought in to the lab were screened through a 1/2 inch mesh screen before any further processing was done. The primary reason for this categorical elimination of the smaller fragments was pragmatic. The information contained in ceramic fragments smaller than 1/2 inch, whether they were sherds or fragments of fired clay, was simply not great enough to warrant the considerable time that would be needed to sort these materials. The small sherds were assumed to be merely broken bits of the larger sherds. In fact, it is possible that such a screening may have created a slight quantitative bias against Barnes pottery because Barnes ware tends to break into smaller sherds than the Mississippian pottery does.

The weight of the "ceramics under 1/2 inch" was measured for each provenience unit and recorded in the catalog. All of these materials were checked over in order to retrieve any artifacts of value such as small coils, squeezes, and other by-products of pottery manufactured. This artifact class was then bagged and placed in storage.

To date, we have not tested the assumption that the sherds which passed through 1/2" screens are representative of the sherds which do not pass through 1/2" screening. The data are available for such a test. Intuitive spot checking of 1/4", 1/8" and 1/16" screened ceramics indicates that very minimal useful information can be obtained as long as abundant larger sherds are available for study.

The emphasis on information pertaining to whole vessel data in the sections of this report discussing the pottery places special importance on clearly explaining the means employed to obtain such data. One primary record of vessel type information was incorporated into the 3-page Zebree Ceramic Artifact Classification Form (Morse and Morse 1976:109-11). This form was created for use during the 1975 summer lab activities chiefly to record the counts and weights of sherds from the various pottery types by provenience over the site. However, it also called for an estimation of the number and kinds of vessels represented by the rim sherds of each ceramic ware. Such an estimation was at times quite difficult, even with a good rim sherd, in that it required a sharp eye to recognize critical subtleties in remnant contour lines. A recent (1977) re-evaluation of all rims found in random squares (our best statistical base) necessitated modification of the 1975 estimates by as much as 25% of any single category total. This adjustment is not at all discouraging; rather it is felt to be indicative of a progressive intuitive and empirical knowledge of the vessel forms extant at the site. There is now at least partial control of the relative proportions of the various vessel types present.

In addition, an artifact card file was begun during the 1975 investigations of descriptions of "reconstructable" pots usually based on large rim sherds from feature deposits. Remnant portions of individual vessels, often accounting for no more than 1/20th of the pot, were carefully measured and described. Standard attributes were recorded, such as paste characteristics, colorations, lip profile, surface treatment, and wall thickness. Also, an approximated cross-section of the whole vessel, drawn to a standardized scale for quick visual comparisons, was placed on the card's reverse.

Of the several large portions of vessels from Zebree that have been pieced together and described on artifact cards, most are from the Big Lake assemblage. Reconstructions have been facilitated by the symmetrical, fully globular and even contoured early Mississippian vessels. Less than a dozen Barnes vessels are represented by a significant portion of the original vessel and while four vessels represent the complete Lawhorn phase pots, at least half of these are burial furniture.

Since the general body contours of the Barnes and Big Lake pots are largely consistent, determining a vessel's original dimensions is not difficult if at least some of the body contour is present. The reconstructions presented in this report are considered fairly close approximations of the actual vessel sizes.

The first measurement taken is the orifice diameter. If a rim sherd contains enough of a consistent arc, a geometric construct which finds the radius of a circle given an arc of that circle is conveniently employed (Fig. 9-2). The center point can be located as follows:

> Draw any two nonparallel chords (A-B and C-D) and construct their perpendicular bisectors (E-G and F-H). The point of intersection is the center of the circle (O) . . . To bisect any given line (A-B and C-D) place the compass at the end point of the segment (A or C). Using a radius that is greater than 1/2 the length of the line, swing an arc that extends well above and below the given arc segment. Now repeat the process, using the other end point (B or D) with the same compass opening. The arcs should meet in two points. Using a straightedge, line up the points of intersection and construct a line (E-G and F-H) which perpendicularly intersects the given line (A-B and C-D). Two such perpendicular bisectors will intersect at the centerpoint of the circle (Norton 1963: 21, 35).

Once the orifice diameter is estimated, the height of the vessel is obtained by use of a full-scale metric grid on which the pot fragment was placed at the correct radius reading allowing the height to be fairly accurately determined against the vertical axis of the grid (Fig. 9-3). Although height is possibly the most difficult dimension to be accurately estimated, the relative morphological conformity of most of the vessel remains under analysis and increased familiarity with the ceramic materials allow one to feel confident enough in the dimensional data assembled to continue investigations along this line.

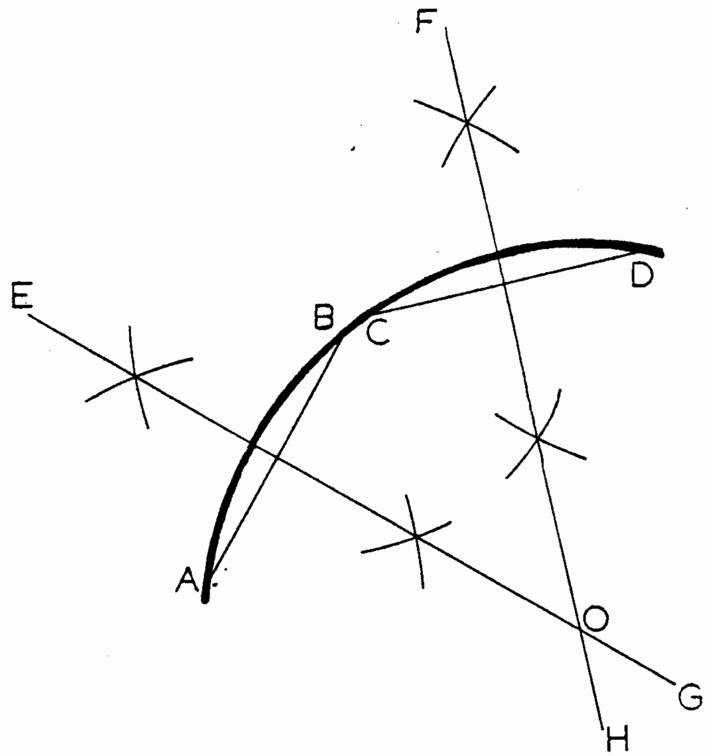

Figure 9-2. Method of determining orifice diameter from a rim sherd.

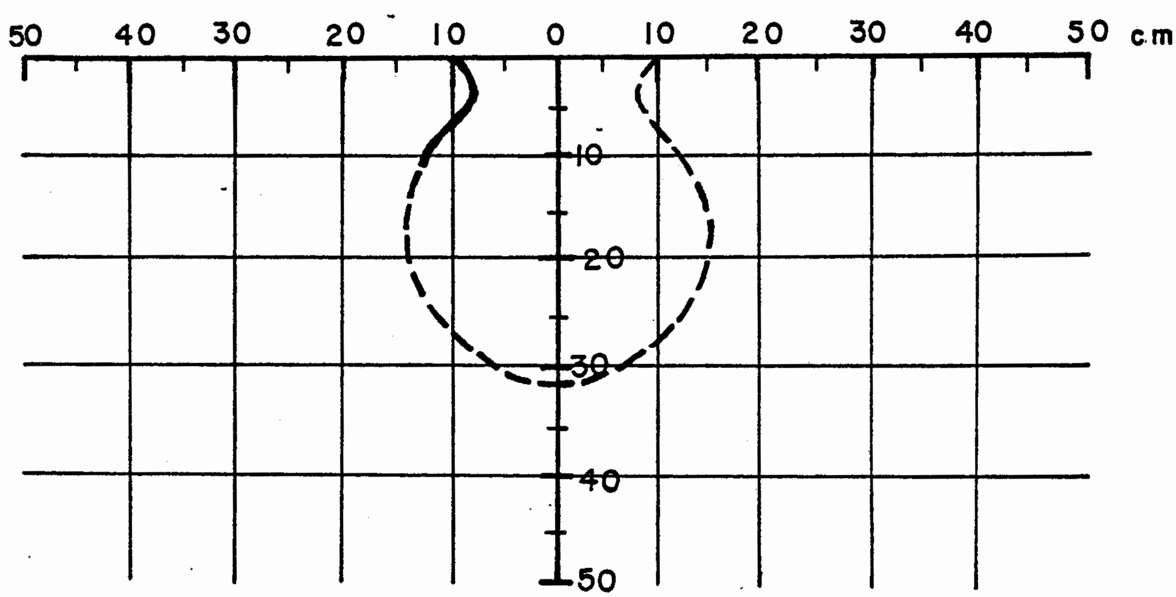

Figure 9-3. Method of determining vessel height by using a metric grid.

The volume capacities of vessels were calculated using a method in which the three-dimensional space of a container interior is divided into a series of right circular cylinders of equal altitude (Fig. 9-4). Reconstructed vessel profiles were first drawn to 1/5th scale on metric graph paper with the wall thicknesses being delineated as precisely as possible. Accurate portrayal of body wall thickness is important due to the sensitivity of this method. As can be seen in the illustration, to form a right-sided cylinder it is necessary to approximate both end portions of each interval or "layer" of the vessel. This approximation can be accomplished accurately on graph paper by placing the vertical end lines so that they *include* and *exclude* equal areas. Once each layer of the form is transcribed into right circular cylinders, the volume can be easily calculated (Vol. = altitude times the area of the base) and the sum of each interval produces the total volume for a given pot. Capacities for jars were figured to the "point of inflection" (Shepard 1971:226) while pans, for example, were "filled" to 1.5 cm below the top. This technique has the advantages of being accurate and easy.

Methodology for Analysis of Skeletons

Sex

Determination of sex was attempted only for post-adolescent (+18 years) individuals. Observations made of the bony pelvis, the long bones and the cranium were weighed in descending order according to their reliability as sexing criteria for skeletal populations (modified from Acsadi and Nemeskeri 1971). For the pelvis, the morphology of the pubic region was evaluated according to the visual method developed by Phenice (1967), consisting of observations of the ventral arc, the subpubic concavity and the dorsal aspect of the ischial-pubic ramus. Ninety five per cent accuracy is claimed for this method, the highest of any observational technique. The breadth of the sciatic notch and appearance of the pre-aricular sulcus are considered slightly less reliable, and were weighted accordingly. Maximum diameters of the heads of the humerus and femur were measured with a sliding caliper, following the procedure outlined in Bass (1971), and compared to standard distributions for Southeastern populations.

Morphological observations on the skull included frontal and parietal bossing, thickness of the supra-orbital margin, size and shape of the mastoid processes, robusticity of the nuchal and supra-orbital regions and shape of the chin (Krogman 1962; Bass 1971). The majority of crania were too fragmentary to warrant an attempt to distinguish male and female crania by metrical criteria.

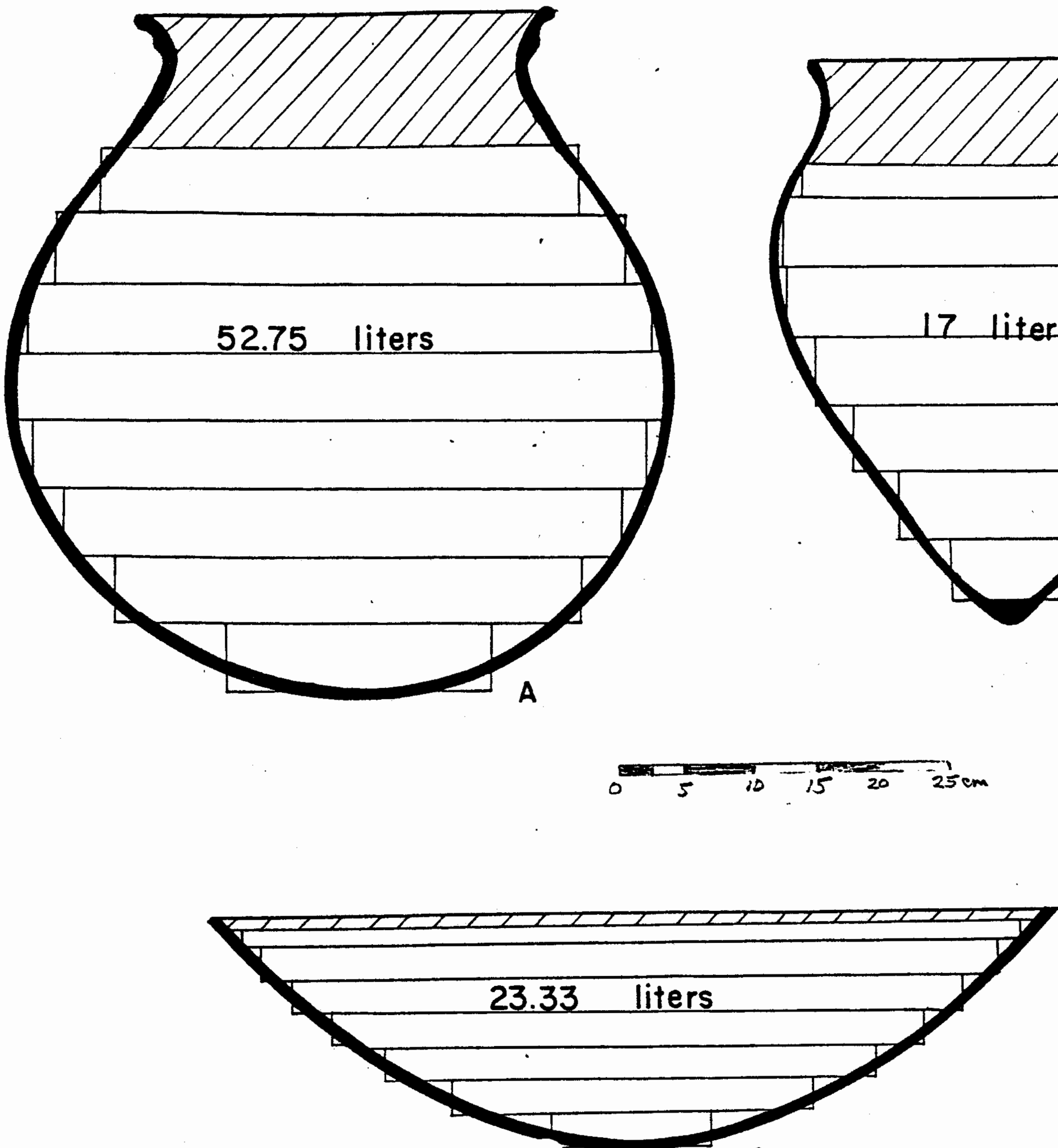

Figure 9-4. Method of calculating volume of vessels in liters with right sided cylinders.

In cases where the sex estimations based on long bones and/or cranial observations disagreed with the estimate based upon the pelvis, the latter estimation was accepted. No sex estimations were attempted for very fragmentary or incomplete individuals.

Age

Subadult individuals were aged by dental eruption and degree of epiphyseal closure (Schour and Massler, in Wheeler 1965; Krogman 1962; Bass 1971). Young adults (aged 18 to 30 years) were aged by the degree of development of the third molar, the closure of the basicranial suture and fusion of the sternal clavicular epiphysis. Ages for older adults (+30 years) were estimated from degenerative changes in the pubic symphysis (McKern and Stewart 1957; Todd 1930; Gilbert and McKern 1973) and sacroiliac aricular surface (Lovejoy, personal communication). This latter technique is particularly appropriate to archeological collections, in which the fragile pubic symphyses are usually vastly outnumbered by the more durable sacroiliac portion of the pelvis.

Degree of closure of endocranial sutures was observed whenever possible, but the ranges of inter-individual variation are so great as to greatly reduce the reliability of this criterion when used by itself (Krogman 1962). The same is true for dental attrition, which additionally displays wide inter-populational variation. Both sets of observations were recorded and correlated in the present skeletal samples with age estimates based upon the more reliable pubic changes.

Biogenetic Indicators

The list of discrete cranial traits observed in this study appears in the appendix, with instructions for scoring partial expressions of each trait (Buikstra 1975: Appendix J). Traits which could not be observed in three or more individuals were omitted from consideration in intra and inter-sample comparisons. The various levels of expression were lumped for appropriate traits in the final tabulation. Had this procedure not been followed for maximizing discrete-trait information from a very small and poorly preserved sample, the resultant tabulated scores, in many cases, would not have been meaningful.

Skeletal and Dental Indicators of Differential Nutrition

Long Bone Measurements: Measurements were taken (when possible) from the left humerus, femur, and tibia of each adult individual, according to the osteometric procedures described in Bass (1971). The right bone was substituted when necessary.

Enamel Hypoplasia: Each available dentition was examined with a hand magnifying lens for evidence of enamel hypoplasia. The age of the individual at the time each lesion occurred was calculated according to the procedure outlined in Massler, Schour, and Poncher (1941). Lesions from the same time period visible on several different teeth were counted as a part of a single 'hypoplastic episode', as tabulation of each lesion separately would result in overenumeration of actual episodes of systemic stress. This method of scoring also minimizes data loss due to missing teeth. The object of correlating specific lesions with specific ages was to construct graphic representations of the ages of highest prevalence of this lesion with specific ages within the three populations at Zebree.

Periosteal Infections: The left tibia of each individual was examined for evidence of periosteal infection. The right tibia was substituted when necessary. Infectious involvement was scored according to the nine-stage system developed by Kipling Owen (Lallo 1973: 207-308). The incidences of each stage of severity were calculated for each sample, and correlated with the ages and sexes of the afflicted individuals.

Trace Element Analysis

Following the procedure established by Gilbert (1975), a 5-gram sample of bone was removed from the medial portion of the anterior tibial crest of each adult in the series. Gilbert defended his choice of this bone over the traditional site of sampling, the rib, on two points: 1) that it is more durable and less subject to destruction, leaching, or contamination in archeological contexts, and 2) its rate of turnover in cellular replacement is very low compared with other bones of the body, and therefore it is more representative of the "average" diet of the individual over his lifetime.

Each sample was analyzed by James Duncan by the atomic absorption method for its concentration of four trace elements: iron, strontium, copper, and zinc. This analysis was performed by the Arkansas

State Soil Conservation Laboratory, Under the supervision of Dr. H. L. Hileman, Associate Professor of Agronomy at the University of Arkansas at Fayetteville.

CHAPTER 10

STRATIGRAPHY AND SERIATION

Dan F. Morse

There are a number of dating or chronometric techniques available to the archeologist (Hammond 1974). Two of these chronometric techniques, radiocarbon and archeomagnetic, will be discussed in the following chapters. A third, dendrochronology, would have been useful to the Zebree Archeological Project from the standpoint of climate and the effect of the New Madrid Earthquake on the bald Cypress of Big Lake (Chapter 6), but was not accomplished due to time and money limitations. However, despite the availability of exotic techniques, the most used methods of dating a site and its components are by stratigraphy and seriation. There are two major reasons for this. One is the expense involved in having samples processed by capable individuals and laboratories. The second is that appropriate samples needed for dating cannot always be recovered. At the Zebree site there was no money available for radiocarbon dating until 1975. The potential data available for archeomagnetic dating are sparse and possibly modified by earthquake activity. At Zebree research has depended mainly upon the principles of seriation and stratigraphy, techniques which provide relative dates for occupation.

Stratigraphy

The basic concepts of stratigraphy date to the second half of the 18th century and are supposed to have been used first archeologically by Thomas Jefferson (Rowe 1961). The sequence of soil deposition at a site dates arifacts and assemblages relative to each other. While employed to a considerable extent by North American archeologists, a surprising number of open air site investigations in the eastern United States have not been exploited to their full potential in this respect. Two major stratigraphic principles are superposition and intrusion.

Superposition

All things being equal, strata are deposited upon each other sequentially. A stratum is an observable soil lens, usually oriented roughly horizontally, which may have other strata superimposed upon and/or submerged beneath. Deeper strata, then, are older than shallower strata if there are no significant factors affecting these relationships. Such factors indeed exist and can cause difficulty. Mixture of deposits occurs commonly and dirt is often removed from nonrandomly placed excavations and deposited over the latest stratum, resulting in a sort of reversed or false (from the archeologist's viewpoint) stratigraphy. This is easily recognized, however, in most instances by careful field observation and clean excavation techniques, especially if a large excavation is conducted. If the samples are collected systematically there is a greater chance for field misidentification being recognized and corrected during labortory processing.

A stratum, or an observable soil lens implies that some physical attribute such as color, texture, or a combination of several attributes, allows the soil lens to be sufficiently distinctive to be recognized during the field operations. Sometimes quantification can be done in the laboratory but suspicion of this possibility must exist in the field or appropriate sampling cannot be done. Color has proved not to be significant in normal open site investigation in many situations. Moisture content, for instance, is one common factor which affects color. Texture can be modified by weathering and by ground water seeps depositing iron precipitate, but these factors can be recognized easily by a trained observer and in some cases one or both of the factors can be useful to the investigation.

Soil texture is the most useful differentiating attribute to look for in investigating the possibility of natural strata deposits at any given site. It is easy to identify and almost always results in significant interpretations concerning the history of the site. All the equipment that is needed is a clean set of finger tips and a sense of touch. The fingers are simply gently scraped vertically on the surface of a wall in an excavation unit, being kept clean by brushing the finger tips on one's jeans. Disconformities tend to bulge slightly due probably to this surface allowing ground water to seep and the texture above will differ from that below. It is best to accomplish the operation with one's eyes closed and absolutely necessary to have someone who you can trust to check your results independently. Color can be useful as a lead since different textures will hold different amounts of moisture, but color can fool the observer since water tends to be distributed vertically. Color and texture can indicate different sources for the soil lens and, in fact, constitute almost the only way lenses of soils can be usefully recognized.

If the different suspected soil lenses originate from the same basic source, then they cannot be readily differentiated in the field unless the disconformities are marked by weathered soil zones or a layer of artifacts indicative of an activity floor of some sort. Artifacts in such a layer must be oriented on a plane--lying flat--and not displaced vertically if significant credibility is to be generated by this interpretation. Often, a deep deposition is approached from the assumption that a sequential history of soil layering is present, but inexperience of the excavator, or soils originating from the same source with no disconformities observable may not allow recognition of natural strata. This is why artificial or measured (metric) cuts are excavated in such cases, with the anticipation that a single observed stratum was built up by soil aggregation and that sampling by artificial levels will result in collecting artifacts indicative of significant cultural changes through time. Internal consistency is the major check against this anticipation, and it is imperative that separate units be analyzed separately.

There are published reports which combine levels across a site, even mixing natural with measured units. In one instance in the Midwest, mound fill from several burial mounds, which could not possibly be contemporaneous with each other, was combined with all plow zones and the first two measured levels beneath each of the excavated mound. The basis for this decision, to combine these levels, is not stated in the report and there is no way to judge whether this was a good idea or not. In some instances, of course, mixture or uniformity of artifact content allows for combining excavation units and more economical discussions. The "Chicago" school of field techniques virtually dictated five-foot square pits and usually 6-inch measured levels. The basic underlying assumption, never explicitly stated, was that in deeper deposits any disturbance of the deposit was uniform through time so that artifacts indicative of cultural (actually stylistical) change through time were essentially where they were deposited. Confusion in the Illinois Valley about whether Hopewell was a sudden and short-lived intrusion of an elite of some sort or an <u>in situ</u> evolutionary phenomenon was primarily due to the lack of good stratigraphic control or lack of awareness of the basic untested assumptions.

In the northern Mississippi Alluvial Valley, the primary problem for a long time has been the relationship of late Woodland with initial Mississippian. Nearly 40 years ago, Phillips, Ford, and Griffin regarded as their major problem the question of whether there was cultural discontinuity or continuity between Baytown and Mississippian. They clearly stated their recovery techniques (1951:241-2) and presented an honest and straightforward discussion of their use of the principles of stratigraphy, a feat not duplicated in other major eastern United States archeological investigations at the time. They made a total of 17 stratigraphic tests at nine sites.

Phillips, Ford, and Griffin used general cultural terms (Tchula, Baytown, and Mississippian) and period designates as letters (A-G). They were hampered with an Old Village-Trappist dichotomy at the Cahokia site which masked initial Mississippi there. Their recognition of the limitations of their methodology and their ability to stay within those interpretational limitations allows a clear view of their work. The stratigraphic tests were all accomplished with measured levels. This tends to mask evidence of reoccupation even where there are drastic differences in the two or more components at a single site. They deliberately did not collect feature fills as separate samples and then stated that this was not a good practice to follow, a refreshing bit of self-criticism. Phillips, Ford, and Griffin concluded that the evidence indicated cultural continuity but warned that a discontinuity might have been hidden by the use of measured levels.

Other studies have tended to support the results of the Phillips, Ford and Griffin's findings. Two sites in southeast Missouri, Kersey and Hoecake, with material culture similar to the Big Lake phase are examples. Interpretations of the components present at Kersey state that the earliest is the Kersey Phase, which included in addition to the usual Baytown ceramic artifacts found in the related Black Bayou phase, Mississippian traits such as "the Kersey Clay Object,... straight lines of post molds, a pink quartzite discoidal, clay disks..." (Marshall 1965:76). The second component, the Hayti phase, apparently includes all the early shell-tempered ceramics. except for Wickliffe Cord Marked which Marshall (1965:63) suggests could be a Baytown form. There are two interpretations of the data in the report. First is the interpretation that "The clay tempered types were gradually replaced by the shell-tempered wares" Marshall (1965:63). Second is the interpretation that all of the shell-tempered ceramics (excepting Wickliffe) are Mississippian ceramics (1965:99). The eight 6-inch levels indicate that shell-tempered sherds tend to concentrate in levels 3 and 4 while grog-tempered sherds tend to concentrate in levels 4 and 5. Phase identification of artifacts, however, appears to be based on intuition rather than vertical placement within the site deposits. This is true of the ceramics certainly, although not of the other Mississippian traits mentioned in the above quote as characteristic of the "Kersey" phase. At conflict is the traditital Midwest view that Mississippian and Woodland are separate entities <u>versus</u> the realization that Mississippian had to develop from Woodland somewhere or perhaps even everywhere. The artifact inventory presented by levels combined from 11½ 5-foot squares and a 40-foot long trench located 400 feet north of the squares, do indicate a transitional period representative of an evolutionary change from Woodland into Mississippian. However, I maintain that the method of recovery, combining measured levels in mixed deposits, has forced this interpretation of the Kersey data.

The "Hoecake Phase" is based on data obtained from the type site, Hoecake (R. Williams 1974:55). Tables tabulate the contents of specific features and levels, which are combined from excavation units within specific areas of the site. The statement is made that "there is no stratigraphy in any of the areas", and unfortunately the fill of house depressions was combined with artifacts lying upon the floors of these depressions. "During the span of the Hoecake Phase, Mulberry Creek Cord-Marked reached its peak, then declined in popularity and was replaced mainly by Baytown Plain and Neeley's Ferry Plain" (R.Williams 1974:84). The ceramics collected are overwhemingly grog-tempered, ranging between 65 and 95%. A minor portion of the ceramics is identified as a combination of grog and shell tempering.

R. Williams' description of the Hoecake phase is quite different from its conception by Phillips (1970:902-903), who, with S. Williams' agreement, readjusted its position from early Baytown (S. Williams 1954) to late Baytown. Phillips sees Hoecake as a purely grog-tempered complex and makes no mention of shell-tempered pottery. Many of the shell-tempered ceramics, the house and pit features and other artifacts are virtually identical to elements of the Big Lake phase. The grog-tempered ceramics and Woodland point styles may represent an earlier phase. The shell-tempered ceramics and initial Mississippian features at Hoecake may represent a phase slightly later than Baytown. On the other hand, there may be a transitional phase between Baytown and Mississippian at the Hoecake site. Unfortunately the analyses and descriptions of data are not sufficiently complete enough to resolve this impasse and we simply do not know at this time what "Hoecake Phase" means.

Observations at the Zebree site involved looking at superposition by measured levels and by natural levels. Measured levels were excavated over much of the site because the "midden" is due in large part to disturbance, mainly the digging of storage pits during the Big Lake phase occupation. This churning thoroughly mixed the soil so that only with difficulty could features be discerned until a depth was reached where the light colored subsoil contrasted sharply with intrusions. Measured levels are convenient to keep the excavation clean, to plot individual artifacts of note and clusters of artifacts, and to check for feature outlines. If we had not had natural stratigraphy to use as a guide, we might have concluded that there was a gradual change from Woodland into Mississippian at the site. However, in Area B, the initial Mississippian inhabitants, the Big Lake phase, covered a portion of the Barnes midden with a distinctive soil which included very little debris, and efficiently capped the Barnes deposit (Fig. 10-1). There is absolutely no doubt, based on this stratigraphic relationship, that Barnes preceded the Big Lake phase at the Zebree site and furthermore that these were two temporally and mutually exclusive complexes at this site. Over and over again, across the entire site, it was noted that Barnes features were "clean"; that is, only Barnes sherds were included. The occasional small shell-tempered sherd could easily be related to disturbance from superimposed deposits where shell-tempered ceramics occurred in large numbers. In addition, the superimposed deposits contained a mixture of sand and shell-tempered ceramics.

Activity floors were also noted. One was an apparent Big Lake phase microlith manufacturing area with debris lying on the surface of a natural soil zone (Fig. 10-1). Another was a Lawhorn phase house floor marked by artifacts on a single plane (Fig. 25-2).

A clay strata is superimposed over the whole site, even capping our 1969 excavations units. Around 1974-75, the site was first observed to be completely flooded. We attempted to observe the evidence of superposition wherever possible during all phases of excavations at the Zebree site, but this constitutes the only indication of flooding during any of the periods of human occupation.

Intrusion

A disturbance which penetrates a soil lens or other disturbance is later than the deposit into which it intrudes. The most commonly recognized disturbance at archeological sites is the cultivation zone. However, this zone can be quite complex (Medford 1972). In the northern alluvial valley, a typical cultivation zone varies from 30 to 60 cm thick, and heavy equipment such as combines can sink as deep as 75 cm in a wet field (Medford 1972:65). The effects of spring plowing followed by discing during periods of high velocity winds can fool the excavator, since sandy zones from which much of the silt has been removed by wind will be present in the uppermost portion of the cultivation zone. The base of a cultivation zone is often marked by an organic lens and occasional stalk fragments and modern seeds, and is not a flat plane but undulates due to spaced penetrating plow points.

Other modern disturbances at a site are common, particularly the "pot hole" usually dug by a commercial "pot hunter" for relics to sell. The use of a steel probe may introduce modern pollen into older deposits; once, we discovered a deeply buried 22-shell which had been pushed downward by such a probe. A typical pot hole is irregularly circular to oval in outline and bell-shaped since the pot hunter often digs beneath the spoil pile. Tunnels may run in any direction as attempts are made to secure objects struck by the probe which is used as a check before the hole is abandoned. Occasionally a dog skeleton will be found buried in the fill due to the dog protesting territorial intrusion by the pothunter. When the pot hole has to be filled in by the owner, trash or rarely a dead pig will be included to take advantage of the abandoned hole which can break a tractor axle.

Dogs dig holes, particularly beneath a house. Oxen-pulled logs will gouge out a trench. Animals dig burrows and dens under the ground. Trees penetrate the ground and fall over with the root mass holding sufficient soil to create a relatively large hole adjacent to a mound. One area hit by a tornado was thought to be a civil war site by the

Figure 10-1. Stratigraphy at the Zebree site. The dark basal zone is Woodland (Barnes) midden. The superimposed ligher zone was deposited during the Big Lake phase. Its surface was a natural floor and contained elements of the Zebree microlith industry. Superimposed over this surface is a third zone also intentionally deposited by the Big Lake phase people. Intrusions from one zone to another are apparent. Some of the uppermost intrusions date to the Sebree occupation of between 1895 and 1940. (Neg No. 692779)

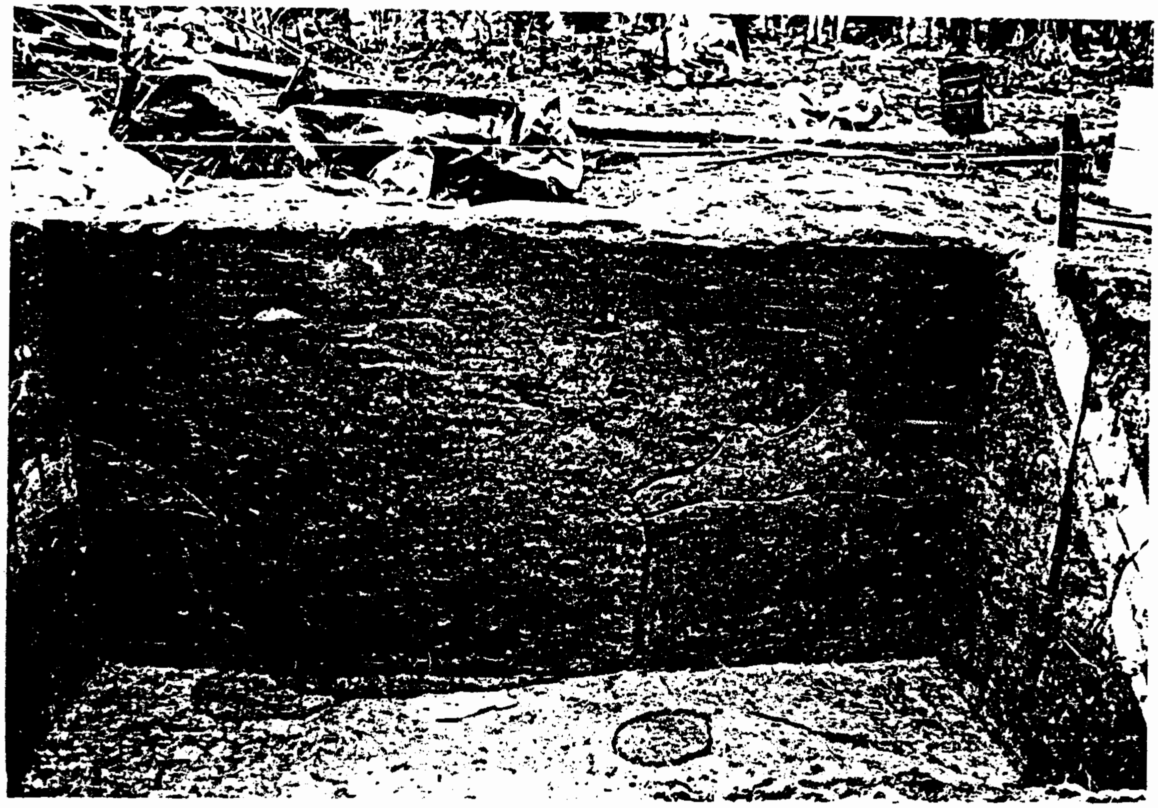

Figure 10-2. An example of intrusion at the Zebree site. A storage pit originates in the uppermost stratum and intrudes completely through a lower Big Lake phase stratum and a basal Barnes stratum. The pit also intrudes into a smaller intrusions, originating in the same soil lens and in turn is intruded by an apparent animal burrow.

landowner based on the large number of "foxholes". Trees also can hold a portion of the midden intact temporarily while erosion or land leveling removes the remainer, then releases that midden into confusing patterns. Insects also dig into the soil seasonally; the cicada is the most usually recognized intrusion of this sort in the northern alluvial valley.

Even the simple act of digging fence post holes and using the surrounding surface rocks as post wedges can introduce large artifacts into deeper deposits with a minimum of disturbance. Increasingly the use of heavy machinery can create confusion. Land leveling can create false sites by depositing midden from one site into several low areas. Deep plowing of the slopes of mounds accelerates the possibility of reversed superimposition through erosion.

Probably the second-most recognized intrusion at an archeological site is the pit feature. The importance of a pit feature to the archeologist is that it may represent a deposit of contemporaneous artifacts. It also allows more complex interpretations of the site itself. The common pit features are ditch, borrow, oven, storage, burial, and post hole-post trench. Pits probably were not dug simply to contain refuse, so the use of "refuse pit" in the literature usually refers to a pit feature which the author cannot interpret functionally. A small test excavation can be completely included within a pit feature and the excavator be unaware of this circumstance since he has nothing to compare stratigraphically.

A pit feature may intrude into and through strata (Fig. 10-2). Its contents must be kept separate since it represents a discrete event separated in time from other events. These contents often are interpreted as contemporaneous. However, since soil is mixed with contemporaneous debris to be discarded, earlier artifacts almost certainly will be included in this soil at a multicomponent site. Many of these artifacts will not be significantly earlier since they are lying about on the surface and therefore apt to be included in the fill. But if one storage pit is filled while another is being excavated, logically the spoil from one will be deposited into the hole ready to be abandoned and the probability for earlier artifacts in that pit increases. A pit feature being filled with significant amounts of primary deposit will contain larger sherds than normal and have a tendency to include complete fragile discarded artifacts such as shell hoes and bone awls. If the deposit is a secondary deposit, the reverse is apt to be true. In addition, the less time involved in the redeposition of secondary deposited material, the less complete the breakdown of elements of that deposit. Since the probability is that any extensive Mississippian activity at a site with Woodland deposits will certainly intrude elements of that Woodland deposit, pit features at mixed sites will include both Mississippian and Woodland sherds. In fact, if two separate temporal components are involved, there could be by count even more Woodland than Mississippian since the former have had more time to break, besides possibly being deposited at least twice.

If the respective pastes of the two traditions are well understood, and if both weight and count of sherds are recorded, there is a way to compute the average sherd size and compare this with the means for apparent primary deposits. This was done for the Zebree data in Chapter 8 and the clear indication is that in all instances of mixture the Barnes sherds form part of a secondary deposit and probably have been removed from their original primary context. The technique appears to be fruitful and should be tested at other sites and in other situations.

One basic rule in stratigraphic studies is always to cross check whenever possible. Other aspects of the basic principles of intrusion were observed at Zebree in relation to the two pottery traditions. Big Lake phase features at Zebree all included Barnes sherds, but were all in areas of concentrated Barnes debris. The numbers of Barnes sherds were directly relatable to the concentration of Barnes debris in that area. In every instance where observation was possible Big Lake features intruded into Barnes features.

The largest feature, a borrow pit, included only Barnes ceramics within its fill (Fig. 10-3). An interior Feature (127) also only included Barnes ceramics within its fill. Both of these features probably are Big Lake and represent initial Mississippi activity at the site before much Mississippi debris could accumulate (Chapter 21).

The Lawhorn phase component in turn intrudes into both the Big Lake and Barnes deposits. This later component is concentrated in space and occupies probably the richest Big Lake phase portion of the Zebree site. The Lawhorn features tended to be least disturbed. A Lawhorn burial, Feature 135, in turn was intruded into by Feature 395, which dates to the early nineteenth century (Fig. 26-1, Chapter 26). In Area B, the Sebree deposit probably dating around 1895-1940 intruded Big Lake phase deposits (Fig. 10-1). An earthquake episode (we assume only one) occurred at the Zebree site and sand-filled cracks clearly postdate all prehistoric deposits and are only interrupted by recent cultivation of the site (Fig. 8-1). The New Madrid Earthquake took place during 1811-1812, and presumably these cracks which were caused by the slumping of land toward the lower elevated clearance to the east occurred during that time period.

It is apparent that the Big Lake phase occupation occurred over a fairly long time period. Not only do storage pits intrude into each other but they intrude into or are intruded into by post hole patterns (Fig. 10-4) and even burials (Fig. 21-2). This latter situation, the

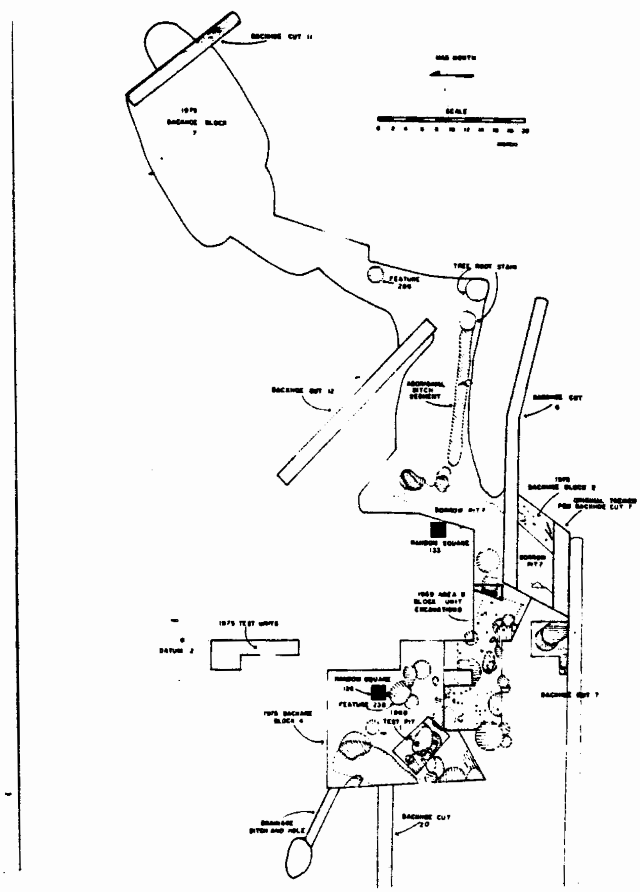

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Figure 10-3. Excavations in Area B, Zebree site.

Figure 10-4. Excavation units at Zebree demonstrating the principle of intrusion.

locus of Burial 3, indicates the occurrence of three different functions for a single village locus through time by the same component. The burial may represent an enlargement of the postdated cemetery area to the west over what was earlier a residential portion of the village. The structure in turn may have shifted slightly when reconstructed so that it intruded into an earlier storage area.

For the purpose of this report, "midden" has been defined as the "subplowzone artifact-bearing deposits not discernably disturbed by either features or other disturbances" (Chapter 8). Archeologists often assume that a "midden" implies aggradation of soil and refuse (Hole and Heizer 1973:121). The word itself originates from the Scandanavian word (<u>midding</u>, <u>modding</u>, <u>mogdynge</u>) for dunghill (Websters' Unabridged Dictionary, 2nd edition). According to Webster, it means "an accumulation of refuse about a dwelling place". The term as used in archeology apparently originates from the Danish "Kitchen middens," officially interpreted by Worsaae and Steenstrup in 1851 (Daniel 1950: 87-88). "Midden" does not mean necessarily a significant increase in elevation as layers of soils are added by natural or artificial means. Midden is a combination of debris accumulation and changes in the soils due to human activity. These changes and how the debris is incorporated into the soils constitute part of the investigation of an archeological site. As pointed out in Chapter 8, subsequent or post depositional modification of the deposits are as important to an archeological investigation as the discovery of the artifacts themselves.

Each site is different to a certain extent. At Zebree the only clear incidence of soil aggradation was in Area B where the corner of the site was built up by its inhabitants by carrying soil from other areas of the site and dumping it there. There is no evidence of flooding; indeed the storage pits and ditches indicate that the water table was lower than today during the rainy season. Soils undoubtedly collected in some places and even possibly were removed from others. The large number of test excavations allowed us to see the variations in elevation of subsoil across the site (Fig. 10-5) and to examine the upper levels outside the site boundary. Our conclusions, after much debate, generally agree. Soil addition is not significant at the site as a whole; 20-40 cm is an absolute maximum at any one locus except for Area B. The usual 60-100 cm deep "midden" is mostly due to mixture and the overturning of soil from the digging of large numbers of pit features (Fig. 10-6). The present surface of the ground is approximately the relic surface. A 20 cm deep upper soil with rootlet concentrations exists outside the site boundary (Fig. 10-7) and looks like " midden" except for the fact that no artifacts are incorporated within its dark, loamy matrix.

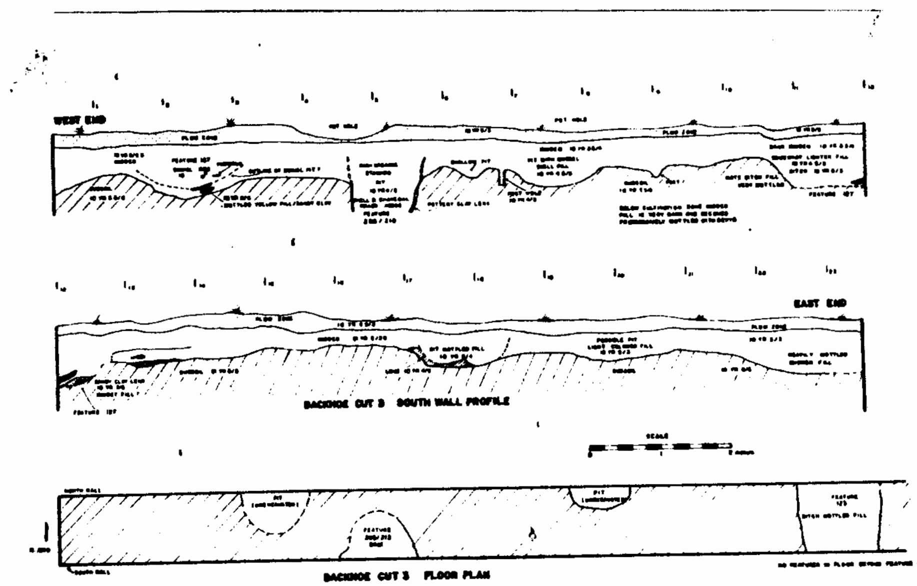

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Figure 10-5. Typical profile, showing extent of distrubance into subsoil.

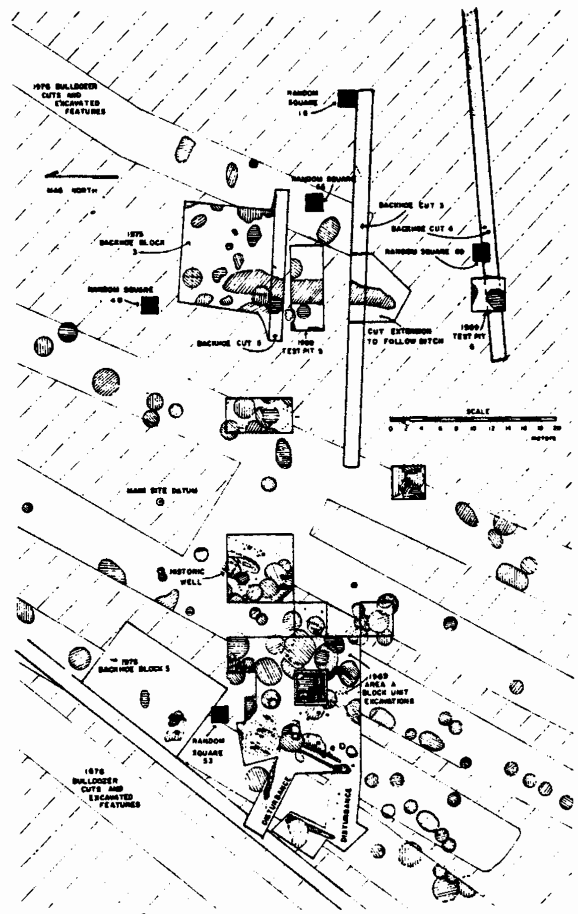

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Figure 10-6. Area A, showing great number of pits in concentrated occupation area.

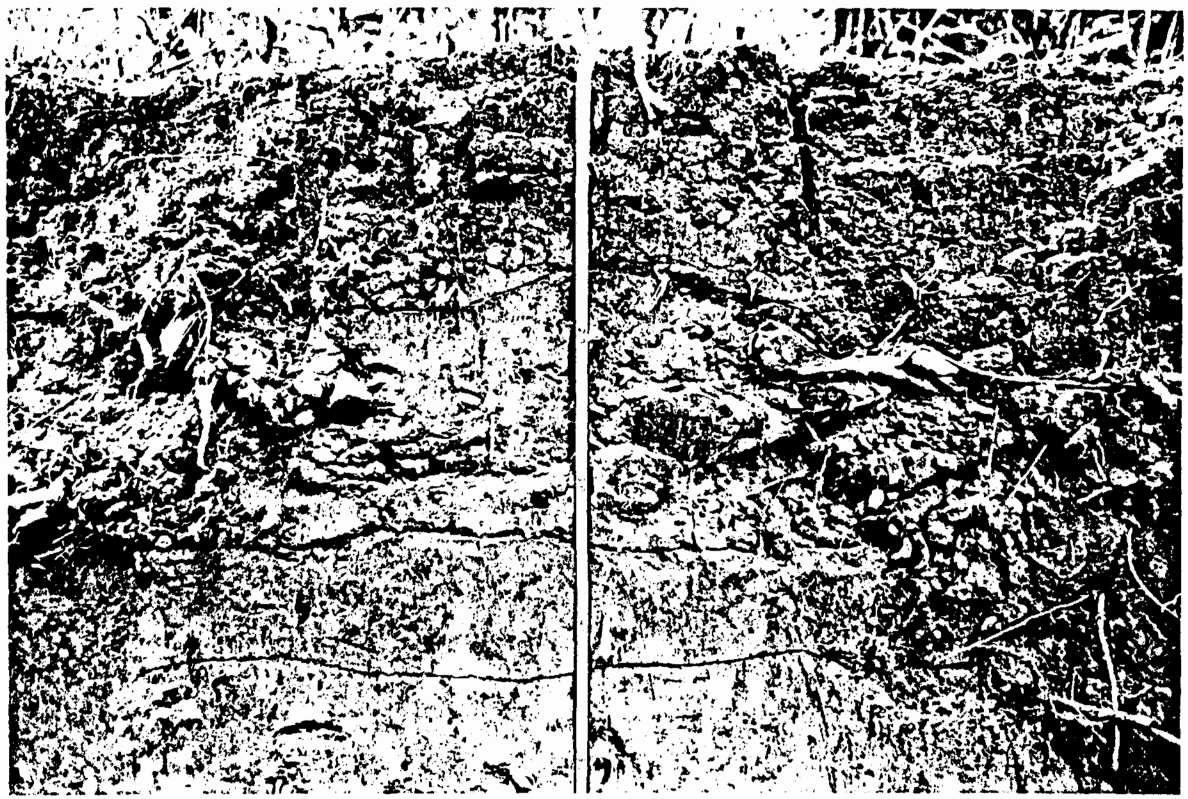


Figure 10-7. Soil profile outside the occupation area of the site. (Neg. no. 752760)

Seriation

The concept of seriation, developed by Sir Flinders Petrie, was elevated to a high level of sophistication in the alluvial valley by James Ford. Observable physical attributes on artifacts change through time and combinations of attribute changes allow even more sensitive temporal interpretations. Ceramics in particular are important in this respect because breakage allows large samples, and they are sensitive to technological and stylistic innovation in relatively short time periods. The two basic kinds of attribute change which can often be traced are technological and stylistic.

Technological Changes

Changes through time can be evolutionary or become more complex in the sense of greater efficiency. Agriculture as inferred by the presence of polished stone hoes and other artifact changes is usually considered an evolutionary change over hunting, gathering, and fishing due to the increased "amount of food obtained per unit of human energy expended" (White 1959:285). It is associated with larger populations and more complex socio-political systems. It is both evolutionary and more complex. There is a technological advantage of agriculture over nonagriculture which goes further than just a hoe and a seed (Chapter 3) and many artifactual changes are associated with the shift.

In the northern alluvial valley, many major technological innovations are associated with the inception of Mississippian in most archeological collections. Arrow points reflect the change from an atlatl or spear-thrower to the bow and arrow, a qualitative shift in weaponry. The appearance and wide spread trade in large stone hoes and spades indicative of intensive agriculture is not comparable to trade in pre-Mississippian society. Ceramics undergo such significant technological changes that there is little similarity between the two traditions. A transitional period probably exists but we question that it is the slow gradual shift envisioned by many investigators. Woodland paste is inferior to Mississippian paste (Chapter 15, 19). The difference is technological not simply stylistical. The underlying assumptions of the pace of change differ for these two kinds of changes. Shell-tempering is very rare in Hopewell (Morse 1963:50); presumbably its technology was not fully understood then.

An example of a possible transitional assemblage is the one described at Hoecake (R. Williams 1974). The title of R. Williams report is "the Baytown Phases in the Cairo Lowland of Southeast Missouri", and R. Williams considers the Hoecake phase to be a late Baytown phase which anticipates several typical Mississippian traits (1974:85). However, he also considers Hoecake to be representative of the "beginning of the Formative stage of development in the Cairo Lowland" (R. Williams 1974:85). Although, his concept of "Early Mississippian Period" (1974:87) also includes wall trench house patterns, temple mounds, strap handles on vessels, and ceramic types actually found in the middle and late periods of Mississippian, we do have a possible transitional assemblage at Hoecake.

The predominence of Baytown ceramics may be from an earlier component or some sort of a strange holdover despite the stronger, lighter and more efficient Mississippian forms already in existence. The former choice seems more logical. The presence of both grog and shell in the pastes of a minor percentage of the sherds is puzzling. This is a superior paste to pure shell tempering and in the rest of the alluvial valley does not appear until the middle period and is most characteristic of the Nodena phase (Bell paste). The grog inclusions may be accidental, there may be a later Mississippian component at the site, or grog is added to some pastes by more traditional potters during the transition to Mississippian. These are all possibilities but the first two choices are the most logical based on what we now know about pottery pastes in the alluvial valley.

A good example of the confusion of technological changes with stylistical changes is the interpretation of the assemblages at the Pinson Mounds and at Obion as "early" Mississippian (Kneberg 1952:195; Faulkner 1971:5). The ceramic transition is interpreted as grog-tempered pastes gradually giving way to shell-tempered pastes. However, grog and shell pastes are contemporaneous at both sites throughout their occupation which is post AD 1000 and probably later (Morse and Polhemus 1963; Crane and Griffin 1970:174). The technological aspect of change versus no change cannot be answered until clays are tested near these two sites. The highlands of western Tennessee probably do not contain the large expanses of backswamp clays which the inhabitants of the northern alluvial valley are restricted to using. Grog is a better temper if finely crushed and used in a superior clay, a clay which does not need to be modified by calcium carbonate (Chapter 15).

Mississippian jars are globular; they need not be constructed with conical bases which probably are due to forming the Barnes jar at an angle because of the danger of the heavy paste causing the vessel to collapse. A globular jar is stronger intrinsically. It also is a more efficient heating mechanism and easier to support over a hearth. The paste is lighter and there is greater latitude in the possible shapes into which vessels can be constructed. The only logical reason for resisting change would be if the clays used would allow these advantages whether the paste changed or not. Replication using local clays is necessary in western Tennessee.

As the discipline of archeology continues to objectively investigate past human behavior, no doubt more changes thought to be stylistical will turn out to be technological. It is important to keep the two principles separate.

Stylistical

Changes in the styles of coke bottles and dress are easy to understand. The changes in ceramic styles often get confusing, probably because we do not understand all of the ramifications involved. In addition we are so used to a concept of single directional change that free variation and cyclical change are difficult concepts to incorporate in our thinking.

Woodland is defined basically in reference to the grog (or clay) tempering of vessels. However, two concentrations of sand tempering are present within or near the alluvial valley. One called Miller is actually located in northeastern Mississippi and is referable to the Northern Alabama tradition of sand tempering. Apparent vestiges of this are seen in the Twin Lakes Phase (Phillips 1970:891). The second is located in a restricted portion of southeast Missouri and northeast Arkansas and has been called Barnes to reference the tradition. Dunklin (Williams 1954; Phillips 1970:903) is a specific phase designation in the Baytown period. Barnes ceramics (renamed Kennett by Phillips) are characteristic of a complex or tradition. We infer that the geographic tightness of Barnes ceramics implies historic relatedness. Sand-tempering is viewed for now as a stylistic alternative to grog-tempering.

A basic question is how late the Barnes occupation is at the Zebree site. If the Barnes complex at Zebree is relatively early, then the discontinuity between its deposit and the later Big Lake phase deposit is understandable within the context of cultural continuity between Barnes and Big Lake. On the other hand, if this Barnes deposit is relatively late and the Big Lake phase relatively early, then the observed discontinuity is more probably a result of actual site intrusion. In Barnes ceramics there is not a great deal of variability nor is there a great deal of change through time. At the Zebree site, 98.1% of the ceramics found in 1969 were cord marked while only 1.5% were plain surfaced. The remaining 0.4% included check stamped, incised, and fabric impressed. In 1975, the random 5% data readjusted these figures to 86.4%, 10.6%, and 3.0% for rims and 86.7%, 12.7%, and 0.6% for body sherds.

Such large percentages of cord marked ceramics in a late Woodland context are not common for the northern alluvial valley. A few sites in west Mississippi are noted as having cord marked ceramics exceeding 80% (Phillips, Ford, and Griffin 1951:Fig. 7, p. 83). There are instances of significantly more cord marked than plain at the Oliver site (Phillips, Ford, and Griffin 1951:257-8) and the Alligator site (Phillips, Ford, and Griffin 1951:262), located in the Sunflower area which is noted by Phillips, Ford, and Griffin (1951:437) as a cord marked concentration. Both sites are interpreted as middle Baytown and the statement is made that "larger percentages of Mulberry Creek Cord Marked" signifies "a slightly earlier period" (Phillips, Ford and Griffin 1951:259).

However, Phillips' Hoecake phase (1970:902) contains up to five times as many cord marked grog-tempered sherds as plain surfaced sherds. He states, further, that "any site in the Cairo or Little River Lowland (north) that has a healthy percentage of Mulberry Creek, say 40% or more, has a Hoecake component. When this type is distinctly in the minority it is well to look carefully for other evidences of an earlier Marksville or later Coles Creek period occupation" (1970:902-903). The Dunklin phase is characterized as a "heavy preponderance of cord marked over plain" (Phillips 1970:903). The figure for cord marked over plain sherds at the Kersey site is 88% (Marshall 1965:Fig. 17). The figure at the Hoecake site is about 58% (R. Williams 1974:Table XXIV).

In the Midwest, the Crew phase dating around the second century is characterized by a predominence of cord marked surface treatment (Morse 1963). The succeeding Steuben phase, dating to the end of the Hopewell tradition in central Illinois, is characterized by an increasing predominence of plain surface pottery (Morse 1963:Table II, p. 19). Cord marking again becomes predominent during the Weaver period after Hopewell (Wray and MacNeish 1961:52-53; 59). This continues until, at Cahokia, pottery is "cord marked to the rim... just prior to the crystallization of the Mississippian cultural pattern" (Fowler and Hall 1972:3).

These data are not completely contradictory if we set up a model of cyclical change from predominence of plain surfaces to preeminence of cord marking during the Baytown period, as part of a cyclical scale of surface treatment preference. At an earlier period, cord marking was preeminent but gave way to plain surfaces as a preference around the end of middle Woodland (Marksville). If this model is valid, it would make the Barnes component at Zebree just about the latest described to date. The presence of a few Coles Creek-like sherds reinforces this interpretation but it is difficult to tell if these might belong to the slightly later Big Lake phase occupation. The interpretation of Barnes at Zebree as late is also reinforced by the presence of a check stamped motif and the lack of rocker stamping, nodes, cross hatching or Marksville zoned stamped motifs. These same presence/absence conditions at sites in general in the Big Lake region also reinforce the interpretation that Barnes is a relative latecomer to this area which previously was unoccupied.

Barnes has its roots in middle Woodland sites in southeast Missouri, specficially along the Ozarks and possibly in the Little Black River area (Price and Price 1975). Zoning and bossing are present there together with a predominence of plain surfaces. Sand tempering seems to be related to the sand dune area of Saucier but other than that no reason for its development is discernable.

A Baytown complex at the Hyneman site located near Weona, between Harrisburg and Marked Tree, has two radiocarbon dates. These are 1330±130BP (M-2112) and 1210±136BP (M-2113) (James B. Griffin, personal communication). These dates demonstrate that the Baytown-Barnes division is a real one and reinforce the interpretation that late Woodland expressions in this general area are relatively late, around AD 700, or just prior to or overlapping with the beginnings of the Coles Creek period.

Mississippian

In 1967 when the Zebree site was first visited, it was evident that the Mississippian ceramics constituted a new Arkansas assemblage. At first, after consultation with Gregory Perino and Dick Marshall, it was identified with the Hayti material from near Kersey, Missouri (Marshall 1965). By late 1968, it was clear that although related, this early Mississippi complex was more complete and would be better controlled as a sample, so the name Big Lake phase came into use. Visits to Cahokia, conversations with Cahokia investigators, and a broad background in previous Cahokia work, helped foster a realization that the "pre-Old Village" complex then emerging at Cahokia was similar to the emerging concept of the Big Lake phase. Specific stylistic similarities involved vessel shapes, red filming as a prominent trait, the small single-post rectangular house pattern, a rectangular burial group lying on a bed of (mussel) shells, the microlith industry, barbed bone and antler harpoons, the "Jersey Bluff" type discoidal, and the use of Mill Creek and Crescent Quarry cherts. A tentative dating of AD 900-1050 was assigned to the Big Lake phase because of this overwhelming similarity to the Fairmount phase at Cahokia, which is bracketed by these beginning and ending dates by radiocarbon (Fowler and Hall 1975:3). The presence of Varney Red Filmed and the Wickliffe funnel indicated that rather than an offshoot of a particular Cahokia Fairmount group, a stronger relationship to an unknown complex in the Cairo Lowland was indicated. It is now clear that such a complex exists, represented by the Hoecake early Mississippian assemblage. It is also fairly clear, based on radiocarbon, that the Big Lake phase dates earlier than originally projected.

"Middle Baytown" is now known as Baytown (Phillips 1970:17) and "early Baytown" is called Marksville period. The original concept of "late Baytown" has been changed to Coles Creek period. The Coles Creek period, dated to about AD 700-1000, can now be recognized as the period of transition from Woodland to Mississippian. Phillips' Coles Creek period (1970:913) in the northern alluvial valley was weakly defined on the basis of check stamped decoration and a recognition that this period was being ignored by other investigators. But now into this period of time the early Mississippian expressions at Hoecake, Kersey, and Zebree fit snugly, as do a large number of other sites, all related by virtue of the stylistic similarity of shell-tempered ceramics and now firmly radiocarbon dated at Zebree to at least AD 800.

"Late Baytown" (Coles Creek period) as proposed by Phillips, Ford and Griffin (1951:433) represented a period of time during which shell tempering superseded grog tempering with both traditions co-existing within the same phases throughout the period. Essentially following Phillips, Ford, and Griffin, in southeastern Missouri a sequence of three developmental phases has been proposed (Price, Price, and Harris 1976:42-45). The first, Buckskull, is identified as "Woodland" but characterized by shell-tempered ceramics in addition to the sand and limestone tempered pastes. Next in sequence is the Scatters phase which, while characterized only by shell-tempered ceramics, is hypothesized to have a Woodland settlement-subsistence pattern. In addition, it is characterized by Woodland-like vessel shapes. The Naylor phase is characterized by jar and hooded bottle forms similar to Big Lake phase vessel outlines, but does not have the large amount of red filming noted for Big Lake. Both the Hoecake (R. Williams 1974) and the Kersey (Marshall 1965) data also have been interpreted in reference to this concept of slow developmental change from Woodland to Mississippian. The Zebree data, however, clearly indicate that at least in one region of the valley the Mississippian tradition truncated the Woodland tradition. There is an expectation that Woodland and Mississippian phases would have co-existed at least until amalgamation was complete. But there is now a skepticism introduced to the accepted idea that it took up to 300 years for the shift from grog to sand temper to shell temper to take place. Undeniable Mississippian phases are now being dated much earlier than heretofore anticipated.

Possible errors of interpretation in the earlier site analyses are the inbuilt tendencies of seriation charts and measured stratigraphic units to force slow and gradual transitional phase conclusions. Although transition did take place, it may have been faster and earlier than formerly anticipated. The major point of this discussion is to indicate that simply because the Big Lake phase does not contain Woodland paste ceramics does not mean that it cannot be early in the sequence of the valley Formative.

The Lawhorn phase expression at Zebree was identified on the basis of similarity to other middle period Mississippian site assemblages in the northern alluvial valley. Matthews Incised and Manly Punctated in particular are characteristic. The open ended wall-trench house pattern, projectile point styles, strap handles on jars, the short cylindrical-necked bottle form, and the plate form all reinforce this identification. Rim notching on bowls and jars is also characteristic of this time period. All aspects of material culture identifiable as Lawhorn are found in the Snodgrass report (Price 1973) which, while about the Powers phase, is the only complete report available for the general time period on general kitchen refuse. The Lawhorn site report (Moselage 1962) is heavily oriented toward grave furniture but does include the only extensive description of general Lawhorn phase traits, and many of these were found at Zebree. This and the location of the Zebree site within the projected Lawhorn phase region is the basis for calling the assemblage Lawhorn.

The early historic component discovered in 1976 was dated to the 19th century because of the prominence of pearlware and the presence of the blue shell-edged motif (Chapter 26). South has published a formula for dating an assemblage based on the ceramics' known and suspected periods of popularity (1977:217). The result of this applied to the Zebree material was 1818. However, the formulae are based on 18th century ceramics and as a result the date at Zebree is pulled back in time. Based on a general concept of popularity of types the Zebree early historic component is dated to between 1820 and 1850.

The later Sebree occupation of the site was assigned to a period extending from about 1890 to 1940 based on bottle characteristics, wire nails, and ceramic motifs popular during that general period. Refreshingly, the actual occupation extended from 1895 to 1940 (Leonard Sebree, personal communication). Attempts to derive beginning dates for historic material dating after about 1860 by seriation is difficult. Formulae similar to South's will have to be devised on such elements as the mean popularity period for stone ware and for glass canning jars to differentiate 1890 sites from 1920 sites. The presence or absence of wire nails, not generally present until after 1900, can help differentiate pre-1890 sites which have considerable stone ware and ironstone sherds, but which lack the transfer prints and pearlware pastes characteristic of pre-1860 sites.

Summary

The results of applying the principles of stratigraphy and seriation to the Zebree data are as follows. The Barnes occupation definitely predates the Big Lake phase and dates to the latest part of the Baytown period, probably around AD 700. This Big Lake phase because of its similarity to the Cahokia Fairmount phase was dated to around AD 900-1050. On hindsight, after several radiocarbon dates were run and the realization that there are no complexes in the Coles Creek Period of AD 700-1000, the phase can be shifted back to near the beginning of this Coles Creek Period. At Cahokia, this period is left blank with the supposition that a transitional phase would eventually be identified. The radiocarbon dates from Zebree indicate that Barnes dates around AD 700-800 and Big Lake around AD 800-950.

The Lawhorn phase house cluster is dated at around AD 1100 to 1300 in a very general way since there are no real controls yet on the middle period of Mississippian development. The archeomagnetic date indicates that the date spread probably is not unreasonable. Dating the historic components has emphasized the difficulties of obtaining precise dates from seriation and suggest that formulae similar to those used by South be devised for 19th and 20th century assemblages. The guess dates for the Sebree occupation were verified by personal interview.

A slightly different approach was taken to stratigraphy, with a division into intrusion and superposition. Intrusion was emphasized because it does constitute a separate set of problems and is useful as a technique of analysis. Midden had to be defined on the basis of the Zebree site and not on some preconceived notion of how midden in general is formed. Seriation was subdivided into stylistic and technological and the point made that Mississippian ceramics are technologically superior to Woodland ceramics and not simply a shift in stylistic preference as assumed by archeologists in previous approaches.

CHAPTER 11

RADIOCARBON DATING

Dan F. Morse, Daniel Wolfman, and Herbert Haas

The radiocarbon dating method, which was first developed more than 30 years ago, has been reviewed in a fairly detailed fashion in many readily accessible publications (e.g., Aitken 1974:26-84) and simplified discussions can be found in almost any introductory archeology text (e.g., Hole and Heizer 1973:205-211). Consequently, the most basic ideas behind the method need not be reviewed here.

Dates are based on the "known" half-life of C-14. Early work suggested that the half life was 5568±30. However, today 5730±40 is generally accepted as the best estimate of C-14 half life. Because of this change, the half-life used must be clearly stated when reporting a date. It has been demonstrated that C-14 was not constant in the atmosphere through time and dates have to be "corrected" to take this variation into account. Different plant species absorb C-14 and C-12 in different ratios which can cause error if not taken into account. The magnitude of this effect, called isotopic fractionation, in a particular sample can be determined in the laboratory by measuring the C-13/C-12 ratio. Radiocarbon dates are most useful when corrections for C-14 variation through time and isotopic fractionation are made. Uncorrected C-14 dates in most cases provide an indication of relative age but are not absolute calendar dates. Uncorrected C-14 dates may differ from true calendar dates by as much as about 65 years during the past 2,000 and more than 600 years for samples nearly 7,500 years in age. Furthermore, the dates are mathematical averages of counts and each has an indicated standard deviation. There is a two-thirds chance that the true date falls within one sigma and a 95% probability it falls within two sigmas. There is also a one-third chance it will fall outside one sigma and a 5% chance it will fall outside two sigmas.

An archeologist has to be prepared to justify the sample submitted. Context is important and confidence that the sample is part of a primary deposit is absolutely necessary. Interpretation needs to be made as much as possible before the sample is selected or submitted. Circular reasoning and excuses are to be avoided if at all possible. Faith in the lab to do a good job and to report the results professionally is as necessary as confidence in one's own professional ability to choose samples wisely.

Selection of the Zebree Samples

A number of radiocarbon laboratories were considered for processing of the Zebree samples. A select few with excellent reputations were written with respect to cost, preparation of specimens and how long it would take to get results. Dr. Herbert Haas, Director, Radiocarbon Laboratory, Institute for the Study of Earth and Man, Southern Methodist University, Dallas, Texas, answered most satisfactorily on October 7, 1976. On March 8, 1977, after permission to forward 12 samples was received from the Survey, all samples were sent to Dallas. Preliminary dates were received from June into October, 1977. The final dates were processed in March and April, 1978.

Sample selection proceeded with care. Nine Big Lake phase and three Dunklin phase samples were chosen. Major criteria for selection were as follows: (1) association had to be absolutely firm; (2) large fragments of wood charcoal were given priority, especially if the sample could be made up from a single specimen of wood to insure that the sample was part of a primary deposit; (3) samples which would indicate a temporal spread for occupation were given priority; (4) samples widely spaced from each other were given priority.

The dates which follow are as reported by the laboratory using the "old" half life of 5568 years and no corrections.

SMU 414:A.D.630+74

This sample consisted of wood charcoal from Feature 53 in the south corner of the site (10R10). It was a small sample collected in 1969 in good Dunklin phase context. All of the 62 body and 1 rim sherds were Barnes cordmarked. One Mississippian sherd was present but undoubtedly derived from Feature 37 which intruded into this pit. The date is considered an excellent one and if anything perhaps a bit early.

SMU 415:A.D.829+70

The sample is made up of wood charcoal from Feature 249 collected in 1975 in good Dunklin phase context. The feature was in Random Square 82, near the center of the eastern border of the site. A total of 538 Barnes and 11 Mississippian sherds were collected. These latter were from the upper portion of the feature and away from the charcoal sample. The date is perhaps a bit late but the lower sigma overlaps with the upper sigma of SMU 414 and matches the lower sigma of SMU 432. These overlapped portions indicate a period of A.D. 700-800 or immediately prior to the group of Big Lake phase dates, an expectation of the investigation.

SMU 432:A.D.863+84

All 321 sherds from Feature 270, which provided this sample, are Barnes, so this is a clean Dunklin phase context. The sample is a combination of wood charcoal, charred nut shell fragments, and persimmon seeds, which could not be helped since so little wood charcoal was present. The feature is located in the west corner of the site (east of the ditch) in Backhoe Trench 2. The date is too late, perhaps, but the lower sigma agrees well with the other dates. All three Dunklin samples were consciously selected from different areas of the site. No ceramic variation which might indicate temporal change was noted by us.

SMU 433:A.D.810+80

The wood charcoal used to obtain this date was collected from Feature 42 in 1969. The association is Big Lake and this is the earliest date at Zebree, or anywhere, for that matter, for Mississippian which may be valid. Feature 42 was intruded into by Feature 41 (SMU 426) and a row of Big Lake phase post holes and was beneath Features 54 and 133. The feature (42) intruded into Feature 43. It was located near the central portion of the west boundary of the site (80R8). Feature 42 was interpreted to date fairly early within the time span represented by the Big Lake phase occupation. It was one of the two rectangular storage pits recognized at the site.

SMU 445:A.D.836+84

Another early date was derived from this sample, also interpreted as dating early on the basis of stratigraphy within the period of occupation by the Big Lake phase at the Zebree site. Feature 95 intrudes into two Dunklin phase pits and is intruded by Feature 116 (pit) which, with 95, is in turn intruded by a Big Lake phase house pattern in the south corner of the site. Intrusion of a pit by a house pattern is interpreted as indicating a fairly substantial time lapse, since these two categories of features represent different kind of usage of the location. Wood charcoal collected in 1969 comprised the sample. The association is good Big Lake phase.

SMU 453:A.D.838+86

Sufficient wood charcoal was collected from Feature 238 so that a small amount is available for future dating. The association is Big Lake phase. The feature intrudes into another pit, Feature 243, in Block 4 in the south corner of the site and hence is stratigraphically later in its location, but the time lapse indicated is not necessarily significant.

SMU 411:A.D.876+74

In 1976, Feature 432 was salvaged. It contained one of the best Big Lake phase ceramic samples from the standpoint of restorable vessels and considerable wood charcoal. The date is on a single portion of wood. Additional dates are possible on the remaining charcoal.

SMU 422:A.D.931+57

This date is derived from wood charcoal collected in Feature 286, a Big Lake phase feature located in Block 7 on the east side of the site north of the south corner. The context is excellent and is Big Lake phase. Additional samples of wood charcoal are available for future dating. The charcoal appeared to have been burned in place, or at least represents a freshly burned episode before being interred into the pit. This sample and SMU 411 have to be considered as good samples as possible from a pit feature.

SMU 450:A.D.941+66

Wood charcoal was the basis for this date from Feature 37, excavated in 1969 in the south corner of the site. The feature intrudes into two Dunklin pits and may have intruded into a Big Lake phase house pattern. The association is Big Lake phase.

SMU 426:A.D.960+63

Feature 41 intrudes into Feature 42 (SMU 443) and it is refreshing that a sample from it dates later than the sample from Feature 42. Wood charcoal was the basis for the date and was collected in 1969. A Varney Red Filmed loop handle was in this pit and indicates a relative lateness in the ceramic assemblage.

SMU 460:A.D.1020+74

Sufficient wood charcoal was collected from Feature 192, located in Block 1 in the west corner of the site, to provide additional samples for dating. The association is mostly Big Lake. After the run was made, we discovered that four rather important sherds were not included in the computer print out inventory. These sherds are two notched lips, one Mathews Incised body sherd, and one portion of a small plain handle. The relationship of these sherds to the charcoal is unknown; all four should be from the Lawhorn phase occupation. The charcoal sample is from fairly deep within the feature; if a late intrusion occurred, the sherds should be from near the surface of the exposed pit fill. All four sherds are very small and were not recognized in the field; Morse doubts very much that they could be associated in time with the Big Lake phase.

SMU 457:A.D.1076+68

Nut shell fragments had to be added to the wood charcoal to make up a sufficiently large sample for this date. The association is Feature 207 in Backhoe Trench 4 in the center of the site. The date is unexpectedly late considering the other results and the lower doubled sigma just barely reached sufficiently into the A.D. 800-1000 time period indicated for the Big Lake phase to reinforce that interpretation. There is no evidence stratigraphically nor ceramically to suppose that this is a particularly late sample. On the whole this seems to be the only "bad" result of the nine samples submitted for the Big Lake phase.

Summary

Three Dunklin phase dates indicate a temporal spread from about A.D. 700 to A.D. 800. Nine Big Lake phase dates indicate a temporal spread from about A.D. 800 to A.D. 1000. Two dates are on samples which include some nonwood charcoal. Both of these dates are late according to the others in the respective series but can be accommodated with a doubled standard deviation. A great deal of care was exercised in selecting the samples and a lab with an excellent reputation for producing valid dates was chosen to run the samples. The dates cluster well. It is impressive that all dates expected to be early in the Big Lake phase series were early and dates expected to be late were in fact later. This may be coincidence however, since the doubled standard deviations overlap considerably.

Cautionary Notes on the Radiocarbon Dates

While the dating method remains sound, many of the assumptions made in applying the method in the years immediately following its development are now known to be false (e.g., secular variation and isotopic fractionation were ignored). In some cases, reevaluation of the data taking these sources of error into consideration has led to surprising revisions of previously held ideas about prehistoric chronology and cultural development (e.g., Renfrew 1973). Since the dating of the components of the Zebree site is crucial to current understanding of the late Woodland - early Mississippian chronology in the central Mississippi Valley and also since the radiocarbon dates are being compared with archeomagnetic results obtained in two samples collected at the Zebree site (see Chapter 12), the principal sources of error and the manner in which corrections should be made are briefly reviewed.

Principal Sources of Error

Considerable attention has been given to secular variation of C-14 concentration in the atmosphere during the past 8000 years. Careful studies of tree-ring dated samples have led to the development of several calibration curves (e.g., Suess 1965; Ralph et al. 1973; Damon et al. 1974; Clark 1975) which differ in detail, but are in general agreement. The principal differences between the calibration curves is due to the way in which each curve was fitted to the data. Seuss (1965) and Ralph et al. (1973) fit curves to the data with minimal smoothing and, consequently, their curves have more wriggles than those developed by Damon et al. (1974) and Clark (1975). Clark (1975:254) has pointed out that the spline functions he used to fit his calibration curve are superior to regression weighted averaging used by Ralph et al. (1973) and the polynomial curve fitting used by Damon et al. (1974). For this reason, Clark's (1975:264-265) calibration tables were used to correct the Zebree radiocarbon dates (see Table 1). Clark (1975:255) notes that the data supports kinks in the curve at only three points (ca. 100, 2200, and 2480 B.P.) but that six "flat spots" in the curve suggest additional kinks may be defined when the sample size increases. When calculating a calendar date from a radiocarbon date using a conversion table, the statistical errors in fitting the curve must be included in estimating the precision and accuracy of the final result. The standard error in fitting Clark's curve is fairly uniform--about 50 years during the past 2700 years and 60 years before that.

A second source of error, isotopic fractionation, can cause serious errors, most notable in plants with the so-called C-4 pathway (most importantly, corn and other grasses). Although there has been a tendency to ignore isotopic fractionation in wood charcoal (presumably because almost all trees have C-3 pathways), Lerman (1972:619) has found that fractionation leads to errors as large as 80 years in some samples of this material. The probability of isotopic fractionation in tree nuts, which constitute a portion of two of the Zebree samples, is about the same as in wood and wood charcoal (Lerman, personal communication). Since isotopic fractionation is primarily due to the differences in the weight of the C-14 and C-12 atoms, determination of differences in the ratio of C-13 (a stable carbon isotope) to C-12 in the sample gives an indication of the severity of fractionation. It is standard procedure to calculate the effect of C-14 fractionation as double that of C-13 but this assumption may involve a small error (Craig 1954:133-35). It is highly recommended that C-13/C-12 ratios be determined in all samples submitted. The small extra charge (usually about $30) is well worth paying for the increased accuracy. Unfortunately, this extra work was not undertaken for the Zebree samples. Damon et al. (1974:365) recommend that if a C-13/C-12 ration has not been determined that an extra factor of ± 120 years should be included when computing the possible error of a radiocarbon date. They cite a paper by Lowdon (1969) to justify this figure; however, there is no discussion of how to correct a date when the C-13/C-12 ratio has not been determined in that article. In Lerman's (1972) study, the range of possible variation of a variety of materials is given. For wood and wood charcoal the range as noted above is ± 80 years, but the standard deviation is only 27 years, based on the data (121 samples) in Craig (1953:68-69) and Lerman et al. (1970:287-288) which was used by Lerman (1972) in determining the range. These data also indicate a systematic deviation in the C-13/C-12 ratios suggesting that 12 years should be added when correcting radiocarbon dates obtained from wood or wood charcoal samples. Until a more

Table 11-1. Zebree C-14 Dates.

Lab No.	Phase	C-14 Age $T_{1/2}$=5568	Sigma	C-14 Age $T_{1/2}$=5730	Corrected Age (Clark)	Corrected Age (Damon)	Corrected Sigma (Damon)
414	Dunklin	669	54	630	698	691	74
415	"	810	48	776	828	829	70
432	"	846	67	813	875	863	84
443	Big Lake	791	61	756	805	810	80
445	"	817	67	783	837	836	84
453	"	819	69	786	840	838	86
411	"	860	54	828	894	876	74
422	"	918	48	887	963	931	57
450	"	928	58	897	972	941	66
426	"	948	55	918	988	960	63
460	"	1012	67	984	1010	1020	74
457	"	1071	60	1045	1092	1076	68

Table 11-2. Other radiocarbon dates from northeast Arkansas. a: this column assumes a halflife of 5568 years was used for reported dates. b: Clark (1975) and Damon et al. (1974) are the bases for "corrections." All sigmas were corrected as reported. c: this is the only B.C. date; all others are A.D. d: corrected age includes C-13 correction.

Sample No.	Site	Phase	BP	Uncorrected[a] BC/AD	Sigma	"Corrected"[b] Clark BC/AD	Damon BC/AD	Sigma
M-1197	3PH11	Helena	2090	140[a]	150	147[c]	147[c]	184
M-1199	"	"	1920	30	150	96	19	161
M-1196	"	"	1730	220	150	259	229	159
M-1198	"	"	1615	335	150	377	350	159
M-2112	3PO54	"Baytown"	1330	620	130	658	642	138
M-2113	"	"	1210	740	136	752	761	151
TX-3074	3CG636	Big Lake(?)	990	960	60	990	978	69[d]
TX-3073	"	"	930	1020	50	1040	1039	61[d]
M-917	3CS40	Cherry Valley	1250	700	120	720	722	137
M-918	"	"	1030	920	150	968	933	160
M-1486	"	"	850	1100	110	1170	1102	120
M-1162	3CT16	"Banks"	875	1075	75	1120	1079	87
TX-700A	3PO6	Lawhorn(?)	1120	830	70	854	848	92
TX-845	"	"	870	1080	100	1130	1084	111
TX-844	"	"	860	1090	60	1150	1093	74
TX-704	"	"	840	1110	80	1180	1111	92
TX-878A	"	"	760	1190	60	1248	1186	74
M-1158	3CG1	Lawhorn	750	1200	150	1255	1194	160
M-1156	"	"	625	1325	150	1363	1308	160
M-1157	"	"	375	1575	150	1483	1536	162
GX-6164	3CG218	Wilson	720	1230	150	1291	1223	160
GX-6161	"	"	660	1290	145	1343	1276	154
GX-6162	"	"	630	1320	115	1360	1303	125
GX-6163	"	"	545	1405	130	1402	1381	142
GX-6160	"	"	525	1425	120	1410	1398	132
TX-786	3PO6	?	690	1260	70	1322	1249	83
TX-750	"	?	690	1260	70	1322	1249	83
TX-851	"	?	470	1480	70	1432	1450	86
TX-848	3PO6	Parkin(?)	600	1350	90	1365	1330	102
TX-877	"	"	500	1450	80	1420	1421	94
TX-847	"	"	370	1580	70	1485	1540	86
TX-846	"	"	370	1580	180	1485	1540	191
M-385	3MS4	Nodena	630	1320	125	1360	1303	135
M-916	3CT13	Nodena(?)	425	1525	150	1461	1490	162

complete study of systematic errors in wood and wood charcoal due to isotopic fractionation is undertaken it seems wise not to make corrections based on this possible 12 year error and change what has been, for many years, a widely accepted value. Consequently this correction was not made for the Zebree dates.

Other sources of error exist. Farmer and Baxter (1972) have observed surprisingly large cyclical variations in the C-14 concentration in adjacent tree rings. In some time periods, a 22 year cycle of C-14 concentrations has been observed suggesting a correlation with the sun spot cycle. Although the magnitude of this error has been disputed (Damon et al. 1973), Aitkin (1974:54) has noted that, whatever the cause, single year samples are subject to an error of up to ± 120 years. For this reason, single year samples, including leaves and nut shells, should be avoided and it is suggested that wood or wood charcoal samples submitted to radiocarbon laboratories have at least 11 and preferably about 22 rings. Post sample growth (Stuckenrath et al. 1966:372-373) and reuse of old wood are continuing sources of varying and usually indeterminable error. In addition, small latitudinal variations of C-14 in contemporaneous tree rings has been observed (Lerman et al. 1970).

Correction of the Zebree Dates

Radiocarbon dates are routinely reported in the journal Radiocarbon in an uncorrected or only partially corrected form. Most reported results are based only on the C-14 concentrations of the sample as determined by beta counting using the "old" half-life of 5568 years. In the interest of maintaining uniformity with results reported in earlier volumes, the currently accepted figure of 5730 years is not used. Some results also include a correction for isotopic fractionation if the C-13/C-12 ratio was determined. The reported error is a one sigma precision parameter based on the counting statistics. Until recently, most radiocarbon dates in the archeological literature were uncorrected but recently there has been a shift towards correcting the results. When discussing radiocarbon dates, it is, therefore, essential to state what corrections have and have not been made. As noted above, the lack of C-13/C-12 ratio data for most of these samples means that a correction for isotopic fractionation cannot be made and the error at the 67% confidence level (in terms of calendar years) is considerably larger than the one sigma value commonly reported.

When correcting standard radiocarbon dates to calendar years, the reported age is changed due to the difference between the currently accepted and "old" determinations of the half-life of C-14, secular variation of atmospheric C-14, and isotopic fractionation. The uncertainty of each of these adjustments should be reflected in the error figure reported. The proper method of combining errors is to take the square root of the sum of the squares of the individual errors. The change in the one sigma value due to the half-life correction is minor. However, the C-14 analyses of known age samples varied considerably and, as noted above, Clark's calibration curve has a standard error of 50 years during the past 2700 years. Since C-13/C-12 ratios can be determined within very tight limits, its effect on the error figure is negligible, but, if the C-13/C-12 ratio is not known, an additional factor due to the one sigma error of this parameter must also be included. In the case of wood charcoal, this figure is 27 years.

Twelve radiocarbon samples from the Zebree site have been processed at the SMU radiocarbon laboratory. Ten of the twelve samples consisted of wood charcoal. The two additional samples (SMU Lab Nos. 432 and 457) consisted of a mixture of wood charcoal and charred nut fragments. The results are summarized in Table 1.

The radiocarbon dates reported by Haas are displayed in four ways: the dates obtained purely from beta counting using both the 5568 and 5730 year half-lives, the corrected dates using Clark's (1975:264-265) conversion table, and the corrected dates using the Damon et al. (1974) conversion table. The Damon et al. (1974) dates are emphasized since many archeologists working in the southeastern United States have used this table. Also presented are the one sigma value for beta counting using the 5568 year half-life and one standard error of the Damon et al. (1974) corrected date, calculated by combining the standard errors for beta counting, and fitting the calibration curve (51 and 31 years), and the standard deviation for possible isotopic fractionation of wood and nuts (27 years). Since nuts were included in sample Nos. 432 and 457, their error figures should be larger (by an unknown amount) due to yearly variation in atmospheric C-14 concentrations.

Incorporation with other northeast Arkansas Dates

While radiocarbon dating in northeast Arkansas is in its infancy, a respectable series of dates exist which are in overall agreement with each other. The samples from Zebree almost doubled the number of known northeast Arkansas dates in 1977 to 27. This total now is up to 46 (Tables 11-1 and 11-2). These dates will be reviewed by cultural period.

Woodland Dates

Four dates were obtained at the Helena site, belonging to the Helena phase, Marksville Period (Ford 1963:46). These dates range from 174 B.C. to A.D. 350 with greater than century and a half sigmas. Alan Toth (personal communications, 1978) regards Helena as an early Marksville expression dating A.D. 1-200. The results would tend to support this dating but could be stretched easily to support a slightly later time period as well.

Two Baytown dates were derived from samples from a pit feature at the Hyneman site near Harrisburg and Marked Tree in Poinsett County. The associated ceramics are grog-tempered with typical Baytown flat-based bowls represented. One rim sherd has a crudely incised line below and parallel with the lip, vaguely suggestive of Coles Creek. The dates are within each other's sigmas and suggest an A.D. 600-800 time period. Considerable charcoal exists in the collections from the Hyneman sites (3PO52 and 3PO54) and could be used to better date the Baytown and early Mississippian complexes represented. Griffin (Michigan) dated these two specimens gratis, since persimmon seeds were associated and in order to get a Baytown Period date for this portion of the valley.

The lateness of the Baytown dates reinforces the Dunklin dates at Zebree. Not only do these complexes appear to be very late in the area, but they also extend into the initial portion of the early Mississippian period. Thus the late arrival of Woodland to this general area is supported and the probability of a Mississippian intrusion rather than an in situ evolution is upheld. However, it is evident that a larger series of dates in good context would make this position more comfortable.

Early Period Mississippian Dates

The time period indicated for the Big Lake phase should not have caught us by as much surprise as it did. The dates at Cahokia indicated an A.D. 900-1050 dating for the Fairmount phase and this was adopted for the Big Lake phase. However, a considerable number of traits thought by Morse to be "Mississippian" are being interpreted at Cahokia as "Woodland" based on ceramic paste association. These traits predate the Fairmount period and continue into this period. There is presently some controversy over just what constitutes Fairmount phase (J. Griffin, personal communication) and there evidently is a need for reappraisal.

The A.D. 1000-1050 dating for the Mangrum site located in Craighead County south of Lake City and east of the St. Francis River is based on two samples from Feature 13 (Klinger et al. n.d.). The report indicates that the red filming has eroded off many of the sherds, but an alternative explanation is that the assemblage for the most part is very late and that red filming is much rarer than earlier at Zebree. Of 257 (or 258) Varney Red Filmed sherds recovered at the site, 101 were in Feature 13. There was a "total" of 2238 Neeley's Ferry Plain sherds (this "total" is also very slightly in error) but some Middle Period type artifacts are included and the site may be multiple component. Unfortunately the total sample is very small, and handles (except for a "strap" handle associated by Million with the Middle Period component), which were extremely rare at Zebree, were absent.

The small jar and bottle at Mangrum are precisely what occurs in the initial Middle Period elsewhere. Morse reexamined the handle under a microscope and concludes it is a "loop" handle. Loop handles are riveted into the vessel while strap handles are appliqued to the vessel. The crosssection of the handle is not as significant as the technique for attachment. Loop handles occur earlier since they reflect a lack of confidence on the part of the potter that she can successfully fire the vessel without losing the handle. It would appear now that there is excellent evidence for a very early Middle Period Mississippian occupation at the Mangrum site and that the phase is not Big Lake but a developmental Lawhorn or more probably a separate unnamed phase transitional between Big Lake and Lawhorn. If true, then the A.D. 1000-1050 dating at Mangrum dates the end of the Early Period and the beginning of the Middle Period Mississippian. It also reinforces the suggestion for a time period of A.D. 800-1000 for the Big Lake phase at the Zebree site.

Trying to find complementary or contradictory dates in southeast Missouri is very difficult (Cottier 1977). With the exception of the series of dates from the Lilbourne site and the Powers phase sites, southeast Missouri dates make very little sense in the patterning of cultural behavior. Be that as it may, there are three uncorrected dates from the Hoecake site: A.D. 420, 640, and 1185. The middle date is a combined mound sample and in its slightly later corrected state may not be too far removed, especially concerning its 130 year sigma, from a true date for the near Big Lake phase association. The other two dates easily could be from samples representative of the earlier Baytown and the later Middle Period Mississippian components, but this logic is rather circular and only suggestive for what is presently a very poor situation in temporal control in the area.

Middle Period Mississippian Dates

The earliest dates for Middle Period assemblages are from the Cherry Valley type site (Perino 1967a:67). The dates indicate a time period of A.D. 1000-1100. The series of dates is not as tight as one would like but is very suggestive. The phase (Cherry Valley) is presently known only from charnel house situations. The pottery is not at all Big Lake in style but the Big Lake ceramics are kitchen, not burial ceramics. The ceramics at Mangrum are certainly suggestive of the possible transition. Beakers, plates, simple bowls with effigy heads, loop handled jars, and globular bottles with constricted necks and dimpled bases are characteristic.

Confirmation is found with the single date at Banks Mound 3 (Perino 1967a:77). There are similarities in the bottle and bowl forms. Beakers and a plate were also represented by a few fragments. Jars had loop handles similar to Cherry Valley. Some vessels were grog-tempered. There were similarities noted to Cahokia Ramey Incised and Powell Plain dated with the beaker form at Cahokia during the Sterling phase period of A.D. 1050-1150. The date of A.D. 1079 fits very well with this and with the Cherry Valley dating.

A total of 12 radiocarbon dates were obtained in 1975 by Zinke (1975:37,56) for the Hazel site. At the Hazel site, there are two components, assignable to the Middle and Late period Mississippian (Morse and Smith 1973). Despite three modern field seasons at the site, Zinke elected to use samples gathered in 1933 by the University of Arkansas. Thus the component association is somewhat vague and any interpretation of these dates is necessarily circular.

In Trench 5 from which nine samples were taken, there is a significant break in age between Levels V and VII. This is the basis for assigning the lower five dates to the Middle Period and the upper four dates to the Late Period. Three dates were on samples from Burial Cluster 17 (1 date) and 10 (2 dates). Two are early and one is late. The late date and one early date occur in the same cluster (10) although Cluster 10 consists of two vertical groupings of burials separated from each other "by a 3 inch layer of earth" (Zinke 1975: 62). But the deeper sample dated the latest! It is quite possible that a third component exists at the site which dates between the two recognized components (Morse and Smith 1973:76), but for now we will interpret only two Mississippian components at the Hazel site.

Some of the deposits at the base of the village midden mound are reminiscent of the Cherry Valley phase (Morse and Smith 1973: Figure 28). Radiocarbon dates from a 1933 trench indicate a time period of approximately A.D. 1100-1200; and these may pertain to this lower complex. Whether this represents a late Cherry Valley expression or a developmental Lawhorn phase is not known. Other artifacts, associated with the house floors (Morse and Smith 1973: Figure 22), do not appear to be typical Cherry Valley, but the same difficulty as before in comparing grave and kitchen ceramics confuses the issue. There are some thirteenth century radiocarbon dates from Hazel and it is noteworthy that archeomagnetic dates ranging from A.D. 1170 to 1240 were run on the house floors exposed in the highway cut and assigned to the "Lawhorn" phase. At the moment, a time period of approximately A.D. 1100-1250 would seem to be a best fit for the Middle Period Mississippian occupation at the Hazel site.

At Hazel, Mathews Incised is conspicuous by its absence. Red filming in the earlier component is rare; only two sherds occurred in Feature 70 which contained so many of the Cherry Valley-like ceramics. Notched bowl rims are also absent.

In Mississippi County there are small surface samples of Middle Period occupations which contain notched bowl rims and rare and very crude, possibly prototype Mathews Incised jar decorations. By the time of the occupation of the Lawhorn site, Mathews Incised is a developed design motif (Moselage 1962:Figures 9, 10, 13). Three radiocarbon dates very widely from each other but can be interpreted to indicate a time period of approximately A.D. 1200 or 1250 to 1300. The closely related Powers phase in Missouri is dated to A.D. 1275-1350 (Griffin 1979:3). Strap handles are characteristic on Mathews Incised and Manly Punctated jars, bowls are more complex, and plate and beaker forms are rare or absent. Painting is rare but relative to all decorated sherds at Lawhorn is predominant. Applique decoration in keeping with the increase in strap handles over loop handles has increased in popularity. There is still a lot of similarity in bottle and jar form to the earlier Cherry Valley styles.

The five radiocarbon dates from the Burris site near Egypt indicate a time period A.D. 1200-1400. Since the Wilson phase is closely related to the Powers phase and to the Lawhorn assemblage, a best guess would be in the A.D. 1250-1350 period. At this time, most large sites are ceremonial centers with a relatively small (in comparison to total site size) permanent population and a larger population scattered in farmsteads nearby. It is a different situation from the Cherry Valley period where the pattern seems to have been a ceremonial center apart from any sizeable permanent population. The ceremonial center is composed of charnel house mounds. Later, populations are concentrated into villages with ceremonial components for the most part and farmsteads appear to be of rare occurrence.

Based on the above, the Lawhorn component at Zebree should post date A.D. 1200-1250 and pre-date A.D. 1350. The archeomagnetic date is in general agreement with this but might be a bit early. No middle period charcoal samples in undisputed context were collected at Zebree so none were submitted.

Late Period Mississippian Dates

The Banks site in Crittenden County, north of Memphis, is probably a multiple component site (Perino 1966). Most of the remains seem to be either a late Middle Period or an early Late Period assemblage. A small portion of the reported remains are classic Nodena phase and probably Protohistoric in time. The reported ceramics are grave furniture and again it is difficult to reference this to kitchen ceramics at Lawhorn and Hazel. However, Mathews Incised and Manly Punctated are in their climax development and some of the incised lines are straightening out as if in transition into Barton Incised and Parkin Punctated, neither of which are typical of the late Nodena phase. Noded vessels are relatively common and form the prototype for the later noded forms such as Fortune Noded. The radiocarbon sample was composed of corn cobs from the center of the village. If it pertains to the transitional period occupation, it is too late but only to the tune of a single sigma; it should date right at around A.D. 1350-1400. If it pertains to the Nodena phase occupation, then it probably is too early, but certainly by no more than its sigma. We already know more than this date can tell us.

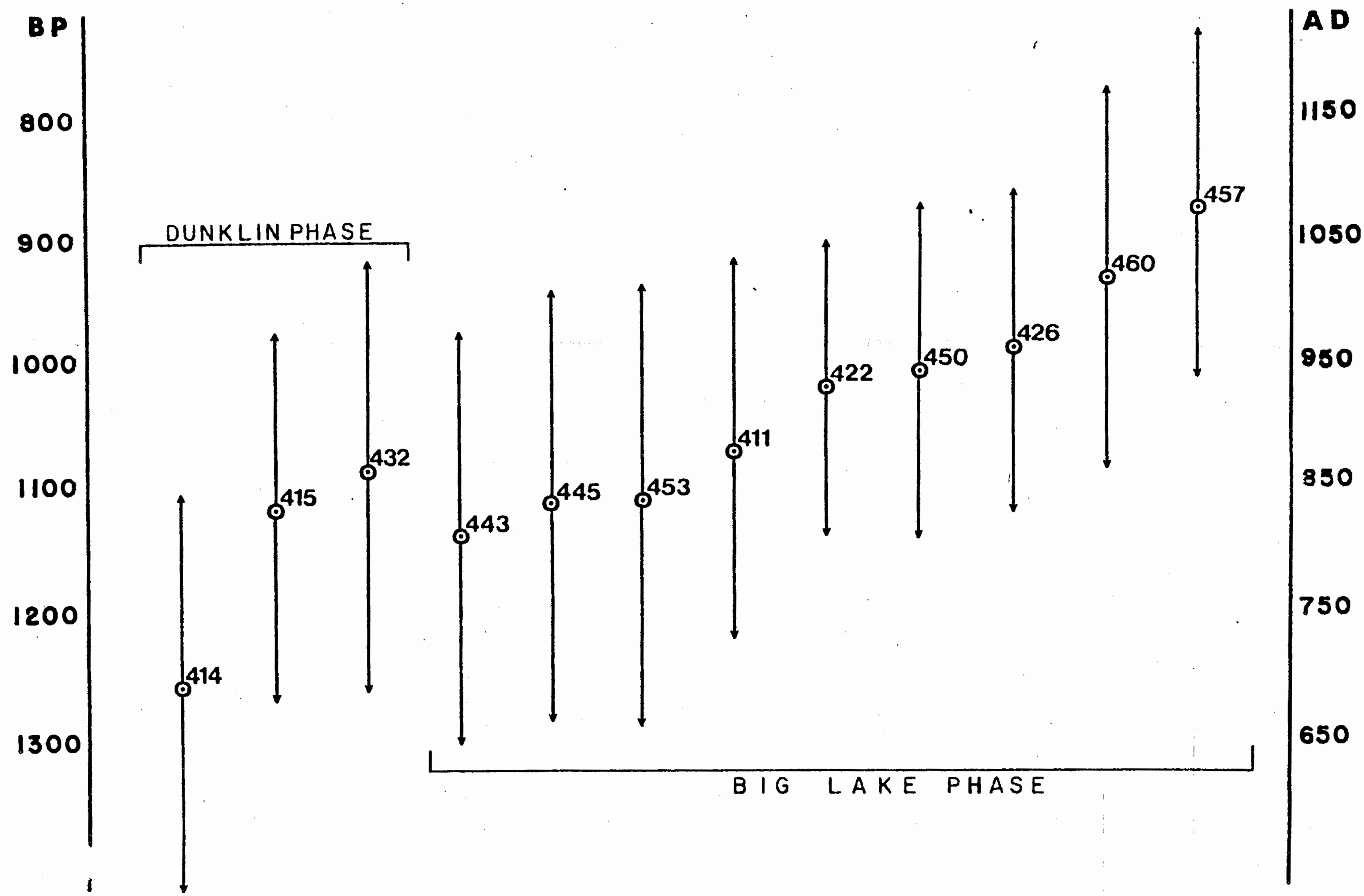
A single date from Upper Nodena was based on a sample submitted by Dr. Hampson, who conducted extensive excavations at the site early in this century. Morse interprets the date as being much too early. He interprets the site as relatively short-lived and as probably extending into the sixteenth century, based on the presence of catlinite artifacts which elsewhere have occurred with sixteenth century Spanish artifacts. Steve Williams (personal communications with Morse) thinks the site predates the sixteenth century, because end scrapers which are characteristic of the Protohistoric are absent. Wolfman points out that archeomagnetic data from Nodena phase components at Armorel and Knappenberger are in agreement with this early date and suggests that perhaps the late Mississippian stylistic seriation is not as well worked out as Morse believes. This difference points out the crucial importance of processing the C-14 samples collected in association with the archeomagnetic samples as soon as possible.

The dates from Hazel indicate an A.D. 1350-1550 time period for the Parkin phase at that site. Morse favors a dating earlier in this time period and the archeomagnetic date supports this to a certain extent. However, considerable erosion of the site might have removed house floors relating to burial assemblages and to the earlier sampling of charcoal eventually used for the radiocarbon dating.

Summary

A total of 12 radiocarbon samples were carefully selected from the Zebree site and processed by the Radiocarbon Laboratory at Southern Methodist University. Three Dunklin phase dates indicate a time span of approximately A.D. 700-800. Nine Big Lake phase dates dated mainly to between A.D. 800-1000. Impressive in this latter series is the observation that samples expected to date earlier or later did so. Comparisons to the 34 other radiocarbon dates known for northeast Arkansas and several dates reported from southeast Missouri reinforces the dating at the Zebree site. The dates are among the earliest known for Mississippi complexes anywhere in the eastern United States.

Figure 11-1. Corrected (Damon et al 1974) Zebree radiocarbon dates. Mean shown with two sigma standard error.



CHAPTER 12

ARCHEOMAGNETIC DATING

Daniel Wolfman

During the course of the excavations at the Zebree site, archeomagnetic samples from two baked clay features were collected. The result from one of these samples is in good agreement with other chronological data. However, the result from the other sample is subject to more than one interpretation. Since these archeomagnetic results are among the first reported in the southeastern United States, a short discussion of this dating method and the potential for its application in Arkansas is presented prior to discussing the Zebree data. Additional information about archeomagnetic dating can be found in my dissertation (Wolfman 1973: 139-776) and in Aitken's text Physics and Archaeology (1974: 135-186). A detailed up-to-date review of the subject is being prepared (Wolfman n.d.).

Archeomagnetic Dating and the Geomagnetic Field

Archeomagnetic dating depends upon two simple facts. Clay when it is fired becomes magnetized in the direction of the magnetic field in which it cools. Consequently, the direction of the past geomagnetic field is recorded in baked clay features which have not moved since the time of firing, such as hearths, kilns, and the floors of burned buildings found in archeological sites. Furthermore, the direction of the earth's magnetic field (often referred to as the geomagnetic field) is changing. There are minor short-term fluctuations referred to as transient variation and larger long-term fluctuations with periods on the order of hundreds or thousands of years referred to as secular variation. For most time periods in the regions where the archeomagnetic dating method has been applied, the rate of secular variation is sufficiently rapid (ca. 1°/10 yrs.) to allow dating of baked archeological features with very good precision.

The two basic facts which make archeomagnetic dating possible have been known for almost 300 years (Boyle 1691 and Haley 1692), and papers discussing the archeomagnetic dating method were published in the last century (e.g., Folgheraiter 1899). Basic research on archeomagnetism was begun in France in the 1930s (e.g., Thellier 1938) and substantive results were obtained in Japan (Watanabe 1959) and England (Cook and Belshe 1958) beginning in the 1950s. Improved equipment and the availability of high speed computers have led to an increase in the use of the method in the last 20 years. However, much of the work accomplished thus far has been undertaken by geophysicists who are primarily interested in obtaining data about past secular variation and relatively few archeological dates have been published.

The geomagnetic field is similar, but not identical, to the field of a bar magnet which is referred to as a dipole field. If the earth's magnetic field was dipolar, compass readings taken at different locations on the surface of the earth would all point to a single pole position which is not the case.

The number of degrees variation between true north and the direction which a compass needle points is referred to as declination. The north seeking pole of a balanced magnetic needle aligned towards magnetic north and suspended so that it can swing in a vertical plane will point down in most of the northern hemisphere and up in most of the southern hemisphere. The number of degrees from horizontal is referred to as inclination or dip. The amount of inclination generally increases with latitude.

In addition to expressing the direction of the geomagnetic field at a point on the earth's surface in terms of declination and inclination, it is often useful to represent this data as a virtual geomagnetic pole (VGP), which is where the magnetic north pole would be located if the geomagnetic field was due to a geocentric dipole. The formulas for determining the VGP from declination and inclination at a specific point are given by McElhinny (1973:24-25). A polar curve is formed by connecting a chronologically sequential series of virtual geomagnetic poles. Unfortunately, it is not possible to mathematically calculate past virtual geomagnetic pole positions. The only way to accurately determine past virtual geomagnetic pole positions prior to observatory records (which have been kept since the seventeenth century in parts of Europe but not until about 75 years ago in much of the rest of the world) is by measuring the remanent magnetic direction in archeomagnetic samples collected from baked features including hearths, kilns, and the floors of burned structures. In order to calibrate the curve, some of these features must be independently dated. Since many of the baked features from which archeomagnetic samples were collected in the southwestern United States were dated by dendrochronology, it has been possible to develop an accurately calibrated polar curve for this area for the time period A.D. 600-1500 (Figure 12-1) (DuBois and Wolfman 1971; DuBois 1975). Polar plots are read in the following way: The center of the figure where the perpendicular lines cross is the geographic north pole. The concentric circles are lines of latitude marking off five degree intervals. The line marked "0" is the zero longitude line and, by convention,

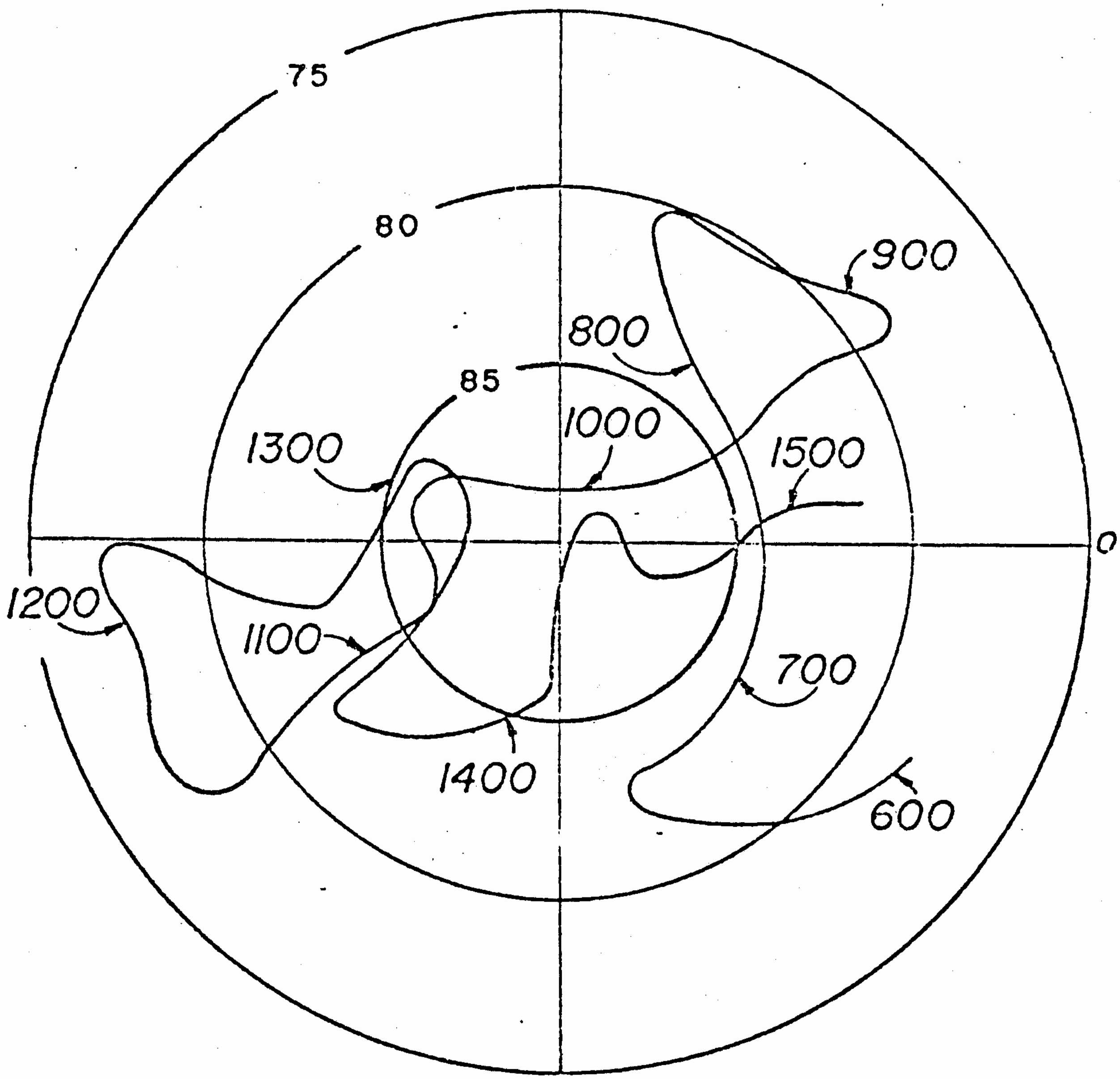


Figure 12-1. Southwest polar curve A.D. 600 - 1500.

longitudes west are measured in a clockwise direction and longitudes east are measured counterclockwise.

Although the geomagnetic field is essentially dipolar, it has significant regional non-dipole components which account for about 20% of its strength. Consequently, contemporaneous VGP's from different points around the earth differ somewhat and each region must be treated as a separate unit when developing an archeomagnetic chronology. Shuey et al. (1970) have considered the problem of the size of a region in which an archeomagnetic chronology can be developed by statistically analyzing the magnitude of non-dipole variations in the modern geomagnetic field and Aitken (1974:161) has suggested that such regions should be about 500-1000 miles in diameter. Even in regions of this size, contemporaneous VGP's differ slightly, but usually the effect on the precision and accuracy of archeomagnetic results is small. Since a polar curve for any area crosses over itself and since there are sections which pass close together of quite different age (Figure 12-1), it is necessary to know the approximate age of the sample before an archeomagnetic date can be determined.

Field and Laboratory Procedures

Specimen collection in the field is carried out by encasing a small column of fired clay carved from the baked archeological feature in a plaster cube. Collection procedures at the Zebree site, using a cross test level and a Brunton compass to orient individual specimens, are similar to those described by Watanabe (1959:27-30) and Thellier (1967). To obtain good precision, a minimum of five or six (and usually eight to ten) specimens are collected from each feature sampled.

In this study, the measurements of the remanent magnetic direction in the specimens were made using a three-axis Superconducting Technology cryogenic magnetometer interfaced with a computer which provided rapid and accurate measurement (Goree and Fuller 1976). As the direction of the geomagnetic field changes, a small portion of the magnetism in a stationary piece of fired clay become realigned. This effect is called viscous remanent magnetism (VRM). Lightning strikes, which generate strong magnetic fields, can also cause realignment of a portion of the magnetism. These secondary components can be eliminated using alternating field demagnetization (Aitken 1974:153-154), which randomizes that portion of the specimen's magnetism that is most easily changed by exposure to a magnetic field. The criterion of least dispersion (Irving 1964:89) was used to determine the optimum level of demagnetization for each sample. Even after AF demagnetization one, two, and, occasionally, three specimen directions may differ significantly from the average direction for the sample. A common procedure used in statistical analyses of many types of data is to exclude those specimens from the sample for which there is a small chance that they belong to the population. In much of the archeomagnetic work undertaken in the United States, including this study, specimens whose directions have less than a 10% chance of belonging to the population of specimen directions are not used in calculating the final result.

Precision and Accuracy of Archeomagnetic Dating

The precision of the paleo-direction is based on the degree of clustering of the specimen directions. A statistic developed by Fisher (1953) is applied to the specimen directions and the precision of the result is expressed by the parameter alpha-95 which is the half-angle of a circular cone about the mean direction such that there is a 95% chance that the true direction lies within that cone. The dipole formula transforms the circular cone into an oval in the polar region. The precision of an archeomagnetic date depends on the rate of change of the VGP, the configuration of the polar curve, the size of the oval of confidence (which is a function of alpha-95 and the distance from the site to the VGP), the spatial relation of the oval to the curve, and non-dipole variation in the region where the curve was developed. It should be noted that when a VGP is directly on the polar curve a greater portion of the curve is included in the oval of confidence than when the VGP is somewhat off the curve. If the precision of the date is based strictly on the portion of the curve included within the oval, somewhat paradoxically, dates obtained from VGP's with poorer accuracy will often have better precision than those obtained from VGP's which fall directly on the curve. It is, therefore, suggested that the precision in years always be at least the length of the minor semi-axis of the 95% oval of confidence in degrees divided by the rate of change of pole position. The formulas for calculating the lengths of the minor and major semi-axes of an oval of confidence are given by Irving (1964:69-70).

After secondary components are removed using alternating field demagnetization, most samples of eight to ten specimens have alpha-95 values in the one to four degree range. Since the rate of change in VGP position in the time periods studied in the Southwest and Arkansas was somewhat more than $1^{\circ}/10$ years and the major semi-axis of the 95% oval of confidence in these time periods was never more than 1.5 x alpha-95 and since the geomagnetic field is nearly dipolar in these regions, the precision of the dates at the 95% confidence level is approximately plus or minus 10 to 15 times the alpha-95 value. The precision of the results can, of course, be improved by collecting more specimens. Since alpha-95 is inversely proportional to the square root of the number of specimens collected, it is often not worth the extra effort. However, it should be noted that much slower rates of change of VGP positions have occurred. Declination and inclination values determined by direct measurement indicate that the rate of change of the Southwest VGP between 1839 and the present was about one-fourth as rapid as during the time period A.D. 600-1500 (Wolfman 1978:3). During such time periods, the precision and accuracy of archeomagnetic dates will be considerably reduced. The accuracy of the method is based on the calibration of the polar curve as well as whether or not a unique pole position exists, since sections of the curve cross each other and sections of different age pass close together (Figure 12-1). Consequently, an approximate age for a sample must first be determined by an independent method (usually phase placement on the basis of material culture is sufficient) and then the archeomagnetic method can usually determine a more precise and accurate date. To a lesser extent, non-dipole variation in the region where the curve was developed as well as systematic errors in collection or measurement can also reduce the accuracy of the method.

Occasionally, an aberrant VGP position at some distance from its expected position is obtained. The sources of such aberrant results in archeomagnetic dating are not always clear. The most obvious sources of error, movement of the baked feature, collecting and laboratory errors, and significant local geomagnetic anomalies are apparently rare. On purely statistical grounds, it is expected that 5% of the results should fall outside the 95% oval of confidence. In developing an archeomagnetic chronology in a new region, it is expected that some problems related to definition of the curve and its calibration will exist, but they should be resolved as work progresses. In addition, it is known (Aitken and Hawley 1971) that in large well baked kilns, the earth's magnetic field is distorted by the magnetism of the structure which can give rise to aberrant archeomagnetic directions, but such highly magnetized structures are rare in North America. More systematic work is needed to determine if all of the occasional aberrant results can be attributed to these causes.

When reporting archeomagnetic dates, it is standard practice to include an error figure (the familiar $\pm$ following the date) which is only the precision of the date at the 95% confidence level but does not include an estimate of the error of the accuracy. The convention of reporting only the precision of the result is also used for radiocarbon dates listed in the journal Radiocarbon.

Archeomagnetic Dating in Arkansas and the Border Areas of Adjacent States

For the past five years, archeomagnetic samples have been collected in Arkansas and adjacent parts of Tennessee and Missouri. At this time, the remanent magnetic direction in about two-thirds of the specimens collected have been measured.

Baked features dating between A.D. 1200 and 1500 including Mississippian hearths and the floors of burned Caddoan structures are abundant in Arkansas. Although not nearly as abundant, there are probably sufficient baked features dating between A.D. 600 and 1200 to allow archeomagnetic dating in this time period as well. Thus far, no baked features earlier than A.D. 600 have been encountered in Arkansas, but the existence of stratified archaic hearths elsewhere in the eastern United States (e.g., Chapman 1975) suggests that archeomagnetic dating in earlier time periods in the state may also be possible.

Thus far, 45 samples, almost all dating A.D. 1200-1500, have been processed. Of these, 32 samples had alpha-95 values of less than four degrees and their VGP's suggest that the Arkansas curve should be a slightly modified version of the Southwest curve (Figures 12-2 and 12-3). Independent dating of the Arkansas samples based on radiocarbon and ceramic cross-dating suggests that the calibration of the Arkansas curve is virtually the same as the Southwest curve, but additional data on this point would be desirable. Consequently, although the precision of the archeomagnetic dates from Arkansas, in most cases, is quite good (on the order of ± 20 to 40 years at the 95% confidence level), the accuracy of the dates which depends on the calibration of the curve might be off by as much as 50 years, but probably isn't. Therefore, until further independent dating is accomplished, all reported archeomagnetic dates should be considered approximate. The results have been more completely discussed in a recently published article (Wolfman 1979).

Unfortunately, only two samples [including one from the Zebree site (ZB48) which is discussed in detail below] significantly earlier than A.D. 1200 from Arkansas have been processed. Consequently, the polar curve for the A.D. 600-1200 time period in this area remains

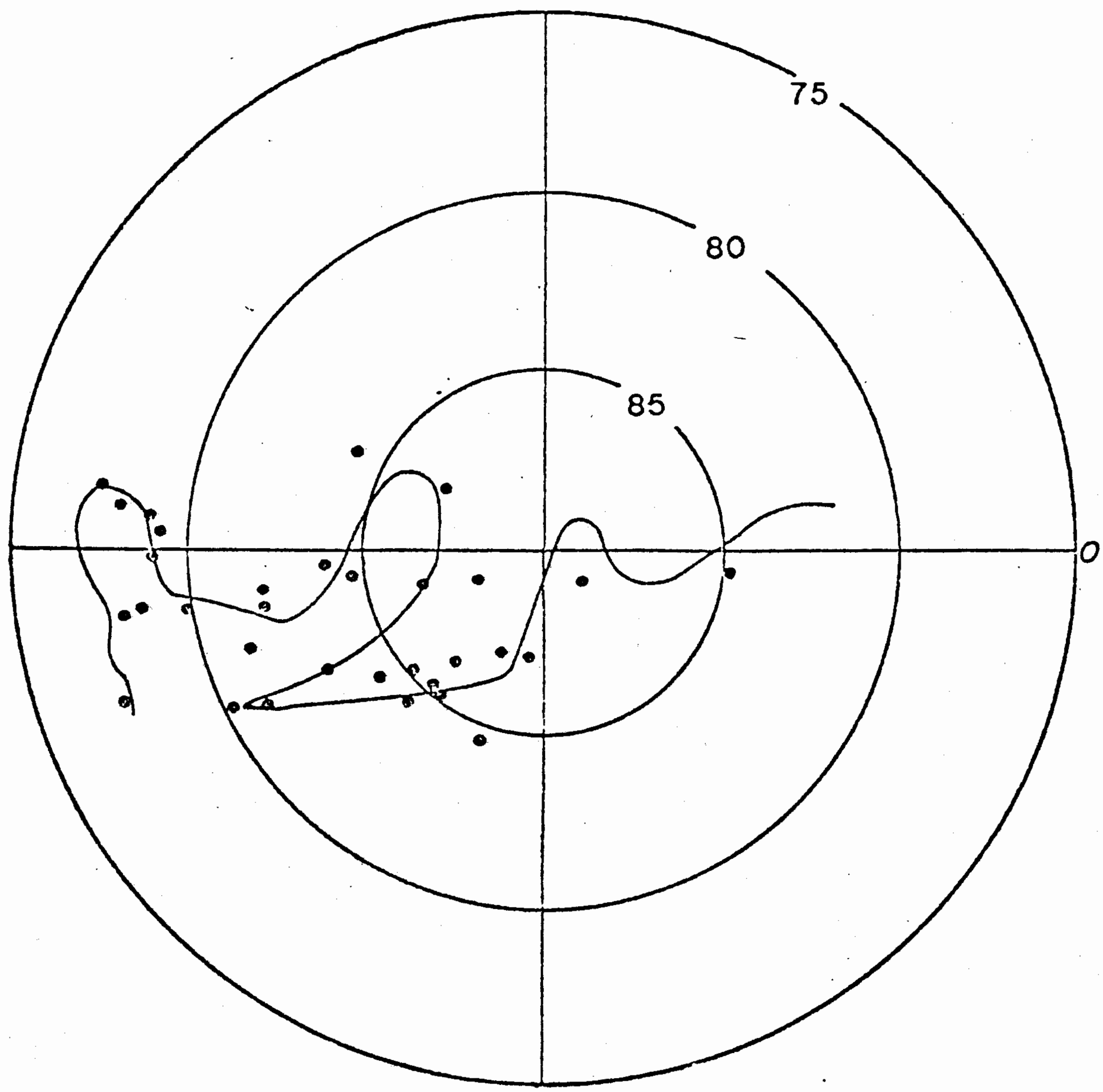


Figure 12-2. Arkansas polar curve: approximate time period A.D. 1200 - 1500.

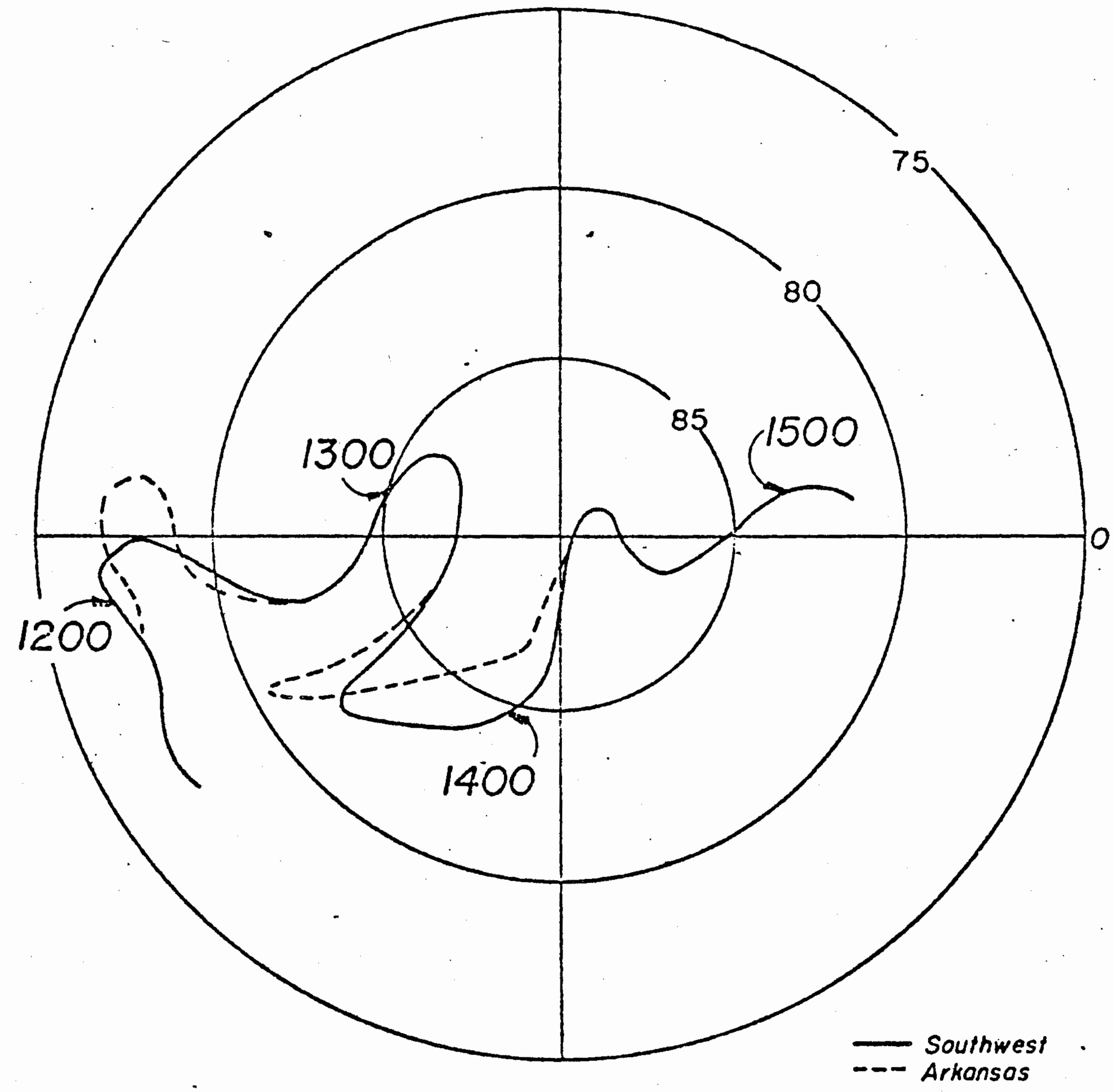


Figure 12-3. Arkansas and Southwestern polar curves A.D. 1200 - 1500 (calibration of the Arkansas curve is tentative).

to be defined. However, the one sample from Arkansas in this time period aside from ZB48 which has been collected and processed, based on independent evidence, dates approximately A.D. 650-800 and its VGP is within one degree of the Southwest polar curve within that time range. Consequently, on the basis of the great similarity of the Arkansas and Southwest polar curves for the time period A.D. 1200-1500, the proximity of Arkansas to the Southwest, and the result from one independently dated sample, it seems likely that the polar curves for both areas during the A.D. 600-1200 time period will also be similar.

The results obtained thus far are very encouraging. All of the virtual geomagnetic poles of samples collected from stratigraphic sequences are in the correct order. Although there are two samples in the A.D. 1200-1500 time range whose remanent magnetic directions indicate ages at variance with the expectations of the archeologists in charge of the excavations from which they came, in both cases, the discrepancy is less than 100 years. Only future work will tell whether the problem lies in the archeomagnetic samples or current understanding of the archeological sequence.

Archeomagnetic Results from the Zebree Site

Two archeomagnetic samples were collected at the Zebree site August 28 and 29, 1975. The results are listed in Table 12-1 and the virtual geomagnetic poles with their ovals of confidence are shown on Figure 12-4. The polar curves for Arkansas in the A.D. 1200-1500 time period and the Southwest in the A.D. 600-1200 time period are also shown on this figure. The archeomagnetic result for sample ZB49 (collected from Feature 282), ca. A.D. 1220 ± 50, is in good agreement with its Lawhorn phase context. The result for sample ZB48 collected from Feature 280 which almost definitely was baked during the Big Lake phase, however, suggests a date somewhat later than expected. The portion of the feature from which the sample was collected was well baked and the specimen directions clustered quite well (alpha-95 = 2.5^{o}). Although there were no diagnostic sherds in the level where this feature was found, the sherds in the levels immediately above it indicate a Big Lake phase placement.

The temporal placement of the Big Lake phase at the Zebree site and in the surrounding region has recently been revised on the basis of 12 new radiocarbon dates (see Chapter 11) and an overall reevaluation of the relevant data throughout the region. Before the results from the radiocarbon samples from the Zebree site were received, on the basis of the ceramics recovered, Morse (1975:216) thought the Big Lake occupation at the Zebree site

Table 12-1. Archeomagnetic results from samples collected from Features 280 and 282 at the Zebree site.

Feature No.	Sample No.	Phase	Demag	N	VGP Lat.	VGP Long.	Alpha-95	Archeomag Date
280	ZB48	Big Lake?	150	7/7	N. 83.7	W. 132.5	2.5	1105 ± 30
282	ZB49	Lawhorn	300	9/8	N. 78.6	W. 171.9	3.2	1210 ± 50

The entries in the fifth column with the heading "N" indicate the number of specimens used in computing the result, followed by a slash ("/") followed by the total number of specimens in the sample.

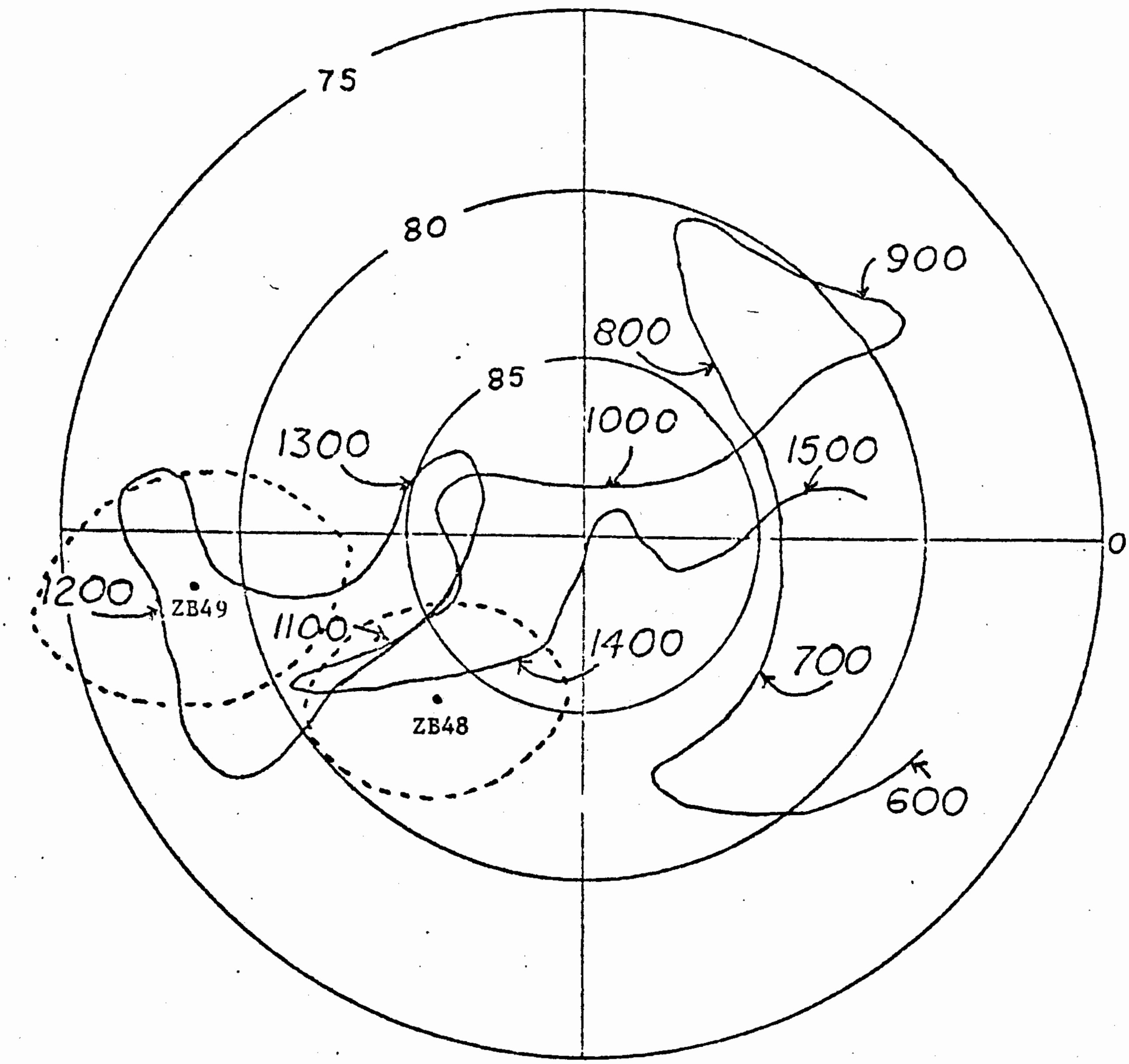


Figure 12-4. Arkansas polar curve A.D. 1200 - 1500 (calibration tentative) and Southwest polar curve A.D. 600 - 1200 with VGP's and 95% ovals of confidence for ZB48 and ZB49.

dated about A.D. 900-1100. On the bases of the radiocarbon dates and the absence of such diagnostic cultural material as Ramey Incised, Morse (personal communication) suggests that the Big Lake phase at the Zebree site dates between A.D. 800 and 1000 and that the Zebree site was abandoned until the Lawhorn phase occupation began at about A.D. 1250. However, two of the radiocarbon dates, (A.D. 1020 and 1076) may be indicative of a somewhat later ending date for this phase at the Zebree site. The 95% oval of confidence around ZB48 includes two sections of polar curve: A.D. 1365-1405 on the Arkansas curve and A.D. 1080-1130 on the Southwest curve. A date between 1365 and 1405 is certainly not possible for a Big Lake phase sample. Although there is hardly any archeomagnetic data from Arkansas samples dating earlier than A.D. 1200, as discussed above, there is good reason to believe that the Arkansas and Southwest polar curves are very similar in the A.D. 600-1200 time period. The data, therefore, suggest an archeomagnetic date of ca. A.D. 1100. Since considerable evidence suggests that the Big Lake phase at the Zebree site ended prior to A.D. 1100, the archeomagnetic result obtained for ZB48 needs to be explained. There are four apparent alternatives.

1. Feature 280 was baked at about A.D. 1100. This is consistent with the archeomagnetic evidence and, if between A.D. 1050 and 1150 the Arkansas curve was slightly to the east of the Southwest curve during this time period, the archeomagnetic evidence would be even stronger. A date of ca. A.D. 1100 is consistent with earlier estimates of the age of the Big Lake phase at Zebree, but it is inconsistent with Morse's current estimate of the time span of this phase at the site. However, since radiocarbon dates of A.D. 1020 and 1076 were obtained, the evidence that the site was abandoned between A.D. 1000 and 1150 is not overwhelming and there may have been a sparse and/or intermittent occupation of the site during this time period.

2. It is possible (but on the basis of radiocarbon and cultural cross dating unlikely) that although the Arkansas curve is very similar in configuration to the Southwest curve, its calibration is up to 50 years earlier. Such a view is in accord with one model of secular variation (Yukutake 1967) but another model (Kawai et al. 1965), which has gained additional support from archeomagnetic data for several areas (e.g., Barbetti 1977), allows the contemporaneity of both calibrations. Ultimately, the question of the calibration of the Arkansas curve will be resolved when more chronological information based on independent dating methods is obtained. A 50-year shift in the calibration would bring the archeomagnetic date for the baking of feature 280 back

to *ca*. A.D. 1050 which is much closer but still somewhat later than Morse's Big Lake phase end date of A.D. 1000.

3. An unlikely but possible third alternative, that feature 280 from which ZB48 was collected and baked during the Barnes phase, should also be considered. It is conceivable (see Figure 12-4), but not very likely, that between about A.D. 600 and 700 the polar curve for Arkansas differed somewhat from the Southwest curve and passed close to the pole position obtained for ZB48.

4. Finally, it is possible that the archeomagnetic result for ZB48 is, for some reason, incorrect, Earthquake cracks have been observed at the Zebree site. Slumping of the deposits in the direction of the cracks could have moved the baked feature which would, of course, change the direction of the magnetic vector. However, I would expect a physical disturbance of the magnitude necessary to move the feature sufficiently to account for the difference between the magnetic directions in the A.D. 800-1000 and the A.D. 1050-1150 time periods would have been noticeable. Other sources of error, including collecting error, are possible but not likely.

Concluding Remarks

Further archeomagnetic work in Arkansas and adjacent states will lead to the development of the polar curve for this area for time periods earlier than A.D. 1200. Although the Zebree site no longer exists, future research in the region will undoubtedly be undertaken to determine if the unexpectedly early beginning of the Big Lake phase implied by the recently processed radiocarbon samples is supported by additional data. Archeological work at other sites in the region may also provide data about the possibility of a limited Big Lake phase occupation at the Zebree site in the A.D. 1000-1150 time period.

Acknowledgements. The laboratory work was undertaken in the rock magnetism laboratory at the University of Pittsburgh. I thank Dr. Victor Schmidt, director of this laboratory, for allowing me to use the equipment. The work on archeomagnetic dating, reported in this chapter, was supported by the Arkansas Archeological Survey.

CHAPTER 13

RECONSTRUCTION OF THE 19TH CENTURY ENVIRONMENT

Suzanne E. Harris

During the past decade reconstructions of the 19th century environment have been used with increasing frequency by archeologists in their interpretations of prehistoric culture. Accepting the inherent problems of surveyor bias, distance between sample points, etc., the information recorded in the 19th century Government Land Surveys remains the best data source for the environment prior to intensive land clearance and agriculture. These surveys, plus other 19th century accounts when available, provide the base line from which reconstructions of prehistoric environments can be made, although this latter type of study is in its infancy at present. Several environmental reconstructions have been made in southeast Missouri and northeast and southern Arkansas: Lewis (1974) in the eastern Cairo Lowlands, and Waselkov and Cottier (1976) in the western Cairo Lowlands, Missouri, northeast of the Big Lake highlands area, Krakker (1977) in Mingo Swamp, Missouri, to the northwest; Wogaman (1976) in Village Creek, Arkansas, to the west; and in southern Arkansas (Rolingson 1976) in the Bayou Bartholomew area.

Initially we had planned to use two additional lines of evidence. First, we had expected to concentrate on prehistoric environmental changes in the vicinity of the Zebree site (and associated changes in human adaptation), resulting from the hypothesized formation of Big Lake prior to the appearance of the early Mississippi population in the area. A lacustrine succession model based on modern studies would have been constructed. After the radiocarbon date (AD 1790) on the basal part of the Big Lake pollen core indicated that the lake possibly post dated the New Madrid earthquake (1812), a more stable swamp environment prehistorically seemed more likely. Second, we had hoped to compare a series of pollen samples from the Zebree site cultural deposits and from the lake core with the 19th century vegetation in order to examine differences between the two. Based on 10 samples analyzed by Dr. Allen Solomon, University of Arizona, pollen was not preserved in statistically significant quantities at the Zebree site, and as just noted the Big Lake pollen cores did not extend into the prehistoric period.

Two types of analyses were used in the reconstruction of the prehistoric environment, or more specifically, the plant communities of the Big Lake Highlands area. The first was a cross-tabulation (X^2) of the 19th century witness trees species and land form, modern soil associations, and line descriptions at the section and quarter-section corners (Appendices, Section VIII). With this method we were attempting to formulate plant associations statistically. The second was a more traditional approach, the mapping of the witness trees and topographic information in the line descriptions, from which intuitive plant associations based on modern vegetational studies were defined. The methodology and results of both types of analysis are presented below, followed by the reconstructed microenvironments of the area and postulations about the prehistoric microenvironments.

The Government Land Surveys

The earliest survey of the Big Lake Highlands area was made along the Missouri-Arkansas state line by George Brown in 1824. The township boundaries (exterior lines) and section lines (interior lines) were surveyed during the mid 1840s. The extreme southwest corner of the research area was surveyed by Israel M. Moore, December, 1845; the eastern two tiers of townships were surveyed by Benjamin L. Owens, December, 1846 and November, 1847, the western tier was surveyed by James M. Danley, November, 1847. The swamps associated with the St. Francis and the Little River and Big Lake were not surveyed. November, 1847, was apparently an unusually wet time; Daniel G. Saunders, a surveyor working the adjacent portion of Missouri, noted heavy rainfall in late October and early November. In 1914 the boundary of Big Lake, somewhat reduced, was resurveyed and the section lines were rerun because virtually all the corners had been destroyed.

The surveyors designated four witness trees, one in each directional quadrant, at each section corner, and two witness trees at each quarter-section corner. The common name of the tree (identified to genus but often not to species) was given, plus the direction and distance from the corner to the tree and the tree's diameter. Line descriptions for each mile surveyed included the dominant timber and understory, above or below overflow, and fitness for cultivation.

The research universe for the Big Lake Highland area, covering approximately 120 square miles, included survey points for which a total of 1033 trees were recorded (plus three quadrants with no trees). The line descriptions did not record any major vegetational changes except swamps and sloughs, and on the west side of the Big Lake Highland a note was occasionally made of entering or leaving "high ground." Thus little diversity in the vegetation of the area was specifically recorded in the Government Land Surveys. The most frequent tree species recorded was sweet gum (17.5%), followed by sycamore (12.4%), ash (10.5%), cottonwood (9.6%), cypress (8.2%), and elm (7.2%). Oaks as a group represented only 6.1% of the total, while hickory was represented by only three trees (.3%). This suggests a sweetgum-elm forest, with cottonwood and sycamore overflow areas and cypress swamps. No prairie was reported in the immediate vicinity, although the Grand Prairie began some three miles to the north of the Arkansas-Missouri state line on the same land form as the sweetgum-elm forest. Undergrowth was usually recorded as briers and vines and was not useful. Surprisingly no cane was noted in any of the mid-19th century surveys although cane was noted in 1824 near Mud Slough about 3 miles east of the St. Francis River.

The cross-tabulations indicated associations of tree species and land forms similar to the tree types proposed by Putnam and Bull (1932). Although only two or three species of a tree type were found to be correlated with a land form, in some cases two tree types appeared to be associated with the land forms at different elevations. A major discrepency was that Putnam and Bull (1932: fig. 3) classified all of the Arkansas portion of the Mississippi Valley east of Crowley's Ridge as first bottoms with the exception of one small area of second bottoms which coincides with the Big Lake Highlands. The typical tree types of second bottom ridges were oak-hickory (#1) or sweetgum-loamy ridge oaks (#4), while the predominate trees of the Big Lake Highland were more similar to the red gum or sweetgum associates (#5), with elm and hackleberry as major correlates. In terms of Putnam and Bull's classification, then, the Big Lake Highland area was most similar to the sweetgum type (#5), with hackberry important, and the cottonwood type (#3) on the lake and creek margins to the east and west. The low areas within the Big Lake Highland were similar to the cottonwood type with willow important. The cypress hardwood type (#11) is most similar to the trees correlated with the swamps and sloughs throughout the area. The ridges west of the Big Lake Highlands were correlated with species of the sweetgum type and the presence of white oak suggested small areas of the sweetgum-loamy ridge type, based on the presence of white oak. The low areas associated with these ridges were correlated with tree species similar to the sweetgum type and the Southern hardwood type.

The correlation of specific nut and fruit tree resources and land forms, soil types, and line descriptions is presented in Table 13-1. The positive correlations were not strong due to the low frequency, but the cross-tabulation analysis is useful for predicting where these species are likely to occur. White oak, hickory, black walnut, hackberry, and mulberry were most frequent on the Big Lake Highlands and other ridges, and the higher or intermediate soils. Cow oak, having the largest and sweetest acorn of the oaks (Stayermark 1963:539) was located on the edge of the ridges adjacent to low wet areas. Overcup oak, pecan, and persimmon were found in low areas.

<u>Cross Tabulation of Tree Species and Land Variables</u>

The distribution of plant associations in the Mississippi Alluvial Valley is dependent upon elevation to a large degree (Putnam and Bull 1932). The Big Lake Highlands area is primarily between 230 to 240 feet above m.s.l. and the relief is generally around 5 feet. We initially considered plotting the approximate elevation above the nearest water source for each of the section and quarter section corner sampling points, but the 5 foot contour intervals of the U.S.G.S. quadrangle maps were too gross for this approach to be useful. Therefore, land variables largely dependent upon elevation were used which included land forms, modern soil associations, and land descriptions in the Government Land Survey line descriptions.

The cross-tabulation (X^2) of the tree species recorded on the GLO maps and the land variables was performed in an attempt to formulate plant associations statistically which could be compared with the study of tree species and topographic units made by Putnam and Bull (1932) in the Mississippi Alluvial Valley, and the intuitively derived plant associations in the following section. The cross-tabulation analysis potentially could indicate the association of specific tree borne nut and fruit resources with specific topographic units and soil types and aid in predicting the occurrence and frequency of these resources. The cross-tabulations are presented in the Appendix, Section VIII.

In coding the land forms two sources were used: a U.S. Army Corps of Engineers map (on file with the Arkansas Archeological Survey, Arkansas State University) which was the only source located specifically delineating the Big Lake Highlands, and the early 20th century soils maps for Mississippi and Craighead counties. Units defined were: 1) Big Lake Highlands ridge, 2) wet areas within the Big Lake Highlands, 3) other ridges, 4) other wet areas

TABLE 13-1

CROSS-TABULATION OF POSITIVE CORRELATION OF NUT AND FRUIT TREES BY LAND FORM, SOIL TYPE AND LINE DESCRIPTION, RECORDED IN WITNESS TREES

Tree Species	#	%	Land Form,[1]	Soil Type	Line Description
White Oak	33	3.0	OR	Du, Td, FSL	1st rate, above overflow
Cow Oak	2	.2	BR, OR	low	1st rate, lake margin
Overcup Oak	6	.6	OL, Slough	Slough, low	overflow, swamp
Red Oak	6	.6	BR, OR, BL, Slough	Td, Rd	1st rate, overflow
Pin Oak	9	.8	OR, OL, Slough	Du, Rd	good, overflow
Black Oak	1	.1	OR	Rd	1st rate
Water Oak	5	.5	BR, OR	Dv, Rd	1st rate
Spanish Oak	4	.4	BR, OL	Rd, FSL	1st overflow
Hickory	3	.3	OR	Td, Du	1st rate
Pecan	1	.1	BL	low	1st rate
Black Walnut	4	.4	OR, OL	Rd, FSL	good, overflow
Hackberry	31	2.9	Br, OR	Rd, Td	1st rate, good
Mulberry	11	1.0	OR, BR, OL	Rd, Du, Dr, Td, FSL	1st rate, overflow
Persimmon	4	.4	Slough, OL	Slough, FSL	overflow, swamp

[1]Land Form: BR = Big Lake Highlands ridge; BL = Big Lake Highlands low; OR = other ridge; OL = other low

SOIL TYPE: Du = Dundee silt loam, Dv = Dundee-Dubbs-Crevasse Complex, Td = Tiptonville-Dubbs Complex; Rd = Routon Complex; F. S. L. = Fine Sandy Loam; low = Sharkey-Steele; Slough = Iberia & Jeanerette and, 5) swamps and sloughs. Both Big Lake Highland categories (ridge and wet) correlated positively with more hydric species than the "other" counterparts. (In the intuitive plotting of the tree species it appears that much more low ground was included in the Big Lake Highlands than had been obvious from the Corps map and the early soils maps.) The Big Lake Highlands land form correlated positively with hackberry, cottonwood, and birch (the latter along the lake margin) while the low areas correlated with cypress and willow. The other ridges correlated with white oak, elm, hackberry, sweetgum, sycamore, and box elder; the other wet correlated with cypress, willow, sweetgum (weak), maple, tupelo, and willow (weak). The sloughs and swamps correlated with cypress, tupelo, and willow (weak).

The soil types were coded into seven categories of related soil types; the lumping was necessary because of differences in soil type names between the two counties involved. The soil categories were formulated in consultation with Dick Ferguson, Soil Conservation Service, Jonesboro, who has studied the soils of both counties.

The soils of the Big Lake Highlands area in Mississippi County have been classified in the Amagon-Dundee-Crevasse Association. These soils are either "poorly drained and somewhat poorly drained soils that are loamy throughout" (Amagon and Dundee Series) or "excessively drained soils that are sandy throughout" (Creavasse Series) (Ferguson and Gray 1971:3).

The soils of Big Lake itself have been classified in the Sharkey-Steele Association. The Sharkey Series occurs at the low elevations and is comprised of poorly drained soils having a thick clayey subsoil. The Steele Series occurs at slightly higher elevations and is comprised of moderately well drained soils that are sandy in the upper part and clayey in the lower part (Ferguson and Gray 1971:3). The following description is summarized from the *Soil Survey of Mississippi County, Arkansas* (Ferguson and Gray 1971).

The Big Lake Highlands proper, paralleling the Right Hand Chute and Big Lake, are comprised of the Dundee-Dubbs-Crevasse complex and the Tiptonville and Dubbs silt loams. The Dubbs and Tiptonville silt loams occur at the higher elevations, 2-4 feet above the present winter high water table. These two soils are essentially similar except for the darker color of the Tiptonville series. The Tiptonville series is classified as a Mollisol and may have been modified by prairie conditions; it has also been

TABLE 13-1

CROSS-TABULATION OF POSITIVE CORRELATION OF NUT AND FRUIT TREES BY LAND FORM, SOIL TYPE AND LINE DESCRIPTION, RECORDED IN WITNESS TREES

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Red Oak	6	.6	BR, OR, BL, Slough	Td, Rd	1st rate, overflow
Pin Oak	9	.8	OR, OL, Slough	Du, Rd	good, overflow
Black Oak	1	.1	OR	Rd	1st rate
Water Oak	5	.5	BR, OR	Dv, Rd	1st rate
Spanish Oak	4	.4	BR, OL	Rd, FSL	1st overflow
Hickory	3	.3	OR	Td, Du	1st rate
Pecan	1	.1	BL	low	1st rate
Black Walnut	4	.4	OR, OL	Rd, FSL	good, overflow
Hackberry	31	2.9	Br, OR	Rd, Td	1st rate, good
Mulberry	11	1.0	OR, BR, OL	Rd, Du, Dr, Td, FSL	1st rate, overflow
Persimmon	4	.4	Slough, OL	Slough, FSL	overflow, swamp

[1]Land Form: BR = Big Lake Highlands ridge; BL = Big Lake Highlands low; OR = other ridge; OL = other low

SOIL TYPE: Du = Dundee silt loam, Dv = Dundee-Dubbs-Crevasse Complex, Td = Tiptonville-Dubbs Complex; Rd = Routon Complex; F. S. L. = Fine Sandy Loam; low = Sharkey-Steele; Slough = Iberia & Jeanerette suggested that some modification may have taken place through prehistoric human activity (D. Ferguson, personal communication). The Dundee silt loam occurs at somewhat lower elevations, .5-1 foot above the winter high water table and is more poorly drained than the Dubbs and Tiptonville soils. The Dubbs, Tiptonville, and Dundee soils have the highest modern agricultural potential, although that of the Dundee soils may be somewhat lower due to its poorer drainage. The Crevasse loamy sand occurs at the highest elevations (3-6 feet above the winter high water table). These soils are too sandy to have a high agricultural potential and may have been extruded from fissures during the New Madrid earthquake.

The predominate soil complex west of the Big Lake Highlands is the Routon-Dundee-Crevasse complex, which also occurs on the Highlands north and east of Manila. The Routon sandy loam also occurs at .5-1 foot above the winter high water table, but is more poorly drained than the Dundee soils and has a lower agricultural potential. The Routon sandy loam is quite similar to the less frequent Amagon sandy loam which also occurs at elevations about .5-1 feet above the winter high table, is more poorly drained than the Dundee soils, and has a relatively low agricultural potential. The Routon soils range from medium acid to neutral, while the Dubbs, Tiptonville, Dundee, and Amagon soils range from strongly acid to medium acid. With the exception of the Tiptonville, all are classified as Alfisols.

The soils of the sloughs in the area are predominantly Jeanerette silt loam, Steele silty clay loam, Sharkey silty clay, Tunica and Iberia clay. The Jeanerette and Iberia soils are classified as silty clay, Mollisols modified by water and may have developed under sedge vegetation. The Steele, Sharkey, and Tunica soils are classed as Entisols or Inceptisols and as such are though to be of more recent deposition than the soils listed above. The agricultural potential of the Jeanerette and Tunica soils is relatively high, but not as high as those soils listed above.

Adjacent to the sloughs are some patches of sand, ranging in elevation up to 6 feet above the winter high water table. These included the Crevasse loamy sand, the Bruno loamy sand, and the Hayti fine sandy loam. The Crevasse and Bruno soils are excessively drained, while the Hayti soils are poorly drained; in each case the agricultural potential is low.

As indicated above, the soils of Big Lake are in the Sharkey-Steele association. The Steele loamy sand or silty clay loam occurs at higher elevations, up to 1-2 feet above the winter high water table. These often occur as patches of sand, extruded by the New Madrid earthquake, which are interspersed by the Sharkey clays. The sand blows average 8-15 feet in diameter and 3-6 inches in height, but may be as long as several hundred feet. The Sharkey soils are on broad flats, and developed in thick beds of clay depositied by slack water. Both soils are thought to be of relatively recent origin and relatively low agricultural potential. The Steele silty clay loam, on which the Zebree site is located, is of a somewhat higher agricultural potential, though not as high as the Dubb, etc., soils.

The soil survey of the western portion of the Big Lake Highlands area in Craighead County is not yet complete, but advance sheets were made available by Dick Ferguson of the Soil Conservation Service. The soils of the western area are similar to those just described.

The Tiptonville silt loam which occurred at higher elevations on the Big Lake Highlands and further west correlated positively with white oak, boxelder, elm (weak), and hackberry (weak). Fine sandy loams also occurring at intermediate elevations correlated positively with white oak and maple (weak). The Dundee silt loams at intermediate positions correlated positively with white oak, black gum, cottonwood, birch, and elm (weak). The intermediate Dundee complex correlated with boxelder and birch, while the broad intermediate elevation Routon category correlated with cottonwood, birch, hackberry, sycamore, maple, boxelder and weakly with ash, willow and sweetgum. Low, wet soils correlated positively with cypress, willow, tupelo, and ash (weak); the slough soils correlated positively with cypress, and tupelo gum. With the exception of a weak positive correlation with the Routon soils, sweetgum, the most abundant tree species in the area, did not correlate either positively or negatively with any of the other soil types.

The land descriptions made by the early surveyors along the survey line were coded into eight categories (including insufficient data) based on terms used to describe the land's potential for habitation. The first rate and good categories correlated positively with white oak, elm, hackberry, and sweetgum: the above overflow category correlated positively with white oak and boxelder. Overflow areas correlated positively with cypress, tupelo, willow, sycamore, maple, and cottonwood (weak). Swamps correlated with cypress, tupelo, and ash (weak). The lake margin correlated positively with cypress, willow, and birch. The line descriptions were generally applied to the entire mile surveyed; the terms were correlated with the trees at the quarter section point and the section corner at the end of the mile. Corners which appeared on the map at the junction of two descriptive categories were coded as insufficient data. This category correlated positively with cottonwood and sycamore, and was coded primarily in the area west of Buffalo Creek. The deepest overflow (8-10 feet) was recorded in the area adjacent to Buffalo Creek.

Mapping the Witness Trees and Formation of the Plant Associations

The second stage of the 19th century environmental reconstruction was the mapping of the Government Land Survey witness trees and the formulation of the plant associations. A base map was prepared showing the 1940s St. Francis and Big Lake lake margins, the relict channel of the late Pleistocene Mississippi River (Saucier 1964), the contour intervals, and the section lines. Witness trees at the section corners, quarter-section corners, and lake margins, swamp/slough boundaries and "high ground" (where noted) were plotted on the base map. Overflow was also noted; the depth of overflow was indicated in the eastern portion of the research universe, but only overflow presence or absence was noted in the western portion.

The swamp/slough boundaries when plotted coincided almost exactly with the relict channels suggesting a relative stability of the water course in the area from the end of the Pleistocene onward. Virtually all of the cypress and tupelo were located within the relict channels, making the interpretation of this plant association fairly straightforward. The interpretation of the higher areas was less clear cut since the contour intervals per se were not sufficiently close to be of value in delineating differences in vegetation. A primary distinction was made according to the presence or absence of overflow. Higher areas of Tiptonville-Dubbs soil complex, Dundee-Dubbs-Crevasse complex, and Dundee silt loam were noted, especially for the eastern portion of the research universe (in Mississippi County). Orthoquads for the area were also used in delineating some of the higher sandy areas, particularly in the western portions of the research universe. In addition, two trips were made through the area to spot check elevation differences at specific points and to compare these with the trees plotted on the map.

Five plant associations were plotted using an intuitive "connect the dots" method in which the boundaries were drawn based on information derived from modern studies of plant associations in the Mississippi Alluvial Valley (Putnam and Bull 1932, Braun 1950, Shelford 1954, Lewis 1974), the cross-tabulations and the line descriptions. Of the various reconstructions of 19th century environments cited at the beginning of this chapter, Lewis' (1974) reconstructed plant communities of the eastern Cairo Lowlands are the most similar to those of the Big Lake Highlands area. The five plant associations from the lowest elevation to highest were:

1. Cypress-tupelo plant association

This association, consisting of only the species cypress and tupelo, was restricted to relatively small areas of Buffalo Creek and Cockleburr Slough. It occurred at the lower elevations, with overflow 8-10' deep and represents the deepest swamp conditions. This association is similar to Putnam and Bull's (1932:14) Southern Cypress type (#14), Lewis' (1974:11) cypress community, and is a stage in Shelford's (1954:40) successional sequence of the Mississippi river flood plan.

2. Cypress-Hardwood plant association

This association included several hardwood species, ash, sweetgum, maple and elm, sycamore and cottonwood, in addition to cypress and was delineated by the relict Mississippi channels. The cottonwood and sycamore may represent transitional areas along the swamp margin. This plant association is similar to Putnam and Bull's (1932:49) Cypress-Hardwood type (#11), Braun's (1952: 292) swamp type, and appears to be intermediate between Lewis' Cypress deep swamp and sweetgum-elm-cypress communities (Lewis 1974:11, 25).

3. Cottonwood-willow-sycamore plant association

This association is dominated by the three species names, but includes low frequencies of other species such as ash and hackberry. The association is similar to Putnam and Bull's (1932:39) Cottonwood type, Braun's (1952:292) river succession, and Lewis' (1974: 11) Cottonwood-Sycamore plant community. This association occurs extensively west of the Big Lake Highlands and it covers a considerably larger area than that of Lewis, which is confined to the Mississippi river margin. This association is usually temporary, but apparently may stabilize in areas subject periodically to washing of large streams (Putnam and Bull 1932:39). This appears to be the case along Buffalo Creek and the slough running from Big Lake (the "arm of Big Lake" in the surveyor's notes). This plant association coincides fairly closely with overflow areas 2-6 feet in depth which were not in the relict channels.

4. Sweetgum-elm-hackberry plant association

This plant association included a variety of hardwoods in addition to the principal types: ash, blackgum, boxelder, several oak species, walnut, hickory, maple, and sporadically trees of the lower elevations. This association is similar to Putnam and Bull's (1932:41) Red Gum (Sweetgum) type (#5), Braun's (1950:293) hardwood

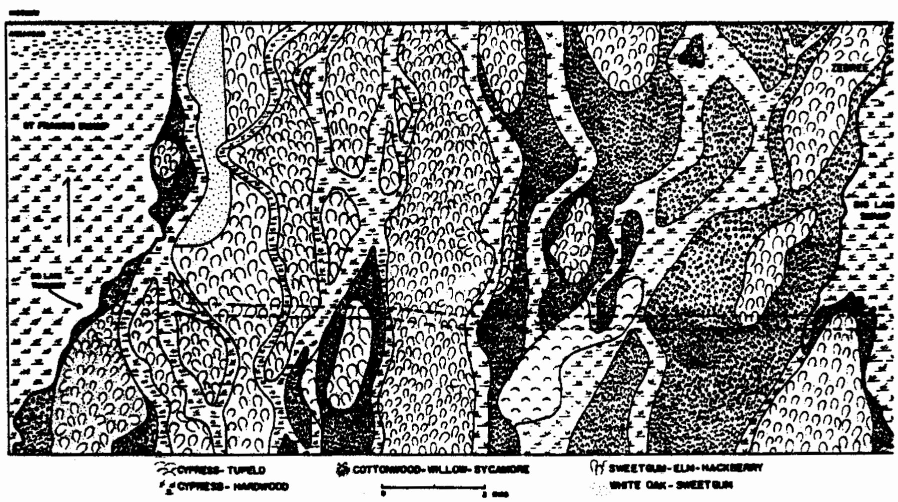

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Figure 13.1. Reconstructed mid-19th century plant communities of the Big Lake Highlands area.

bottoms, and Lewis' (1974:11) Sweetgum-Elm plant community. This association apparently includes more variation than the others, and this may be related to seasonal inundation. While this association was made in the fall and it may be that somewhat higher elevations of perhaps 1-2 feet were inundated for short periods during the annual spring flooding (cf Buffaloe 1961:160). The Big Lake Highlands area west of the Zebree site was predominately ash, elm, and sycamore, suggesting a slightly lower general elevation. The southwest corner of the research universe, however, appeared to represent somewhat drier conditions reflected by white oaks and may include areas similar to #5 which could not be delineated using the 1/2 mile sampling point interval.

5. White oak-"sweetgum" plant association

This association was limited to a narrow north-south ridge adjacent to the St. Francis River in the northwest corner of the research universe which represented the highest and driest area. It is similar to Association 4 with the addition of white oak. This association is similar to Putnam and Bull's (1932:40) Red Gum (Sweetgum) loamy ridge type (#4) and Oak-hickory type (#1), Braun's (1952:295) ridge bottom forest, and Lewis' (1974:11) Sweetgum-elm forest. (The term white oak-sweetgum may appear a misnomer since no sweetgums were recorded as witness trees in this area. However, given the similarity to Association 4, it was decided to use "sweetgum" as a cover term.)

Biotic Communities of the Big Lake Highlands Area

A discussion of the concepts of microenvironments and biotic communities may be found in Lewis (1974:5-7). Following Lewis, the biotic communities concept will be used since it is more widely accepted in ecological studies, although emphasis will be placed on the utility and relative abundance of various plant and animal species of importance to man. These biotic communities will be essentially similar to the plant association above. The areas mapped within the various plant associations, particularly the sweetgum-elm-hackberry plant association, contained more variation than can be detected from the government Land Survey records and may have contained small areas of some other plant association.

The most productive environment for acorns and hickory nuts was the white oak-"sweetgum" biotic community. This community occurred at the highest elevations in the area and could be mapped only along the east side of the St. Francis River. The highest, driest areas *may* have supported small areas of oak-hickory forest, but this could not be detected using the survey records. The two oaks producing the most edible acorns, white and cow oaks, would have been relatively more abundant in this biotic community than any other. From the list of important tree species given by Putnam and Bull (1932:37,40) for the redgum-loamy ridge oaks (and the oak-hickory forest) several hickory species including pignut, modar nut, shag bark, plus walnut and pecan, would have been must abundant here. Deer were the most important large mammal, particularly during the fall mast season when turkey was also abundant. Other large mammals, wapiti (elk), and bear, were also present. Small mammals included oppossum, raccoon, cottontail rabbit, grey squirrel, and fox squirrel. Predators were mountain lion, bobcat, and wolf (Shelford 1963:100,103).

The sweetgum-elm-hackberry biotic community, as noted above, covered large portions of the Big Lake Highlands area and contained various smaller habitats. Several species of oak (water, Nuttall, willow, Shumond) were available, plus water hickory, pecan, persimmon, hackberry, and redgum (Putnam and Bull 1932:41). Vines included various species of grape and catbriar (Shelford 1963). Mammal species listed for the previous biotic community were also present and more abundant here than in any of the communities at lower elevations discussed below.

The cottonwood-willow-sycamore biotic community, of course, contained few nut bearing trees, although some hackberry, mulberry, and persimmon were present. Several vine species were associated with this community, grape being most important to man (Shelford 1963:95). The large and small mammals, particularly raccoon and oppossum of the higher elevations, were present (Shelford 1963: 97). Shelford (1963:100) suggests bear and wapiti preferred areas adjacent to larger rivers so they may have frequented this community. The semiaquatic mammals, swamp rabbits, muskrat, beaver, and otter, were also present. Various resident and migrant birds were present (Shelford 1963:97). The now extinct Carolina paroquet may have been common in this community also (Lewis 1974:21).

The cypress-hardwood biotic community was associated with sloughs and swamps and was inundated for most of the year, although some peripheral portions may have dried during the summer. Some oaks (overcup, Nuttall, pin) were present, along with water hickory, hackberry, persimmon, and various maples also occurred. Raccoons and various semiaquatic fauna (swamp rabbit, beaver, muskrat, otter and mink) were the most prevalent animal. The mammalian composition of the swamp periphery probably changed seasonally as some areas became drier and more favorable habitats for larger species (deer, wapiti, etc.) and various smaller mammals. Portions of this community where cypress was more abundant may have supported heronries of fish-eating birds (herons, cranes, cormorants, egrets) (Shelford 1963:111).

The cypress-tupelo biotic community was inundated for a longer portion of the year. Few other floral species were of importance; the primary faunal species were fishes and fish eating birds, and some aquatic mammals. This community may have included marshes or other areas of standing water.

A marsh or littoral biotic community, not defined in the government Land Surveys, probably existed on the edges of permanent standing water in lakes, ponds, and sloughs. (This is similar to Lewis' [1974:26] water millet-lily marsh.) The 1824 government Land Survey of the Missouri-Arkansas state line mentions rushes, suggesting a marshy area along Buffalo Slough just west of the Big Lake Highlands. Marsh and open water areas must have existed at Big Lake and along the St. Francis River during the 19th century, although these areas were not surveyed then and little description of the vegetation was given. Fortunately a general study of the St. Francis River swamp from the northwest corner of the research universe to Kennett, Missouri, was made by Coulter (1904:54-62) around the turn of the century. Moving lakeward from the cypress-tupelo community, Coulter (1904:56) noted the following zones: 1) willow and button bush; 2) emergent vegetation: knotweed, water parsnip, lizard tail, arrow arum, cattail, and water millet; 3) floating leaf vegetation: American lotus (yankopen, Nelumbo lutea), and yellow water lily and; 4) free floating vegetation: water fern and duck weed. Portions of many of these species were edible, for example, seeds of knotweed and American lotus and roots of cattail, arrow anum, and possibly water parsnip. This biotic community also included aquatic mammals (beaver, muskrat, river otter, mink), fish-eating birds and seasonally migratory birds (various duck and geese species), turtles, newts, frogs, and fish (catfish, buffalo, gars) (Lewis 1974:27; Reid and Wood 1976:385).

An open water or limnetic community may have been present in portions of the Big Lake and St. Francis Swamps. The flora was primarily various algae species. The fauna was essentially that of the marsh community, with a greater abundance of fish.

CHAPTER 14

PALYNOLOGICAL STUDIES OF BIG LAKE, ARKANSAS

James E. King

The location of the Zebree site on the upper end of Big Lake presented a favorable situation for the application of pollen analysis to archeological problems. The lake provided the potential for obtaining a pollen derived vegetational history in close proximity to the Zebree site, but without the problems usually associated with the analysis of pollen from cultural deposits. While pollen analysis of archeological sites has been a valuable tool in elucidating prehistoric life-ways in the arid western states, its value in Eastern North America has been much more limited and fraught with problems (King, Klippel, and Duffield 1975). By sampling the lake sediments for pollen it was hoped that a continuous paleoenvironmental sequence of several thousand years duration could be obtained to complement the environmental data being gathered from the site. While our initial goal of developing a long pollen sequence did not materialize for reasons brought forth in this report, the shorter pollen sequence recovered from the lake proved equally valuable especially for its implication concerning the geological origin of Big Lake and the St. Francis Sunk Lands, and their relationship to the New Madrid earthquake of 1811-1812.

Only a bare sequential outline of Holocene vegetation change is known for the southern Midwest. Palynological sites in the region are few and far between, and what data is available must be extrapolated over wide areas. A pollen diagram recording the vegetation changes at the Old Field swamp near Cape Girardeau in southeastern Missouri (King and Allen, in press) indicates that prior to 8800 BP (6800 BC) the Mississippi Valley was occupied by a rich bottomland flora. About 8700 BP (6700 BC) effective precipitation apparently declined and ground water levels lowered as the swamp decreased in size and its swamp forest species were replaced by grass and herbs. This mid-Holocene period of drought, recently redefined by Wright (1976) as the Hypsithermal, continued at the Old Field, with minor fluctuations about 6500 (4500 BC), until approximately 5000 BP (3000 BC) when the pollen indicates renewed development of bottomland forest and increased water level in the swamp. The occupation at the Zebree site thus occurred during this third phase (post-Hypsithermal) of the Holocene environmental sequence. As more palynological sites are studied and additional pollen diagrams produced from the Midwest, a clearer and more detailed picture of vegetation change will be developed. The analysis of the pollen from Big Lake adds some of this needed detail to the broad sequence outlined above.

Big Lake and the St. Francis Sunk Lands

The St. Francis Sunk Lands in northeastern Arkansas and adjacent Missouri occur in an area of the Lower Mississippi Valley that was devastated in 1811-1812 by a series of seismic events referred to as the New Madrid earthquake. This earthquake, which epicentered near New Madrid, Missouri, affected a wide area of the the south-central United States and is listed as one of the greatest quakes in recorded history (Fuller 1912; Eppley 1965). The earthquake consisted of three major shocks, December 16, 1811, and January 23 and February 7, 1812, each followed by several days of almost continuous aftershocks and ground movement. These quakes were accompanied by earth swells "like the long, low swell of the sea," landslides, sand blows, bank caving and the formation of deep long fissures; the shocks were felt from Canada to New Orleans and as far east as Boston (Eppley 1965). The quakes had an intensity of XII on the Modified Mercalli Scale which is the maximum intensity possible and indicates almost total destruction.

Unfortunately for science, the interior of the United States was sparsely settled at the time of the earthquake and as a consequence there is little primary information concerning its immediate effects on the landscape. Most reports of the earthquake are secondary and seldom allude to specific geological phenomena. As a result, the relationship of the New Madrid earthquake to many topographic features within the region is uncertain.

The Lower Mississippi Valley, south of New Madrid, contains several lowland depressional features occupied by shallow lakes called "Sunk Lands" (Fuller 1912), the most widely recognized of which is Reelfoot Lake in eastern Tennessee. The group known as the St. Francis Sunk Lands comprise three such depressional features on the west side of the Mississippi Valley along the St. Francis and Little rivers and include Lake St. Francis, Hatchie Coon Sunk Lands and Big Lake.

Big Lake (Fig. 14-1), a complex of relict braided stream channels on the Little River, occupies an area almost 18 km by 5 km and encompasses over 11,000 acres. The lake area contains about 9000 acres of either open water or shallow water swamps and has been under federal protection since 1915 as a National Wildlife Refuge. The wooded

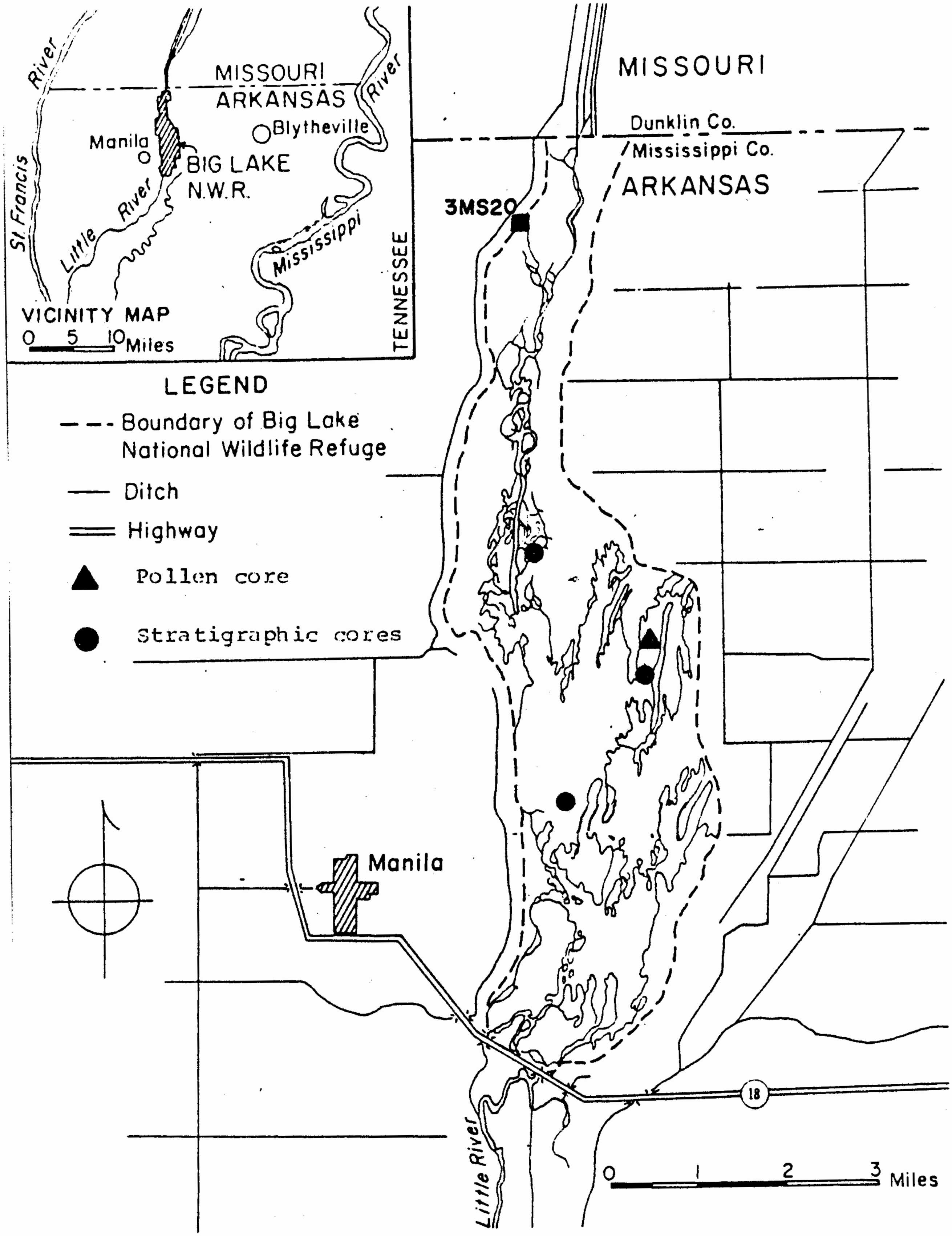

Figure 14-1. The location of Big Lake within the National Refuge, and location of core samples.

tracts within the refuge contain one of the largest areas of unaltered native vegetation in this part of Arkansas, including at least 500 acres of virgin bald cypress (*Taxodium distichum*).

The St. Francis Sunk Lands have historically been assumed to have originated as a result of the New Madrid earthquake (Fuller 1912; Eppley 1965). However, Saucier (1970) has presented evidence that Big Lake and the other basins within the St. Francis Sunk Lands developed prior to this earthquake. Based on geologic mapping (Saucier 1964; 1970) and the absence of faulting or other evidence of suballuvial tectonic activity, he suggests that these depressional features are the result of an earlier episode of alluvial drowning and that they were apparently unmodified by the 1811-1812 earthquake.

Alluvial drowning occurs when the natural levees of one stream aggrade fast enough to block or partially dam the mouth of a smaller tributary stream. The smaller stream is then ponded in its lower reaches because of its inability to aggrade to the level of the rapidly increasing levees of the master stream (Saucier and Fleetwood 1970). As the St. Francis River and its tributaries, including the Little River, were intercepted by the Mississipi River, 1000 to 1500 years ago, portions of the relict braided channels in the St. Francis system would have undergone alluvial drowning forming the sunk lands (Saucier 1970).

The Big Lake Sediments

The alluvial drowning model of the formation of Big Lake indicates that there should be natural lacustrine sediments spanning the last 1000 years or so. These sediments should have the potential for a pollen chronology of equal duration. As a consequence, in August 1975, we collected cores of the lake sediments for pollen analysis.

These cores were taken with a 5 cm diameter modified Livingston piston corer from a platform constructed by lashing two jon boats together producing a stable surface that would hold four people and still allow room for coring. After a series of test cores from various locations within Big Lake, the primary core site was selected in an isolated bay on the eastern side (NW1/4 Sec 23 T15N R9E) about 2 km east of the main channel of the Little River (Fig. 14-1). This core, collected in 2 m of open water penetrated to a depth of 160 cm before bottoming on hard, dry sandy clay. The stratigraphy of the core selected for pollen analysis (Fig. 14-2) is:

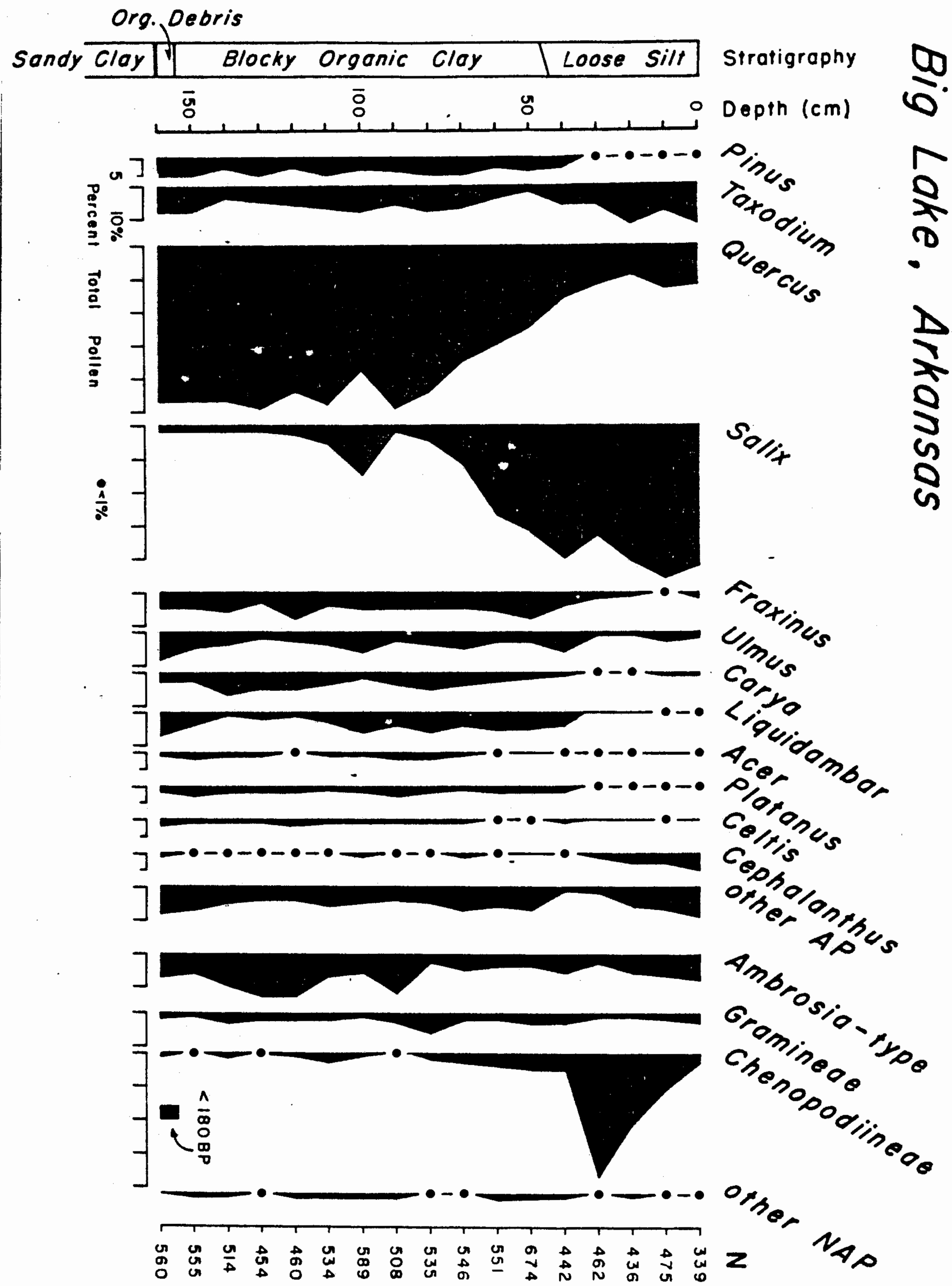

Figure 14-2. Relative pollen diagram from the lake sediments of Big Lake. The Other AP include trace amounts of *Betula*, *Ostrya/Carpinus*, *Nyssa*, *Juglans*, *Vitis*, *Corylus*, *Fagus*, *Alnus*, *Morus*, *Myrica*, Cupressaceae, *Planera*, *Xanthoxylum*, and *Diospyros*. The Other NAP include *Artemisia*, Cruciferae, Umbelliferae, Polygonaceae, Saxifragaceae, and Unknowns.

0 - 45 cm	loosely consolidated organic silt
45 - 155 cm	blocky organic clay
155 - 160 cm	sticks, twigs, leaves and organic debris
>160 cm	hard, dry non-organic sandy clay

We were unable to penetrate below 170 cm.

Several other cores collected from the lake elsewhere revealed a similar stratigraphic zonation but without the organic debris unit. In all of the cores from the Big Lake system sandy clay or sand were encountered within approximately 150 cm. A radiocarbon date run on the sticks, twigs and organic debris (155-160 cm) from the core selected for pollen analysis yielded a date of <180 BP (I-9714).

Pollen in the Big Lake sediments, extracted by acid digestion and acetolysis (for a discussion of pollen extraction techniques, see Gray 1965), was abundant and well preserved in the organic clays. Pollen was not present, however, in the underlying compact nonorganic sandy clay and sands below 160 cm. The pollen samples were cut from the core at 10 cm intervals and pollen grains were counted to sums of over 300 excluding aquatic types. Pollen percentages were calculated as a percentage of the total pollen counted.

The main feature of the pollen diagram (Fig. 14-2) is the decline of *Quercus* (oak) and the increase of *Salix* (willow) in the upper half of the section starting about 80 cm. In addition, above 40 cm many of the trees and shrubs which had been present before either decline or disappear. These include *Pinus* (pine), *Fraxinus* (ash), *Ulmus* (elm), *Carya* (hickory), *Liquidambar* (sweet gum), and *Platanus* (sycamore). Only *Taxodium* and *Cephalanthus* (buttonbush) appear to increase during this period. The herbs remain relatively unchanged throughout the diagram although *Ambrosia* (ragweed) declines slightly and Chenopodiineae (the goosefoot family) increases conspicuously at 30 cm, then declines again. The pollen evidence indicates that the decline of oak and the increase in willow began about 20 cm before the decline in the other trees and shrubs. This pattern probably reflects the manner in which the presettlement forests of the Big Lake area were cleared and the land converted to agriculture during the 19th and early 20th centuries.

Discussion

Although the cores did not contain a long history of paleoenvironmental change, the pollen, stratigraphic and radiocarbon evidence did indicate that the sedimentary regime of Big Lake was radically altered somewhat less than 180 years ago, a time that suggests the New Madrid earthquake as a possible cause. There are no organic lake sediments older than this at the primary core site on the eastern side of the basin and the stratigraphy encountered in the other cores suggests the same for the rest of the lake. Stratigraphically, the lake sediments are similar to what is found in recent man-made lakes and ponds. The absence of pollen in the basal nonorganic sandy clays further suggests they are nonlacustrine.

The organic sediments contain pollen representing a sequence of vegetation change that is consistent with recent exploitation of the landscape by Euro-Americans. Although the forests bordering Big Lake were not placed under protection until 1915, the continued presence of *Taxodium* pollen throughout the core suggests that the local swamp forests was not removed by logging, even though historic accounts indicate that cypress was a prized lumber species in northeastern Arkansas. The oak decline, starting between 70-80 cm, possibly marks the initiation of large scale lumbering in the area when the first major drainage system was completed in 1905. Prior to this time logging was apparently not sufficient to disrupt the regional pollen rain because the older portion of the pollen diagram is rather uniform. The pollen data suggests this first period of large scale lumbering involved primarily cutting the oaks as the other arboreal taxa do not decline until later, at 30-40 cm. Many of these other species are bottomland inhabitants and apparently were less important economically. The cutting of many of these bottomland species was also not possible until the final drainage network on the lowest areas was constructed in the 1920s and 1930s at which time the "final" clearance of the area was started and the rich bottomlands converted to agriculture. The stratigraphic change to loose silt (40-50 cm) in the lake sediments and the decrease in tree pollen of almost all species at that point probably reflects this progressive clearing of the lowlands.

Two anomalies stand out in the upper half of the diagram; the peak in Chenopodiineae pollen at 30 cm and the general increase in willow. The final drainage of the bottomlands would have created large expanses of mud flats, the principal habitat of *Amaranthus tuberculatus* (Steyermark 1963). This plant, a probable source of the Chenopodiineae peak, would have spread rapidly on the newly drained areas with little or no competition and produced large amounts of pollen for a few years until the new (lower) water levels were established and the mud flats finally dried out. During this brief period large quantities of Chenopodiineae pollen would have been shed into the lake system. The increase in willow, a riparian species, can be attributed either to its actual increase along the Little River, or more likely, to its disproportional increase in the vegetation following the removal of the lumber species, especially oak.

The lack of the distinctive *Ambrosia* increase usually associated with land clearance in the Midwest (King, Lineback, and Gross 1976) as well as elsewhere in the Southeast (Watts 1975), may be an artifact of the shielding affect of Big Lake's bordering forest. Although the region has been converted almost entirely to agriculture, the size of Big Lake with its 11,000 acres of local pollen sources may have been enough to dampen out the ragweed increase. On the other hand, there are a few comparable pollen diagrams from the southern Midwest and the *Ambrosia* increase may possibly not be as prominent in this area. Further work is needed to completely document the affects of Euro-Americans on the pollen rain.

The pollen, stratigraphic, and radiocarbon evidence from the lake sediments suggests that Big Lake is of relatively recent origin and may have been formed about the time of the New Madrid earthquake. The sediments in the present lake are shallow and at the site of the pollen core date from only the last 180 years. Other local evidence however, suggest an older origin for Big Lake. Fish, mussel, duck, and plant remains recovered from the Zebree site (Morse and Morse 1976) indicate that an established aquatic environment was present a little over one thousand years ago and was being exploited by these prehistoric peoples. In fact numerous lines of evidence from the site indicate that the main reason for the location was the attractive aquatic resources and environment. The excavations at this site did, however, reveal numerous cracks which are attributed to the New Madrid earthquake (Morse and Morse 1976).

Based on the sediment cores and the evidence cited, several interpretations of the formation of Big Lake are possible. A predecessor of Big Lake, formed a thousand years earlier by alluvial drowning as suggested by Saucier (1970), could have been flushed out by the New Madrid earthquake. Although a mechanism for this is not readily apparent and Saucier (personal communication) thinks this very improbable, the intensity and duration of the quake (Eppley 1965) seem to have been of sufficient magnitude to make this interpretation possible. This hypothesis would explain both the archeological evidence as well as the absence of lake sediments and pollen before 180 years ago.

A more probable explanation is that the sands and sandy clays encountered in the cores at an average depth of 150 cm accumulated as a result of a large influx of sandy sediments during the earthquake and overlie preexisting lake sediments. The hand-driven coring device used was unable to penetrate the sands. This hypothesis could easily be tested by collecting deeper cores with power equipment.

Alternatively, Big Lake could have been formed by an as yet unsubstantiated subsidence of the Little River valley during the New Madrid event. This scenario would mean the preexisting Little River and associated abandoned oxbows would then have been the aquatic environment being exploited.

Clearly, additional cores of the bottom sediments from the lakes in the St. Francis Sunk Lands are needed before their origin will be fully understood. However, it now seems likely that Big Lake and possibly the rest of the St. Francis Sunk Lands were drastically affected by the New Madrid earthquake.

CHAPTER 15

BIOTIC AND NONBIOTIC RESOURCES

Dan F. Morse and Michael B. Million

Too few people appreciate the scientific knowledge of low energy ("primitive") societies. A traditional image of simple peoples with complex supernatural beliefs must be balanced by the realization that human beings have been "competing" successfully for millions of years with a variety of environmental situations. Interaction with or the ability to maximize the potential of an environment may be a better concept than competition.

Science as used here is the ability to predict results. Chert is chipped in certain ways with highly predictable results (Crabtree 1972). It can be changed in its chipable attributes and/or color by thermal treatment (Crabtree and Butler 1964). Sandstone used as abraders has the same attributes we use when selecting sandpaper for specific jobs (Morse 1976c). Edge angles must be anticipated for effective cutting (Wilmsen 1970). A knowledge of wood must be present to manufacture a wide variety of items successfully ranging from dugout canoes to house posts and utility vessels. To make pots in northeast Arkansas involves a knowledge that lime, manufactured by burning mussel shells, added to common backswamp clay allows changes in clay attributes needed for good products. Storage in underground pits took advantage of the preservation qualities of carbon-dioxide produced by respiration (Coles 1973:43-44). A basic knowledge of what to eat, how much to plant, and how much to store to guard against potential future droughts, tornadoes, and other natural disasters is, of course, absolutely necessary to human survival.

Reference should be made to Figure 15-1 of the elements present in a society's social and biophysical environments as an introduction to the following discussions. The articulation of a human group with its environment is based partially on what is available to exploit and the socio-technological potential of extraction and use. The success of this articulation in prehistoric groups can sometimes be suggested through archeological research.

Soil

Agricultural potential

A prairie soil is not farmable by a low energy system, and until the advent of the steel breaking plow, prairie soils could not be

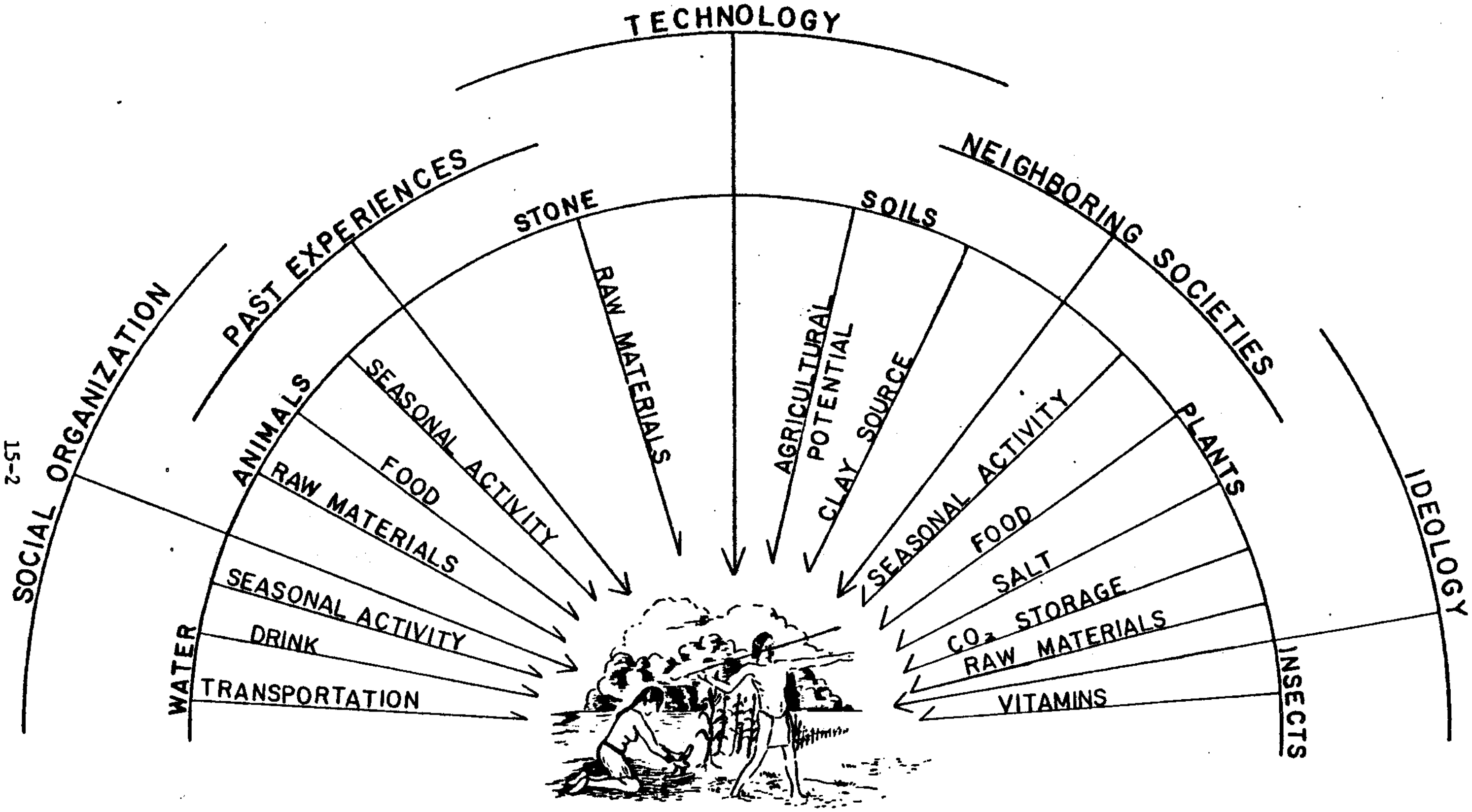

Figure 15-1. Influences on human behavior.

cultivated effectively (Edwards 1948:21). Forest soil, on the other hand, is a highly exploitable resource for horticulturalists and intensive agriculturalists using digging sticks, stone hoes, and the practice of slash and burn. A levee or point bar soil with a young soft wood cover(cottonwood and willow) is probably the most desirable. Burning creates potash out of the cut shrubs which enriches the soils. Windrow felling and burning the base are two known techniques for downing trees (Coles 1973:21). Larger trees can be ringed or farmed around. Crops can get an early start, often sequential since several crops may be planted within the same shallow hole, and weeding is minimal. Protection from small mammals and birds probably constituted a major difficulty, perhaps necessitating farmsteads located to be within or adjacent to crop lands. Some fields could lie fallow and in the case of horticulturalists, fields could possibly be left alone until harvest thus allowing the group to go elsewhere during the growing season.

Soils of the Big Lake region (Fig. 15-2) are loamy and sandy (Ferguson and Gray 1971). The Dundee, Tiptonville, and Dubbs silt loams are classified I-1 unless frequently flooded. This means that in Mississippi County, these soils are the best farming soils available with the least management. However, if frequently flooded, a characteristic of the Dubbs soil, cultivated crops cannot be grown successfully. Cultivation is to be expected on higher areas or ridges. According to the Mississippi County soil map (Ferguson and Gray 1971:Sheet No. 2), a square mile of prime cultivation land exists immediately north and northwest of Zebree, south of the Missouri state line, and another 1/4 of a square mile or more stretches to the southwest along the levee.

<u>Pottery clay</u>

Suitable clays for pottery manufacture are not only available in the immediate Big Lake vicinity but are extant in enormous quantities near the site and throughout the entire Mississippi delta system (Bruce et al. 1958:4-5; Ferguson and Gray 1971:2-3; Horn 1968:17). Attributes of several common backswamp clays in Mississippi County are presented in Table 15-1. These clays are typically composed of the finest particles due to their deposition in long-standing slackwater areas. Aside from the coarse vegetable inclusions, decomposed organic materials account for as much as 3-4% of these soils. Standardized tests determining the linear shrinkage rates of two common clays, Sharkey and Alligator demonstrated shrinkages of 12-14% (Table 15-2). Figure 15-2 is a generalized soil map adapted from the Soil Conservation Service soil survey for Mississippi

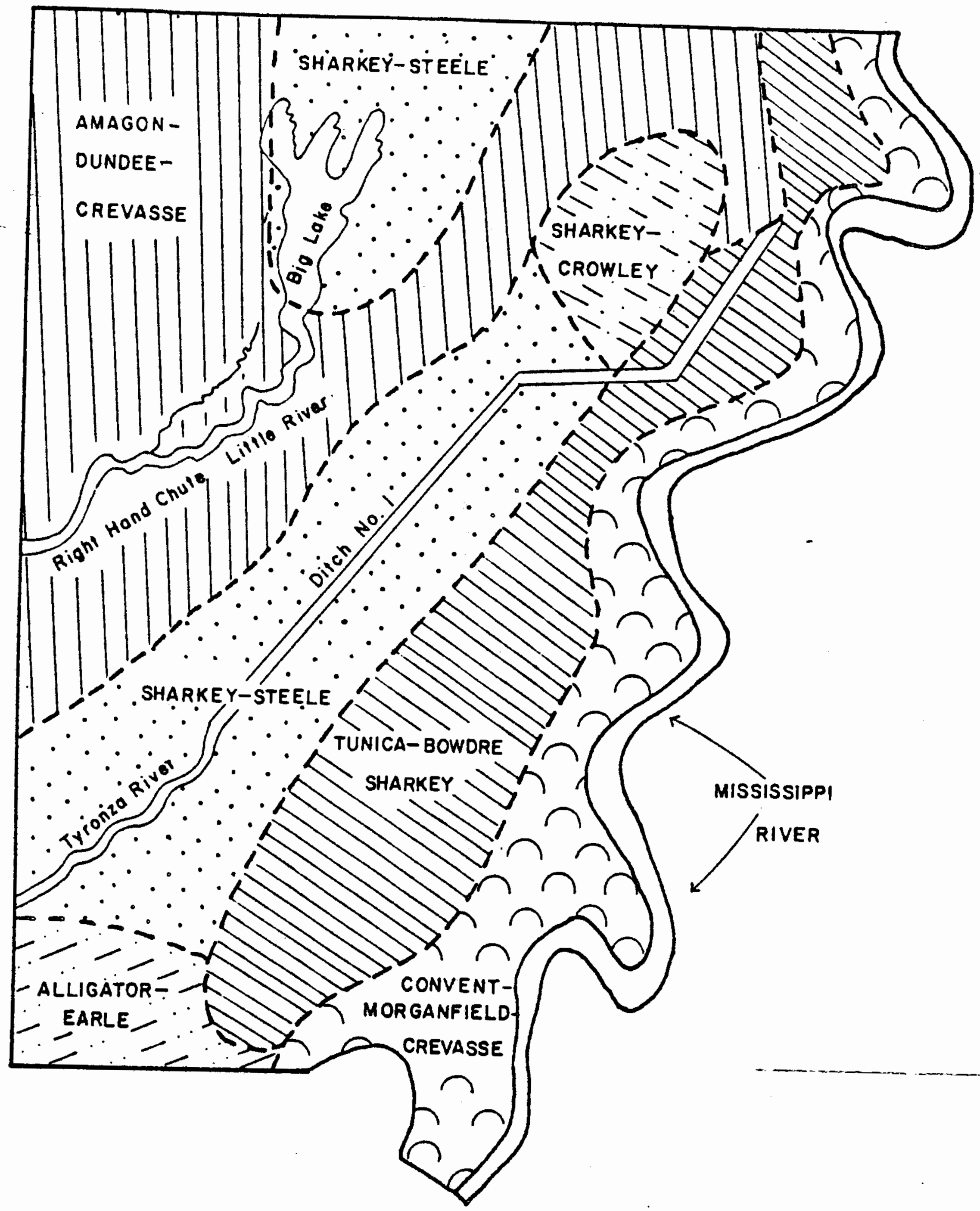

Figure 15-2. Soils of Mississippi County. Adapted from Ferguson and Gray (1971:2, Fig. 2).

Table 15-1: Characteristics of common backswamp clays in Mississippi County, Arkansas. Partially adapted from Ferguson and Gray 1971.

CLAY	SHARKEY	ALLIGATOR	TUNICA	EARLE	IBERIA
COLOR	DARK GRAY TO DARK GRAYISH BROWN	LIGHT GRAYISH BUFF TO MED. GRAY *	DARK GRAY TO DARK GRAYISH BROWN	DARK GRAY TO LIGHT BROWNISH GRAY	VERY DARK GRAY TO BLACK
PH	NEUTRAL	ACIDIC	NEUTRAL	ACIDIC	NEUTRAL
SHRINK/SWELL POTENTIAL	HIGH	HIGH	HIGH	HIGH	HIGH
DEPTH FROM SURFACE (INCHES)	6 - 72	9 - 74	0 - 84	5 - 34 55 - 76	4 - 47
PARTICLE SIZE DISTRIBUTION					
TOTAL SAND	1.5 - 11.2	2.3 - 7.1	1.2	1.5 - 7.0	.9 - 4.4
SILT	22.1 - 38.8	17.8 - 49.9	46.8	44.1 - 55.1	38.0 - 55.1
CLAY	54.1 - 65.7	43.0 - 79.9	52.0	43.4 - 48.9	43.8 - 68.7
% ORGANIC CONTENT	3 - 4 %	3 - 4 %	3 - 4 %	3 - 4 %	7 - 8 %

Table 15-1: (continued)

CLAY	BOWDRE (sic)	CROWLEY (sic)	FORESTDALE (sic)	JEANERETTE (sic)	STEELE Clay
COLOR	V. dark grayish brown w/yellowish brown mottling	Light brownish gray w/yellow mottling	Dark gray w/ brown mottling	Dark gray w/ dark yellowish brown mottling	Dark gray w/ yellowish brown mottling
PH	Neutral	Acid	Acid	Neutral	Neutral
Shrink/swell Potential	High	High	High	High	High
Depth from Surface (inches)	6-17"	16-29"	12-26"	60-72"	23-64"
PARTICLE SIZE DIST — Total Sands			1.11		3.9
PARTICLE SIZE DIST — Silt	No data available		41.4		38.8
PARTICLE SIZE DIST — Clay			47.5		56.3
% Organic Content	3-4%	3-4%	3-4%	7-8%	3-4%

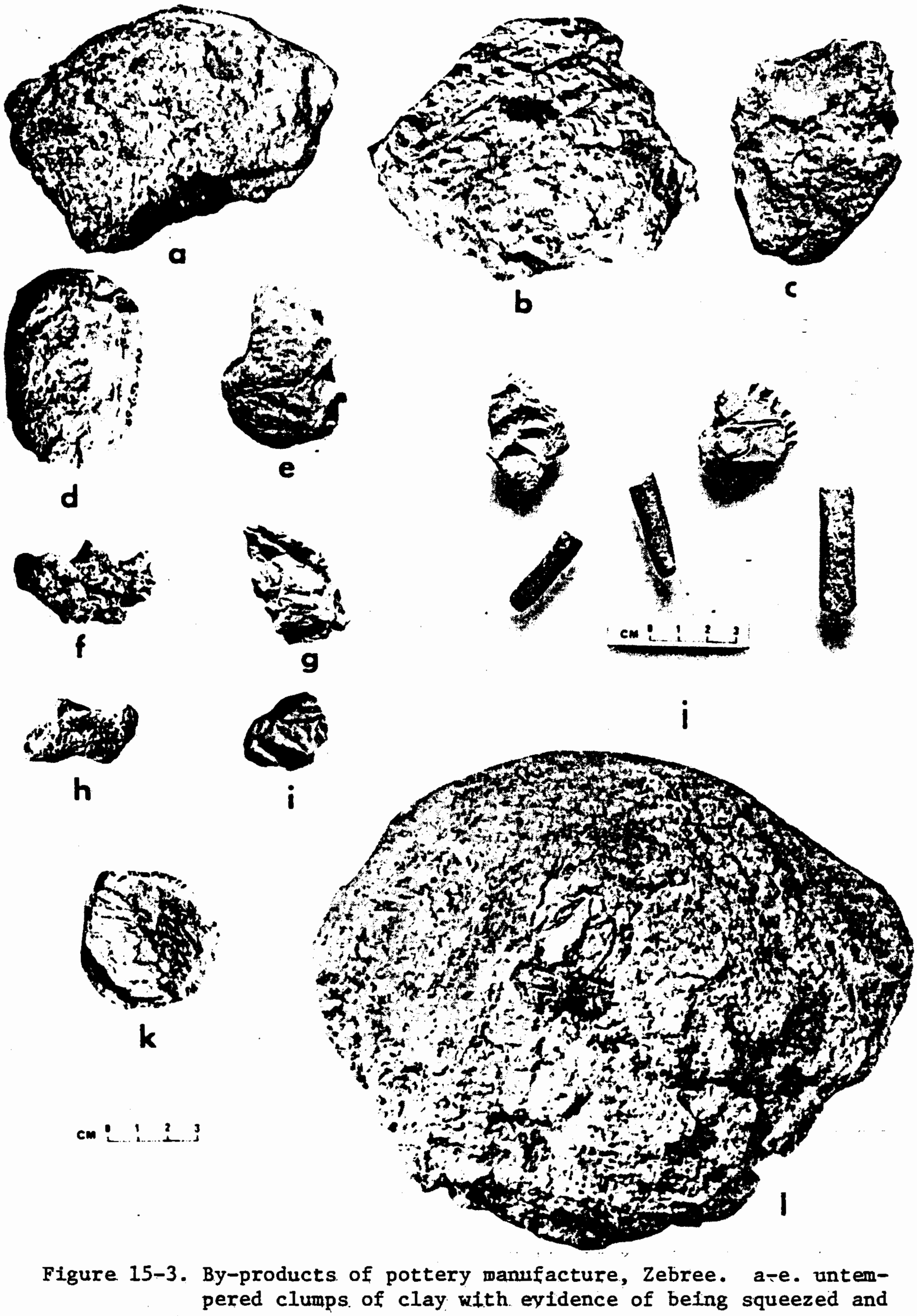

Figure 15-3. By-products of pottery manufacture, Zebree. a-e. untempered clumps of clay with evidence of being squeezed and possibly wedged; f-i. twists; j. pinches and coils; k. base of vessel showing coiling; l. 64 kg lump of shell-tempered pottery clay.

County (Ferguson and Gray 1971:2) illustrating the distribution of these soils. X-ray diffraction analysis did not differentiate between the various types of local backswamp clay (Table 15-4; Bruce et al. 1958:6).

Raw clay is easily obtainable within the floodplain of the Right-hand Chute of Little River. Barnes pottery clay probably was gathered from backwater deposits of Little River. It may have been necessary to exploit relatively hard beds of clay deposit which require a thorough soaking as the first step of processing. Dried backswamp clays are extremely hard and attempts to crush and grind them have proven very ineffective, especially since they are so easily processed using the "wet" method. After being allowed to slake, the clay is quickly cleaned by passing it through a sieve-like netting or coarse fabric which catches the undesired natural inclusions. These typically include moderate amounts of vegetable fiber and an occasional small pebble. A concentration of such pebbles could very well indicate an area of clay processing.

The most attractive location for clay procurement for the Big Lake phase, however, is the bed of Big Lake itself, assuming its existence by around AD 750. The lake is very shallow, 1.5 to 2.0 meters, and has probably been so since its formation. Lake bed resources are, therefore, easily exploited. The substrata are composed of clay and silty clay sediments which rest atop a hard, dry sandy clay stratum at roughly 160 cm (Chapter 14). The upper clay lake deposits, classified as Sharkey clay by the Soil Conservation Service (Ferguson and Gray 1971:19), have been naturally levigated to a very fine and relatively clean clay that can be quickly collected and processed for use in the production of pottery. Unwanted natural inclusions do exist, even in open water areas, and primarily consist of coarse vegetable matter and the shells of mollusk and gastropods, most of which are deceased. The vegetable materials are usually partially decomposed American Lotus (*Nelumbo lutea*). The total proportions of these undesired inclusions is low and, considering the ease of gathering the clay in a water-saturated state, they are of minimal importance and can be quickly picked out by hand.

Within recent times, sand has been introduced into the Big Lake vicinity as a consequence of the New Madrid earthquake, according to several investigators (Ferguson and Gray 1971:19; Saucier 1970: 2849). The sand occurs as hundreds of small circular patches (3-5 m diameter), called sand blows, which are thickly scattered over most of the area. Assuming that this is the correct origin of this sand, which occurs most frequently in the higher areas of the lake bed and has mixed with the clays, it could not have been a factor in aboriginal times.

Other uses of clay and soil

It is perhaps not surprising that a variety of prehistoric artifacts were made of clay given the abundance of clay and the rarity of stone available to the Indians. Most of the variety exists within the Big Lake phase.

Abraders were made from Barnes potsherds and the sandy paste no doubt allowed a coarse abrasion. Finer abraders were made of Mississippian potsherds. Discs, often perforated centrally, were also made of potsherds.

Pottery artifacts not made of recycled potsherds included beads, tobacco (?) pipes, gaming discoidals, plugs for vessel orifices, spacers for firing large pots, tools to scrape salt, and cones possibly for supporting vessels over a fire to boil food. Clay also functioned to line hearths and as house insulation or plaster. All of this clay was locally available within or just beyond the Zebree site.

The ground itself within the site provided a medium into which cavities could be excavated for the storage of food, the burial of the dead, and burial of unwanted trash. We feel that most pits were for storage of food and that a secondary function, perhaps only incidental to the pit being closed, was trash disposal. The village midden is too full of discarded trash to infer a conscious and consistent disposal of trash in specific loci.

Soil was moved around the Zebree site. This is most apparent during the Big Lake phase. The excavation of an outer ditch, large "borrow" pits, and a number of storage pits necessitated the removal of the soil obtained to somewhere else. The removal along the outer ditch and from the "borrow" pits appears to have allowed the southeast corner of the site to be elevated. Whether this was to make the lake edge seem more prominent or was accomplished to straighten the edge or to elevate to guard against flooding is not known, but whatever the reasons there does seem to have been a movement of soil around the site.

Water

Water is important mainly for transportation and nourishment. For probably at least 10,000 years, sophisticated dugouts were made in Arkansas (Morse and Goodyear 1973). The De Soto accounts include a description of large war canoes (Phillips, Ford, and Griffin 1951:

352-353). It is possible that control of a major waterway into the uplands was a basic factor in regional Mississippian behavior (see Chapter 1). During the Pioneer Stage of the 19th century, water travel was widespread and economically important (see Chapter 26).

Water was available for drinking literally everywhere. Even during much of the early 20th century, drinking water was commonly obtained from streams which are plentiful in this region. Even on the Zebree site itself, water could be obtained by drilling a well to between 3 to 5 m into what basically is a natural sandy filter. A well would produce cool water in the hot summer.

Floods, common during the main rainy season in early Spring, allowed fish to swim into temporary pools destined to become isolated and to eventually dry up completely. Nets set against the current or gigging in shallow pools would produce considerable riverine resources.

Water was also used for boiling food, bathing and as a leaching element in producing salt. It also would be useful in the production of oil for lubrication and cooking. Oils from cracked acorns and bear fat are rendered by boiling water.

Plant Products

There are recorded 37 species of herbaceous plants, 9 of shrubby plants, and 20 tree species (Department of Interior, Final Environmental Statement 1976:14-15, 77, henceforth referred to as DIFES) in the Wildlife Refuge. We doubt that this is a complete inventory for this region. In his *Flora of Missouri*, Steyermark states that while "large sectors of each county in the state remain botanically unexplored . . . a total of 2,438 species" are known in Missouri (1963:ix). Many of these seem to be represented in southeast Missouri from maps in the publication but no summary of species by region is present.

In the Upper Great Lakes region, 400-500 plants were used by Indians of about 2000 available (Yarnell 1964:44). The major uses were as food and for medicinal purposes. Other uses were as beverage and flavoring, dye, smoking, charms, and utility (Yarnell 1964: Table IX, page 46). The historically observed use of plants contrasts sharply with the archeological evidence. A first step should be an inventory of what is available, a logical selecting of what probably was used, and together with a type collection of pollen, seeds and other parts, some charred to varying degrees of effects, a test of expectation.

Food

Many of the foods used by Indians were also used by Euro-American pioneers and their descendants. Approximately 80% of the 110 food species listed by Yarnell (1964) are represented by the same species or a closely related species in southeast Missouri (Steyermark 1963). A number of species not listed by Yarnell for the Upper Great Lakes region are known to exist in the northern alluvial valley.

Salt

The discovery at the Zebree site of large numbers of broken "salt pan" vessels indicated the probability that saltwater was being evaporated for the crystalline salt at the site itself (Keslin 1964: 37). There are no known salt springs in the vicinity of the site nor are there any known salt deposits with one possible exception (see Chapter 4). The presence of pottery funnels at the site, and the knowledge that something called "salt," results from a leaching process involving the ashes of a lake plant (Schultz 1962:124-125), caused the formulation of a hypothesis that salt was manufactured at the Zebree site. The American Lotus (*Nelumbo lutea*) was chosen because of its similarity to the plant used by the Suya Indians of interior Brazil (Schultz 1962:124-125) and because after a short hiatus, this plant was once again Big Lake's most prominent lake plant. There American Lotus is an ornamental plant with large lily-like leaves and a large sunflower-like seed pod. The seeds look and taste like nuts. The roots, leaf stalks, and leaves are also edible (Steyermark 1963:668-669).

In 1969, Morse and Bobby Brown collected samples of *Nelumbo lutea* for possible analysis. Chester North did the following analysis (North 1975). The leaves and stems were separated after drying at room temperature and then ground in a small hammermill. Two 1 gram samples of each, accurate to three decimal places, were weighed into marked crucibles and ashed in a muffle furnace at about 500° C. The ashed samples were then leached with 1/10 normal ammonium acetate and the volume of each brought up to 100 ml. Analyses were run on the atomic absorption unit located in the Department of Agronomy at Arkansas State University for sodium and potassium. The measurements obtained were converted to parts per million (Table 15-3). Considerable amounts of sodium and potassium were discovered in the material analysed. Of special interest was the higher concentration of sodium and potassium found in the stems.

Table 15-2. Sodium and Potassium Concentrations in *Nelumbo lutea*

SAMPLES	TEST I		TEST II	
	Na ppm	K ppm	Na ppm	K ppm
Stems	3800	8500	5900	20000+
Stems	3800	9800	6600	20000+
Leaves	1500	8300	1900	15000
Leaves	1900	6100	1950	16000

Titration of the solutions with nitrate using potassium chromate to form the indicator (Mohr method of chloride determination) showed a large amount of a halogen to be present. Both chlorine and bromine respond to this test; however, bromine is normally found in very low concentrations (personal communication, Dr. A. W. Tennille, Professor of Agronomy, Arkansas State University).

In conclusion, it seems highly possible that salt could have been produced by the Big Lake phase through a process of burning *Nelumbo lutea* leaves and stems, leaching the ash and evaporating the filtrate to dryness. The resulting salts would contain potassium chloride, sodium chloride, and combinations of other impurities. Other plants need to be similarily tested, a definite test for chlorine must be made, and the practicality of manufacturing the salt has to be experimentally tested. There is no question, however, that the appropriate artifacts (salt pans and funnels) are in the Big Lake deposits, and we assume, therefore the capability of this process was known to the Big Lake phase.

Food Storage

The ability of a society to store food successfully against the following year's disaster or until a large amount of food can be harvested once again depends to a great extent on how stable and how large the population is. The domestic dog in a sense is a kind of food storage since dogs can be eaten. The dog, also because it could warn of predators as well as human enemies, was an important facet of food storage. However, here we are more concerned with the ability to cache foodstuffs without a significant loss due to spoiling. Of great importance is the ability to store seeds for next year's planting.

In cases where large, permanent populations are involved, large permanent storage facilities must be constructed and maintained. Pit features are common for the earliest two components at the Zebree site. Each component dug characteristic pits. Barnes pits are conical in cross-section and often have a layer of mussel shell on the base. Big Lake phase pits often are cylindrical. The former probably held about .75 - 1 kl and the latter between 1 and 4 kl. Both, when discovered, tend to be filled with trash but we do not think this was a primary function. Village refuse is common and scattered, clustering about the living area. If there were a practice of burying trash to get rid of the mess, a landfill project or dumping trash away from the village would be more economical.

Both types of pits seem to be for the storage of food, most particularly vegetation or grain. Experiments conducted on below ground storage (Coles 1973:39-45; Reynolds 1974) indicate that this is practical. Until the development of mud plaster, most evidenced on house walls archeologically, above ground storage may not have been possible. The essential ingredient of storage is a sealed storage pit.

> The principle of grain storage in a pit is essentially quite simple. In a sealed container, grain will continue its respiration cycle using up the oxygen in the intertranular atmosphere and giving out carbon dioxide. Once the atmosphere is sufficiently anaerobic the grain reaches a state of dormancy. Provided that the anaerobic atmosphere is maintained, the moisture content remains unaltered and a consistent low temperature which inhibits microflora activity prevails, the grain will store successfully for a considerable period (Reynolds 1974:119).

Preservation may be good to excellent depending upon a variety of factors such as temperature, moisture content, varmints intruding from the side, and others. Seeds would germinate after a year or more of storage with up to 60-70% success. The pit could be resealed after being used with minimal loss. Food in most cases was almost all edible after long term storage. Studies have been conducted upon shape effectiveness and upon erosion patterns (Reynolds 1974). Most studies have centered upon the storage of grain and the Big Lake phase pits almost certainly were so used. The Barnes pits may have been used for other storage but since they probably were horticultural, grain could have been stored. Experiments also should be conducted upon vegetation lining as an effective CO_2 producer to store acorns or other foodstuffs.

Fuel

Wood was readily available for cooking and heating. Pottery firing experiments have indicated that dry wood is the major fuel required. This would have been available from dead wood timber, particularly limbs fallen from trees, driftwood, and the residue from repaired or torn down structures. Grasses, cane, and corncobs cause too much soot although this can be removed with a dry wood refiring. It is possible that saline water was evaporated to recover the crystalline salt by heating the open pan over a fire. But a more pratical method might have been to place the pans in the sun for rapid evaporation.

Wood

Oak and cypress appear to be the major woods preferred for house construction with cypress functioning as interior roof supports and the oak as wall studs for the cane lathing and mud plaster in Mississippian houses (Jim Price, personal communication). Probably oak was used for Woodland structures although soft woods such as cottonwood might have been used since these structures seem to have been more temporary than the later Mississippian ones. Oak is postulated since it could be bent in the apparent Barnes hogan style house. Cypress probably was the choice for dugouts based on the pioneer emphasis on this tree and the fact that very large specimens were available. Utensils such as bowls and mortars and ornamental wooden artifacts would have been from a variety of woods. Whittled fastening pegs could be manufactured from branches. Bows probably were made of the Bois D'Arc available in the uplands and in Illinois. Hafts may have been made from walnut or other similar woods for grain and color as well as durability and easy working. Vises could have been made for flint knapping.

Cordage

Single and multiple twine, cordage, basketry, and nets were probably made from plant products for the most part, although sinew and feathers may also have been employed. A good indication of the kinds of artifacts probably produced can be learned from preserved examples in Ozark shelters (Scholtz 1975). Indirect evidence of many of these items is found in clay impressions and, in the case of human skulls, distortions caused by cradle board attachment. The fibers identified by Scholtz are Ozark in orgin and while some used at the Zebree site may have been upland products, many are locally available.

Thatch and Cane

Cane split with hammerstones probably constituted the basic wattle for wattle and daub walls. Cane also probably was used to construct beds and to make arrow shafts and flutes. Swanton (1946: 344) references taking crawfish by using baited cane sections. Grass thatch was probably used as roof cover. Grass or rush mats were undoubtedly used in a variety of situations including the top lining for clay-sealed storage pits.

Fish Poison

Buckeye and trumpet creeper were made into a poison for fish in the historic period (Swanton 1946:342-343). Roots were pounded up and put into a pool during a time of low water. The intoxicated fish would float and could be easily killed. Whether this was done at the Zebree site is not known but both plants exist in the Zebree site environment.

Animal Products

There are presently more than 200 species of birds, 22 of mammals, 27 of reptiles, 8 of amphibians, and 38 species of fish and minnow which inhabit the Wildlife Refuge part-time or year round (DIFES 1976:17-18). A total of 30,000 ducks, 90% of which are mallards, are on the Big Lake at the peak winter season (DIFES:17). "Because of its narrowness, this (Mississippi River) corridor has the greatest density of dabbling duck passage of any migration corridor east of the Rocky Mountains" (Bellrose 1968:8). Bellrose estimates that 400,000 mallards spend the winter in northeast Arkansas and that 150,000 geese pass through on their way to the coast (1968:8,19).

Very little if any of this fauna can be considered inedible. Meat may be fileted and dried, thereby considerably reducing the weight and size. It can be the main ingredient in a sort of pemmican or dry ration. These storage solutions are apparently very old. However, not all was eaten and what was eaten was selectively obtained. In addition:

> The projected yearly cycle of exploitation of animal populations by Middle Mississippi groups can be divided into two basic seasons: a summer season during which various species of fish were the most intensively exploited, with aquatic species of turtles and perhaps rabbits being of secondary importance, and a winter season of exploitation during which a wide variety of terrestrial mammals, migratory waterfowl, beaver and turkey were taken. The white-tailed deer was the most important animal species taken during this winter hunting period (Smith 1975:122).

Virtually every part of the white-tailed deer was used. Deer mandible sickles (Cleland 1965:61), awls, needles, fishhooks, and harpoons made from long bone, deer rib scrapers, antler batons for chipping stone, antler points, and even phalanges perforated for use in the pin and ring game were made of bone and antler. Sickles and the pin and ring game elements were not found at the Zebree site. Hide and sinew, and brain to cure the hide, were also important facets of Indian culture. Raccoon, turkey, dog, and small mammal and bird long bones for beads, in that general order were used for purposes other than as food. Bony gar scales were used as arrowpoints. But the white-tailed deer was the largest available mammal with the largest bone for working and was therefore the most used. Elk and buffalo for the most part did not exist in this region until historic times and bear does not seem to have been hunted very much. A very thick bone exists in the deer foreleg and could be worked into thick harpoons and awls. Natural growth stress lines in the bone were taken advantage of, as exemplified by fishhook construction.

Bone is processed by a method referred to as "groove and snap." Bone is not merely shattered and good sharp splinters selected for use. As in chert knapping, the craftsman knows just how to work the bone. Grooving partly into the bone, usually one-third, allows the bone to be broken along that groove as a result of a smart rap with a hammerstone or simply by snapping the bone, using a hand or a block as a vise. A long bone has to have one or both ends detached and the remaining tube cut and snapped into relatively flat preforms for tools or ornaments. The tool used most often was a chert artifact with a burin or chisel-shaped engraver tip and a knife, sometimes serrated. A sandstone or multiple ridged chert core rasp would have been useful and sometimes evidence of a small axe used in trimming is apparent. Special stone wedges, called piéces esquillès, appear to have been used to split the longitudinally grooved tubular bone.

The use of freshwater shellfish for food has been exaggerated in the archeological literature (Morse 1967:232-235; Parmalee and Klippel 1974). The amount of food available may not even match the caloric expenditure to extract it. Except as a backup food in portions of the Midsouth during the late Archaic, its use as a food may not have been significant and possibly was only a dietary diversion or condiment.

A major use was made of the shell itself rather than the meat of the mussel. Strong when fresh, the half shell or valve makes an excellent hoe and digging implement. It is easy to manufacture--only a hole has to be pushed through its center--and does hold up well based on informal experimentation. Where observable, perforated valves exhibit wear (Morse 1963:46; Morse 1967:119). This does not mean that all perforated shells were used as hoes or spades.

Mussel shells were also made into spoons, pendants, and gorgets. Gastropod beads also were manufactured and seem to be a prime characteristic of initial Mississippian in the alluvial valley. The gastropod shells (*Anculosa praerosa*) appear to have been traded from further north. Probably traded also from the north, although they originate in the Gulf Coast of central Florida, are conch or whelk from which beads and other ornaments were made during the Mississippian period.

Mussel shells used for tempering pottery

Mississippian potters collected the shells of freshwater molluscs for use as a tempering agent. The extreme plasticity and high shrinkage rate of the local "gumbo" delta clay requires the addition of a nonplastic substance. Tempering also opens up the texture of a paste so that the finished vessel can dry more uniformly, reducing much of the strain created by differential drying rates of various portions of a pot. Shell, however, has been found to be especially efficient in transforming backswamp clay into a quite flexible and easily managed paste for a specific technological reason. This extra advantage of shell was recognized by the earliest Mississippian potters and explains why shell-tempered pottery so overwhelmingly and rapidly gained acceptance as a superior pottery ware throughout the northern Mississippi Alluvial Valley and in much of the eastern United States.

> Shell is composed of calcium carbonate which acts to reduce a clay's plasticity in a manner other than the usual introduction of relatively large, nonplastic particles. The minute, plate-like clay particles are small enough that the identical ionic charges on their surfaces have sufficient repelling force to keep them slightly separated. Calcium carbonate has the capacity to neutralize this force so that when the clay particles collide during their random movement they tend to stay together. This flocculation process is facilitated by the presence of water and creates 'large' clay particles which consequently enhance the working quality of fine textured clays. When shell is blended into the clay, the shift in its feel is distinct and takes place in only a few moments (Million 1975a:218).

Modern highway engineers commonly take advantage of the stabilizing effects of lime (also a calcium carbonate) by adding it to unstable clay beds (Horn 1968:29-30, Table 4).

Although suitable shells would have been obtainable from sandbars in most streams and rivers, Big Lake itself may have provided the most easily gathered shells. If Big Lake was present and ecologically similar at the time, a variety of mollusc species which populate its shallow substrate would have been available and possibly collected in connection with the gathering of clay.

The fact that these shells were burned before being crushed and added to the clay has been previously established (Porter 1964:3-4). Fresh, unburned shell is extremely hard and brittle. Burning the shell allows the crystalline arrangement of the shell structure to undergo a mineralogical change with an accompanying volume change (at about 100 degree centigrade) before it is fired. If this breakdown of the crystalline structure was not accomplished prior to the firing stage, the vessels would be certain to shatter once heated.

Shell can be processed effectively in a deep wooden mortar or similar device and further refined using net-like sieves if desired. A byproduct of temper preparation potentially recognizable in the archeological record is the burned, gray-colored "hinge" and "beak" areas of the shell which tend to remain hard and are usually simply discarded. A very few such residual fragments have been found at the Zebree site.

Cogent evidence that shell was burned before being added to a clay was obtained from x-ray diffraction tests performed at Arkansas State University in 1973-1974 (Million 1975:202). An unfired, 6.6 kg lump of shell-tempered pottery clay excavated from the bottom of a Big Lake phase pit (Feature 56) (Fig. 15-3 1) was analyzed along with samples of local backswamp clay, a Mississippian sherd, and burned and unburned shell (Table 15-4). A comparison of the 10 most significant "d" values for each group of samples illustrates that the basic Mississippian paste is a blend of local backswamp clays and a *burned* shell temper. Unfortunately, the diffraction analysis was not sensitive enough to differentiate between the various clay types as they all apparently contain equal proportions of a few commonly held mineral compounds. This problem has been encountered by other investigators (Bruce et al. 1958:6). The "d" value is the distance between the planes of atoms in the lattice of the material being tested, in this case clay. Identical or near identical "d" values signify the presence of the same element in the respective clays.

Insects

Insects were eaten in Arkansas (Wakefield and Dellinger 1936) and are a world-wide part of human diet. Recently, analysis of

Table 15-3: X-ray diffraction d values for 10 most intense lines. d=distance between the planes of atoms in the lattice of the material tested. See text for explanation.

Sharkey Clay, Alligator Clay, Daub		NFP Sherd, Unfired, shell-tempered clay, & Fine shell & grog sherd		Burnt Shell		Unburnt Shell		Red Slip	
d value	% intensity	d value	% intensity	d value	% intensity	d value	% intensity	d value	% intensity
4.52	35	—	—	—	—	—	—	—	—
4.28	40	—	—	—	—	—	—	4.29	25
—	—	—	—	—	—	3.46	100	—	—
3.36	100	3.34	95	—	—	—	—	3.36	100
—	—	—	—	—	—	3.32	70	—	—
—	—	3.04	100	3.04	100	—	—	—	—
—	—	—	—	—	—	2.74	40	—	—
2.59	30	2.58	10	—	—	—	—	—	—
—	—	—	—	2.50	20	2.52	20	2.47	10
—	—	—	—	—	—	2.40	20	—	—
—	—	—	—	—	—	2.36	20	—	—
2.29	20	2.29	30	2.29	25	—	—	2.29	10
2.14	20	—	—	—	—	2.13	10	2.14	10
—	—	2,09	25	2.10	25	—	—	—	—
—	—	—	—	—	—	2.00	100	—	—
—	—	—	—	—	—	—	—	1.99	10
—	—	1.92	25	1.92	25	1.90	30	—	—
—	—	—	—	1.88	25	—	—	—	—
1.82	35	1.82	15	—	—	1.83	15	1.82	20

Table 15-3: (continued)

1.68	10	—	—	—	—	—	—	1.68	10
—	—	1.61	15	1.61	10	—	—	—	—
1.55	30	—	—	—	—	—	—	1.55	20
—	—	1.53	10	1.53	10	—	—	—	—
—	—	—	—	1.44	10	—	—	—	—
1.38	25	1.38	10	—	—	—	—	1.38	20
—	—	—	—	—	—	—	—	1.19	10
—	—	—	—	—	—	—	—	1.20	10
—	—	0.85	30	—	—	—	—	—	—

some insects have revealed that there is a high caloric value, a high protein content, and perhaps most importantly, in at least the case of the locust, a significant vitamin source (Brothwell and Brothwell 1969:68-69). One of the most pressing problems in the nutrition of low energy populations is the source of many vitamins taken for granted today. Insect research may well provide some of the answers.

Not in context was the interesting case of Cicada nests common in deep strata in sandy soils at Zebree which in 1969 were mistaken for miniature bowls. Insect debris in context are important from the standpoint of indicating permanent structures and seasonality. Mud dauber nests, for instance, constitute a common Mississippian site phenomenon.

We do not know how insects functioned as pests. The present high mosquito population is locally regarded as greatly increased from the historic period due to the introduction of bovines and other mammals and an increased human population which provide a necessary medium for survival (Ozark Oral tradition). Malaria is felt to be a historic New World disease (Drake 1850).

Stone

With the exception of small pebbles, stone resources are only present in the uplands. Some were probably obtained from direct visitation while other stone probably was obtained by trade. Direct control of resources is assumed to be an important aspect of Mississippian culture and on this basis it is logical to assume that most stone was obtained directly. The small pebbles, probably originating in the soils as ice-rafted gravels, were used as components of a rattle in at least one instance at the Zebree site. Otherwise, their importance is limited to a possibility of indicating, by clustering, pottery manufacture loci.

Orthoquartzite

Approximately 9-1/2 miles northwest of Paragould, just on the western edge of Crowley's Ridge, is an impressive outcropping of orthoquartzite. Probably at least 10 acres are involved and sufficient stone is present for the creation of rock shelters. The outcropping occurs on the western and eastern faces of a high ridge. The largest masses are on the west and overlook the Western Lowland. The color range is wide, mostly being very light reddish or brownish gray. A more precise location is longitude 90°38'38" and latitude 36°7'30".

There is debitage at the outcropping and there is little doubt that this is a quarry site (3GE241). Debitage is recoverable at nearby lowland sites and the distinct impression is that there is rather drastic decrease in orthoquartzite debris 10 to 15 miles away from the quarry. It nowhere is of a very common occurrence and does not seem to be a very suitable stone for knapping. It was associated at the Zebree site with the Big Lake component and consisted primarily of backed flakes and cores plus minor debitage. Orthoquartzite was cataloged as a separate entry in the catalog and it is possible to do a distributional study on these items. A plan to precisely identify this and other stone through some spectrographic method was not funded and precise identifications of sources cannot be made at this time.

There is little doubt, however, that the Zebree site inhabitants knew about this unusual outcropping. Whether obtained directly or indirectly, it is in accord with the hypothesis that the Big Lake phase is oriented toward exploitation of the St. Francis River area.

Crescent Quarry chert

Between the towns of Crescent and High Ridge, Missouri, are a series of quarry pits dug into a distinctive seam of chert (Leonard Blake, personal communication). The section, placed on the National Register of Historic Places, is surprisingly undisturbed and most impressive. The location is 20 miles southwest of St. Louis, near the confluence of the Meramec River with Big River. An approximate location is longitude 90°35' and latitude 38°30'.

This chert has been called "Dupo" in previous reports on the Zebree site, because it was thought to have come from outcrops near Dupo, Illinois, opposite to the mouth of the Meramec River. In March of 1977, attempts to locate such outcroppings were negative. The Crescent Hills or Crescent Quarry chert is very distinctive (Ives 1975; Ives 1974: Table 4). Samples collected to compare to the lithic debris recovered from the Zebree site made the identification almost certain, i.e., based on visual examination, the two cherts are identical.

Crescent Quarry chert at the Zebree site is associated exclusively with the Big Lake phase. It was mainly used for the production of microliths. This is also the situation at the Cahokia site and at the quarries. Leonard Blake and Dan Morse collected a microlith core in March of 1977 at the Crescent Quarry. Samples of chert were collected from road cuts for knapping experiments (see Chapters 7 and 12).

In St. Francois County, Missouri, there is approximately a 13-mile stretch between the northern end of the St. Francis River and a meander of the upper portion of Big River. Whether it is feasible to canoe this distance is not known nor is it known if it is reasonable to expect a portage there. But the St. Francis River is a probable means of transportation for anyone directly exploiting the Crescent Hills area for chert.

Mill Creek chert

The Mill Creek locus has been described by Morse previously (1975b:64; Fig. 15-4). Mill Creek chert outcrops as nodules, often in large and flat oval shapes in Union County, Illinois (Phillips 1900). Titterington describes several caches of unused agricultural implements (1938:5) made of this chert. Investigations at Southern Illinois University appear to indicate that Mill Creek chert may be carried elsewhere for working into tools and that Cahokia is not necessarily the focal point for a trade in Mill Creek chert (Jon Mueller, personal communication).

However, it is evident that Mill Creek chert is the Mississippi Valley equivalent of obsidian. It's use is an early primary unifying characteristic of Mississippian and continues in importance throughout the Mississippian period. We suspect that investigations of Mill Creek chert distribution with comparison to Meso-American and Near Eastern models of obsidian procurement and trade could be fruitful. These Union County uplands would appear to be easily accessible to the Cairo Lowlands but it is obvious that Cahokia is handling Mill Creek chert and other cherts from the same vicinity (Illinois kaolin or novaculite and Dongola chert) both of which also are present at the Zebree site.

Dover chert

This chert is located in Tennessee near its border with Kentucky along the Cumberland River on the Highland Rim section of the Interior Low Plateau province. It was not as important as Mill Creek chert but is present on southeastern sites in increasing amounts during the Mississippian period; for instance, Dover chert at the Zebree site concentrates in post-Big Lake deposits. It never was as popular as Mill Creek.

Dover chert occurs as large boulders and was made into specimens similar to those made from Mill Creek chert. The Duck River cache (Peacock 1954) is alleged to be made from this chert (Lewis and Kneberg 1958:103) but based on an examination made by Morse in 1962, many if not most of the bifaces are probably made of Mill Creek chert.

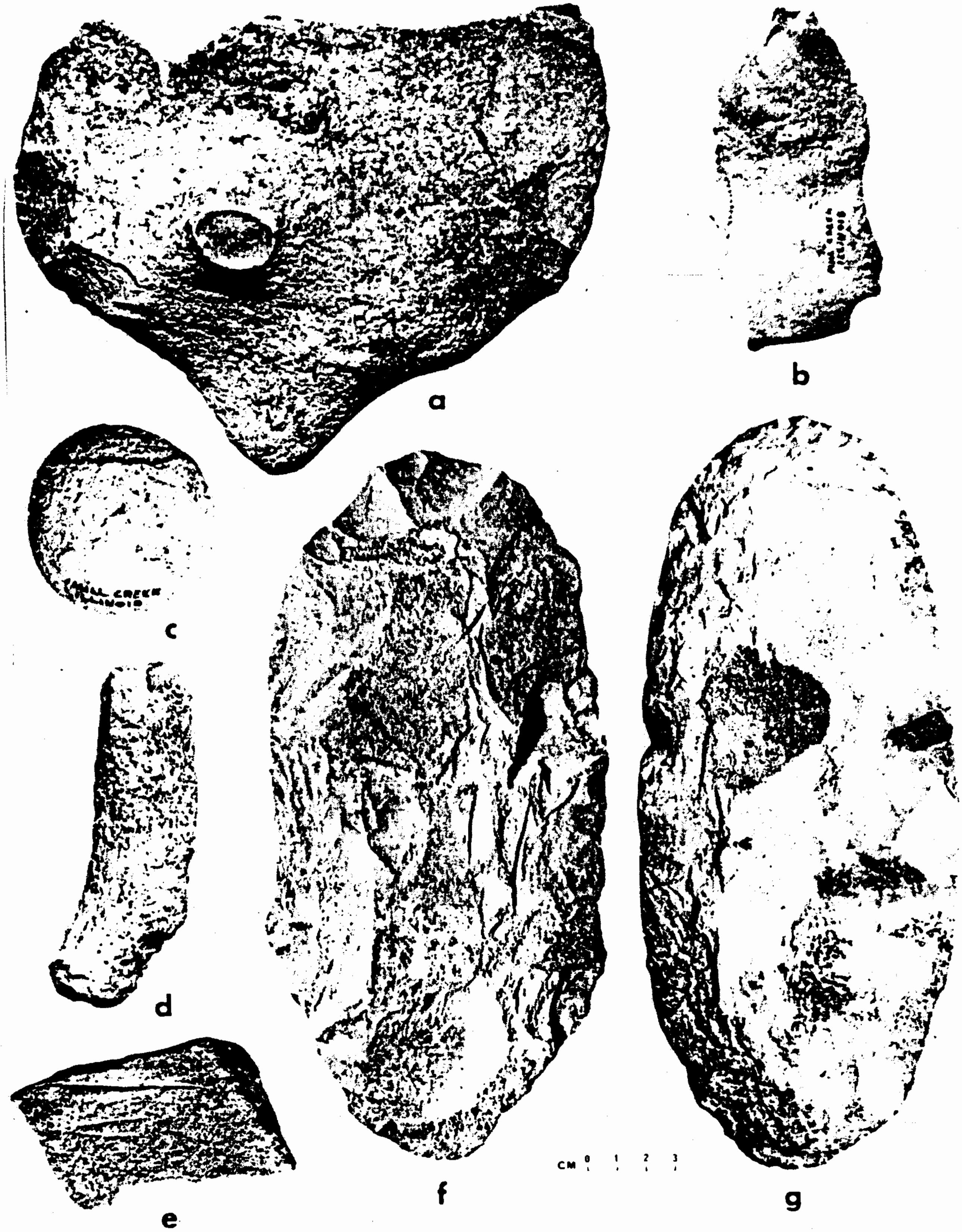

Figure 15-4. Artifacts associated with the Mill Creek chert industry in Illinois. a. partly worked nodule; b. flake removed by soft hammer; c,e. pebble preform abraders; d. antler baton; f. preform; g. polished hoe.

Crowley's Ridge chert and other gravels

The gravels in Crowley's Ridge include both quartzites and cherts. Much of the chert is too fractured for efficient use but only a short period is needed to search the various creek gravel beds to locate good quality chert. Cobbles with one or two corners removed and sparse debitage and broken preforms and hammerstones of quartzite are scattered along creek banks indicating that quarrying for knapping purposes probably was general and mostly individualistic. Sites near Crowley's Ridge contain considerable stone, mostly bad, indicating that quarrying in some cases was more inclusive for non-knapping purposes, probably mostly for use in earthovens. This latter use probably involved some group behavior and probably rafting. Some Crowley's Ridge chert is an agate and some is chalcedony, an indication of diverse northern sources for the gravels and the variety of materials available for the knowledgeable searcher. A sample of Crowley's Ridge chert is described by House (1975:82). It tends to be a distinctive mottled brown and red with a brown cortex. Quartzite can occur as large flat cobbles suitable for quick modification into bifaces. Crowley's Ridge chert was associated with all three components at the Zebree site.

Ozark cherts

Only a beginning has been made in gaining knowledge of the lithic resources available in the Ozark Highlands (House 1975:85-90, Manger 1977; Mathis, personal communication; Price, personal communication). There is a gravel deposit on the escarpment which is similar in altitude and appearance to that on Crowley's Ridge. The chert cobbles, however, are smaller and of relatively poorer knapping potential at an outcropping visited by Jim Price and Dan Morse in 1976. A collection of a similar gravel deposit was also found to be virtually identical to a sample from Crowley's Ridge (Mark Mathis, personal communication).

There are several varieties of chert available in the Ordovician, Devonian and Mississippian strata exposed in the Ozark escarpment (Manger 1977). There also is tremendous variety within one or more of the chert formations, particularly Boone (Manger 1977:212). This chert was gathered either directly from within or adjacent to the outcropping of the matrix or from gravel beds downstream from the primary strata. Price's "hillside nodular chert" retains an unweathered cortex while gravels incorporating these nodules have had the cortex extensively modified by water action (Price, Price, and Harris 1976:19). Manger's approach, in attempting to identify the precise geological strata for each chert, is a proper initial step and needs to be continued. To date, the best known Ozark chert is the distinctive black Pitkin chert (Erwin n.d.; House 1975:85) which is found in gravel deposits near the primary deposition strata, the Upper Mississippian Pitkin limestone. What has been apparently misidentified as Boone chert, named after the Lower Mississippian Boone formation, may actually be Middle Devonian Penters chert (Manger 1977:212). Since much of the water-worn lithics found on Crowley's Ridge originated from Ozark strata and since a significant amount of Ozark chert cobbles were gathered from secondary gravel deposits, it will always be difficult if not impossible to differentiate with any degree of certainty between Ozark and Crowley's Ridge cherts. Ozark cherts found at Zebree seem definitely associated with Big Lake and Lawhorn phase and probably were utilized by Barnes. Any identification given within this report must be considered at best a probability guess based upon personal experience with cherts from both regions.

Sandstone

Very little attention has been given sandstones in the archeological literature and the northern alluvial valley is no exception. To be used as an abrasive, sandstone has to be selected carefully for the project in mind. Variables include size of particles, hardness of particles, angularity of particles, size uniformity of particles, spacing of particles (called structure), and strength of bonding of particles (called grade). The St. Francis River allows access to a variety of sandstones in the Ozark Highlands to the north of Zebree. There is some evidence in the northern valley that considerable greater variety exists in Mississippian assemblages than in Dalton collections in terms of both shape of abrader class and in the attributes given above. Our status in understanding the function of abraders and the availability of appropriate outcroppings is on a lower level than our knowledge of cherts.

A distinctive ironstone outcrops in the creeks of Crowley's Ridge. It is a coarse sandstone solidified by an iron matrix. It occurs in layers and is easily obtained. Near Bono is a 20-acre outcropping of large sandstone boulders, some of which may have been suitable for abrasion.

Experiments conducted in 1975 on the use of lithics in earthovens demonstrated that sandstone retains heat longer than chert (House and Smith 1973). It also demonstrated that sandstone fragments badly and that its lower proportion in relationship to chert and quartzite in an actual earthoven situation may not be representative of its importance. Earthovens in the northern alluvial valley are known to exist from late Archaic through middle Woodland. In all cases, pottery objects and fragmented chert and sandstone are present in these pit features. These are largely unpublished finds made during salvage operations in northeastern Arkansas. No earth-ovens are known for the Mississippian and it is not known when this cooking technique might have phased out during late Woodland. A variety of sandstones from the Ozark Highlands and from Crowley's Ridge were associated with the Big Lake phase of Zebree. The presence of sandstone for use as abraders for Lawhorn and Barnes is indicated by manufacturing scars on bone tools.

Basalt and granite

Igneous rocks are available in the Ozark Highlands of south-eastern Missouri and "Granites of excellent quality are quarried in Iron and St. Francis counties" (Branson 1944:388). A great deal of confusion exists in the eastern United States archeological literature concerning the identification of igneous rocks. Despite fairly specific geological definitions of igneous rocks, one can have the same rock identified as different classes by different geologists. This is often due to the reluctance of the archeologist to allow a tool to be sacrificed for a thin section identification or to be able to afford to have all debris so thin sectioned and identified. But again, the headquarters of the St. Francis River are located within this region of igneous outcroppings. Artifacts apparently made from stone in these outcroppings occur within the Big Lake deposits at Zebree.

Mineral-based paints

Galena cubes are a Mississippian trait and probably constitute the base for a white paint (Griffin and Morse 1961). A white slip was also prepared from kaolin (Shepard 1971). Galena is available in the Ozark Highlands of southeast Missouri in large quantities (Branson 1944:393-394). Galena must be oxidized to be used as a paint base. Both galena and hematite are associated with the Big Lake phase at Zebree.

Hematite is commonly found on many Mississippian sites and has been assumed to be the pigment involved on all red-slipped sherds. X-ray diffraction analysis performed for these studies, in cooperation with the ASU Physical Sciences Department, has shown the red slip to consist of an unspecified iron compound within a clay base made of local clays (Table 15-4). The iron compound has not been identified to a particular mineral type, primarily because the clay matrix largely dominates in the slip, masking the relatively low proportions of the pigment. The d values of 2.47 and 1.99 in Table 15-4, are measurements of the iron-compound used to pigment the red slip, but are insufficient to identify the compound accurately.

A ceramic slip is typically defined as a very thin "soup-like" clay and water suspension (Fewkes 1942:118-119; Rhodes 1957:59, 160). Usually a well cleaned clay is levigated and the finest-grained, upper portions of the slaked clay are used as slip. Often a ground mineral powder or a plant extract (particularly in the Southwest) are added to the clay matrix to act as pigmentive or cohesive agents (Shepard 1971:31-43). Hematite was used as a colorant only. The slip, or *engobe* in modern ceramic literature, is wiped or brushed onto a vessel's surface by a hide or rag of fabric or leather or perhaps a brush of plant fiber or hair. The slip is applied while the pot is still in a slightly moist state and the process therefore requires that the drying rates for the slip and the pottery paste be adequately similar. Otherwise, the slip is likely to crack and fall off. Once the whole has dried to a leather hard state, it is polished with a smooth pebble or similar tool. This operation erases any evidence for the type of slip applicator utilized and creates a relatively dense and compact layer which is strongly bonded to, yet distinct from, the body of the vessel itself.

Hematite occurs in "well drained, highly oxidized soils" which include gravelly soils, sandstones, and limestones (Horn 1968:13 & 15) where clay-like particles of hematite can often form red clayey soils. Gravels are present in large quantities in both Crowley's Ridge and in the Ozarks. A primary source of hematite procurement, therefore, is in the small creeks and other erosional cuts into such well drained soil masses.

Various experimental slips have been prepared using several different local clays and hematites collected as far away as north-central Arkansas. Attempts were made to compare these with the dried slips found at the Zebree site after all samples were applied and polished onto test-tiles made of typical shell-tempered paste. Although the first experiments are considered only preliminary, one of the prehistoric specimens compared very well with one slip made from a dense, red clay found in a vein in an Ozark gravel pit. In another experiment, a pot was fired that had been slipped with ground hematite in combination with a thin Sharkey clay base and turned a distinct red color upon cooling.

All told, the existing evidence lends some strength to the idea that two distinct slip processes were utilized by these early Mississippian potters, each involving a different form of natural hematite. One method is accomplished in grinding the relatively soft lumps of hematite, often found in creek gravels, into a fine powder which is added to a thin clay base. A second possible method is performed using the clayey hematite deposits occurring in veins within gravel beds. Such a high iron concentrate in clay form could be processed into a material known as *terre sigillata*. This composition "is familiar as the burnished surface seen on the classical wares of the Greeks and . . . on the pottery of many primitive peoples" (Rhodes 1957:192). It is prepared by allowing an "iron bearing plastic clay" to slake until completely wetted at which time it is thoroughly stirred and then left to settle for several days. Top water is poured off and only the finest particles in the upper one-third or less of the red clay slip are collected for use. This preparation is applied to the vessel and can be burnished once it has partially dried.

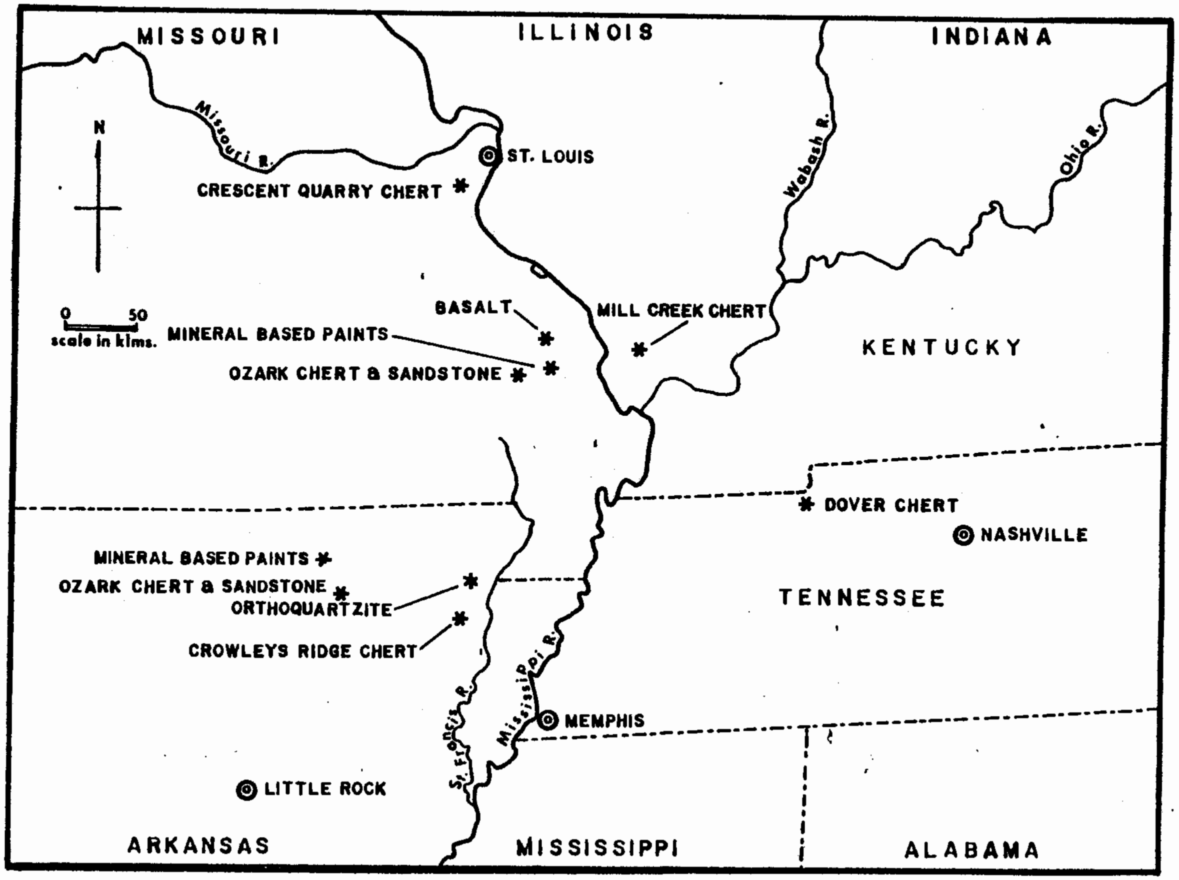

Figure 15-5. Major lithic resources near the Zebree site.

CHAPTER 16

THE BARNES CERAMIC COMPLEX

Michael G. Million and Dan F. Morse

The Late Woodland component at 3MS20 is most abundantly represented by ceramics. The basic sand-tempered ware present at Zebree was originally defined by Stephen Williams (1954:204) with the establishment of two pottery types based on differential surface treatment, Barnes Cord Marked and Barnes Plain. Although Phillips (1970:94-95) has changed Barnes Plain to Kennett Plain to avoid duplication in type nomenclature, *vis-a-vis* Barnes Cord Marked, the original designation has been retained in this report in accordance with Morse (1975b:45). This approach is thought to be less confusing since it avoids the possibility of segregating sherds of a single vessel (i.e., a jar with a cord marked body and plain neck and rim area) into exclusive vessel types. In short, Barnes Cord Marked and Barnes Plain cannot be considered mutually exclusive vessel types. Although the areal distribution of most decorative variations on the site have been examined, the primary research emphasis in this chapter is placed on the morphological analysis of whole vessel forms and related functional implications.

Technological and Processual Aspects of the Barnes Pottery Industry

The pottery "paste" used by the Barnes occupants at 3MS20 was prepared with clay probably procured from locally available backwater deposits which primarily included low areas, east of the sandy highlands, in the floodplain of the Right Hand Chute of Little River (Chapter 15). This type of clay would commonly be found in two natural conditions, this is, it could be gathered wet from the bottom of a depression that contained slackwater or it might be collected from a stream bank, or dried bed, in an indurated state. In either case, coarse vegetable materials are relatively abundant. There are two primary reasons the clay would be soaked before use as a pottery clay. The first is so that each minute clay particle may become thoroughly wetted as this greatly enhances it workability. Secondly, the clay's impurities are most effectively cleaned while the clay is water saturated. It may be cleaned manually by picking out the larger inclusions or, alternatively, by passing the clay through a net or sieve. The latter method could be fairly easily accomplished and is very efficient. Replicative efforts have shown that the clay is not efficiently processed by crushing it when dry as it is extremely hard in a dry state. Therefore, soaking the clay to increase its workability and the ease of 'wet' cleaning were probably sufficient rationale for processing the clay with the aid of water. The two activities could even be performed concurrently. The net and cord impressions on Barnes sherds are supportive evidence that a wet means of processing raw clay with a sieve was certainly possible.

The high shrinkage rate of backswamp clays, which is due to their miniscule particle size, compelled aboriginal potters to temper the clay with nonplastic inclusions. The sand used by Barnes potters, as does any adequate temper, reduces the amount of shrinkage and opens up the texture of the clay so that it can dry more uniformly thereby easing the strain created from differential drying rates for various portions of a pot (Shepard 1971:25-26). Tests conducted with various experimental sand-tempered pastes show that a typical Barnes sherd consists of about 25-33% sand by weight. There is no doubt that sand was deliberately added to the paste. Even though such a paste can reduce the 12-14% shrinkage rate of untempered clays to about 9%, it is quite stiff and relatively difficult to control effectively. This restrictiveness is an important technological consideration in explaining the rather severe lack of variety in shape in the Barnes vessel assemblage. In contrast, and as is discussed more fully in Chapter 15, the burned and crushed mussel shell temper used by Mississippian potters, with its additional "flocculating" effect on backswamp clays (Million 1975:201-208), could be used in roughly one half the proportion (10-15% by weight) that sand temper requires and attain the same degree of shrinkage reduction without losing nearly as much plasticity.

The type of sand commonly found as temper in Barnes sherds at Zebree, with little variation being noted, is apparently wind worn as the individual quartz grains are typically "crudely rounded and characteristically dull or frosted in appearance," (Butzer 1973: 175). Individual particles normally measure less than 1 mm in diameter while a significant proportion grade to a much smaller size. These sands were abundantly distributed in the highland areas west of Big Lake, usually on locations of higher elevation. Even though these sands were almost certainly carried to the vicinity by alluvial processes (Saucier 1974:4) they have apparently been subjected, within recent geologic time, to aeolian modification producing irregularly shaped, frosty sand grains.

Once the paste ingredients were combined and evenly blended by wedging, the coil method of construction was employed to build the vessel. Relatively thick coils formed by squeezing instead of rolling out on a work board are much more frequently represented in the unintentionally fired by-products of Barnes pottery manufacture.

One construction technique seems the most logical for the Barnes jar form (Fig. 16-1). Beginning with a small, thick modeled base which is not necessarily conical, the large coils are attached and blended to form the vessel body. As the pot grows, it is held at a low slant or tilt so that the base of the pot does not have to support the heavy upper portions. The density of the paste and its relatively weak self-supportiveness probably necessitated such a procedure. This operation would have the effect of pointing the base of a vessel (Hodges 1965:115) and would account for the conical bases on Woodland vessels commonly found in the eastern United States (Griffin 1950). The pointed base was maintained as a contour element by the potter and probably was made distinct in the final forming of the pot using a cord-wrapped paddle. Moreoever, this lack of internal cohesiveness in the paste may have practically demanded that the shape of the jar be capable of providing considerable vertical support once the container was fired and in daily use. Viewed in this light, the conoidal shape of the Barnes jar may be structurally, not stylistically, validated.

Variations in Vessel Morphology and Related Functional Implications

As previously stated, the basic pottery form manufactured by Barnes potters is a conical based jar. This form accounts for an estimated 97% of the total number of Barnes pots represented by the rims from the random square sample (Fig. 16-2). The remainder of the containers are small, plain bowls which, with the exception of a scalloped-edge bowl from the 1975 excavation, are the only other form recognized for this period (Fig. 16-3). Obviously there was a heavy dependency on the jar form. While only nine individual jars have been reconstructed with any accuracy, it is nevertheless apparent that the shape shown in Fig. 16-2 was the traditional form conceptualized by the Barnes people for a jar-type container. The slight variations observed in the jar shape are not believed to be specifically intentional, but are thought to be more reasonably explained by the difficulty of manipulating the ponderous sand-tempered paste and the individual vagaries of the potters' work. In fact, considering the disposition of the paste, the relative conformity of jar shapes indicates not only adept manipulation of the clay, but also signifies deliberate effort in duplicating the "ideal" form. Variations in size, however, are probably to some degree reflective of differences in functional intent.

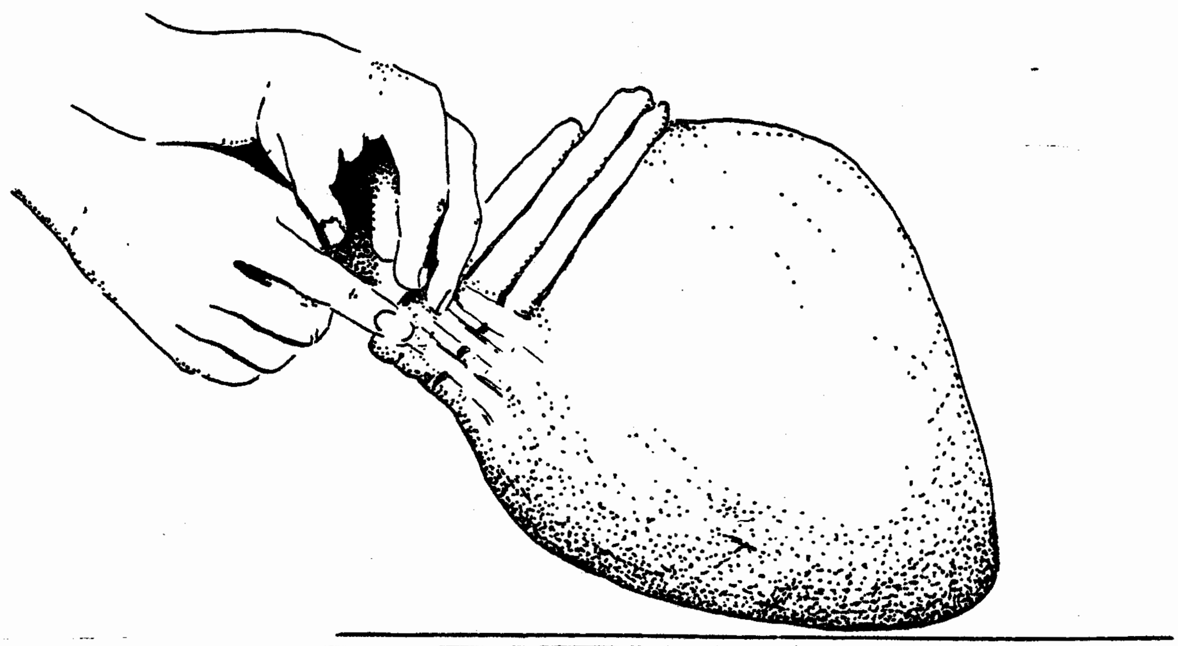

Figure 16-1. Hypothesized method of manufacturing Barnes jars.

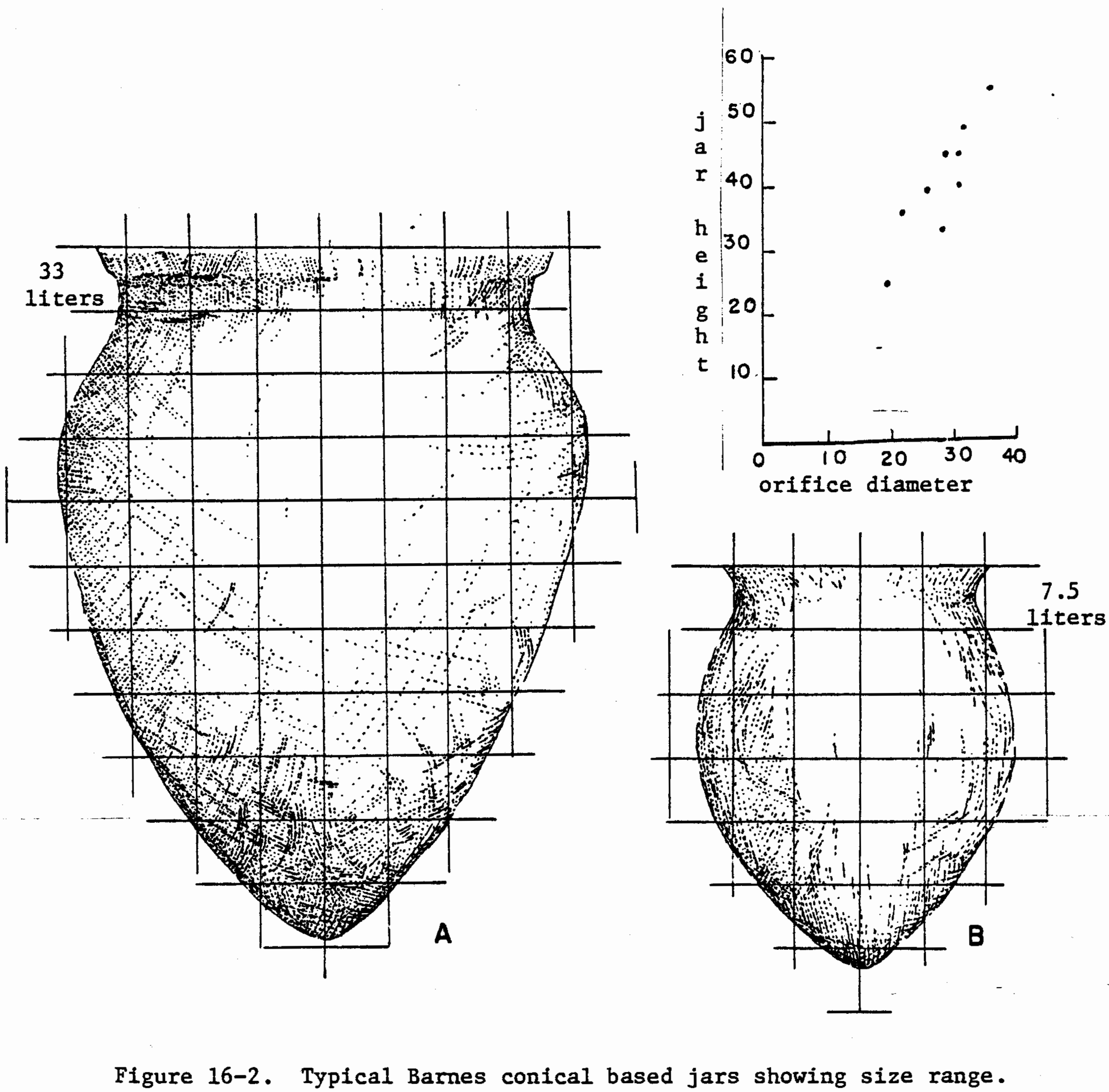

Figure 16-2. Typical Barnes conical based jars showing size range.

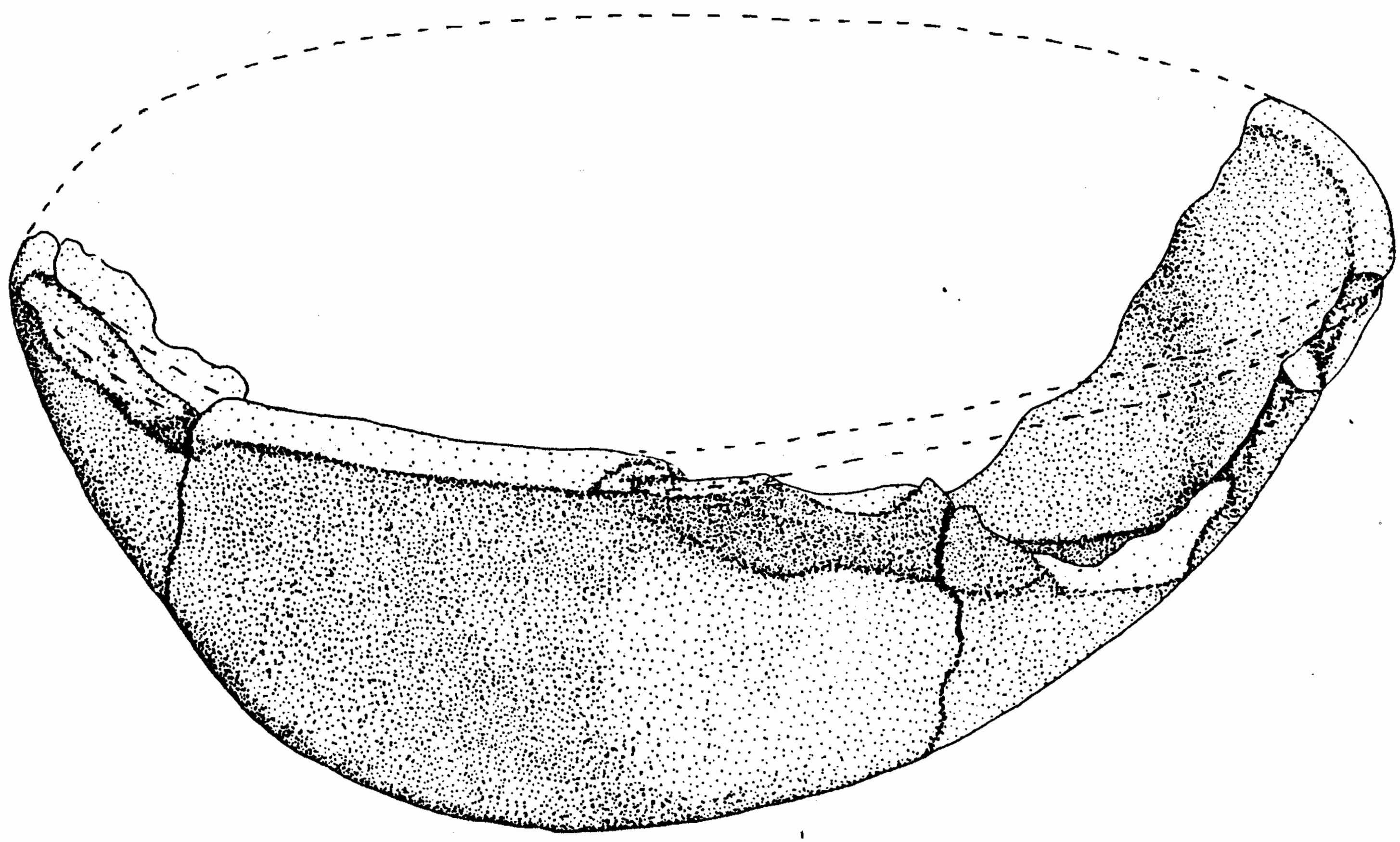

Figure 16-3. Reconstructed Barnes individual food bowl. Full size.

The distribution by size of our reconstructed Barnes jars is graphically illustrated in Figs. 16-2 and 16-4. These vessels do not cluster tightly around a particular size; rather, the majority seem to graduate evenly within a capacity range of roughly 13-24 liters. The dimensions of an average vessel can be extrapolated from the graph as one just under 30 cm in orifice diameter and just above 40 cm in height. The volume of a vessel of this size is calculated at 17 liters (see Chapter 9 for a discussion of computing sizes of vessels).

Evidence of actual prehistoric function(s) of the Barnes jar is frustratingly lacking in the archeological record. The vast majority of Barnes sherds were excavated from "sheet" or kitchen midden deposits or from features whose fill is loosely categorized as trash. This naturally suggests vessel exhaustion in day-to-day utilitarian service. One body sherd of a large jar, unfortunately collected from the spoil of a pot hole, does exhibit a small amount of carbonized material adhering to the inner surface. The logical interpretation here is that the large, conical-based jar, by far the most common late Woodland vessel at the site, was used prehistorically as a cooking receptacle. The absence of Poverty Point objects and earth ovens, which apparently were used to cook foods in earlier Woodland and Archaic societies, supports this interpretation. Additional or alternative usages could include the temporary storage of foodstuffs and water. Repair holes are infrequent. However, other containers, such as those made of wood, gourd, cordage or animal skin, should have been present as well.

The presence in the Barnes assemblage of a low frequency group of small jars, which seem to account for approximately 6% of all estimated jars, is suggested by one reconstructed vessel as shown in the graph (Fig. 16-2) and by several rims. Maximum capacity of the single measurable example is 7.5 liters. These small jars may have been employed in a much wider range of idiosyncratic usages which probably included tasks that were as commonly performed by containers of wood, gourd, baskets, and other devices. But it is more reasonable to expect that these are cooking vessels for smaller household groups.

At the opposite extreme, a single 33-liter capacity vessel is representative of a similarly low frequency group of a particularly large jar form. Such a container may have served in similar contexts as the common sized jars but in activities involving larger social units (i.e., community or extended family functions) or they could have served some other function. A large jar of this kind is difficult if not impossible to objectively recognize unless a large section is present. This is due to warpage of the vessel during manufacture owing to its weight.

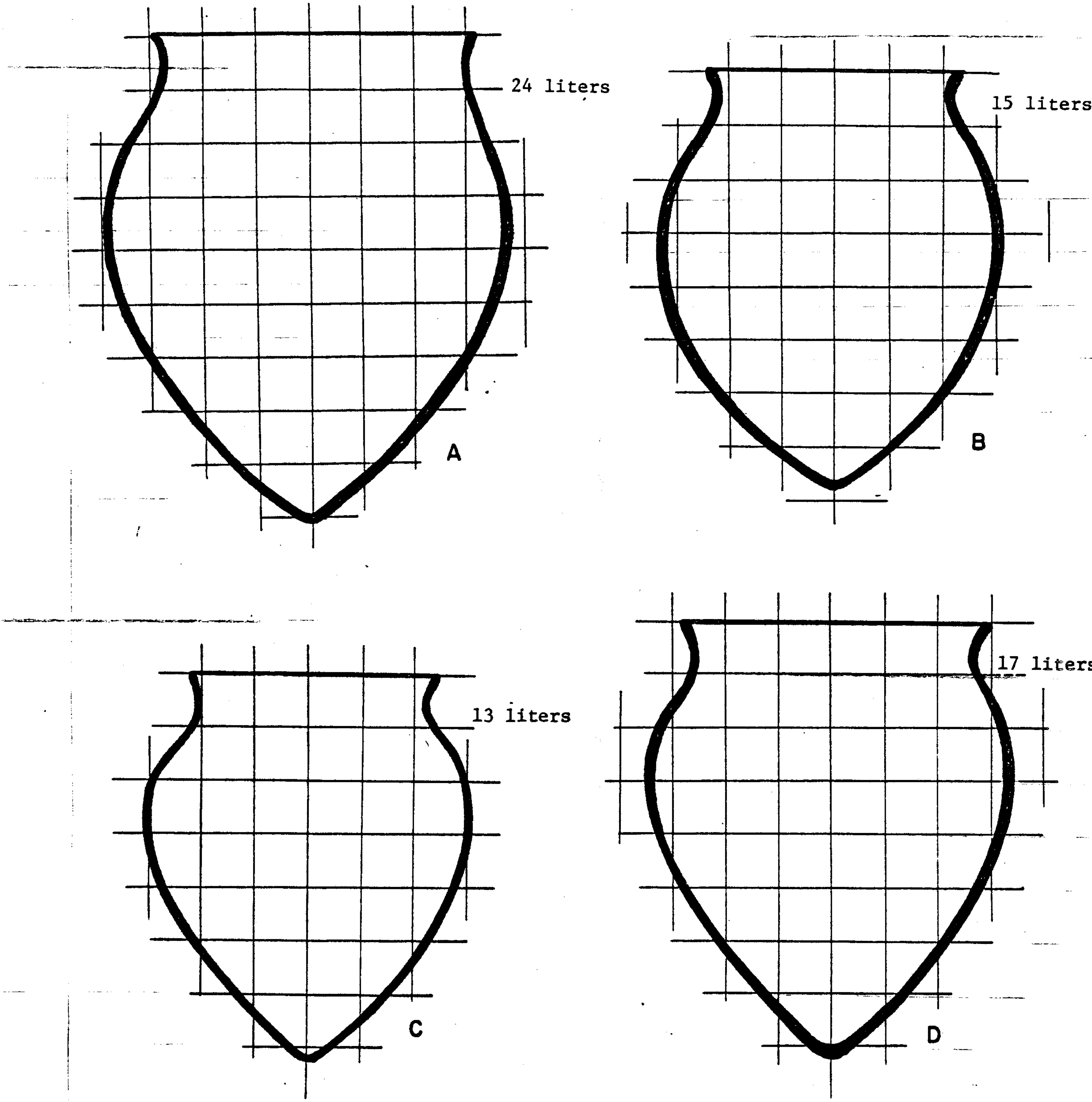

Figure 16-4. Calculation of capacity of typical Barnes jars.

Very little information was recovered concerning the Barnes bowl form. We do know that bowls almost always have a plain surface treatment and seem to have been constructed by modelling as opposed to the coil method. An estimate of maximum capacity is approximately 0.75 liters although the "typical" bowl may have been smaller than this figure. With bowls comprising only approximately 3% of the estimated recovered Barnes vessels, it is possible that individual serving containers were generally made of some perishable material such as wood or gourd or that somehow bowls are underrepresented in the probabilistic sample (see Chapter 20).

Turner and Lofgren (1966) have published some very pertinent observations which may be applied to the Zebree data. The prehistoric Western Pueblo mean ladle capacity was found to be 0.36 liter and the mean food bowl capacity is 0.69 liter or twice the ladle size. The 0.69 value is similar to the Barnes 0.75 liter value for small bowls. Western Pueblo small jar size means range between 3.1 and 4.9 liters and are equatable to a mean household size estimation ranging between 4.495 and 5.199. A capacity of around 3.5 liters or slightly larger would seem to equate with a household size of around five based on these data.

Small jars in Barnes may measure around 7.5 liters or approximately twice the size of a Pueblo cooking jar. This might indicate a household size twice that of the Pueblo, around 10 individuals. The "typical" Barnes jar size is 17 liters with a range from 13 to 24 liters. Suggested is a typical maximum social grouping of 20 to 35 with a central tendency of around 25 based on comparisons to Western Pueblo data. The maximum jar size is 33 liters, possibly large enough to feed just under 50 individuals. These data suggest that households numbered around 10 and that clusters of 2, 3, 4, or at the very most 5 households may have interacted together perhaps as a village (see Chapter 17).

Decoration

Barnes Cord Marked is a sandy paste pottery with cord marking visible on the exterior surface (Figs. 16-5a-e, g and 16-6). Barnes Plain is a sandy paste pottery with no observable imprints left from a cord marked treatment (Fig. 16-5f). Classification in the pottery tables in the appendix is of sherds, with no attempt to represent other than what was directly observable under a 10 power hand lens. The typical jar is completely cord marked on the exterior surface. Occasionally the lip and rarely the rim or rim strip is plain.

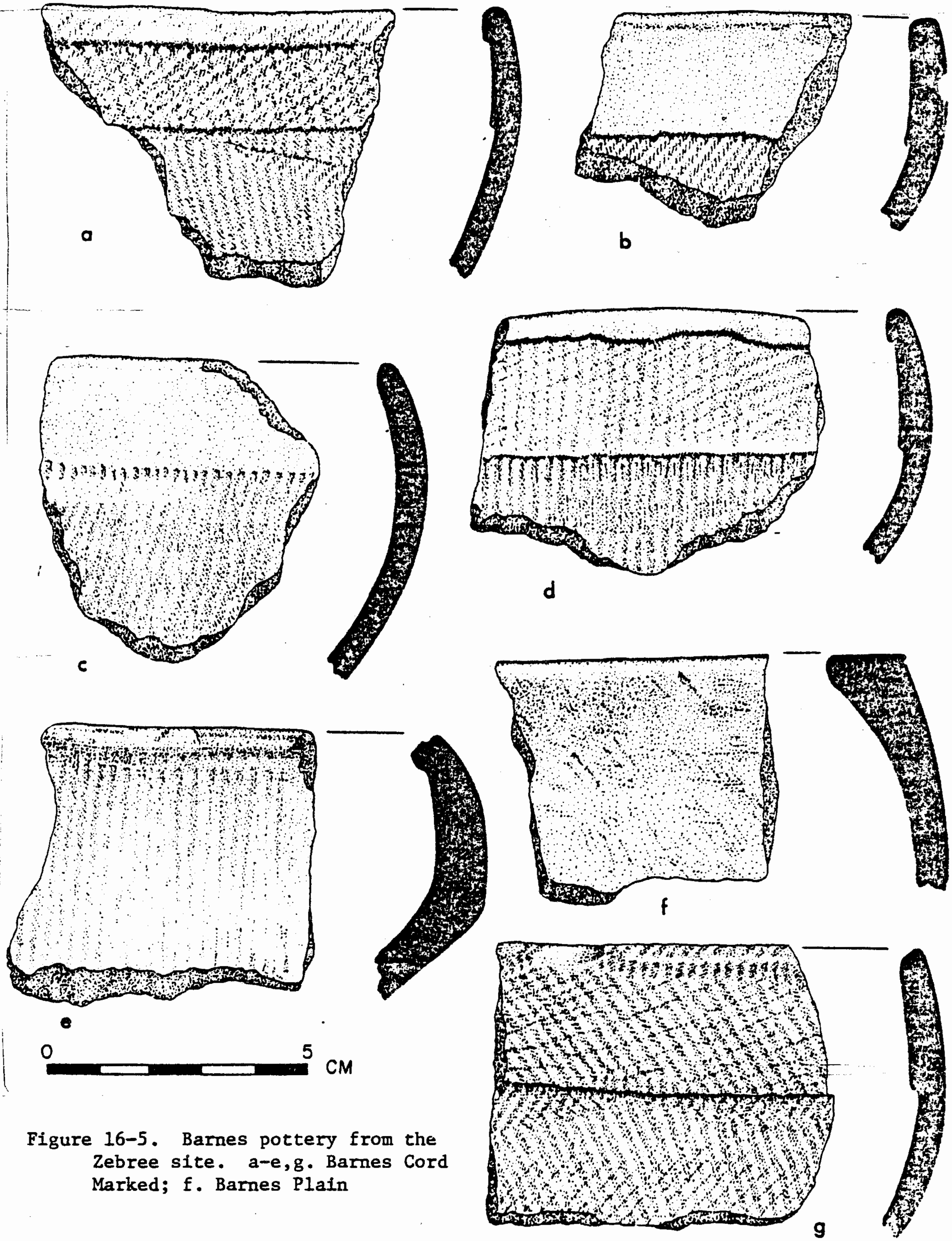

Figure 16-5. Barnes pottery from the Zebree site. a-e,g. Barnes Cord Marked; f. Barnes Plain

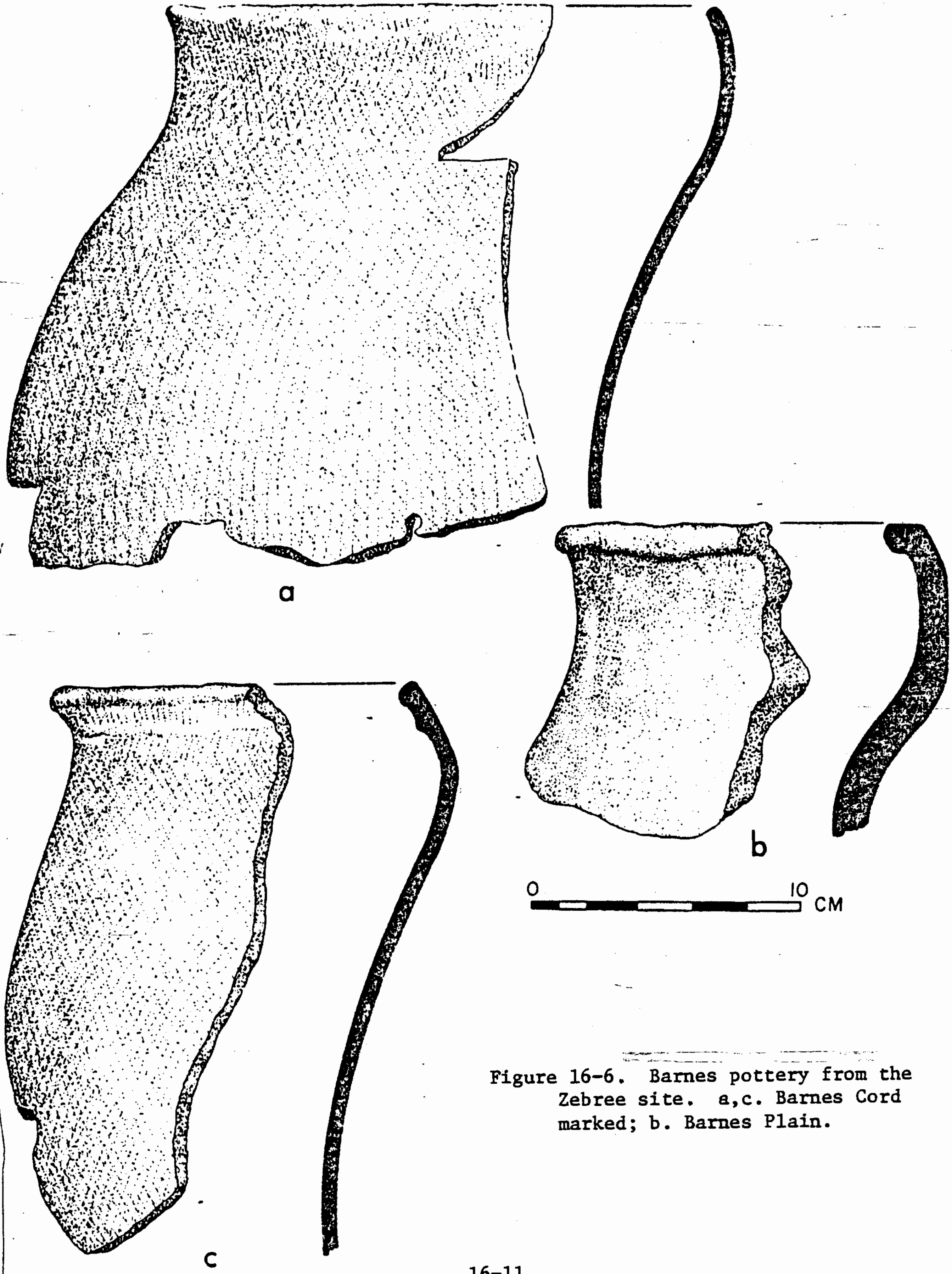

Figure 16-6. Barnes pottery from the Zebree site. a,c. Barnes Cord marked; b. Barnes Plain.

Plain jars are rare in the Zebree Woodland assemblage. Some of the Barnes Plain rims found are small remnants probably from Barnes Cord Marked vessels. The remainder are from relatively small jars, miniature jars and bowls. Approximately 11% of the rimsherds from random squares are plain surfaced and many of those are from bowls and cordmarked vessels. Almost 13% of the Barnes body sherds from the random squares are plain surfaced.

Over stamping in the area of cord marked surface treatment is normal. Often on the rim, over stamps are perpendicular to each other giving an impression of check or net impressed decoration. In 1975 almost 80% of the cord marked rim sherds were identified as perpendicular over stamping by cord-wrapped paddles. Usually, the impressions on the rest of a jar are superimposed almost directly upon each other. The cord used seems to be mostly 2-ply and ranges between 1 and 2 mm wide. One very fine cord marked body sherd has cords less than 1 mm wide, spaced eight to a centimeter. Normally there are either three or four cords per centimeter. A 1 mm wide cord spaced three to the centimeter gives a different overall effect than a 2 mm wide cord spaced four to the centimeter and there is a possibility, not followed in the present analysis, that a detailed investigation could separate out definite traditions.

Fabric impressed sherds are present in very small numbers and are very difficult to recognize. Virtually each suspected sherd has to be submitted to the detailed examination of a clay impression. Based on the 1969 experience of spending an enormous amount of time in concluding that only 15 sherds were probably fabric impressed, we did not emphasize the identification of fabric impressed sherds. Not a single sherd was noted in 1975 which was considered as fabric impressed although some possible sherds were noted. Obviously this is a little used alternate to cord marking as a surface treatment. Its presence was not expected since as a motif on a Woodland paste it normally dates to a much earlier period (Phillips, Ford, and Griffin 1951:2).

There is some evidence that cord marking increases through time during the late Woodland (see Chapter 10) in the northern portion of the alluvial valley in contrast to an increase in plain surfaces through time to the south (Phillips 1970). At least it was partly on this basis that the Zebree Barnes component was viewed as a late expression of Barnes. This view is reinforced by a lack of middle Woodland decorative motifs and by the presence of decoration considered to be late within the late Woodland.

One example of a Barnes Plain rim sherd with notched lip was found in 1969. The sherd is from a jar smaller than usual. The notches are 2 mm wide and deep and are spaced 9 mm apart. A cord marked treatment apparently once existed on this small sherd and was smoothed over; possibly the body of the jar has a cord marked surface treatment. At the Steuben site in central Illinois Weaver Notched or Wavy Lip appears at about the time Hopewell is phasing out (Morse 1963). Notched or wavy lips occur rarely on Coles Creek Plain (Ford 1951:Fig. 26 dd,ee). It is a rare motif on Baytown Plain (Phillips, Ford, and Griffin 1951:80). A rim sherd from a bowl was found in Feature 249 at Zebree which has a rounded lip accentuated by an exterior incised line 6 mm beneath the lip. On the slightly exterior bend of the lip are a series of minute notches perpendicular to the lip measuring no more than 3 mm long and less than 1 mm wide.

Five sherds were separated on the basis of one or two possible parallel incised lines. The lines were vague, shallow, and narrow. Four (classified as "other" under Barnes body sherd categories) were found in the random squares and one was found in 1969 (Morse 1975b:58). It is difficult to discern whether this is purposeful incising for decoration or merely incisions due to a scraper point as the vessel was turned during a final manufacturing step. All of the sherds so treated had a cord marked surface treatment.

Two punctated sherds were recovered in 1969; none were recognized in 1975 or 1976. A thin (5 mm) sherd was found in Feature 37 with at least two rows of deep circular punctates just beneath the neck of the vessel. The rows are parallel with the neck edge and spaced 12 mm apart. The punctates are 2 mm in diameter and 2-2.5 mm deep. They are spaced 5 mm apart. The punctates were made into a smoothed Barnes Cord Marked surface treatment.

The second sherd, found in 80R12, has a plain surface. Near one edge in a row parallel to the edge is a series of semiconical punctates, the so-called fingernail punctates. A single punctation takes up an area measuring 5 mm square and is 1 mm deep. They are 7-8 mm apart with alternate quartermoon punctates and raised areas.

Since punctation and incising are motifs found throughout Coles Creek (Phillips 1970) and date both earlier and later than this time period, it is a little surprising that punctation and incising are not more apparent in the Zebree Barnes assemblage. On the other hand, there is little decoration other than cord marking for this component and this lack of emphasis on inscribing or punching designs on pots is a characteristic from now until the advent of the middle period Mississippian after around AD 1150 or so in the northern alluvial valley.

One Barnes Plain bowl from Random Square 17 has a scalloped rim. The single rounded scallop on the small sherd representing this vessel is 25 mm wide at the base and protrudes 10 mm beyond the lip. Similar examples in Coles Creek are referred to as triangular lugs (Phillips 1970:186, Fig. 11d,g). These occur infrequently on Baytown Plain (Phillips, Ford, and Griffin 1951:80) and this may be what the Zebree sherd represents.

A total of 93 check stamped sherds were found during all of the excavations at the Zebree site. Sixty-one of these were found in Random Square 68 and eleven were recovered from 12R16 in Area B in 1969 (Fig. 16-7). These can be called a primary and a secondary center for check stamped sherds. Immediately around the primary center were another five sherds and scattered between this area and the ditch were another five sherds. Two sherds were recovered from Feature 290 at a fair distance to the north. Nine sherds were found immediately around the secondary center. There is an excellent possibility that all recovered sherds are from the same vessel or at least from two vessels of the same approximate size upon which the same paddle was used. Ten of the eleven sherds in square 12R16 were in Zone C and the eleventh was recovered from Zone D immediately beneath Zone C. Zone C is an artificial strata deposited by the Big Lake phase probably immediately upon occupation of this locus. A large Big Lake phase feature located near Random Square 68 may have provided some of the soil for this zone and the probability is that sherds in Area B were transported there by the Big Lake phase people.

Each check stamped relief unit tends to measure 3 by 4 mm and the deepest impression is 0.6 mm. The treatment is sloppy in many cases involving overstamping, paddle dragging and smoothing parts of the relief units to obliteration. This decoration technique in the Mississippi Valley occurs on a Baytown paste (Phillips, Ford, and Griffin 1951:87-88) and is known further south as Ponchartrain Check Stamped (Phillips 1970:154). In both instances it is regarded as a very late style; in fact, Phillips views it as late Coles Creek period. At the Zebree site, it presumably would data immediately before the Coles Creek period and in the Baytown period since a Barnes paste is involved. Its presence in northeast Arkansas reinforces the concept that the Baytown paste check stamped was inspired by the north Alabama Wheeler Check Stamped tradition and that Ponchartrain Check Stamped was inspired by the Florida Wakulla Check Stamped tradition.

A total of 37 sherds from the random squares exhibit exterior rim folds (Fig. 16-5a,b,d) (Phillips, Ford, and Griffin 1951:78,85). In 1969, 9% of the sherds in Area A had rim folds in contrast to

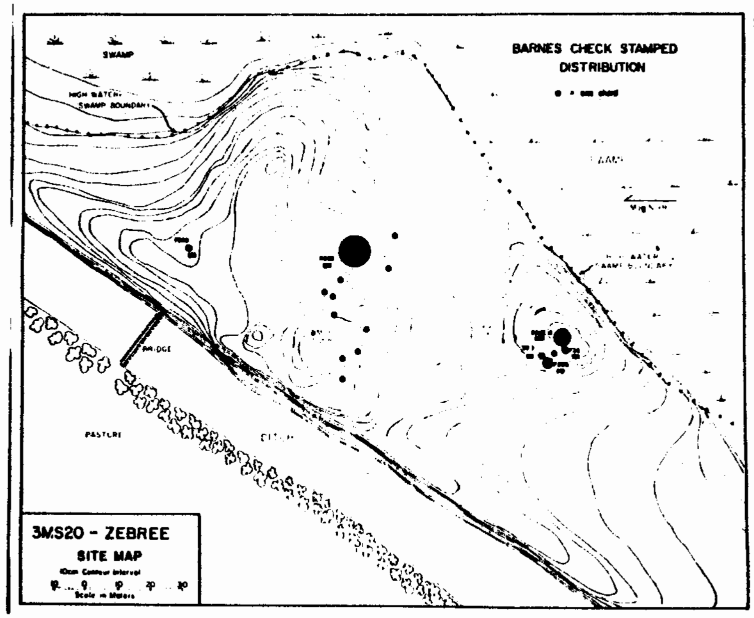

Figure 16-7. Distribution of Barnes Check Stamped at the Zebree site.

29.4% in Area B (Morse 1975b:53). The random squares indicate a figure of 12% overall incidence of rim folding in contrast to the 1969 20% figure. More importantly the 1975 sample was not clustered similar to the 1969 data and refútes the 1969 hypothesis that there are major ceramic differences between these two areas of the site.

Variations in rim folds are given in the appendix. They measure between about 15 and 35 mm in width, this variation possibly relating to overall vessel size. Cord marking tends to be overstamped perpendicular elements and lips tend to be smoothed and rounded. Very rarely a double fold is present. It is possible that a detailed analysis of rim fold and lip variations might result in pinpointing attribute shifts through time but small samples and the uncertainty of results prevented such an analysis at this time.

Possible Examples of Toys or Initial Attempts to Make Pots

A strange plain "vessel" fragment was found in Feature 202. The surface is rough and the object is basically molded. It seems to be bowl-shaped but any reconstruction is hampered by its crudity and the fragile nature of the few sherds recovered. One reconstruction is a bowl form with a maximum diameter at the orifice of around 140 to 150 mm and a maximum height of 90 to 100 mm. The base is a 15 mm high pinched knob which tapers from 20 mm in diameter to 10 mm across. The lip is smooth and flat. It may be a crude lid or a crude bowl with a pinched base in imitation of the subconical jar bases. An alternative explanation is a miniature vessel or someone's initial attempt at making a vessel. An initial discovery reaction of a tetrapodal base does not seem plausible at the present moment.

In Feature 4 was found an untempered miniature Barnes vessel (Fig. 16-8). It measures 29 mm high and 30 mm wide with an orifice diameter of 24 mm. A basal nipple similar to that described above is 3 mm high and 10 mm in maximum diameter. The rim sherd of a slightly larger plain jar which would have measured around 80 mm high and also in maximum diameter was found in 1969. In Random Square 82 was recovered the rim sherd of a probable miniature jar but no size data can be reconstructed. An untempered plain miniature bowl fragment was recovered in Random Square 104.

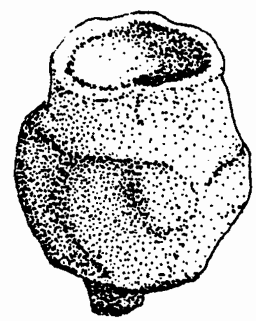

Figure 16-8. Miniature Barnes jar. Full size.

Possible Trade Pots

A total of ten body and four rim sherds are grog tempered and probably represent Baytown trade vessels. In addition to these, one Coles Creek sherd is also described although this most probably represents a trade vessel during the period of the Big Lake phase. Baytown is represented by Baytown Plain, Mulberry Creek Cord Marked, and Withers Fabric Impressed sherds. The latter pottery type normally is associated with early and middle Woodland but at the Zebree site probably is later and reflects an alternate to cord marking. The binominal pottery type name (here suggestive of an earlier Woodland period) thus contains a built-in temporal conflict with reality in cases such as this (Overstreet 1977; Mason 1966:184).

Three body sherds from Random Squares 26, 44 and 103 are Mulberry Creek Cord Marked. Another three body sherds are Baytown Plain and eroded surfaced sherds possibly from one vessel found in Random

Square 57. Two additional body sherds of Baytown Plain were found in 1969, in Square 82R12 and from the general area on the surface near Datum One. Three Mulberry Creek Cord Marked rimsherds, probably from three different vessels, were found in Random Square 36. One Baytown Plain rim sherd was found in Feature 166.

In 1969, a decorated Baytown paste sherd was recovered from Square 80R6. The exterior surface of the small sherd exhibits a single row of triangular punctations measuring 2 by 4 mm in extent and spaced 5-7 mm apart along a sloppily incised line measuring less than 1 mm wide. To assign this sherd to a type would only confuse the issue since it could conceivably be placed in one of a number of categories as only a limited section of the vessel is represented. There are both Baytown and Coles Creek types somewhat similar to the sherd.

A Greenhouse Incised (Coles Creek Incised, *var. Greenhouse*) rim sherd was recovered from the third level in Random Square 106. It exhibits three lines on the exterior surface and one line on the lip. The description given by Phillips (1970:72) described this sherd fairly closely:

> Two or three lines widely spaced on thin tapered rims of smooth, 'polished,' fire-clouded gray ware comparable to the *Little River* and *Vicksburg* varieties of Baytown Plain. Lines usually *not* overhanging. Row of punctations below lines does not occur. Single line on lip occasional; more than one very rare.

Phillips, following Ford, places this variety of Coles Creek Incised late within the Coles Creek period. This conflicts to a certain degree with the presence of the variety at the Zebree site. The dating is too late for the Barnes component and almost too late for all of the Big Lake occupation of the site. The context of the sherd at the site does not help. All we can surmise at the present time is that the sherd is representative of a traded bowl during the latter part of the Big Lake phase occupation of the Zebree site.

A very few Barnes sherds contain substantial amounts of grog tempering. Individual body sherds were found in Random Squares 17, 18, 19, 43 and 48. Whether this reflects an awareness of Baytown pottery or not is not known but it is interesting to note that they tend to cluster in the northern part of the site. However, this is also the first cluster of random squares to be excavated and analyzed and we suspect this was considered a free-variation attribute which ceased to be observed soon after analysis began.

Estimation of Total Sherds and Vessels

One objective of the random square strategy was to gain some sort of idea of the total amount of refuse within the sampled area if not for the whole site. Admittedly any estimate, especially one based on a 1% sample of only one-half of the site area, is conditioned by several variables. First the results of making estimations will be presented, then the major variables as we perceive them will be discussed.

In the area sampled, a total of 12,042 Barnes sherds were recovered using the 1/2 inch screening mechanism explained in Chapter 9. The total weight of these sherds is 55,419 g. Multiplying these figures by 100 results in values of 1.2 million sherds and 5.5 million grams. According to Anderson's comments in Chapter 7, the latter figure should be increased by approximately 24%, to 6.8 million grams. If these pots weighed between around 4500 and 7000 g, then from just less than 1000 to about 1500 jars are indicated. These figures have to be viewed as maximum amounts.

The mean weight of a Barnes sherd is 4.6 g. Its density is 1.75 g/cm^3 and the usual thickness is around 0.75 cm; thus, the "average" sherd can be viewed as 1.9 by 1.9 by 0.75 cm thick. This figure compared with the apparent typical surface area of a jar results in an estimate of around 1000 or slightly more sherds per jar. This in turn in turn indicates a total population of jars of around 1000.

The total estimated Barnes vessels recovered in the random squares number 244. Of these, several are bowls. If all things were equal, this would indicate a population of 23,700 jars and 700 bowls in the one-half portion of the site sample. This figure is, of course, not only absurd but considerably higher than the previous figures. The difficulty here is that sherds, not pots, were being sampled and we can say at most that of around 1000 to 1500 potential pots at the site, we found fragments of a *maximum* of 244. Actually we found fragments of far fewer than 244 pots. While we were able to control for vertical identification within a single random square, we did not have the time to match rim sherds across random squares. The check stamped situation demonstrates just how far sherds from a single vessel can travel within a site and there is no reason to suspect that this was a unique case. Chapter 10 adequately demonstrates the movement of sherds from midden to plow zone and there is little reason to suppose that the midden remains completely intact through time and later occupation for the benefit of the archeologist. We suspect that our Barnes pot sample is nearer 100 than 244.

A population of 1000 pots in only one-half of the site still seems high in view of some of the comments made in Chapter 17. Over a 100 year period, around 20 pots a year would have to be broken at the Zebree site by the Barnes inhabitants, if it can be assumed that the same average exists over the remaining half of the site. However, we know from the density maps that the sampled area includes the most intensively occupied portion of the site and perhaps of the Big Lake Highlands. The remaining portion of the site probably was only half that intensively occupied, but that still leaves us with 15 pots a year to be broken just at this site.

Barnes pots break more easily and more would be expected to be broken over a given period of time than would be expected of Mississippian pots. If the ideas expressed in the following chapter about seasonality are partly correct, then it is conceivable that pots were deliberately broken, perhaps before a move (Fig. 16-9). Morse still feels that there are too many pots indicated by this reasoning, but Anderson and Million believe that the figure of 1000 for sampled area is not altogether unreasonable.

Only seven food bowls are represented and large jars are more common than smaller jars. This is a logical expectation when a random sampling strategy is employed. The larger the vessel, the more probable that a fragment of it will be found. In addition, the larger a jar, the more probable that it will be represented several times in a horizontal sampling scheme. Food bowls and smaller jars probably are much more common relative to larger jars than the recovered figures indicate.

Remarks

This section has outlined several important facets of Barnes ceramics and provided considerable insight into the nature of the Barnes occupation at the Zebree site. First is the explanation of the conical base for Barnes and Woodland jars in general as a product of the technology involved in manufacturing the jar. Earlier concepts have generally assumed that this shape was desired with the usual explanation being that it could be supported easily in a hole or upon a perforated stone cairn or the like. No one actually has felt very comfortable with this view and the explanation presented here should provide some relief.

Figure 16- 9. Feature 270. Barnes pots broke more easily than Mississippian pots. It is possible that some vessels were deliberately broken before moving the village. Neg. no. 753059.

A second insight is that sand-tempered sherds are denser than shell-tempered sherds and that pots so constructed are inherently weaker and readily break. Weakness is also due to the shape of the Woodland jar, necessitated by the manufacturing techniques involved. Decoration is minimal except for rim folds which may have served to strength the rim area.

There are distinct concentrations of Barnes ceramics at the site (Chapter 17). The central portion of the site which was heavily favored in the 1% sample either was a favored area of occupation and/or the locus of a significantly larger group than elsewhere. Vessel type distortion relative to frequency is experienced in the sampled area due to the expectation that larger jar rim sherds probably are most apt to be scattered horizontally and are most apt to be collected during a representative recovery strategy.

If these pottery vessels pertain to the preparation and consumption of food, then several interesting observations are possible. First, the food bowl is present in significant numbers. There do not appear to be many serving bowls. Jars used for cooking range from 7.5 liters to 33 liters. They may cluster into three categories. The largest jar is very rare indeed as it should be overrepresented of all jars in the random square data since horizontal distribution of rim sherds was not controlled for in this analysis. The "typical" or actually most common archeologically recovered jar size mean is around 17 liters. It is tempting to extrapolate from a study on Western Pueblo by Turner and Lofgren (1966) and indicate that the typical social unit eating together is around 25 individuals. Furthermore, it might be extrapolated from these data that the minimum group is around 10 and the maximum size around 48. It is also tempting to view the different occupations at the Zebree site as reflecting a growth from around 10 to nearly 50 of the same group. Such a population increase had been predicted earlier (Morse n.d.).

CHAPTER 17

OTHER ASPECTS OF THE BARNES OCCUPATIONS

Dan F. Morse

Very little is known about Barnes other than the ceramics. The Zebree Archeological Project specifically was oriented toward filling this gap as much as possible. After the final analyses were completed, it became apparent that three strong Barnes concentrations probably exist in still relatively unexcavated parts of the site. An additional season could have allowed us to take advantage of the information gained from the 1% sample and follow those leads. Parts of two of these areas exist beneath the present levee and on the bank and might be testable at a later date. The combined variables of pot hunting and bank erosion, however, might negate this possibility. The following discussion is organized into tools, features, subsistence, midden formation, and settlement pattern.

Tools

Although a great deal of attention was paid to obtaining lithic debris samples from the Barnes component, no definite debitage from an uncontested Barnes context could be identified. All of the heavy elements from flotation samples taken from features and from midden deposits were examined with negative results. Based on the points found at the site and described in a following subsection, Crowley's Ridge was being exploited for chert. There is one possible Pitkin chert specimen which is fragmentary and badly eroded. Similar chert is available, although rarely, in the ridge. Ridge exploitation with occasional trade for Ozark lithics seems most probable. Other recognized tools were made of antler and bone.

Stone points

A total of 22 points was recovered during all of the excavations at the Zebree site which could be attributed to Barnes. Eight of these were found in 1975. Most occurred in mixed deposits which contained significant amounts of Big Lake phase ceramics but we feel confident in classifying them as part of the Barnes occupation at the site.

As a group, they are fairly typical of late Woodland points in the eastern United States (Table 17-1; Figs. 17-1 and 17-2). For instance, they are not well made and have a crude appearance. Only one appears to have been thermally treated and flake scars tend to dig into the biface. The material with two exceptions is chert, probably from Crowley's Ridge. In two instances quartzite, probably also from Crowley's Ridge, was the stone used. Eleven of the points tend to have expanding stems, six have bulbous stems, three are side notched, one is a heavy corner notched specimen, and one is a rounded stemmed point. There is a great deal of modification on most of the points. All 22 seem to be cutting and scraping bifaces, due to their steep lateral retouch and constricted distal ends. Several exhibited resharpened tips with polished and retouched wear as if used to punch or engrave. Moderate wear on tool edges matched that observed on stems and in notches but virtually every point exhibits significant wear and polish near or at the distal extreme.

The concept of curate behavior may be appropriate here (Reid, Schiffer, and Neff 1975). These specimens possibly are discards, while still useful tools including projectile points were carried elsewhere as the group shifted their residence. On the other hand, most are complete and if recycled for use as punches or gravers would probably still be useful. Small tools have a tendency to be lost, particularly if the village floor is a continuously disturbed sandy loam. It is also possible that many of these points represent tools made by Big Lake phase people from discarded or lost Barnes points.

Comparison with an Illinois terminal Hopewell assemblage (Morse 1963) demonstrates that while similar to many members of this group there are significant differences interpreted here as due to a slight temporal discontinuity. The prominence of the Steuben-like point at Zebree does indicate a stylistic tie with the Illinois site horizon and a dating not far removed from the fifth century. Rounded stems and corner-notched points are more prominent in the Illinois assemblage. Snyders and Gibson points are conspicuously absent in Barnes. This reinforces an interpretation that the Zebree Barnes components are later than the ascribed fifth century A.D. date for the latest Hopewell component at the Illinois Steuben site.

An unresolved question is whether Barnes people used the bow and arrow. Small side-notched points from Woodland contexts (Morse 1963:59; Perino 1973:86) have tended to indicate that the bow and arrow, at least in Illinois, came into use during the waning of Hopewell. The present indication in the northern alluvial valley is that small points possibly indicative of the bow and arrow do not

Table 17-1. Barnes projectile points from the Zebree site. An asterisk indicates the point is broken.

Provenience	Size in mm	Shape	Modification	Fig. ref.
Sq 74R10, 40-60 cm	36x20x9	Exp. St.	Heavily worn tip and edges	Fig 17-1a
Sq 14R14, Zone C	38x20x10	Exp. St.	Heavily worn tip and edges	Fig. 17-1b
Fea. 53B	37x26x9	Exp. St.	Graver tip with polish	Fig. 17-1c
Sq 12R22, -17 cm	36x23x9	Exp. St.	Heavily worn tip and edges	no illus.
Fea. 37	41x19x6	Exp St.	Worn edges & burin-like truncated worn tip	Fig. 17-1d
Sq 82R12, 20-40 cm	45x20x6	Exp. st.	Worn tip & edges	no illus.
Fea. 208	47x21x6	Exp. St.	Worn tip & edges	Fig. 17-1e
Fea. 367	28*x23x7	Exp. St.	Worn edge; broken	Fig. 17-1f
RS 67, 11-24 cm	63x24x10	Exp. St.	Heavily worn edges, graver tip with polish	Fig. 17-1g
Fea. 218	50x29x13	Exp. St.	Heavily worn edges, and graver tip	Fig. 17-1h
Fea. 196	25*x23x8	Exp. St.	Heavily worn edges; worn on break at both edges	Fig. 17-1 i
Fea. 35	57x25x10	Bulb St.	Worn edges, graver tip w/ polish	Fig. 17-1j
Sq. 80R4, 20-45 cm	31*x22x9	Bulb St.	Battered & worn on break	no illus

Table 17-1, continued

Provenience	Size in mm	Shape	Modification	Fig. ref.
Sq 80R4, 40-60 cm	35x23x9	Bulb St.	Heavily worn edge, worn other edge & tip	no illus
Sq 80R4, 60-80 cm	39*x18x6	Bulb St.	Broken in firm, worn edges	Fig. 17-1k
FEa. 18	44x17x7	Bulb St.	Heavily worn edges and tip	Fig. 17-1 1
B.T. 13	38x23x9	Bulb St.	Heavily worn edges graver tip with wear	Fig. 17-1m
Sq 12R12, -35 cm	50x24x9	Side nt.	Worn tip and edges	Fig. 17-2a
Fea. 208	49x23x8	Side nt.	Possible renotched point. Worn edges, heavily worn tip	Fig. 17-2b
RS 93, 12-32 cm	27*x28x9	Side nt.	Worn edges; broken in fire?	Fig. 17-2c
Fea. 186	56x32x11	Cor. nt.	Corner of base broken away. Worn edges & heavily worn tip	Fig. 17-2d
Fea. 432	57x30*x8	Rd. St.	Thermal treated? Shoulder broken. Worn edges and feavily worn tip	Fig. 17-2e

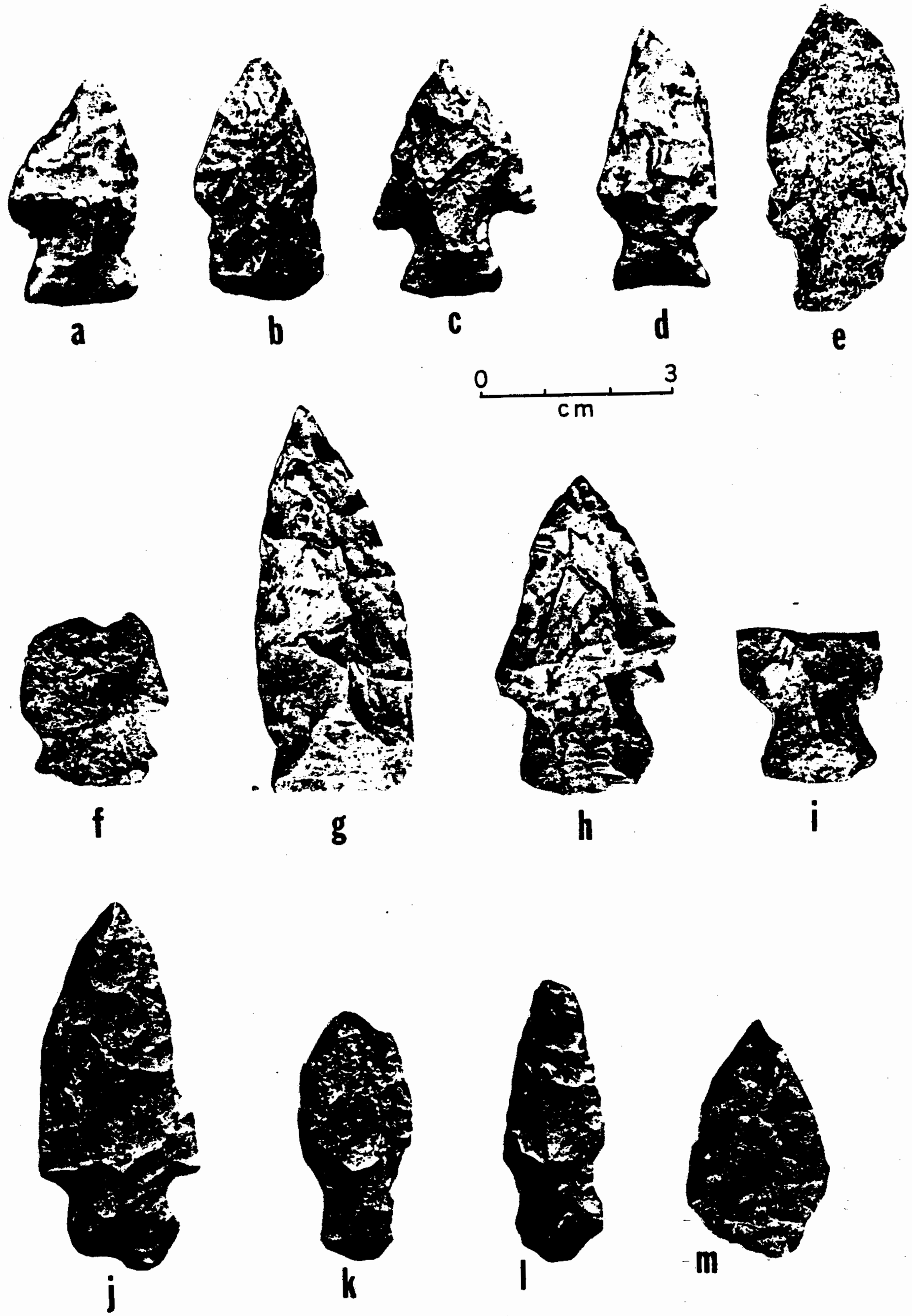

Figure 17-1. Barnes projectile points (see Table 17-1 for descriptions).

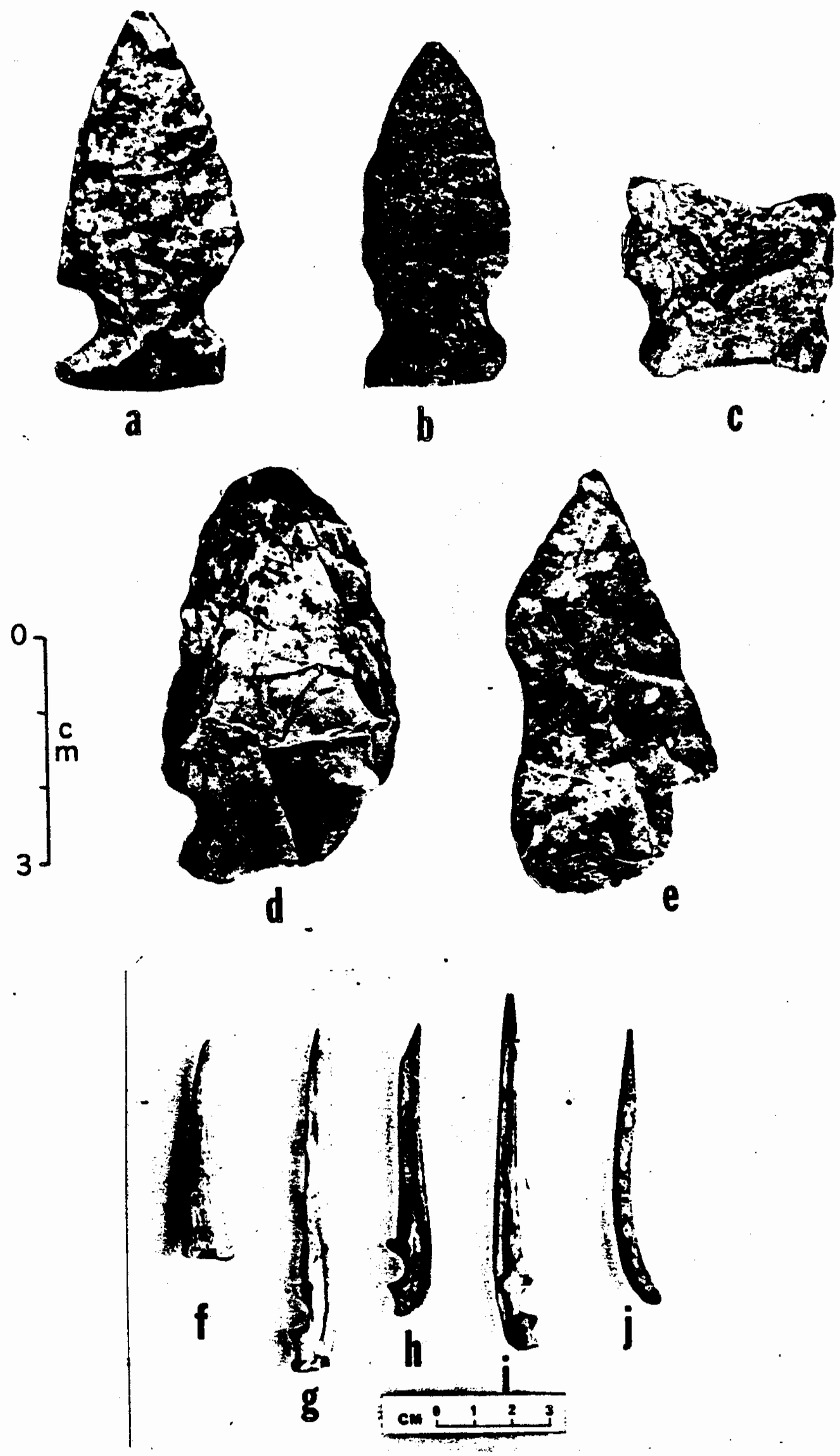

Figure 17-2. Barnes projectile points, a-e (see Table 17-1 for descriptions); f. antler point; g-i raccoon ulna awls; j. raccoon baculum awl.

appear until the advent of Mississippian. It is possible, of course, that perishable material such as wood and cane was used for the manufacture of arrow points and that larger bifaces were used solely as cutting and scraping tools. However, if Barnes and Baytown lacked the bow and arrow they would have been hard pressed to oppose a Mississippian intrusion no matter how significant the differences between the respective social-political organizations might have been.

Antler points

Two antler projectile points were found in 1969. One was the tip of a finished point and the second a complete but unfinished specimen. Both were laterally scraped with a finely serrated side scraper, possibly a hard percussion flake similar to examples found in the site deposits and described together with the Big Lake phase tools, or by a stone point similar to those described above. Polished facets near the tip of the unfinished point may have been accomplished with a sandstone abrader. Such abraders have been recovered in the mixed deposits and are described with the Big Lake phase artifacts. An unfinished 4 x 7 mm notch in the base of the unfinished point was cut out by a tool possibly similar to some of the stone points described above or a flake. The unfinished base is ground flat. The unfinished point measures 81 x 11 x 9 mm.

Bone awls

Three worked ulnae and a baculum of the Raccoon (*Procyon lotor*) found in 1969 attest to the utilization of this animal by Barnes people. All of these bones only need sharpening at one end to make a perfectly satisfactory awl. The ulnae indicate three different raccoons were involved, one of which was immature with an unclosed proximal epiphysis. Manufacturing wear on the distal ends indicates that side scrapers and sandstone abraders probably were used to make these awls.

In 1969, most of a triangular-shaped bone awl made on a large, very thin portion of a longbone, probably of a large bird, was recovered. The base is slightly smoothed, still retaining part of the original groove made to snap the bone, but the sides are well-ground and polished. The concave marrow surface is not ground significantly while the exterior surface is polished.

Features

A total of 49 Barnes features were recognized. These cluster similarly to the Barnes sherd clusters (Fig. 17-3). Classification was into the following categories: post holes, basin-shaped pits, basin-shaped pits lined with mussel shell, mussel shell "cache", sherd concentrations, and irregular disturbances. No burials were discovered.

Post Holes

The only actual post holes recorded in the feature list as Barnes appeared to be part of a house pattern in Area B found in 1969. Circular and oval patterns of post holes are a basic Woodland characteristic (Cole and Deuel 1937, Fig. 32) and provide a significant difference from rectangular Mississippian houses which incorporate foundation trenches and probably daub in their construction. At the Zebree site, post holes measured between 15 and 20 cm in diameter and the possible pattern is a short portion of an arc which if continued could define an area at least 4 meters in diameter if circular and larger if oval.

At Zebree, obtaining additional evidence of structures was complicated by the inability of the small random square to locate house patterns and of the sandy soil to preserve them. The possible Barnes houses at Zebree seem very similar to late Archaic houses as described elsewhere (Winters 1969; Morse 1967; Robbins 1959). Possible Archaic house floors range from 2 to 13 m in diameter. They seem to be circular where clearly defined although there is a hint that rectangular structures or at least fire screens are present.

Investigators in the past have been reluctant to infer that preceramic peoples lived in houses (Webb and DeJarnette 1942:3-8). Evidence is now present, however, for structures in deposits pertaining to some of the earliest levels of human existence (Terra Amata, for instance). If we accept that houses have a long history then we have a firmer basis from which to infer that the type of residence is interrelated with the type of behavior. The difference between the circular pattern of post holes in contrast to the later rectangular patterns with foundation trenches probably cannot be over emphasized. The labor apparently necessary for the former is much lower in terms of man-hours than for the latter (Coles 1973). Indicated are a relative lack of socio-political central control for Barnes, fewer people available for work conscription, and less investment in housing so that seasonal movement could easily take place.

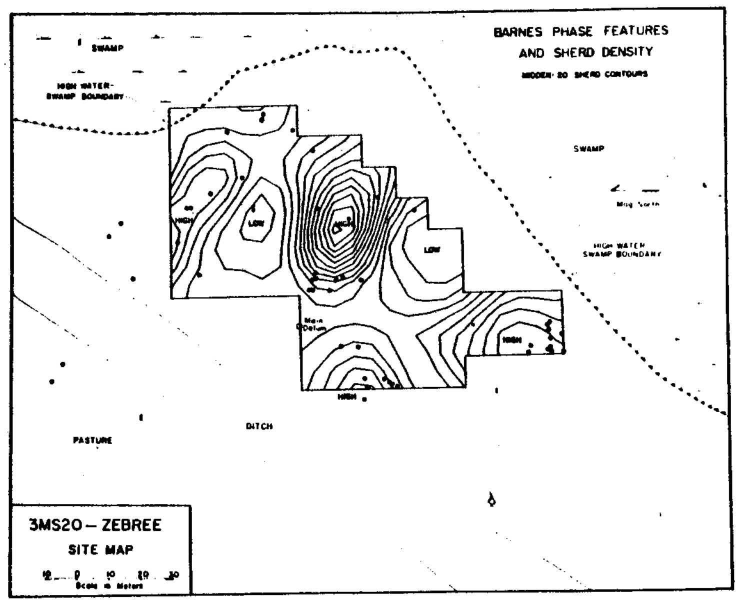

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Figure 17-3. Late Woodland feature locations, based on all field seasons, and Barnes sherd density in 1975 random square midden levels (20 sherd contour intervals).

Pits

A total of 39 Barnes pits and multiple pits were identified during the several excavations at Zebree with 22 of these being found in 1975. Average sizes differ according to the year excavated: the 1968-1969 pits average around 84 x 81.4 cm in diameter; the 1975 pits average 120 x 114 cm; and the 1976 pits averaged approximately 1 m in diameter. Most of the pits in 1975 occurred in the small random squares and most probably were overestimated. Nevertheless, the difference in size is felt to be real and to reflect spatial differences. Most of the pits found in 1968-1969, for instance, were located in Area B. Three of the five largest pits described were located in Area A. Almost all of the pits found in 1975 and 1976 are outside Area B and most concentrate in the central-most concentrated Barnes locus.

Six definite shell-lined pits were recorded and an additional two may have been shell-lined at one time before extensive disturbance caused this to be a questioned characteristic. Another pit was clay lined. The shell typically was double layered on the base and the lower sides, with the convex or exterior face of the shell up. The field impression was that this facilitated the storage of something. These and other pits were usually circular in outline, rarely oval and in some cases when oval were obviously two intersecting pits. In cross-section they tended to be basin-shaped and when sufficient upper portions were preserved looked much like an inverted bell, with outflaring rims. The bases ranged to a depth of slightly over a meter below the present ground surface. Depth of the pits below the observable upper limit rarely exceeded 40-50 cm, the two deepest measurements being 70 and 92 cm. If these were storage pits then they held, on the average, almost a metric ton--a little more in the center of the site and a little less in Area B. This assumes that the present ground surface was approximately the relict ground surface. A pit this size would contain half or less than half the usual supply of grain expected for a household size of 10 (Flannery 1976:27) if a single pit was used for storage for a single house and household of 10. It could mean that only sufficient food for half a year needed to be stored at the locus, or that each household had more than one storage pit or that the household was made up of less than 10 people. The figure of 10 for the Barnes extended family is primarily based on the 7.5 liter cooking jar hypothesized in Chapter 16 as the household cooking jar. This size is approximately twice the capacity for what appears to be minimum or household sized jar in the succeeding Big Lake phase and the capacity of a household jar for Western Pueblo. Further evidence that these pits were used for sealed storage of cached materials is shown by two accidentally fired clay fabric impressions. These are from Feature 270 and from Zone D, both dating to the Barnes occupation. Matting was probably placed over the pits and then sealed with clay. The contents would be preserved by this storage method (Reynolds 1974) which is similar to but not identical to the method probably used by the Big Lake phase.

Pollen in two Barnes pits (Table 6-2) were identified as Ambrosia, Helianthus-type, Monolete fern spore, Liquidambar, Polygonum, persicaria-type, and Cronus-type. The second in the list, sunflower, would seem to be the most expected candidate for flora storage. These pollen suggest a late summer to late fall use of these two pits. One sunflower seed was found in Feature 188. Other seeds found in Barnes features included wild bean (*Strophostyles*), persimmon, and grape. Acorns, hickory, and black walnuts were also recovered from several Barnes features. Four features contained significant amounts of unidentified seeds. Only one feature contained any corn and that feature is mixed (contaminated by later deposits) and the association questionable. If corn were stored in these pits, remnants should have been present.

Other features

Every time a locus of artifacts was considered significant, it was assigned a feature number. This practice resulted in the inclusion in the feature list of six sherd concentrations and a cluster of mussel shell called a "cache." These seven undoubtedly were in pits since they were obvious spatial clusters of debris but the pit no longer could be discerned. Irregular-shaped pits may have been badly disturbed excavated pits, pits caused by animal burrowing or tree falls, or even pits badly dug by inexperienced Indians. It is not that Indians were completely neat about their pit digging, but rather that for the most part a symmetrical, evenly dug pit is easier to dig, clean, and use.

Subsistence

The major problems regarding Barnes subsistence are: 1) Were they horticultural and did they grow corn? 2) Is there evidence of seasonal habitation? and 3) What kind of environment was available for exploitation? Evidence was collected in the form of pollen, seeds, and bones and these were identified whenever possible in light of these problems.

Domesticated flora

There was one instance of corn associated with a possible Barnes feature. Eleven fragments (4 cupules and 7 kernels) of corn together weighing .05 g were recovered in Feature 262. In this feature, seven Big Lake phase sherds and 142 Barnes sherds were collected. Mixture is apparent but how much is not known. The Barnes sherds averaged 4.38 g, so based on the evidence presented in Chapter 8 this may or may not be a primary Barnes deposit. The six Neeley's Ferry Plain sherds weighing 6 g apiece on the average do match what is expected for this type in a primary deposit. It is a shallow circular basin-shaped pit first recognized 38 cm beneath the surface in Area B (Backhoe Trench 7) which in the field was simply labeled as a "possible Barnes feature." There are Mississippian features on all sides extending to greater depths and the chances for contamination are maximum. The flotation sample was collected from a region of the pit thought to be undisturbed but that does not mean that it was not disturbed by later intrusions. The presence of a tree over the pit and attempts to backhoe beyond the pit to follow a line of small post holes complicated matters. Feature 281, located adjacent to Feature 262, contained corn in substantial amounts and the probability that this is the source of the contamination is quite high. In summary, then, to date there is no positive evidence for the growing or eating of corn by Barnes people at Zebree. Eighteen definite and possible Barnes features were examined through flotation samples for corn and the only possible association can readily be identified as corn introduced from later deposits.

The presence of *Helianthus*-type pollen in two features and on the surface of Zone D indicates the possibility of domesticated sunflower. Only one seed, however, was identified from Barnes deposits and although this seems to be a plant long cultivated in the eastern United States, we cannot state with any high degree of probability that it was being grown by Barnes people. *Chenopodiaceae* pollen also was recovered from the top of Zone D in Area B, the surface of the Barnes midden in that part of the site. No definite seeds were recovered from any of the other Barnes deposits so the fact that this is also a known long-term cultigen in the eastern United States does not necessarily mean it was grown or eaten by Barnes people.

No squash or gourd fragments were recovered from the Barnes deposits, again surprising in view of the known long period of cultivation of this plant in the eastern United States. In summary, the only direct evidence of domesticated flora is sunflower and this evidence is in the form of a single seed plus sunflower-like pollen. Chenopodium may have been a cultigen at Zebree by Barnes time but the evidence is even slimmer than that for sunflower.

Nondomesticated flora

A significant amount of unidentified seeds amply attest to the fact that we do not have adequate control over our data at this point in the analyses. An adequate type collection to reference the data is a necessary next step. Acorn, hickory, and in one instance, black walnut, occur in feature fill. This is expected since nut shells and to a certain extent the meat tend to outlast other seeds and fruits. It most definitely does not mean that Barnes subsistence was based primarily upon nuts. Various sizes of acorns also attest to the exploitation of more than one type of oak. Other Barnes flora identified by seeds are *Strophostyles* (wild bean), persimmon, and wild grape. The wild bean not only is edible but is "a good wild plant for fallow and wornout fields" due to nitrogen enrichment (Steyermark 1963:951). Persimmon is usually not palatable until after the first freeze. A large percentage of the original weight is convertible into food, today usually in the form of puddings and breads. Grapes of various kinds, normally the muscadine, occur in the immediate region and today are collected for jams and home brewed wine. In 1969, Leonard Blake identified *Lithosperum* (gromwell) or *Onosrodium* (false gromwell) from Barnes features.

Charcoal has not yet been broken down into genus and species. Most of the charcoal is from wood, cane, grass and bark. Most wood seemed to be oak and perhaps this wood tends to last longer than other charcoal or the charcoal burning process makes the rings more prominent and hence oak-like in appearance. Much of the charcoal would have come from firewood, probably branches either removed during house construction or gathered in the nearby woods, or as driftwood from the river.

Domestic fauna

An expectation is that the dog was a part of Barnes society. No dog bones or burials however, were found in definite Barnes deposits. The possibility of immature animal capture for use as pets could not be tested.

Wild vertebrate fauna

Only a total of 54 bones were recovered in 1968 and 1969 which could be associated with Barnes. All recognized species were duplicated in the 1975 sample which is drawn from definite Barnes features (Table 17-2). The basic sample is Feature 249 and Zone D in Random Square 126.

A total of 354 bones have been identified as from Barnes refuse in the 1975 excavation. These translate into 75 individuals. While only 12 of these are mammals, because of the numbers of raccoon and white-tailed deer this translates into 60% of the total by estimated meat weight. Fish constitute most individuals and over 24% by weight of total meat if the weight figures are correct. Birds, although high in absolute numbers, actually make up only a relatively small amount of weight, around 6%, about the same as the turtle classification with much smaller numbers represented.

The lack of turkey may be due to small samples. Since this is an upland bird, it is not actually expected to be present near the Zebree site. The list in total seems to represent a fairly typical riverine-lowland environment. A relative lack of ducks in the Barnes deposits (as compared to Big Lake phase deposits) when it is known that occupation was present during the height of the duck-goose migration season, supports the hypothesis that a large lake to attract ducks in significant numbers was not present during the Barnes occupation.

Invertebrate fauna

Mud dauber nests were found in 34 features at the Zebree site over the whole excavation period. Only *one* (Feature 249) is associated with Barnes. Several possibilities for this present themselves. One is that Barnes structures, whether houses or storage pit covers, were not suitable for the nests. Another is that the site was occupied seasonally after the nests were constructed elsewhere, with houses being temporary or dismantled rather than left up for the next occupation. A third possibility is that our samples are too small, since there is evidence that mud daubers existed for a long period in this immediate region (Price and Krakker 1975:32).

Mussel shells constitute a common Barnes characteristic (Table 17-3). The hypothesis that Big Lake came into existence between the periods of Barnes and Big Lake occupations is discussed in Chapter 4. Two predictions were made to test the hypothesis that a lake did not exist during the time of Barnes occupation. One was that

Table 17-2. Barnes faunal assemblage based on 1975 samples.

SPECIES	NO. OF ELEMENTS	M.N.I.	LBS. OF MEAT PER INDIVIDUAL	TOTAL LBS. OF MEAT
MAMMALIA				
Peromyscus cf. *maniculatus* (White-footed mouse)	18	1	---	---
Oryzomys palustris (Rice rat)	6	2	---	---
Sciurus niger (Fox squirrel)	6	1	1.5	1.5
Mustela vison (Mink)	2	1	1.5	1.5
Sylvilagus floridanus (Eastern cottontail)	11	3	2.1	6.3
Procyon lotor (Raccoon)	15	2	17.5	35.0
Odocoileus virginianus (White-tailed deer)	16	2	75.0	150.0
Totals-Mammalia	74	12	---	194.3
AVES				
Ectopistes migratorius (Passenger pidgeon)	54	5	.7	3.5
Colinus virginianus (Bob-white)	2	1	---	---
Passeriformes (Passerines)	14	3	---	---
Anas acuta (Pintail)	1	1	1.4	1.4
Anas carolinensis (Green-winged teal)	2	1	.7	.7

Table 17-2, continued

SPECIES	NO. OF ELEMENTS	M.N.I.	LBS. OF MEAT PER INDIVIDUAL	TOTAL LBS. OF MEAT
Anas discors (Blue-winged teal)	1	1	.7	.7
Anas platyrhynchos (Mallard)	8	2	1.8	3.6
Anas strepera (Gadwall)	1	1	1.4	1.4
Aix sponsa (Wood Duck)	2	1	1.0	1.0
Anatidae sp. (Ducks)	17	3	---	---
Lophodytes cucullatus (Hooded Merganser)	2	1	1.8	1.8
Fulica americana (Coot)	2	1	.8	.8
Florida caeralea (L. Blue Heron)	1	1	3.7	3.7
Totals-Aves	107	22	---	18.6
		OSTEICHTHYES		
Lepisosteus sp. (Gar)	51	1	1.0	1.0
Catostoma/ *Moxostoma* sp. (Suckers)	9	2	6.2	12.4
Pylodictus olivaris (Flathead Catfish)	26	7	.5	3.5
Ictaluris punctatus	53	10	3.2	32.0
Ictaluridae sp. (Catfish)	42	3	1.4	4.2

Table 17-2, continued

SPECIES	NO. OF ELEMENTS	M.N.I.	LBS. OF MEAT PER INDIVIDUAL	TOTAL LBS. OF MEAT
Amia calva (Bowfin)	4	1	1.0	1.0
Micropterus salmoides (L. Mouthed Black Bass)	12	2	2.0	4.0
Aplodinotus grunniens (Fresh-water Drum)	11	2	2.0	4.0
Stizostedionae sp. (Walleye or Sauger)	9	6	2.0	12.0
Totals-Osteichthyes	217	34	---	75.1
		REPTILIA		
Terrapene carolina (3-Toed Box Turtle)	4	1	3.0	3.0
Chelydra serpentina (Snapping Turtle)	4	1	10.0	10.0
Trionyx spinifer (Softshell Turtle)	3	1	3.0	3.0
Pseudemys floridana (Missouri Slider)	7	1	3.0	3.0
Testinata sp. (Turtles)	6	1	---	---
Colubrid sp. (Non-poisonous Snakes)	1	1	---	---
Totals-Reptilia	25	6	---	19.0
		AMPHIBIA		
Bufo sp. (Toad)	1	1	---	---
TOTALS	424	75	---	307.0

Table 17-3. Mussels associated with Barnes features (F. 114, 248, 288). Identification by Richard Rockwell with the aid of Paul Parmalee.

NAME	VALVES	
	Number	Per Cent
Fusconaia flava flava	119	23.5%
Fusconaia flava undata	61	12.0%
Amblema plicata	50	9.9%
Lampsilis radiata siliquoidea	33	6.6%
Pleurobema cordatum ssp.	28	5.6%
Proptera purpurata	27	5.4%
Quadrula nodulata	24	4.8%
Quadrula pustulosa	19	3.8%
Tritogonia verrucosa	19	3.8%
Lampsilis teres	16	3.2%
Pleurobema cordatum pyramidatum	16	3.2%
Elliptio dilatatus	12	2.4%
Quadrula quadrula	11	2.2%
Obliquaria reflexa	10	2.0%
Quadrula metanevra	9	1.8%
Actonaias carinata	7	1.4%
Fusconaia ebenus	7	1.4%
Lampsilis ovata	7	1.4%
Fusconaia flava ssp.	6	1.2%
Plethobasus cyphus	6	1.2%
Ligumia recta	4	0.8%
Anodonta grandis	3	0.6%
Leptodea fragilis	2	0.4%
Lampsilis fallaciosa	2	0.4%
Plagiola lineolata	2	0.4%
Ptychobranchus fasciolare	2	0.4%
Proptera capax	1	0.2%
TOTALS	503	100.0%

lake species are generally larger and heavier than stream species (Parmalee 1967) and hence the Barnes species on the average should be smaller and lighter than those collected by the Big Lake phase (Chapter 22). The shell was fragmentary so that actual measurement was not consistently possible. But weight divided by number of identified valves indicated overall averages consistent with the predicted difference. However, the ranges involved almost completely overlap each other and this is not a conclusive test. Mississippian potters might have selected for larger shells but would have used all but the hinge area, so that if anything, weights would be depressed rather than inflated by this variable.

The other prediction involved the selection of stream-oriented species over lake-oriented species by Barnes. The difficulty here is that the same species tend to occupy both niches, especially when the lake has a stream running through it. In addition, there is little doubt that small lakes exist in a meandering stream environment. Big Lake, according to the Saucier hypothesis, is more a stream enlargement with damming backing up a shallow reservoir than it is a large lake. The samples are fairly evenly distributed according to habitat preference (Rockwell 1977). Most Barnes associated species as a group prefer a small stream with a medium to large river the second preference. Most Big Lake phase species (Chapter 22) prefer a medium to large river environment with a small stream the second preference. It is possible that a shift from primarily small stream to shallow, larger river-lake took place during the Barnes occupation and extended into the Big Lake period. However, it is also possible that the same environment is being differentially exploited by two different subsistence systems. Both tests are more suggestive than definitive.

Faunal and floral remains indicate a fall to spring occupation. Riverine resources are important but a large lake may not be present. An expectation that there would be evidence of horticulture, particularly within the context of probable food storage pits, was not realized but this may be due to a low sample recovery.

Midden Formation

An undisturbed midden zone in Area B measured up to 40 cm thick. Because it was capped by the Big Lake phase with soil brought from other parts of the site, this midden was relatively undisturbed by later occupations. Elsewhere, any Barnes midden tended to be extensively disturbed through intrusion of later features and general surface disruption and possible clearing. It has become apparent during the analysis that the intuitive feeling obtained during the 1969 excavations that little actual midden accumulation took place during the Barnes and subsequent occupations is a valid concept. There is little doubt on our part that there is *some* soil or midden accumulation, perhaps up to 10 or 20 cm or so in places, but that a concept of accumulation up to a meter or more is not valid. The traditional concept of midden, after Webster, is "an accumulation of refuse about a dwelling place." The upper 10 to 20 cm of the soil adjacent to the Zebree site is loose due to a profusion of roots and dark from organic content and moisture. It is our contention that what is called "midden" here is nothing more than mixed deposits which may or may not include significant accumulation (Chapter 10). A sandy village floor (or archeological dig ground surface) tends to be loose and prone to churning. Pits being dug constantly recycle soil into a topsoil environment, much like Darwin's earthworms.

Clearing for a house upsets vegetational stabilization of the surface soils. Digging storage pits creates a zone of loose, now organic-filled soil. Burning adds charcoal which darkens the soil and moisture breaks down the organic inclusions. Rootlets spread throughout the clearing, further loosening the upper soil. Dogs, children, and adults further turn over soil. Waste disposal is an additional factor. Rain will firm up a sandy soil but a garbage soil will tend to create mudholes, and the winter-spring rainy season would keep it that way. The dry summers would permit silt loss from wind erosion and a sandier stratum. Zone D, the only good Barnes midden, is siltier in content than the soil immediately superimposed upon it. It is grey in color and is relatively sparse in sherds in contrast to many Barnes features. The 40 cm of darker siltier soil with little actual artifact concentration fits in with a concept of late summer to early fall occupations of the ridges by Barnes people and a spring-summer occupation of lower elevations. During the spring and summer, any new ground left unattended will, within a few weeks, spring up in a variety of weeds and vines. The house frame could be left in place while the covering mats or skins are removed for transport. All of this, of course, is untestable at the present moment, but is a pattern or model suggested by the data at hand.

Using the density maps showing Barnes ceramics by weight or by count (Figs. 17-4 and 17-5) there are at least four spatial concentrations. A fifth may have existed to the northwest based on feature concentration. The central one is the most intensive; it exhibits twice as many contour lines as any of the others. This indicates that greater activity took place here and there may well be more people living at this locus than elsewhere. On the other hand, this

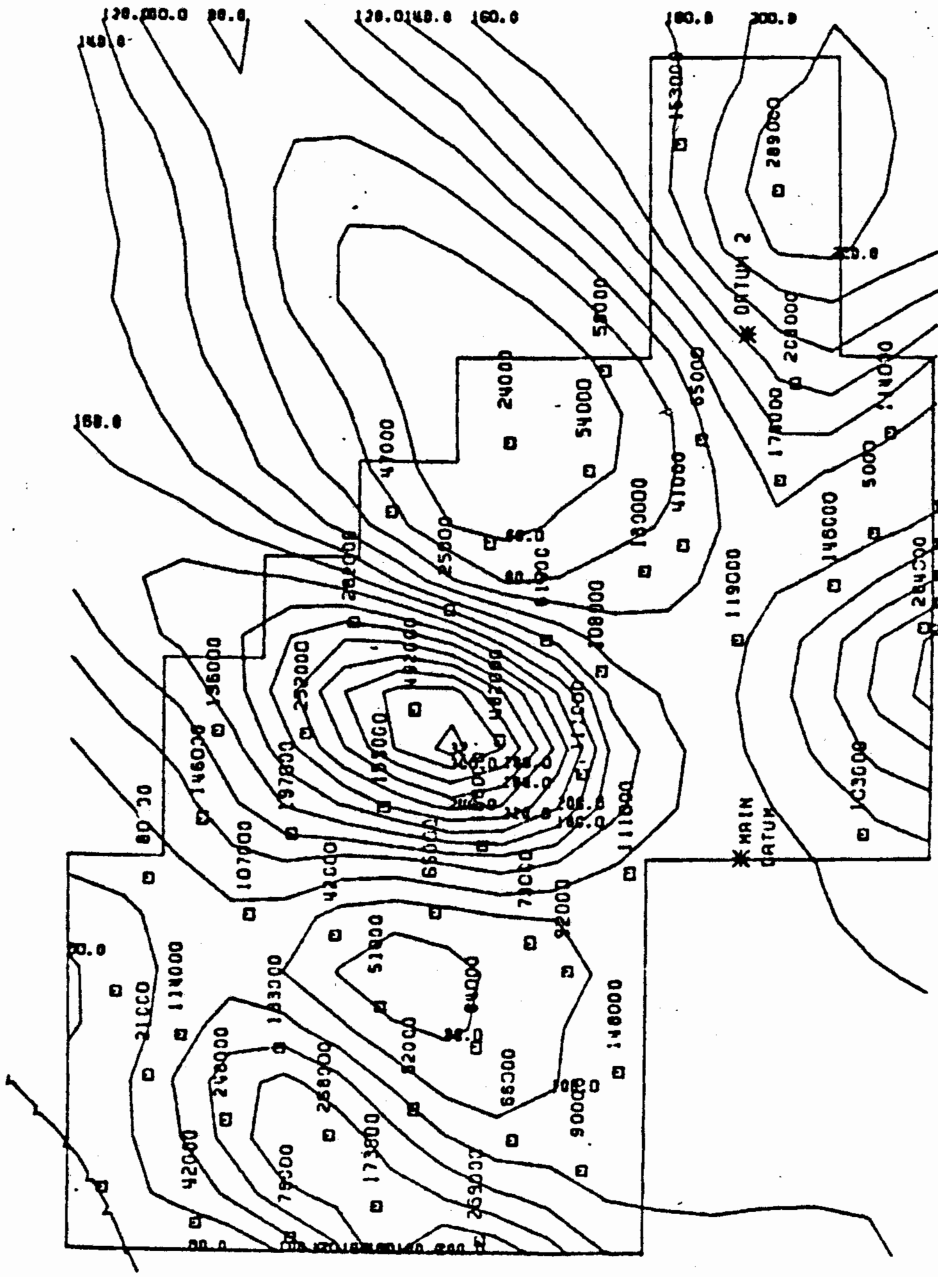

Figure 17-4. Site density map of Barnes ceramics in midden by count.

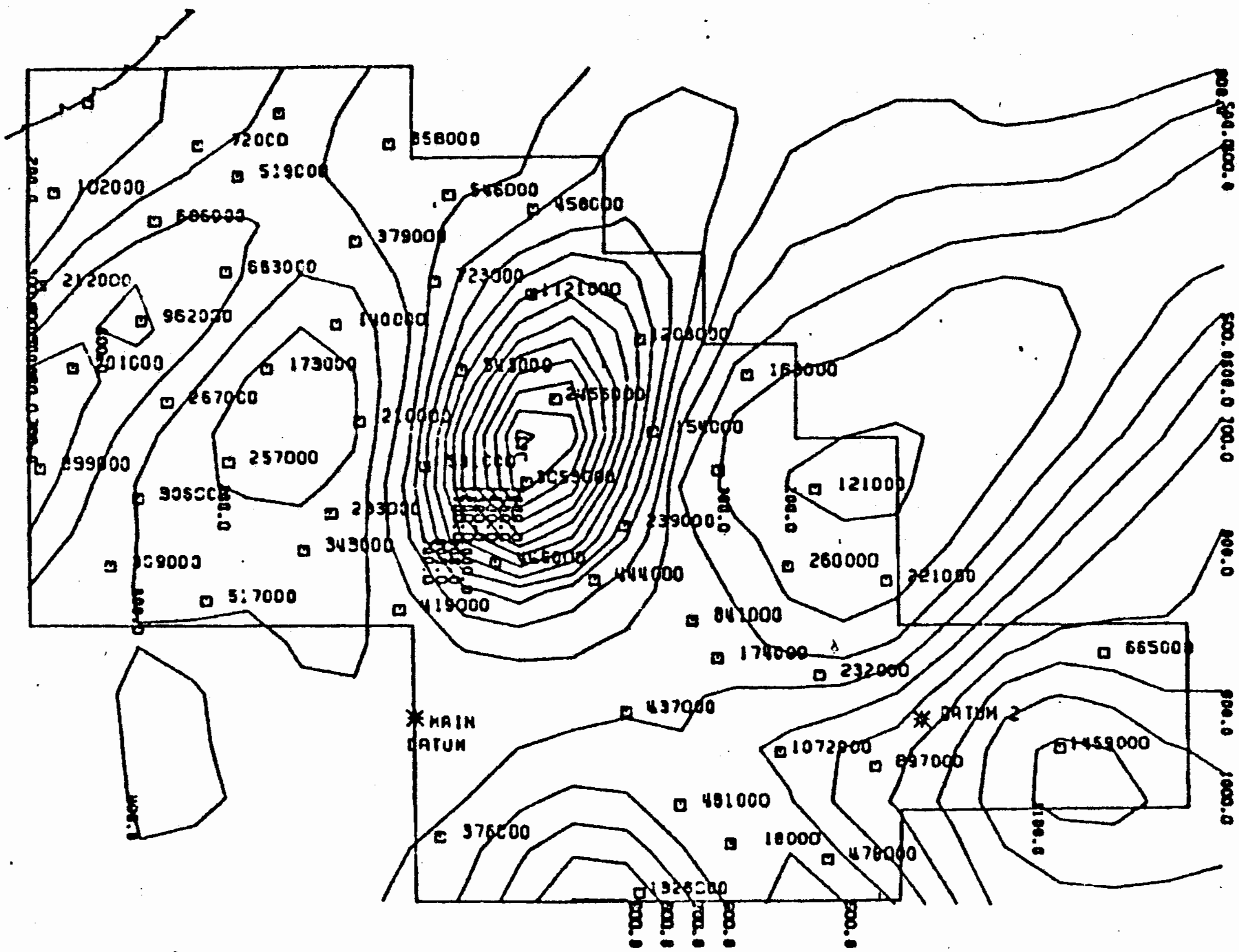

Figure 17-5. Site density map of Barnes ceramics in midden by weight.

may have been simply the locus which was most apt to be occupied or the area occupied is restricted so that debris is more concentrated than where such a restriction is absent.

Basic questions revolve around the possibility of multiple occupation at a single locus, and the possibility of all four clusters being contemporaneous house sites. The two low areas on the sides of this central locus furthermore restrict spatially the occupation of that particular high area. It may have been in fact the highest area at this period since Area B was built up by the Big Lake phase with soil addition. Sherds occur down into the low area but the large size, for instance, of the sherds to the south of this area (Fig. 17-3) indicate that less Barnes (and later) activity took place where those larger sherds occur (Chapter 8; Table 8-5). To the north of this in the Zebree site, a more general, larger high area allowed more latitude for occupation. The same may be true for the other two loci although in these, occupation does not appear to have been as heavy. The most probable explanation for the higher concentration seems to be multiple occupation.

Winter habitation may well have brought together more than one household. Basic household size appears to have been around 10 and the winter grouping may have tended to be around 20-40 (or two to four households) based on cooking jar sizes and extrapolation from western Pueblo figures. In an egalitarian society, one might expect that a pot large enough to feed everybody would at least be kept on hand (Swanton 1946). The presence of four concentrations reinforces an interpretation of up to four contemporaneous households making up a village. Variation in intensity of occupation from concentration to concentration is an expectation based on a model of fragmentation into household residence units for at least part of the year.

The random square data may give us a chance to match sherds horizontally for information on the geographical spread of broken pots. These data in turn can help indicate whether two or more concentrations are contemporaneous or not. This, of course, will have to await the attention of someone with more time and financial resources than any of us have at the present stage of our analysis.

Settlement Pattern

Late Woodland cannot be viewed simply as a stage transitional to Mississippi. The late Woodland way of life existed as a cultural whole and is not merely an anticipation of the use of shell-tempered

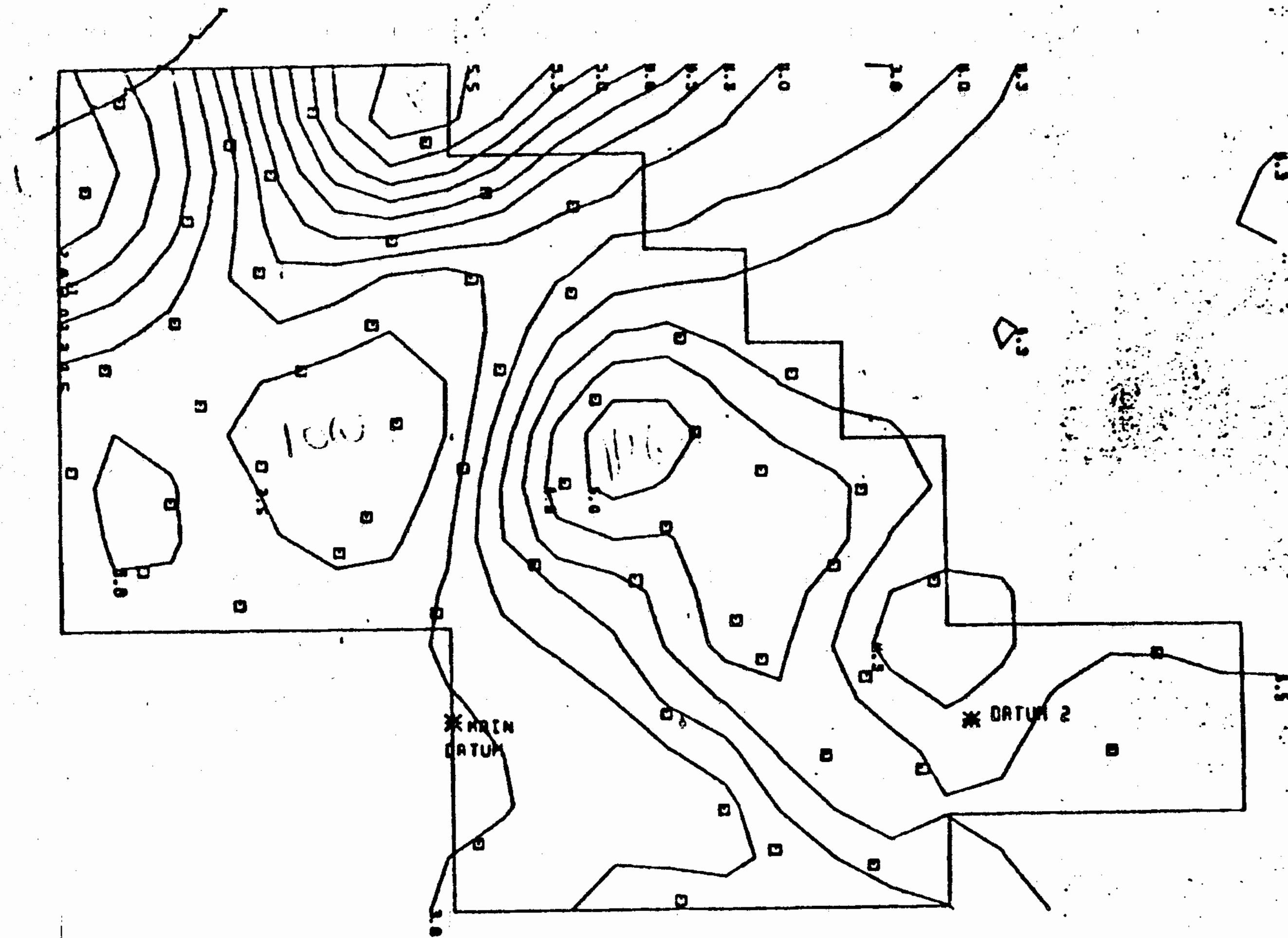

Figure 17-6. Site density map of average size of Barnes ceramics in midden.

ceramics, of intensive agriculture, and of other later events. Through time there is an obvious evolution of societies from simpler to more complex forms as socio-political developments change and larger groups of people are controlled by more complex mechanisms. We view this process of cultural evolution as a continuous one but probably tend to be biased by data from our own society where cultural change has been extremely rapid. Late Woodland must have been a much more static culture than even most peasant societies of today.

Another traditional interpretation of late Woodland is based on the concept of period in the eastern United States. There *are* broad periods, horizons, or stages present with recognizable uniform attributes. An investigator in one area of the eastern United States can conduct research in another area with minimal difficulty in learning the local sequence. This phenomenon emphasizes horizontal similarities, and differentiates only between broad temporal classes of sites and artifacts. As a result, there has been a tendency to view late Woodland as a homogeneous class of behavior and to view Baytown (including Barnes in the traditional approach) as exhibiting an even greater homogeneity of behavior. But no two archeological phases and no two human societies are exactly alike. There are alternative behavioral solutions to social and physical environmental stimuli.

Tribal organization incorporates a great deal of variability (Sahlins 1968). In Chapter 3, Baytown and Barnes are examined in respect to hypotheses presented by Sahlins (1961) as a result of his examinations of the Tiv, Dinka, and Nuer. Excavations of the Zebree site and a surface survey along a quarter-mile wide east-west transect from Big Lake to the St. Francis River have produced data useful if not for testing some of these hypotheses at least accommodative within the main hypotheses pertaining to the social-political structure of Barnes in the seventh century.

Barnes is hypothesized in Chapter 3 to be weakly structured in terms of the ability to create large cohesive social-political units. To date, judgmental surveying with the area of sand-tempered ceramics has not produced large mound sites similar to those recorded for the area of grog-tempered ceramics. The Zebree site analyses, furthermore, have provided a standard against which Barnes sites with large amounts of ceramic material may be judged, to wit, that a lot of potsherds does not necessarily mean a high or stable population.

Cooking jar size may indicate a basic household size of around 10 individuals in Barnes. At Zebree, there are four and possibly five concentrations of Barnes ceramics which could indicate up to four or five contemporaneous households, co-existing at the site. The central area is the most intensive in terms of numbers of pot sherds. Either more people lived at this locus at any given time or this was the favorite locus and the one most apt to be reoccupied. We favor the latter interpretation. We have rejected a third suggestion that it is the dump for all areas since all areas have abundant refuse and few prehistoric societies are expected to establish land fills. Cooking jar size may indicate that up to 48 individuals might have eaten out of the same pot. The usual Barnes jar appears to be sufficiently large for from two to four households. These interpretations fit our concept of up to four clusters based on the density maps.

Also involved here is a concept that "villages" were flexible units with households which came together or went their separate ways seasonally. On the other hand, we could be seeing data representative of increasing population. Although both processes are undoubtedly involved, the household might be expected to be able to exercise their option as to where they wished to live and with whom they wanted to associate for a specific period of time. Storage pit size may indicate that storage was for a period of time shorter than a year, perhaps half a year. This fits a concept of seasonality. The season involved apparently is late summer or early fall to around early spring. The lack of mud dauber nests could be due to a lack of a suitable environment for them, if the house covers were removed and the frame left in place when households left. This is stretching the data, perhaps, but we are attempting to fit everything into a single model. Fauna and flora indicate that the Barnes occupation almost certainly extended over this period. In addition, the high ground is best occupied during the winter rainy season.

The transect survey was an intensive survey of an area one-quarter mile wide and 15 miles long. The line chosen was a continuation of the line selected in the Cache survey (1975). Its selection there was random. We eventually hope to continue this same line completely across the lowland from the Mississippi River into the Ozark Escarpment. The Big Lake region portion was selected in 1976 to collect data directly relative to the Zebree Archeological Project. Every 40 acre section of the transect was examined. Individuals walked within 10 m of each other. Isolated finds were plotted and tagged. Any two artifacts occurring within 10 m of each other were designated a site and any tool found was designated a site. All artifacts, with the exception of obviously modern pop bottles thrown from tractors and gravel scattered from existing roads, were plotted (these latter were so numerous that they would have slowed the survey down considerably). Lithic, sherd, and historic scatters were paced so that accurate information could be obtained on size of scatter. Farming conditions and history were noted. With few exceptions, all prehistoric artifacts observed were collected. The few exceptions were relatively large sites, but all but the smallest pot sherds were collected from them. From historic scatters, artifacts sensitive to time and those exhibiting maker marks and variety (such as marbles to indicate children) were collected.

The results of the transect with respect to Barnes localities are shown in Figure 17.7. Lithic scatters were interpreted as Barnes since Crowley's Ridge cherts are involved and preceramic remains are relatively rare in this region (see Chapter 1).

Sites were divided for convenience into categories primarily on the basis of the presence or absence of sherds, and size. Sites with sherds only, ranged in number of artifacts from three to six (small), eight to 14 (medium) and up to 36 (large). Sites tended to be about 1000 m^2 in extent. Lithic scatters were divided into debitage, and tool(s) with or without debitage. The maximum number of items was nine, with two to four items representative of most loci. Tools consisted of hammerstones, points, scrapers, and choppers. There were a minor number of instances where lithics outnumbered sherds in a combined lithic and sherd locus. Only one or two sherds and up to nine lithic items were represented in such sites. Otherwise, sherds and lithic site collection were overwhemingly made up of ceramics. Collections from small sites weighed less than 100 g, consisting of up to 13 items. Collections from large sites weighed more than 100 g and up to 700 g and more with most averaging around 450 g. The size of collection can be equated generally with relative size of site area. One large sherd and lithic scatter contained a polished chip from an Illinois novaculite spud. There were no other Mississippian artifacts present despite a total collection being gathered by experienced personnel. This chip represents the best candidate for a Mississippian trade item in Barnes context.

Site patterning does occur because sites classified similarly tend to cluster together. These data indicate that these sites are responding to some consistent spatial or environmental stimulus. Most noticeable is the spatial clustering of ceramic or ceramic and lithic sites within a short distance of major relict channels which could have been active streams. Eight of ten such possibilities are positive associations. The two exceptions are near each other, equal distance from the county line in the center of the

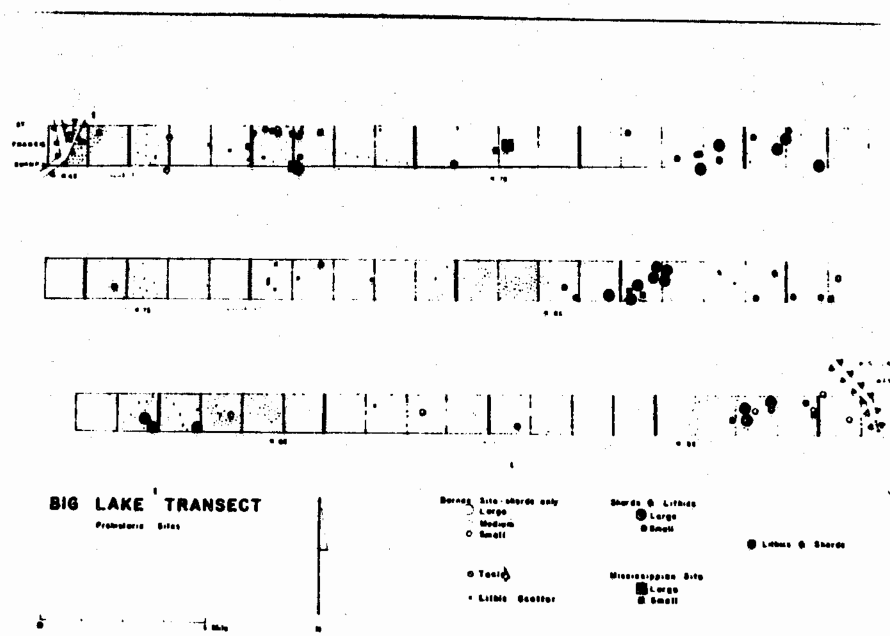

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Figure 17-7. East-west transect showing the relationship of Barnes and probable Barnes (nonceramic) sites to the environment and to Mississippian sites.

transect and themselves border a cluster of lithic scatters. This is the divide between the St. Francis and Little River drainages. At the eastern extent of the transect, sherd and lithic sites essentially are associated with the cottonwood-willow-sycamore zone while those to the west are associated with the sweetgum-elm-hackberry zone. Sites located westward tend to include more lithics in their collections, presumably because they are located closer to the Crowley's Ridge lithic sources.

Both ends of the transect are subject to overflow, the sweetgum-elm-hackberry much less than the cottonwood-willow-sycamore zones and then only during times of very high water. The spatial east and west clustering could reflect the exploitation of two micro-ecological zones and/or the presence of two Barnes lineages with a buffer hunting zone in between the two drainages. Additional probabilistic sampling must be done to the north and the south but this test transect has produced satisfying results. The best agricultural soils occur with the sweetgum-elm-hackberry zone and this is precisely where the Mississippian sites cluster. The presence of Barnes sites in the same zone might imply seasonal horticulture but does not prove it. The presence of Barnes ceramic sites in large concentrations even in the cottonwood-willow-sycamore zone supports the concept of seasonal exploitation site locations and the notion of weak social-political structure. Mississippian stability is indicated by the larger two sites' location in the western end and the sparse incidence of even small Mississippian ceramic sites. In one system, people literally are traveling to food sources. In the other, food sources probably are being created by way of some domestication at the site location or being brought from elsewhere to the site.

Beyond the transect but within the Big Lake Region are other Barnes sites. The only indication of Baytown is an occasional sherd within a collection of Barnes ceramics. Figure 17-8 maps the relationship of Barnes and Baytown sites in the northern alluvial valley. Barnes can be viewed as surrounded on all lowland sides by an encroaching Baytown. The apparent overlap of a Barnes locus east of Blytheville by a northern and a southern Baytown push does indicate two basic traditions located respectively to the north and to the south. Crowley's Ridge splits the southern distribution into two basic traditions and there may be additional splits evident once more intensive investigations of the Baytown region are accomplished. Figure 17-9 is a detailed mapping of the southern edge of the Barnes distribution. South of the area, recorded sites are essentially pure Baytown except near the Tyronza River where the overlap continues. The Western Lowland data is mainly based on a probabilistic survey by Klinger (1977) in the Village Creek watershed and in part on a

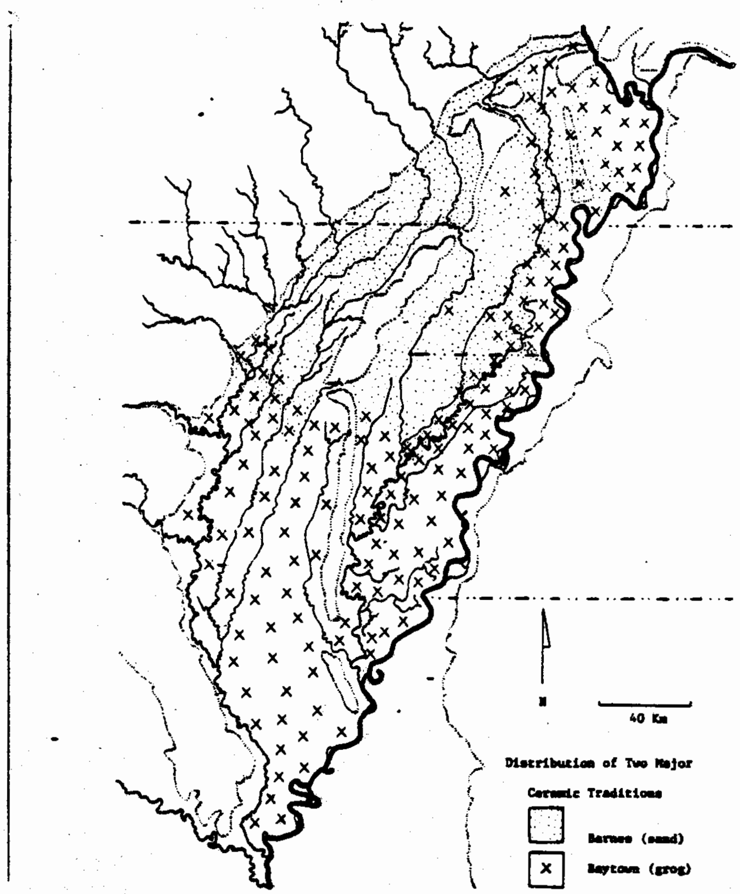

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Figure 17-8. The distribution of late sand-tempered and grog-tempered ceramics in the Northern Mississippi Alluvial Valley.

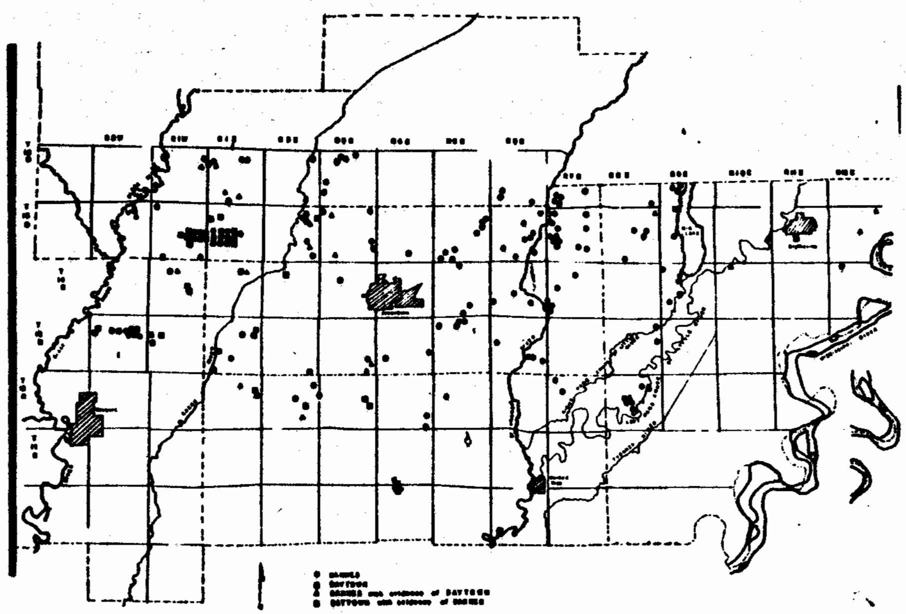

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Figure 17-9. The distribution of Barnes and Baytown traditions in northeast Arkansas.

less intensive but probabilistic survey by House along the Cache River (Schiffer and House 1975). These surveys represent objective site recording utilizing modern scientific methodology. The overlap of Barnes and Baytown is clear and the interpretation that two distinct pottery traditions exist is supported. The overlap is interpreted here as resulting from the amalgamation of Barnes by Baytown. The extension of Baytown northward along the Ozark Escarpment is impressive and may explain how the late Woodland of the Western Lowlands were capable of acculturating to Mississippian rather than amalgamating to the Big Lake phase. Barnes would appear to have been too weakly structured politically to undergo such an acculturation, but Baytown, by virtue of a stronger political cohesiveness, might have been capable of responding to the diffusion stimulus of an enlarging chiefdom system based on intensive agriculture.

Summary of the Barnes Complex

Barnes at the Zebree site is marked by Barnes Cord Marked pottery and little lithic debris. The ceramics and lithics agree with the radiocarbon dating of around the seventh century A.D. Little other decoration is evidenced; for instance, there seems to have been only a single check stamped jar at the site. Baytown trade vessels are rare. Points were modified for use as scrapers and gravers to a considerable extent. There was a possible trade for or exploitation of Ozark chert but almost all of the chert recovered could be obtained in Crowley's Ridge.

The basic household size seems to have been around 10. Between two and four, perhaps as many as five, households may have wintered at the Zebree site. Houses were circular or oval in outline and probably consisted of mat or skin covered bent pole frames. Storage pits and probably burials were near the house. Sometimes pits were lined with mussel shell. At least a sufficient amount of food was stored to feed a household of 10 through the winter. A storage pit may have been opened to feed the community at large. Some cooking jars apparently were sufficiently large to feed the whole community.

A generalized riverine winter diet was practiced. Birds, especially ducks, and fish were emphasized, together with turtle but most meat by weight was obtained from raccoons and white-tailed deer. Sunflower, wild beans, persimmon, grapes, and nuts of various kinds were eaten. The sunflower may have been planted and harvested before occupying the winter village.

Summer villages were established elsewhere, on lower ground, or winter loci could have been occupied during the winter or summer. Hunting stations in swamps and individual household sites located during the transect survey indicate specialized collecting, planting, hunting, or fishing during the spring and summer months. Maximum community size may have been near 50, at least in the Big Lake region. With fragmentation into household residence units during much of the year environmental exploitation could be maximized. Other Barnes communities probably existed within the Big Lake region and across the St. Francis and even west of Crowley's Ridge and to the north. The ability to group into large political units to combat the spread of Baytown culture or the Big Lake phase is not apparent in the archeological record. An adaptive strategy of extended family household residential units exploiting the resources of the Big Lake area with either a small seasonal village or scattered household settlement pattern seems to best fit the evidence at and near the Zebree site.

CHAPTER 18

THE BIG LAKE PHASE POTTERY INDUSTRY

Michael G. Million

Mississippian culture is marked by a revolutionary advance in ceramics (see Chapter 15). The recognition of burned, freshwater mollusk shells as a superior temper allowed a far more effective exploitation of the abundant backswamp clay resources present in the Mississippi delta. The paste was a tremendous improvement over previous aboriginal wares. Much less tempering was needed than with the less effective Woodland wares before an adequate reduction in shrinkage and stickiness was achieved. The stronger internal cohesiveness and flexibility of Mississippian paste allowed the manufacture of globular, round-bottomed vessels with superior structural strength. These enhanced working qualities of a shell-tempered paste resulted in a greatly diversified array of vessel forms through time.

Research Emphasis

The Big Lake phase occupation at 3MS20 is one of the earliest Mississippian components recognized in the southeast to date. The known ceramic assemblage recovered from this population consists of utilitarian vessel forms. Most of these containers are thought to have been used routinely within the household for domestic-culinary tasks. The assemblage also includes two, and possibly a third, specialized forms which appear to have been produced primarily or exclusively for salt manufacturing activities.

Since the 1975 field season, the orientation of Zebree prehistoric ceramic analysis has shifted from stylistic-typological queries toward a techno-functional approach. Emphasis has been placed increasingly on obtaining information relating to morphological variations in domestic containers and their corresponding functional implications. Numerous vessels were "reconstructed" on standardized description cards from those vessel remnants that were of adequate proportions to provide reasonably accurate, whole-vessel dimensional data (see Chapter 9). Correlations of orifice diameter and vessel height are presented in graphs for each vessel form. As intuitively anticipated by Morse (1975b), some distinct clustering by size is apparent. Capacity ranges have been calculated for each group. Much of the following discussion will therefore center around the vessel illustrations, which are drawn to 1/5th scale (the grid overlays are in 5 cm squares), and the accompanying graphs.

In addition , results of ceramic replication experiments have been incorporated into these analyses because they have shed light on many aspects of prehistoric pottery industries which are unapproachable from sherd attribute analysis only. Controlled replications of the processual tasks involved in Mississippian pottery production, which by no means have been exhausted, have proved to be a valuable research tool, complementary to analysis of artifacts.

It is hoped that the results of these analyses justify the partial deemphasis of the more traditional stylistic and typological studies that primarily involve observations of specific attributes of the sherds. The value of these latter efforts is not to be undermined. Rather, prehistoric ceramic research is considered more effectively accomplished by taking advantage of a synthesis of the two analytical approaches.

Vessel Descriptions

Three distinct shell-tempered wares were utilized by the Big Lake phase potters at Zebree. (A ware is defined as an assemblage of vessels that share common paste and surface treatment attributes.) These are Varney Red Filmed (VRF), Neeley's Ferry Plain (NFP), and Wickliffe Thick (WT) in descending order of estimated vessel numbers. Although NFP is also present in the Lawhorn deposits, the bulk of these sherds undoubtedly belong to the Big Lake occupation. Descriptions of vessels particular to each pottery type will be discussed in the following section of this chapter. In brief, the Varney ware consists of three distinct size groups of jars--large, medium and small, large shallow pans, gourd-like hooded bottles, and a few simple bowls. The NFP ware was primarily used for large jars, but some smaller jars and plain bowls are present. Wickliffe Thick was apparently employed solely to produce a funnel-shaped vessel form.

Estimations of the numbers of vessels represented by rim sherds from the randomly sampled area of the site for each pottery type are presented in Table 18-1. As mentioned in the Barnes ceramic chapter, adjustments have been made within (vertically) each random square unit so that rims from the same vessel are not counted more than once. However, horizontal "spread," where the same pot may occur in several random squares has not been checked. The percentages should not, thus, be taken as precise quantification of the proportions of Big Lake pottery. Besides the horizontal spread of broken vessels, another uncontrolled variable is the differential breakage rates of the various sizes and types of vessels.

Table 18-1. Estimation of relative proportions of Big Lake vessels based on rim sherds.

Vessel Type	CERAMIC CATEGORIES							
	N F P		V R F		W T		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Large jar	50	69.5	76	41.4	--	--	126	46.8
Medium jar	5	6.9	28	15.2	--	--	33	12.3
Small jar	8	11.1	6	3.2	--	--	14	5.2
Large bowl	--	--	3	1.6	--	--	3	1.1
Small bowl	9	12.5	1	0.5	--	--	10	3.7
Pan	--	--	65	35.4	--	--	65	24.2
Hooded bottle	--	--	5	2.7	--	--	5	1.8
Funnel	--	--	--	--	13	100	13	4.8
TOTAL	72	100.0	184	100.0	13	100.0	269	100.0

Anderson, in Chapter 8, amply demonstrates that not only is there differential preservation of recoverable sherds in differing site environments (plow zone, midden, and features), but that preservation differs according to type. While his figures can only be taken as suggestive, there remains little doubt that these variables significantly influenced the ceramic data available for analysis. The large standard deviations are probably due to inadvertently misinterpreted midden and feature indentification due to differential mixture.

While NFP sherds on the average vary from 2.2 to 5 gm from plow zone to feature, VRF varies from 3.5 to 9.8 gm. All things being equal, there will be around twice as many NFP sherds from the same number of vessels of comparable size. The screening experiments demonstrate that VRF tends to be more greatly represented relative to

NFP in the greater-than-½"-mesh samples with a significant reversal in the smaller screen-sized samples. Anderson feels that roughly 47% of the NFP and 20% of the VRF were lost by only looking at sherds over ½" in size. This is not a criticism of the method for sherd examination since that is entirely justifiable by virtue of time and eye strain, but those results have to be taken into account in viewing the sherd count tables in the appendices.

There are 7,260 NFP sherds recorded from the random squares weighing 23,309 gm and 4,316 VRF sherds weighing 23,786 gm. In light of Anderson's computations then, the adjusted figures for total weights of recovered sherds are 34,255 gm NFP and 29,743 gm VRF. Anderson's figures also indicate that approximately twice as many NFP sherds are produced as VRF from a similar vessel. This is verified in two ways. First, the average weight of the NFP sherd is 3.2 gm and that of the VRF sherd 6.2 gm. Second, comparing the two adjusted values for these two categories of sherds results in a ratio of 2.05 times as many NFP as VRF. The NFP category is inflated to an unknown but assumed insignificant amount by the inclusion of eroded or plain portions of VRF vessels and small WT sherds. It is pretty obvious that WT sherds can only be easily recognized over a certain size. The average WT sherd weight based on 69 sherds weighing 550 gm is 7.8 gm. There are 11 rimsherds in this total and it is not logical to expect such a high rim-to-body sherd ratio even though there are two rims to each of these vessels. However, the total amount of WT involved is probably relatively insignificant. These data indicate that all factors being equal, there were about as many NFP vessels as VRF vessels.

But, there are only 120 NFP rim sherds in contrast to 238 VRF rim sherds, almost exactly the opposite extreme indicated by the body sherds. This is reflected in the estimated vessels for the two categories, 72 NFP and 184 VRF. The factor which is not equal is that different styles and sizes of pots are involved and each is expected to have a different rim-to-body sherd ratio. Rim sherds tend to be significantly larger than body sherds, 10.6 gm for NFP and 17.4 gm for VRF. In addition, many of them came from the same vessel or were too small to make a statement concerning size since 358 rim sherds form the basis for an estimation of 256 vessels recovered from the random square units. One-third of the rims were not suitable for an estimation of vessel form. The rim-to-body sherd ratio is 59 and that for VRF 17. Not only is VRF a stronger ware but apparently is used for vessels with a low rim-to-body sherd ratio. Reference again is made to Table 18-1. A total of 87.5% of NFP estimated vessels are jars and a large proportion of those are large jars. There are no large bowls or pans recorded for NFP at the Zebree site. On the other hand, only 59.8% of the estimated VRF vessels are jars and not nearly as many are large jars proportionally. In addition, 37.0%

of VRF vessels are pans and large bowls, vessel forms with low rim-to-body sherd ratios. Small jars and small bowls will be underestimated in relationship to large jars and pans, since there is a greater probability of finding rims from the same vessels belonging to the later category. A crude "body-rim sherd Index" may be derived by the formula:

$$\frac{\text{Capacity in liters x Height in cm}}{\text{Orifice Diameter}} = \text{body-rim sherd index}$$

Results are in order of expected large number of body sherds to rim sherds:

Large jar	69.3 x 3.3 =	229
Hooded bottle	25.5	84
Medium jar	19.5	64
Small jar	5.6	18.5
Pan	3.5	11.5
Large bowl	1.5	5
Small bowl	0.3 x 3.3 =	1

These very crude figures give a rank order and possibly even a crude ratio between each vessel form. For instance, large jars produce the most body sherd relative to rim sherds, perhaps about 20 times as many per rim sherds as do pans, and 230 times as many as do small bowls. However, ideas about vessel form proportions within or beyond the recovered ceramics will have to depend both upon concepts developed through other means (see discussion at the end of this chapter) and greater attention to body sherd categorization.

Varney Red Filmed Pottery

The Varney Red Filmed type was defined by Williams (1954:209-211) as it occurs in the Malden Plain, at the Old Varney River site (8-P-1), where only the pan and large jar were reported. This early Mississippian ware is characterized by vessels constructed of a typical shell-tempered paste to which a slip of a clay-hematite composition has been generously applied, usually with the exception of hooded bottles, to the interior surface. The slip which is almost always burnished to a fine polish fires to a handsome red color. The paste is overtly indistinguishable from the NFP paste. Maximum average shell particle size is 1.5 mm while the average minimum visible particle is about 0.2 mm. Experiments have shown that a large portion of the shell temper added is a fine carbonate dust which is invisible once added to the clay. However, VRF sherds are typically heavier and stronger than NFP sherds. The reason is apparently due to the presence of the dense (iron pigmented) slip which increases the overall density of a VRF sherd.

Characteristics such as the nicely polished red slip, gracefully recurved jar rims, and very clean, symmetrical vessel contours are indicative of the conscientious and individualistic technique of these initial Mississippian potters.

It should be emphasized that the large quantity of red-slipped vessels at the site represents a considerable amount of extra person-hours necessarily involved in their manufacture. In fact, the time required to prepare, apply and finish the red slipping on a Varney vessel is equal to or greater than the time needed to hand-build the pot itself. The preoccupation of Big Lake potters with this surface treatment has one or two plausible explanations. First, the polished slip is undoubtedly helpful in retaining or repelling a liquid substance. The compaction of the fine clay particles forms a thin but dense clay layer which is considerably less permeable than an untreated surface. Such a treatment on the interior surface of the shallow, salt-evaporating pans appears most logical. However, its occurrence on jars, bowls, hooded bottles, and even a few Wickliffe funnels(usually a thin wash) has yet to be related to a functional advantage. A second, and possible complementary, explanation of the high frequency of Varney vessels is that this ware is stronger. Actually, the red filming may have sealed the pottery from shell leaching and other potential destructive variables.

Minimal evidence for the manufacture of red slip exists at Zebree. A few small irregular fragments of a good quality hematite (Fe_2O_3) and one triangular shaped hematite cube with ground sides have been collected from the site and are thought to be related to the production of the Varney slip. Considering the abundance of red-slipped pottery, these few remnants actually account for very little of the debris that might be anticipated. However, our retrieval of only a few hematite fragments may reflect a scrupulous aboriginal management of this valuable resource since its procurement is possible only by traveling out of the delta terrain.

During the 1976 field season, two "balls" of a red clayey substance were recovered from Feature 327. Of the two objects (catalog No. 76-1247-90), one is only partially present and the other nearly complete. The larger sphere is 75 - 80 mm in diameter and would have weighed about 500 gm if complete. These artifacts are probably dried slip preparations, and if so, they suggest the possibility that Varney slip in a dry form was a commodity that was traded for or obtained directly via the St. Francis River by the Big Lake peoples. The larger sphere had even received a thin (2 mm) exterior covering of a grayish color (Sharkey?) and would seem to be a reasonable unit for transportation. In any case, it is expected that at least a portion of the Varney slip was prepared locally by the Zebree potters themselves. Substantive evidence is in the form of a small thin, waterworn slab of light gray sandstone, 73 x 49 x 8 mm, found in a storage pit (Feature 50) during the 1969 excavations that was apparently used

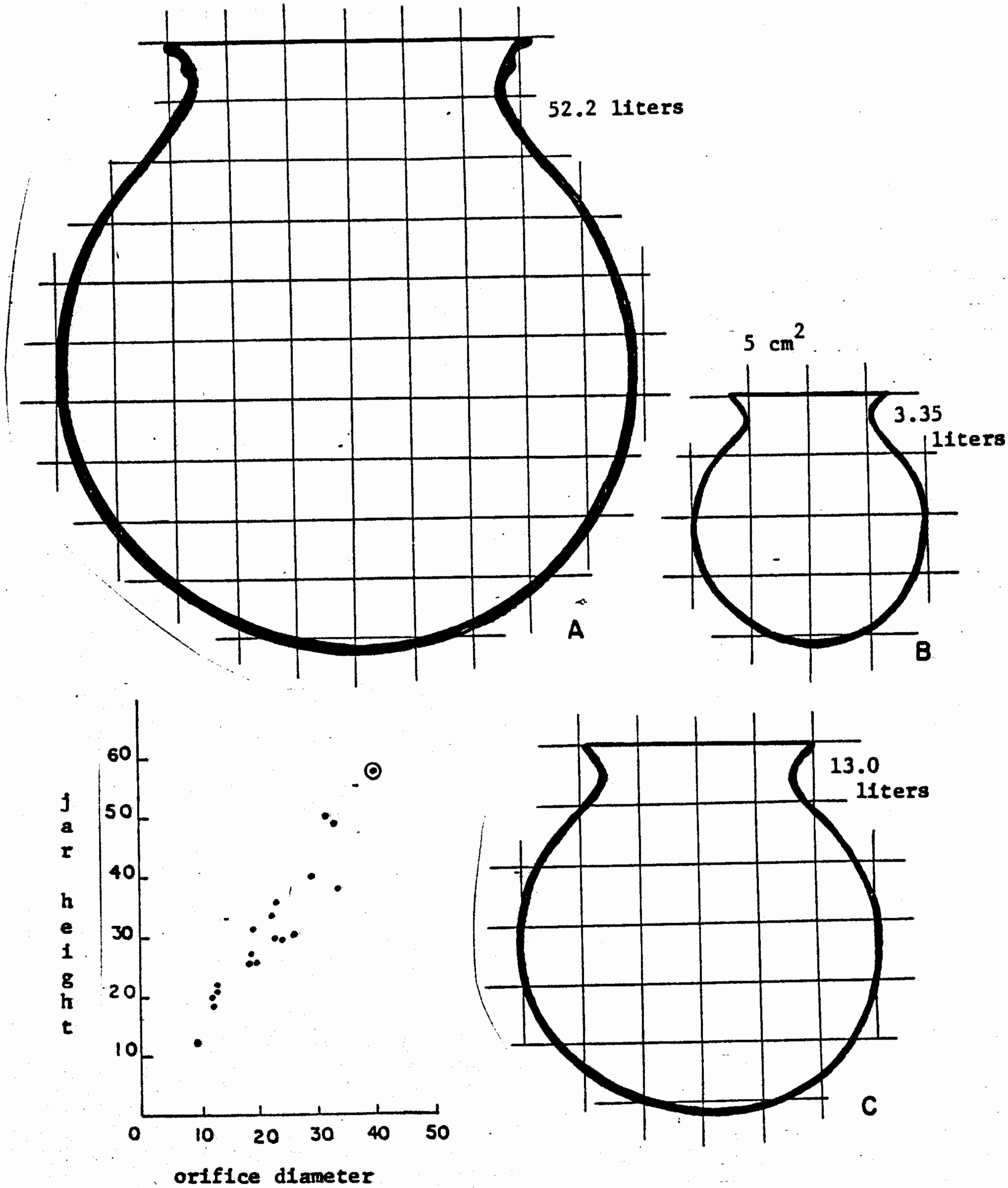

Figure 18-1. Varney Red Filmed jars representing the approximated dimensional mean of the three hypothesized clusters. A, large; B, small; C, medium.

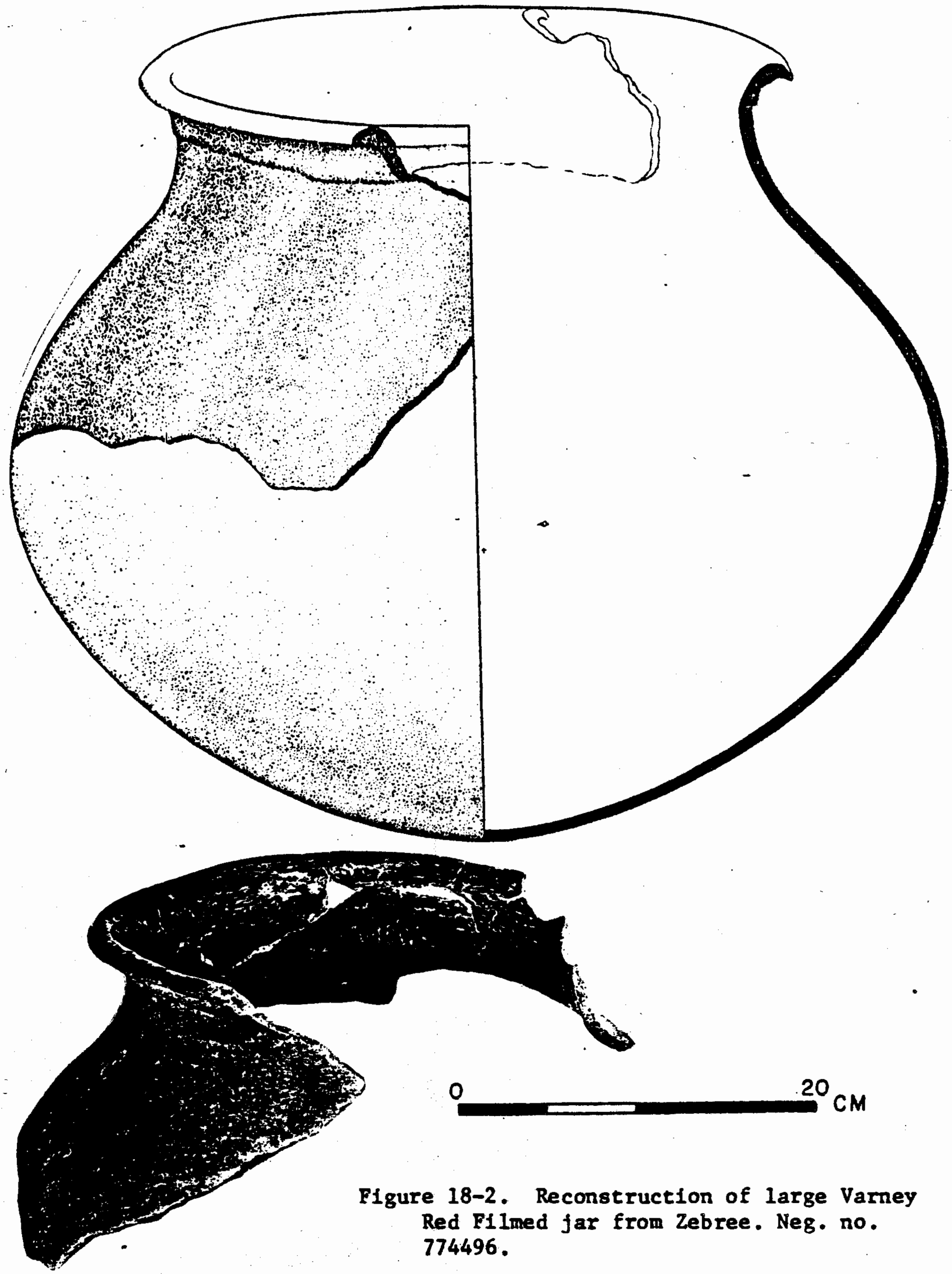

Figure 18-2. Reconstruction of large Varney Red Filmed jar from Zebree. Neg. no. 774496.

as a paint palette. Such a palette would be necessary to grind the hematite down to a fine powder before being added to the clay slip. Both sides of the slab have been abraded, exhibit numerous striations, and display a red stain.

Jars

Approximately 60% of all Varney vessels recovered are jars (Table 18-1). Variations in the jar form are slight and all of these vessels can be classified as independent restricted forms with inflected neck contours (Shepard 1971:231). Jar bodies are globular, round bottomed and most commonly display strongly recurved rims. The later interjects an aesthetically pleasing contour to the rim design. The jar's interior surfaces in 99% of the cases observed have received a thick, well polished red slip. Markings from the burnishing tool, probably a smooth stone, are readily evident. The exterior surfaces are slipped on about 42% of the sherds observed, but the slip usually appears as a much thinner, unpolished application and often is seen as patches, as if from a red paint covering the potter's hand. Rim folds, possibly for strength, occur on large vessels and very rarely notched lips are observed. Around 2% tend to have centrally grooved lips. Jars apparently occur in three distinct sizes. The smallest jars show a much tighter dimensional conformity than medium sized jars which in turn are more closely clustered than the largest jars. It is, of course, much easier to construct a smaller vessel to a preconceived size than it is to do so with a large pot. But it seems reasonable to infer that distinct size categories of jars were present for utilization in specific behavioral-processual contexts.

The large jar group begins with jars that measure 30 cm in the orifice diameter and at least 40 cm in height. A jar which approximates a dimensional mean for large jars is illustrated in Figure 18-1a, and has a volume capactiy of just above 52 liters. The circled dot at the upper extreme of the graph (Figure 18-1) represents one of the largest known VRF jars. The upper two thirds of the vessl were dug from a site (3CG434) near Monette, Arkansas by a local collector and has a capacity calculated at 64 liters. Morse has seen an even larger VRF jar excavated from a site in Missouri.

Certain problems exist in the construction of larger vessel forms that are not a factor in smaller pots. Appreciation of the techniques required were somewhat condescendingly discussed by Holmes in stating that:

> "in building a large vessel the walls had to be carried upward by degrees, time being required to allow the plastic paste to set and thus to become capable of supporting additional weight. The danger of failure in subsequent stages of the work also increased with the size, and a vessel of clay two or more feet in diameter and 3/4ths that height, carried successfully through all the steps of modeling, drying, burning, coloring, and ornamentation may well be regarded as a triumph of barbarian manipulative skill" (1903:60).

To hand build a large ceramic container with even walls and contours does indeed demand adept management of the clay and knowledge of the techniques involved. The few larger Mississippian jar forms known in the northeast Arkansas area, including both VRF and NFP types, stand 60 cm or taller and had capacities approaching 90 liters. Jars seem to be the only vessel form to attain this size.

As Holmes observed, larger vessels were most effectively constructed in stages. A base consisting of 1/3 to 1/2 of the pot is first formed by blending a series of large (3-5 cm diameter) coils in the desired shape. Efforts to duplicate such a vessel have shown that some type of supportive device has to be employed until the clay has dried sufficiently to hold its own weight. To support a large pot and maintain the convex line in the base, a cushion of fabric or hide, the base of an old pot or a basket-like "cradle" were possibly of assistance. Once the pot had stiffened, the upper portions could be added without danger of damaging the vessel structure. Furthermore, as the clay slowly lost moisture, the overly thick walls were scraped and thinned to the desired thickness. The paddle and anvil are extremely useful and efficient tools for shaping and thinning any larger vessel (Figure 18-3) and were also undoubtedly utilized (Fewkes 1941:162-164;Shepard 1971:59-60,185). In fact, a large pottery anvil was excavated from a possible firing basin (Feature 286) and would have been appropriate only for the manufacture of larger containers.

Large jar rims are occasionally only moderately flared instead of recurved, similar to the large NFP form shown in Figure 18-13. Average wall thickness of large jars is 7-8 mm while the lip is often thicker at 9-11 mm. In fact, an extra rim coil was noted just under the lip exterior of a few large VRF jar rims and is presumed to provide additional support of the lip and rim area.

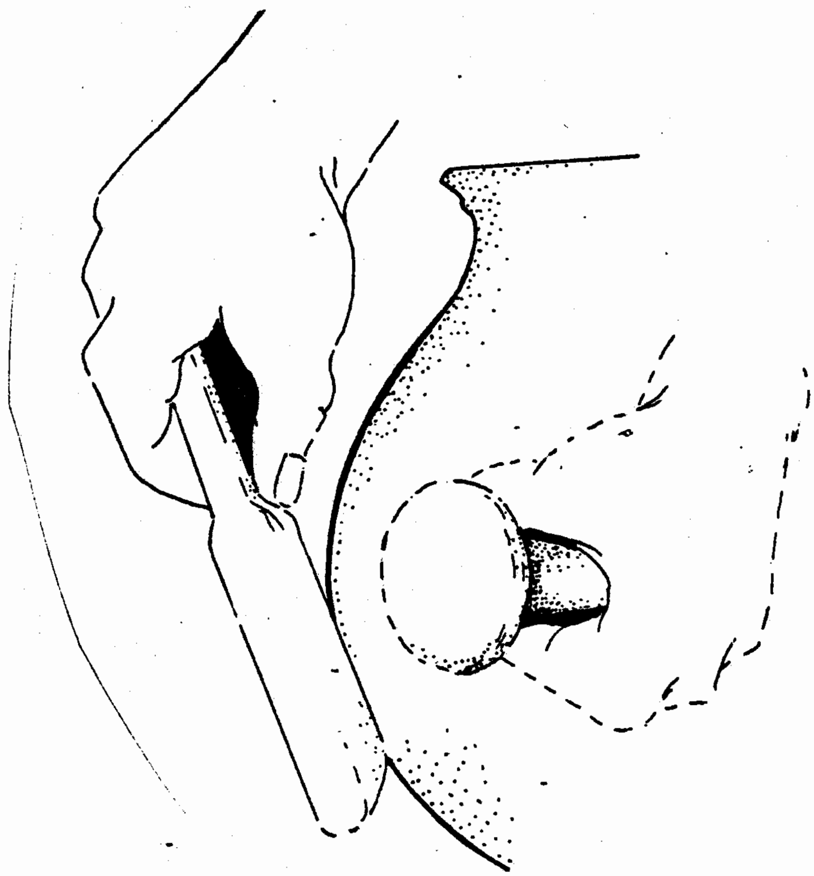

Figure 18-3. Paddle and anvil technique for shaping and thinning pottery.

That the function of these large containers held a significant place in the Big Lake society is strongly suggested by the time, skill, and care obviously taken in their making. Such large containers could be used to prepare enormous amounts of food. An alternative hypothesis is as a component of the salt manufacturing process. These vessels may have been used to collect water which had been passed through a ceramic funnel containing ashes of the American Lotus, Nelumbo lutea (see Chapter 16). No particular evidence of wear have been noted on the large Varney jar remnants. Use as a storage container and perhaps a water reservoir are possible other alternative functions to use for cooking.

A medium sized cluster of jars is apparent in the graph (Figure 18-1). Figure 18-1c illustrates a mean size for this class of jars and it has a volume of 13 liters. Even though the range of size variation is considerable, this cluster is nevertheless distinctly separate from the smaller and larger jar forms. Capacities vary from 8 to slightly over 20 liters. These vessels probably account for 1/3 to 1/2 of all Varney jars. Most reconstructable Varney jar remnants were of this size class. Wall thickness of these jars averages at 6-7 mm with the lip being slightly thicker. Extra rim coils or rim folds were not observed on medium or small sized jars. Medium jars more frequently display well slipped exteriors that are carefully applied and polished than do the larger jars. Rim profiles tend to be strongly recurved or "rolled" but a moderately flared rim is not uncommon.

A primary function of the medium VRF jar is thought to be in cooking and food-processing operations. The dense, compacted layer of slip on the interior surface of a container would significantly reduce its permeability. Stabilization of a round-bottomed pot in a fire or hearth can be easily accomplished by deploying fired clay supports. Pottery objects, called cones, which could have served in this manner occur on the site and are discussed later in this chapter. The convex base of these vessels is believed to efficiently distribute heat received in a fire.

The small jar category exhibits the tightest clustering by size of all Varney jars as presented in graph in Figure 18-1. A jar 20 cm in height and 12 cm in orifice diameter (Figure 18-1c) is apparently the dimensional norm preconceived by Big Lake potters. The only intact whole vessel from the Big Lake components was a jar of this size (Figure 8-4), having a volume calculated at 3.35 liters. Slipping was performed in the same patterns as present on the medium sized jars. Fortunately, wear is exhibited by several small jar remnants. The illustration of the small VRF jar in Figure 18-5 depicts this wear on the lip area of the pot. The recurved rim is practically obliterated by small nicks and chips missing from the lip and this area is generally rounded and smoothed from use.

Figure 18-4. Varney Red Filmed jar found in situ in Feature 257. Neg No. 753055.

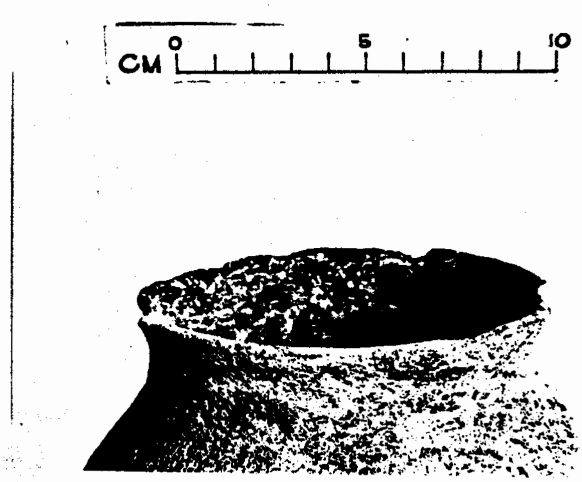

Figure 18-5. Small Varney Red Filmed jar showing wear on the lip. Neg. No. 774498.

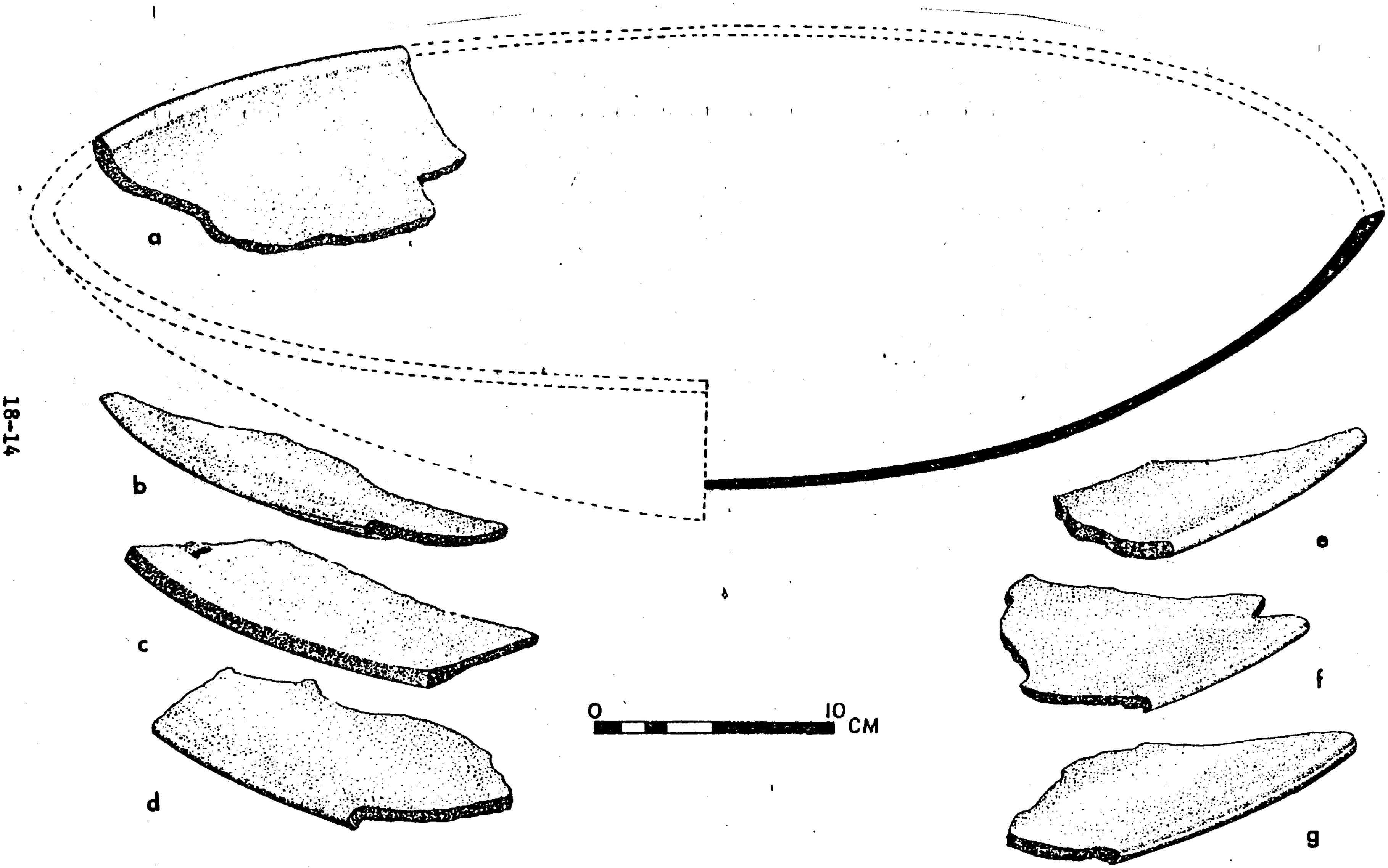

Figure 18-6. Varney Red Filmed pan rim sherds showing lip variations.

Regular use of a ladle or spoon is almost certainly responsible for the wear displayed. Routine service in cooking tasks is consequently hypothesized for this form.

Pans

Pans constitute a common ceramic feature in the recovered sherds (Table 18-1). Lip variations occur and are shown in Figure 18-6 but are not felt to be the result of a particular technical advantage. Considerable size variation is present as is illustrated by Figures 18-7 and 18-8 which show a cross-section of the pans reconstructed. Maximum pan diameters begin with 50 cm and the largest measures 77 cm. Most pans are under 70 cm diameter, however. In height, these pans typically range from 12 cm to 15 cm. Although most of these containers have a volume of at least 15 liters, the full capacity range if from 9.5 to 26 liters. The graph in Figure 18-7 depicts this dimensional variety in 18 reconstructed pans. Several pan fragments were recovered from the site and all are relatively symmetrical with rounded bases. Wall thickness averages 8-10 mm.

Production of the Varney Red Filmed pans requires special techniques in order to be effectively accomplished. Their shape, however, is primarily what creates problems during building. The low-sloped walls, which are designed to provide a shallow container to maximize evaporation rates, are in no manner capable of supporting themselves when first formed out of a moist pottery clay. Examination of the larger VRF pan sherds reveals some evidence for the methods of construction used.

The interior surfaces of these sherds are well smoothed and pebble polished and finished with several layers of the Varney slip. Some rim sherds exhibit vertical striations and some exhibit horizontal striations, the direction probably dependent upon the diameter and depth of the pan involved. The exterior is generally somewhat smoothed but also tends to display randomly appearing grass impressions along with small superficial "cracks" which seem to indicate that a slight expansion took place at some point during the building process. The coil blends are normally well executed and coiling is known as the method of construction only by an occasional coil break and horizontal lines indicating coil junctions.

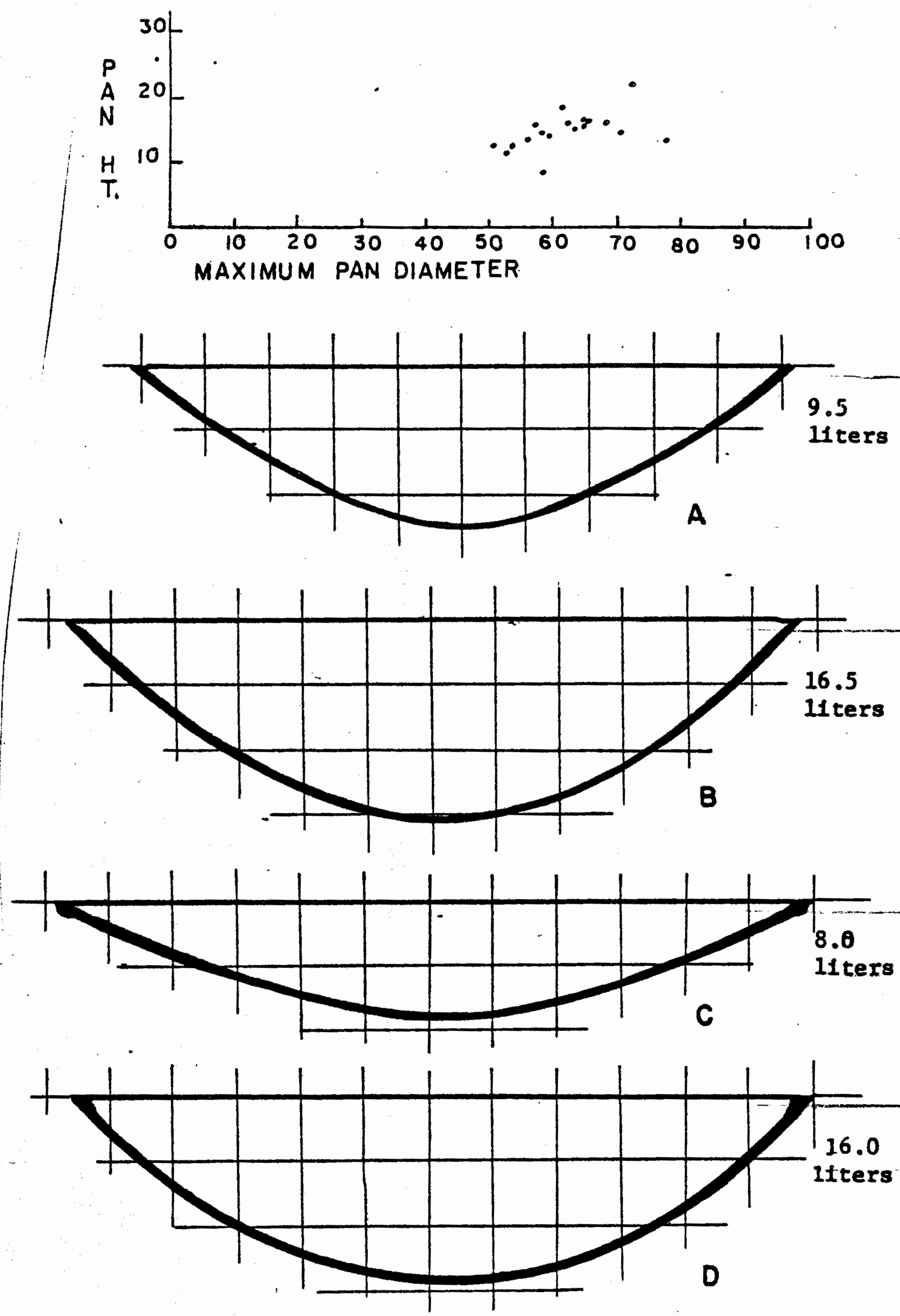

Figure 18-7. Varney Red Filmed salt pans.

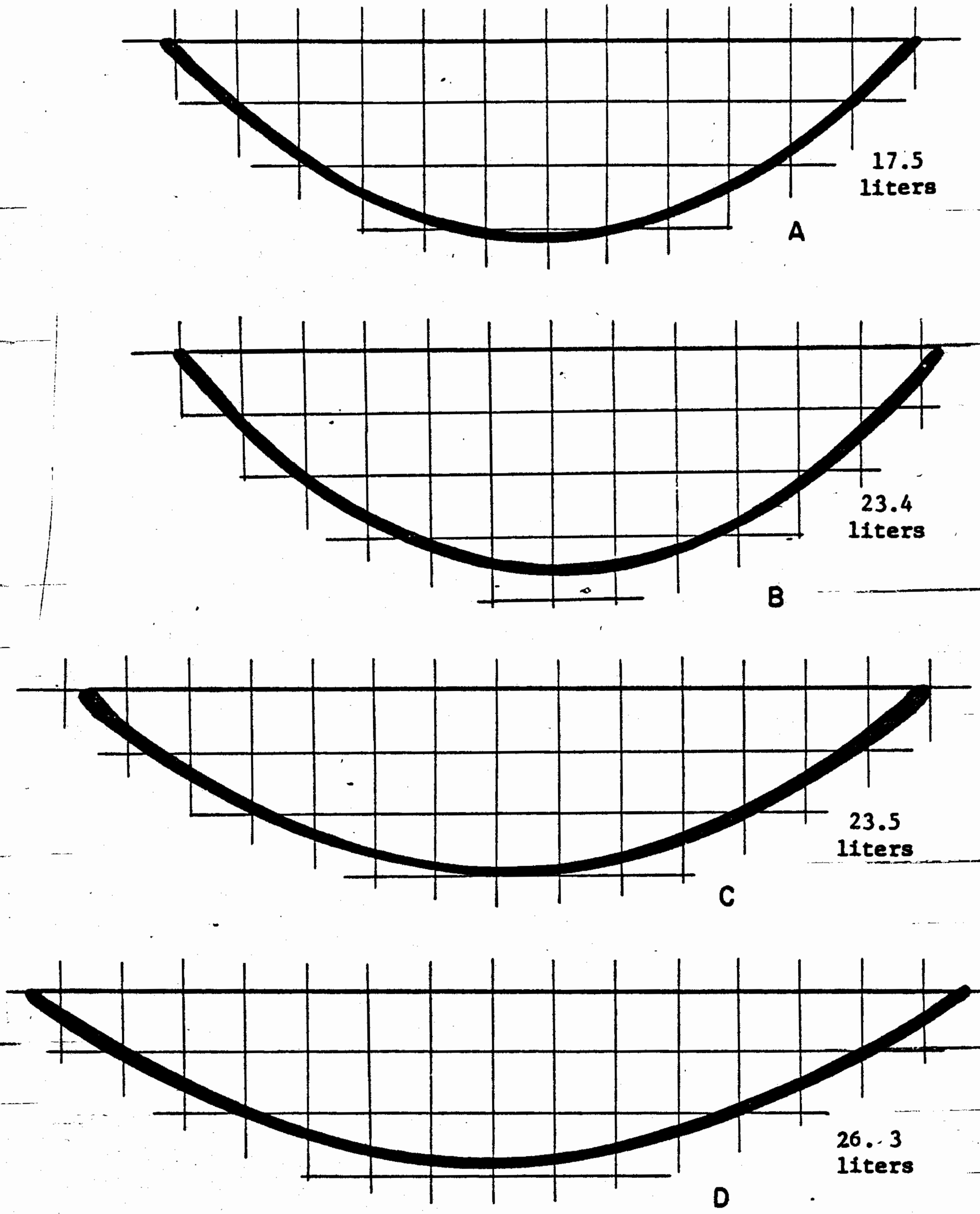

Figure 18-8. Large Varney Red Filmed salt pans.

The pan shape dictates that a mold of some type be used to support the considerable weight of the wet clay forming the periphery of the vessel. A hard-packed, basin depression in the earth was reported by Keslin (1964:72-74) and interpreted as a mold used for the manufacture of pans in the Cole site in Saline County, Missouri. A great number of pans were found at that site which is located at a large saline spring. No similar basins were recognized at the Zebree site, although they possibly existed, and a basket, a wooden form, or another pan are logical alternatives as molds. Evidence of a common mold as implied by two pans from a pit (Feature 208) which were of identical size. To duplicate exactly the dimensions and shape of another vessel is very improbable for potters dependent on hand building techniques unless a form of some type is used.

Lining the mold with coarse fabric or grass is necessary to prevent the wet pan from adhering to it. These vessels must have been carefully coiled with the potter keeping one hand underneath the newly forming vessel at the spot where the coils were being added and then immediately blending them together. It was probably necessary for the potter to shift around the mold continually while adding the coils as turning the heavy, wet pan inside the mold would almost certainly be detrimental to the pot's structure. When the pan was built to the desired size, it was smoothed and padded down with a smoothing stone and/or a pottery anvil, until it was flush against the mold, in order to even the contour and prepare the inner surface. This action may explain the small cracks in the exterior surface of the aboriginal specimens since the pan would have been constructed slightly smaller than the mold so that the potter had room to manipulate both sides of the wall. Once the interior surface was well smoothed the slip could be applied. Grass was apparently used as a mold lining in the Zebree Big Lake industry as a few impressions are often evident on the exterior surface of pan sherds. Because the lining could not be removed until the pan was capable of being lifted out of the mold, or in other words, until the pan was relatively stiff, any impressions on the exterior of the pan would tend to remain. Big Lake potters showed great care in building symmetrical pans with even graduations of wall thickness.

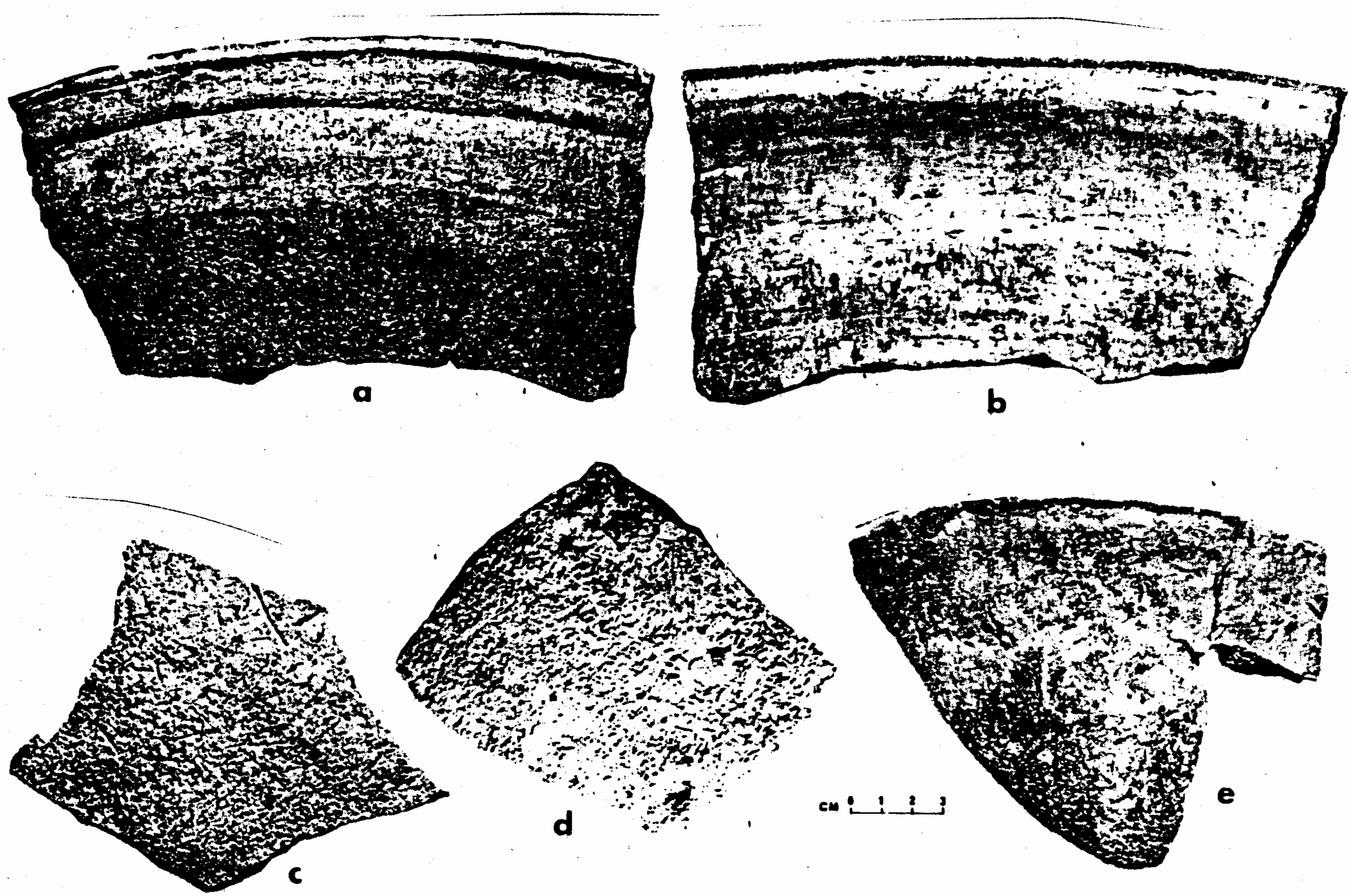

Figure 18-9. Varney Red Filmed pan and bowl sherds, Lawhorn phase, Zebree site. a-b. opposite surfaces of a pan rim; c-d. pan body sherds with grass impressions; e. bowl rim.

The Varney pans probably are specialized containers for use in salt production activities at Zebree. In many areas of the central states, pans have been observed in large numbers at sites near saline springs or streams (Keslin 1964, Holmes 1903:27-31). Their shape is designed for rapid evaporation of saline solutions either by boiling or a slower evaporation by placement in the sun.

Bowls

Varney bowls at most constitute 10% of all VRF vessels. Several rimsherds were collected at the site, however, that were of adequate proportions for a reasonably accurate dimensional reconstruction of 14 bowls . Twelve forms are illustrated in Figure 18-10 (two bowls were of nearly identical size). As the profiles show, these bowls are simple, plain-rimmed, and exhibit a general shape conformity. Though a few bases are somewhat flattened, rounded bases are most commonly suggested by the body sherds. The only bowl which displayed much variation in rim treatment is shown in Figure 18-10i, where the rim is flared outward. Although the sample number is small, these bowls seem to cluster in four loose groups (a-d, g; e-f, h-j; k; and l) which may or may not have been conceptualized by their producers.

The first group ranges in diameter from 12 to 20 cm and in height from 5 to 7 cm; the second ranges in diameter from 20 to 25 cm and in height from 7.5 to 13 cm; the third is represented by one bowl which is 30 cm in diameter and 12 cm high, and the fourth cluster is represented by one vessel which is a large, steep-sided bowl measuring approximately 47 cm in diameter and 20 cm in height. Wall thicknesses of all but the last vessel average at 6 to 8 mm. All bowls were slipped on both interior and exterior surfaces.

Bowls normally serve as food serving containers and this function is hypothesized here also. Although wooden and gourd bowls were probably in use as well, ceramic bowls are obviously a more common element in this early Mississippian assemblage than they had been in Woodland times. Three sherds were found in 1969 in a Big Lake context which exhibited notched rims.

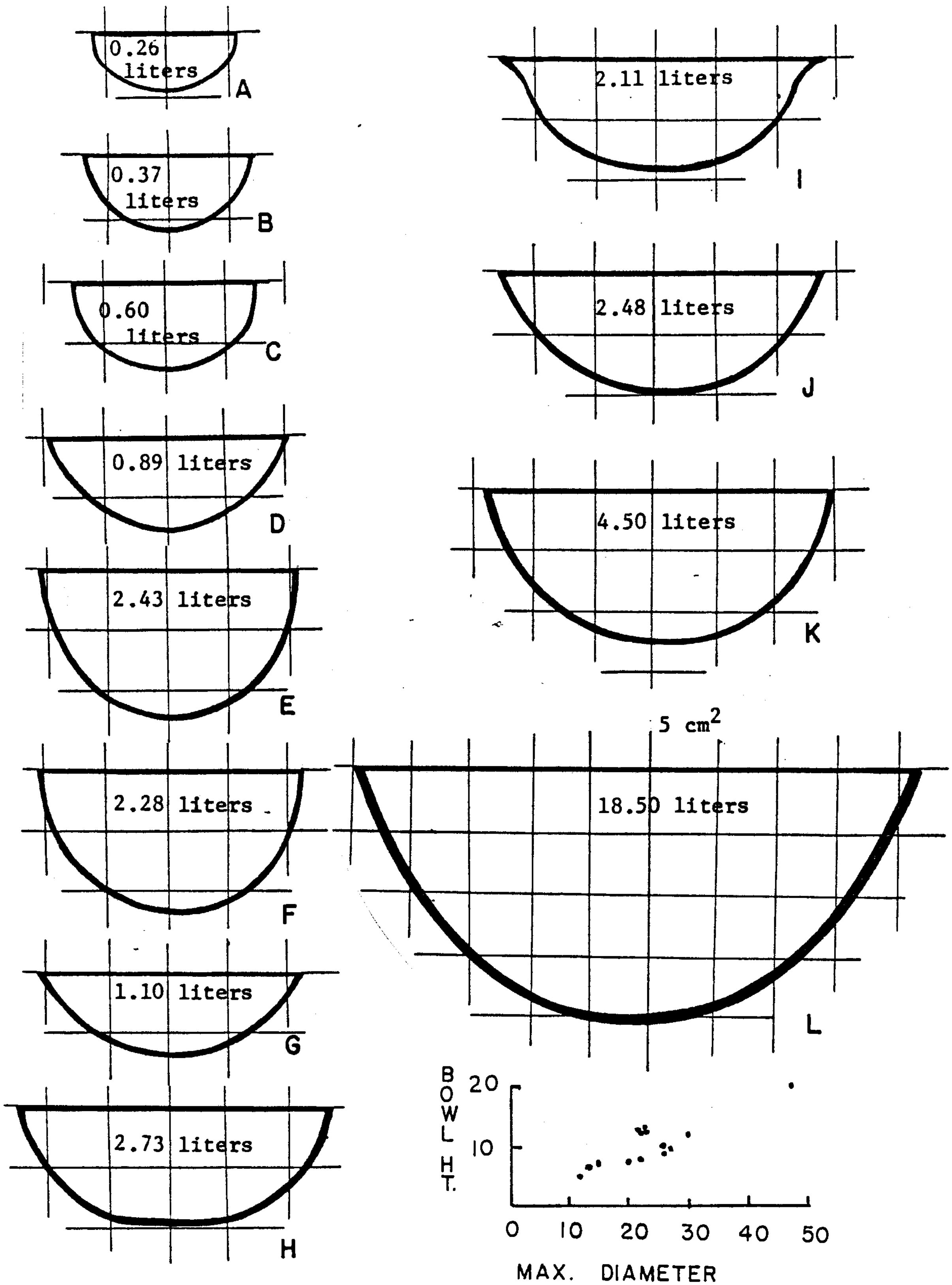

Figure 18-10. Reconstruction of Varney Red Filmed bowls from the Zebree site.

Hooded bottles

Hooded bottles are actually ceramic vessels manufactured as approximations of gourd containers. Figure 18-11 illustrates the variation within hood styles. A central dimple which signifies the gourd stem is most prevalent (Figure 18-11a, d). Near complete hood fragments displaying two dimples (Figure 18-11 b), Friar-like conical extensions in back of the opening (Figure 18-11c,e), and plain, undecorated hoods were present. The illustrated hooded bottle (Figure 18-11d) is based primarily on a vessel found during the initial testing of 3MS19 in 1968. Other Big Lake phase hooded bottles are known only by less than two dozen hood fragments from 3MS20. One vessel illustrated (Figure 18-11d and Figure 18-12a) has a capacity (at 2 cm below the lip) of 4.4 liters. Estimated original height is 28-30 cm with a maximum body diameter of about 20 cm. The vessel is relatively thin with a wall thickness of 4 to 5 mm. The orifice measures 53 mm wide and 35 mm high. The exterior surface only is red slipped and polished.

The function of these vessels is almost certainly related to the storage of food or seed grain. Associated artifacts are clay plugs called Kersey Clay Objects by Marshall (1965: Figure 47), several of which have been found at Zebree (Figure 18-11f). These plugs are made of untempered clay and all were probably preserved by accidental burning. The use of plugs on bottles by Mississippians is demonstrated by a plugged bottle found at the Bradley Place (Moore 1911: Figure 45). That a sealed container is conducive to the effective storage of grain has been demonstrated by experimentation (Reynolds 1974; 119). In an airtight receptacle (or subsurface pit) the natural respiration process of grain will continue until the oxygen is used up and an anaerobic atmosphere composed of carbon dioxide is created in which the grain becomes dormant. In combination with a low temperature and constant moisture content, these conditions insure that grain will store successfully for extended periods of time. Sufficient seed could be stored in such bottles to sow several acres.

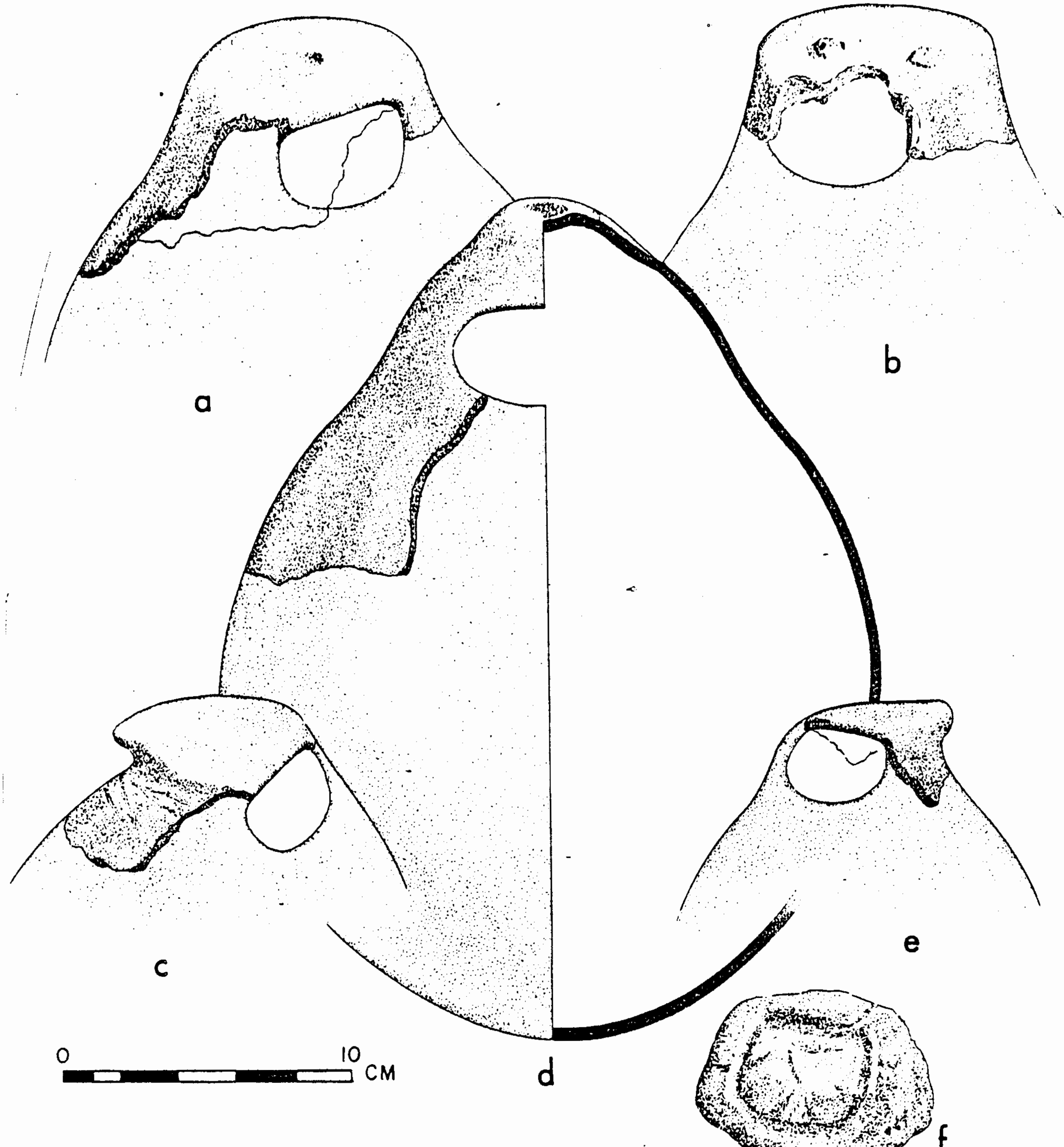

Figure 18-11. a-e. Varney Red Filmed hooded bottle form, Big Lake phase, showing variations of hooded area; f. clay plug.

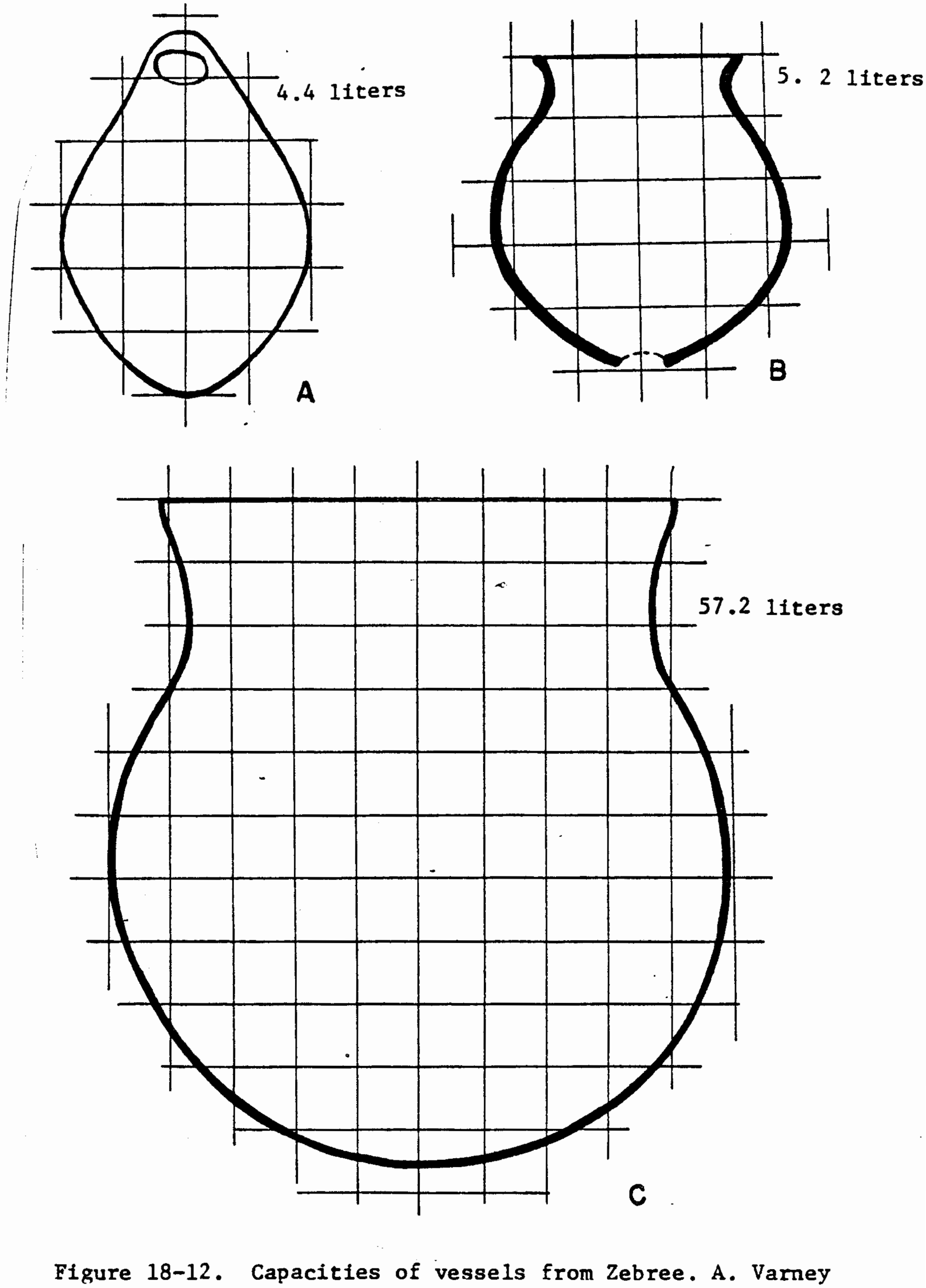

Figure 18-12. Capacities of vessels from Zebree. A. Varney Red Filmed hooded bottle; B. Wickliffee Thick funnel; C. large Neeley's Ferry Plain jar.

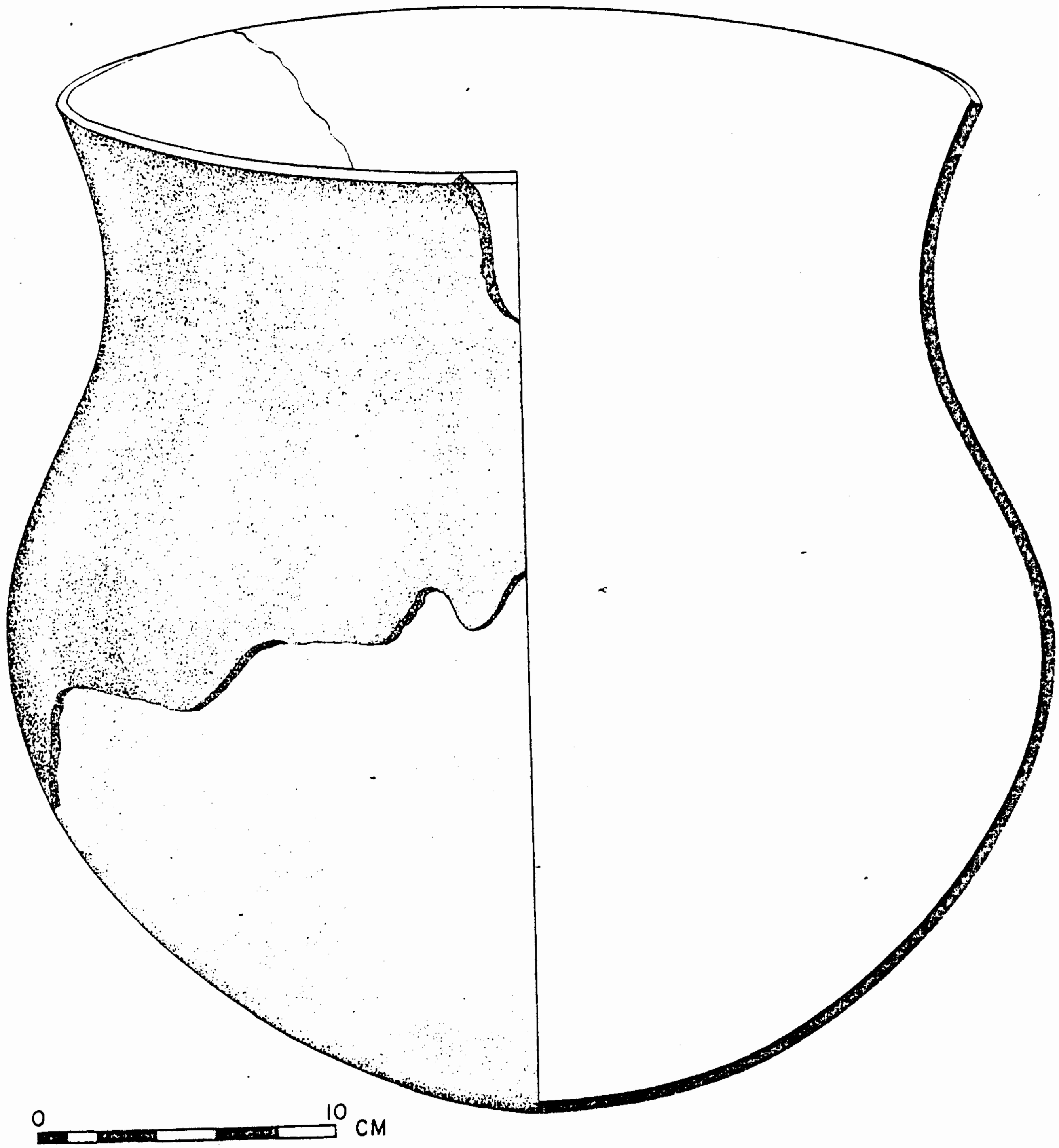

Figure 18-13. Reconstruction of Neeley's Ferry Plain jar from Zebree site.

Neeley's Ferry Plain Pottery

Neeley's Ferry Plain (NFP) is the basic utilitarian shell-tempered paste found in assemblages of the Mississippian cultural expression. It was first defined by the Phillips, Ford, and Griffin archeological survey of the Lower Mississippi Alluvial Valley (1951: 105-110). This ware is overtly identical in its paste composition to the Varney pottery but lacks the red slip surface treatment and seems to be a weaker paste since it seems to break down more. Vessel exteriors are moderately to well smoothed and only rarely polished. These vessels generally fire to a light brown or pale yellowish brown in color. One characteristic of the NFP sherds is that they tend to become partially leached when acidic soils and/or rainwater react with the shell (calcium carbonate) temper. This ware has been referred to as Mississippian Plain by other investigators (Williams 1954: 202; Phillips 1970: 130-135).

The large jar form appears to be responsible for producing the vast majority of NFP sherds. Using the dimensional mean of all NFP sherds from the Zebree site, it was calculated that a large jar, as illustrated in Figures 18-12c and 18-13, could theoretically be broken into well over 2500 sherds. Estimations based on rimsherds (Table 18-1), indicate that over 50% of all NFP vessels are large jars. In any case, the large jar is the only NFP form for which significant dimensional data has been accumulated at Zebree, with the exception of a single, deep bowl.

The jar shown in Figures 18-12c and 18-13 is the largest of three such vessels reconstructed. It stood an estimated 55 cm high and originally measured about 40 cm in orifice diameter. The volume has been calculated at approximately 57 liters. Wall thickness is generally 7 mm. Rims of this jar form are typically only moderately flared with slightly inflected necks. The recurved rim so characteristic of the Varney jar has not been observed on a NFP jar. These vessels never exhibit any type of appendage or surface treatment other than a well smoothed surface. Some NFP sherds do appear as if some type of animal grease or plant extract was applied to their interior surfaces. A grayish color results and such a treatment may have been to "cure" the vessel by making it less permeable.

Figure 18-14. Neeley's Ferry Plain bowl, Zebree site.

The use of these large jars in the Big Lake society is speculative at best. Use for cooking foods for large numbers of people is an obvious possibility. How effective such containers are for food storage, as water reservoirs, or for utilization in the salt manufacturing process has not been demonstrated.

Although simple, plain bowls were apparently very popular (Table 18-1), the only bowl of adequate proportions for reconstruction is from an apparently atypical, deep bowl. It was recovered from a sherd concentration in Feature 24 and is shown in Figure 18-14. The orifice measures just over 19 cm and height is 21 cm. Maximum body wall thickness is 11 mm while the flattened lip is 6 mm thick. The exterior surface is smoothed, but not polished. Volume is 4.25 liters and the vessel's function is not specifically known. Only small bowls were recovered from the random squares and these may have been the normal food bowl.

Wickliffe Thick Pottery

Wickliffe ware was first defined as a series by Williams (1954:214-218) where it was subdivided into a cord marked, an incised, and a plain variety. It has since been redefined by Phillips (1970: 171-172) as a single type. Only one vessel form has been attributed to this type of pottery and that is the highly specialized funnel, see Figures 18-12b and 18-15. Wickliffe Thick is a distinctive ware consisting of a coarse, shell-tempered paste. Sherds are considerably thicker than other Mississippian sherds, from comparably sized vessels, measuring usually 10 mm in thickness. Surface treatment was most frequently a rough cord-marking although a trailed incising and an occasional sherd that had been thinly slipped, over the cord-marking, were noted. According to the count and weight tables in the appendix, this type is not easily recognized during hurried sorting and usually only relatively large sherds are recorded.

Two largely complete funnels were excavated from 3MS20 and both are similar in size. These vessels measured about 16 cm in diameter and 24 cm in height. The lower orifice was 5 to 6 cm in diameter. Volume was figured at just over 5 liters. The funnels seem to have been made in a short time and/or with distinctly less care taken in their manufacture. The surfaces of the sherds tend to flake easily (probably owing to the coarser temper) and breakage along coil lines is often apparent. Their function is very likely limited to use in production of salt. The funnel would have served to contain the ashes of the American Lotus so that water could be slowly trickled through the vessel allowing the salts to enter into solution with the water (North, Chapter 16).

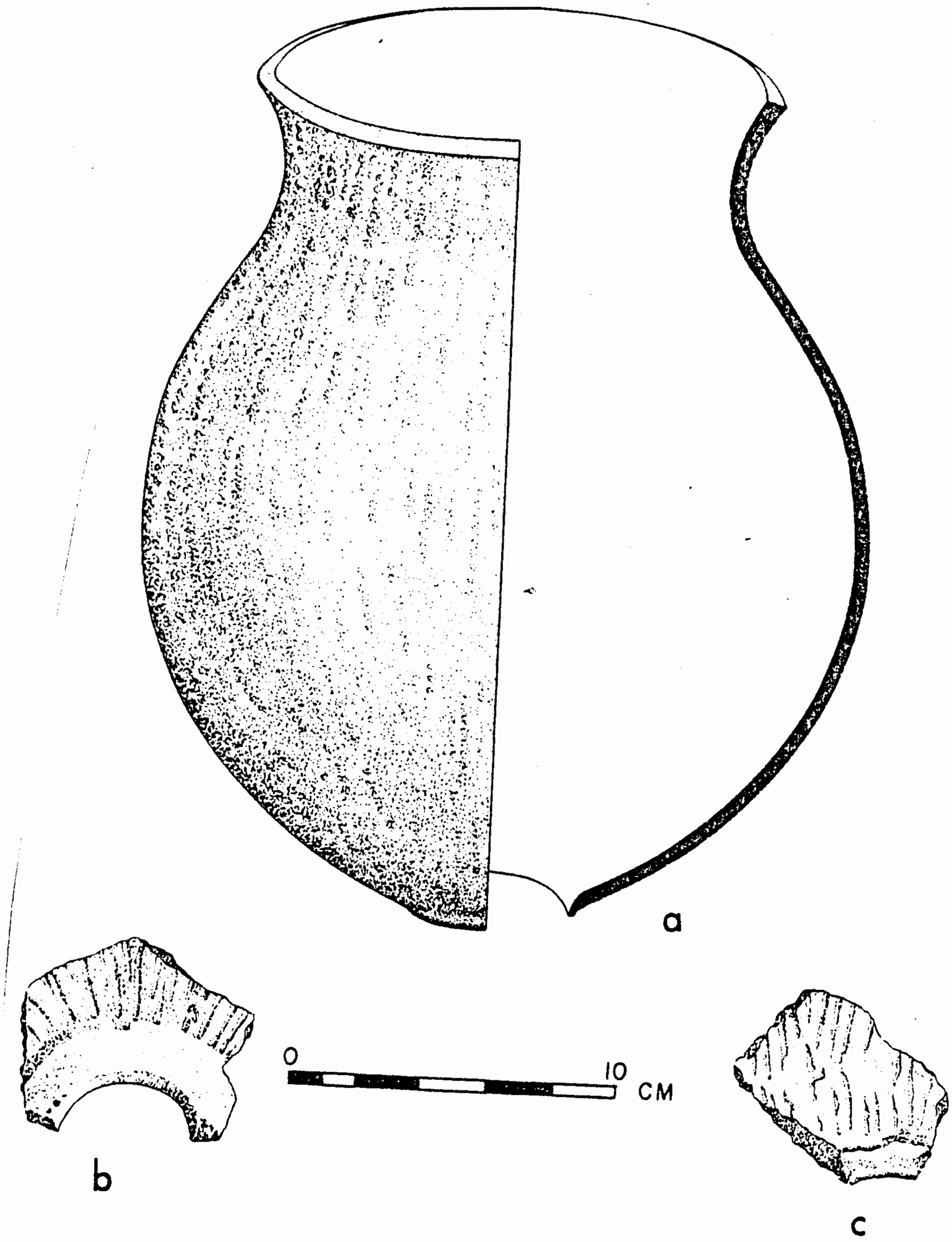

Figure 18-15. Wickliffe Thick funnel, Big Lake phase. a. reconstruction of vessel form; b-c. variations of funnel rim area.

A permeable, straining material or perforated pottery disc was probably placed over the lower opening.

Unusual Shapes

Ladles

Four ladles, one plain and three VRF, were recovered from Zebree. Two were found in 1969 and two in 1976. Other ladle fragments probably were found and mistaken for handles and small bowl sherds. The NFP one is included here for convenience.

Pothole 6	Plain (sandy inclusions)	Solid handle
80R6	VRF	Solid handle
Feature 330	VRF	Open handle
Feature 362	VRF	Solid handle

Only one of the ladles is complete; the other three are fragments including the junction of the handle with the bowl. The complete ladle is small (Figure 18-16c), with an approximate capacity of 3.40 cc. The largest ladle might have had a capacity of up to 250 to 300 cc and the other two fall considerably below that.

Their function is a puzzle. Smaller than southwestern ladles (Turner and Lofgren 1966), they might be some sort of a measuring utensil. Gourds make better ladles than pottery but pottery ladles is an apparent trait found with late Woodland artifacts near Cahokia. A small clay ladle was founded at the Pulcher site (Griffin 1977: Fig. 6a).

The complete ladle has a flattened proximal end as if a crude hand was meant to be depicted on the end of an arm. The smallness of at least the complete one indicates a function as a toy while the larger example may actually have functioned as a ladle.

Miniature Vessels

Fourteen very small vessels from 1969 and two from 1975 are in the Zebree assemblage. They probably mostly represent toys.

76R4	Bowl	Plain
F60	Bowl	Plain
F60	Bowl	Plain
82R12	Bowl	Plain
12R20	Bowl	Red filmed
12R12	Bowl	Plain
House Ext	Jar	Plain
12R14	Jar	Plain
76R2	Jar	Plain
76R2	Jar	Plain
76R2	Jar	Plain
72R18	Jar	Plain
F102	Jar	Plain
72R18	Bowl	Brushed
F286	Bowl	Plain
F250	Jar	Interior Red Filmed

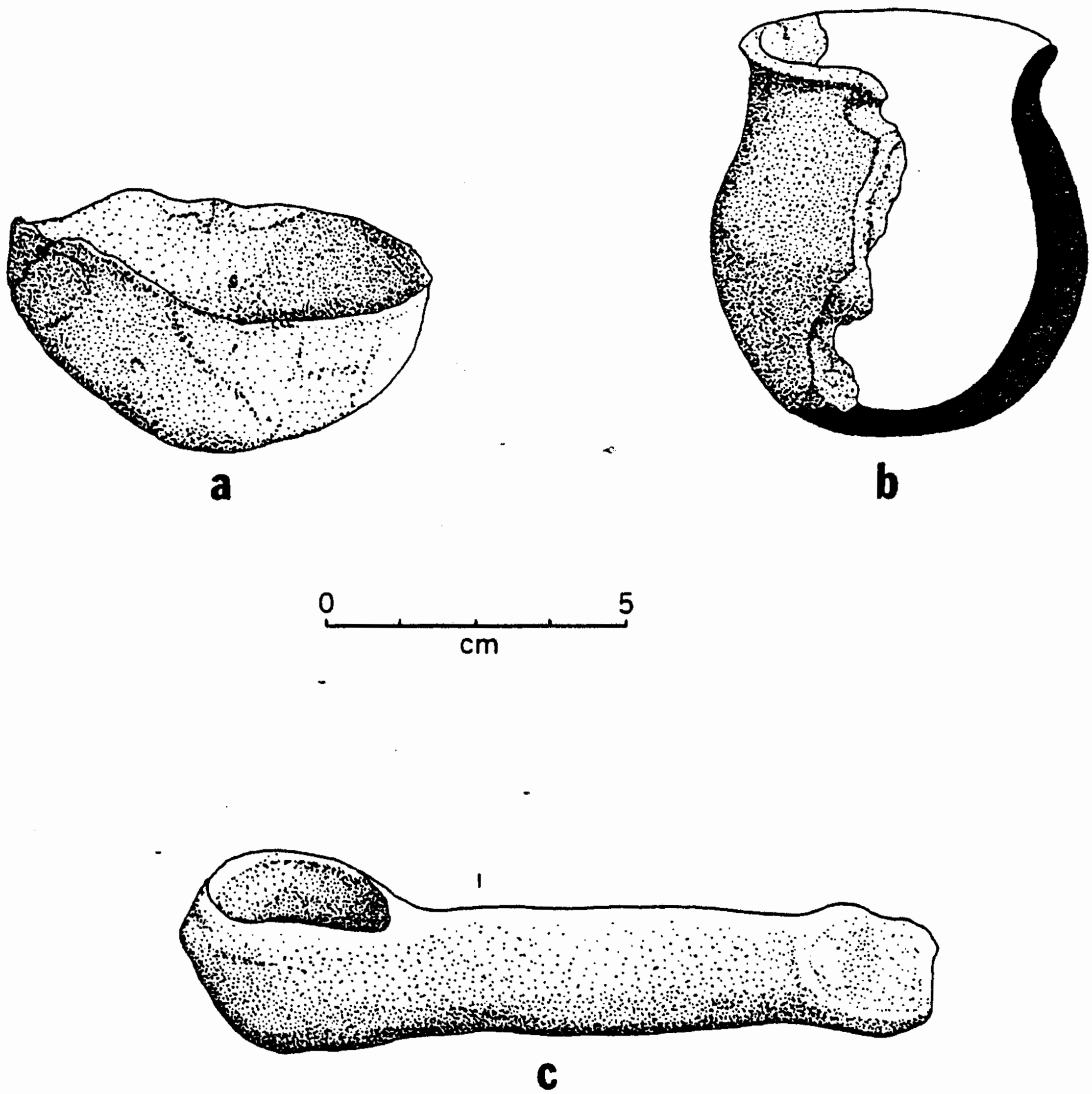

Figure 18-16. Miniature vessels from the Zebree site. a. small bowl; b. Neeley's Ferry Plain jar with perforated lip; c. miniature ladle.

Five of the bowls including the red filmed example and three jars are not tempered. Their paste appears to be a sandy unprocessed clay. One bowl includes coarse carbonized organic matter. All but two jars and the brushed bowl are very crudely modeled. The bowl which is complete exhibits small interior scratches, possibly from finger nails. One jar has a heavily shell-tempered paste and has 1/2 of a perforation near the lip at one broken edge (Figure 18-16b). It is smoothed on both faces. The interior displays a thin red slip which did not oxidize to a deep red color.

Bowls apparently measure around 75 mm in diameter by 30 mm high, and 40 by 32 by 26 mm high. The complete one measures 35 by 18 mm high. Jars range in height from 30 to 60 mm and in diameter about 50 and 70 mm.

Extrapolation from our experience results in an interpretation as toys. This is in part confirmed by the crude nature of most of them. At the Hazel site, similar but better made small vessels were buried with an infant and apparently a stillbirth (Morse and Smith 1973: Fig. 9a,b,g), probably symbolic but also suggestive. On the other hand, Perino describes 24 "medicine cups" at the Banks site as being associated with male adults (1966: 131).

Evidence of Pottery Manufacture

Odd lumps of pottery clay are usually conspicuous in the immediate vicinity of any potter at work. Hand-building in particular creates a variety of such objects as a matter of process. "Squeezes" may be pulled from a vessel under construction or a clay lump occurs during manufacture in an adjustment or modification of the work. A hard clot of clay, a dirty portion of paste or any undesired inclusion will routinely be torn or cut out and discarded. In addition, the coil blending and scraping steps both produce a considerable amount of paste remainder. In the former case, the clay is still damp and can be incorporated back into the original portion if care is taken. Scraping, on the other hand, results in a drier residue that requires resoaking to be useful again. Conscientious recycling of paste residuum would seem a normal practice of potters whose final product was so carefully made.

Manufacture by-products recovered from Big Lake deposits occur in relatively low frequencies although very probably only a small proportion of such objects manage to be preserved. Squeezes, coil sections and amorphous fragments of both tempered paste and untempered clay show up occasionally in the midden deposits although a very few were found collectively in pits. When the spatial distribution of these artifacts was plotted over the site, they proved to be rather uniformly scattered. In Barnes and in Big Lake, pottery biproducts are associated with probable house cluster areas and indicate that pottery manufacture for both complexes is a basic household economy. Not of the least importance is the potentially valuable record they contain in the form of several well preserved palm and fingerprints displayed on many of the objects. Undoubtedly these should be examined by a trained in-individual for information pertaining to the sex and age of Big Lake potters. Provenience of specific categories are provided in the appendices.

Pottery-making tools

The tool kit used by each potter in pottery-making tasks was undoubtedly well cared for and an important item of personal property. Tools are a necessity for proper and efficient performance of the various processual steps. The nature and function of several tools that were likely to have been utilized in the Big Lake phase pottery industry are briefly presented as follows:

- a digging stick or similar implement and some type of container would be needed for clay and possible shell procurement.

- sieves of woven fiber or cordage (similar to a burlap bag) or possibly of woven split cane matting were probably used to process soaked clay and to refine the crushed shell temper.

- a deep wooden mortar and pestle could be effectively used to crush burned shell for temper and possibly for processing some clays.

- a working "board" or platform of some type is necessary in order to have a flat, clean surface upon which to wedge, coil and otherwise work with the pottery clay. A wooden slab, possibly covered with a fabric, would serve well.

- supportive rings or pads of fabric or leather, basket or wooden supports or any similar device were certainly needed for the stabilization of a vessel during construction and so that the round-bottomed contour of Mississippian pots could be maintained until the paste had partially dried.

- numerous containers small and large, made of clay, wood or gourd were necessary for holding water, tempering, clay, slip preparations, and other materials.

- numerous varieties of perishable hand implements made of wood, cane, and bone could be used for cutting and a large number of other clay manipulations.

- scraping tools formed of gourd, shell, wood or other materials are used for thinning and shaping vessels being constructed.

- mushroom shaped "anvils" were made of pottery clay by Mississippian potters specifically for use in combination with a wooden paddle as a means of thinning and shaping the body contour of larger vessel forms. The anvil is held against the interior wall while the paddle is carefully struck on the exterior surface (Fewkes 1941; Fig. 18-3). These tools may have been dusted during use with processed shell tempering powder to prevent them from sticking to and tearing the moist clay.

- a rag of soft leather or fabric would serve several purposes such as smoothing wet walls and applying a slip.

- polishing stones of smooth, waterworn chert or quartzite pebbles are commonly found on Mississippian sites and were often used to burnish a vessels's surface, especially if slipped.

- a palette of sandstone can be used in the preparation of pigmented slips; hematite can be ground to a fine powder with such a tool.

- a stone flake, even if unretouched, would be useful in a variety of processual steps in the pottery-making sequence.

Pottery firing technology

Firing is perhaps the most delicate step in the entire manufacturing sequence. In the aboriginal United States, the kiln or any type of controlled pottery furnace was unknown. The Big Lake phase vessels are an excellent example of results from a well-developed open pit firing technique (see Rhodes 1968) where generations of experience are undoubtedly represented. Even though only the basic principles of firing are involved, there are several crucial factors that have to be precisely controlled in order to insure a negligible vessel loss rate. In fact, this "simple" firing method demands a considerable amount of intuitive know-how and decision-making to be performed successfully.

Observations of the Big Lake phase sherds indicate that a clean, hot "oxidizing" atmosphere was consistently attained. The color of the vast majority of Big Lake phase sherds is a pale brown to light yellowish brown which indicates that the firings provided conditions which permitted the iron impurities common to deltaic clays to burn out clean. Without this condition, the large, relatively thick vessels, such as the Varney pan or jar, would have no chance of receiving enough heat to become durable and incapable of slaking. An oxidizing atmosphere in firing is one in which there is an ample supply of oxygen to combine with the ceramic materials being fired. When soot and other impurities replace the free air in the atmosphere, it is then called a reducing one (Shepard 1971: 213-222). "Fire clouds" are simply locally reduced portions of a vessel and can be seen to shift during a firing as the conditions immediately surrounding the pot continually change. Fire clouding does not imply a poorly fired vessel, rather, they may have been intentionally created for aesthetic effect in some aboriginal industries.

Prior to being fired, a newly constructed vessel must be allowed to air dry slowly, possibly for weeks in a controlled manner. Yet, they still contain appreciable amounts of moisture. Any free moisture retained in the clay pores is undesirable because it will turn to steam when heated and will result in "popping" and spalling which ruin a pot. A thorough preheating of any vessel made of the fine-grained alluvial clays is necessary since this clay type, more so than others, retains water for long periods inside the tiny capillaries present in the paste. In fact, even if they have been dried in the sun for days, these vessels have to be heated at least 3 or 4 hours near a fire before they can be fired.

A firing design with which the writer has been able to successfully replicate the results achieved by Mississippian potters is presented as follows (and in Figure 18-17). First, combustion materials are collected before beginning the firing procedure; the principal fuel required is dry wood. In a woodland environment, a tremendous amount of dry, dead timber would be available and it is stressed that green or rotten wood is unacceptable. Recycled wood from downed structures and driftwood collected from the river banks might also serve. Dried grasses and cane could have been useful as kindling.

Firings of this nature are generally conducted in a shallow pit to help conserve heat. A basin 1.5 - 2.0 m in diameter and about 30 cm deep would accomodate almost any expected firing load. The same considerations are of importance here as in the fire pit hypothesized in the salt processing, that is, such a locus of activity was logically placed away from dwelling and structures that might accidently catch fire. After a fire is built in the pit, it usually needs to be fed for two to four hours, depending on conditions, until a thick bed of coals have accumulated. The humidity, the quality of fuel wood, size of firing, the amount of wind (draft) and other variables all differ with each firing situation. The vessels to be fired are , ideally, preheated at this time (see Fig. 18-17a). When enough coals have formed, they are spread and evened in the pit and any remaining flames are smothered. The pots are carefully stacked on top of the coals (Fig. 18-17b), and will accept the temperature difference only if they have been adequately warmed.

Large pieces are most safely fired individually (Fig. 18-18). One of the larger vessel remnants from the site is from a large VRF jar with a well oxidized red slip in the interior surface which extends outward along the recurved rim. The lip of this vessel exhibits three small, evenly spaced black spots that are reduced from contact with some type of spacer or support probably of fired clay. The pot was fired in an inverted position, as shown in Figure 18-18, and originally had four opposed supports. Maintaining the jar slightly above the coals allows heat and oxygen to circulate much more evenly.

Once the pots are securely stacked, the hot coals are grouped closely around them (Figure 18-17c). More wood is gently added until they are covered with fuel. If the new fuel does not catch immediatedly, it can be quickly kindled with dry grass. As the fire burns down, the vessels are reoriented as necessary with long sticks. Usually a firing such as this one will take one hour or less after the pots are placed on the coals. Refiring experiments in which a few Mississippian sherds (from 3MS4) were placed in a small electric kiln have suggested that temperatures achieved in aboriginal firings were in the range of 600 to 650 degress centigrade (Million 1975).

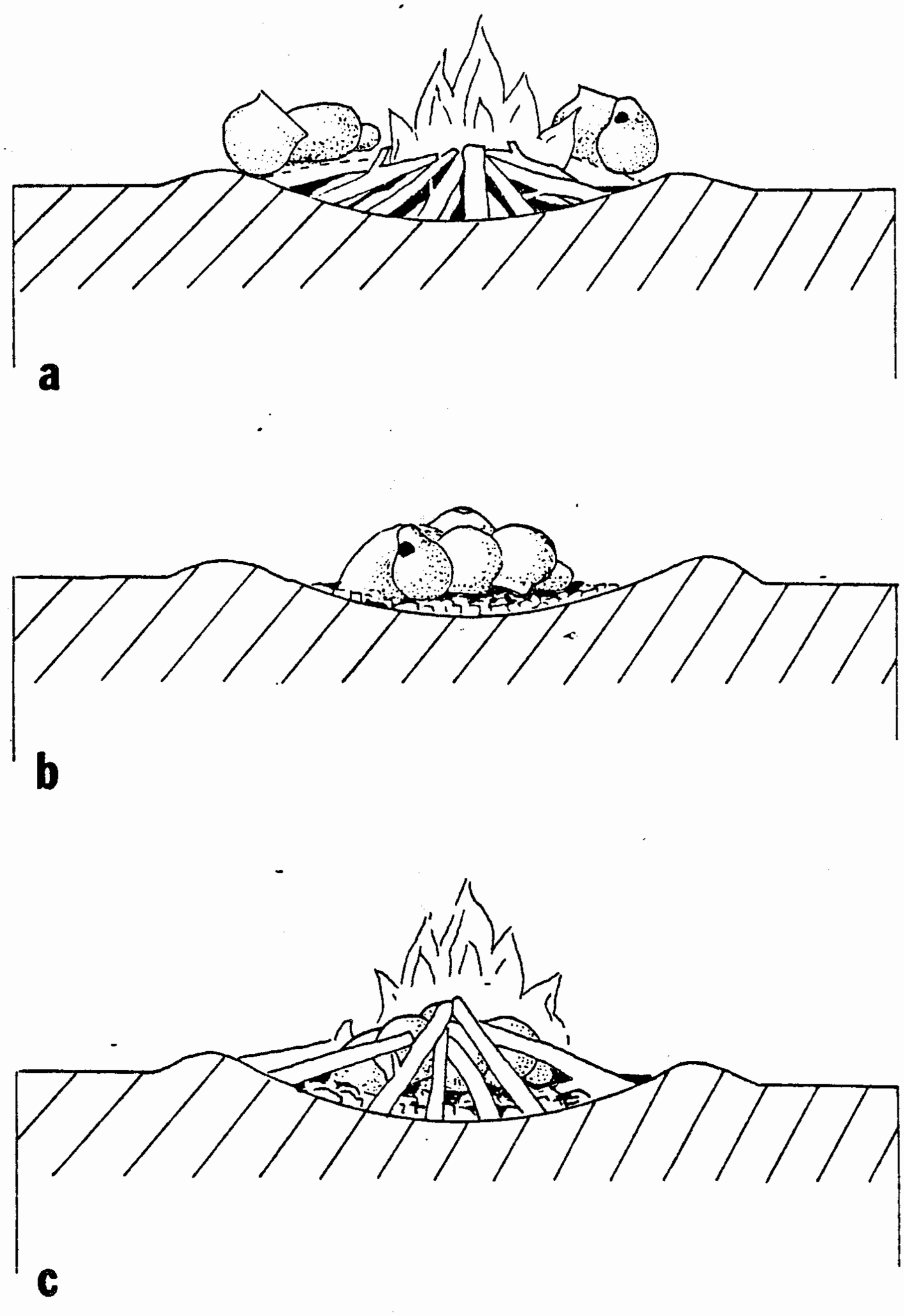

Figure 18-17. Firing of vessels by open pit method. a. warming pots while coals are formed; b. stacking vessels over coals; c. firing.

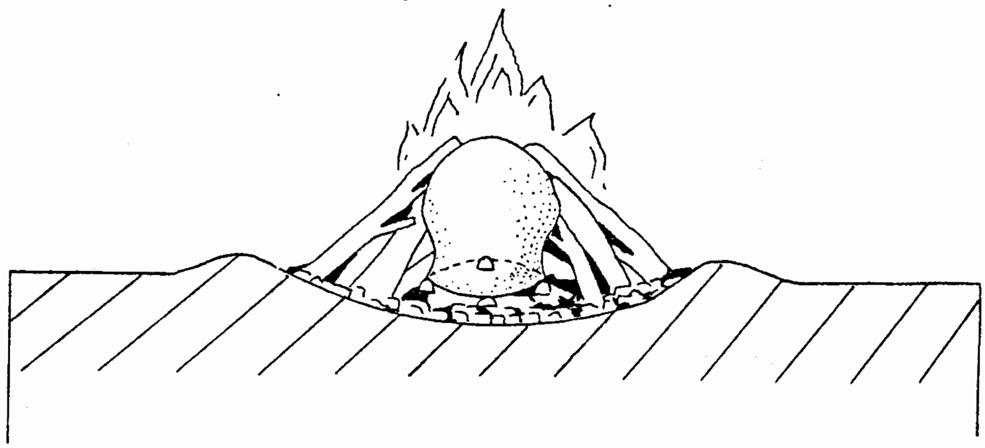

Figure 18-18. Firing a large vessel in individual open pit.

It is difficult to estimate the quantity of vessels that could potentially be fired at any one time because of size variations of the different forms in the assemblage. However, at a minimum, two to three dozen small and medium sized pots could be fired in a pit 2.0 meters in diameter. In many community situations, it may have been advantageous to conduct a series of firings with some pots being preheated as others were being fired.

Two features, F286 and F429, were recognized that could have served as firing pits. The former is located on the south edge of the site, is about 2.0 meters in diameter, and has a partially burned, flat-bottomed floor. Only the lower 20 cm of the pit was undisturbed but charred limbs were observed lying horizontally just above the base. Vessels represented by sherds occurring in the fill, sometimes in clusters, include 1 VRF hooded bottle, 2 and probably 3 VRF pans, 1 large and 1 medium sized VRF jar, and 1 Wickliffe funnel. A large pottery anvil and a toy bowl were also contained within the deposits. Feature 429 showed considerable signs of burning with layers of flat sherds, burned clay, and charcoal. This pit is smaller (60 x 40 x 25 cm) and located in the northern edge of the site and may or may not have been used as an area for pottery firings. Both pits occur at the edge of the site in relatively low Big Lake refuse areas, an expectation for the hot fire needed in a site with dry thatch roofs.

Cones

Large amounts of small, eroded fired clay fragments occur in the site midden deposits and discerning their original form is difficult. However, a few larger remnants are suggestive of several shapes (Fig. 18-19). These fragments occur in basically three paste compositions and in order of occurrence are 1) a clay which apparently occurs naturally with a moderate to heavy amount of fine sand (this clay tends to turn a deep brownish orange or red upon oxidation) 2) untempered backswamp clays 3) the typically shell-tempered Mississippian paste and 4) the Barnes paste which is heavily tempered with coarse sand. The first clay was probably selectively procured for several possible functions that may have included plaster for building construction, hearth and floor linings and vessel supports. For many uses, these clays would have to be accidently burned before they could be preserved yet vessel supports would have to be fired prior to use. Most of the NFP and Barnes paste fired clay objects are by-products of vessel construction, but fragments of molded objects do occur (Fig. 18-19), especially of the NFP paste.

A primary function of many of these artifacts is thought to be as supportive devices ancillary to round-bottomed Mississippian vessels. Maintaining a solid foundation for a vessel placed in the coals of a hearth or fire pit is essential to the cooking process. Forms a, c, and f in Figure 18-19 seem particularly adapted to the stabilization of cooking vessels and are most commonly made of the first and then the second clay type. The fine sandy clay is denser and therefore possibly more suitable for continual use in a hot fire. Several of these objects were made with a finger-sized hole in them which would greatly facilitate manipulation of these devices with a stick while they are in use. Three or four such objects would hold a vessel just above a bed of coals, allowing an even dispersal of heat to the convex base of the pot. Cones, brickettes and other similar fired clay objects have been previously reported in the archeological literature (Williams 1954: Fig. 65, Moselage 1962: Fig. 27, Price 1969: Fig. 9, Perino 1966: Fig. 31 and 32). The majority of these artifacts are reported elsewhere within Middle Mississippi deposits but the Big Lake phase peoples were almost certainly utilizing some of the remnants as described from 3MS20. Cones, most commonly appearing at Mississippian sites as in Fig. 18-19e,f are frequently found in hearths or their immediate vicinity. Other uses that have been offered, aside from deployment as vessel supports, include utilization as torch holders, spit supports for roasting meat and heat retainers for

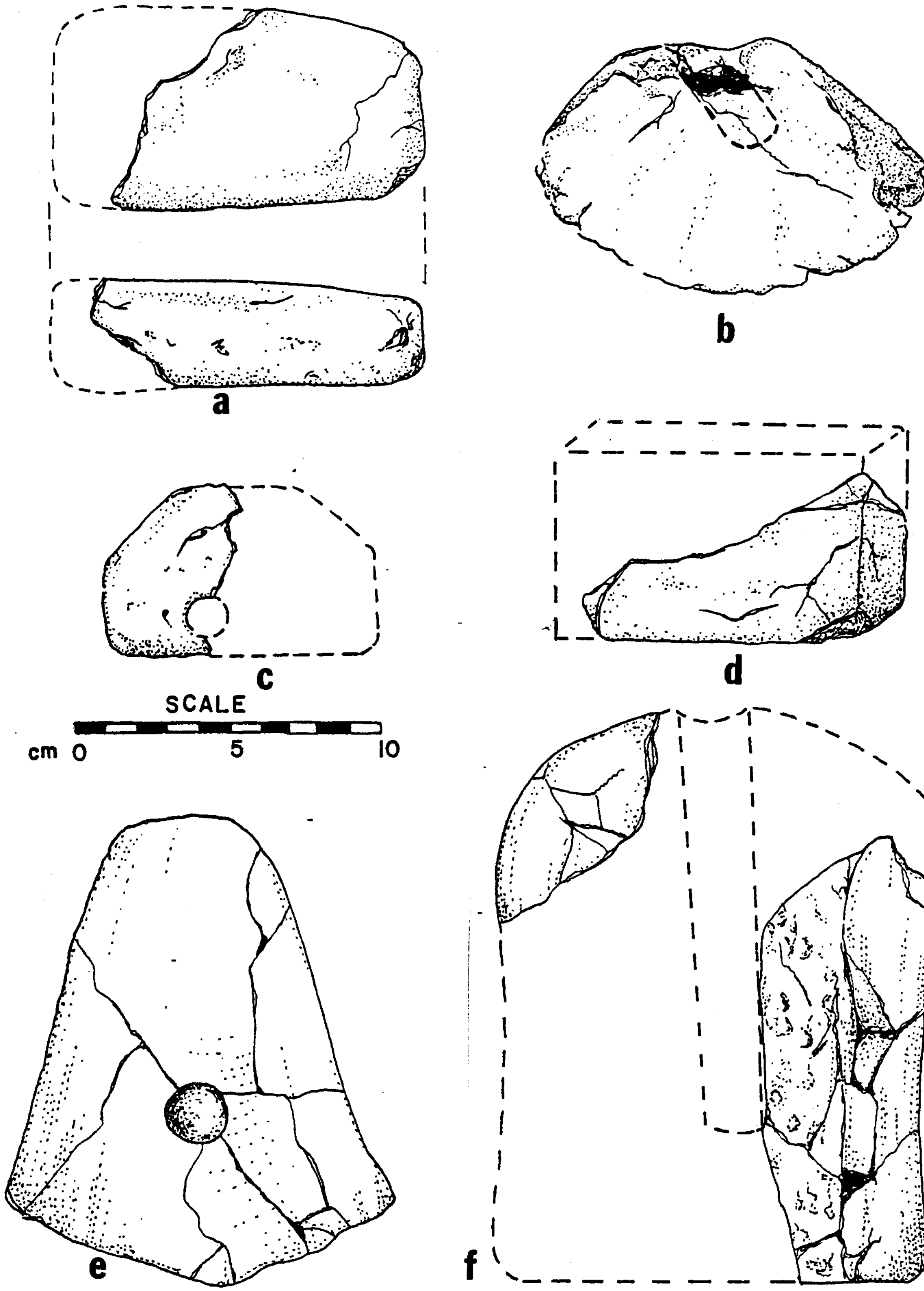

Figure 18-19. Fired clay objects.

some type of alternative cooking method. Their use for support of globular vessels is thought to be more plausible. However, the fact that a few cone fragments exhibit grooves abraded into the exterior surface suggests that they have been used additionally to shape bone tools. Many of these objects may have also been constructed for spacers in firing large pottery vessels. Marks from such spacers are visible on the lip.

Concluding Statements

The Big Lake phase pottery assemblage represented at the Zebree site contains some of the finest quality utilitarian vessels known in the eastern United States at such an early time level. Tremendous care, skill, and time were required to manufacture these vessels. Replication experiments indicated an advanced technological development. This is particularly true of the Varney ware.

Variations of style and within individual vessel forms do not seem to allow for a very long elapsed time period during the Big Lake phase occupation. A few generations at most are intuitively judged as possible. The slight variations that do occur, such as subtle differences in vessel lip formation and hooded bottle styles among others, are more reasonably accounted for by the personal preference of individual potters rather than depth of time.

The consistent symmetry of contour of these vessels has allowed fairly accurate reconstructions of whole vessel dimensions from many of the larger sherd remnants. This information has indicated that, in most cases, specific sized containers were conceptualized and manufactured by the potter. Such clustering is particularly true of the Varney pan and jar forms. In fact, there is strong evidence for the existence of three "sub-forms" on the basis of size in Varney jars. Jars and pans of the Varney type are also most numerous and it may be that the other vessel categories would have displayed similar clustering tendencies had they been as frequent. Dimensional data in combination with estimations of vessel frequencies have given us a picture of an utilitarian assemblage, in contrast to mortuary pottery which is the assemblage commonly reported in the archeological literature.

Insights produced from research involving the processual aspects of this industry has significantly enhanced our knowledge of Mississippian pottery manufacture. It has also provided correlates of behavior associated with the procurement, processing, and manipulation of the natural resources employed. In several cases, specific technological achievements have been demonstrated.

CHAPTER 19

THE ZEBREE MICROLITHIC INDUSTRY

Dan F. Morse and Michael Sierzchula

The Cahokia (and Zebree) microlithic industry represents the first microlithic industry to be described for the eastern United States since the recognition of the Jaketown tools (Haag 1951). First recognized at the Cahokia site (Mason and Perino 1961; Morse 1974a) it was then discovered in northeast Arkansas (Morse 1971c) and next in northwest Florida (Morse and Tesar 1974; Watson 1974). In 1972 a microlith similar to those found at Zebree and at Cahokia was collected from a Caddo site in southwest Arkansas (Morse 1974a). Hints at other microlith loci exist near Chattanooga, Tennessee (Lewis and Kneberg 1956:117), and Virginia Beach, Virginia (Floyd Painter, personal communications). The Florida discovery involving the reporting of over 800 microliths in a single volume of the *Florida Anthropologist* is an excellent example of how major artifact classes can remain hidden despite intensive investigation if the investigator is bred on ceramic studies and a lack of knowledge or appreciation of world stone technology. If nothing else is accomplished with this chapter other than forcing eastern United States investigators to examine their stone artifacts with half as much concern as they exhibit for ceramic fragments, the contribution will be significant.

Lithic studies at Zebree were not funded in the revised proposal to the Corps, and Mickey Sierzchula, graduate assistant, Arkansas Archeological Survey, decided to use the microlithic data as a basis for his MA thesis at the University of Arkansas. The thesis and the investigation is incomplete at the present moment but we decided to describe briefly what we have, because of the importance of this blade industry to students of eastern United States prehistory.

Unfortunately, relatively little has been published concerning blade and core industries in the eastern United States. In fact, the use of the term "blade" to refer to a long, slender biface is still traditionally used by many. This use has apparently retarded the Old World meaning being accepted over much of this area until the mid-1960s. During the past two decades, increasing attention has been focused on blades and cores, despite what they were called. True blades as defined by Bordes and Crabtree (1969) are now becoming recognized as an integral part of much of the eastern prehistoric sequence. In fact, we are now coming to the realization that assemblages lacking true blades constitute the rarity, not the other way around.

The earliest complex in the eastern U.S. with associated true blades is Paleo-Indian, but probably the best publicized core-blade tradition is associated with Hopewell. Until the early to mid-1950s, very few investigators realized that other lithic technologies even involved a blade technique (Ford, Phillips, and Haag 1955:145-148).

Two microblade traditions have been recognized, to date, in the eastern United States. The Jaketown Microlith Industry was reported fairly early, by Haag (1951: Haag and Webb 1953). The type site is located in central Mississippi and is terminal Archaic. The stock utilized consists of large chert pebbles 50-60 mm in maximum dimensions. Cores average about 40 mm in maximum length with platform angles averaging around 45-50° (Ford, Phillips, and Haag 1955:137). Jaketown microcores have a flat striking platform produced by the removal of one flake. Since usually only 1/2 of the core was fluted, the cores appear tabular. Preparation of the striking platform edges involved battering down over the fluted surface and edge grinding, a characteristic similar to Hopewell cores.

The Cahokia microlith tradition was first reported in 1961 (Mason and Perino) although the cylindrical so-called "drills" have been known since before 1938 (Titterington 1938:16). While processing a collection at the University of Michigan in 1959, Morse noticed the small cores and subsequently contacted Gregory Perino who at that time was actively engaged in research on Cahokia. Perino took Morse to Mound 12 where the ground was covered with hundreds of cores, blades, microliths, and assorted core preparation debitage. Similar artifacts occur at various loci within the Cahokia site but this and an adjacent mound undoubtedly represent a major concentration. The apparent association is with the Fairmount phase although little attention has been oriented toward this specialized lithic industry, because of the complexity of the Cahokia site, perhaps the largest in the eastern United States.

The following sections highlight the prominent characteristics of cores, blades, and microtools found at the Zebree site. Metric data are based on a paper by Sanger, McGhee, and Wyatt in *Arctic Anthropology* (1970) to insure conformity for interregional comparison. Results of Sierzchula's experimental work on replication and the use of microliths are presented in later sections.

Microlith Cores, Blades, and Tools at the Zebree Site

Raw Material

Nearly 90% of the recovered elements of the microlith industry of Zebree are made of a distinctive chert known as Crescent Quarry (see

Chapter 15). The remainder includes Ozark and Mill Creek chert, Illinois novaculite, and Crowley's Ridge cherts in that approximate order of prominence. Unfortunately, a spectographic analysis could not be conducted to test the visual observation that the majority stone was indeed Crescent Quarry chert. Local cherts, however, can be ruled out and the closest known chert similar to what occurs at the Zebree site is at Crescent Quarries. In addition, this is apparently the majority chert used at the Cahokia site to produce microliths. When Morse and Blake visited the quarries, a microlithic core was collected from a quarry pit spoil bank.

Samples gathered for replication studies by Morse and Blake in early 1977 were obtained at a road cut so that the National Register portion of the Crescent Quarry site would not be disturbed. A small sample was gathered at a quarry for comparison studies with the Zebree chert, from areas which already exhibited disturbance. The stone obtained for replication differs from the quarry chert. This former tended to be bluish in color, had a few inclusions, and contained considerable bedding planes and cracks. The quarry chert is basically whitish in color with a great deal of color variations, with pink, purple, grey, and particularly tan banding. In addition, it is homogeneous and in contrast to the road cut readily exhibits flake scars. These are relatively minor differences, for the replication experiments reported here, but the chert used was at one extreme of the outcroppings available to the aboriginal miners and they preferred the other extreme.

The bedding planes and cracks noted on the chert used for replication may have resulted from the weathering of a better chert. Utilizing the bedding planes allowed the production of chunks and flakes suitable for making into microcores. This natural blocky structure is a distinct advantage over the other cherts available to Big Lake knappers. The probability that this chert is much more suitable for making microcores helps us understand why such a large distance would be traveled to quarry it. In addition, this is obviously the traditional chert utilized for this industry at Cahokia, which, on the Fairmount phase level, shares a number of cultural traits with the Zebree site.

Cores

Classifying cores recovered at Zebree is an extremely difficult and probably misleading endeavor. Mason and Perino (1961) had distinguished two types of cores: columnar and amorphous. Morse (1975b) added a third type, pyramidal.

Columnar cores at the Zebree site are essentially rectangular in shape with bladelet scars along one or more sides (Fig. 19-1). Few are as columnar as they are at Cahokia. Many have only a few bladelets removed from one side and are not as polyhedral as the classic columnar core. Zebree cores tend to be bidirectional and 10% are definitely bipolar, particularly very small obviously exhausted specimens. Slightly over half of the Zebree cores (56%) were classified as columnar in 1969.

Pyramidal cores are essentially triangular in shape and form a minority, about 16%, of the three main core classes. The apex or apexes of the core are used as a striking platform from two directions. The remaining Zebree cores, 27%, were placed into the amorphous category. These include thin flakes and chunky-shaped chert fragments used sparingly as cores.

Sierzchula has hypothesized that one core "type" represents a stage in the reduction of cores as blades are produced. There are nine possible sequences. Columnar cores may be the desired type of core to produce blades. Some of these may have become pyramidal cores as new striking platforms were generated during the reduction sequence. Amorphous cores may include both preform cores, unsuccessful columnar or pyramidal cores, final attempts to detach blades after a pyramidal core stage, and miscellaneous such as thin flakes which have produced a single possible bladelet. Sierzchula reclassified the cores, omitting several--mostly amorphous flake cores--from the 1969 analysis, with this sequence possibility in mind. Respective mean weights can be be an effective test of the possible sequences, followed by experimental attempts to replicate the indicated sequence as a further test. The only apparent possibility is that pyramidal cores may represent a first step since they tend as a group to be slightly larger. However, their shape dictates that they be larger to produce the desired blade length at the given angle, and it would appear that all hypotheses concerning the ordering of shape of core into a reduction sequence are negated. However, since all cores presumably represent the exhausted stage for that particular core, some from one category may have been derived from another.

The average number of blade scars on a sample of 130 1969 cores was found to be 3.6, with a standard deviation of 2.51, and a range of 1 to 12. Columnar cores averaged 4.8, pyramidal cores 3.1, amorphous chunk cores 2.0 and amorphous flake cores 1.6 blade scars. The 127 cores in Sierzchula's sample averaged 5 blade scars per core (Table 19-1).

A noticable characteristic of these cores in contrast to earlier cores is the platform preparation. While considerable retouch is evident, it tends to be in the form of edge battering from the edge back over the platform rather than down the fluted face of the core.

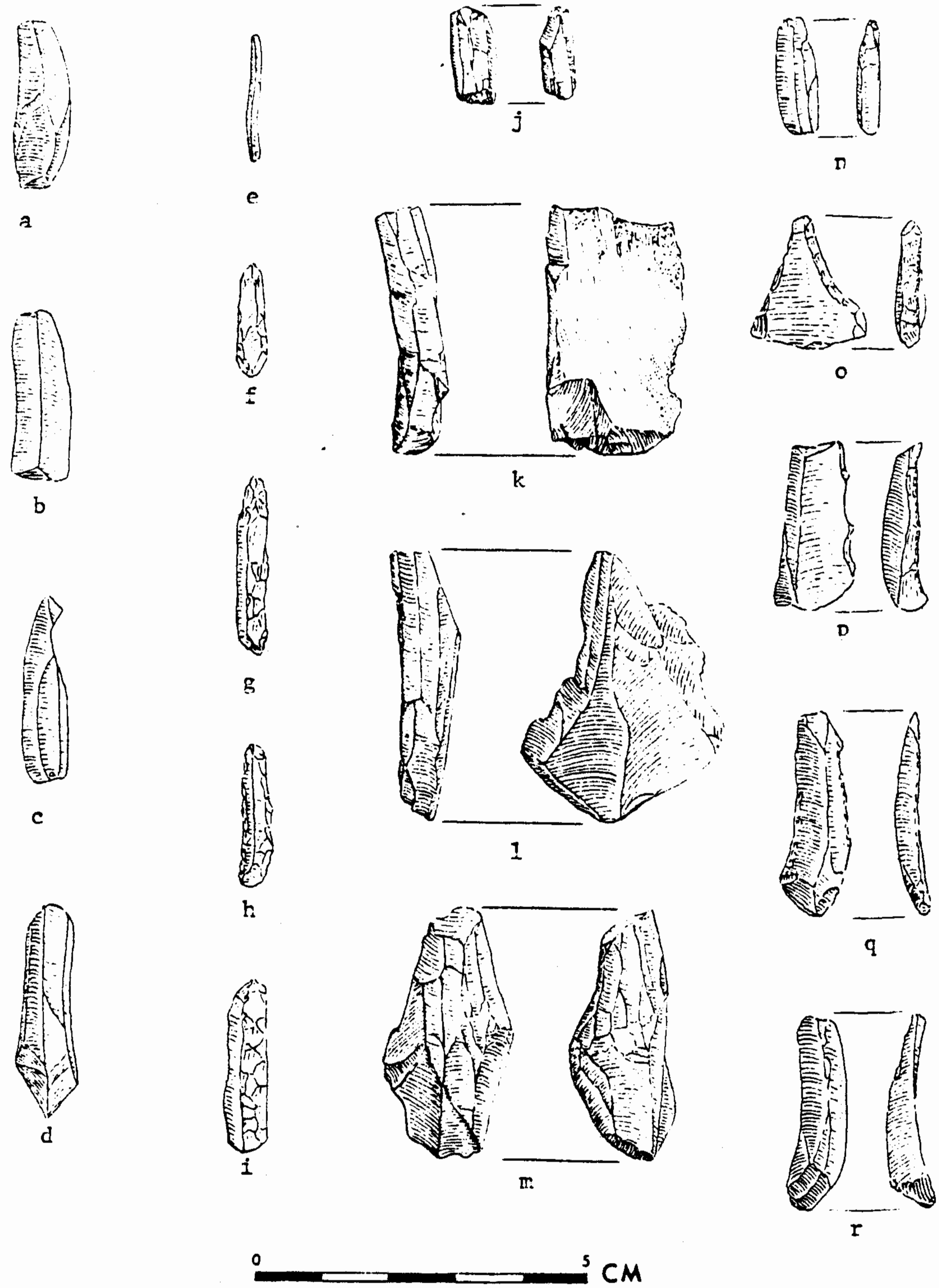

Figure 19-1. The Cahokia Microlith Industry as represented at the Zebree site. a-d. blades; e-i. cylindrical microliths; j-m. cores; n-r. tabular microliths.

Table 19-1. Comparison of Cahokia and Zebree cores. All measurements made by Sierzchula.

	CAHOKIA	ZEBREE
Length		
Number	86	127
Range	23-61	17-62
Mean	40.1	31.5
Standard Deviation	8.2	6.9
Width		
Number	86	127
Range	13-42	9-48
Mean	24.3	23.4
Standard Deviation	7.0	6.2
Thickness		
Number	86	127
Range	6-38	4-26
Mean	14.5	12.5
Standard Deviation	5.1	4.7
Weight		
Number	86	127
Range	2.9-41.9	1.3-58.7
Mean	15.8	10.3
Standard Deviation	9.1	9.0
Number of "Blade" Scars		
Number	86	127
Range	1-16	1-13
Mean	6.6	5.0
Standard Deviation	3.1	3.0

Blades

Bordes and Crabtree (1969) distinguish between a "true blade" and a blade. Both are at least twice as long as wide but the former exhibits one or more arrises on its dorsal surface. This distinction is to allow the investigator to recognize purposeful blade technologies since only rarely are "true blades" accidently detached by a nonblade technology. At Zebree the 1969 blades were divided into over twice as long as wide and less than twice as long as wide (Table 19-2). These latter were undoubtedly detached from the microcores but did not fit the standard definition of "blade" (Fig. 19-2). A total of 274 blades were recognized in 1969 but only a minority would fit the description of "true blade." Sierzchula only recognized a total of 61 blades for his 1975-1976 sample and these plus five 1969 blades in his incomplete investigation are the basis for the measurements in Table 19-2. Due probably to selection bias of the two respective investigators, these measurements differ slightly from those published on the 1969 blade sample. All of the blades must be reviewed to select an objectively selected sample, suggested here to be "true blades."

Microliths

A total of 285 microliths have been recognized in the Zebree lithic collection which approximates 3000 fragments. One hundred and ninety-five of these were intensively studied between 1969 and 1975 by Morse and this section is based on that investigation. The 90 microliths collected in 1975 and 1976 have been inventoried by provenience in the appendix but otherwise have not been subjected to such an analysis.

The basic classification of microliths is into cylindrical and tabular. These are also the basic classes of Pitzer et al (1974: 126) wherein they are labeled "Microblades With Triangular Cross-sections" (crested and ridge being also referenced) and "flat, parallel microblades." Their first category includes tools exhibiting only a single arris whereas our category includes an occasional double-arrised tool; in addition, our tabular category includes an occasional single-arrised tool. Another distinction is also apparent between these two categories. The first is usually extensively retouched whereas the second rarely is retouched and then sparingly.

Tabular microliths are mainly blades chosen for natural working areas. They make up approximately 40% of the total assemblage. Most are transverse edged tools, mainly used as gravers. The second largest category were used as lateral edged scrapers and a minor number were used as oblique transverse edged scrapers. Tabular microliths probably were hand held and used to work bone, shell, and possibly wood. No experiments have been conducted using tabular microliths.

Table 19-2. Metrical data of Cahokia Microlith categories from 3MS20 in mm.

Category	No.	Range Length	Range Width	Range Thickness	Mean Length	Mean Width	Mean Thickness
Cores	131	13-68	7-46	4-27	30.6	21.4	11.4
Columnar	74	13-68	7-45	4-25	30.9	21.9	12.6
Pyramidal	21	21-62	15-46	4-19	32.7	25.3	10.9
Amorphous (Chunk)	8	22-36	18-32	9-27	30.2	25.1	15.6
Amorphous (Flake)	28	16-44	8-36	4-11	28.3	18.1	7.7
Core Rejuvenation Flake	48	11-31	6-20	2-10	19.7	14.4	8.1
Blades	388	7-44	3-17	1-11	18.4	8.1	3.0
(>2:1)	274	9-44	3-13	1-11	19.7	7.4	3.1
(<2:1)	114	7-28	5-17	1-8	15.5	9.9	2.9
Microliths	195	6-44	2-15	1-8	19.8	6.4	3.8
Cylindrical	110	11-33	2-11	2-7	19.1	5.1	4.0
Finished	101	11-33	2-11	2-7	19.0	5.1	4.1
Split or unfinished	7	14-24	4-6	2-3	17.4	4.7	2.7
Others	2	26-29	7-10	4-5	27.5	8.3	4.5
Gizzard Stone	6	6-12	2-6	2-3	8.2	3.9	2.3
Tabular	79	7-44	3-15	1-8	21.6	8.3	3.7
Transverse Edged	40	7-33	3-13	1-8	19.1	7.1	3.6
Retouched	9	14-22	4-10	2-4	17.3	6.2	2.7
Utilized	31	7-33	3-13	1-8	19.6	7.4	3.8
Scraper	3	7-25	7-11	2-4	16.0	9.3	3.0
Graver	28	10-33	3-13	1-8	20.0	7.1	3.8
Lateral Edged	26	15-37.5	4-15	2-6	23.6	9.7	3.7
Concave	6	15-37.5	6-12	2-5	24.8	9.6	3.3
Convex-Straight	20	16-31	4-15	2-6	23.2	9.8	3.8
Oblique Transverse Edged	11	13-30	6-14	2-7	24.1	9.6	4.4
Multiple Edged	2	28-44	7-13	5-6	36.0	10.0	5.5

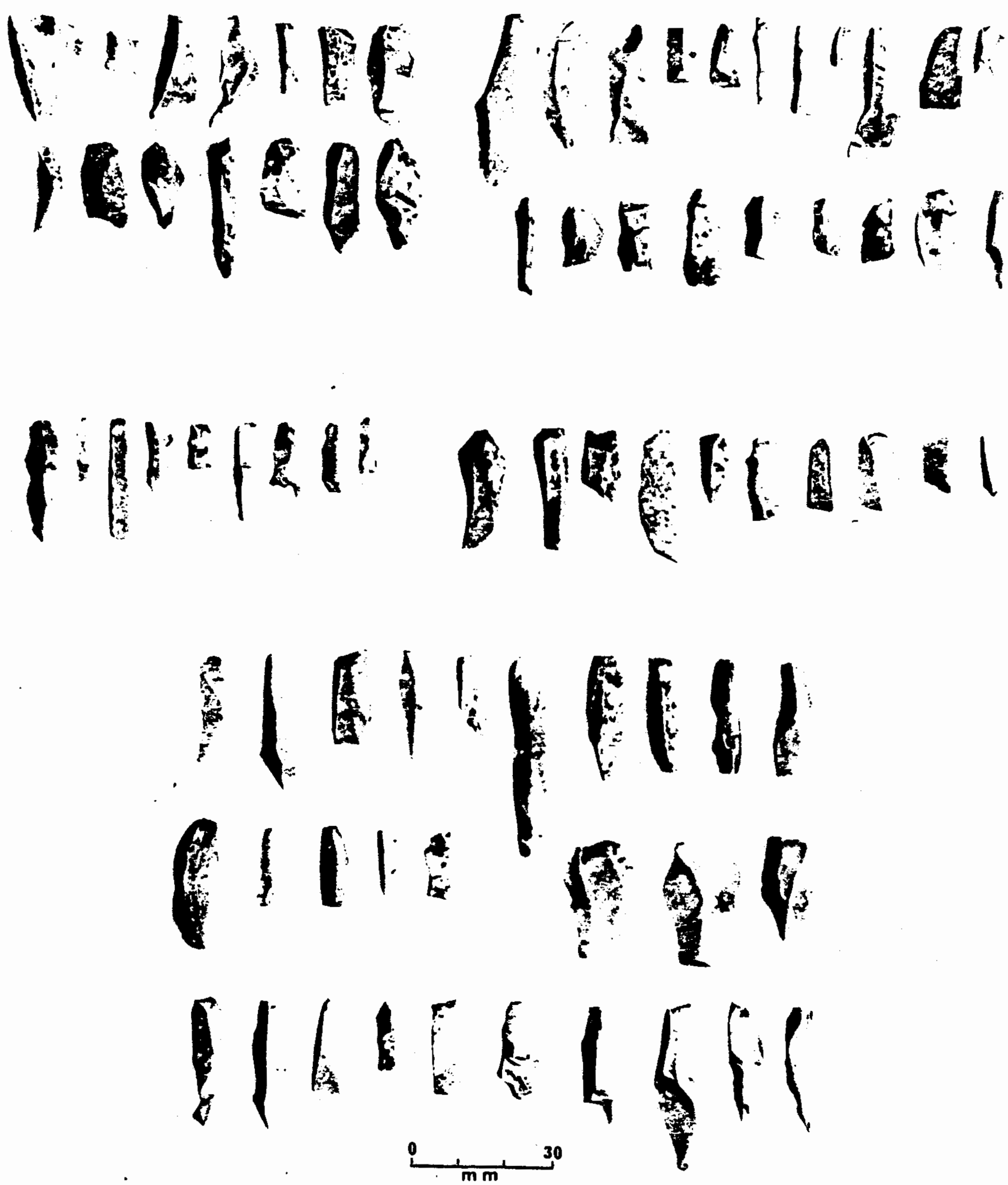

Figure 19-2. Microlithic elements: blades. (Neg no. 752030)

Approximately 60% of the recognized microliths were cylindrical in basic shape. (Table 19-2). Six of these had been modified considerably, probably by being used by chickens as gizzard stones. These were found in deposits which would have been beneath the Sebree house. They are ground smooth all over with flake scars completely obliterated. Only the basic shape, size, and material indicate that they once were microliths. The unmodified cylindrical microliths vary from this double-pointed pin-like artifact to single-pointed slightly thicker specimens to thick blades retouched for much of their length but leaving an expanded base suitable for holding between one's fingers (Fig. 19-3). The truer cylindrical shapes undoubtedly were hafted; these are the variety replicated and experimented with as discussed in the following sections.

Comparisons of the microliths with waste blades indicate the major attributes desired in producing usable blades. Mean length is very similar, with the microliths on the average being less than a millimeter shorter than the waste blades. However, average exhausted core length, over 10 mm longer than the average blade, might indicate that usable blades may have been longer. This is confirmed in part by the measurements on tabular microliths, normally little modified. Transverse edged tabular microliths (Fig. 19-3) average length is generally around the same as cylindrical microliths with scrapers being shorter than gravers (16 and 20 mm respectively). Lateral edged tabular microliths, however, average 23-24 mm long. These latter, furthermore, are being selected from blades with greater lower range in length. Most blades measure between 15 and 25 mm in length and all but 15 measure between 10 and 30 mm long. Most cylindrical microliths measure between 15 and 20 mm long and all but 13 are between 15 and 25 mm. These figures are relatively similar. Since the distal end of the usable blade almost certainly had to be truncated to retain a uniform thickness in cylindrical microliths and in some cases the proximal end also had to be truncated to remove the bulb of persussion, the original blades selected must have been longer on the average than the recovered discarded blades. However, many blades were chipped out of the core form rather than driven to the end of the core. This produced a fairly even thickness throughout the blade's length, but necessitated a large core.

Equally informative are comparisons of respective width and thickness. Waste blades exhibit a fairly symmetrical unimodel curve for width. Half of the 1969 sample are between 5.6 and 8.9 mm wide. In contrast, more than 3/4 of the cylindrical microliths are between 2.5 and 6.6 mm wide and only ten are greater than 6.6 mm wide. On the other hand, laterally used tabular microliths are as wide or wider on the average as waste flakes. Retouch undoubtedly did narrow the blades selected considerably, and little selection for blades for tabular microliths took place, but selection for narrowness

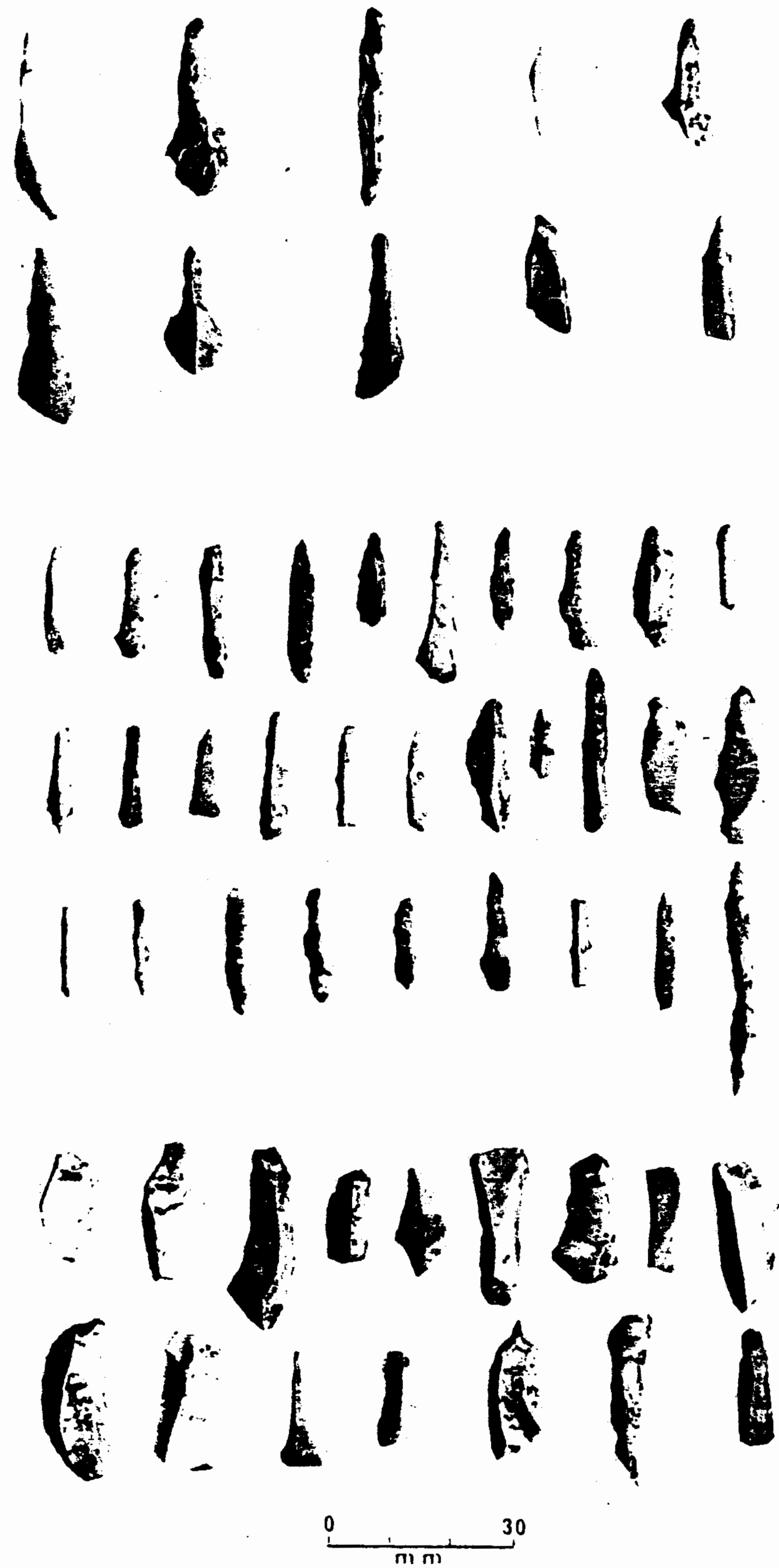

Figure 19-3. Microlithic elements: microliths.
(Neg no. 752029)

for cylindrical microliths probably did. This certainly was the case for thickness. A total of 210 1969 blades measured between 1.5 and 4.6 mm thick whereas 70 cylindrical microliths measured between 2.6 and 4.6 mm. Even tabular microliths are relatively thick. There was selection for long naturally cylindrical shaped blades to be manufactured into cylindrical shaped microliths with a minimum of retouch. The cores reflect this in exhibiting scars which removed corners which would have been essentially triangular in cross section. At the same time, these cores were also producing thicker and wider tabular blades between the prominent ridged portion of the core for use. Shorter and thinner blades were discarded. Mason and Perino's assumption that "good" blades are straight, flat blades (1961:554) in this case is erroneous.

A total of 58 cylindrical microliths are essentially rectangular in cross section and 43 are triangular in cross section. Twenty-five of the former were chipped bilaterally from the same surface (the surface originally attached to the core) and an additional eight were chipped from a third edge on the opposite face. Most of the remainder were on alternate or adjacent edges usually in a counter-clockwise but sometimes in a clockwise direction (looking at the tip). Fourteen of the triangular artifacts are bilaterally-chipped from one surface and 16 more have been chipped from all three edges. Most of the remainder again are chipped in a counterclockwise direction. Eight microliths were retouched only on the tip end because narrow blades were available.

Only 20 of the 101 cylindrical microliths are double ended in the sense of being used on both ends. Three of these are questionable since the slight wear on one end in each case may be preparation for hafting. Six are rounded and worn on one end, three are beaked and worn on both ends, one is beaked and worn on both ends, one is beaked on one end and wedge-shaped on the other, nine are beaked or wedge-shaped on one end and rounded and and worn on the other, and one has a broken tip and possible oblique-transverse use on the opposite end.

There are a variety of shapes noted for the hafting end of the 81 single-ended microliths. Most commonly (about 1/3 of the tools) they are flat on the proximal end as if all or part of the striking platform was retained. In a few cases this area seems to be a result of breaking the bulbular end away by snapping the blade in two. Another way of treating the proximal end was by rounding it with retouch or rounding it but leaving it in a bulbous state. The remaining ends were wedge-shaped or pointed, often because the blade happened to break that way, or because the distal end of the blade was used as the proximal end of the finished microlith. Nine microliths had lateral flanges and one was side notched possibly to help in hafting. Two others were made on blades removed from another side of the core and partially thinned. The thinned area was retouched into a cylindrical shape and the rest of the blade left as an expanded base.

Four microliths were unused; another nine were broken at the tip end. On the remaining 88 microliths (with a total of 108 tips) two general categories of tips were noted. Fifty-eight of the tips were rounded and worn, sometimes polished, on the distal end, and another 33 are beaked and worn or polished. Four others are broken and slightly worn and the 12 others are variations of the first two categories. The most common observable tip dimension was 2 mm in diameter (46 tips), followed by 2 x 3 mm in extent (23 tips), 3 x 3 mm (11 tips), and 1 x 2 mm (10 tips). An additional 16 tips deviated from these dimensions. No dimension greater than 5 mm was observed and usually maximum extent where wear was observed was around 3 to 4 mm. This is sufficient to account for the perforation of most known shell disc beads and for the observed dimensions on longitudinal grooves found on bone and antler.

Determining the function of each tool is difficult. Observations were made on the extent of tip polish (up to 5 mm) since we felt this might distinguish between gravers and drills. A total of 53 observed tips were polished for less than 1.5 mm (33 of these were not polished at all) and 55 were polished for more than 1.5 mm (26 of these were recorded as polished for 2 mm). Several of these latter were observed to have minute flakes detached bidirectionally at the tip which would be expected in a bidirectional rotary drill. Shell disc beads usually are 3 to 5 mm thick and 2 or more millimeters of polish might be expected if the beads are drilled biconically (which they often are although many are drilled all the way through before beginning from the other surface). However, when Morse made a cylindrical microlith he finished it by grinding it on the "sherd abrader" he made from a Barnes Cord Marked body sherd and got "use polish" on the tip. We found we could drill easily even with a microlith modified as a gizzard stone, so a new bit would have rounded edges to allow the tip to begin a hole. In other words, our observations on tip polish may relate to manufacture rather than usage. All we can say now is that these microliths function as gravers and/or drills. Even to produce shell bead blanks, considerable engraving must be accomplished, although we found flake knives were easier to use than microliths.

Comparison of the Zebree and Cahokia Microlith Industries

Microlith elements collected from Mound 12 at Cahokia in 1958 by Morse are used as comparative material to the Zebree assemblage. Table 19-2 presents metric comparison for cores from Zebree and Cahokia. Table 19-3 compares microblades from four sites.

The reduction sequence, from microcore to microtool, appears to be the same for both the Zebree and Cahokia microlith industries (Don Crabtree and Jeff Flenniken, personal communication). Similarity of the platform angles plus certain morphological and technological attributes of the two industries adds substance to this inference (Appendix, Section IV). However, it is not known if the same method of reducing the raw material to microcores is being used at both locations. A distinct size difference between the microcores from both sites may indicate the addition or subtraction of some step at some point in the reduction sequence of the microcores from Zebree.

While the raw material probably is the same for Cahokia and Zebree, the size of nodules and flakes being transported to each area may be expected to differ. All factors being equal, the respective distances to the quarries influence us to believe that greater modification of the stone is expected at Zebree than at Cahokia. The fragments should be more potentially usable initially with less expected waste. In addition, the cores are expected to have been pushed beyond exhaustion to maximize potential and to minimize waste.

Most of the reduction should be accomplished for either site at the Crescent Quarries. Large cortexed flakes are not expected at the habitation or manufacturing site, nor any waste expected from reducing nodules to core preforms, but if any waste does exist, it should be more apparent at Cahokia than at Zebree. At Zebree there actually is very little total stone of any kind. The apparent projected total number of microliths in the random-sampled 1/2 of the site is around 5500 and the site total could have been approximately 11,000. The sample indicates a total of 3600 cores and 7,000 blades for the whole site area assuming that the sample area is approximately similar to the whole site. There would appear to be about three microliths and two waste blades per core on the average. Sierzchula's experiments, however, imply that four or more microliths and waste true blades are produced per core. Other debitage (approximately 3000 pieces) seems to be related to core rejuvenation and trimming. Only one possible preform was recovered and no debitage was noted to indicate much other than core exhaustion was involved at the site.

At Cahokia, there is a major concentration at Mounds 11 and 12 of microlithic elements. In addition, elements exist virtually all over the site complex although in much fewer numbers. To our knowledge, no actual tabulation of special distribution has been accomplished, although considerable emphasis on controlled collections has been maintained. At the Zebree site, a special pattern did not develop in the random square excavation either due to small samples or to the lack of a real pattern to discover. In 1969, six apparent working areas were recorded. One involved a meter of concentrated debris in the western half of Square 14R14, and the second, an overlapping less definite pattern. The debris was directly upon the surface of Zone C, a Big Lake deposit of soil made directly upon the Barnes midden soon after occupation or the site area by the Big Lake phase. Two concentrations were recognized in the field as possibilities in Squares 78R6 (Test Pit 2) and in Square 78R8. Two were postulated in the lab in Squares 76R2 and 78R2. In 1975, at about 50 cm beneath the surface in Random Square 35, a small concentration of lithic debris turned up in the lab. Field checks beyond the profile were negative. The density map showing 1/4 inch screened lithics indicates two highs in the northern portion of the sampled area. Bucket samples were not analyzed and the heavy fraction of flotation samples has not been examined. Unfortunately, the lithic density has little meaning since the catalogued classes of chert, tools, orthoquartzite, etc, were combined into a category of simply lithics during coding. This was partly due to time limitations and partly due to some inconsistencies in the catalogue.

In 1975, a site located less than 1/4 mile away from Zebree was recorded. The informant collected all the lithic debris he saw at the site and although we were able to confirm that microlithic elements did indeed exist there, we have no concept of how it may or may not be patterned. Based on the informant's collection, it is a major concentration. Few sherds exist at the site and those collected are Barnes. Apparently this is a specialized site similar to the Mound 12 locus at Cahokia.

Similarities with Cahokia include such specific traits as mean angle on the striking platform of blades and platform preparation of the core. Blade size is similar but Zebree blades tend to be shorter. Morse does not think that the width and thickness variables are as significant as indicated in Table 19-1 since the Cahokia set is measured to the nearest 0.1 mm and the Zebree sample to the nearest 1 mm. The 1969 averages are closer to those from Cahokia data, but the blades do indicate that less critical criteria are used in selecting blades for use.

As predicted by the hypothesis of more intensive use at a site located further from the quarry, Zebree cores are lighter and smaller. Some of this difference might be due to selective bias by Morse when the Cahokia cores were collected. Based on the greater number of blade scars exhibited on Cahokia cores over Zebree cores, Morse developed a hypothesis that Zebree cores were cruder or less efficient because the site was situated on the periphery of the main region of the industry or that it was representative of an earlier phase in the development of the industry. However, we would expect that efficiency would increase with distance from the quarry since the raw material is more difficult to obtain. Again, the larger Cahokia cores indicate more waste of stone by weight and size than at Zebree. Indeed, some extremely small Zebree cores exhibit evidence of extreme bipolar technology, as if this were a very rare piece of stone.

Replication of the Zebree Microlith Industry

It is often possible to produce a lithic assemblage by more than a single technique (Don Crabtree and Jeff Flenniken, personal communications; Solberger and Patterson 1976:525). For this reason a variety of flintknapping techniques were tested at different stages of the reduction sequence. Experimentation in reduction sequences by Sierzchula, earlier experimentation and manufacture of tools by Morse (1975b), and suggestions from Don Crabtree and Jeff Flenniken allowed us to narrow the possibilities to the more probable.

Nodule to Microcore

The Zebree microlith industry can be separated from other blade industries by two important criteria. First, other blade industries involve the modification of one nodule into one or perhaps two cores. In the Zebree microlith industry, a nodule has the potential to produce a large number of microcores. To complicate matters, these microcores can be placed into different categories based on morphology and exhibit a wide size range within the boundaries of a single subtype (Morse 1975b:130). Second, the blades being selected for microliths are relatively thick. The main purpose of a microtool apparently is to function as a drill or graver and not as a cutting tool for which thin blades are suited.

The problem is how to reproduce as many useful pieces of stone from a nodule as possible, to make into cores, which are morphologically and technologically similar to and the same size as the aboriginal material. While Sierzchula attended the Washington State University flintknapping school in the summer of 1976, Jeff Flenniken suggested bipolar percussion as one possible technique for reducing a nodule into useful pieces of stone. After some modification to the stone nodule, this was found to be the only possible way to reduce a nodule into pieces small enough to serve as microcores.

The major modification to the nodule was reducing it so that it was thin enough to be broken by bipolar percussion. Some of the raw material already was sufficiently thin. However, large nodules were also collected by Morse and Blake upon which bipolar percussion would have been totally ineffective. With such a nodule a search located all possible bedding planes and cracks. Morse noticed that the stone outcropping at the aboriginal quarry was loaded with these bedding planes and cracks. An effort was made to reduce the nodule along the imperfections in the stone to the point where no such imperfections remained. If by chance the nodule was still too large to reduce by bipolar percussion, large, thick flakes were removed until the desired thinness was reached. It should be noted that all stone removed from the nodule thus far, except for those pieces with thick cortex, are potential microcores.

An anvil of basalt and a hammerstone of quartzite (see Fig. 19-4) were used to reduce the nodule fragments (shatter). Depending on its size, the nodule or fragment was placed either on the flat surface of the anvil or held against one of the anvil corners and struck, preferably opposite the contact point. In a few cases, but not all, a diagnostic flake was produced from the method. No similar flakes were present in the Zebree material. The shatter from this bipolar percussion was next classed according to size and potential to function as one of the specialized core types (*e.g.* pyramidal or columnar). The major criterion used in grouping the shatter into possible core preform types was the presence or absence of a flat surface or (if there was not a flat surface) the possibility of easily creating one.

Large flakes were placed in a special category. They could be processed into microcores by two methods. But first the distal end of the flake had to be truncated if it terminated in a feathering fashion rather than a stop or hinge fracture. The first technique tested was the use of bipolar percussion to split the flake in half. However, this technique creates only one ridge to start the removal of blades, and there is no guarantee that the flake will split along the distal-proximal axis. It does not seem to be an efficient technique. In addition, the Zebree debitage did not indicate bipolar preparation.

The second method tested on large flakes was to split the flake by striking it on the original platform at the appropriate angle. This created two good ridges to start the removal of the blades. There is material in the aboriginal assemblage to support the use of this method.

The shaping of the shatter is a relatively short and simple process. Striking platforms from which blades could be struck had to be manufactured or those already present preserved. In addition, prominent ridges needed to be created by simply removing large (in relation to the shatter) extraneous pieces of stone which are not functional. Those ridges are absolutely necessary for the production of thick blades suitable for the Zebree microliths.

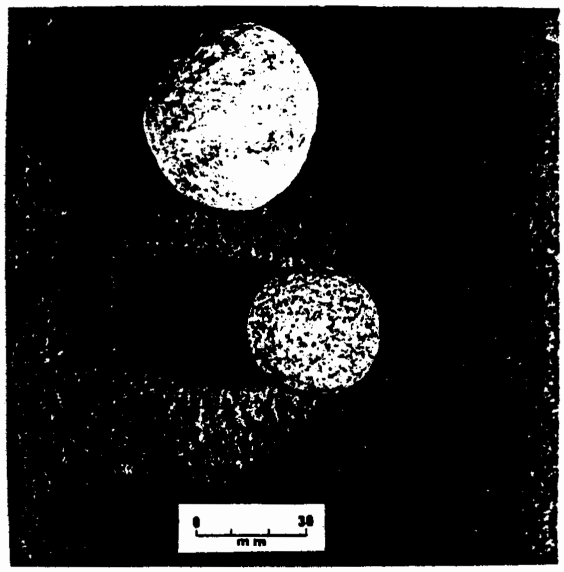

Figure 19-4. Hammerstones used in replication. (Neg no. 774154)

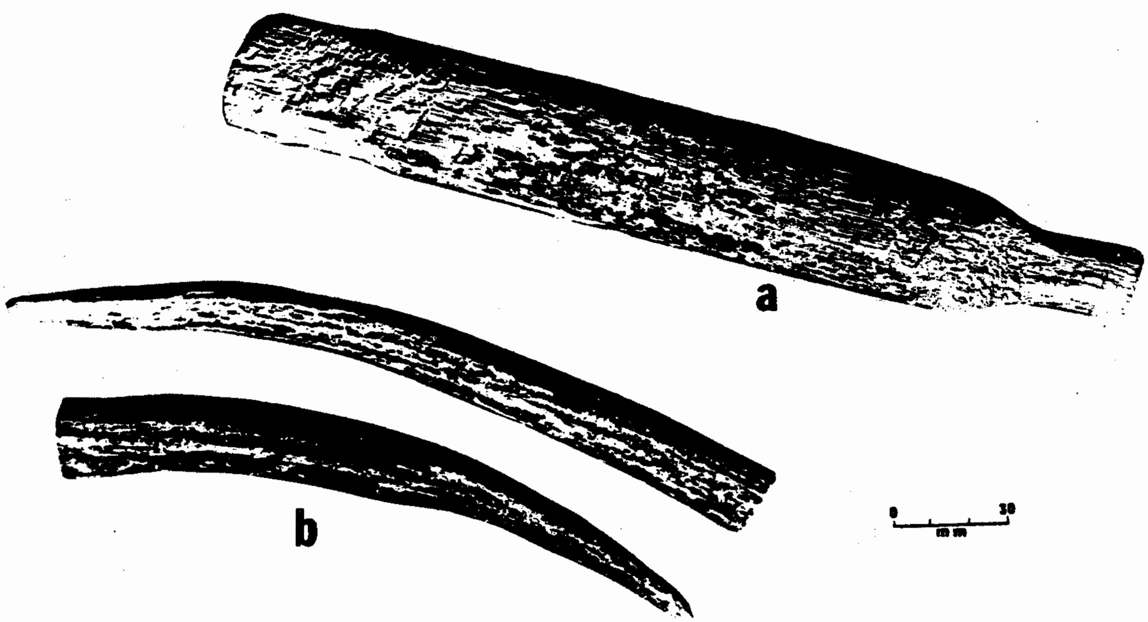

Figure 19-5. Wooden baton (a) and antler punches (b) used in replication. (a.neg no. 774184; b.neg no. 774187)

Microcore to microblade

Three techniques for removing blades from a core were tested: indirect percussion, direct percussion with an antler baton, and direct percussion with a hard hammer. In addition, two different sized hammerstones were tested in the third method for the removal of blades. A fourth possible method, pressure in a vise (Pitzer *et al.* 1974:131) was not tested. Morse (1975b:125) had suggested that indirect percussion may have been used to detach microblades. A vise made of two 2 x 4's with a bolt to hold them together was used to steady the core in the experiment. A wooden wedge was anchored in the vise opposite the core to give it a secure fit. A large antler tine punch and a wooden baton to strike the punch (Fig. 19-5) were used. An unsuccessful attempt to remove a blade necessitates the removal of the wedge to release the core so it can be repositioned to take advantage of another striking platform. In addition, multiple blades on Zebree microlith cores cannot be removed without modifying the position of the core several times. Often a blade which intuitively should have required little or no effort to be removed stayed put. No amount of variation in the angle the punch was held helped matters. Finally, punches cannot remove large flakes from a core to create prominent ridges after the core has reached a point of potential exhaustion. A hammerstone is necessary to perform this task. Those factors indicated that this technique is not efficient and probably was not used.

A second technique tested was direct percussion with an antler baton. A white-tailed deer antler was used. This experiment was unsuccessful since more weight apparently is needed to remove microblades.

The third method tested was direct percussion with a hard hammerstone. Two hammerstones of different weight were tested to see if weight played any part in the successful removal of blades or if an implement with a certain degree of hardness was all that was needed. While both hammerstones could successfully remove blades, Sierzchula liked the feel of the heavier hammerstone better. There was initially some doubt whether or not the knapper would be able to hold the core and still detach blades successfully. This point was overcome by simply wrapping a forefinger completely around the core leaving the striking platform exposed. Using this holding technique it was possible to remove blades, as well as flakes to create ridges, and rotate the core quickly to the next striking platform. Interestingly, there were fewer broken blades when a finger was wrapped around the core. This technique probably is the one used by the aboriginal knappers.

Table 19-3: Metric data of blades from Zebree compared to a sample of blades from the Cahokia, 8-By-43, and Jaketown sites. Terminology and technique of measurement after Sanger, McGhee, and Wyatt (1970). All measurements are in mm. Morse measured the non-Zebree blades and Sierzchula measured the Zebree sample.

Measurement	Big Lake Phase Zebree	Fairmount Phase Cahokia	Weeden Island II? 8-By-43	Terminal Archaic Jaketown
Length of Complete Blades				
Number	66	64	15	30
Range	10-54	14.0-46.6	15.0-33.0	21.7-48.1
Mean, Std. Dev.	19.4, 7.1	25.3, 7.2	25.8, 5.3	33.8, 8.2
Length of Proximal Fragments				
Number	--	--	9	40
Range			7.6-23.8	14.0-45.8
Mean, Std. Dev.			15.4, 5.7	26.5, 5.9
Length of Distal Fragments				
Number	--	--	5	--
Range			8.8-30.0	
Mean, Std. Dev.			23.6, 9.1	
Width just Distal to Bulb of perc.				
Number	66	64	28	70
Range	4-15	2.9-13.0	3.8-12.0	3.8-20.3
Mean, Std. Dev.	9.4, 2.4	7.0, 2.4	9.5, 2.8	9.8, 2.9
Thickness just Distal to Bulb of Percussion				
Number	66	64	29	70
Range	1-5	0.8-6.3	1.1-6.4	1.8-5.3
Mean, Std. Dev.	2.6, 0.9	2.8, 1.4	3.6, 1.3	3.2, 1.0
Thickness Times 100/Width				
Number	66	64	28	70
Range	11.1-50	13.0-126.0	10.8-58.5	17.6-63.2
Mean, Std. Dev.	27.8, 9.1	42.6, 19,8	39.0, 10,8	33.9, 9.1
Platform Angle				
Number	66	64	24	65
Range	50-90	50-90	65-85	35-90
Mean, Std. Dev.	74.3, 9.0	74.8, 10.8	74.6, 7.2	65.0, 11.39

Table 19-3, continued.

Measurement	Big Lake Phase Zebree	Fairmount Phase Cahokia	Weeden Island II? 8-By-43	Terminal Archaic Jaketown
Left Lateral Angle 10 mm from Proximal End				
Number	---	64	27	70
Range		15-100	20-100	20-70
Mean, Std. Dev.		50.2, 18.8	46.7, 21.0	39.1,11.9
Right Lateral Angle 10 mm from Proximal End				
Number	---	64	27	70
Range		15-95	20-75	20-95
Mean, Std. Dev.		47.4, 20.2	43.7, 25.0	41.0, 16.0
Sum of Left and Right Lateral Angles				
Number	---	64	27	70
Range		30-165	40-155	54-155
Mean, Std. Dev.		97.7, 27.3	90.4, 28.7	80.1, 21.7
Breakage Class (%)				
Complete	---	50.8	51.8	30
Proximal Fragment		22.2	31.0	40
Distal Fragment		21.4	17.0	24
Medial Fragment		5.6	0.0	6
Arris Class (%)				
One Arris	---	31.3	48.3	30
Two Arrises		51.6	48.3	54
Three or More Arrises		17.2	3.4	16
Platform Preparation (%)				
Ground	---	0.0	0.0	89.4
Battered (B)		17.7	22.7	3.0
Multiple Faceted Platform (MFP)		45.2	27.3	0.0
Both B and MFP		4.8	4.5	0.0

Microblade to Microtool

Two knapping techniques were tested in this final stage of reduction: direct percussion with a hard hammerstone and pressure flaking with an antler tine. Direct percussion was suggested by Don Crabtree as an alternate to test, based on the irregular flake scars along the margins of the tools which normally are the result of percussion and not pressure. Pressure with an antler tine has been suggested by Morse (1975b). Two variations--with and without the use of a support--were tested. Free hand percussion was discontinued due to the inability of Sierzchula to hold the blade steady and strike it with sufficient force to detach flakes. The second technique proved to be just as futile. A small hammerstone and a board with a small V-shaped groove cut in it were the tools used in this test (Fig. 19-6). Flakes were removed but holding the blade while striking it proved ineffective. There was a high abortion rate using this technique; over three-fourths of the blades were broken before they were half completed.

An antler tine from a white-tailed deer was used throughout the pressure flaking experiment. Three methods for holding the blade were tested: holding the blade in the hand using a leather pad for protection, the use of a sherd vise as described by Morse (1975b: 137), and use of a wood vise.

Holding the blade with a hand using only a leather pad was unsuccessful. The blade could not be held steady with fingers while pressure flaking. In addition, the hand does not offer sufficient support to enable the removal of "knots" caused by stacked step fractures. A high abortion rate is characteristic of this method. It was possible to almost finish the microtool, but all tools were eventually broken.

The sherd vise (Fig. 19-7) was successful to a degree. It was possible to replicate the microtool by simply placing the blade arris in the V-shaped groove incised in a sherd using a nibble with the antler tine to remove flakes. However, there was some difficulty in removing "knots". The breakage rate using this technique was very low, about two out of six attempts.

The use of a wood vise (Fig. 19-6) made similarly to the sherd vise provided ample support to remove "knots" and the abortion rate was only one in ten. This is a superior technique possibly due to the give of the wood and a logical method for the Big Lake knappers.

Figure 19-6. Wood vise used in replication. Neg no. 774183

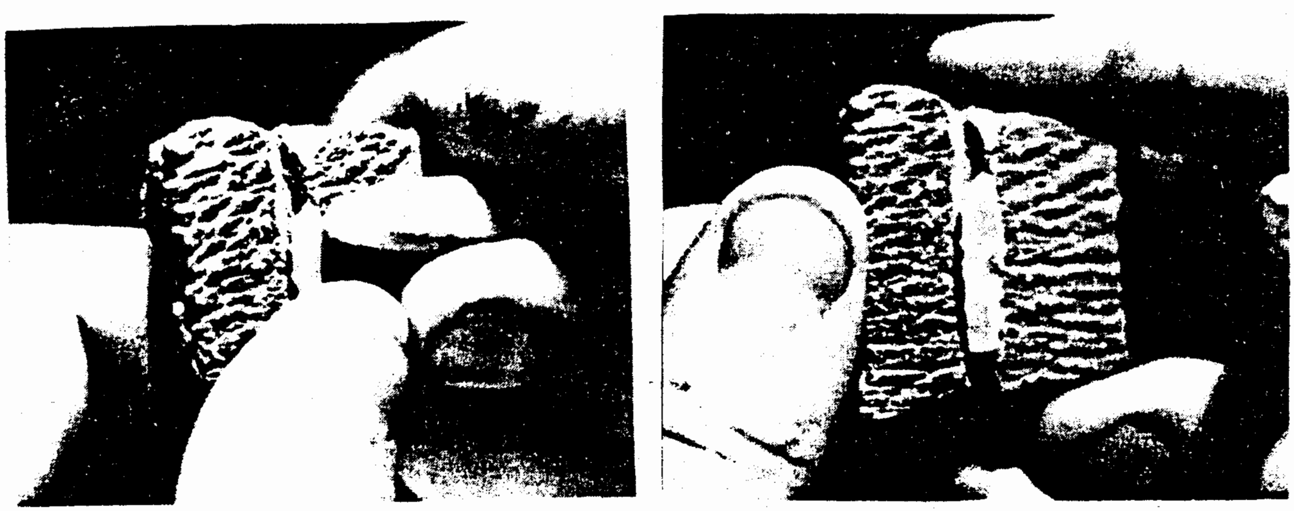

Figure 19-7. Experiments with microliths using a sherd vise.

Use of the Microliths

Experimentation using elements from the replicated Zebree microlith industry was conducted in four phases: the drilling of shell, the drilling and engraving of wood, the drilling and engraving of green bone, and the drilling of teeth.

Experimentation was conducted primarily to investigate the functional potentiality of the Zebree microlith industry. A second reason was to produce wear patterns. Unfortunately, in some instances, not enough work was done to produce wear patterns due to the shortage of materials or the failure of the microtool to perform the desired function.

Drilling Shell

The whelk used in this phase of the experiment was obtained from the east coast near Swansboro, North Carolina (Fig. 19-8). Two specimens varying in thickness, 1 mm to 4 mm, were used. The outer portion of the shell was removed from the inner part by "indirect percussion" using an antler tine and a wooden baton. Morse (1975b:141, 144, 184) was able to produce bead blanks by using a flake to incise the shell and then snapping the shell along the grooves produced (Fig. 19-9). For the purposes of this experiment, the shell was simply reduced into small pieces with the aid of a hammerstone.

The cylindrical microtools were hafted in fresh cane (*Arundinaria gigantea*) without the aid of glues. The cane was cut so there would be a joint near the hafting end to prevent the microtool from being completely forced into it. If some play existed in the hafting area of the microtool, some cane was split and forced into the area between the microtool and cane. The action of drilling helped keep the blade socketed but since the cane interior molded itself around the stone tool it tended to be held fast. Charred cane did occur in Big Lake phase deposits. It was found that by employing this method of hafting the microtool was immovable. No other method for hafting microtools was tested.

Initially, experimentation with drilling shell was conducted based on the description offered by Morse (1975b:137). A piece of shell was placed on a flat surface. The cane, with a microtool mounted in one end, was rotated back and forth between the palms of both hands with a downward pressure being exerted at the

a

b

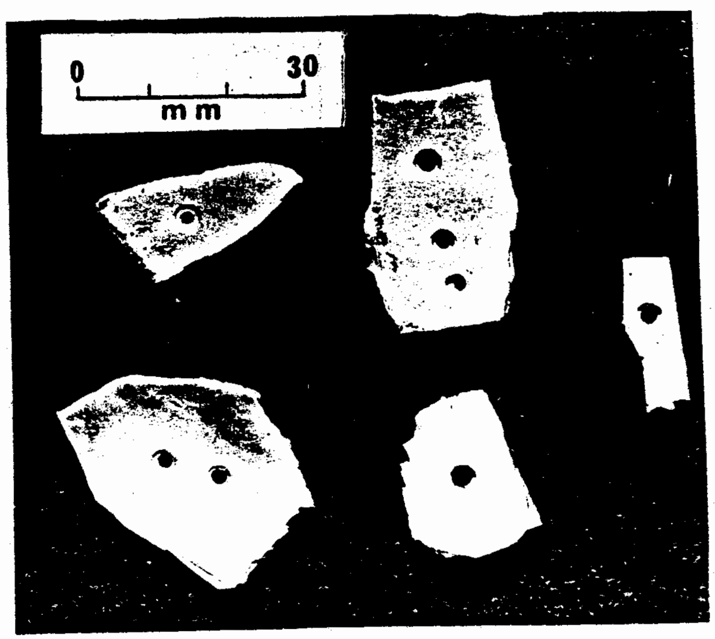

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Figure 19-8. Bead preforms made experimentally from whelk. (a--neg no 774156; b--neg no 774157; c--neg no 774147).

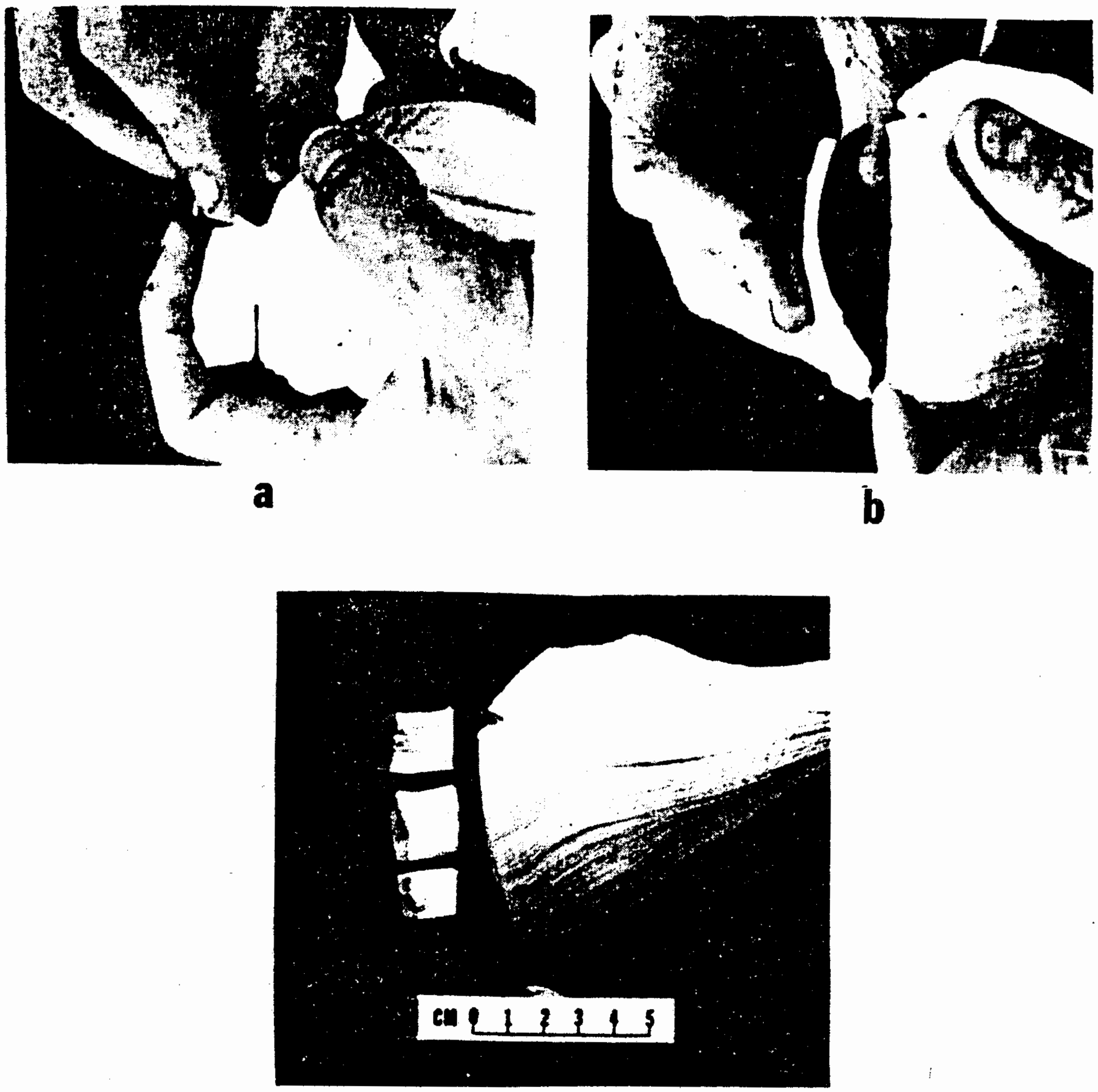


Figure 19-9. Manufacturing bead preforms. a. grooving a whelk with a flake; b. snapping grooved section; c. hammer-snapped bead blanks from grooved section.

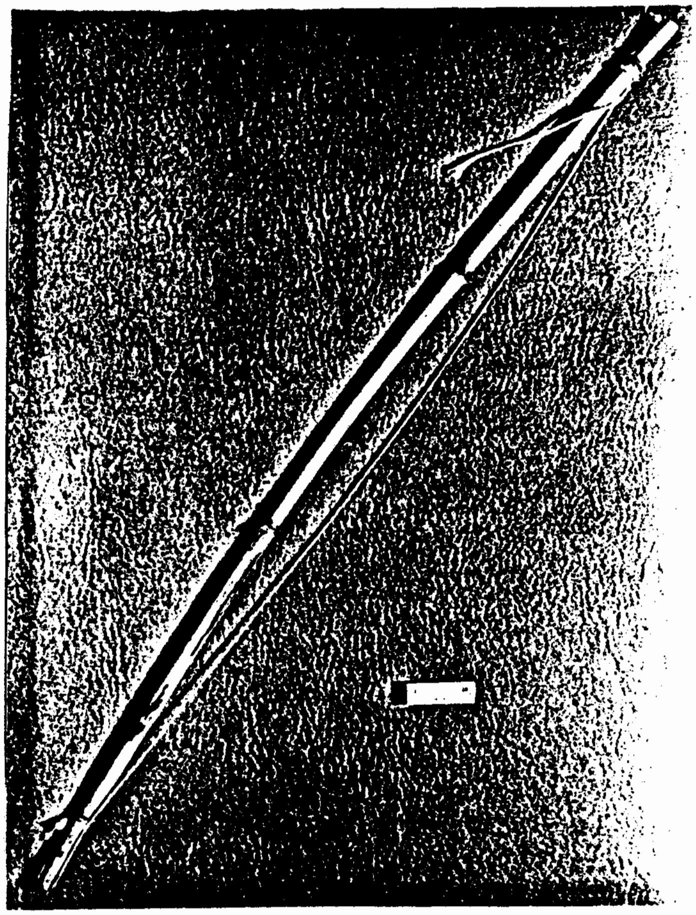
same time. An initial problem was the wandering of the microtool across the surface area of the shell due to its smoothness, solved by roughening a small area on the shell with an expanding base microtool. The rough area allowed the microlith to stay put as drilling was started slowly.

A second observation was made concerning the hafting area of the microtool. It was found that the microtool would perform the desired function more adequately if the cane was as straight as possible. Some cane is offset at the joints. This causes vibration and handicaps the individuals doing the work. This is also true of the drill tip which must be straight and in line with the cane shaft.

The time and energy expended to drill a partial hole caused Sierzchula to change to a bow drill. A thick piece of cane was cut and strung with string since no sinew or twine was available. A small block of wood with a small indentation was employed to exert a downward pressure on the hafted microlith while the bow drill was used (Fig. 19-10). This increased the speed of drilling considerably, especially when a lubricant was placed in the indentation. If a lubricant is not used the cane shaft binds. A modern lubricant, Vasoline, was used in this experiment, but animal fat probably would be more effective.

It took approximately ten minutes to drill a hole through a 2.5 mm thick shell. Every fifteen to thirty seconds the lubricant should be replenished. A section of animal fat would by-pass the problems experienced in the use of cream. Both biconical holes and holes drilled from one side were produced (Fig. 19-8). Two microliths were used to drill twelve holes in shell and both are still functional. It is a puzzle why so many microliths were made since they do not appear to wear out. One indication is that other functions are involved in addition to those experimentally tested. Another is that more people are making beads than microliths since beads take longer to manufacture.

All remaining platforms have to be removed from the microtool by abrasion both to ease hafting (Morse 1975b:137, 139) and to prevent quick breakage. Initial attempts to drill using the bow drill caused the unabraded microtool to grind a thick end (Fig. 19-11a) An unground microlith was then used to attempt to complete a started hole. This microlith also was ground down to the point where it was no longer functional and produced no appreciable depth to the hole. A third abraded microlith was used to drill seven holes with no observable damage to the functional end (Fig. 19-11b).



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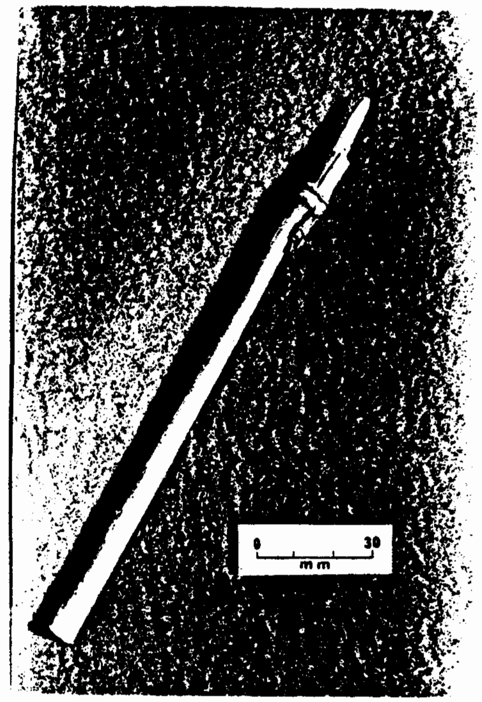

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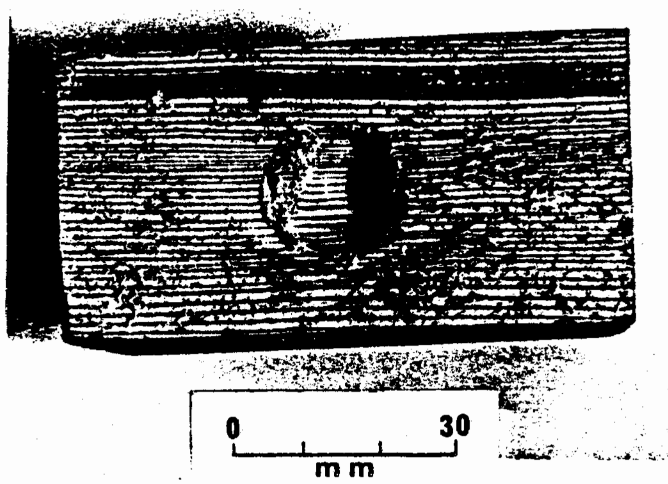
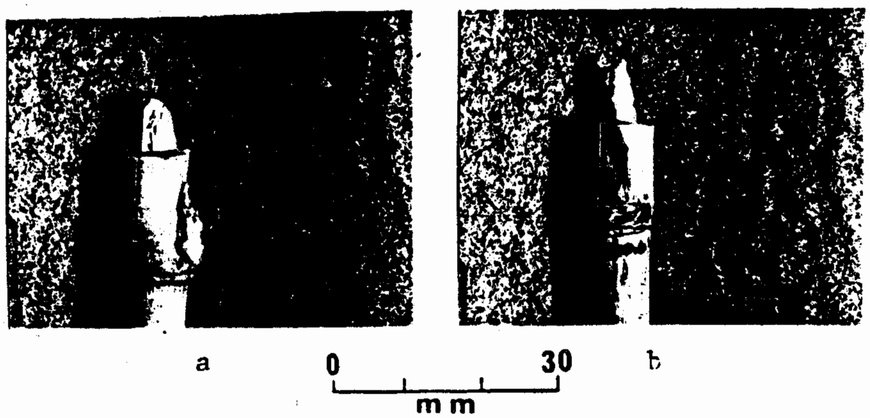


c

Figure 19-10. Bow drill (neg nos. 774149; 774181) and chin rest (neg no. 774182) used in experiments.



Figures 19-11. Microthics used to drill holes in shell. a. rounded point resulting from not removing platforms (774145); b. unaffected tip because edges were abraded beforehand (774146).

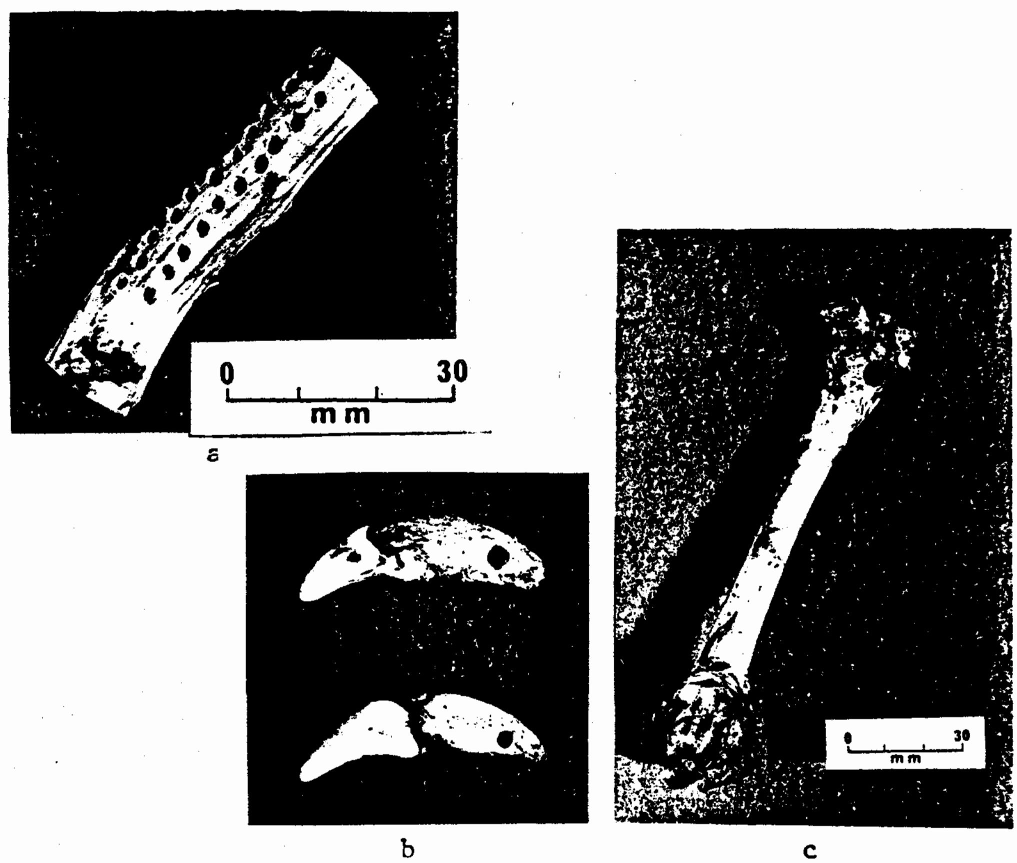


Figure 19-12. Holes drilled with microlith in: a. wood (774153); b. canines (774148); c. green bone (774152).

Drilling and engraving wood

The wood used is sugar maple (Acer saccharum) and measured 24 mm by 24 mm. The bark was removed. The bow drill, a cane shaft with a microlith mounted in one end, a block of wood with a small indentation, and a lubricant were used in this phase of the experiment similar to that described above. A preliminary analysis of the microtools recovered from the Zebree site and those surface collected from another site located near Zebree (Morse 1976d:51) revealed a low incidence of twist fractures characteristically identified as occurring while drilling wood (Don Crabtree and Jeff Flenniken, personal communication).

The first attempt to drill a hole in wood appeared to support this idea. The first microtool broke exhibiting a poor example of a twist fracture. However, 19 holes were drilled using another microtool without any trouble and it is possible that the first microtool broke due to the slipping of the block of wood used to exert downward pressure of the cane shaft. The holes drilled were generally 3 mm to 4 mm in depth (Fig. 19-12a).

Replicated microliths approaching the maximum size range of those present in the Zebree industry were employed for engraving experiments. They were hafted by the same method to haft microtools used to drill different materials.

Sugar maple was the wood used in the engraving experiment. Engraving wood with a microtool was unsuccessful. The microlith was pulled toward the experimenter at angles varying from 90 degrees to about 25 degrees. The microtool snapped (see bone engraving) flush with the cane at a 90 degree angle.

Drilling and engraving green bone

The green bone used was a femur from a domestic dog weighing between 15 and 20 pounds. The implements used to drill the bone were a bow drill, a cane shaft with a replicated microtool hafted in one end, a piece of wood to exert downward pressure on the cane shaft, and some lubricant. Each of the implements were used in the same manner described above. The bone was scraped clean of excessive fat and meat.

The function of drilling green bone was performed adequately by elements of the replicated Zebree microlith industry with the aid of a bow drill (Fig. 19-12b). Drilling with a hand held cane caused every microlith to snap. As with engraving wood, engraving bone was unsuccessful (Fig. 19-13a). The microtools were unable to perform the desired function with any speed and every microtool used snapped at a 90 degree angle (Fig. 19-13b). This is thought to be due to our lack of knowledge of how to engrave, because broken microliths in the Zebree assemblage exhibit the breakage characteristic of drills broken during the experiments. There is no doubt that Zebree microliths were used to drill and engrave.

Drilling teeth

Canines were obtained from the mandible of the dog described earlier. All the tools used in the preceeding experiments were used in this one and in the same manner.

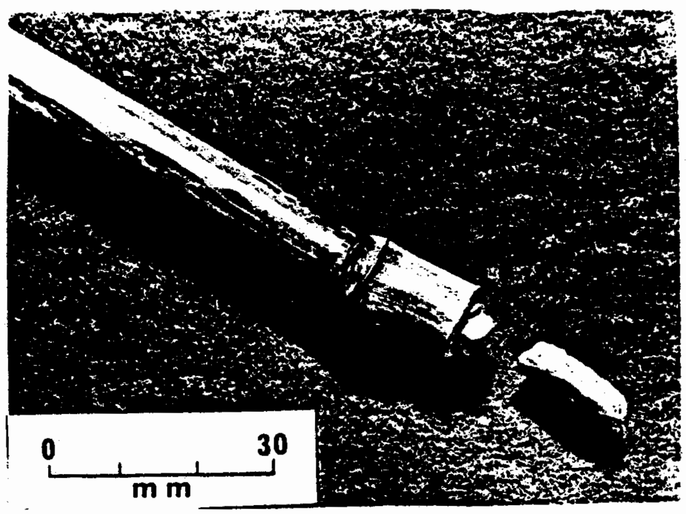
The area where the hole was to be drilled was roughened to allow the microtool to get a bite. It took less than two minutes to drill a single hole in the canine from one side (Fig. 19-12c).

Remarks

A Cahokia-like Microlithic Industry is prominent at the Zebree site and is Big Lake phase in time. Raw material probably was transported from the Crescent Quarries *via* the St. Francis River and it is thought that the Big Lake phase was in control of this river system, at least north of Marked Tree, Arkansas. Cores produced special blades by using a hard hammer percussion technique. Selected triangular cross-sectioned blades were manufactured in a wooden vise with an antler pressure tool. The resulting cylindrically shaped microliths were ground on all edges and both ends and hafted in a cane section without benefit of glue or other binding. Despite the absence of bow drills in the Southeast in the ethnohistorical literature (John Cottier, personal communication), most probably a bow drill was used for drilling shell beads and canines. Other hafted microliths were used as gravers on bone and probably shell. Still another category of expanded-based microliths probably were hand-held while used.

Comments have been made to Morse that the microlithic industry could not have been oriented toward the drilling of shell beads, because shell beads are rarely found and shell debris is rare to nonexistent in the microlithic concentrated regions. Considerable shell is found inland from the Gulf from where the majority of whelks were derived. In fact, the Cahokia site probably is the

a



b

Figure 19-13. Engraving experiments. a. dog femur engraved longitudinally (774150); b. microlith snapped from engraving bone (774151).

locus of the greatest inland concentration of whelk in the eastern United States (Parmalee 1958). At Mound 12, little shell debris or shell beads are in evidence. Shell debris was rare at the Zebree site, except for *Anculosa*. One examination of a shell bead find near Marked Tree dating to the middle period of Mississippian has revealed a possible explanation (Morse 1972b). Every bit of the whelk had been used. By the time all the beads had been finished and a gorget manufactured, there simply would have been no shell left over. In the case of Zebree, the source probably is Cahokia. Cahokia does present evidence of waste in that whelk are so plentiful that only the best parts are used. Beads are relatively plentiful, but not necessarily at the site where they are made. Whelk bead necklaces are found rarely with late Woodland burials away from Cahokia (Perino 1973: Fig. 82, p. 161); whelk gorgets also occur rarely in late Woodland complexes contemporaneous with initial Mississippian (Perino 1973: Fig. 99, p. 190).

Experimentation has demonstrated that these cylindircal microliths can be used for drilling. Breakage patterns indicate that Zebree tools were used for drilling and for engraving. Very similar microliths found in similarly large numbers at Santa Cruz and Santa Rosa Island, California, still retained a white residue on the tips which reacted to hydrochloric acid indicating that it was shell (Pitzer *et al* 1974:133). There are microlithic elements in Florida similar to these in the Cahokia Industry. They occur in one of the two areas suspected to have produced whelks for trade inland to the rest of the eastern United States. It may develop that making shell beads was important on the Mississippian-Woodland frontier.

CHAPTER 20

OTHER BIG LAKE PHASE ARTIFACTS

Dan F. Morse

There are two basic formats to choose from when describing portable archeological specimens. The traditional way is to proceed by classes of material (e.g., ceramic, stone, bone) and within each class describe categories and/or types according to specific physical attributes (e.g., pottery with cordage impressions, beads, sherd abraders). The other basic format is by inferred function (e.g., weapons, containers, musical instruments).

Either method is valid and both have drawbacks. Functional descriptions involve considerable difficulty, particularly since inference is relied on so much more than observable physical characteristics. When the traditional way of describing artifacts by physical attributes is followed, we find ourselves reading about projectile points and abraders under several different headings, and we may discuss fishing while describing net impressions on ceramics. In this report, we will attempt to discuss the archeological material culture under general behavioral categories. This will hopefully provide only minor frustration for active researchers in the valley in relation to the need to understand what was excavated.

Wood Working Activities

An idea of the kinds of wood working possible in the southeast using stone tools can be gained by looking through The Material Culture of Key Marco, Florida (1975). At the Zebree site, which was relatively rich in nonperishable items, wood only seems indicated by post holes and fragments of charcoal. However, the stone tools themselves provide evidence for considerable wood working, although only in a very general way at this early stage in investigations of wear patterns and analogies to wood working in past European and Euro-American societies.

Chipped chisels and adzes

Chisels and adzes are described together since we have not yet developed a consistent method, such as by weight or size, to differentiate consistently between these two classes. Chisels are pushed or driven with a mallet; adzes are swung.

Adzes constitute the basic artifact described in this subsection. There are seven complete or nearly complete specimens, nine fragments (three of which were used subsequently as cores), and nine polished chips which probably were detached from adzes or chisels. Four chips and one bit fragment are of Crescent Quarry chert and one chip, possibly from a polished spud (Fig. 20-11) is probably of Illinois novaculite. One fragment is of Mill Creek chert. Another is of unknown chert but probably not local. The remainder are made of pebble chert available in Crowley's Ridge. The basic outline is oval to an expanding distal end shape. Bits are gouge-like. Striations, when they occur, are on the convex (dorsal) surface and parallel with the long axis of the specimen. Weathered cortex of the original pebble is on one or both faces toward the butt end. Polish from abrader grinding occurs on both faces and edges, particularly on the convex (dorsal) face of the bit. Polished areas tend to be red indicating the possibility of thermal treatment. One specimen almost certainly was thermally treated and another has been burned gray after breakage and discarding.

All of those items have been either broken or exhausted after considerable bit renewal. Complete specimens measure between 60 and 75 mm in length, and indications are that this is the lower effective extreme of the range for the class. A "typical" chipped adz is 75 x 30 x 15 mm with evidence of considerable bit renewal (Fig. 20-1b). The broken "half" of a less used one is 65 x 38 x 20 mm. It broke during use, a conclusion based on the nature of the break (see next section). Nodena phase chipped adzes usually are larger than 100 mm in length. The Big Lake adz is crude in comparison to the Nodena phase chipped adz although both were made the same way from the same kind of material.

Chisels as defined here are small transverse edged bifaces which tend to have gouge-like working edges (in contrast to an end scraper class) and expanding distal ends. Five complete or nearly complete examples and the distal end of a sixth are probably Big Lake phase artifacts (Fig. 20-11 i-j). Some or all could be Barnes artifacts since similar specimens are found at both kinds of sites. All are made of Crowley Ridge-like chert. One was thermally treated. Range in size is 40 x 23 x 9 mm to 70 x 39 x 13 mm.

In addition to stone chisels, the bit of a bone chisel which measures 23 mm long was recovered (Fig. 20-7d). It is 8 mm wide at the bit and 4 mm thick at the break. A large number of manufacturing striations are present. The bit has been resharpened but probably broke before being used very much because it looks essentially unused.

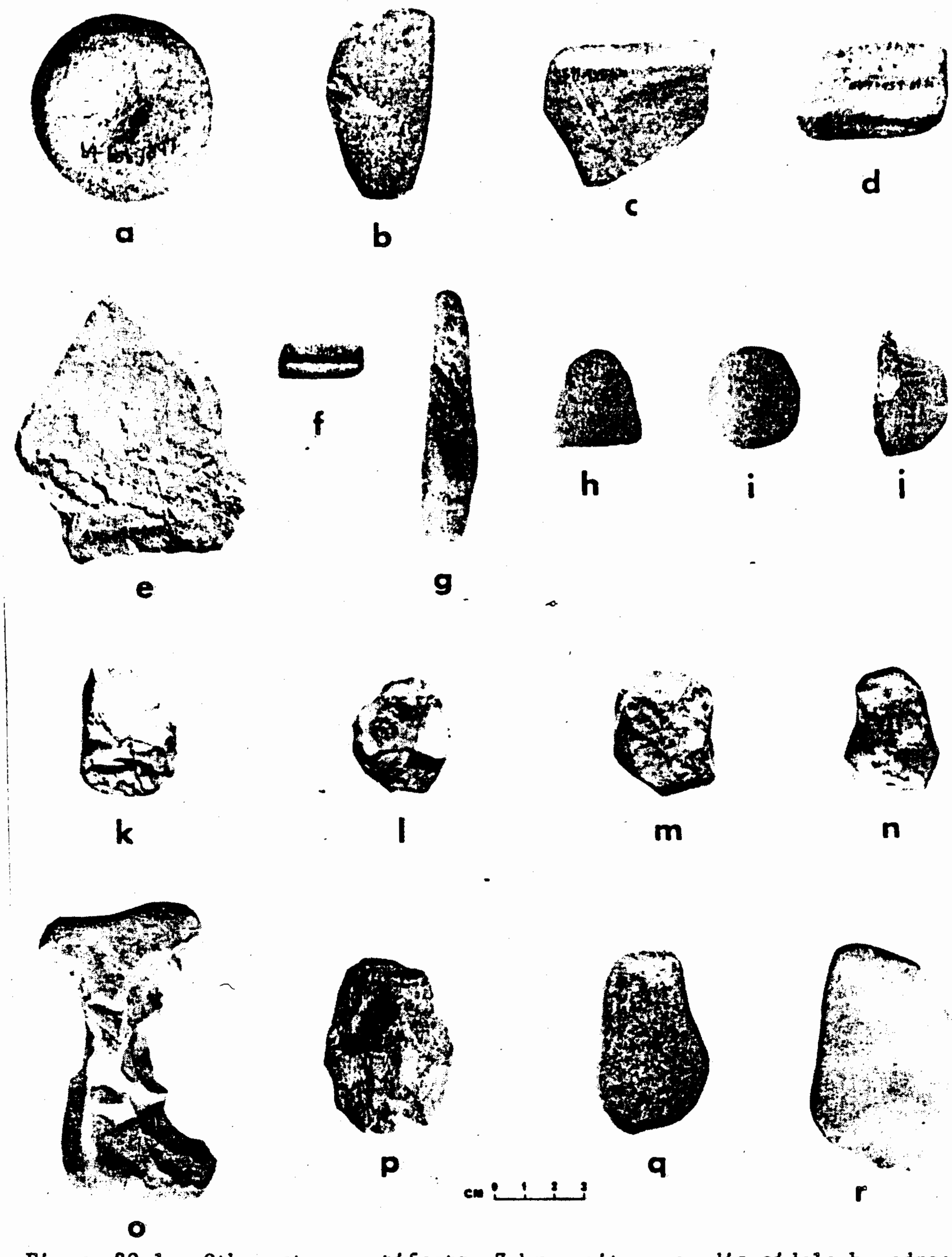


Figure 20-1. Other stone artifacts, Zebree site. a. discoidal; b. adze; c-f. sandstone abraders; g-j. polishing stones; k-m. pebble hammers; n-O. pebble choppers; p-q. hammerstones; r. paint palette.

Groundstone adzes and celts

Two limestone and six granite or basalt examples are in the collections. An adz with a narrow poll and flaring bit (Fig. 20-1b) measures 62 x 36 x 14 mm and is made of a light gray limestone. One corner of the bit is badly broken. Another is the butt of a heavy celt measuring 84 x 56 x 28 mm. It broke while being used, based on the nature of the break. Comparison with an unsuccessful replicated fluted point demonstrates that the force of a blow traveled from the bit toward the poll and at midpoint veered out to one face. Characteristics of the break are a concave break with an overlap remnant opposite the point of release. In addition, an additional break occurred further along the face from the point of release toward the poll but hinged outward after only a short distance.

There are two lateral midsections of celts; one from a very large and heavy specimen. Unlike chert and limestone, granite celts tend to break into blocky fragments. A base of a third specimen is from a medium-sized celt or a large adz. Another poll fragment is almost certainly from an adz since the cross section is plano-convex. A bit fragment of another medium-sized celt unfortunately had not been used sufficiently for wear striations to be produced which would enable verification of use as an axe and tell how deep it protruded into the wood being worked. Two chips from the face of a celt or adz were also recovered.

A small rectangular "celt" was recycled into a chopper. It measures 42 x 32 x 13 mm. It could have been a carpenter's hatchet.

Sandstone abraders

A variety of gray sandstone abraders of different textures were collected at the Zebree site (Fig. 20-1c-f). One is made of Crowley's Ridge "ironstone." Much of the sandstone is friable and in a relatively poor state of preservation. The pieces range from flat, tablet-like fragments with a smoothed surface to amorphous chunks with shallow V-shaped grooves. Seven concave, eleven flat, and three convex surfaced abraders might have been used to grind wood, bone, or shell ends, or even stone tools. Seventeen abraders had shallow V-shaped and more widely U-shaped grooves but none appear wide enough to grind much more than the tip of an awl.

A total of 49 abraders was found. Some may be fragments of the same abraders. With one exception, they do not appear to have been used extensively. A flat sandstone fragment (37 x 33 x 5 mm) may be part of a saw for use on bone or shell. Several unworked fragments of sandstone were recovered; these probably represent broken abraders and/or byproducts produced during the manufacture of abraders.

Sandstone for abraders probably was obtained in the Ozarks by the Big Lake phase. This needs to be tested by collecting appropriate examples of sandstone along the St. Francis River and in the Ozarks.

Perforators

A total of 39 artifacts, divided into three categories, are classified as perforators. The first category contains 33 specimens made on flakes (Fig. 20-2a), all of which are short and stubby. Sixteen have flat bases, mostly striking platform remnants, and 11 have thin bases because the point is lateral to the striking axis of the flake, and most have battered and/or polished tips. The presence of steep bilateral retouch and/or natural flat facets suggests these artifacts were "backed" to be hand held. This also indicates the use of these objects as gravers. These flakes were considerably modified. Four specimens have been made on blades but modification has disguised the fact. Average measurements are: 22 x 14 x 5 mm.

The other two categories, each with three specimens, have extensive retouch similar to the first. Three are long pointed unifaces (Fig. 20-3b,c); two of these may be backed by steep retouch. One of the latter also has a concavity at the wide end and appears to be a multiple function tool (graver, backed side scraper, and spokeshave). The other three tools simply seem to be exhausted gravers which may be imperfect members of the first category (Fig. 20-3d-f). They tend to be expanding to a base but have short or snapped pointed tips with little of the steep lateral retouch noted on the first category specimens. The flakes chosen are cruder and larger and could not be retouched into the expanding graver category.

Other uniface chert tools

A total of 108 flakes were modified into recognized tools with only a minimum amount of retouch. A small percentage are made of Crescent Quarry or other exotic chert. The remainder are made of Ozark and Crowley's Ridge chert. Following White (1968: Fig. 29) the Zebree uniface tools were classified according to the location of the working edge in relation to the long axis of the flake with the bulbar end held proximally. Definite functions, such as making arrowshafts (Sollberger 1969) have not been attributed to these tools.

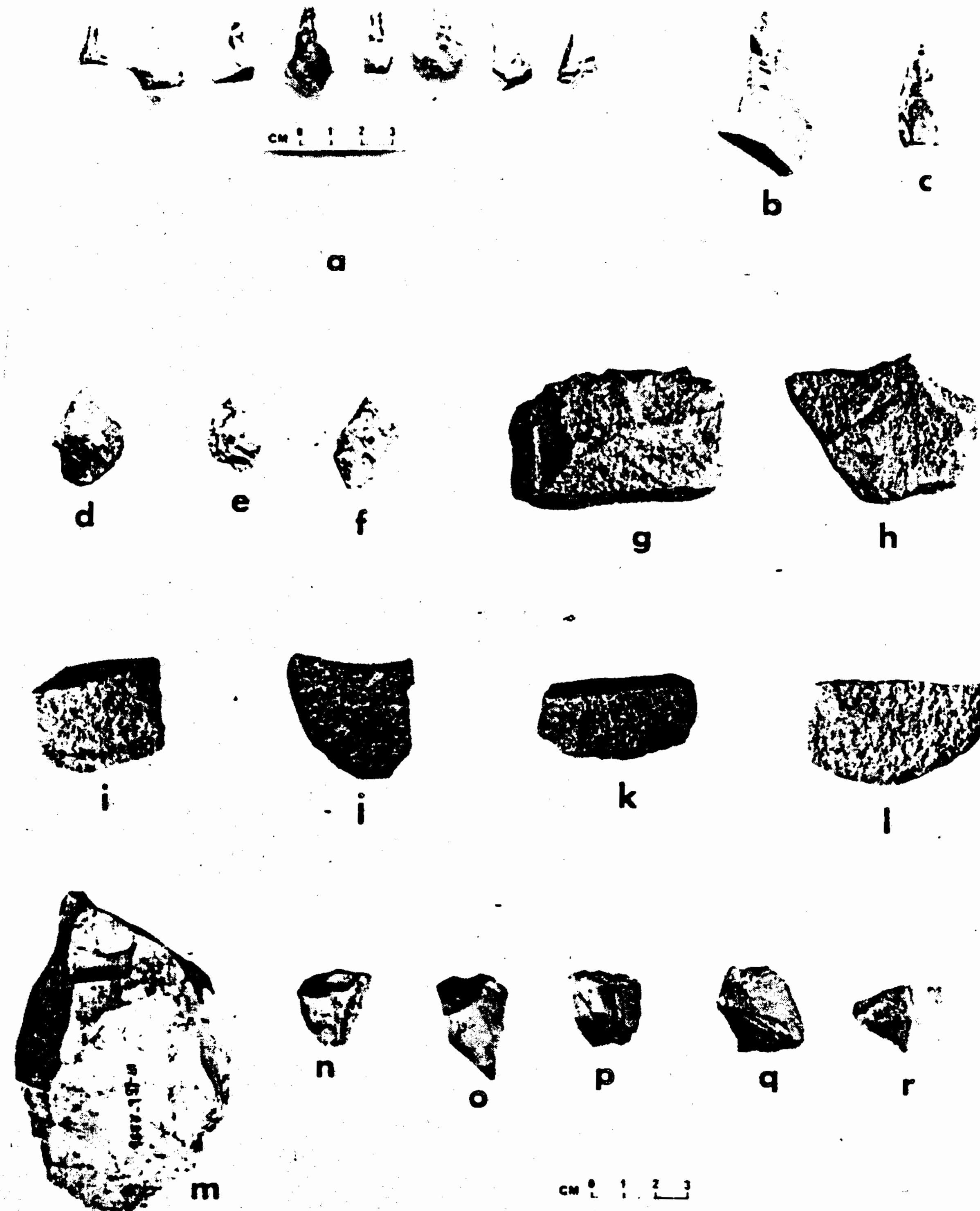


Figure 20-2. Miscellaneous chipped stone artifacts, Zebree site. a-f. perforators; g-h. quartzite cores; i-l. backed quartzite flakes; m. core or core preform for microblades; n-r. exhausted pebble cores.

The 15 transversed edge unifaces (Fig. 20-3a) seem an unexpected low proportion of the total unifaces, when one considers the number of end scrapers found at the later Mississippi sites along the St. Francis River. Mean measurements are 22 x 26 x 6 mm. The favorite flake for transverse use seems to have been an expanding percussion flake. Eight of these were found. Two are biface preform trim flakes (flakes of bifacial retouch) while the other six seem to have been detached from cores. One of the flakes has the bulbar end as the working edge; the other seven were used distally. Four additional percussion flakes, probably from cores, have a central ridge caused by the previous removal of flakes over both lateral surfaces. The resulting narrow distal end was used.

Most of the 24 oblique-transversed unifaces (Fig. 20-3) are made on oval-shaped flakes, each with use scars evident on part of the distal rounded end and adjacent side. One tool is used on the bulbar end. Two are backed naturally due to the previous removal of flakes. One Crescent Quarry flake is backed by retouch. It measures 60 x 21 x 7 mm. Another is blade-like, made on a polished chip and has a graver tip. With a few exceptions, the flakes are crude-looking and not used extensively. Ten are made of Crescent Quarry chert. One is made on a large Mill Creek flake. Its measurement is 28 x 20 x 6 mm.

Two categories containing the laterally utilized and/or retouched uniface tools are extremely variable as to the flake selected. The range is from a true blade to a very chunky core flake. There are 27 flakes with convex or straight lateral working edges (Fig. 20-3c) and 32 with concave lateral edges (Fig.20-3d). Ten in the former category are backed and these are mainly the larger flakes.

The 32 concave-edged scrapers or spokeshaves can be divided into three classes based on working edge. Eleven tools have steeply retouched concavities. There is also a tendency for these working edges to cluster into two classes. Six flakes have concavities which measure between 21 and 29 mm long and are 1 mm deep; four of these have a working edge angle of about 65° and the other two are around 50°. Five other unifaces have steep concavities ranging between 6 and 13 mm wide and are between 2 and 3 mm deep. Working edge angles range between 55° and 75°. One tool has two concavities with a possible graver tip between, and another has three concavities.

The other concave-edged scrapers are made on flakes for which little or no modification was involved. Half have concavities ranging between 10 and 17 mm long, and 1 to 3 mm deep with working edge angles between 40° and 55°. The working edge angle may be simply a consequence of the flake size since the scrapers which have working edge angles of between 75° and 85° are made on chunky flakes. The concavities of these range between 8 and 13 mm wide and between 1 and 2 mm deep.

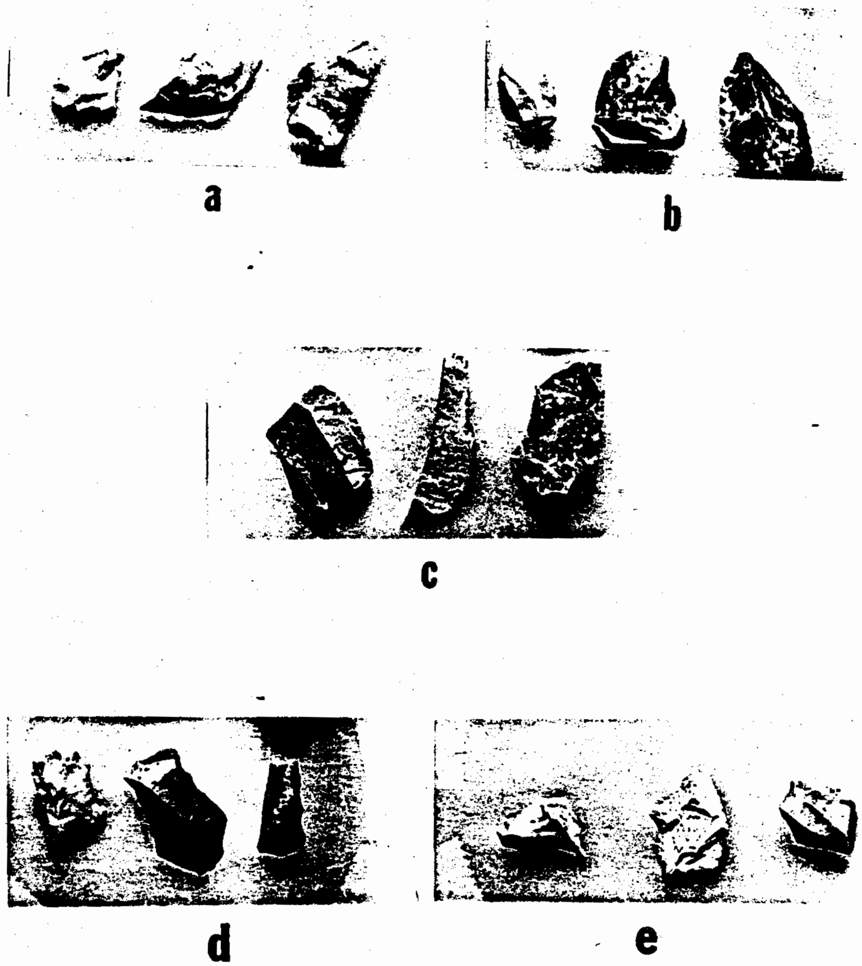


Figure 20-3. Other uniface tools, Zebree site. a. transversed edge unifaces; b. oblique-transversed unifaces; c. convex or straight working edge; d. concave lateral working edge; e. retouched tip used as graver.

Most of the concavities are lateral to the striking axis of the flake. Some flakes, however, are wide and short which disrupts the mean dimensions considerably. Rarely the concavities are at the bulbar or at the transverse end. Concave edged scrapers mean measurements are 30 x 26 x 8 mm.

A total of 10 chert unifaces have a small retouched tip suitable for use as a graver (Fig. 20-3e). Six of the flakes have tips on the transverse edge and four have tips on the lateral edge. One short flake has its tip lateral to the transverse edge of the flake. Normally the tip is parallel to the longest dimension, and the gravers were measured with the long axis parallel to the working tip. Gravers average 18 x 16 x 5 mm.

Other bifaces. The highly polished bit of a drill made of Dover chert was found in Square 76R6. It measures 21 x 6 x 7mm. At least 15 mm of the length, based on grinding, appears to have been used. Distinct perpendicular striations exist on the two edges of the artifact's long axis and there is little doubt this artifact functioned as a drill.

Eight tips of pointed bifaces were found. These probably are mainly from points and knives. One exhibits polish but no striations on 3 mm of the tip.

Chopper-plane. A discoid chopper weighing about 225 g is made on a pebble. Its single working edge is unifacially chipped so it could be used similar to a plane. The unmodified portion of the pebble provides a naturally backed hand hold.

Stone Tool Manufacture

Chipped stone tools

Considerable debitage was recovered from the Zebree site. It was not possible to examine this in detail because of the limitations of the contract. Cherts from the Ozarks and Crowley's Ridge as well as from the Crescent Quarries are represented. Most if not all of the lithic tools recovered from the site were manufactured there. One exception is the Mill Creek spade or hoe, since no debitage except that from a finished and used specimen has been recognized, but a considerable number of chips with polished faces were recovered.

Hammerstones

There are basically two kinds of hammerstone made from a chipped pebble or made from smooth pebble. Six were made from chipped pebbles, five of which were essentially spherical and are oval in shape.

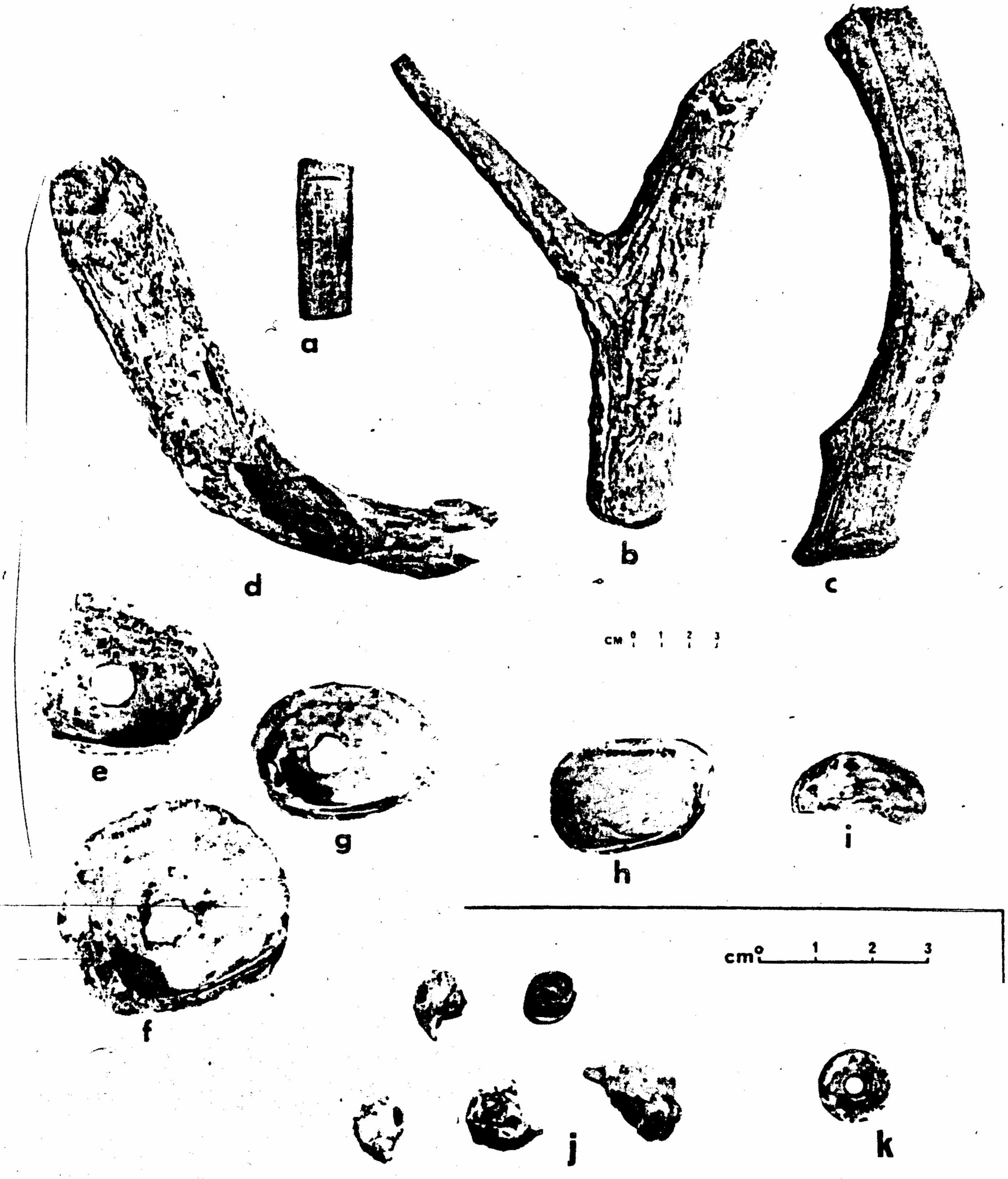


Figure 20-4. Antler and shell artifacts, Zebree site. a. antler bar; b. antler baton; c. possible antler baton; d. antler scraper; e-g. shell hoes; h. shell spoon; i. shell gorget; j. gastropod beads; k. conch disc bead.

Battering is on the edge of the spherical specimens (Fig. 20-1k-m) and on the end of the oval specimens (Fig. 20-1 p-q). Weight is generally around 55 gm; one weighs 170 gm. Apparently the primary decortication flakes were removed to allow a tighter grasp.

Three complete specimens and fragments of six others are spherical hammers made on pebbles. They weigh around 200-250 gm each. Two are battered on one end while one is truly spherical due to intensive and general battering. All but one is quartzite; the exception is chert.

Ten smooth pebbles are oval in shape. Nine are quartzite and one is chert (and is a good candidate for adz preform). Two smaller ones with double-end battering weigh 225 gm. The others weigh around 200-300 gm and two weigh 500 and 700 gm. Two flat smooth-surfaced hammers with edge batter weigh around 170 gm, and one roughly rectangular specimen weighs about 225 gm. All three of these latter are quartzite.

Antler batons

A very sturdy, well-balanced, and comfortable antler baton was found in Feature 4-2 (Fig. 20-4b). What had been the proximal end of the antler rack was battered until it was rounded. The other end, 177 mm distant, exhibits breakage from chipping and/or hammering. This part of the antler has been trimmed to be hand held. A total area of 60 mm has been shaved for a depth of 2.5 mm around the entire circumference. A tine just beyond this shaved handle was left intact and when the baton is held this tine can rest on the hand.

A possible baton "preform" (Fig. 20-4c) with its single lateral tine removed measures 216 mm long from the naturally shed proximal end to the other truncated end. Grooves near the proximal end indicate that about 60 mm was to be cut away. If so, this would have resulted in a slightly curved cylindrical baton. On the other hand, this end would have been best suited for knapping; the artifact can be held comfortably and it may merely be an unused baton. Another apparent broken and well worked baton was being recycled into preform strips.

Pressure tools

A split antler artifact is rectangular in outline, grooved and snapped at both ends, sawed longitudinally for splitting, ground on both ends and scraped, possibly with a chert scraper, over all of its outer surface (Fig. 20-4a). It measures 57 x 21 x 13 mm and it may have been either a knapping tool or an element of a guessing game.

Experimentation clearly indicates that antler tines are needed to duplicate the battered retouch of the microlithic tools found at the Zebree site and to do much of the finer knapping. Several tines with this possible function were recovered. Because of the nature of the primary rutting function of antlers, verifying a knapping history subsequent to being shed will be difficult. One tine exhibits scraper striation along the distal end, another has a polished tip, a third has a sharpened tip and is highly polished at that tip for 6 mm, and a fourth is worn with a polished tip. They all would appear to be excellent knapping tools.

Quartzite-abrader

Five quartzite pebbles with polished and striated surfaces probably were used to grind the edges of bifaces during the knapping process to accommodate the soft hammer better (wood or antler baton). Two are large (250, 680 gm) and two are small (60, 85 gm). Three are roughly rectangular in shape with one flat face worn while the other two are a corner of a cobble with two wide ground facets on one edge and on the other a heavily striated concave surface.

Other cores

Cores, besides those associated with the Cahokia Microlith Industry, are rare. Two "pebble hammers" may be made on exhausted cores.

Within the fill of the east wall trench associated with a house was found a large Crescent Quarry chert core (Fig. 20-2m). It measures 107 x 73 x 43 mm. Only four blades 50 to 60 mm long and 20-30 mm wide have been removed and probably the core had been little more than prepared for the manufacture of blades for tools. Although amorphous in shape, basically it is oval with one end thicker and truncated for use as a striking platform.

Eleven exhausted cores (Fig. 20-3n-r) are made on Crowley's Ridge pebbles. Color ranges from tan to mottled gray and red to light gray. Cortex is present on part of one face in each case. The exhausted core is basically shaped like a cone or disc. Numerous flake scars are present and there is considerable battering on the striking platforms probably indicating the knapper can detach no further flakes. They weigh about 60 gm apiece.

One Ozark (?) white chert core weighing about 80 gm was aborted probably because it is filled with fissures. Interestingly, three chips from this stock were found in the same feature.

Five crude oval-shaped and one fan-shaped bifaces are also present in the collections. All appear to be unfinished specimens or preforms. Three may actually be exhausted cores and one a chisel preform. Another eleven artifacts seem to be edges broken from large bifaces, perhaps during the process of manufacture. A final specimen in this "other" category is a small chunk which may be either a rejected core or an unsuccessful attempt to make an implement.

Stationary abrader

In 1975, a large very finely grained quartzite cobble was found by the backhoe. One face has a concave surface with fine striations in two consistent directions. This probably is a stationary abrader (it weighs 5 kg) upon which the heavy wood-working tools were manufactured. The cobble measures approximately 200 mm wide and 110 mm thick with the working face measuring 135 mm in one direction and 150 mm in the other. The curvature fits the sides of complete celts and chisels from the other Mississippian sites perfectly. Since the abrader is fine textured, it would be used in the final finishing step of the manufacturing process.

Debitage

Ground stone tools were chipped and battered to a final preform stage before being ground. The chert chisels still exhibit flake scars. Basalt and granite tools do not, but chips representative of early stages in manufacture exist. Three relatively small chips and a relatively large flake have been recognized in the collection. They vary from each other and tend to fall into two classes of broken celt material. Branson (1944:387-388) comments that "southeastern Missouri is the most easily available source for granites in the central Mississippi Valley." and notes that a variety of crystal size and color is present. The debitage is instructive because it is from preforms, not finished tools. This means that celts were probably being made at the site from material directly derived from the upper reaches of the St. Francis River. A broken portion of a large quartzite artifact was found. It is ground on one convex face and possibly was being made into a big celt when it broke. It measures 70 x 57 x 47 mm. It also might have been an abrader to use on ground stone tools.

Shell, Bone, and Antler Artifacts

Shell, bone, and antler tended to be well preserved at the Zebree site. Many specimens preserved attributes which can provide considerable technological information.

Byproducts

Titterington (1938:9-10) relates the discovery at Cahokia of a cache of 1960 beads made of mussel and conch shells. Besides 1084 disc beads in this cache there were 386 unfinished beads.

> . . they are irregular pieces of shell roughly triangular to square in shape with a hole more or less centrally placed. Some show that the original shell had been cut about 1/3 of the way through, and the piece to be made into a bead broken out. The line of fracture did not always follow the groove that had been made . . .
>
> From the study of specimens in this cache, it seems probable that a shell which was to be made into beads was marked off and then deep grooves cut in the surface, probably by means of the sandstone saws of other sharp-edged implements. They were then broken up along lines following the grooves as nearly as possible. The individual pieces were drilled and the sharpening was done after the drilling (Titterington 1938:9-10).

At site 3PO218, located immediately north of the Hazel site (3PO6) near Marked Tree, Arkansas, a similar cache of 1400+ shell disc beads were found in a broken vessel (Morse 1972b). The context appears to be middle Mississippi (probably Lawhorn phase). The beads probably were made from a single large whelk (probably Busycon) with all of the shell being used in some way. The beads were in various stages of manufacture. A few were undrilled, others were drilled but not in the shape of a perfect disc, while still others appeared to be finished beads which, according to their discoverer, were found lined up as if strung. At the nearby Hazel site was found a flat abrader slab suitable for having a string of beads rolled upon in the manner described by Orchard (1929:26-27) for the Zuni. The Hazel abrader in addition has a sizing groove near one edge.

A small Banks Noded vessel was found at site 3MS7 with a string of 43 beads inside (Pecotte 1972). The vessel was brough intact to the lab and cleaned without moving any of the 33 beads still *in situ*. The beads are graduated from smallest (12.5 mm) to largest (29.5 mm) and the string would have been about 31 cm long. This obviously was not a string for wearing but may have been either a manufacturing string or a trade string.

Although only one complete bead associated with the Big Lake phase was recovered at Zebree, there seems little doubt that making beads was an important industry at Zebree and in Mississippian society.

We found twelve definite fragments (Fig. 20-5p) which can be considered byproducts. These have seven mussel shell and five conch shell sections. All five of the latter exhibit cuts and grooves. Only three of the mussel shell sections exhibit grooves or cuts; the other four are so classed because of a "squared" appearance not expected from normal breakage. Several additional badly weathered strips and sections of possibly cut shell were also found (Fig. 20-5 q-r).

Bone debitage includes six grooved and snapped bone ends (Fig. 20-5a-d) which were identified as follows: (1) proximal end, swan (?) humerus, (2) distal end, goose (?) humerus, (3) immature distal end, deer metatarsal, (4) distal end, deer tibia (5) proximal end, deer tibia, and (6) immature proximal end, deer femur. Eleven midshaft fragments of grooved and snapped bone are all large mammal bone, probably deer (Fig. 20-5 e-k).

Two additional artifacts have been "sawed" longitudinally (Fig. 20-5l-m) although the sawing was probably done with a microlithic graver rather than a sandstone saw. Laterally retouched chert or quartzite scrapers possibly could have been used also.

Much of the bone manufacturing activity involves grooving the bone at least one-third around one or both ends. This groove guides the break when hit smartly so that usually a clean, straight break takes place at the site of the groove. The diaphysis or midsection is further processed by cutting longitudinally into strips which constitute preforms for awls, fishhooks, and other tools. The groove-and-snap technique is a basic technological feature of most societies. (In fact, field archeologists use this same technique to remove the point of a shovel by incising with a file and snapping the point off in a vise or with pliers.)

Antler byproducts were also recovered. One 21 mm long tine had been grooved and snapped away from the rest of the antler. Another is a fork of the deer rack from which two tines and the main branch were detached. This latter has been badly chewed by rodents. A very small fragment exhibits grooves indicating this was a second attempt to trim an end. A broken antler 128 mm long found in 1969

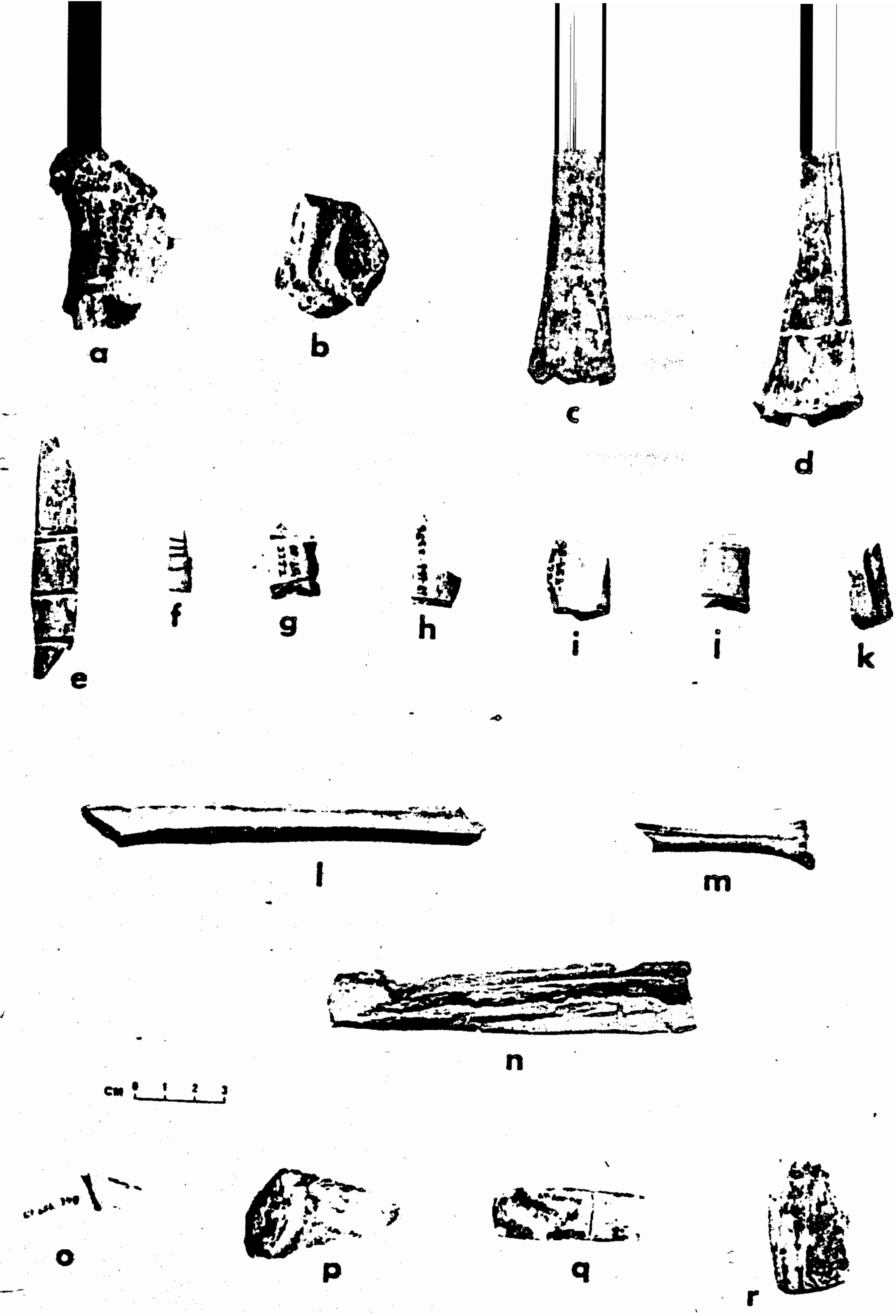


Figure 20-5. Bone, antler, and shell debitage, Zebree site. a-d. grooved and snapped bone ends; e-k. grooved and snapped bone; l-m. sawed bone; n. antler bar; o-p. shell bead manufacturing by-products; q-r. sections of cut shell.

rack for knapping purposes. Another surface of the antler demonstrates that getting a start was not easy. A series of striations cluster together and are parallel with the antler. Comparing the striations under the microscope with a microlithic tool classified as a graver revealed a near perfect match. Broad incisions (1 mm) composed of multiple parallel striations are present. These may have been caused by the ventral blade surface of the tool being held downward at an angle (using the flat of the tool). The multiple striations are actually a result of using chert tools. These striations, situated within a broad band, are apparently often the result of using the tip of a microlith. This will need experimental confirmation.

A second antler as large as this one was found in 1976 which is more instructive. Strips of antler up to 120 cm long and 5-12 cm wide were being systematically removed as 5-6 cm thick dense antler preforms, probably for awls and harpoons. The naturally shed proximal end of the rack is present and battered and smoothed as if used as a knapping baton.

A smaller broken tine section also appears to have been discarded after cutting a series of strips. It appears to have been an example of recycling an antler handle. The fragment measures 62 x 18 cm with a smaller lateral tine base at the midway point. A rectangular piece of antler measuring 34 x 14 x 6 mm may have been meant as a handle but probably was not finished. Another bar is quite different. Broken on both ends it measures 23 x 6 x 4 mm and is a sawed strip, plano-convex in cross-section.

Wedges

Pièces Esquillès occur at the Zebree site but could be exhausted bipolar microlith cores. They could have helped in the splitting of longitudinally grooved bone.

Abraders

A total of 436 apparent sherd abraders were found. Pottery types used included Barnes Cord Marked (336 specimens) Barnes Plain and eroded surface (4), Varney Red Filmed (40), Neeley's Ferry Plain and eroded surface (35), and Wickliffe Incised (21). Some of these may belong to other components, but most, probably over 90%, belong to the Big Lake phase.

The sherds used are small and easily held in the palm of a hand. One to several parallel grooves with a U-shaped cross-section were incised usually into one surface only (Fig. 20-6a-c). The grooves in most cases cut into one edge and tend to flatten out onto the sherd surface. Barnes Cord Marked sherds were the favorite and the grooves are perpendicular or diagonal, never parallel, to the cord impressions. A total of 90% of the Barnes Cord Marked specimens were worked on the exterior surface only. Two were used on the edges rather than on either surface. Grooves range between 12 and 51 mm long, 2 and 7 mm wide, and from less than 1 mm to as much as 4 mm deep. The average dimension is 29 x 4 x 1 mm. The deep grooved abrader is extremely rare (Fig. 20-6e); only four were found. Either these were someone's favorite abraders or they were used to abrade a different kind of bone object. In one case, advantage was taken of the base of a rim fold.

Another type of sherd abrader, also very rare, has scratches or rather an area of wear on one surface (Fig. 20-6f). There were 15 of these and ten are made on Barnes Cord Marked sherds. Almost certainly these were used to abrade in a different manner, perhaps to finish an extra thin tip. However, on one specimen from Square 12R18, made on a Barnes Cord Marked rim sherd, both surfaces have grooves, scratches, and wear areas. The presence of all three kinds of abrasion on a single sherd indicates that the things being abraded are closely related. No measure was made to determine the abrasive characteristic of the sherd abraders. Undoubtedly, a craftsman had a variety of abraders. They appear to have been instrumental in the manufacturing and/or resharpening of bone awls and possibly other bone and wooden tools or ornaments. In addition, one cylindrical microlith was grooved on the ends and laterally (Chapter 19).

A clay impression was made of an experimentally grooved sherd. Each of the grooved sherds was similarly impressed and the impression compared with the replication. A total of 25 Barnes Cord Marked sherds and ten Neeley's Ferry Plain and Varney Red Filmed sherds were identified as similar. The 35 are represented by very distinct V-shaped grooves which do not appear to have been used as abraders and which seem to have been grooved with a lithic tool. The apex of the impression of the groove is very sharp and the sides tend to be rough rather than smoothed from being used extensively as abraders (Fig. 20-6g-1).

At least one amorphous clay object and two ceramic cores were noted with abrader scars.

Orthoquartzite-backed knives

There are an estimated 3.5 kg of orthoquartzite recovered from the Zebree site represented by about 300 specimens, mostly small debitage. The source is 3GE241, located on the west side of

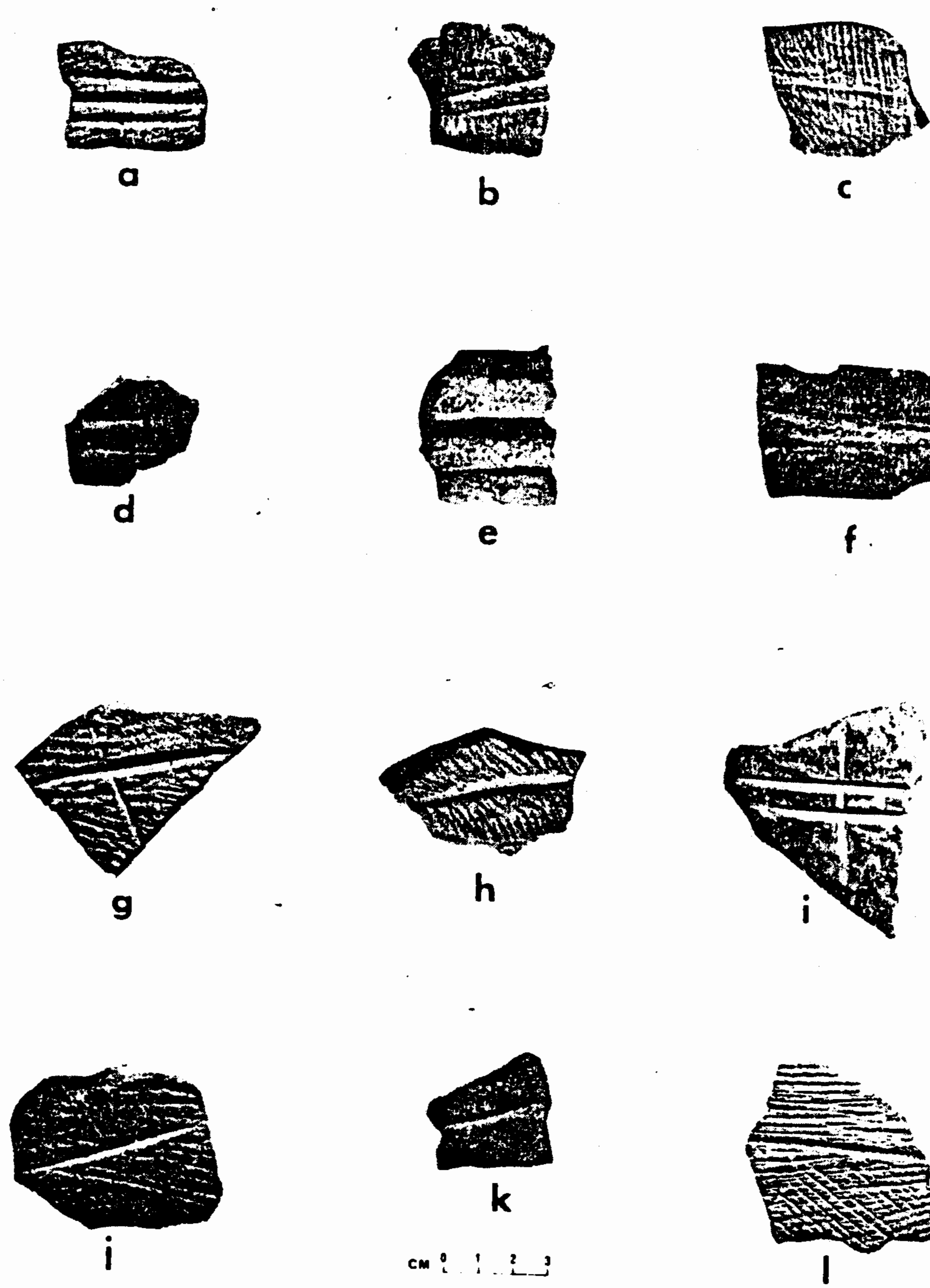


Figure 20-6. Grooved sherds, Big Lake phase. a-d. grooved sherd abraders; e. deeply grooved sherd abrader; f. 'scratched' sherd abrader; g-l. possible grooved sherd vised.

Crowley's Ridge approximately opposite Paragould.

Seven "choppers" (Fig. 20-2g-h) actually appear to be exhausted cores, which in at least three cases were used as a hammerstone or chopper. Each has at least one chipped edge and one flat edge.

A total of 26 "backed" knives are represented (Fig. 20-2i-l). Each has a chipped and/or working edge which is usually convex and rarely straight. They are light to heavily ground on the working edge. All are made on thick percussion flakes and either retain a wide flat striking platform or may have been truncated to obtain a flat edge. The flat or backed edge usually is perpendicular to the working edge but rarely is the main working edge opposite the backed part of the knife. They range from 31 x 15 x 7, to 84 x 45 x 22 mm. Average size is 47 x 34 x 12 mm. The knives appear to be a heavy cutting tool of some sort. They were not hafted and each fits comfortably in the hand. Striations on one edge are clearly parallel to the edge but this could be a result of intentional smoothing on an abrader. Actually this would be an ideal tool to groove "sherd abraders." In addition, these knives would be effective "saws" for grooving shell preparatory to blocking into bead preforms. Many of the tools show breakage on the working edge bascially oriented onto a single face, as if the knife were being drawn toward the user as a scraper. However, this may be a result of resharpening the knife.

Kitchen Activities

The basic utensils in a kitchen are pots and pans, knives and spoons. Pots are discussed in Chapter 18. Spoons and ladles probably were often made from gourds and the mortar and pestle was probably made of wood. Knives are probably some of the bifaces and unifaces discussed elsewhere. Not much seems to be left to describe here, but kitchen activity is one of the major components of any society and quite a few artifacts represent some of this activity.

Burned clay was abundant at the site and is represented by small reddish fragments. Such artifacts can result from burning to clear an area, burning trash, or any number of activities. Density maps of burned clay were not even consistent with those of charcoal as we had expected in attempting to further test the location of household activity, particularly kitchen activity.

Pebble choppers

Five smaller discoid choppers were found. One edge is chipped into a crude bifacial denticulate working edge suitable for dicing food. They measure about 40 x 30 x 15 mm and weigh around 30 gm. One small oval pebble has a crude chisled end. Two larger discoid choppers are pebbles with a single working edge. They weigh around 110 gm apiece and measure around 50-60 mm across and 20 mm thick. An unusual chopper made on a tan Crowley's Ridge cobble (Fig. 20-1 o) has one side of a basically rectangular-shaped cobble retouched by percussion into a concave-edged denticulate. Measuring 106 x 55 x 30 mm it would appear to be a suitable tool for stripping bark. The working edge is 73 mm long.

Spoons

A small (69 x 38 x 14 mm) mussel shell which had been modified for use as a spoon is made from the right valve of a deep, very thin, almost rectangular shell with a smooth exterior and small pseudo-cardinal teeth (Fig. 20-4 h). Except for its small size, it is similar to *Protera purpurate* (Lamarck). Extensive grinding and subsequent weathering has changed the shell and made identification difficult. The inside has been scraped so much that several lines are visible and the edges are battered and ground.

Nonceramic containers

Three small fragments of worked turtle shell were found. Two marginal laminae from the carapace are represented. One has been ground on the distal and possibly the proximal ends. The sides are not modified and apparently other marginal laminae were part of the artifact. A hole 3 mm wide and 4 mm deep intrudes into the proximal end. Under a microscope, the hole and edge look natural. There are no striations (except for one of our cleaning incisions within the hole) and no other evidence of modification. The distal side of the plate has a large number of parallel striations which are perpendicular to the edge of carapace. Its function may have been as a container, possibly as a scraper, or as a dipper.

The other laminus has unmodified edges on all but the exterior. Other laminae were involved. The interior was scraped and ground smooth. The exterior edge is V-shaped (like the unmodified margin or a painted turtle) and under a microscope appears to have been polished either from use or as a finish. This may have been a container or scraper.

The third specimen is part of a plastron. It is roughly rectangular with one complete ground edge and two adjoining ground edges which are interrupted by the loss of at least one laminus.

Strainers

Two broken multiple perforated discs made from Varney Red Filmed pot sherds were recovered (Fig. 20-10g). The most complete probably had seven holes and was 105 mm in diameter. It may have been used in the base of a funnel but this diameter is the same as the inside diameter of the more complete Varney Red Filmed small jars and probably is a strainer for a drink brewed from roots or leaves, fruit seeds or skins, or other unpalatable items. That multiple perforated discs are used in vessels is shown by three bottles from central Arkansas with built in "strainers" (Davis 1967). Another possible function suggested by Davis is as part of a rattle.

Cones

Cones are described in detail in Chapter 18. Their presence is noted here since they most probably are supports used in the hearth for cooking jars (Fig. 20-10s-t).

Perforated deer skull

A deer skull (Fig. 20-7k) has all of the face broken away and a large (45 x 35 mm) hole broken into the brain cavity on top. The hole is oval in shape and one possible use of the skull is as a rattle, but we could find no evidence of cutting or abrasion. In fact, we could not even find the expected butchering marks. The antlers appear to be shed. There are several 1-2 mm striations incised into the antler surface. One explanation of this object is that it was used for the extraction of brain for skin preparation. The deer probably was killed around April-May so the summer coat could have been obtained and the animal's own brain used for working the skin (Severinghaus and Cheatum 1156:84-88; Plate VII). However, the even hole and the cut marks together with the missing face indicate a more obscure function.

Fleshers

Three distal deer humeri scrapers were collected (Fig. 20-7a). During butchering the proximal ends of deer humeri are shattered and this provides for a pretty good scraping or gouging tool. On one

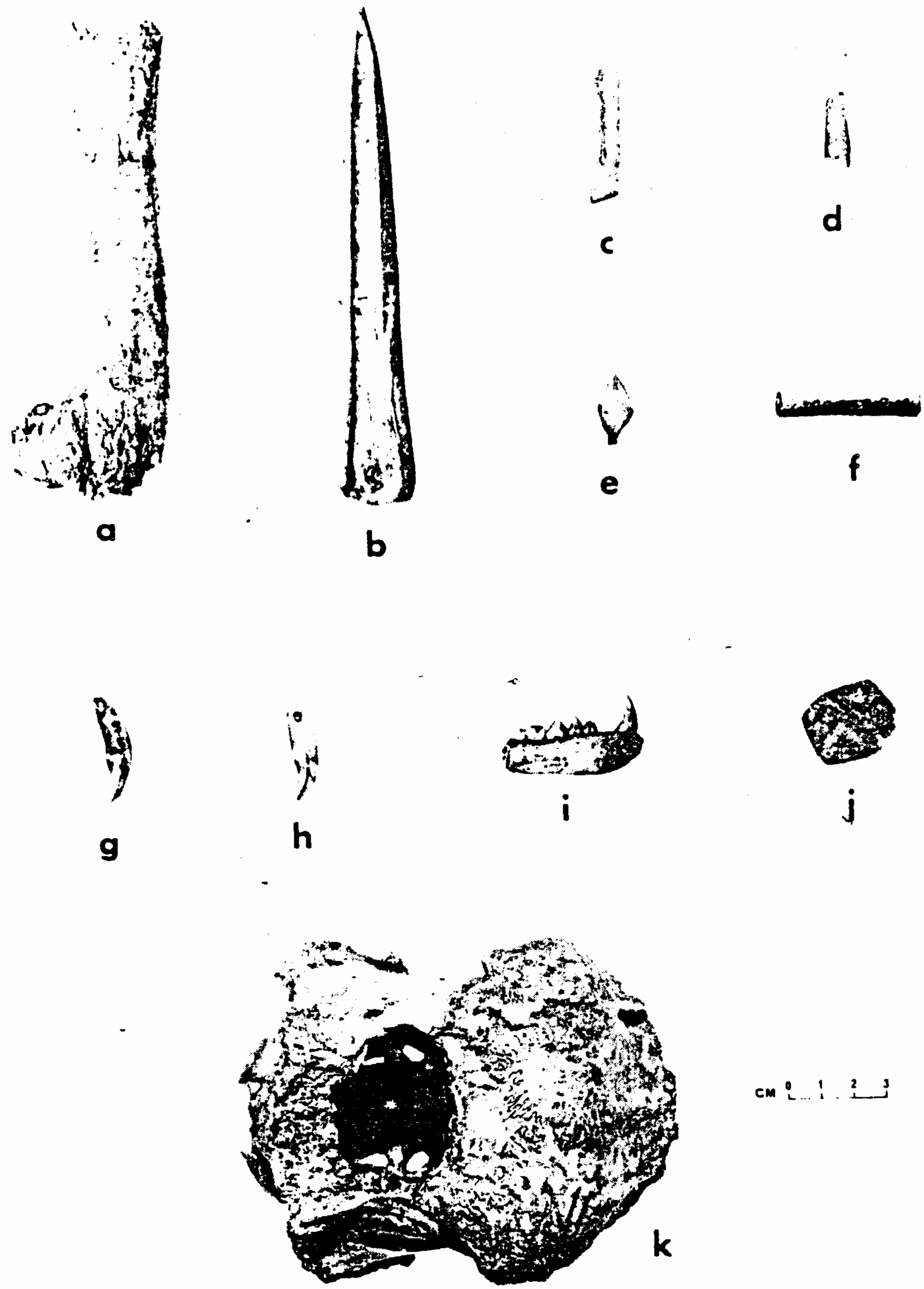


Figure 20-7. Bone artifacts, Zebree site. a. deer humerus scraper; b. perforated awl; c. unfinished fishhook; d bone chisel; e. gar scale point; f. bead; g-h. canine pendants; i. cut raccoon jaw; j. cut skull section;. k. perforated deer skull.

example, the shattered end has considerable use polish and exhibits the hammerstone blows which give it a serrated edge. The other two examples were broken on the working edge. Slight use polish exists on parts of the splintered "proximal" end (of the original bone). These scrapers probably were used as fleshers (George Frison, University of Wyoming, personal communication).

Scrapers

Eight (plus a ninth discussed under "Splintered Bone Awls") scrapers made on splintered bone are mostly deer humeri, with deer metatarsals being the next bone favored (Fig. 20-8s-t). Most have extensively retouched edges plus polish from use; the others have a minimum of lateral retouch with polish indicating that advantage is being taken of a natural thinned edge. The naturally thin humerus may not need chipping if it breaks just right when splintered. These scrapers vary between 57 and 125 mm long. Variation in size would seem to depend on the independent needs of the user and the choice of splinters. Presumably these are skin preparation tools or fleshers.

A distal deer tibia has broken bifacially and seems to have been used very briefly. A burned, split mammal femur midsection has use polish along one longitudinal broken side. It measures 31 x 22 x 12 mm. A small, thin mammal bone splinter has a 4 mm wide highly polished tip. Two short, thick deer long bone splinters have crude rounded ends showing considerable use polish. A third artifact is similar except that all surfaces were abraded. It measures 24 x 20 x 8 mm. These artifacts seem to reinforce the individuality of the scraper classes. An antler tine measuring 60 mm long has a beveled tip as if modified with a flat abrader; however, the only finishing striations observable are near the snapped end. The tip does have a worn, polished appearance and this might be a skin working tool.

Awls

A total of 15 complete or almost complete awls were made from appropriate splintered mammal long bones (in most cases, obviously deer). There are several varieties of splinter awls. Three awls are made from splinters still retaining a split section of the long bone end: the craftsmen had begun to split a deer metatarsal, but only made very shallow grooves lengthwise on the opposite sides before it broke (Fig. 20-8e). The broken end was a natural point and this tip has use polish. Another two are made from the battered distal portion of an adult and an immature deer humerus. The first has a well ground point and shank and the latter has just the bare minimum of grinding required to cause it to be classified as an awl.

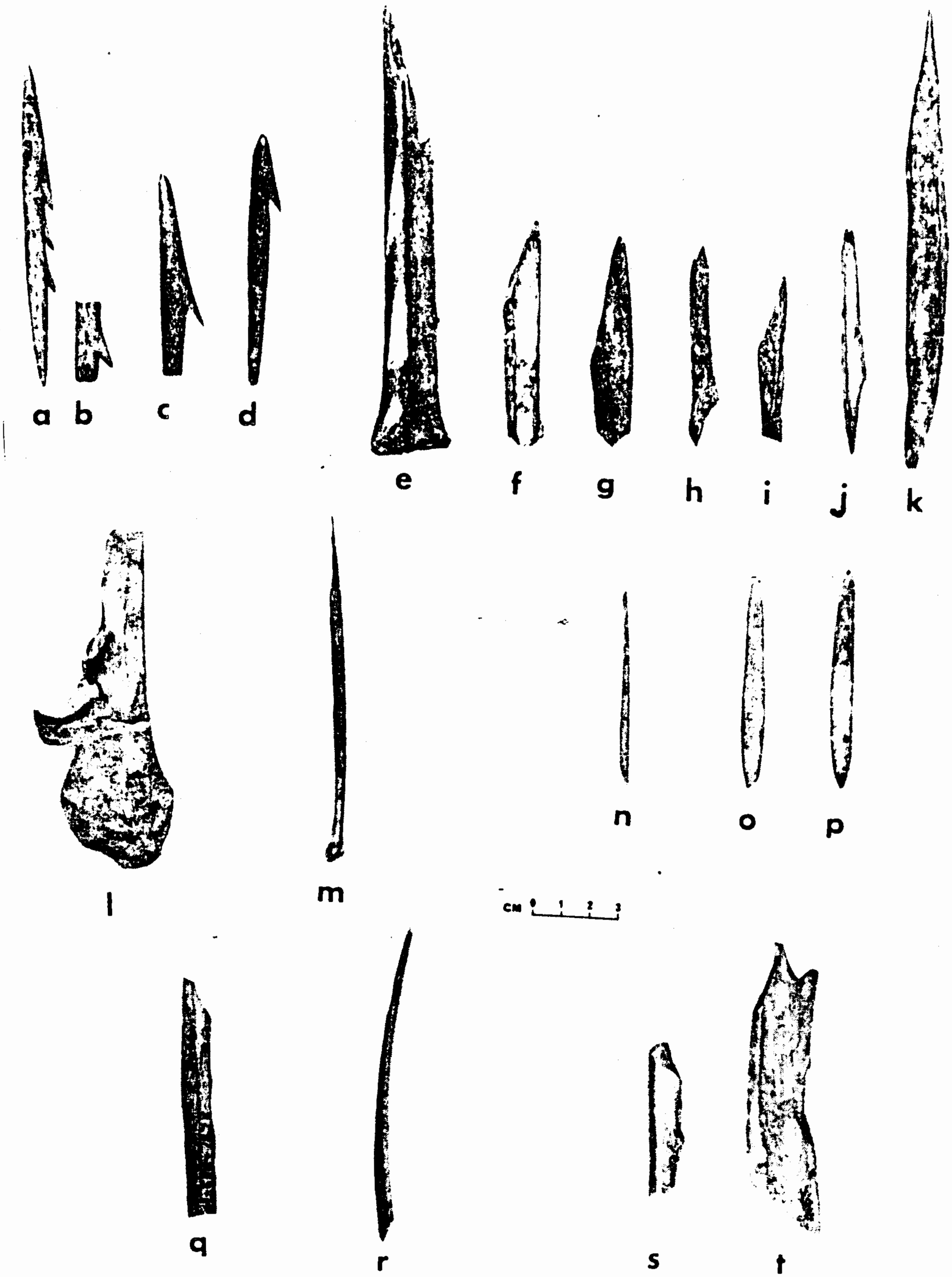


Figure 20-8. Bone artifacts. Zebree site. a-d. harpoons; e-k. splintered bone awls; l. deer ulna awl; m. bird bone awl; n. unperforated needle-awl; o-p. bipointed awls; q. unfinished bipointed awl; r. deer rib scraper; s-t. splintered bone scrapers.

The remainder are made of splinters from the long-bone shaft (Fig 20-8f-i). Nine are very crude. At least four are made of deer metatarsal splinters and one from a humerus. They are ground just enough to have a crude tip, although one has been completely retouched along one edge and apparently had a dual function as a perforator and side scraper. They vary between 50 and 100 mm in length.

Two splintered bone awls measure, respectively, 58 x 15 x 7 mm and 85 x 9 x 3 mm and are long and narrow, with long sharp tips (Fig. 20-8j-k). An additional awl is made on a splinter apparently resulting from trying to snap a long bone which had been grooved to make a bone bead. All 15 of these awls probably were made by using grooved sherd abraders since they fit the grooves almost perfectly.

Three deer ulna include two from immature deer based on the absence of epiphyseal closure of the proximal ulna. Both have been cleaned as inferred from abrader or side scraper striations but it appears that the point broke off before each awl could be completed. The third specimen was a finished awl before the point broke away (Fig. 20-8l). This end broke or was broken bifacially and there is a very slight polish indicating a short-lived existence as a scraping tool.

Two thin bird long bones were made into awls. The rounded point of one measuring 120 x 10 x 5 mm (Fig. 20-8m) was made on a shaft measuring less than 4 mm in diameter.

Two needle-like awls were recovered. One is but a small broken tip measuring 2 mm in diameter. The other specimen is complete and measures 67 mm long and 4 mm wide (Fig. 20-8n). The area above the tip is only 2 mm in diameter. It is apparently made from the distal portion of a mammal ulna and has been modified considerably. This awl is not perforated for use as a needle. Five awl tips are made of mammal long bones and broke off of well-made awls. An additional six midsections from carefully made mammal bone awls were also found.

Salt Pan scraper

One nearly complete and three proximal and two distal spud-shaped pottery objects were collected (Figs. 20-9 and 20-10n-r). A distal and proximal end probably are part of a single specimen.

Two proximal ends are battered, three distal ends are rounded, while one has multiple punctures on a pounded surface. The complete specimen has a 46 mm wide battered proximal end and measures 70 mm long and 20 mm in diameter. The broken proximal end without battering measures 32 x 26 x 12 mm. The battered third proximal end measures 42 x 37 x 17 mm.

The nearly complete one measures 78 x 52 x 19 mm, is red slipped, has two 2 mm perforations (Fig. 20-9) and is made of Neeley's Ferry Plain paste. Wear is present on the end of the "handle", on one "shoulder" and along the distal working edge. This latter area is polished to a certain extent from use. The best guess concerning function for these items is to scrape salt from pans after the water (Chapter 15, 18) has evaporated.

Pottery Industry

This section complements Chapter 18. There the behavior is discussed, some of the related artifacts described and a mention made of all artifacts expected to be present in conjunction with the reconstructed ceramic technology.

Scrapers

One mussel shell valve exhibits possible edge abrasion such as that expected from scraping pottery vessels. If held in the right hand, the hinge would be between the thumb and forefinger and the shell drawn toward the potter who presumably held the vessel in her left hand.

A broken deer rib (113 x 19 x 6 mm) is highly polished along the thin edge of the rib for 45 mm, where it apparently was broken while being excavated (Fig. 20-8r). This may be a skin working tool, but would have served very ably as a scraper used to smooth the surface of relatively large pottery vessels.

Beneath a large sphere of unfired shell-tempered pottery clay in a storage pit (F56) was a crushed deer antler (Fig. 20-4d). When it was restored, a possible pottery tool emerged. The base has been badly broken by hammerstone (and axe or chopper?) blows, probably to detach it from the skull. Both a tine and the main branch just below the tine were similarly removed. The broken edge of this latter main branch was apparently evened and smoothed for use as a pottery trowel. It measures 205 x 55 x 37 mm.

Paint palette

An irregularly oval-shaped, flat waterworn pebble of light gray sandstone probably was a paint palette (Fig. 20-1r). Both surfaces have been abraded and exhibit numerous fine scratches. A red stain is on all of one surface and part of the other. There can be little doubt that this stone was used as a paint palette. It measures

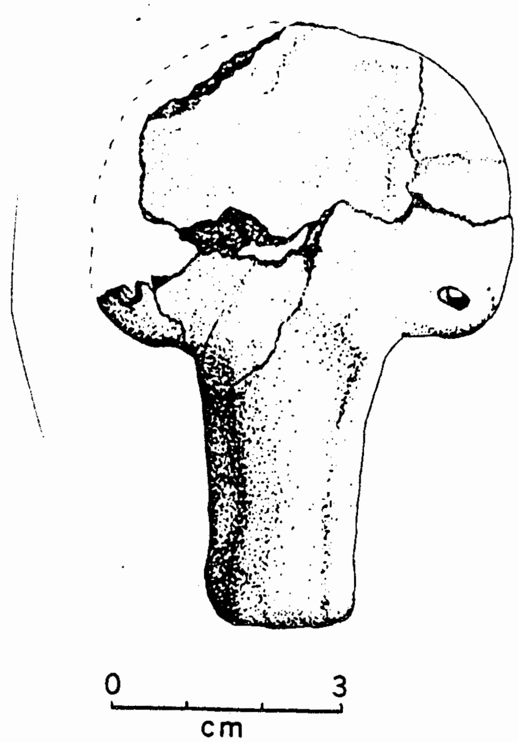


Figure 20-9. Small ceramic "spud-like" object, entirely red slipped, with two perforations, from Big Lake phase pit.

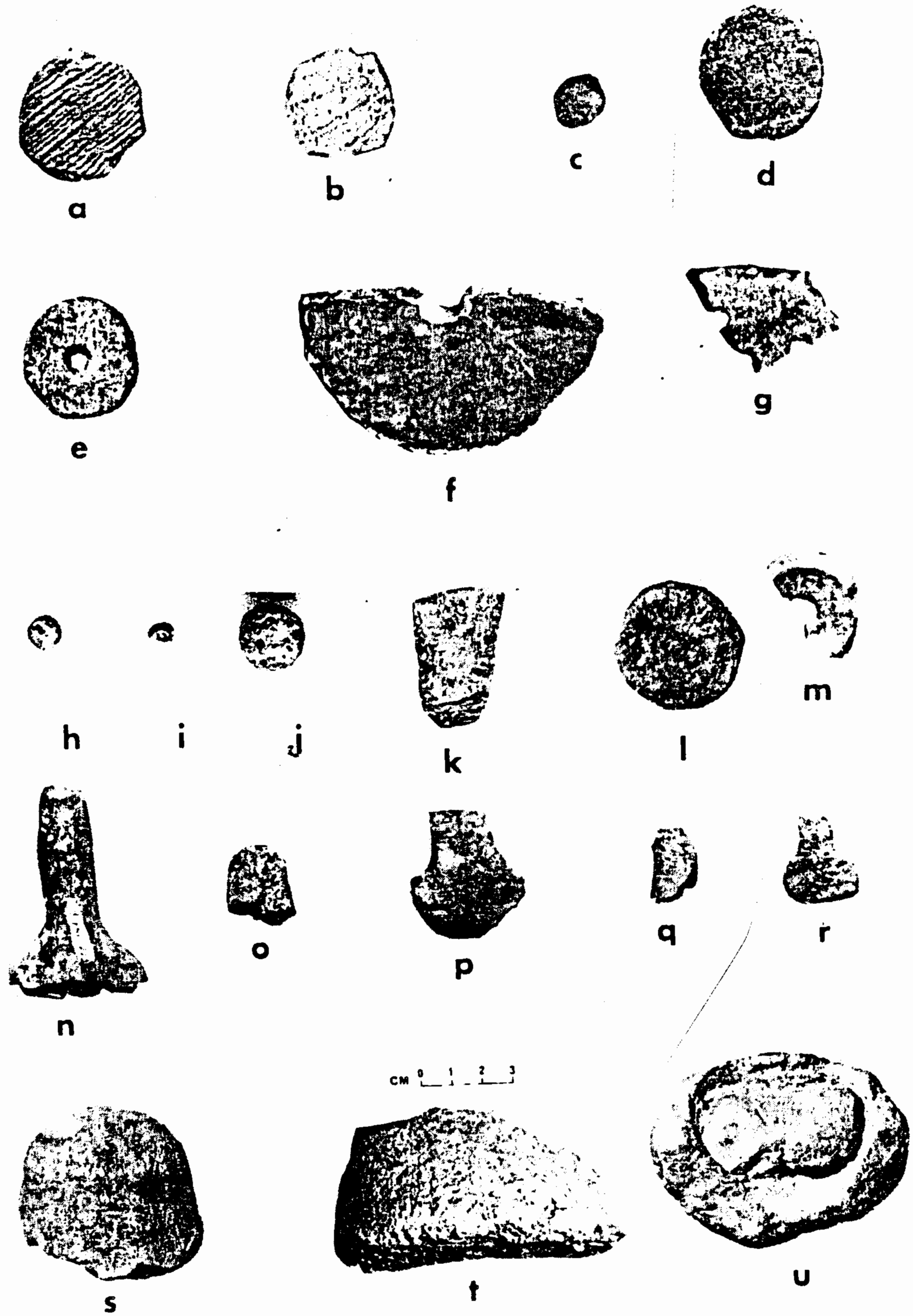


Figure 20-10. Miscellaneous pottery objects, Big Lake phase. a-d. unperforated discs; e-f. perforated discs; g. multiple perforated disc; h-j. beads; k. elbow pipe sherd; l. biconcave discoidal; m. perforated biconcave discoidal; n-r. 'keys'; s-t. cones; u. Kersey plug.

73 x 49 x 8 mm. The red stain is hematite and was probably used in the manufacture of Varney Red Filmed vessels. Paint found at Zebree is discussed in Chapter 18.

Pottery Polishing Pebbles

Nine polishing stones range widely in shape (Fig. 20-1g-j). Their identification is based on two physical attributes. All are relatively small, so that they can easily be held by the fingers of one hand, and each has at least one polished facet. These stones are described as follows:

Both surfaces of a flat fragment of ironstone have been smoothed and the longest side and adjacent edges are ground. It measures 64 x 29 x 11 mm.

The long edges of the broken end of a half of a flat, oval pebble made of basalt are ground from use. It measures 32 x 30 x 8 mm thick. Another half of a broken flat, oval basalt pebble is ground flat from use on the rounded end opposite the break. The break may have caused the pebble to be discarded. It measures 45 x 25 x 9 mm and exhibits beveling and wear on two long edges. It also has a break in one corner which may have caused its discarding.

An irregular gray chert pebble with a flat, ground surface measures 44 x 16 x 15 mm. A tan quartzite pebble (82 x 22 x 17 mm) is triangular in cross section with each edge heavily smoothed from use. Also each face has been at least lightly smoothed. A spherical quartzite pebble measuring 32 x 30 x 19 mm has battered edges and a single polished face. Two irregularly rectangular quartzite or chert pebbles measure 42 x 30 x 17 and 36 x 22 x 18 mm. Polished faces and adjacent edge corners are characteristic. One is broken but this would not seem to interfere with its use.

At site 3MS25 in 1968 we found a rectangular-shaped pebble with very heavily ground sides. No two of these stones are alike. Quite possibly we have found the stones which were discarded, perhaps because they were not very comfortable, serviceable, or for some other reason. Certainly we do not expect polishing stones to "wear out" except in the sense of becoming too sharp to keep from digging into the vessel side. The use of the pebble edge is interesting since later polishing stones (in the Nodena and Parkin phase, for instance) are typically flat chert or quartzite pebbles polished on both faces. Striations on the Zebree artifacts indicate that the edge-ground flat pebbles are being pushed with the long axis and that those with smoothed faces are being pushed in a single direction. Both can be matched with polishing grooves on Varney Red Filmed sherds.

Anvils

Two fragments of pottery anvils were recovered. Both are from large, mushroom-shaped objects and are parts of the disc portion which measured slightly over 100 mm in diameter. They are made with Neeley's Ferry Plain paste and would have been used to help construct large jars (Chapter 18).

Byproducts

Squeezes, coil sections, pinches of excess clay, and even a large sphere of processed clay constitute the shell-tempered by-products. In addition, untempered but processed clay occurs and undoubtedly one or more of the recognized shell clusters could have been meant to provide temper. This is all described in Chapter 18.

Spacers

Pottery objects thought to have been used to support large jars off the ground during firing are described in Chapter 18.

Agricultural Activity

The preserved remnants of hoes and spades are described in this section. Heavy cutting tools suitable for clearing land are included in the woodworking section. Identifiable digging sticks are not preserved in the deposits, although this probably has been a basic tool for a long period prior to Mississippian (Morse 1968); the careful examination of feature sides did not reveal tool marks. Storage of seeds may have been in hooded or gourd effigy bottles described in Chapter 18. Storage pits, probably for corn grain, are described in Chapter 21. Ceramic objects probably associated with these last two traits are discussed here since they do not properly constitute kitchen activity.

Hoes

Thirteen hoes were found made of the valves of mussel shells *Crenodonta peruviana* (Lamarck), possibly *Proptera purpurator* (Lamarck); and possibly *Lampsilis* (Fig. 20-4 e-g). The complete hoes range between 60 and 83 mm long and tend to be about 60 mm wide. The bits are battered, in many cases until there is a straight edge. The holes vary between 10 x 13 mm and 21 x 17 mm. The mean size is 13 x 16 mm. These holes appear to have been made by punching, mainly from the exterior surface. Experimentation demonstrated that this is a quick and efficient means of making a hole. The valve is laid flat with the dorsal face up. A punch is set centrally, slightly toward the hinge and struck with a mallet. Fresh shell is hard and experimental use of a replicated mussel shell hoe indicated its effectiveness.

A much more efficient hoe, however, is made of stone. The association of large stone hoes with initial Mississippi is important from two standpoints. First, it represents a real technological advance. Earlier apparent stone grubbing hoes occur in Illinois Hopewell,(personal observation)but these are small and made of normal strength cherts such as Burlington. The Mississippian stone hoe is large, up to 35 cm and longer, and wide, up to 20 cm. It is made most usually of Mill Creek chert which is probably the hardest chert available in the Valley (Francois Bordes, personal communication). It also outcrops as large flat boulders suitable for chipping into large hoes or spades. At Zebree, a total of 35 chips (mostly flakes of bifacial retouch) were recovered which exhibit "polish" and match our Mill Creek chert sample (Fig. 20-11 m-o). They undoubtedly were detached from hoes or spades. The "polish" actually is a silica from a vegetable source (Witthoff 1967), possibly corn stalks. Retouching might renew the cutting edge rounded by the silica and gouged by sand grains in the soil, but most retouch appears to function to repair broken edges or to recycle a broken hoe into other tools. In the Zebree assemblage, a biface (preform ?) was made of a hoe fragment. Two chips indicate thermal treatment but in both cases, the dull ventral surface signifies that the chips were burned after detachment, probably accidentally.

Eight similar chips from hoes or spades made of Dover Chert were also recovered (Fig. 20-11 k-1). All eight are from shallow deposits in the vicinity of the Lawhorn phase hamlet and none may actually be part of the Big Lake phase material culture. Dover chert does become relatively prominent during the Lawhorn phase period but to date has not occurred in the valley in an earlier context.

Clay seals

A total of eight vessel plugs called "Kersey Clay Objects" by Marshall (1965: Fig. 47) were found (Fig. 20-10 u). Seven have the oval imprint of a hooded bottle on one surface while one does not have such an imprint. All probably were accidentally burned. The use of similar objects as plugs is dramatically shown by a plugged bottle found at the Bradley Place (Moore 1911: Fig. 45). The plugs are made of untempered pottery clay. Presumably they function basically to guard stored corn seed against insect damage, and to allow CO_2 respiration for preservation of the germination qualities of the seed.

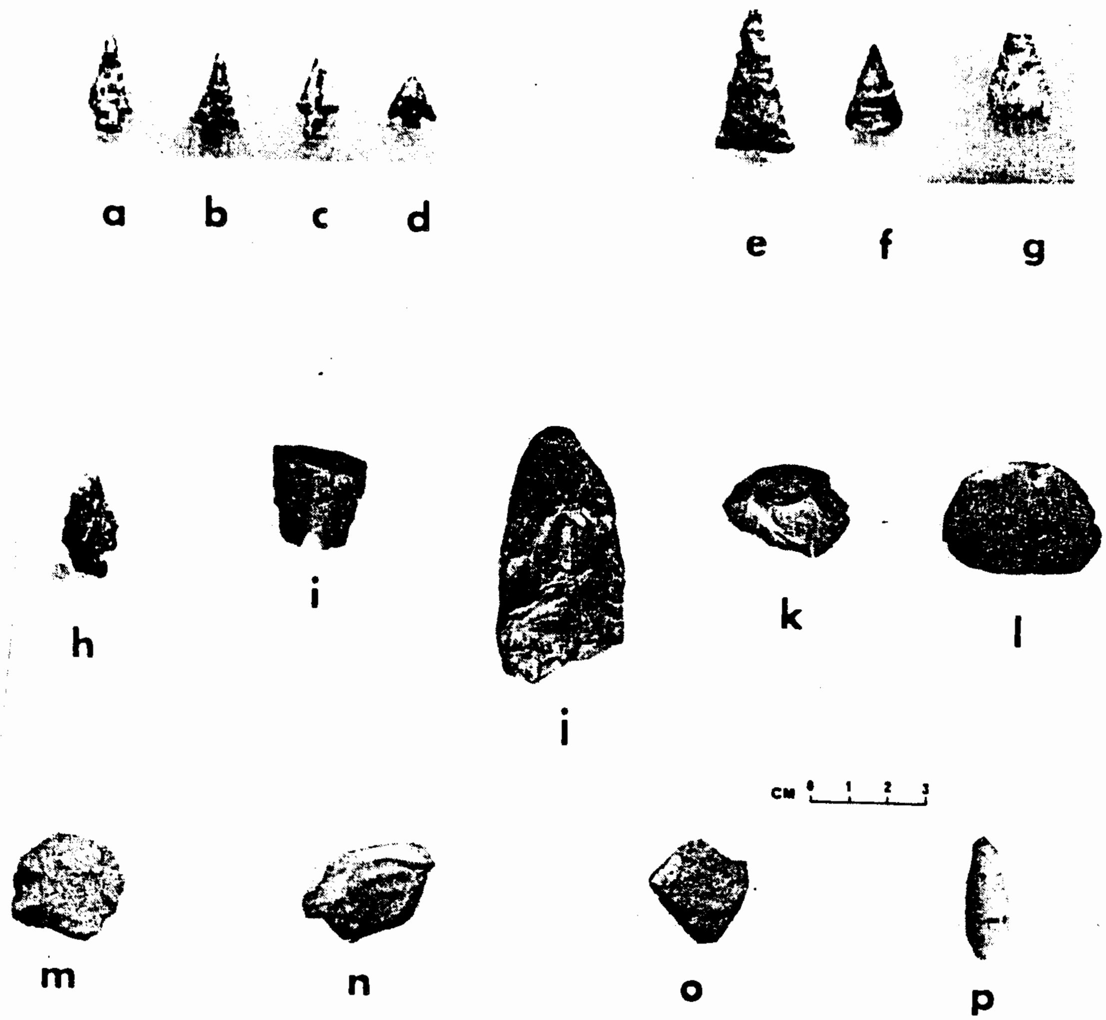


Figure 20-11. Bifaces and polished flakes, Big Lake phase. a-d Sequoyah points; e-g. Madison points; h. Haskell (?) point; i. chisel bit; j. unfinished chisel; k-l. Dover chert spade chips; m-o. Mill Creek chert spade chips; p. Illinois Koalin chert chip.

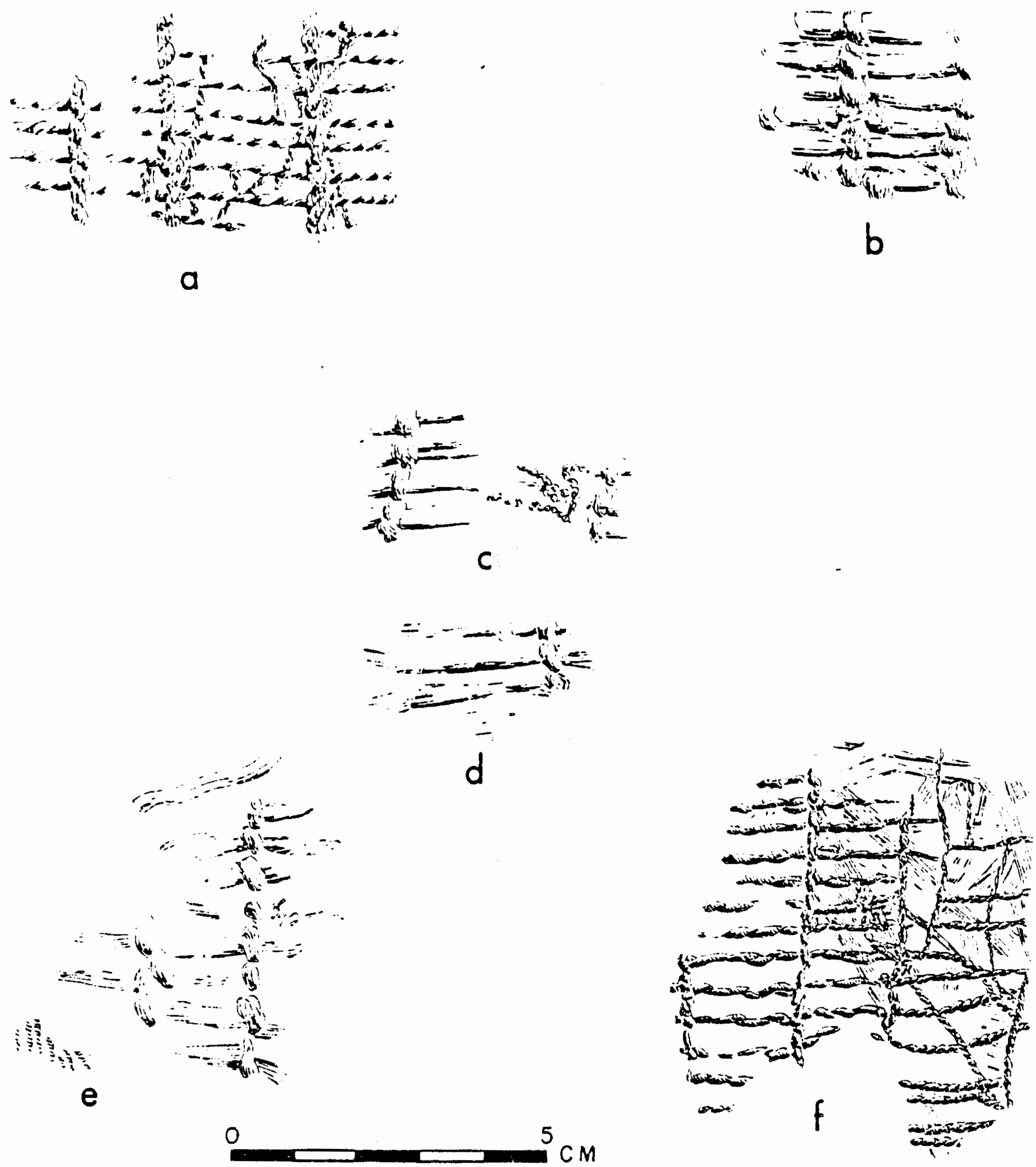


Figure 20-12. Drawings of textile impressionson clay lumps or sherds, Zebree site. a,f. net impressions; b-e. mat impressions.

Clay was apparently also pressed upon a fabric or grass lining covering storage pits. This explains the high incidence of accidentally burned clay with grass, mat, fabric, net and cordage impressions.

Several specimens have grass or split cane impressions on one surface, but ten exhibit the impressions of a woven mat (Fig. 20-12 b-e). The fibers involved are coarse and untwisted. Bunches of grass seem to be the major components. A narrow bunch is looped around successive wefts of larger bunches. The fibers do not look like split cane.

Thirteen examples with clear impressions of nets were recovered as well (Fig. 20-12 a, f).

Other fabrics include very indistinct cloth impressions which appear to be a simple twined, coarse close weave. String impressions are present in a few cases but no other weave patterns were discernable.

Hunting

Evidence of individual hunting exists in the form of arrow points suitable for the largest mammal available in the Big Lake phase region, the White-tailed deer. Traps no doubt were used but there is no recognized direct evidence present. It may be possible some day to estimate how many of a certain species such as deer might have been successfully killed based on our random sample. Problems exist in the sampling design but we still have no effective method to gauge the relative importance of hunting to the Big Lake phase in relation to the Barnes economy. There seems to be little doubt that human predation is insignificant to the deer population (Smith 1974). The enormous numbers of ducks and geese seasonably available at Big Lake were undoubtedly effectively exploited by the hunters there.

Arrow points

A total of 11 small Sequoyah points were found (Fig. 20-11 a-d). Except for a slightly less bulbous stem on some examples, due perhaps to retaining the striking platform of the core on untrimmed bases, they conform very well to the description in Perino (1968:88-89). They are made on thin flakes with minimum edge retouch to create a serrated, corner-notched point. Most are 20-30 mm long; one is only 13 mm long. Width ranges between 11 and 15 mm and thickness is from 3 to 4 mm. There are four to five serrations per centimeter. Most are made on gray tan and mottled red Crowley's Ridge-like chert, one may be made on Crescent Quarry chert, and one is made on unidentified good quality gray chert.

One is thermally treated. Three are missing bases and one is represented by a shoulder. These points are barbed and designed to inflict pain and to break before being forced out. The broken examples indicate that that particular game was brought to the site for butchering. One complete point was found in the upper-most level of Feature 249, a radiocarbon dated Barnes feature. This plus a very few Big Lake phase sherds probably represent slight mixture at the very top of the pit. The radiocarbon sample was obtained from below this upper level.

Three larger corner-notched, unserrated "scallorn" points also were found (Suhm and Jelks 1962: 287). The only complete specimen measures 44 x 16 x 5 mm. All three are made from a tan chert and at least one and probably several were thermally altered. One is missing its basal tang.

Madison point. Four Madison points conform to the description in Perino (1968: 52-53), although considerable variation exists both in Perino's description and within the Zebree assemblage (Fig. 20-11 e-g). Size varies from 23 x 14 x 3 mm to 37 x 22 x 6 mm. All are bifacially retouched to the extent that only one retains a small portion of the original blank flake. All four are made of chert which is available in the gravels of Crowley's Ridge and in the Ozark Highlands.

Haskell points. A single point fits Perino's description (1968:32-33) of the Haskell point (Fig. 20-11 h). It measures 28 x 15 x 4 mm. Burned to the extent of a color change but before thermal fracture occurred, it has been rechipped into a drill. Burning took place after the tool was discarded. The 3 x 4 mm tip is well polished and grinding extends 12 mm laterally from the tip. Flake scars at the tip appear to be smoothed from use as a drill.

Any of the point types described above may contain Lawhorn phase examples since all are known from Lawhorn period sites.

Arrowshafts probably were made of cane. At site 3MS10, a layman collector found fragments of a charred bow and arrowshafts, the latter made of cane. Burned cane was recovered from the Zebree site and even a large plug obviously pulled from the open cut end of a cane turned up.

Several hundred gar scales were collected at Zebree but only one is definitely modified for use as a stemmed projectile point (Fig. 20-7 e). A lateral tang has been detached and the remaining one notched. It measures 22 x 12 x 2 mm. Gar scale points might have been used for hunting or fishing.

Knives

Kniyes for butchering were essential. No good complete biface was recognized as a hunting knife. Flakes of bifacial retouch are in the debitage collection and possible aborted preforms and small fragments exist. It is possible that naturally backed flakes were used for butchering meat. Biface knives might be more apt to be lost or broken at hunting camps. Hints at biface knives made of exotic chert and quartzite exist in later Mississippian phases but possible complete examples are only known from graves.

Fishing

Fishing was important to the Big Lake phase. Besides the artifacts discussed below which provide direct evidence of some of the methodology, several other techniques probably were employed. For instance, the log nét undoubtedly was utilized (Swanton 1946: 335).

Nets

Net impressions on clay were mentioned under the Agricultural section. Louis Gregoire interpreted the two specimens he drew as follows: One specimen (Fig. 20-12 a) was composed of simple 2-ply S-twist strands and replyed warp strands. Two warps are Z-twists and the other (to the left) is an S-twist strand. The other specimen (Fig. 20-12 f) is badly disintegrated in the upper right of the impression. On the left are 2-ply weft strands twisted into 2-ply warp strands. All are S-twist.

The extra strands on these two net impressions undoubtedly are for repair. In several places, knots are noticeable. Anyone who has fished in gar-infested waters will tell you that repairs have to be made often. The net openings measure around 5 x 20 mm. The kind of net represented probably is a seine. Fish caught by such a net would include small to medium-sized buffalo, gar, and catfish in backwater pools or lake sloughs cleared of tree debris. No recognized weights were collected, limiting the type of nets to those with pole or splint borders.

An eyed awl made from a deer metatarsal is well polished with a perforation at the butt end (Fig. 20-7b). It was probably used for making fishing nets. When found in the base of Feature 8, it was broken in half with the two fragments separated some 40-50 cm apart. The awl measures 149 x 25 x 9 mm. The perforation is 3 x 4 mm.

Fishhooks

A broken complete fishhook and a broken, unfinished fishhook were found (Fig. 20-7c). Typically, a section of long bone was cut (via the groove and snap method) to a rectangular shaped blank. In the unfinished specimen, a rectangular area was being cut out within the blank and the specimen broke during this step. Apparently, only one fishhook was made in contrast to the practice of some eastern United States artisans who created two hooks from a single blank. Another curiosity is the presence of the remnants of at least four drilled perforations. This is the first instance I have seen or heard of a hook being made by drilling a series of holes along the edge. Usually the center is cut out.

The broken complete fishhook has a 32 mm long point and was obviously intended for large fish. It could have been used on lines, either individually from tree branches or several hooks spaced on a single line. There is a possible broken fishhook preform in the collection. The split interior surface is ground flat.

Harpoons

A total of four barbed harpoons were recovered at the site (Fig. 20-8 a-d). Two are complete, one has the base broken away and one is represented by a mid-section. Three are single barbed and one is triple barbed. At least three are made of bone (probably deer metacarpal) and one may be made of deer antler. Provenience and metric data are summarized in Table 20-1.

Essentially the harpoon is a bi-pointed, barbed cylinder with a narrow shank which exhibits a slight swelling near the shank end. This latter characteristic would allow hafting into a cane near a joint.

The Zebree harpoons appear to have been made for a soft fleshed fish. The barbs flare outward as if to allow a greater area of grip. The triple-barbed harpoon is built to allow each barb toward the point a larger area to grip. If we can assume the manufacture of these tools is directly related to their function, then these harpoons probably were used to gig catfish, suckers (buffalo), and drum. Gar can be taken more successfully by a bow and arrow and bullfrogs are easily gigged by a double pronged fish spear.

Three harpoons are known to have been found at Cahokia. Jim Porter found a single barbed specimen (personal communication) and Perino found a single barbed specimen (Perino 1950: 60, page 62). Charles Bareis (personal communication) commented about a third Cahokia specimen as follows:

Table 20-1. Barbed harpoons from the Zebree site.

Catalog No.	Provenience	Maximum Width (mm.)		Maximum Length (mm.)				Comments
		At Barb	Below Barb	Specimen	Shank	Tip	Barb	
69-656-1557	Feature 91	11.0	9.0	109.4	34.0	47.6	7.0	3 barbs, complete (Fig. 20-8a)
69-656-2328	Square 80R6	13.0	9.0	28.0	9.0	17.0	6.6	single barb, mid-section (Fig. 20-8b)
69-656-1405	Feature 80	15.0	9.0	68.0	23.0	45.0	8.0	single barb shank broken (Fig. 20-8c)
69-656-1682	Feature 123	11.4	8.0	83.0	62.0	21.0	6.0	single barb complet (Fig. 20-8d)

> A barbed harpoon was recovered from the large garbage pit beneath Mound 51 at Cahokia about 1965. . . . recent radiocarbon dates on nuts from the pre-mound pit have dated the pit roughly between 1000 to 1100 A.D. I feel the pottery is associated with the Early Cahokia or pre-Old Village context. This is essentially an Early Mississippi assemblage.

More recently a cache of harpoons was discovered in Mound 72 at Cahokia (Melvin Fowler, personal communication). This dates harpoons at Cahokia fairly securely with the Fairmount phase.

Three bi-pointed "awls" are made of deer metatarsal midsections (Fig. 20-8 o-p). These are often called "fish gorges" but actually may have functioned as a projectile point in a fish spear. Culin (1907:315) pictures similar artifacts as used in a guessing game. They measure 70-76 x 7-8 x 5-7 mm. Near one end of each is a 1-2 mm bulge which would allow hafting in a cane staff.

Two additional partially worked metatarsal midshaft splinters probably were being made into bipointed awls (Fig. 20-8 q). They measure 77 x 7 x 6 mm and 81 x 11 x 9 mm. The latter specimen has been chipped and battered along one entire side. Its surfaces are covered by series of striations which appear to have been caused by a flat abrader.

Trade

Trade in the central Midwest area at the beginning of Mississippian culture involved three major recognized items: Mill Creek chert spades (and other styles), conch shells (and beads), and *Anculosa* shell. All three occur at Zebree with the advent of the Big Lake phase. *Anculosa* is probably native to the Ohio River (Baker 1941). Mill Creek chert is native to a specific location in southern Illinois north of the Cairo Lowlands. Conch shells are native to the Gulf of Mexico and most available from between Panama City and Tampa, Florida. Cahokia may be a central center to which and out of which conch shell and Mill Creek chert flowed. *Anculosa* could be somewhat more important in the northern alluvial valley than at Cahokia or elsewhere, since *Anculosa* has not been mentioned as prominently in the general literature.

From the vicinity of the Mill Creek workshops also come Illinois Novaculite or Kaolin chert and Dongola chert. These occur at Zebree in Big Lake phase deposits but Dongola is only represented by one specimen and Illinois Novaculite is even rarer than Mill Creek chert. Other apparent exotic cherts are present but to date no pattern apart from that involving Mill Creek chert has emerged.

Ozark chert, granites, sandstones, limestones, lead, hematite, and other resources such as an occasional turkey, or the slab of oolitic limestone found in Feature 337, are available to the Big Lake phase for direct exploitation if they do indeed politically control the St. Francis River from around Marked Tree upriver to the headwaters near where all of these items outcrop. This river also allows direct access to the Crescent Quarries, so basic to the Microlithic Industry. The overriding theme in all aspects of the Big Lake phase material culture is tied into the river. Yet ties to Hoecake must have persisted and even allowed a backup support for its frontier existence. Trade for the exotic may have been important, perhaps crucial, for back up from the direction of Hoecake and the reinforcing tie into Cahokia *via* the St. Francis. The Mill Creek chert was technologically important and was used domestically. Shells made into shell beads were more important socially and possibly are flowing through Zebree to Barnes groups to keep the peace, to provide a frontier buffer zone, and to obtain Crowley Ridge resources such as chert and quartzite.

Recreational Activities

Games must have been a large part of life for the Big Lake phase based on the number of artifacts interpreted as gaming devices. No doubt, many items discussed in other sections functioned more for recreational pursuits. Artifacts such as toy vessels obviously are recreational. Oddly, the cup and pin game (Morse and Morse 1963) is absent, based on a lack of recognizable components of that particular popular game.

Pottery discs

A total of 64 discs made from potsherds were recovered. Of these 53 are unperforated (Fig. 20-10 a-d). Varney Red Filmed pottery was favored, with 35 discs. There were also 12 made from Neeley's Ferry Plain sherds, six made from Barnes Cord Marked, and two made on Wickliffe Incised sherds. Nine discs are biconically perforated (Fig. 20-10 e-f) and one is incompletely perforated. All these are made on Varney Red Filmed. Another broken fragment of a Neeley's Ferry Plain disc could not be identified as to whether it was perforated or not. These discs might have been used in a sort of toss-type game similar to a local modern game of tossing washers into holes. However, there are other more probable functions for pottery discs based on ethnographic sources. Culin describes the basics and varieties of disc games found amoung Indians in the ethnographic present. He indicates the following items used in the dice game:

> The essential elements consist, first, of the dice, and, second, of the instruments for keeping count. The dice, with minor exceptions, have two faces, distinguished by colors or markings and are of a great variety of materials - split canes, wooden staves or blocks, bone staves, beaver and woodchuck teeth, walnut shells, peach and plum stones, grains of corn, and bone, shell and pottery discs (Culin 1907:45).

He also indicates a number of guessing games played by Indians, the most pertinent here being the stick game. Discs were used instead of sticks only near the Pacific coast (Culin 1907:227), but I think the discs in northeast Arkansas are most apt to have been used in a guessing game.

> The number of sticks or disks varies from ten to more than a hundred, there being no constant number. The first operation in the game, that of dividing the sticks or disks into two bundles, is invariably the same. The object is to guess the location of an odd or a particularly marked stick (Culin 1907:227).

In the late Mississippi Nodena phase, bone dice made of deer astragali occur as well as pottery discs (Morse 1973). This may indicate that at this time period the discs did not function as dice. Perforated discs are also very rarely found in relation to unperforated discs on Nodena phase sites. In fact, at 3MS65 only two of 32 pottery discs are perforated. Use in a guessing game would seem to be the most logical function of these discs, at least based on ethnographic analogy. Another interesting function of a gaming disc pointed out by Culin (1907:381) is to flip one to decide which of two sides of players plays first - a sort of "coin" toss. Discs made on Varney Red Filmed pottery would be particularly useful here.

Size of measurable discs varies between 19 and 103 mm in diameter with a mean of 45 mm. A number of other possible disc fragments were observed in the body sherd collection but we openly separated definite discs from other pottery for this discussion.

Discoidals

A ground stone discoidal was found in Feature 59 (Fig. 20-1 a). It measures 62 x 61 x 40 mm. It is a thick disc with flattened ends and a convex side. A small (17 and 12 mm in diameter and 2 mm deep) depression is present in the center of each flattened surface. The material is tan sandstone which has been burned.

An almost identical discoidal was found at 3MS25 in 1968. In Illinois similar artifacts are called "Jersey Bluff discoidals"

(Perino 1971:112-115) but there has been no formal attempts to verify the apparent late Woodland association there. At Big Lake, the association appears to be clearly with the initial Mississippi occupation and presumably, along with the pottery discoidals, is an indication of the chunky game (Culin 1907).

Part of a possibly very large hard limestone discoidal was found in 1976 at Zebree. The fragment is quite small relative to the usual discoidal size if it is part of a discoidal. The only unbroken surface is convex but does not include any edges.

A total of 15 clay discoidals are represented (Fig. 20-13). They are very similar to pottery discoidals found in a late Woodland context at the "Discoidal Hill site" in Calhoun County and at the Jersey Bluff Nutwood site in Jersey County, Illinois (personal observation). In contrast to the Illinois specimens, these appear to be associated with early Mississippi, do not have "x's" incised within the concavities and include some very nice examples. A similar, although smaller, pottery discoidal was found in northwest Florida (Morse, Morse, and Morse 1973) in an apparent early context and indicate a wide geographical spread.

The Zebree specimens range from very crude to very carefully made. Three are flat discs similar to those made on sherds but these were manufactured as discs. Two are perforated. All three measure around 40 mm in diameter and 11-12 mm thick. The two perforations are 3 and 6 mm in diameter. Two other discoidals are thicker (16-18 mm) but about the same diameter and are crudely biconcave. A third is smaller (30 x 35 mm) and thicker (24 mm) but made essentially the same. Another, made on a Neeley's Ferry Plain paste, is 55 mm in diameter, 20 mm thick and better shaped, with two slight 10 mm in diameter dimples on each face.

The eigth discoidal is well made. It measures 36 mm in diameter and 21-22 mm thick. The sides are evenly convex and the faces are evenly biconcave. It is made on a Neeley's Ferry Plain paste.

The remaining seven discoidals are relatively thick (18-26 mm), small (42-46 mm), and have biconical perforations punched from flat to concave faces. The edges are flat or convex. With one Neeley's Ferry Plain paste specimen there seems to be no deliberate tempering of the clay, with the possible exception of one sandy paste. All are relatively carefully made. They look more like wheels than discoidals. The biconical central perforations were 6 mm and about 10 mm in diameter. One specimen exhibits polish on the inside of the hole except in the center where there is the most constriction. These are not spindle whorls.

Religion

What appears to be a squared section of human skull was recovered (Fig. 20-7 j). It measures 27 x 23 x 7 mm and the sides are convex. Culin (1907) indicates that bone discs are used in guessing games. This may actually be a shaman's or priest's artifact. There is also the possibility that this is an inset and we have only part of the complete artifact.

Four possible bone teeth from scratchers or scarifiers are made apparently from bird long bone diaphyses. They range from 55 to 85 mm long, 6-10 mm wide and only 1-3 mm thick. Similar awl-like teeth have been found in comb-like sets with the teeth nested in line and have been interpreted as scarifiers.

Part of the bowl of a shell-tempered elbow pipe found (Fig. 20-10 k) was square, the complete side measuring 31 mm. Its lip is 5 mm wide and its maximum height, since the lip slopes considerably, is 44 mm. A small part of the base of the bowl of a large Neeley's Ferry Plain paste elbow pipe and a cylindrical rim of possibly large pipe was found. The latter is tempered with clay and some sand. A complete pipe apparently was found by a pothunter at the site in the spring of 1975.

Probably drums, rattles and possibly cane flutes were used. Two artifacts recovered may have been musical rasps (Bluhm and Liss 1961:115). One specimen has smoothed edges and three grooves spaced 15 and 17 mm apart. The other is a broken thin (bird?) long bone 20 mm long. It is grooved and snapped at both ends and has four additional grooves circling it. This may be either a musical rasp or a decorated bead. An irregular bone fragment is worn and scraped all over as if used as a charm. It measures 25 x 13 x 6 mm.

Ornamental Objects

Pendants, necklaces, ankle and arm bracelets, earrings, hairpins, and ear or lip plugs, tattooing and scarifying implements, and other items not recognized are ornamental. At Zebree, a larger percentage of artifacts were classified as ornamental than is expected of a village assemblage. Many of them seem very crude to us but finer examples may not have become part of the archeological deposits.

Beads

Twelve apparent beads made from clay were collected. Three have a sandy Barnes-like paste, three a slightly sandy paste and the remainder are basically untempered. All occur in a Big Lake phase context. They are roughly made, apparently hastily perforated and shaped into disc and spherical shapes for the most part. Complete ones weigh between 1.5 and 3 gms and usually measure about 11-13 mm in diameter with a 2-3 mm diameter perforation.

These could be substituted for shell beads for children or possibly are trade from Barnes. The lack of much whelk shell debris and beads at the site indicates the shell was being used up and the beads were flowing away from the community. What appeared to be sample error in 1969 seems less likely after the 1975 and 1976 seasons.

A single bead made from conch or whelk shell was found beside a cut strip of conch shell in Feature 13 (Fig. 20-4 k). The bead is 13 mm in diameter; in fact, there is only a 0.1 mm variation in the bead's diameter. It varies between 3.1 and 3.6 mm thick. The biconical perforation varies between 2.6 and 3.8 mm in diameter. This bead is identical to beads found at Cahokia (Titterington 1938: Fig. 32, bottom row).

A total of 10 cut long bones from small mammals and birds were found. These are presumably beads, although other possible functions are to hide sticks in a guessing game (Culin 1907). The range in length is from 13 to 44 mm. They are crudely grooved, sometimes with several striations, and snapped at the grooves (Fig.20-7 f).

A large number of gastropods were modified to be strung as beads (Fig. 20-4 j). These are *Anculosa* which have been ground flat in front to expose the inner whorls or have the apex of the spire ground down in addition to a perforation in the final body whorl. Both varieties of bead are found in early Mississippian contexts (AAS files 3PO52).

<u>Pendants</u>

Three "shell gorgets" were recovered (Fig. 20-4 i). Each is made from the valve of a mussel shell. One has the hinge region ground down and the ventral half cut away while the other two are unmodified except for two perforations. The gorgets measure around 50 mm x 25 mm. The two perforations measure 1-2 mm and 5 mm in diameter and are set 10 mm apart. All three would have hung with the long axis lateral to the string.

A sphere of light, porous pottery 23 mm in diameter has a series of connecting holes in one area which would allow it to be worn as a pendant (Fig. 20-10 j).

Two canines (raccoon?) were found perforated for suspension as beads or pendants (Fig. 20-7 g-h). They measure 31 and 34 mm long and have biconical perforations 2 mm in diameter near the proximal end of the root.

The left part of a raccoon mandible has been detached by grooving and snapping immediately behind the first molar (Fig. 20-7 i). The only teeth missing are the premolar and the incisors. The symphysis has been lightly ground. The careful and thorough cleaning, observable as scratches under a microscope, and the lack of graver-like wear on the canine tip suggest that this specimen is an ornament.

A clay "labret" was found as well. It is oval and measures 18 x 12 mm with a 3-4 mm wide and 1-2 mm deep central groove. This could be a bead or ear plug and not necessarily a lip ornament. It is carefully made and well fired.

Mica

One irregular-shaped thin chert of mica measuring about 20 cm square is in the Zebree Big Lake phase assemblage. It could have been used in a headdress.

Paint

Two hematite-based spheres the size of a medium-sized fist and other hematite possibilities are described in Chapter 18.

Red is represented by a triangular-shaped hematite cube with ground sides. It measures 24 x 18 x 12 mm. White could be derived from galena. Two cubes were recovered which measured 24 x 18 x 12 and 16 x 10 x 10 mm. A trapezoidal block of Kaolinite, measuring 20 x 17 x 12 mm had been ground on at least five sides. It could have been used as a paint filler or for white paint.

CHAPTER 21

THE BIG LAKE HOUSEHOLD AND THE COMMUNITY

Dan F. Morse

The subsistence-settlement patterning of Big Lake phase sites and features is investigated in this chapter. Specifically, we wish to examine house patterns and related features such as storage pits and burials making up the "household cluster" (Winter 1976). Next to be covered is the relationship of houses to each other concentrated as midden clusters and their overall patterning within the village. Big Lake phase villages do not stand alone; geographically contiguous sites form clusters which make up a community. These communities in turn cluster into a region or district, the Big Lake phase itself. Beyond the Zebree site and the Big Lake region are other contemporaneous phases participating in the beginnings of the Mississippian tradition within the northern Mississippi Alluvial Valley.

The Household

An archeological feature assemblage which is standard at village sites is the "household cluster" (Winter 1976). The basic features are one or more posthole patterns indicative of structures, pits probably used to store food and for other reasons, graves, possible hearths, and a debris scatter or midden. All of these features occurred at the Zebree site.

Houses

The individual houses at Zebree in the Big Lake phase are relatively small for Mississippi structures. Total floor space varies between 6.6 and 11.4 sq m for an average of around 8.5 sq m. Individual postholes vary between 6 and 8 cm in diameter and are spaced 20 to 30 cm apart. The pattern is rectangular with corner postholes present; one house pattern involved shallow wall foundation trenches. In one instance in Area B, possible indication of a 60 cm deep basin was found.

Orientation of the long axis of the exposed houses at Zebree was around 15° and 35° east of north and $55-60^{\circ}$ west of north. This orientation is only somewhat similar to the orientation of the long axis of the site which is around $50-60^{\circ}$ east of north. Presumably, houses were constructed to take full advantage of solar energy and it is possible that the doorway, thought to be located centrally in one long side, and the corner of the house were oriented toward the south to maximize the winter sun position and avoid the summer sun. Houses also should have been spaced so as to not shade another south facing wall. Variations in specific house orientation could be explained by presuming they were built at different times. The Zebree house is similar to what is called the "Bluff" type house at Cahokia (Warren Wittry, personal communication; Porter 1969:149, Fig. 63), which seems to be the earliest recognized house type in the Fairmount phase at the Cahokia site.

Houses similar to the Zebree structures occurred at the Hoecake site in Missouri. A total of 11 houses at Hoecake range between 6.8 and 12.8 sq m for an average of 9.2 sq m and are oriented usually with the long axis 15° to 30° east of north and 60° to 75° west of north (R. Williams 1974:68). The Hoecake house pattern is rectangular with larger posts tending to be in the corners and with no other apparent interior support posts. Postholes are immediately within a rectangular pit extending to 8-50 cm beneath sterile subsoil (2 to 5 "levels" beneath the surface). No floor debris or floor features were recognized and no interior hearths were found at Hoecake.

The amount of roofed living space varies with different cultures. A comparison of the log cabin with the typical three bedroom home of today is an obvious example. Ninety houses at the Snodgrass site in Missouri averaged around 22.3 sq m (Price 1973: 81). They ranged up to 43.9 sq m; one at the other end of the scale is reported as 1.9 sq m. Significantly, the 38 houses which together with the major courtyard were surrounded by a plastered wall as an inner village segment, averaged 30 sq m and the 52 other houses averaged 16.6 sq m (Price 1973:85, 87). Six of the inner ward houses are smaller than the overall average. Fifteen structures in the inner ward are larger than the mean for that ward. Some of the larger structures could be sodality buildings, and at least one could be a "temple." Whatever final interpretation is made about the Snodgrass site, it is apparent that the average house has increased in size between early (Zebree) and middle (Snodgrass) Mississippian times. Other period houses in Arkansas provide the same statistics. For instance, an apparent residence at 3CS118 measured 20.7 sq m, while an adjacent nonresidential outbuilding measured 16.6 sq m. At 3LW106, a house rebuilt twice increased from 17.6 to 33.6 sq m. The two complete Lawhorn phase houses at Zebree measured 21 and 21.3 sq m and a house at 3CG629 measured 42 sq m.

House size figures continue to be within this range later as well. At the Nodena site (Morse 1973d), a house was originally 27 sq m in size and was rebuilt so it was 32.5 sq m. The average of 12 Nodena phase houses at the Banks site is 23.4, with a range from 12.1 to 42.7 sq m (Perino 1966:19-32). This is also the approximate size range of Formative houses in Mesoamerica, 15-35 sq m (Flannery 1976:23).

If we were to accept Naroll's (1962) average of about 10 sq m of roofed area per person, we would have to conclude that one person lived in each house at Zebree during the Big Lake phase and two to four people in later Mississippian structures. It is much more reasonable to interpret each structure as a house lived in by a single nuclear family. It is apparent from historic records concerning early Euro-American occupation in the United States that enclosed spatial needs is a cultural phenomenon. We have changed from having up to three families within a single room structure (Leslie Abernathy, personal communication) to the standard 1200-1600 sq ft three bedroom structures constructed today.

There are several house patterns present at each midden cluster within the Zebree site. In some cases, these undoubtedly represent the decay of an old house and the construction of a new house by a single nuclear family through time. But, for the most part, these houses are interpreted by us as occupied by closely related nuclear families living near each other. The midden cluster then is interpreted as a lineage habitation. This interpretation is reinforced to a certain degree by the presence of larger cooking jars and by a great deal of refuse. In the later, more compact Mississippian villages there is evidence of close interaction between adjacent houses. At Snodgrass, for instance, sherds found in separate nearby houses fit together (Price 1973: Appendix B).

Household Economy

That each Big Lake phase house at Zebree probably represents a single nuclear family of around five is reinforced by the 3.5 liter capacity cooking jar which seems best suited to feed around five individuals (Chapter 18). This jar seems to be the basic Big Lake phase vessel. They tend to exhibit ladle damage or are chipped on the lip possibly due to a variety of uses including the employment of a multiple perforated pottery disc strainer. Smaller jars possibly functioned as canisters, an interpretation based on the finding by Price (1969) of a small jar on the floor of Structure Eight at the Turner site (Powers phase) which contained hickory nuts. Larger jars may have functioned as cooking jars for the lineage or possibly for storage. The basic bowl size is one with an average capacity of .67 liters. Since this is the same essential capacity figure for bowls in

Barnes, Lawhorn, and Western Pueblo, this probably is an individual food bowl (see Chapter 16). Larger bowls probably functioned as serving dishes. Each household's tableware essentially consisted of individual food bowls, one or more cooking jars suitable for feeding around five people, small jars which may have functioned as canisters, and a variety of larger bowls used for serving. In addition, there may have been larger cooking jars and serving bowls for feeding the extended family or lineage. Dishes may have been prepared for village or sodality functions as well.

Evidently each Big Lake phase household is involved in the manufacture of pottery, lithic, bone, and other tools, possibly microliths, and less probably salt. This is based on the distribution of artifacts at the site. Pottery manufacture is to be expected in a basic household economy. Distribution of pottery making byproducts is general at the site, not in one locus. Shell perhaps indicative of pottery clay preparation and charcoal possibly indicative of firing tend to be slightly away from the midden concentrations. Possibly, these represent areas where potters, probably females from a lineage, get together to accomplish their handicraft.

The general distribution of the microliths was not expected since a priori we expected microlith production to be a specialized activity. But there does not seem to be sufficient lithic debris for every male to have knapped microliths and possibly each lineage had a specialist. Salt pan sherds are distributed generally within the site, but Wickliffe ware tends to be concentrated in the center of the site. This is a possible indication of a village specialist in salt making. At the later Snodgrass site, Wickcliffe is concentrated in one portion of the site with most sherds actually occurring in a single structure (Price 1973:145-148, Fig. 42). The Suya of Brazil make salt from aquatic plants and while several women collect the plants for burning, only one woman actually pours the water through the ash contained in a funnel (Schultz 1962:126).

Domesticated flora. Each household probably is responsible for obtaining its food. In considerable contrast to the Barnes phase evidence of corn agriculture is abundant for the Big Lake phase. There are 46 instances of corn found in flotation samples in the 1975 season alone. Only one additional find was made using the ¼" mesh screen. These corn fragments overwhelmingly are from 16 features which probably were storage pits. The corn in general seems to be similar to corn associated with the Cahokia Fairmount phase (Cutler and Blake 1969) but tends toward higher row numbers (12+), and thinner cupules (5.7 mm) than at Cahokia based on Cutler and Blake's description (in the Appendix) from features 41, 46, and 47 and other loci at Zebree.

Seeds for planting may have been stored in the hooded bottles which probably are gourd effigy pottery vessels. A small lateral orifice near the top of the bottle was apparently sealed with a clump of clay, called a "Kersey Clay Object" (Marshall 1965). These also occur at Hoecake (R. Williams 1974). One nearly complete bottle from the Buckeye Landing site has a capacity of 4.4 liters. Based on modern larger corn kernels this capacity is sufficient to plant an acre or more and this would probably yield about 75 liters or more of shelled corn for storage (George Berger, Dean of Agriculture, ASU, personal communication). Probably more than one race or form of corn was being grown based on the variety known archeologically (Cutler and Blake 1969; Jones 1977). This would have necessitated more than one seed storage vessel per household. The sealed jar would have allowed respiration of the seeds and the production of carbon dioxide which in turn would have preserved the seed for germination for a very long period of time (Coles 1973; Reynolds 1973).

There is little doubt that corn was a staple in the Big Lake phase. Less certain is the cultivation of sunflowers and chenopodium which, while rarely present, are in association with Big Lake phase deposits. More puzzling is the absence of Cucurbita (squash and pumpkins) and Legenaria (gourds). Beans are present but all seem to be wild bean rather than domestic bean. Domestic beans occurred at the Nodena site (Leonard Blake, personal communication) which dates after about A.D. 1350-1400 and it is not known how early their cultivation began in the eastern United States.

Wild flora. The usual nut shells are present in the Big Lake deposits owing to a greater resistence to disintegration. Included are black walnut, several varieties of acorn, hickory, and a single pecan found in 1969. Smartweed is abundant, including a double handful found inside a Varney Red Filmed small jar (Fig. 18-4; Richard Yarnell, personal communication). American lotus, wild bean, persimmon, wild grape, hackberry, and morning glory have been identified. A very large collection of unidentified seeds still remain to be analyzed and little of a flora procurement pattern can be constructed on what has been identified to date.

Domestic animals. Seven possible dog burials with at least a skull present have been found at Zebree (Fig. 21-1). The bone of Feature 151 was fragmentary and much of the animal was missing. The dog was adult and small to medium-small in size. The right ulna, which is the only complete long bone, measures 129 mm long. The other burials were similar to this one.

Two dogs were found in the random square excavations which could indicate a village population of 400 dogs over a 200 year period or an average population of around 20, assuming a lifespan

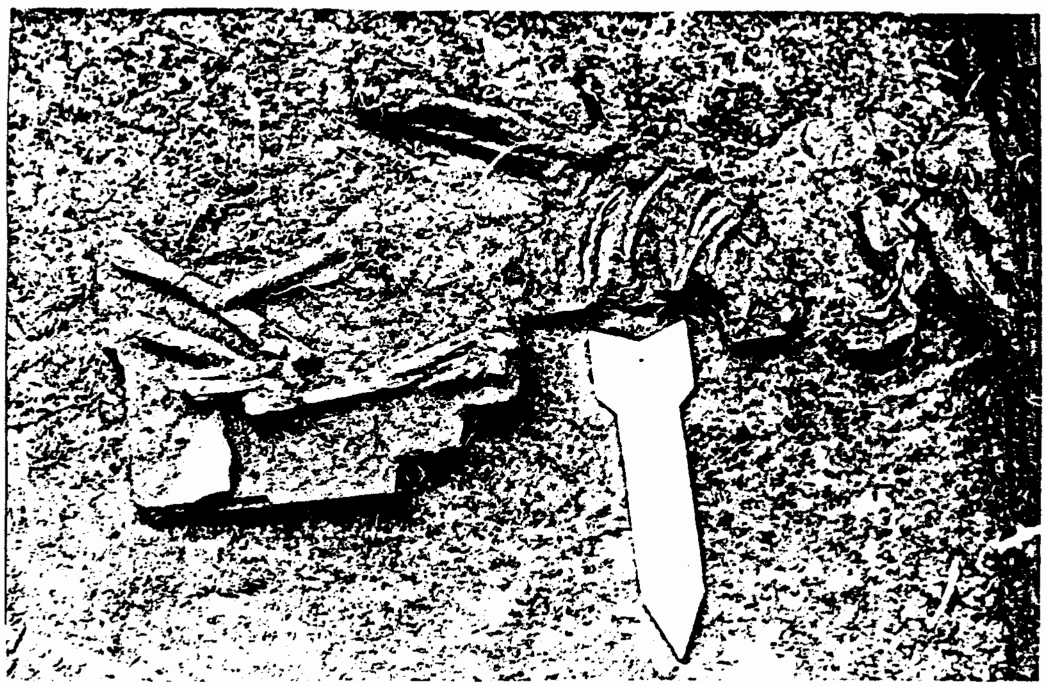


Figure 21-1. Dog burial, Feature 227, located by random square excavation. (Neg no. 752860)

of ten years apiece. Dogs are rarely found in Mississippian sites (Smith 1975a). The apparent high incidence, supported by the presence of loose bones in midden deposits, at Zebree might be due to their value as sentinels in a frontier village. Based on the storage pit descriptions and the fauna-flora analyses, there was more than ample surplus food available to support a large canine population.

Experiments carried out to see if dog-gnawed bone could be identified were negative. Either no marks were made or the bone was completely eaten with no trace left. What effect such a variable might have upon the recovered fauna remains is not known.

Wild fauna. A basic Big Lake phase fauna list based on 1975 feature samples is presented in Chapter 27. A larger list, but less phase precise, by John Guilday and Paul Parmalee on the 1969 fauna (Appendix, Section III-F) is mostly from the Big Lake phase deposits.

Mammals, fish, and birds provided considerable bulk-food. Attempting to integrate these data into an overall subsistence picture is difficult. For instance, zooarcheologists use a traditional weight table. At Zebree, fish vertebrae indicating the possibility of catfish weighing up to 60 pounds were recovered from Big Lake deposits. Harpoons, interpreted as jigs for large Buffalo fish, are present. Big fish are characteristic of lakes (Cross 1967:207). Until proper interpretations can be made from weights of species, based on recovered bones properly sampled, little can be said about major economic foci, but Big Lake itself provided much more bulk food than we can presently quantify.

Turkey is present in low numbers in the Big Lake phase deposits in contrast to its absence in Barnes. This may be interpreted as control of upland resources including turkey by the Big Lake phase or may merely be due to a larger sample. A greater variety of ducks and geese are present in the Big Lake phase sample than in Barnes, interpreted here to indicate the presence of Big Lake by this time. Mussel shell samples (Chapters 18 and 22) also indicate that Big Lake is present by this period. The importance of a major lake to Mississippian as postulated by Bruce Smith (1975a:167) appears supported by the Zebree data. It is unfortunate that we have been unable to objectify and quantify these data better so there could be no mistaking the interpretation.

Preliminary trace element analysis of the human skeletal material at the Zebree site may be interpreted as support for the importance of the lake for protein to most of the Big Lake society members (Chapter 23). Red meat consumption, here interpreted as mammals, is not reflected in the preliminary analysis. The recovered human skeletons appear to have subsisted on a basically vegetable diet which includes unknown percentages of fish and fowl. The mammal bone recovered at the site is overwhelmingly concentrated at a single midden cluster (Fig. 21-2); in fact, at the midden cluster, Area A, predicted to represent the elite of the village (Jim Price, personal communication). Apparently a select few, mostly living in one midden cluster, are eating red meat. This is also apparently the case at Cahokia Mound 72 (Jerry Rose, personal communication). Peebles and Kus (1977) postulate that the Mississippian chiefdom is not as egalitarian as pictured by Sahlins. That certain goods such as red meat are being taken out of circulation and consumed rather than redistributed back to the general population would appear to be supported by these Zebree data. In contrast, fish and fowl bones are distributed about equally in all major midden areas at the Zebree site.

Storage Pits

These pits are usually called "refuse pits" (R. Williams 1974:Figs. 21, 22). Indeed, they usually contain considerable kitchen midden which probably represent the best data available at the Zebree site. However, the concept of sanitary landfill is a modern one based on a realization that open trash is not healthy. Excavations at the Zebree site tend to demonstrate that open trash making up a general midden is characteristic. Reaction to "bad" smells would appear to be as much a culturally learned trait as is the desire to clear living areas of all surface trash.

The most probable function of the large Zebree pits is for food storage. It is a natural and easy way to store vegetable foods. A pit with a volume of 1.16 cubic meters will hold 44 bushels of barley (Coles 1973:42). Zebree cylindrical pits range in capacity from around 1.36 up to about 3.9 cu m with an average of around 2 cu m. These would hold about 57 bushels of shelled corn on the average today and up to 110 bushels in the case of the largest pits.

A total of 68 pits were recognized at Zebree which are cylindrical, slightly to moderately bell-shaped, with flat bases and large in size (Fig. 21-3). Two are rectangular in outline. Other pits were recorded which are large but basin-shaped rather than bell-shaped at the base. Posthole patterns around at least two pits may indicate extensions above ground, or may merely mark the pits. Similar pits have been found associated with Illinois Hopewell (Wray and McNeish 1961:17).

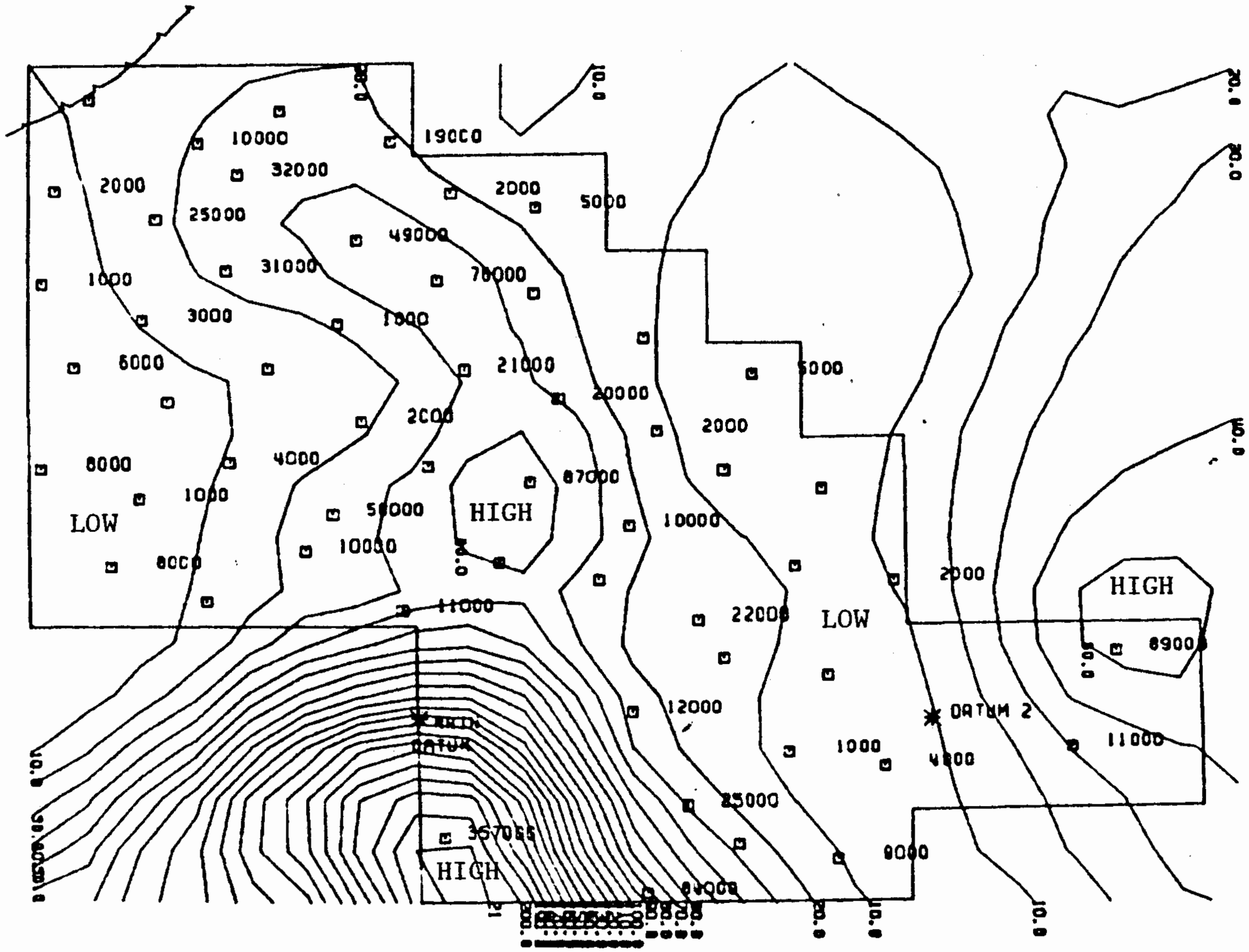


Figure 21-2. Mammalia bone distribution by count across the site.

Figure 21-3. Storage pits, Big Lake phase, showing cylindrical (above) and bell shaped (below.

Sealing of pits can be done with wooden lids or a fabric or rush mat caulked with clay. Lateral lining is not necessary in a sealed pit (Reynolds 1973). Debris piled on top might aid the preservation of the stored grain and also marks its location. This debris often constitutes the initial fill upon abandonment of the pit (Coles 1973:39, 40). Invariably the "best stuff" seems to be almost directly on the base of a typical Zebree pit. Numerous rush mat, fabric, and net impressions have been found on clay clumps in Big Lake phase deposits. Vegetational respiration produces CO_2; the higher the temperatures, the greater the rate of respiration (Coles 1973:44). The CO_2 preserves the stored grain or other vegetable foods. Factors affecting the grain are moisture and burrowing mammals such as mice. Even these, however, do not affect all of the stored food. While germination is relatively easily affected, the edibility of stored food is rarely affected; in a wet situation in one experiment, half the grain was still edible (Coles 1973:44). If flooded, a beer-like aroma may greet the excavators (Reynolds 1973:126), but if flooding continues, the grain may be dried and eaten. Pit storage is an effective technique and well within the technological grasp of low energy systems ("primitive cultures").

Pits may be opened and resealed after removing a portion of the contents with additional, relatively minor loss on the periphery of the stored grain (Reynolds 1974:118), but this is an inefficient and wasteful operation. In an egalitarian society, pits could be opened sequentially for a larger kin group than just the household. If one metric ton can feed one household for a year (Winter 1976:27) and at least half of a typical Zebree pit is preserved, then each pit can feed four households for at least three months and 28 households for around two weeks. The size of the pits are calculated from the ground surface and may be exaggerated but even then reflect a heavy dependence on vegetable food, probably corn, and indicate the probability of large surpluses and the possibility of pan-village ceremonies such as redistribution feasts.

The bell-shaped pit is a technically better storage pit than other shapes (Reynolds 1973:126-127). It can evolve from a straight-sided cylindrical pit by the process of cleaning microflora from the pit sides so the pit may be reused (Reynolds 1973:129). Bases are harder to reach and the belling probably results from the cleaning process itself. The erosion of open pits also can cause belling since the upper portions are held intact by roots while the lower sides collapse. A large basin-shaped pit can simply result from the upper portions finally collapsing from natural erosion if left open (Reynolds 1973).

Burials

Human skeletal information is discussed in Chapter 23. The major burial position was extended on the back in a rectangular grave with a general orientation along the same axis as the houses. Burials 5 and 6 are actually one grave with two individuals, both female. One is extended while the other is flexed over the lower limbs of the first. Flexed burials are usually a characteristic in this general region for Woodland and Archaic cemeteries and not expected in a Mississippian grave.

Burials and bone loci cluster around and within the high density midden areas of the site indicative of a basic household association, in contrast to a central cemetery pattern. The remains of 27 fairly intact skeletons (including two rescued from pothunters in early 1977) and the isolated bones from at least 26 loci were recovered (Fig. 23-1). Infants and children are, with one exception, not represented in the intact skeleton inventory but are represented as a significant percentage of the isolated bone collection. Females are relatively tall and healthy and tend to live slightly longer than males.

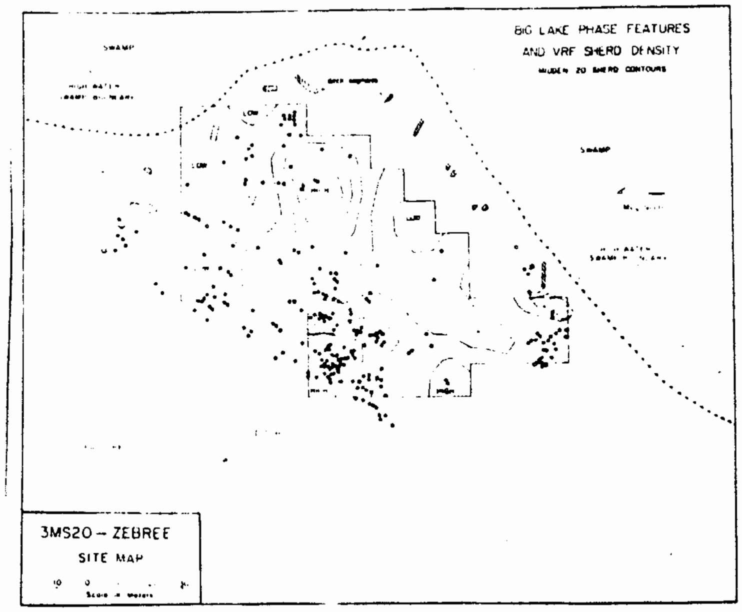
Grave furniture was absent in all cases. Presumably nonperishable personal property was given away and any nonperishable kinship artifacts used during the funeral ceremony must have been returned to their storage place after the funeral. Burial probably was in a deer skin or fabric shroud based on the position of skeletal elements.

The Village

The village is rectangular in outline and oriented northeast to southwest. There was a palisade system around its edge. Houses were clustered into discrete groups within its borders.

House Midden Cluster

There was approximately 11,550 sq m (1.15 hectares; 2.84 acres) of midden originally making up the Zebree site. The central portion of the site was tested by the random squares spaced so that a 1% sample was recovered from one-half of the site. The artifacts were counted and/or weighed in the various sample units and the results presented in the appendix as density maps contoured to investigate the distribution pattern of various classes of artifacts. These density maps clearly exhibit contour line clustering indicative of higher discrete densities of artifacts for each class (Fig. 21-4). Together, the maps



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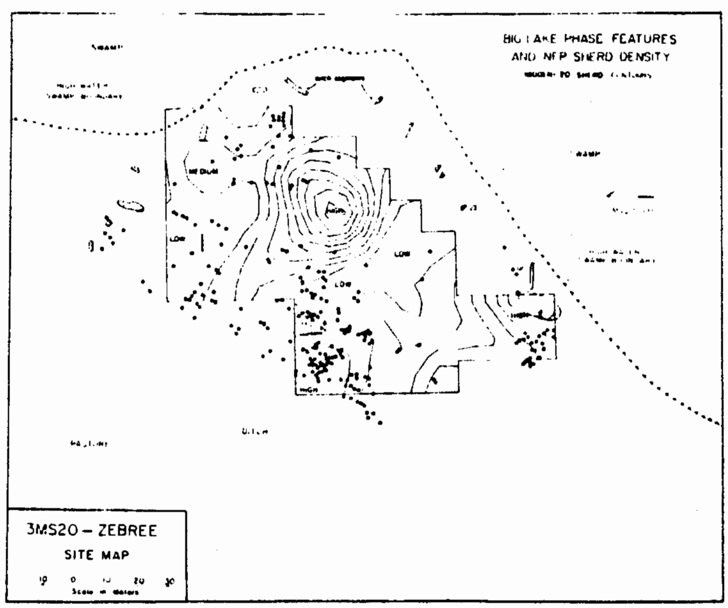

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Figure 21-4. Feature locations and potsherd concentrations at the Zebree site. a. density map of Varney Red Filmed in the midden, 20 sherd count; b. density map of Neeley's Ferry Plain in the midden, 20 sherd count. (a. Neg no. 774335; b. neg no. 774336) demonstrate that there are four specific loci where all artifact classes are represented by high densities, and three loci where several high densities of artifact classes are present. Our conclusion is that at least seven Big Lake phase midden loci existed within the Zebree village.

Three of the middens are essentially in the center of the site and there is one near each of the four corners. Evidence of at least nine houses was recorded at Zebree (Fig. 21-5). Four of these house patterns were fairly complete while the other five are represented by only portions of posthole lines. House patterns were recognized in four midden areas. There are at least four houses indicated in Area A and three in Area B. One house is clearly indicated near the northeast corner and one or more may be represented by the postholes found near the center of the site. The midden clusters at Zebree appear to represent house groupings within the site area.

At the Hoecake site, up to six house features were exposed in an area but in this one instance, two were superimposed over three of the other patterns indicating that no more than four could be contemporaneous. That the household clusters were not completely investigated is indicated by the finding of only two burials (R. Williams 1974). A large number of pits were located and two possible (communal) hearths recorded. The house cluster at Hoecake appears to include up to four houses and an unknown number of satellite features such as burials, pits, and hearths.

The medium sized Big Lake phase jar, thought to have functioned as a cooking jar, averages around 13 liters and ranges between 8 and 20 liters. If it can be assumed that each 3.5 liters represents a group of five individuals (Chapter 18) and that these volume data are representative, then the medium size cooking jars indicate that an average of 19 (four households) are eating together and a range of 11 to 29 (two to six households) are supping together at least on occasion. Such behavior is recorded ethnographically (Swanton 1946:551). Based on these data we should expect to see a pattern of two to six contemporaneous house patterns and an average of four contemporaneous house patterns in each house/midden cluster. This fits nicely with the recorded houses at Zebree and at Hoecake. Even in a relatively crowded village like the Snodgrass site, houses spaced close together appear to be engaging in some activity together and may constitute a house cluster of closely related people (Price 1973: 231).

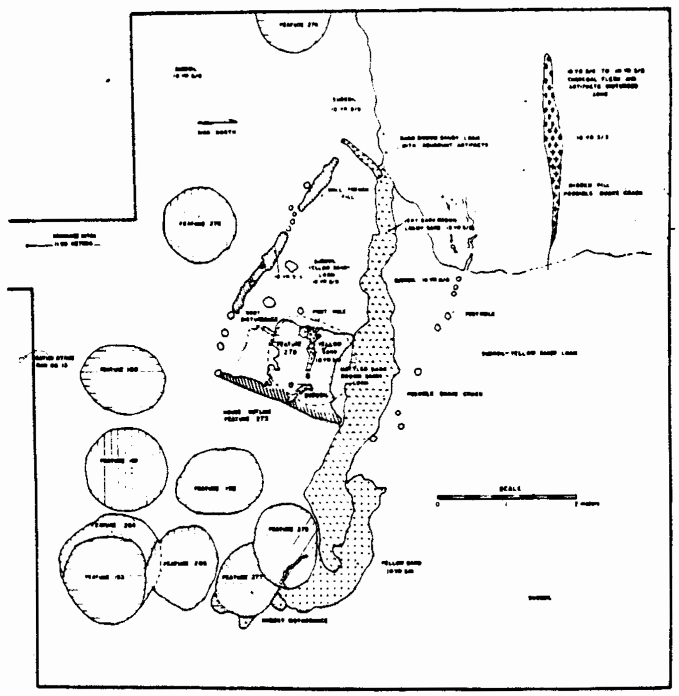

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Figure 21-5. House pattern and pits, Big Lake phase.

Population Estimations

Estimations of population size can be made using several different approaches at the Zebree site. Estimations made at the Snodgrass site (Griffin 1977; Chapter 25) indicate that around 25-29 sq m per person constitute the average space for a member of the Powers phase within a village. Extrapolating this to the Zebree site would indicate a population of around 380-460. However, at Snodgrass structures were very close to each other throughout the village and the extrapolation based on space conception would necessarily represent an exaggeration for Zebree where structures are spatially clustered.

At Cahokia, an estimation, based on extrapolating from intuitive sampled areas interpreted as representative of the whole site, was made of eight houses per acre (Gregg 1975). Using Naroll's formula of 10 sq m per person, each house was assigned 1.86 individuals and each acre 14.8 people. Extrapolation to Zebree give a population figure of 42. Naroll's formulae, however, are not valid since spatial need within a structure is a culturally learned trait and not a cultural universal. If it is assumed that the eight houses per acre represents 40 individuals per acre (or 100 sq m per individual), then a guess population estimation for Zebree would be about 114. At Cahokia, the estimation assumed that the excavated area was representative of the whole site but this assumption is not true. However, the excavated portions of the habitation regions at Cahokia can help provide a basis for population estimation at a small site such as Zebree.

At the Zebree site, there are seven separate middens, each probably the site of two to six houses or an average of four contemporary houses possibly representative of seven social segments. Multiplying the number of middens (7) by the average number of houses per midden (4), the expected average household size (5) gives a population estimation of 140. Each midden area seems to represent at most around 600 sq m. Using the Snodgrass site figures, each midden area population maximum average is 21-24 individuals which multiplied by seven (number of middens) gives an apparent maximum population figure of around 150-170. This figure is not far removed from the earlier derived 140. However, if the average medium size cooking jar can be hypothesized as feeding around 19 people this give a population figure of 19 x 7 or 133 individuals. The medium size jar may have functioned to cook food for the population of one house/midden cluster. This could be tested with good metric data from Mississippian houses with intact kitchen assemblages.

In the random squares there were at least seven loci producing human bone. The random squares represent a 1% sample of half of the site. If these bone loci represent seven separate skeletons then 1400 human skeletons may be postulated for the whole site. If the site was occupied by Big Lake phase people for around 200 years and if the average age at death is 20 (adult average for males is 37 and for females 40.5, see Chapter 23), then an apparent average population of 140 is indicated. The 200 year period is viewed as a maximum and is based on the radiocarbon dates, evidence of rebuilding, amount of midden, and number of pottery vessels.

Random squares provided clear evidence of nine cylindrical, bell-shaped pits; one rectangular, bell-shaped pit, and 16 relatively large basin-shaped pits. Another three pits in random squares were relatively small. These data indicate a possible total of 2600 storage pits in half of the site and 5200 in the whole site. If one pit represents one household's use for one year and if a maximum of 200 years of occupation at Zebree took place, then a population figure of 130 results $(\frac{5200}{200} \times 5)$. If the cylindrical pits were used at least twice, the figure can be raised to 180:

$$\frac{(1000 \times 2)\ (1600 \times 2)}{200} \times 5$$

The various population estimations are summarized in Table 21-1. These methods of estimating are weak due to small samples and a low percentage sampling size. It is interesting to note that most of the estimations are clustered at around the 145 figure. Two estimations (houses and pottery jar size) are based essentially on the same data and might better be regarded as a single estimation. Two others (skeletons and storage pits) are based on very low numbers. Larger samples could change these figures rather drastically. An estimate not included in the table is even more shaky due to the assumptions involved. The largest jar class at Zebree has a mean capacity of 52 liters, enough to feed approximately 74 people if it were a cooking jar. The usual pan-village sodality in the southeast is based on a dual division or moiety (Swanton 1946:663-665) and if this jar type were used in moiety functions, the indication is a village population of around 148. In Western Pueblo (Turner and Lofgren 1966), jars greater than 8 liters in size become more frequent after the advent of the kiva. A kiva is the circular structure identified with a particular Kachina Cult, a religious fraternity cross-cutting residence and kinship lines as a pan-village sodality. Increased frequency of large jars seems to be related to social organizational changes and might signal the advent of dispersed clans and matrilocality in the Southwest in contrast to an earlier "monolineage community" in the Southwest (Longacre 1970).

Table 21-1. Population Estimations for the Big Lake phase at the Zebree site. Each type of extrapolation is discussed in the text.

TYPE OF EXTRAPOLATION	POPULATION ESTIMATION LOW	MEDIUM	HIGH
25-29 Sq m/person for whole site			380-460
25-29 Sq m/person for high density midden		150-170	
8 houses/acre (100 Sq m/person)	114		
Average medium cooking jar size and number of high density middens		133	
Apparent average house and midden population and number of middens.		140	
Apparent skeleton population		140	
Storage pits		130-180	

Status Differentiation

The "Area A" midden of the Zebree site seems to have been the richest in terms of exotic artifacts and included Burial 3, the group burial. This area is located near the center of the western edge of the site opposite the lake. In Mississippian, this usually is the apparent location of the elite (Price 1973; Chapman 1977). However, no extra large structure patterns were recognized anywhere within the site, although this might have been due to sample error and the lack of well defined clay house floors.

Burial. All eight skeletons in Burial 3 were buried in the flesh in an extended position (Fig. 23-2). The grave occupied a roughly rectangular area measuring 1.80 x 1.65 m and oriented just east of magnetic north. The bones were badly disturbed and there were no grave goods. Burial 3 is somewhat similar to later Fairmount phase graves found at Cahokia Mound 72 (Fowler 1969:19). It is different from other Zebree graves because several skeletons are present in one grave. All are adult and possibly this is a charnel house for high ranking individuals.

There were four males and four females represented in Burial 3. With the exception of Burial 3-H, skulls were oriented north. The exception was oriented so that the skull pointed toward the west. Burial 3-A (male) was on its back at the eastern side of the group. Its ribs lay over the skull of Burial 3-B (female). Burial 3-C (female) was on its back between 3-B and 3-D and lay on a bed of mussel shells. Burial 3-D (male) lay on its back. Next to it, also on its back, was Burial 3-E (male). It also lay on a bed of mussel shells. These shells continued beneath Burial 3-F (female) which also lay upon its back. Burial 3-G (male) lay on top of Burial 3-F. This skeleton was found extended upon its dorsal surface and was considerably disturbed by animal burrowing. Burial 3-H (female) lay at the northern end, oriented east to west, and was upon a bed of mussel shells. The following male-female pairs are indicated by proximity: A-B, C-D, E-H, F-G. In two instances, the female was apparently the older of the pair and in one instance the male was older.

We surmised in 1969 that Burial 3 probably was an extension of the ceremonial portion of the site eastward over a previously mostly residential zone or at least an area previously used for sodality structures. The grave intruded a Big Lake phase structure. The house in turn had intruded a Big Lake phase feature, an indication of an even earlier settlement shift. In 1975 and 1976 attempts to find more status graves were negative. Most probably any such graves, if present, were destroyed by ditching, logging, or the Lawhorn occupation.

Status graves in the so-called "Hoecake phase" may be in burial mounds at the Hoecake site (R. Williams 1974). The Story Mound 1 site in particular produced "three subsurface log-lined tombs in the mounds, which contained 14 burials and associated artifacts" (R. Williams 1974:82, referring to an unpublished 1969 manuscript by Dick Marshall). R. Williams also reports a combined radiocarbon date of A.D. 640± 130 (M-2212 and M-2213).

Labor specialization. Pottery manufacture probably was accomplished by women (Swanton 1946). There is no real evidence for specialization beyond a sexual division of labor in the Big Lake phase as far as normal household needs such as pottery, tool manufacture, house construction, and the acquisition of most food is concerned.

One possible exception may be the knapping of microliths. There do not seem to be sufficient tools and debitage to suppose that all males knapped microliths, but there is no real evidence that this was a specialty. Essentially, every midden concentration has lithic debris which leans heavily on the microlithic industry. The same seems to be true of heavy wood-working tool manufacture, although the debitage is not prominent and any concentration would not be statistically significant. It is possible that each lineage, the occupants of a house/midden cluster, number amongst them at least one male who specializes in the manufacture of microliths and possibly the use of them in making ornaments and bone, antler, and shell tools. On the other hand, these are tasks which every male may be expected to master.

Shell concentrations adjacent to charcoal concentrations are in juxtoposition to the midden concentrations. Rather than indicating a specialization by a single woman in each lineage, perhaps all the women in a lineage making pots and firing them gather together in a single work area to gossip and keep each other company. Million's description of the extra fine workmanship (Chapter 18) may indicate specialization, however, and it is possible that a few women who excel at making pots make the larger ones just as it is possible that certain tools may be made by those who were gifted or more ambitious.

Specialization is a very difficult thing to show archeologically at Zebree. The only real possibility is the manufacture of salt. Wickliffe ware tends to concentrate in one area of the site, the central midden. At the Snodgrass site, 16 of 23 recovered pan sherds were found in a single structure, an indication of specialization in manufacture. Pan sherds at Zebree are distributed across the site. Perhaps the evaporation could take place anywhere, or broken pans were carried across the site or pans functioned in other ways than just as salt evaporation vessels. The evidence is inconsistent and we do not have any hard facts showing someone specializing to the exclusion of normal household economic duties.

Diet specialization. Preliminary trace element analysis on the human skeletal material indicates that red meat (e.g., mammals) is not being eaten in significant quantities, at least during the last year of life (Chapter 23). The preliminary findings do not indicate the results of the tests on Burial 3, thought to represent the status individuals. Fish, fowl (such as ducks), and vegetables are indicated as the usual diet.

Remains of fish and fowl are distributed essentially in all the midden clusters. However, mammal bone concentrates overwhelmingly in and around Area A, the suspected ranking lineage midden (Fig. 21-2). Somebody is eating mammals, or at least butchering significant numbers of them. This provides a hint that certain foods, including large mammals, are reserved for a minority of the population and that minority might be the ranking lineage or ranking lineage heads. Interestingly, deer constitute the major Southeastern large game (Swanton 1946). The region adjacent to Big Lake does not contain much deer today but was known for deer hunting locally at the turn of the century possibly after lumbering created forest edges attractive to deer. The environmental reconstruction does not indicate an ideal environment for deer and no deer bone was found in the early 19th century well deposit. Deer may have been a scarce commodity and insufficient to feed the whole Big Lake phase society. For instance, four times as many deer bone was found at Crosno as at Zebree (Williams 1954:6-10). In a chiefdomship redistribution system, scarce goods can be retained by the ranking individuals (Peebles and Kus 1977). According to the bone debris, deer were being butchered and presumably eaten mainly in Area A. The tested skeletons from Zebree are from individuals who had not been eating much red meat, in contrast to the status burials at Cahokia found in Mound 72.

Pan-Village Behavior

The large jars might be for storage, such as bear oil (Swanton 1946: 549), but the large 52 liter capacity jar may also be a cooking jar capable of feeding some 74 people for use in pan-village or pan-tribal activities. Pans also might have functioned to serve food, but are thought to have been used for evaporating saline water. As suggested earlier an average storage pit was capable of feeding the entire village for almost two weeks.

Pan-village behavior is reflected in the presence in the material cultural inventory of the stone (and smaller pottery) discoidal. This is the main element in the chunky game, played on a central flat bare area for the benefit of the village (Culin 1907). A variety of ball games were played by the southwestern Indians, often between moieties or villages (Swanton 1946). These may have functioned as a type of redistribution feast or ceremony since large amounts of property are stated to have changed hands on the basis of betting.

The ability to marshall relatively large numbers of people to work on public projects is evident at Cahokia where the largest mound north of Mexico was constructed and where apparent astronomical observatories were made of huge cypress logs set upright in circles measuring 240 and 480 feet in diameter (Wittry 1969). These appear to be oriented with the summer and winter solstices and probably were used for planning coordinated planting and harvesting activities. At the Snodgrass site in the Powers phase it is evident that a large and complex village with outer palisade system and an inner walled ward with some 90 houses was built in a very short period of time (Price 1973).

The Zebree site appears to have been occupied within a short space of time. Evidently there was a model, whether mental or fabricated, by which the village was constructed. This model is seemingly based on the layout of the Cahokia site itself. Cahokia is oriented on a north-south axis 3.5 km in length with the two ends making up two corners of the site (Fowler 1964:15). The other two corners are the furthest extension of an east-west axis extending 4.6 km in length. Included are about 1500 hectares. At Cahokia, it is apparent that important triangulation points are marked by special mounds and post pits. At the Hoecake site, using a combination of the mounds shown, the excavation areas, and contour lines shown on Map 8 by R. Williams (1974), approximately 80 hectares can easily be contained in a roughly rectangular area oriented generally northeast to southwest. Two mounds appear to mark the furthest extent of the Hoecake site and a third possible mound is located almost exactly halfway between these two. Most of the remaining mounds are located west of this central axis. The axis is approximately 14° east of the 45° angle reported at Cahokia.

Where defined, Mississippian sites are rectangular in shape. The midden together with possible palisade ditches roughly covers a rectangular area indicating that Zebree is a normal Mississippian site in essential outline. The long axis of the rectangular Zebree site is approximately to the northwest, based on magnetic north in 1969 (estimated as 6° 42' east of true north). Its corners, however, are not established exactly on a true north-south and east-west axis, but are slightly east and south. In the center of the site is a deep feature (127) oriented north-south which may have been a post pit (Fig. 21-6). Check stamped sherds from a vessel probably broken in the area near Feature 127 were incorporated in the fill deposited by the Big Lake phase in the southern corner of the site as Zone C. Zone C in Area B was deposited upon the Barnes midden before any observable soil weathering could take place. Both events seem to be related and both appear to have occurred almost immediately upon occupation of the site. The fill of Feature 127 was composed exclusively of Barnes debris, evidently before Big Lake phase debris existed in this specific area. This is true of the borrow pits in Area B and of most of the ditch fill around the site. Big Lake midden was found in the fill and although this was unusual it serves to emphasize that the ditch system is a Big Lake feature. These data indicate that a central post was established and the corners and sides of the site triangulated in quickly. Presumably some 28 houses and the palisade system were constructed at the same time again as quickly as possible. At the King site in Georgia, "the geographical center of the village was marked by a large post" (Ferguson 1977:651).

Figure 21-7 superimposes a hypothesized site model over the Zebree topography and the suspected ditch remnants defining the border of the site. It is assumed that Feature 127 is the center point and that true north is the azimuth. Corners of a square were established at a distance of 80 m from the center point. This establishes the sides at a distance of around 57 m from the center point. This model will not fit the Zebree topography. If each axis is shifted as if connected at the center point, the corners can be moved to a better fit with the topography. On Figure 21-7, the square model is identified as "original model?" and the changed model as "skewed model?" respectively. The question marks insure that there be no doubt that this is considered by me as a possibility and not as a conclusion. If the east-west axis is shifted southward about 5° and the north-south axis shifted eastward about 15°, the topographic adjustment has been made. The site plan is now rectangular, approximately 100 x 124 m or around 12,400 sq m. All of the Big Lake features except for suspected ditch segments are contained within this plan. In addition, all midden is within the skewed model. Most impressive is the alignment of suspected ditch segments essentially along the edges of the model.

The apparent elite area is on the west edge of the model separated from the eastern side by a region exhibiting a low density for all artifacts. This could be a plaza or square. Beyond the eastern wall is a slough which leads directly into Big Lake. In 1969, it was thought, based on contour lines and a general lack

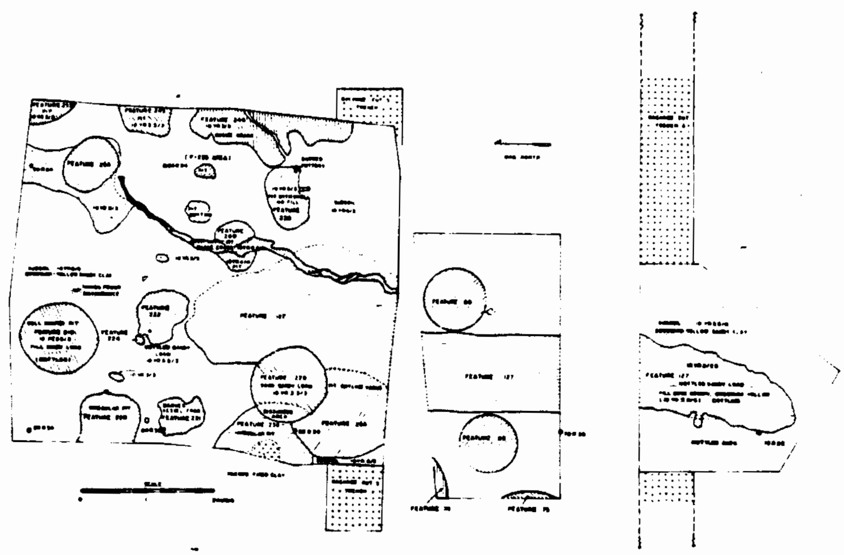

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Figure 21-6. Feature 127, hypothesized center point of the Big Lake phase village.

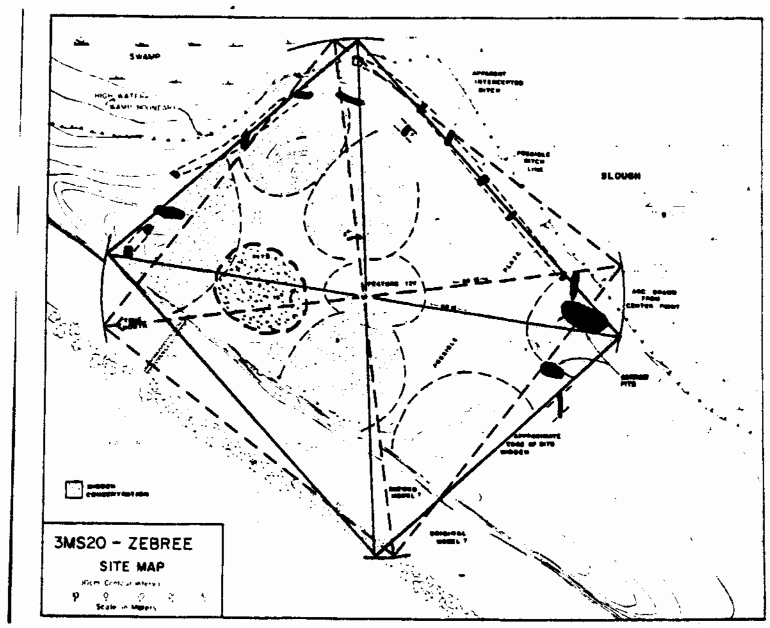

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Figure 21-7. Model of Big Lake occupation at Zebree site. By mistake, a midden area is indicated in the extreme north corner. This is actually a low density area.

of midden, that much of this area was washed away by flood water. This is still a possibility but in 1974-1975 flooding deposited silt in this area. The area would appear to be essentially today as low as it was in A.D. 700.

This village plan is a recurrent theme in later Mississippian phases in the northern alluvial valley (Price 1973; Chapman 1977). Seven probable midden concentrations based on the 1% probabilistic sample in the central portion of the model and feature loci outside the probabilistic sampled area are indicated on Figure 21.7. Except for the extreme southwest corner of the site extending just to the top of the opposite bank, this model predicts that none of the site exists on the other side of the modern drainage ditch. Extensive work in 1976 with a dozer and shovel was conducted on the west side of the ditch in expectation of finding portions of the Zebree site. A single Big Lake phase artifact, a microlith core, was found near the probable site of the west corner extension. Not another single artifact was found which could be identified as Big Lake but two features identifiable as Barnes were recovered.

Other aboriginal work at the site involved excavation of two borrow pits in Area B which intruded Zone D, the Barnes midden after which the area was mounded over with the Zone C soil (Chapter 10). Soil was apparently scooped up just outside the site area at this southern corner and used as fill for the borrow pits. Later part of this area was filled again with the addition of Zone A-B over the initial Zone C. The activity here and to a lesser degree at the eastern corner where apparently more than one ditch was excavated appears a lot like busy work, as if there almost were too many people working on the site construction. We averaged about 15 people in the field during the 1975 excavation and it was difficult enough to keep track of everything that was going on. The Big Lake phase might have had 145 people there; presumably many were on work parties to obtain logs, cane, thatch, and food. Others presumably were digging palisade ditches, foundation ditches for houses and the house depressions themselves, splitting cane and tying thatch, and feeding and possibly even guarding the workers. In addition, there must have been young and old to take care of and potential feuds to officiate. There could have been around 1500 large (probably bald cypress) logs to obtain for the 430 meters of palisade (Anderson 1969:98) and possibly over 1000 smaller (probably oak) logs to bring in for the houses (based on the drawings in R. Williams 1974:62-64 which indicate 40 logs per house), cane to split for the walls, mud to prepare as daub for the walls and thatch to get ready for the roofs.

Experiments in Denmark have been conducted on building houses approximately ten times the size of the Big Lake average house (Coles 1973:55-57). About 150 man-hours is needed for each Big Lake phase house based on those experiments, or about a total of just over 4000 man-hours for all 28 postulated houses. If this is doubled to account for the palisade system to 8000 man-hours and if we assume that approximately 75 people were engaged at least 40 hours a week on this project, then about three weeks is the estimated minimum project period. The site area had already been cleared to a certain extent but probably remnant Barnes structures had to be cleaned out.

The Community and Beyond

Probably the main approach to the Zebree site was from the east, from Big Lake up a slough which curves past the eastern corner. This was the same slough used by Sebree in the early 1900s to guide duck hunters and to fish. This is the high corner of the site, Area B, upon which Sebree's house stood. The area was made high by the Big Lake phase perhaps to impress anyone visiting by water as well as to approximate a right-angled corner to accommodate a rectangular site plan. The view from the now dry slough is impressive.

Big Lake Phase

Almost immediately adjacent to the Zebree site are two related Big Lake phase sites. One is a ceramic scatter possibly representative of a single household or a house cluster. It is located 100 meters to the south and had been completely destroyed by the time we were aware of its existence. Such satellite sites are to be expected as population increases, whether due to biological or social (amalgamation) means. This is an expected first step toward establishing a daughter village (Flannery 1976).

The second site consists of a microlith scatter located 750 m to the south of Zebree. This is the only site known to date in the Northern Alluvial Valley besides Zebree to contain all elements of the microlith industry. Very few Big Lake phase sherds are present but the large amount of surface lithics is unusual for this general area. These two sites together with Zebree make up the Zebree community. A specific survey for additional sites has not been accomplished.

Modern ditching probably has destroyed any chances to test hypotheses relating to dispersal of population out from Zebree, assuming that Zebree is the regional center for the Big Lake phase as indicated by its rich midden, variety of activities, and chronological primacy in the region compared to other Big Lake phase sites. That sites indeed did exist literally throughout the length of the new ditch was related to us by the ditching personnel themselves. We had recorded and tested two small villages (Rice Landing and Buckeye Landing) in 1968 but were never able to conduct an intensive or probabilistic surface survey. A definite third small village, Floodway, and a suspected fourth site exist to the south and a fifth (Old Varney) is north and west on the St. Francis River. Other sites exist inland, between Big Lake and the St. Francis River.

The known settlement pattern from Zebree south along Little River is shown in Figure 21-8. Villages tend to be about 8 km apart except in one instance where the Buckeye Landing site is located halfway between Zebree and Rice Landing which are spaced 7.5 km apart. This pattern is similar to Flannery's apparent linear stream pattern in the early formative in Oaxaca (1976: Fig. 6.9). In the case of the Big Lake phase, all known sites are west of the Little River (Fig. 21-8). Both Big Lake and the Mississippi crevasse channel (Left Hand Chute of Little River) appear to be effective barriers for eastward orientation. That the hinterland is westward and northward toward the St. Francis River is indicated by the location of Old Varney and other sites to the south along the east side of the St. Francis River. Camps undoubtedly exist but would not be easily identified. Quarries are expected to be up the St. Francis and also not easily recognized. We will have to be content for the time being with ceramic sites.

Big Lake phase sites seem to be present as far south as Marked Tree, Arkansas (Klinger 1977). Closely related sites exist west of Marked Tree, at Weona, and indicate that the braided surfaces of the Malden Plain constitute part of the Big Lake phase region. Southward, the Mississippi occupation is more intensive during the later Lawhorn and Parkin phases and to date earlier expressions if they exist have not been recognized. The farther away from Zebree, the more different the site assemblages are. This may be an indication of lateness or possibly a reflection of the amalgamation of Woodland complexes. Weona, for instance, is the scene of Baytown occupation in contrast to Barnes. The ceramics interpreted as initial Mississippian include Big Lake vessel forms and considerable red filming. But the ceramics can not be accurately characterized merely because they include Varney Red Filmed or Wickliffe wares. It is a complex situation and until now very little could be accomplished toward investigating, much less resolving, the beginnings of Mississippian south of Marked Tree.

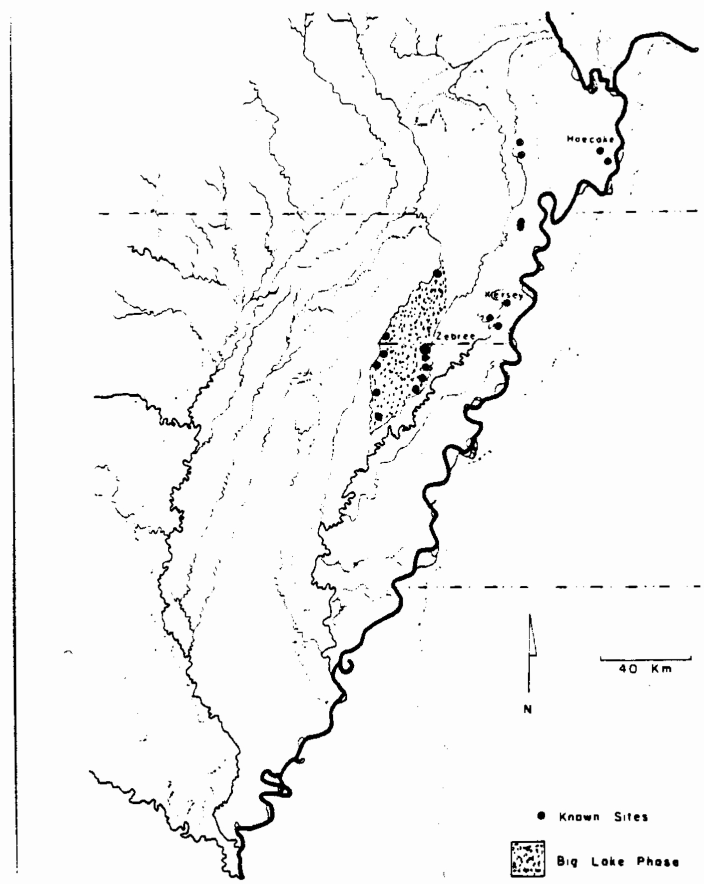

Figure 21-8. Big Lake phase settlement pattern.

East of Big Lake is another region made complex by the presence of a large amount of Nodena phase artifacts. Varney Red Filmed is present as far south as Blytheville and once was thought to represent trade vessels from the Big Lake phase. However, it is more reasonable to suppose habitation or trade as part of the Hayti phase located immediately north in Missouri.

The Big Lake phase exists to the west to the St. Francis River. Based on the orthoquartzite (Chapter 15) which probably was quarried just on the western edge of Crowley's Ridge, the Big Lake phase region may eventually have extended to the ridge. West of Crowley's Ridge in the Western Lowlands a separate expression of initial Mississippian was apparently developing, probably in response to the presence of the Big Lake phase and to developments west of Sikeston Ridge.

Hoecake-Hayti Expressions

There are four apparent clusters of sites related to the Big Lake phase. The identification of the sites mentioned here are based on an unpublished manuscript by Dick Marshall (n.d.) and examination of artifacts collected by John Cottier and currently curated by Jim Price at the Southeast Missouri Archeological Research Center in Naylor, Missouri. Price also contributed valuable information to this discussion. All recognized sites are located east of Right Hand Chute of Little River.

Hoecake cluster. Within the Cairo Lowlands are several sites with initial Mississippian-like artifacts. Hess and Hoecake are the two best known but Hoecake is the largest and there is published data (Marshall 1964; R. Williams 1974; Hopgood 1969b). The collection from Hoecake is impressive. Included are pottery ladles, hooded bottle fragments, pottery discoidals, Varney Red Filmed pan sherds, Wickliffe funnels, pottery trowels, "Kersey clay objects," pottery beads, a paint palette with powdered hematite on one surface, and relatively large amounts of Mill Creek chert, Crescent Quarry chert, and granite/basalt fragments. These all relate to the Big Lake phase. The Crescent Quarry chert artifacts include two apparent microlithic core preforms, but nowhere in the literature or in this particular collection are there any good examples of the microlithic industry. This lack may be due to inappropriate recovery techniques or lack of recognition or to collector activities. The surface collection in Naylor is biased toward broken tools and large items while complete nicer artifacts are rare. There is an enormous number of Baytown sherds, particularly folded rims, and a substantial amount of Cairo Lowland phase artifacts similar to those found in the Powers and Lawhorn phases. The large number of granite and basalt fragments indicate that adzes and celts are being manufactured at the site. Dover chert is also present but may belong to the later occupation. Dongola chert is present and suggests how that one example arrived at the Zebree site.

There is a great deal of similarity between the Cairo Lowlands and the Big Lake Highlands, with its newly created lakes, its prairie, adjacent Crowley's Ridge, and Mississippi meander belt (Williams 1954:6-10). Comparing Williams' faunal list for Crosno (1954:114-116) with that presented by Guilday and Parmalee for Zebree (1969) reveals a very close similarity in the species represented. About the same percentage of reptile bones and about 13 percent more bird bones were recovered at Zebree. The Crosno fish bones were not counted. However, four times as many deer bone were found at Crosno and in addition one-seventh of the bird bone was identified as turkey. It does appear that deer and turkey were not as readily available at Zebree as at Crosno and that perhaps waterfowl were more available than at Crosno.

McCoullough cluster. Marshall mentioned two sites, Paul McCoullough and Hann Brothers' Farm, between Little River and Sikeston Ridge as containing similar material to the initial Mississippian expression further south. Both sites have been land-leveled and apparently there is no published account nor available collections to consult. Whether other sites exist within the Moorehead Lowland or not is not known at the present time. These sites could be part of the Hoecake cluster but are approximately 35 km from that cluster.

Double Bridges cluster. Approximately 35 km to the south is a third cluster represented by the Double Bridges and other sites. Marshall mentions the close proximity of other sites. No observation was made personally on any artifacts from any of these sites. This area is known as the Portage Open Bay Drainage (Hopgood 1969a).

Hayti phase. Besides the Kersey site (Marshall 1969), to the south are the Machlin and the Cooter-Holland sites. They are located within the Pemiscot Bayou Drainage immediately north of Blytheville. To the north at a distance of about 35 km is the Double Bridges cluster and about 35 km to the west-southwest is the Zebree site. Virtually everything identified as part of the Big Lake phase occurs at Kersey. Some reasons for distrusting the division used by Marshall are discussed in Chapter 10 and will not be reiterated here. The microlithic industry is absent but this may be due to lack of recognition.

The Western Lowlands

West of Crowley's Ridge, a different sort of initial Mississippian expression seems to have developed. The main characteristic is a flat-based cylindrical bowl which is shell-tempered. The shape is reminiscent of earlier Baytown forms. Three general areas where this form has been reported are south of Naylor (Price, Price, and Harris, 1976), along the central portion of the Cache River (House 1975), and at the confluence of the White and Black Rivers (Morse 1969a). No attempt has been made to detail the material in Arkansas since only surface collections and a minor salvage operation are involved and there is little or no control over the data. In Missouri, Price has summarized a sequence of three phases in the Little River and the Fourche Creek area (Price, Price and Harris 1976:42, 45; Price and Price et al. 1975:56-57). The earliest is the Buckskull phase which is Woodland with some shell-tempered pottery. The second in time is Scatters with the shell-tempered "flower pot" shaped bowl and the third is Naylor with similarities in vessel form to the Big Lake phase.

Possibly what we see in the Western Lowlands is a Baytown complex changing to Mississippian due to the presence of the Big Lake and Hoecake phase expansion. Whether it can be detailed at the moment as three phases is moot. There is no real temporal control on this material and it is only now being generally recognized; the apparent succeeding Powers phase is still interpreted as a site intrusion in spite of the real possibility now of a local development (Price and Price et al. 1975:60). These differing interpretations reflect the difficulty of suddenly pushing back a period some 200-300 years, leaving us faced with a void into which we may or may not hypothesize a developmental scheme.

Coles Creek

This complex is little understood culturally. The Coles Creek elements appearing in the Northern Alluvial Valley indicate that influences and probably artifacts are traveling as far north as up the White River to near Chandlers Landing (Moore 1910:342-348). Further downstream are sites with Coles Creek-like pottery on the White River near Searcy (Figley 1968). The same is true near Brinkley (House 1975:159) and Coles Creek sherds appear as far north as Fair Oaks. Possible sherds have been found at Zebree and near Jonesboro. The Toltec site (Rolingson 1977; Anderson n.d.) near Little Rock may be a Coles Creek related site (Phillips' Toltec phase; 1970:916) with related sites near Brinkley. Until more is known about Coles Creek proper, little can be extrapolated northward to the Northern Alluvial Valley peripheral expression, and little can be gained here by creating unfounded hypotheses of relationships.

Cahokia

The Cahokia site itself seems to be central to events occurring in the middle portions of the Mississippi Valley. This is the largest site with the largest mound known north of the Valley of Mexico. Much of this site was begun or constructed during the Fairmount phase (A.D. 900-1050), 100 or more years after Mississippian appeared in the Cahokia areas. Exotic cherts and shells together with other items are found there. It is located at or near the major crossroads of the eastern United States; the mouths of the Missouri, Illinois, Ohio, Tennessee, and Cumberland Rivers range from 55 km north to 300 km south and east of Cahokia. Much of its economic orientation is south, however, toward the Cairo Lowlands near where Mill Creek chert, granites and basalts, the anculosa snail and other raw material is located, and through which conch shell probably was traded. No attempt, at least in print, has been made to explain why Cahokia is located where it is. One obvious circumstance is the size of area needed to support such an array of earthworks and the American bottoms is a rich agricultural region. There was a diversity of environments to exploit and a fairly sizable population available for efficient exploitation.

The site intrusion seen in the case of the Big Lake phase is not directly from Cahokia. The basic identification of the Big Lake phase is with the Cairo Lowlands where the large early site of Hoecake is located. However, no matter where the actual physical migration to Zebree began, the social and emotional tie would appear to have been with Hoecake and with Cahokia.

Remarks

Around A.D. 750-950, a change had occurred within the northern Mississippi Alluvial Valley. The Barnes complex, seemingly destined for oblivion no matter what it did, and the Baytown complex, underwent a change. This change involved a shift in social-political complexity from autonomy to multisociety integration and a change from horticulture to an intensive agricultural base. The shift in house form itself is indicative of the shift in political power. Human labor sufficient to build complete villages in a short period of time was available and controllable. The house changes from a circular to oval structure for an extended family capable of building it quickly and seasonally to more permanent and better insulated rectangular houses with trenched foundations necessitating the cooperation of efficient work forces for its construction. Social change is reflected in the size of cooking jars and the settlement pattern. Probably the conical clan is present in contrast to the earlier probable lineage system.

The Cairo Lowland probably was the primary site of the development of Mississippian culture in the Northern Alluvial Valley. How it might have begun there is still based on little evidence in regard to its material culture. Did it develop _in situ_, was it a site intrusion, or was it part of a contemporaneous widespread shift from Woodland into Mississippian? The relationship to Cahokia is very strong and Cahokia, by virtue of its size and complexity, has to be reckoned within any scheme of Mississippian development. However, the Fairmount phase as now defined at Cahokia is later than the alluvial valley expressions and it will be difficult to isolate the transitional period at the Cahokia site.

Once into the alluvial valley, Mississippian in its initial form spread to the south and west. At the Zebree site an intrusion is clearly indicated. Presumably the Big Lake phase intruded as a unit from the direction of the Cairo Lowland. The Big Lake phase probably developed eventually into the Lawhorn phase although a gap of around 150 years is present due to pushing the Big Lake phase back in time as a result of radiocarbon dating. Lawhorn, in turn, probably developed into the Parkin phase. The history of this development seems to be tied to direct control of the St. Francis River with respect to quarrying in the upper reaches for granite, basalt, chert, sandstone, hematite, and other raw resources necessary to the satisfactory operation of the Mississippian phases.

The Cairo Lowland expressions probably eventually developed into the Nodena phase but this is a long way from being actually demonstrated. The Hoecake site is crucial to any interpretation and land leveling operations on the sites of southeast Missouri may have already rendered much of the data unrecoverable.

In the Western Lowlands, a different sort of expression is tentatively seen. The development of several Mississippian phases may have taken place but all seem to be closely related. The eventual late prehistoric phase, the only one known to date, is Greenbrier just up the White River from its confluence with the Black River. What happened in the period between the beginning of the Mississippian and the Greenbrier phase is a matter of conjecture without much foundation for conjecturing.

The beginnings of intensive agriculture as a base for complex cultural behavior is not a simple picture. Existing populations were transformed into more complex sociopolitical units in a number of ways. One way was migration and the amalgamation of the indigenous populations. Another was acculturation with the preservation of some local attributes. Acculturation seems to have been more probable with a Baytown base and location in secondary geographical subdivisions. The combination of an important tributary of the Mississippi River, the St. Francis, and the presence of the politically unstructured Barnes groups may have influenced the Zebree site intrusion. Subsequent to the Big Lake phase encroachment upon Barnes territory, amalgamation to the initial Mississippian pattern probably took place.

CHAPTER 22

FAUNAL SUBSISTENCE PATTERNS

Eric A. Roth

An examination of various aspects of southeastern faunal subsistence patterns as determined from the Zebree faunal remains considered the following aspects of aboriginal subsistence: 1) food procurement patterns; 2) microenvironmental exploitation; and 3) determination of seasonality. This chapter concerns the faunal remains of the Big Lake phase and compares it with Barnes faunal (see Chapter 17 and Tables 17-2 and 17-3). No remains were found exclusively associated with the Lawhorn phase at Zebree.

Food Procurement

Cleland, while discussing cultural faunal procurement strategies proposed a bi-polar cultural classification. He stated that cultures can be regarded as either "focal" or "diffuse". To Cleland:

> "a focal subsistence economy is directed toward the procurement of one or a few similar kinds of food, while a diffuse economy is based not on the reliability of one food resource, but on an ability to exploit a variety of such resources" (1966:43).

While on the surface such a dichotomy may appear too general to be of much significance, Cleland points out that his scheme yields important cultural insights, since each system has inherent advantages and disadvantages. For instance, the fact that focal adaptations arise in the presence of only a very reliable resource means that the resource is rarely threatened, while diffuse economies must exploit a variety of resources due to the unreliability of a single resource base. Conversely any change which takes place in a focal economy occurs only at the expense of a long established tradition and thus under drastic conditions, while change in a diffuse economy occurs more easily since alternative resources are already being exploited.

Moreover, the descriptive terms "focal" and "diffuse" can be quantified through the use of the "Species Diversity Index" as formulated by Wing (1963). This formula is as follows:

$$SDI = \sum_i p_i \ \mathrm{Log}_e p_i$$

or the summation of the percentage (p) of individuals of the species identified, times the natural logarithm of that percentage. Using this formula a value of 0.0 would indicate a single species utilization, or no diversity. Similarly, a value of 4.61 would indicate a maximum possible diversity, based on 100 species present.

A second, simpler method of calculating Species Diversity Index is as follows:

$$SDI = 1-(p_i)^2$$

where "p_i" is the percentile of the species identified within the faunal assemblage or particular taxonomic unit of that assemblage. In this case the diversity index, again based on maximum of 100 species, would range from 0.0-1.0, lower values representing focal economies, while higher values indicating diffuse economies. Tables 22-1 and 22-2 present the identified fauna for the Big Lake phase. Table 22-3 presents the computational data of the Species Diversity Index arrived at by the utilization of this second method for the two major Zebree components. In doing so, these elements which yielded indentification only to the generic level were omitted.

Table 22-1. Big Lake phase faunal assemblage.

MAMMALIA

Species	No. of Elements	M.N.I.	Lbs. of Meat per Individual	Total Lbs. of Meat
Peromyscus cf. maniculatus (White-footed mouse)	63	6	---	---
Oryzomys palustris (Rice Rat)	52	5	---	---
Sciurus niger (Fox Squirrel)	72	3	1.5	4.5
Odontra zibethecus (Muskrat)	3	2	2.1	4.2
Mustela vison (Mink)	21	2	1.5	3.0
Sylvilagus floridana (E. Cottontail)	45	6	2.1	12.6

(Table 22-1 continued)

Species	No. of Elements	M.N.I.	Lbs. of Meat per Individual	Total Lbs. of Meat
Sylvilagus aquaticus (Swamp Rabbit)	2	1	2.0	2.0
Sylvilagus palustris (Marsh Rabbit)	5	2	2.5	5.0
Procyon lotor (Raccoon)	34	4	17.5	70.0
Odocoileus virginianus (White-tailed Deer)	63	6	75.0	450.0
Ursus americana (Black Bear)	1	1	210.0	210.0
Totals--Mammalia	361	38	----	751.3
		AVES		
Ectopistes migratorius (Passenger Pigeon)	14	2	.7	1.4
Colinus virginianus (Bob-White)	1	1	---	---
Cynocitta cristata (Blue-jay)	1	1	---	---
Quiscala quiscala (Grackle)	1	1	---	---
Passeriformes sp. (Passerines)	14	2	---	---
Anas acuta (Pintail)	9	2	1.4	2.8
Anas carolinensis (Green-winged Teal)	14	3	.7	2.1

(Table 22-1 continued)

Species	No. of Elements	M.N.I	Lbs. of Meat per Individual	Total Lbs. of Meat
Anas discors (Blue-winged Teal)	8	3	.7	2.1
Anas platyrhynchos (Mallard)	32	4	1.8	7.2
Anas rubides (Black Duck)	5	2	1.8	3.6
Anas strepera (Gadwall)	1	1	1.4	1.4
Aix sponsa (Wood Duck)	4	1	1.0	1.0
Lophocytes cucullatus (Hooded Merganser)	2	2	1.8	3.6
Phalacrocorax auritus (Double-crested Comorant)	3	1	3.0	3.0
Spatula clypeata (Shoveler Duck)	8	2	.5	1.0
Anatidae sp. (Ducks)	29	3	---	---
Fulica americana (Coot)	5	1	.8	.8
Branta canadensis (Canada Goose)	10	2	5.6	11.2
Chen sp. (Geese)	1	1	4.0	4.0
Strix varia (Barred Owl)	1	1	2.0	2.0
Melagris gallopavo (E. Turkey)	6	2	8.5	17.0
Grus canadensis (L. Sandhill Crane)	1	1	6.0	6.0
Totals--Aves	170	39	---	72.2

(Table 22-1 continued)

OSTEICHTHYES

Species	No. of Elements	M.N.I.	Lbs. of Meat per Individual	Total Lbs. of Meat
Lepisosteus sp. (Gar sp.)	230	6	1.0	6.0
Catostoma/ Moxostoma (Suckers)	47	6	6.2	37.2
Pylodictus olivaris (Flathead Catfish)	14	4	.5	2.0
Ictaluris punetata (Channel Catfish)	54.	5	3.2	16.0
Ictaluridae sp. (Catfish)	108	10	1.4	14.0
Amia calva (Bowfin)	8	3	1.0	3.0
Aplodinotus grunniens (Freshwater Drum)	108	5	2.0	10.0
Stizostedion sp. (Walleye or Sauger)	39	10	2.0	20.0
Lepomis macrochinus (Blue-gill)	3	1	.3	.3
Ictiobus sp. (Buffalo Fish)	29	3	9.5	28.5
Micropterus salmoides (L. Mouthed Black Bass)	90	11	2.0	22.0
Totals--Osteichthyes	730	64	---	159.0

REPTILIA

Species	No. of Elements	M.N.I.	Lbs. of Meat per Individual	Total Lbs. of Meat
Terrapene carolina (3-Toed Box Turtle)	4	1	3.0	3.0

(Table 22-1 continued)

Species	No. of Elements	M.N.I.	Lbs. of Meat per Individual	Total Lbs. of Meat
Chelydra serpentina (Snapping Turtle)	14	1	10.0	10.0
Trionyx spinifer (Softshell Turtle)	23	3	3.0	9.0
Pseudemys floridana (Missouri Slider)	65	3	3.0	9.0
Colubrid sp. (Non-poisonous Snakes)	11	1	---	---
Totals--Reptilia	117	9	---	31.0
		AMPHIBIA		
Bufo sp. (Toad)	17	2	---	---
Rana sp.	23	4	---	---
Totals--Amphibia	40	6	---	---

Table 22-2. Big Lake phase mussels. Sample is based on Features 155 and 238. Identification by Richard Rockwell.

NAME	VALVES	
	Number	Per cent
Amblema plicata	187	30.1
Fusconaia flava flava	77	12.4
Quadrula pustulosa	46	7.4
Lampsilis teres	39	6.3
Tritogonia verrucosa	39	6.3

(Table 22-2 continued)

	Number	Per cent
Plagiola lineolata	35	5.6
Proptera purpurata	35	5.6
Elliptio dilatatus	32	5.2
Quadrula nodulata	25	4.0
Puerobema cordatum ssp.	24	3.9
Quadrula quadrula	20	3.2
Fusconaia flava undata	15	2.4
Fusconaia ebenus	13	2.1
Actinonaias carinata	8	1.3
Fusconaia flava ssp.	8	1.3
Quadrula metanevra	7	1.1
Lampsilis fallaciosa	3	0.5
Arcidens confragosus	2	0.3
Lampsilis ovata	2	0.3
Obliquaria reflexa	2	0.3
Lampsilis radiata siliquoidea	1	0.2
Leptodea fragilis	1	0.2
TOTALS	621	100.0%

TABLE 22-3. Species Diversity Index Computations.

	No. of Species	M.N.I*	S.D.I
Barnes	27	54	0.9237
Big Lake	40	108	0.9669

*minimum number of individuals

Microenvironmental Exploitation

Both Zebree components exhibit a highly diffuse faunal economy. Because of this the question naturally arises as to which micro-environments were consequently exploited and to what degree of intensity in such systems. The immediate vicinity of the Zebree Site boasts of the following microenvironments: open lake, swamplands, deciduous bottomland hardwood forest, riverine, forest edge, and prairie. These specific microenvironments are briefly described below:

1) Open lake--this microenvironmental zone encompasses Big Lake, a large body of water over 8,000 acres in area.

2) Swamplands--in reality these areas are oxbow lakes formed by the meanderings of the Mississippi River. Although seasonally flooded these lake-swamps are for the most part in the process of filling in and should properly be termed "backwater lakes" (Lambou 1959).

3) Deciduous bottomland hardwood forest--a mixed forest association which has been termed "oak-gum-cypress" (Morse 1975b:5).

4) Riverine--this microenvironment is represented at Zebree by the Right Hand Chute of the Little River which empties into Big Lake.

5) Forest-edge--a zone which forms a transitional interface between the hardwood forest and lacustrine areas.

6) Prairie--in addition to the present-day microenvironments at Zebree a discontinuous lowland prairie existed in the site vicinity during the early 1900's (Stephanson and Crider 1916). Apparently this prairie also was present in prehistoric times, as witnessed by the recovery and identification of two prairie forms, the prairie chicken (*Tympahachus cupido*) and the thirteen-lined ground squirrel (*Sperophililius tridecemlineatus*) from the 1969 Zebree excavations (Guilday and Parmalee 1971).

The preceeding descriptions, brief as they are, point out that a great variety of diverse microenvironments occur in close proximity to Zebree. Such diversity would have been potentially advantageous to prehistoric fauna for it exemplifies an ecological system featuring a variety of distinct botanical communities within a small area, resulting in the maximization of edge area between such communities. Such situations have long been noted for their faunal diversity and abundance, and have been termed the result of the "edge or boundary effect" (Odum 1966:217). Stated simply, the edge effect is a marked tendency for greater faunal density and variety along ecotones, or vegetational community junctions.

Some of the reasons for this effect are as follows: 1) a greater variety of food plants is likely to occur along a boundary than within a uniform vegetational block; 2) ecological requisities such as shade, water, and escape cover from predators may be easily accessible in an ecotonal situation; 3) organisms with broad ecological niches exhibit seasonal movements as certain food resources are depleted in specific microenvironments and are replaced by differing food resources in other ecological settings; the proximity of different microenvironments would facilitate such movements; 4) ecotones support not only organisms from the different biotic communities they separate, but they also may support their own unique faunal assemblage, confined to the ecotone and referred to as "edge species".

Smith (1974) in his study of Middle Mississippian animal exploitation patterns has called attention to the advantages this "edge effect" would give not only to prehistoric fauna but also to prehistoric hunters. As Smith points out, the prehistoric exploitation of ecotonal situations would result in the relatively easy eatablishment of diffuse economies based on the procurement of multiple species of fauna. That the Zebree populations also enjoyed such a situation is suggested by the Species Diversity Index which revealed that the two major components featured a diffuse faunal resource base. The task which arises is that of quanitfying the diverse microenvironmental utilization of the Zebree faunal subsistence patterns.

For this purpose a habitat preference scheme devised by Cleland (1966) was utilized. To quote Cleland:

> "...a scoring system was devised which weights habitat preference according to type of habitat(s) in which a species is most frequently encountered. If a species is found almost exclusively in one habitat that habitat was scored two points. If however, a species occupies habitats other than the preferred one, these were each scored one point." (Cleland 1966:102).

Table 22-4 shows the habitat preferences of the total Zebree assemblage when scored in such a fashion. Some species were excluded from the list: Mammalia--species suspected of being intrusive in nature (e.g. *Peromyscus* cf. *maniculatus* and *Oryzomys plaustris*); Aves --the group *Passerformes* since osteological identification could not procede below the family level; Osteichthyes--the sucker group since identification could not distinguish between *Catostoma* and *Moxostoma*; Anuridae--it was feared that their remains were also intrusive.

Sources utilized in the compliation of the Mammalian habitat preference included Cleland (1966), and Smith (1974). For Aves the sources employed were Robbins et al. (1966) and McElroy (1974).

TABLE 22-4. Species habitat preferences. Key: RI = riverine, LA = lake, SW = swamplands, DF = deciduous forest, FE = forest edge, PR = prairie.

	RI	LA	SW	DF	FE	PR
Eastern Cottontail				1	2	
Muskrat	1	1	1			
Swamp Rabbit			2			
Marsh Rabbit			2			
Fox Squirrel				2		
Mink	1	1	1		1	
Raccoon	1	1		1	2	
Black Bear	1			1	1	
White-tailed Deer				1	2	
Pintail	1	2				
Blue-winged Teal	1		2			
Green-winged Teal	1		2			
Gadwall	1	2				
Mallard	1		2			
Shoveler	1		2			
Merganser	1		2			
Wood Duck	1	1	2			
Canada Goose	1	2	1			
Coot	1		2			
Eastern Turkey				2		
Sandhill Crane			2			
Passenger Pigeon				2		
Grackle	1	1				
L. Blue Heron	1	1	2			
L. Nosed Gar	1	2	1			
S. Nosed Gar	1	2	1			
Channel Catfish	2	1	1			
Flathead Catfish	2	1	1			
Freshwater Drum	1	2	1			
L. Mouthed Black Bass	1	2	1			
Walleye	1	2	1			
Sauger	1	2	1			
Bowfin	1	2	1			
Snapping Turtle	1	1	1			
Missouri Slider	1	2	1			
Soft-shelled Turtle	2	1	1			
3-Toed Box Turtle	1	1	1	1		
Totals	32	33	38	10	8	0

Fish habitat preference was based on fish population studies (Forbes and Richardson 1914, 1920) conducted on the Upper Illinois River. In the case of Reptilia the basic reference source was Conant (1958).

The results show the overall Zebree microenvironmental orientation was towards exploitation of aquatic areas. As stated previously such a finding is in agreement with those made following the 1969 Zebree faunal analysis (Guilday and Parmalee 1975). Such a scheme, however, has two basic weaknesses: it does not yield any indication of possible shifts in microenvironmental utilization which may be inherent in each of the two cultural components, and such a scheme does not indicate the dietary contribution of the species/genus exploited from each microenvironment. In order to compensate for these deficiencies, a scheme for quantifying the contribution of each microenvironment to the diet of the Zebree components has been formulated. In this method the minimum number of individuals recovered from each component plus the projected meat yield for each species was analyzed in association with the species habitat preference. In the case of preferred species habitat such calculations were doubled in accordance with the previously discussed scheme of Cleland (1966:101). Figures 22-1 and 22-2 graphically illustrate the results of such methodology.

Examination of the figures reveals that while far more individuals are represented from the aquatic microenvironments, i.e., riverine, lake, and swamp, an overwhelming proportion of the projected meat yield, which is the most relevant index of dietary contribution, comes from the terrestrial microenvironments, i.e. deciduous forest and forest edge. In short, while the aquatic microenvironments accounted for 85% of the minimum number of individuals overall, in terms of projected meat yield the terrestrial microenvironments yielded 65% of the total edible meat. Thus in contrast to the earlier statements that Zebree reflects a prehistoric faunal exploitation pattern oriented toward procurement of aquatic species, it appears that the terrestrial microenvironments were even more important in such an exploitation pattern, for they yielded the majority of edible meat through the forms of both small and large mammals. Finally both the large (40%) contribution of the forest edge microenvironment to the overall projected meat yield in combination with the fact that all microenvironments, with the exception of the prairie zone, were exploited by both components indicates the importance of the already mentioned "edge effect" to the prehistoric Zebree inhabitants.

Determination of Seasonality

The third aspect of the Zebree components subsistence patterns to be investigated will be that of faunal procurement seasonality.

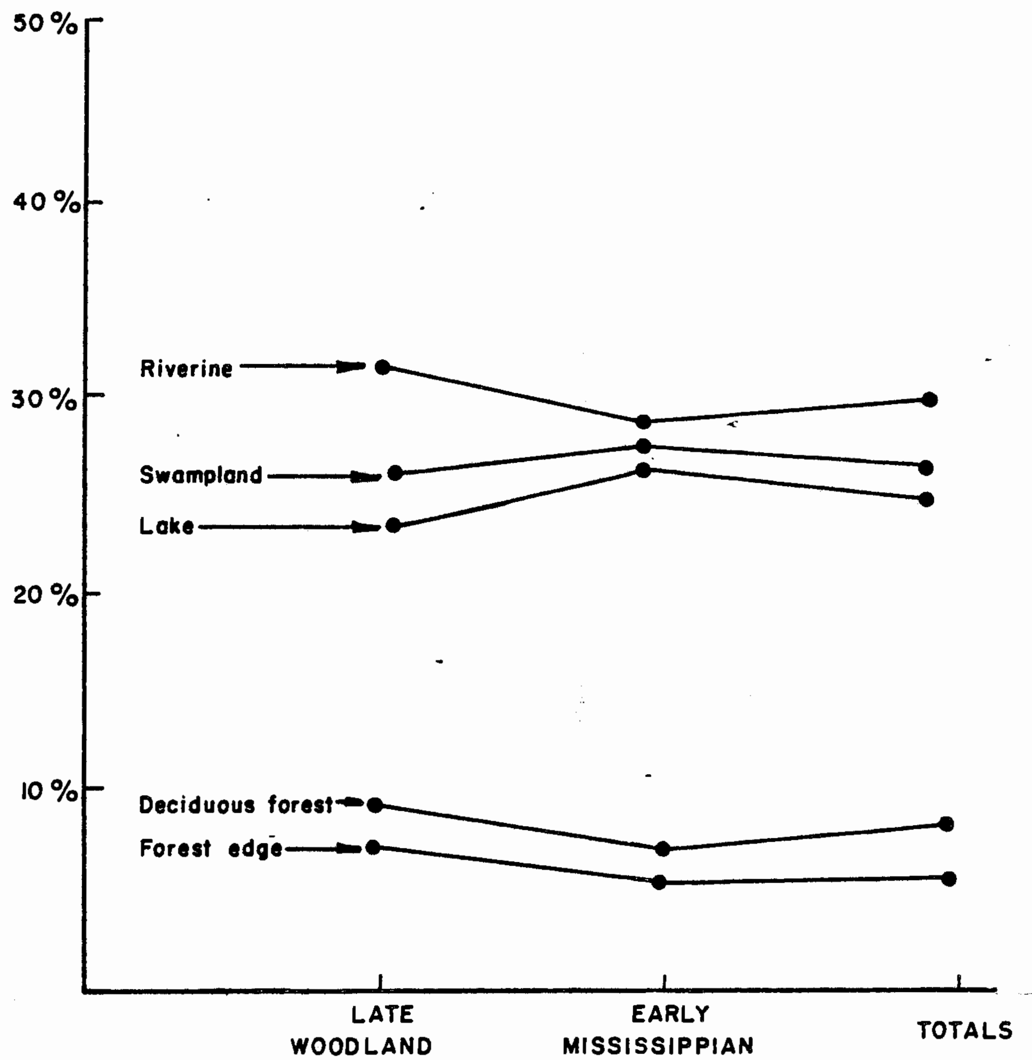

Figure 22-1. Minimum number of individuals from Zebree micro-environments.

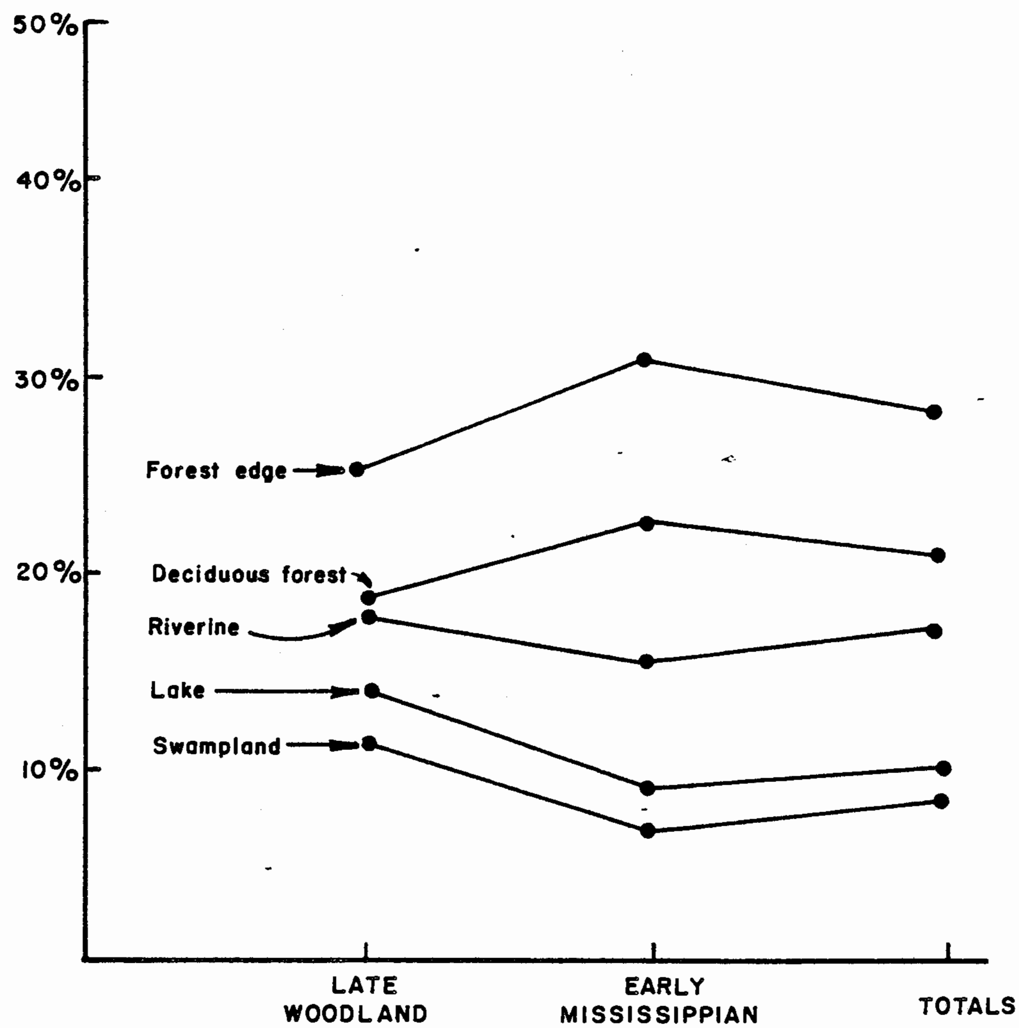

Figure 22-2. Projected meat yield from Zebree microenvironments.

Smith (1974:28) notes that:

> ". . . Data from one or more of four sources is invariably employed in attempting to determine the seasonal nature of exploitation of animal populations by prehistoric groups, with these four sources being: 1) direct archaeological evidence, 2) ethnohistorical sources, 3) modern descriptions of hunting patterns, and 4) wildlife studies."

One of the noteworthy features of the Zebree sample is that is essentially modern in regards to species content, with only one species being extinct and one extirpated from the Mississippi Valley. Modern wildlife studies conducted in the general area can be confidently applied to the Zebree faunal assemblages in order to reconstruct animal species availability.

Figure 22-3 illustrates the primary reasons of exploitation of eleven Southeastern species; species as determined by Smith (1974: 329) based both on direct archaeological evidence and ethnohistorical sources, as well as an intensive survey of the ethological habits of modern fauna in the Southeast. From such information three broad taxonomic groups can be separately analyzed: 1) migratory waterfowl, 2) fish species, and 3) terrestrial mammals.

The Zebree site is well suited to migratory waterfowl analysis since abundant waterfowl elements are present in both major components and because the site's locale is within the central section of the Mississippi Valley Flyway, an area where detailed seasonal availability of migratory waterfowl have been conducted (Mississippi Flyway Council 1958a, b). Today more than two dozen species of swans, geese, and ducks that frequent continental North America utilize the flyway. Smith (1973:226) notes that since these waterfowl move north to breeding grounds in the spring and south again in the fall to their wintering grounds we may expect to find three basic groups or patterns of flyway utilization in the central section:

1) Those species that breed but do not winter in the central section of the flyway.

2) Those species that do not breed, but winter in the flyway.

3) Those species that neither breed nor winter in the central section.

To the present-day species which exhibit such patterned behavior may be added an extinct species, the passenger pigeon (*Ectopistes migratorius*). The seasonal availability of this species has been

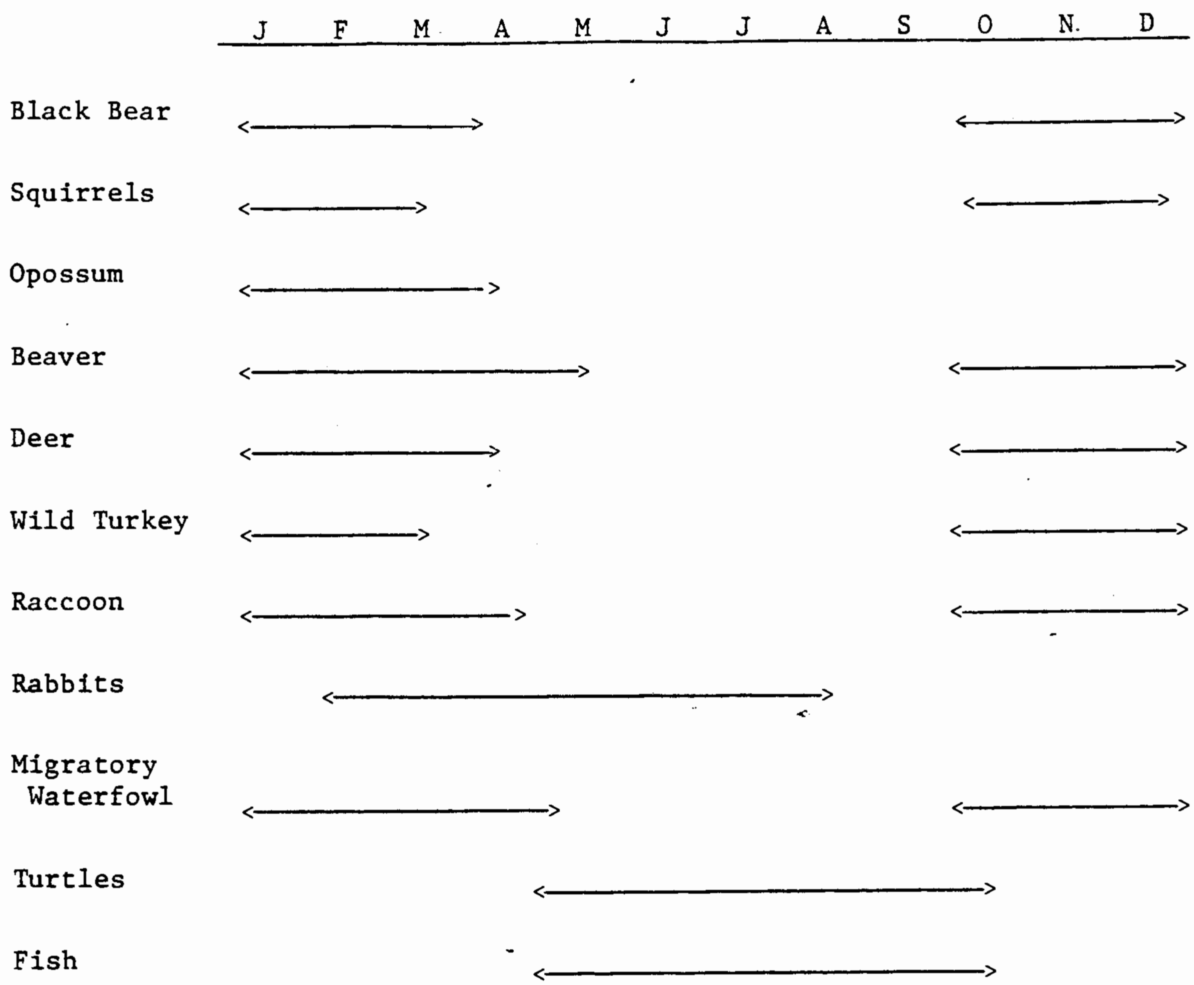

Figure 22-3. Hypothesized middle Mississippian seasonal animal exploitation patterns. (after Smith 1973:329)

reconstructed from historic sightings for the state of Arkansas by Scharger (1955:269). The seasonal availability of this species, plus others commonly found in the central section of the Mississippi Flyway, are presented in Figure 22-4.

When such seasonal availability is examined in light of both Zebree major components, a fall-winter exploitation pattern is apparent, with cultural scheduling being timed to coincide with the peak of the fall migration. Such a suggestion of scheduling is further strengthened by the presence of three wintering species, the Canada Goose (*Branta canadensis*), the pintail (*Anas acuta*), and the mallard (*Anas platyrynchos*) none of which arrive in the central section of the flyway before November. Similarly, both components contain the remains of the Wood Duck (*Aix sponsa*), and the Hooded Merganser (*Lophodytes culcullatus*), two species which breed but do not winter in the flyway, migrating southward in mid-October. These two species' availability overlap but slightly with the more abundant wintering species, suggesting that both components represent cultural scheduling to exploit migratory waterfowl intensively at their peak of availability.

Turning to the fish remains, both ethnographic and ecological factors favor summer as the prime season for intensive exploitation of the Zebree fish resources. Swanton (1946:257), describing the annual cycle of faunal exploitation by early historic Indians of the Southeast, states:

> ". . . Nevertheless even the inland tribes were not without opportunities to enjoy a fish diet in summer, for they had fish traps led to by converging lines of rocks, and it was then that they resorted to the poisoning of fish in pools in the shrunken streams or drugged them for the same purposes."

That the Barnes or Big Lake Zebree inhabitants possessed the same fish procurement technology as did Swanton's historic groups is immaterial; what is important is the strategy of capturing fish in dried pools. In the earlier brief descriptions of the Zebree microenvironments it was noted that those habitats termed swamplands are in reality oxbow lakes created by the meanderings of the Mississippi River and should properly be termed "backwater lakes." For the most part such features are strictly seasonal, being initiated by flooding of the Mississippi during early winter and late spring, and drying out in the heat of mid-summer. During such a summer cycle fish trapped in isolated pools die of suffocation or fall easy prey to predators (Paloumpis 1957:62), forcing the remaining fish to move into larger, permanent oxbow lakes during the summer season. Such shallow, isolated lakes have been shown to support large fish biomass

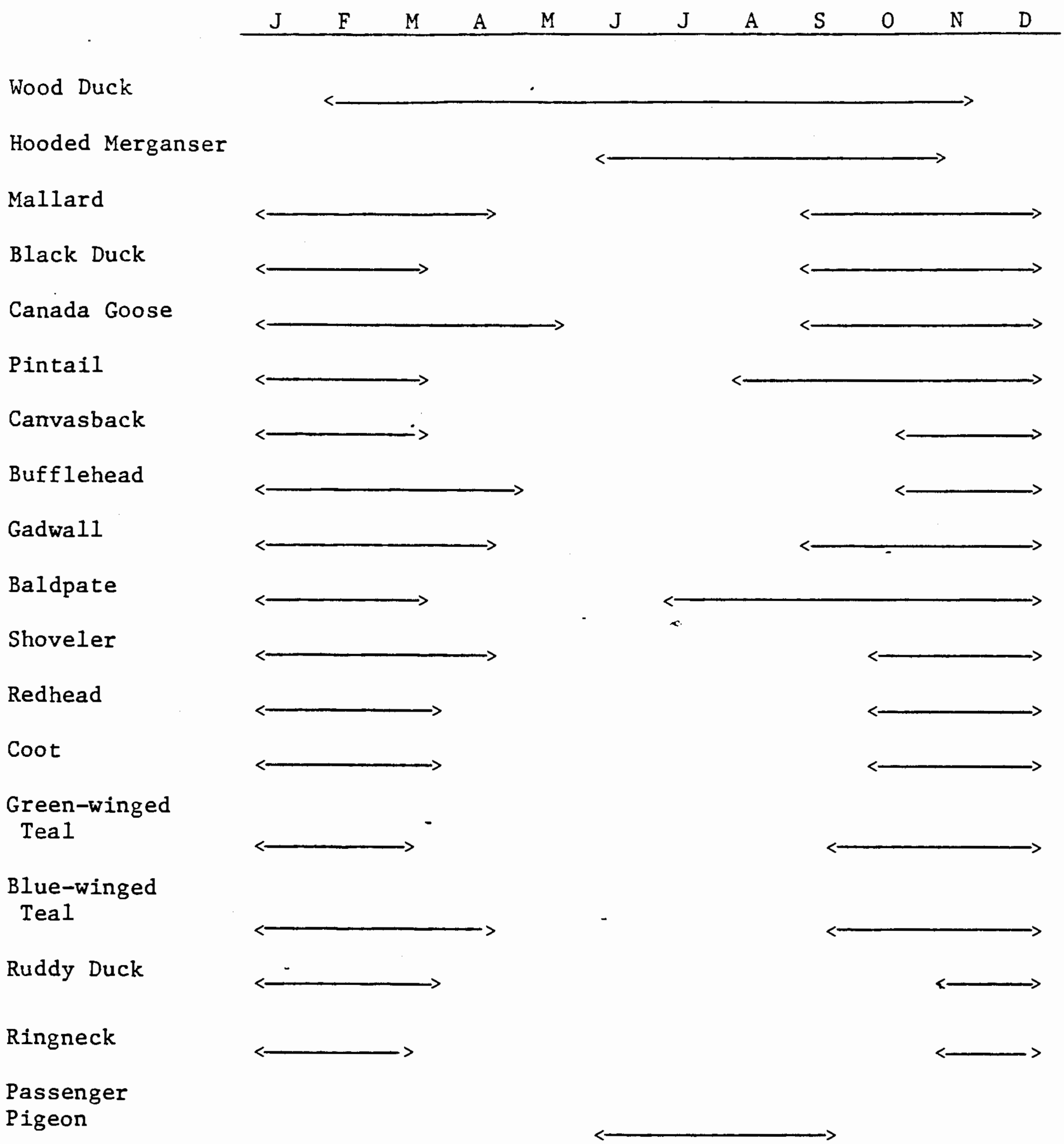

Figure 22-4. Seasonal availability of migratory waterfowl in the Central Mississippi Flyway. (after Smith 1973:237)

(Lambou 1959:15) which have yielded abundant fish harvests in modern times (Carlander 1954) with a minimum of effort. The importance of such pools to prehistoric peoples has been commented on by Parmalee et al. (1972) for late Woodland groups and by both Griffin (1967:15) and Smith (1974:290) for Mississippian peoples. The large quantities of fish remains uncovered at Zebree for both major components, often exhibiting a high density of such elements within a small area, suggests summer harvesting from such oxbow lakes.

In regard to mammalian forms, the most important species, both in terms of minimum number of individuals and projected meat yields is the white-tailed deer (*Odocoileus virginianus*). As in the case of fish, ethnographic, ethological, and ecological factors can aid in the reconstruction of seasonal exploitation of this species. From an ecological standpoint the fall and early winter periods would be the most advantageous time to hunt deer in this area. It is at this time that deer concentrate in the upland hardwood areas in order to exploit abundant acorn mast crops. Such fall deer concentration is further increased by the fall flooding of the Mississippi River, which would have acted as a further enticement for deer to retreat to the forested areas.

As a result of abundant acorn crops it is this fall-to-early winter period during which deer attain their maximum yearly weight (Severinghaus and Cheatum 1956:83), thus taking deer at this time would represent an exploitive faunal procurement pattern yielding maximum gain from minimum effort. Ethological attributes of the white-tailed deer also contribute to the advantages of fall procurement. In the general area the mating season for the species lasts from the first week in September until the last week of November. During this period the males lose their timidity in their quest for does, and become a more vulnerable prey species. That aboriginal peoples were well aware of such behavior is evidenced in Swanton's (1946) ethnographic references to the use of deer skins and/or heads to attract bucks. Specifically Swanton, referring to Yuchi informants, states:

> "My informants also remember this style of hunting. They said that as it was usually undertaken in October or November when the bucks seek the does or seek each other to fight, either the head of the doe or the head of a buck could be used." (Swanton 1946:317)

The concentration of mast crop in the fall would also suggest that this period would be the most advantageous for the procurement of two other terrestrial mammals, the fox squirrel (*Sciurus niger*) and the raccoon (*Procyon lotor*), plus one upland game bird, the

Eastern turkey, (*Malagris gallopavo*), all of which are dependent on this crop during the fall-winter time period. Similarly fall would also have been the logical time to hunt the black bear (*Ursus americana*), for it is at this time that this formidable beast is inactive. To quote Hallowell (1926:42) concerning the Southeastern aboriginal bear hunting techniques:

> "They usually hunted the bear before he came forth from his winter quarters, in a hollow tree or cave".

While the terrestrial mammals discussed so far all feature fall-winter periods of optimal availability and hence procurement, Swanton (1946:256) also notes that historical aboriginal peoples in the Southeast also undertook a short summer hunt which featured taking rabbits, as well as deer and raccoons in smaller numbers.

Discussion and Conclusions

In the preceding sections emphasis has been placed on investigating singular facets of the Zebree faunal assemblage as they relate to Southeastern prehistoric subsistence patterns. This section will focus on an integration of such factors so that the Zebree animal exploitation strategy may be viewed as a related functional system.

One immediate conclusion which may be reached upon comparison of the two major components is that they are in actuality very similar. (For differences of opinion concerning how similar the two procurement systems actually may be, consult Chapters 17 and 21. Eds). Similarity was brought out in the calculation of the Species Diversity Index, which determined that both components featured highly diffuse faunal economies. Viewed in another context it can be stated that of the 44 total species identified for the two components, 29 are present in both components. Such cultural continuity is unexpected, for it has been pointed out that the introduction of domestic corn (*Zea mays*) in the early Mississippian component and its continued presence in the middle Mississippian remains from Zebree represents the implementation of a focal horticultural subsistence base, a base revolving around the planting, maintainance, and final harvesting of a staple crop. Such a subsistence shift is evident in the ethnobotanical record of the Zebree site, for the late Woodland component has yielded only evidence of hickory and acorn remains, indicative of a "wild" resource gathering economy. That such a change is not evident in the *overall* animal exploitation pattern at Zebree is interesting in that it is an example of cultural stability in the presence of otherwise radical cultural change. (For differences of opinion consult Chapters 17 and 21. Eds.)

That such stability is featured strengthens Swanton's (1946: 296) contention that "we are plainly dealing with one economic province", and increases the confidence levels that can be assigned to the utilization of such ethnographic sources for the Southeast, both on a synchronic as well as a dichronic plane. Undoubtedly such stability was aided to a large extent by the physical environment of the Zebree locale. Situated as it is within a context of highly diverse microenvironments, each capable of supporting different faunal assemblages, the prehistoric inhabitants of Zebree were able to harvest a wide variety of faunal species, aided by the ecological concept of an "edge effect."

While enjoying such an advantageous ecological situation, however, there is evidence that the Zebree inhabitants scheduled their hunting activities to coincide with seasonally available faunal resources in these differing environmental settings. For example, migratory waterfowl were harvested during the height of fall migrations, while the summer periods yielded large returns of fish through a hypothesized intensive exploitation of the numerous oxbow lakes in the immediate site locale.

It must be pointed out that such aquatic microenvironmental exploitation, while yielding a large majority of the minimum number of individuals represented in both components, did not produce a great amount of the total projected meat yield. Thus while the overall faunal assemblage does indicate an "aquatic orientation" (Guilday and Parmalee 1975) it has been stressed that the terrestrial habitats were of great importance. (For differences of opinion concerning relative importance of the aquatic environment, consult Chapters 17 and 21. Eds.)

CHAPTER 23

THE BIG LAKE PEOPLE: SKELETAL POPULATION

Mary Lucas Powell

Description of skeletal populations in archeological reports has advanced a great deal from the typical appendix at the back of a report concluding that there were men, women, and children at a site, some of whom had an occasional interesting pathology. A physical anthropologist should be part of the research team in both the planning stages and during the actual excavations to observe and recover all necessary data. Unfortunately, this did not occur during any of the field seasons at the Zebree site. The Zebree skeletal material was first studied as a class project at the University of Arkansas under the direction of Sandra C. Scholtz; the material was reanalyzed by Mary Lucas Powell as the subject of her M.A. Thesis there. Bioarcheological data was not actively sought by the Zebree Project research designs, although any burial found was worked out as thoroughly as any other feature. Although a large portion of the site was sampled, it is not felt that the skeletal sample collected is an adequate one for answering many significant questions about the various Zebree populations. Much of the sample may have been destroyed when the first ditch was dug in the 1920's and by subsequent pothunting. [Editors]

Introduction

The full research potential of human skeletal material has seldom been realized in American archeology prior to the last decade. That this potential has remained largely untapped was due in part to the lack of communication between the archeologists who excavated the material and the osteologists who were called upon to analyze it.

The discipline known as bioarcheology now promises to bridge this communication gap. As archeologists gain a new appreciation of the ability of populational-based, problem-oriented analyses to shed light upon questions of subsistence strategies, labor specialization, social differentiation, and biogenetic relationships within and between prehistoric populations, and osteologists take a more active part in the recovery of this data base, the problems of obtaining adequate samples of human skeletal material have become particularly relevant.

The Zebree Archeological Project recovered a total of 26 burials, plus a quantity of loose human bone, during all field seasons (Fig. 23-1). The purpose of the present study is to evaluate this sample on the basis of its adequacy to test certain hypotheses derived from the major research goals of the project.

Demographic Profile

Establishing the demographic profile of the study population is the first step in any bioarcheological analysis. The validity of the demographic profile--the degree to which it represents the age-sex composition of the living population from which it was drawn--is the first criterion of the validity of the sample itself. If it does not accurately reflect the demographic parameters of its parent population, the types of analyses that may be undertaken, and, more crucially, the value which may be placed upon such analyses, will be severely restricted. This problem has only rarely been addressed in osteological analyses of archeological populations (for notable exceptions, see Hooton 1920; Cook 1974; Lallo 1973); it is, however, a source of potential error so critical as to seriously undermine studies of disease epidemiology, labor specialization, and social differentiation within a sample.

Table 23-1 presents the demographic profiles for the Big Lake and Lawhorn phase populations at Zebree, as determined from the available skeletal material. Also presented for comparison are the profiles for the three temporally sequential populations at Dickson Mounds; this data was taken from the life tables constructed by Lallo (1973) in his study of these populations.

Inspection of the table reveals several obvious gaps in the Zebree profiles. In the Big Lake phase sample, no individuals between the ages of 1 and 15 (actually between 1 and 20) are represented. By comparison, the Mississippian-acculturated late Woodland sample from Dickson Mounds (thought to be culturally equivalent to the Big Lake pahse) contains 47 individuals of these ages, 28.5% of the total sample. The Lawhorn phase at Zebree is even more poorly represented, with only four of the ten age categories containing even one individual. Construction of life tables for the two Zebree populations was impossible, given the small sample sizes. Therefore, they cannot be compared with the same degree of sophistication achieved in Lallo's analysis.

The distribution of the two Zebree samples by sex is equally biased. Only one of the two adults from the Lawhorn phase could

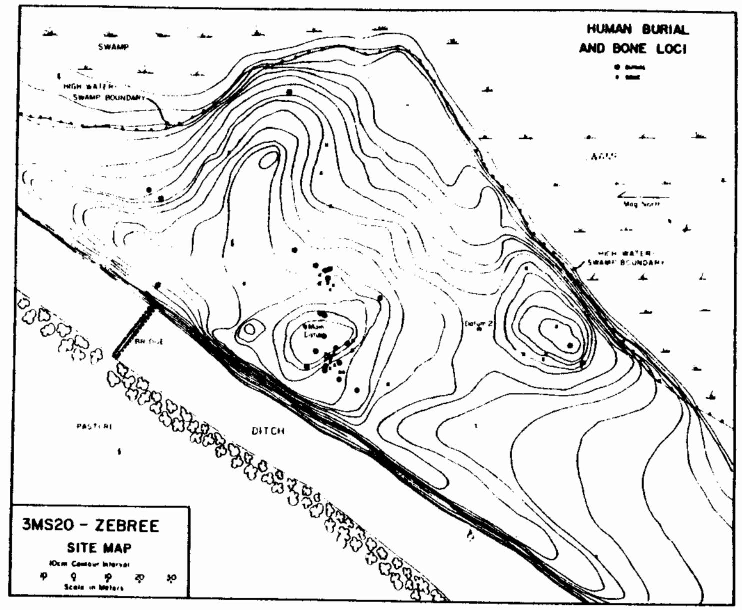

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Figure 23-1. Human bone and burial locations, 3MS20, based on all field seasons.

Table 23-1. Demographic Profiles at Dickson Mounds and Zebree (Sexes combined). Dickson Mounds is based on Lallo (1973).

	Age Categories (% of total populations)										
	0-.9	1-2	3-5	6-10	11-15	16-25	26-35	36-45	46-55	56-65	TOTALS
Dickson Mounds											
Late Woodland	11 (9.6)	7 (6.1)	7 (6.1)	10 (8.8)	7 (6.1)	14 (12.4)	12 (10.5)	16 (14.0)	20 (17.6)	10 (8.8)	114 (100.0)
Mississippian-Acculturated Late Woodland	39 (17.0)	19 (8.5)	18 (8.0)	18 (8.0)	9 (4.0)	39 (17.4)	19 (8.5)	20 (8.9)	34 (15.2)	10 (4.5)	224 (100.0)
Mississippian	48 (21.9)	19 (8.7)	16 (7.3)	17 (7.8)	10 (4.6)	23 (10.5)	24 (10.9)	27 (12.3)	25 (11.4)	10 (4.6)	219 (100.0)
Zebree											
Big Lake Phase	4 (17.4)	0 (0)	0 (0)	0 (0)	0 (0)	1 (4.3)	5 (21.7)	7 (30.4)	6 (26.1)	0 (0)	23 (100.0)
Lawhorn Phase	2 (40.0)	0 (0)	0 (0)	1 (20.0)	0 (0)	0 (0)	1 (20.0)	1 (20.0)	0 (0)	0 (0)	5 (100.0)

be assigned a sex designation (male) with any degree of confidence. In the Big Lake phase sample, females outnumber males by almost two to one: 13 to 7. This does not match the sex distribution observed by Lallo for his Dickson Mound samples:

	Female	Male
Late Woodland	31	41
Mississippian-acculturated late Woodland	61	61
Mississippian	61	48

The obvious conclusion is that the two Zebree samples most probably do not reflect the actual sex and age distributions of the living populations. In Lallo's Mississippian-acculturated late Woodland sample, 62.9% of the population died before the age of 25 (141 out of 224). At Zebree, no one except the four infants was assigned to that age category (0 - 25 years) in the Big Lake phase sample. At Dickson Mounds, 32.6% of the Mississippian-acculturated late Woodland population died between the ages of 25 and 55, compared with 93.7% of the Zebree Big Lake phase sample.

Cook (1974) has discussed the deleterious effect of certain mortuary practices upon the demographic parameters of archeological skeletal samples. It is possible that the extreme imbalances in the sex and age ratios in the Big Lake phase sample stem from the destruction of a portion of the site by a ditch construction in the 1920's. Morse was given accounts by local "artifact collectors" of numerous pots and skeletons taken from this ditch as it was dug, although an interview with Leonard Sebree did not confirm this (Morse, personal communication).

Biogenetic Relationships

One of the principal research goals of the Zebree Archeological Project was to elucidate the nature of the relationships (both biogenetic and cultural) of the Big Lake phase population with other socio-cultural groups in the same geographical region. Several points of archeological evidence indicate that the Big Lake phase may have been a site unit intrusion possibly from as far away as the Cairo Lowlands to the north (Chapter 21). Beyond this is a cultural, and perhaps even a biological, relationship to the Fairmount phase at Cahokia.

The theory that the Mississippian cultural tradition was spread throughout the Southeast from Cahokia via population migrations was tested by Wolf (1976) through comparisons of morphological, metrical, and nonmetrical data from six Mississippian skeletal populations representing sites from southern Illinois to Georgia. He was unable either to confirm or to reject his hypothesis that all had been drawn from the same original breeding population.

Human skeletal material from the Big Lake phase at Zebree was to be compared with appropriate samples from the regions from whence the hypothesized migration occurred. Migration might have introduced a sufficient quantity of new genetic material to produce quantifiable phenotypic differences observable in skeletal samples from the Big Lake phase populations and their Barnes phase predecessors at the site. Before such a comparison can be attempted, however, assumptions concerning the nature of phenotypic expressions of underlying genotypes must be clearly stated.

Three assumptions are as follows: One, that the proposed parent population in the Cahokia area or in the Cairo Lowlands differed sufficiently in genotype from the Barnes phase population already established at Zebree for phenotypic differences to be detectable in skeletal samples. Furthermore, two, that the proposed migration must consist of a breeding population of sufficient size for their genetic contribution to be detectable by phenotypic indicators in skeletal samples. Finally, three, that any observed phenotypic differences between skeletal samples from the Barnes and Big Lake phase populations do reflect differences in genotype rather than different physiological adaptations to different cultural and environmental settings.

With these assumptions in mind, the problem of choosing a set of phenotypic skeletal indicators most appropriate for measuring epigenetic variation between archeological populations could be addressed. Buikstra (1975) listed six potential measures in her study of "biological distance" between Hopewellian populations in the lower Illinois Valley. She rejected all measures except cranial and post-cranial nonmetrical variations, on the grounds that they were too susceptible to bias by "noise" introduced into biophysical record by cultural and environmental factors. These factors include artificial cranial deformation (common among Mississippian skeletal populations) and nutritional and mechanical aspects of varying subsistence strategies which may alter skeletal morphology and obliterate dental features through attrition and caries. In addition, postdepositional damage to skeletal remains frequently renders them unsuitable for metrical comparisons, a

CHAPTER 24

LAWHORN ARTIFACTS

Dan F. Morse

There was a minor Lawhorn phase-like component at the Zebree site, probably around A.D. 1150-1350±50. It was a hamlet consisting of three structures, probably a satellite-farmstead of a large village such as the Hornersville site located only a few miles to the north. Such sites existed in profusion during the middle Mississippian period in much of the northern valley lowlands. The 1969 excavation exposed almost the entire component and little was added in the investigation of 1975 except for a basic confirmation of the views expressed based on 1969 data. The combined field investigations give us a unique chance to look at a completely excavated hamlet and a considerable area immediately adjacent to it.

Ceramics

Grave furniture consisted of two vessels and numerous potholes indicated the possibility of other similar finds before scientific investigation began at the site. Most of the recovered ceramics represent kitchen debris. Common are plain cooking and canister jars and plain food and serving bowls. Rarer are decorated vessels and bottles and plates. A complete ceramic analysis would include population estimates of specific categories based on a time consuming matching of all rimsherds. The following discussion is more an inventory by type and prominence indicated in a relative way only.

Neeley's Ferry Plain

Jar. Generally Lawhorn phase jar rim sherds exhibit a fairly straight profile with a slight tendency to angle outward. The body is globular, almost round. This is similar to the "standard Mississippi jar form" described by Phillips, Ford, and Griffin (1951:105). Rims tend to be high, 30-50 mm, thin, 4-7 mm, and the body tends to be a little squat, as if the spherical shape was pushed slightly downward from above. This is essentially the same rim profile and body contour found on Matthews Incised; although it is fairly easy to tell if large sherds are not Big Lake phase, it is not so easy to tell whether the small plain rim sherds are part of a Matthews Incised jar or not. Since most sherds were small, absolute counts are not too meaningful for phase identification.

Bottle. Near the skull of Burial 7 was a small bottle (Fig. 24-1 b). It measures 122 mm in diameter and 126 mm high. Capacity is 650 ml. The shoulder is high and the short (30 mm) neck constricts from a 51 mm diameter to a 46 mm diameter two-thirds of the distance to the lip before flaring to a diameter of 50 mm at the flat lip. The inside width of the orifice is 39 mm. The base (45 mm in diameter) has a dimple 28 mm wide and 2 mm deep. The lip of the dimple has been worn considerably from use, to the extent of the defined base, and obviously this is not merely a grave vessel. The exterior surface is polished. Color variation is similar to that described for the Matthews Incised jar, possibly indicating that both were fired in the same manner using the same clays. Three plain bottle neck fragments and one dimpled base sherd were also recovered.

Bowl. This is a fairly common shape and the same general size range is present as is seen in Big Lake phase bowls. Most of the recognized 39 Neeley's Ferry Plain bowl rims recovered in 1969 concentrated with other Lawhorn phase material of the site. It would be difficult, however, to attempt to identify the component membership of each bowl sherd found at the Zebree site.

Plate. A plate rim recovered was probably about 125 mm in diameter and perhaps as deep as 50 mm. The rim is 22 mm wide with a rounded lip measuring 4 mm thick. The base of the rim measures 7 mm thick and the body is 5 mm thick. Made on a Neeley's Ferry Plain paste, the sherd is well polished, a mottled buff color, and similar to plain and O'Byam Incised plate rims found in a middle period Mississippian context at the Hazel site (Morse and Smith 1973).

Matthews Incised (and Manly Punctated)

Sherds with a Neeley's Ferry Plain paste and one, two, or three parallel, curvilinear lines incised on the shoulder of a jar were classified as Matthews Incised (Walker and Adams 1946:91; Williams 1954:224; Phillips 1970:127, 128). This is the most distinctive and common type at Zebree in the Lawhorn phase. None of the designs were of the guilloche or Beckwith variety. Probably the best demonstration of the variety of motifs involved in Matthews Incised and particularly Manly Punctated (included by Phillips as a variety of Matthews) is a series of eight jars pictured in Perino's Banks site report (1966: Figs. 37-40). There is no argument that these two "types" are closely related but the involved varieties are even more complex than Phillips indicates.

The sherds at Zebree are so small that we could not effectively segregate motifs on the basis of number of lines involved (Fig. 24-2 a-c). There are 140 body sherds and seven rim sherds, one of which

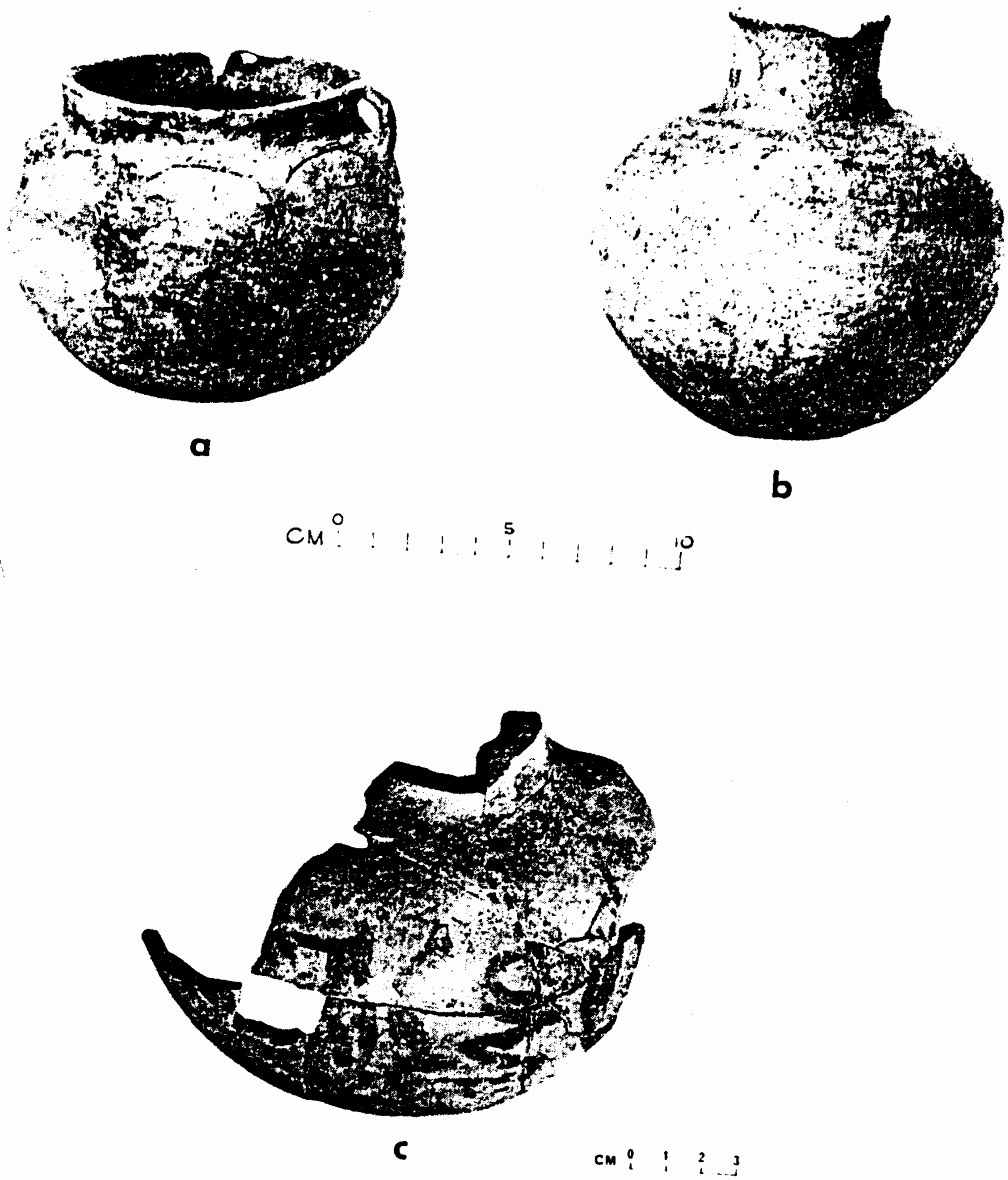

Figure 24-1. Vessels from the Lawhorn phase, Zebree site. a. Matthews Incised jar with strap handles; b. Neeley's Ferry Plain bottle; c. Carson Red on Buff bottle.

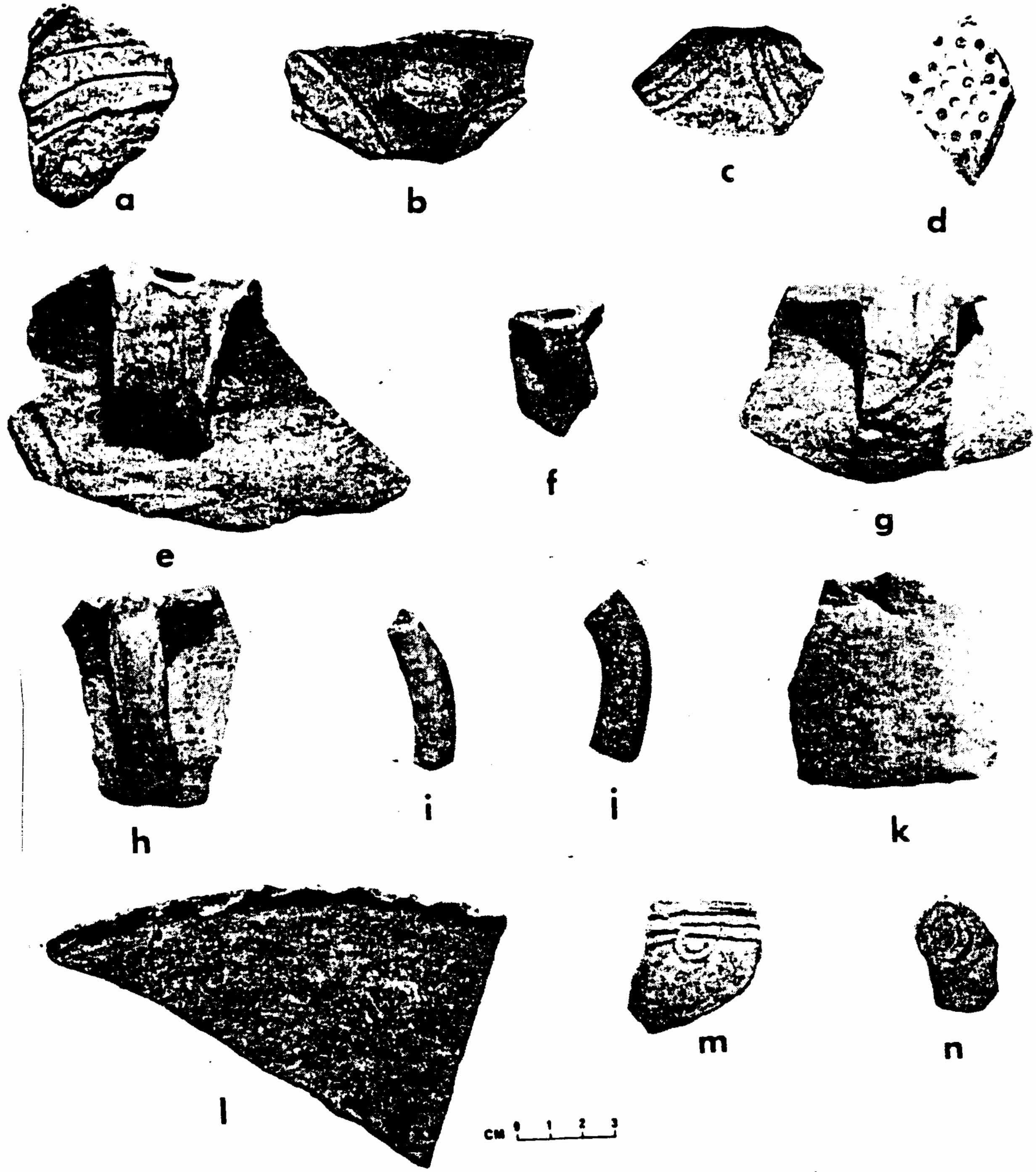

Figure 24-2. Shell-tempered sherds, Lawhorn phase, Zebree site. a-c. Matthews Incised; d. punctated; e-g. strap handles; h-j. loop handles; k. lug; l. scalloped lip; m. Mound Place Incised; n. miscellaneous incised.

has a complete strap handle (Fig. 24-3). Four additional body sherds have remnants of strap handles. All the sherds are from relatively small medium-sized jars. In capacity they appear to range from around four liters up to perhaps as large as 10-12 liters. None are sufficiently complete to make very definite statements concerning sizes. All motifs are running curvilinear lines with the possible exception of a portion of a single rectilinear line on a sherd from Square 14R16. This small body sherd has a single line which is straight for its total length of 33 mm. This line measures 1 mm wide and 1 mm deep. The usual width of the Zebree Matthews Incised line is 2-3 mm, with a U-shaped cross section. The line technically is trailed rather than incised, to a depth of about 1 mm, and there is a tendency toward lateral ridges. The execution is generally sloppy.

Possible variations in the decoration of Manly Punctated are single row of punctates with or without incised line (Fig. 24-4) and with or without red filmed treatment; double row of punctates with or without red filmed treatment; and, group of punctates with or without incised line(s). Punctates were probably made with a variety of objects, including broken twigs, rounded and sharpened stems, cane and possibly even the jagged ends of split bone (Fig. 24-2 d). Punctates associated with incised lines tend to be conical and about 2-3 mm in diameter and less than 1 mm deep. Punctates in groups or linearly arranged tended to be 1-2 mm wide and 1 mm deep. Four noded sherds were also recovered, one of which may be decorated with Matthews incising as well. This is not unexpected (Perino 1966:Fig. 37).

A complete vessel (Fig 24-1 a), found on the floor of a house, is almost identical to that pictured by Cole, *et al.* (1951:324, Fig. 6i). It is a small, globular jar measuring 123 mm in diameter and 97 mm high; capacity is 600 ml. The outside oriface is 94 mm and the inside is 84 mm across. One small strap handle (a second had broken away before being deposited) measures 24 x 11 x 5 mm thick. A series of eight fairly evenly spaced incised loops, incised with a fine pointed tool, are present. This is somewhat unusual since normally only six loops are present. The loops measure between 34 and 51 mm wide and are 10 and 20 mm high. Only a single line is involved. The slightly rounded lip has been notched with an uneven edged tool, but through use, most of the shallow notches have worn away. The notches are 1 mm wide and spaced 5-6 mm apart on the interior edge of the lip. Rim height is 15 mm; rim thickness is 5 mm. The exterior surface is polished. Color varies from a small patch of pale yellowish brown to a dominating grayish brown. There are small patches of very dark gray probably due to soot or local reduction.

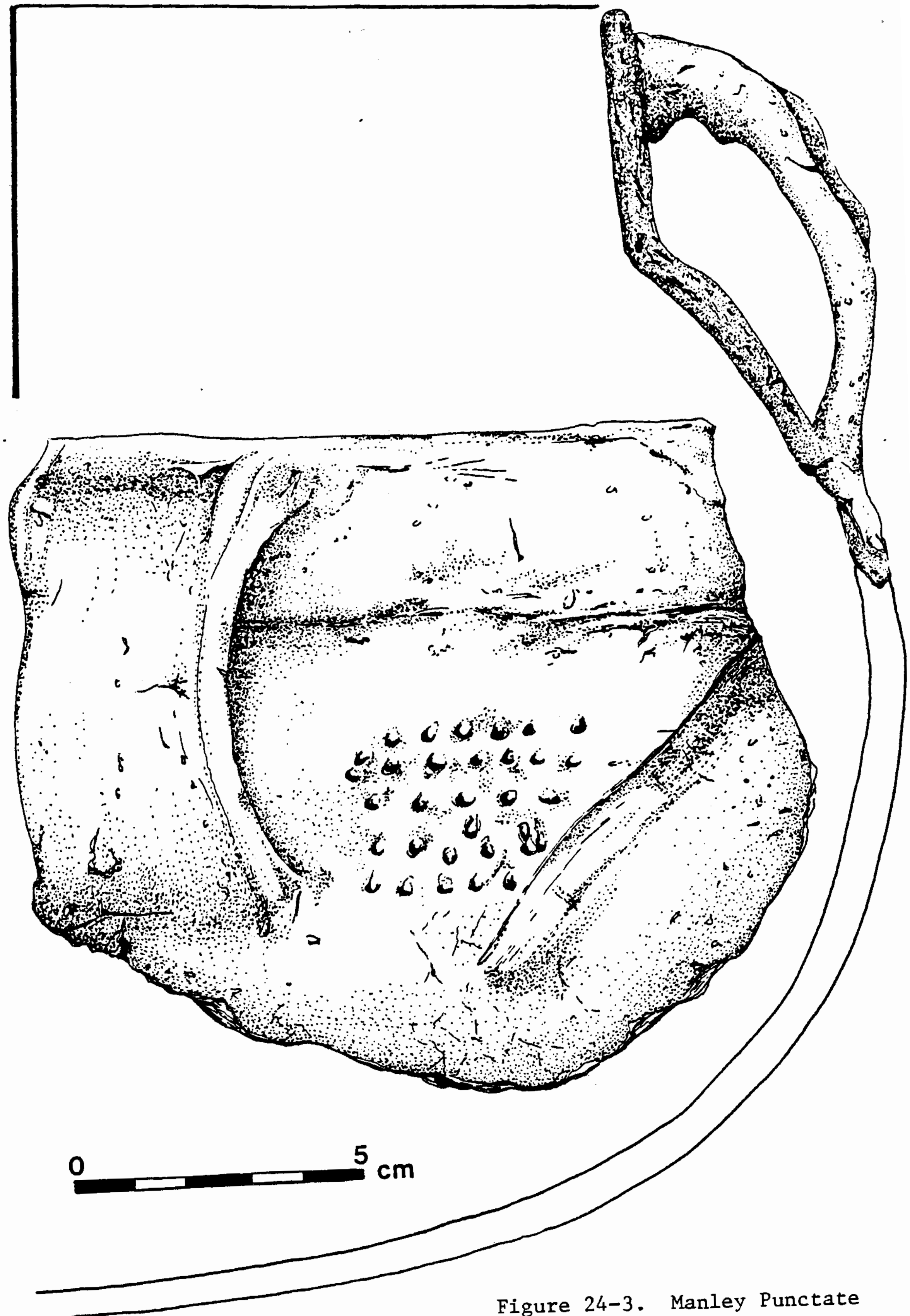

Figure 24-3. Manley Punctate jar with strap handle.

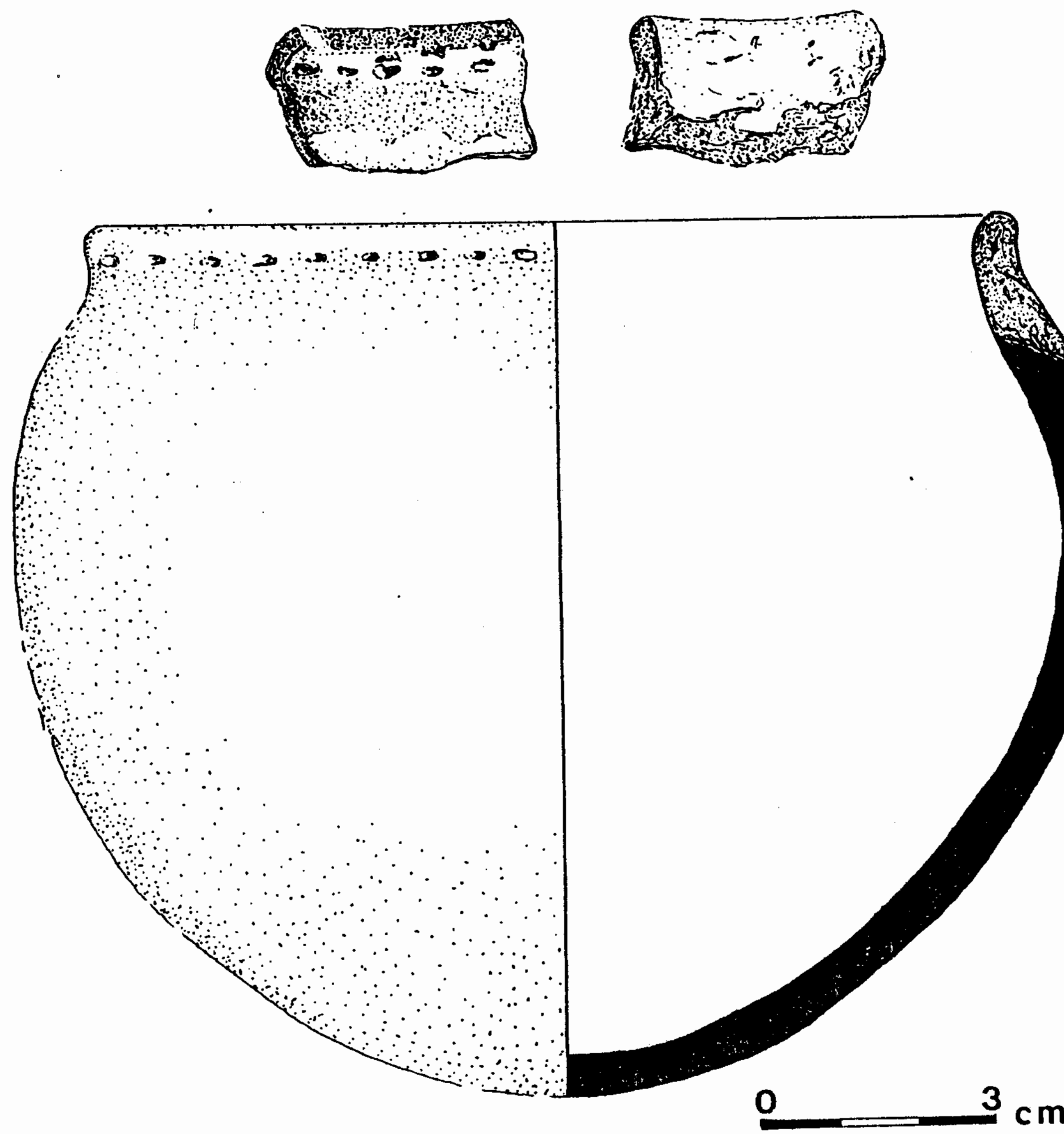

Figure 24-4. Manley Punctate jar with single row of punctates.

Carson Red on Buff Bottle

A Carson Red on Buff bottle was situated so that it probably was on the floor of a house (Fig. 24-1 c). It has been badly broken by the roots of a tree and was further fragmented by shovel and axe since it was on the edge of a trench being dug to expose the southern wall trench of the house. No other Carson Red on Buff sherds were recovered from the Zebree excavations.

Overall height was probably around 200 mm if there was no annular ring present. Maximum width probably ranged somewhere around 150-160mm. It seems to have been a globular vessel with a short, narrow, and asymmetrical neck (44 x 50 mm high). The neck is incurvate and has a rounded, very worn lip. Quite possibly this is a smoothed-over coil break. The paste is tempered with shell and grog. It is not as finely processed as Carson Red on Buff vessels at Nodena phase sites where Bell Plain paste tempered with fine shell and grog represents the best in pottery in the northern alluvial valley (Million 1975). This Zebree find represents the earliest recognized definite shell-grog paste in this region.

The painted decoration is almost worn away, but a definite design seems to be present. It is not a regular repetitive motif on the third of the vessel represented and hence could be animistic. This is based on the assumption that it is not abstract art and not the primary strokes of a general red filmed treatment which has mostly eroded away. Microscopic examination does indicate red spots almost everywhere but much of this could be oxidized iron in the buff background. Color of the buff area is a pale yellowish brown. Carson Red on Buff was a minor type at the Lawhorn site (Moselage 1962:25).

Fish effigy bowl. What appears to be the ceramic effigy of a buffalo fish (*Ictiobus*) was discovered with Burial 27 during the hectic salvage in 1976 (Fig. 24-5). It is a small vessel, measuring 105 x 77 x 50 mm in height with an oriface of 55 x 45 mm. The fish lies on its side to allow a bowl shape. The head is cleanly built and the single dorsal fin and two short front ventral fins protrude slightly. The tail was broken before burial and the break is smoothed. The paste is typical Neeley's Ferry Plain. Surface color varies from Gray to buff; the buff is eroded while the gray exhibits a polish. The soil inside was kept for flotation at a later date.

Other decorations

Notched lip. In addition to 61 Neeley's Ferry Plain jar rims with notched lips, there was a Matthews Incised jar with notched lip and strap handles (Fig. 24-6). Three additional rim sherds with notched

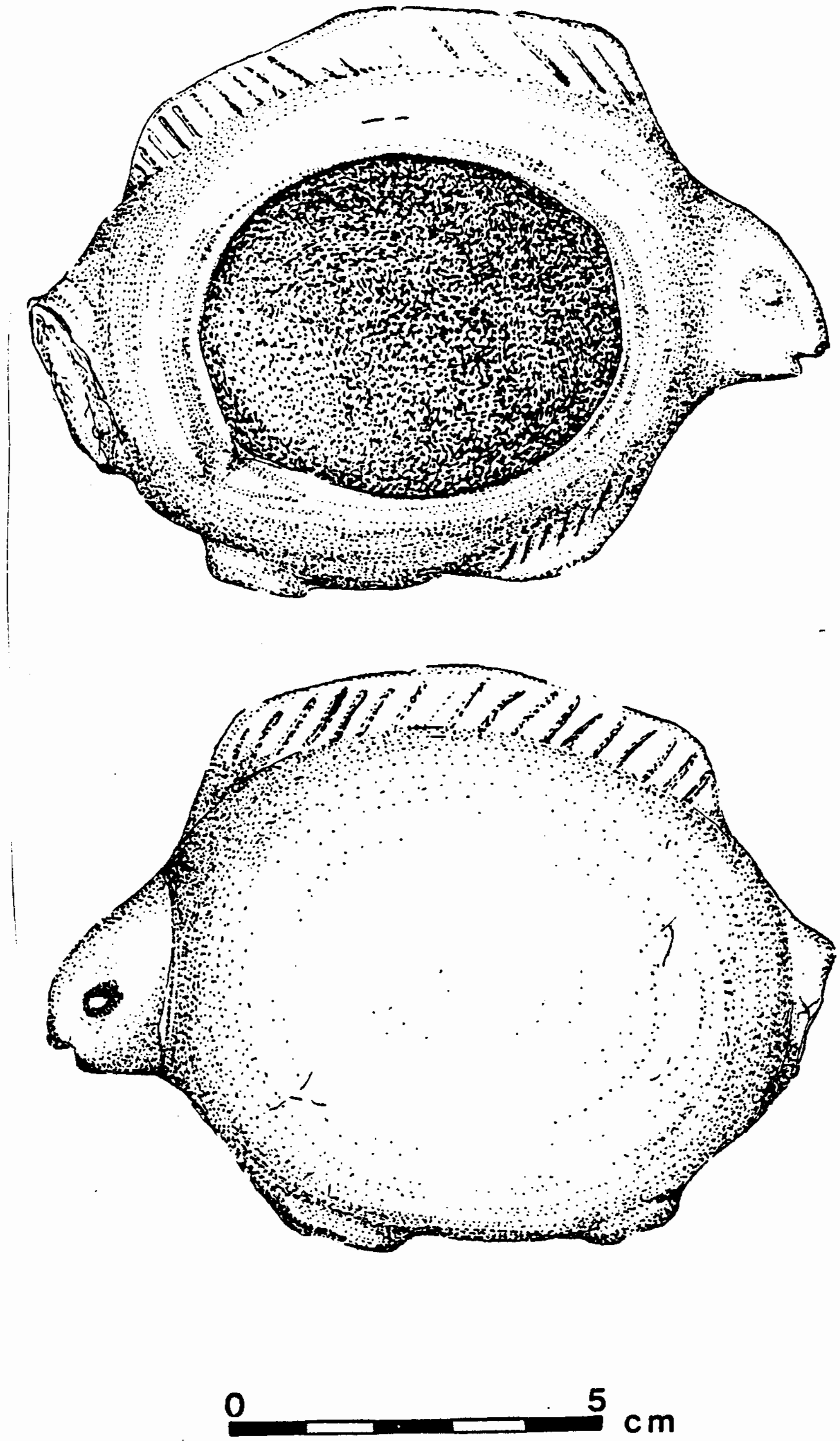

Figure 24-5. Ceramic effigy of a buffalo fish found with Burial 27, Lawhorn phase.

lips have a light red film on one or both surfaces and seven bowl rim sherds have notched lips. Notches usually are 5-6 mm wide and the centers spaced 10 to 20 mm apart. They could have been made with the edge of a wooden paddle and a smooth cylinder of some sort. There is a tendency for the lip to overhang slightly as if there was an excess of clay there. Notches varied from D-shaped to conical to linear. Rim notching is characteristic of middle period sites but is usually more characteristic on bowls than jars (Price 1969:198).

Scalloped lip. Eighteen scalloped lipped bowl fragments were found. One is very large and conceivably could be a pouring spout and another is very small and probably is a pouring spout. The other 16, with one exception--a notched flat lip--exhibit interior beveled lips and scallops between 8 and 30 mm wide. There are 2, 3, or 4 on opposing sides of a rim circumference. They only occur on bowls and are very characteristic of middle period assemblages (Price 1969: 187).

Red filming. This is a very different sort of red filming treatment from Varney Red Filmed. It is more of a thin wash than a polished thick red layer. Two bottle rim sherds with a buff surface have remnants of red on them. They could have been from a Carson Red on Buff bottle but are very badly eroded. Red filming was used rarely on some of the sherds already described above or to be described.

Other notched. Two bowl rim sherds exhibit diagonal notches which make the rim look like a rope. This treatment is a rudimentary "Haynes Bluff" type (Phillips, Ford, and Griffin 1951:123).

Other incised. Two bowl rim sherds exhibit three and four incised lines, immediately beneath and parallel to the lip. One even curves in a two line loop. This is included within the type Mound Place Incised by Phillips (1970:135-136).

A miniature jar rim has a double circle incised on the upper shoulder. The whole design measures 19 x 15 mm and the 1 mm wide incision is crude. Other small fragments of incised motifs were found and probably are remnants of motifs and even possibly vessels already described.

Pinched applique. Two body sherds have small coils pressed into the exterior surface. The sherds are too small to tell if they are Vernon Paul Applique (Phillips, Ford, and Griffin 1951:120) or a rare characteristic to be included within Neeley's Ferry Plain (Phillips, Ford, and Griffin 1951:106).

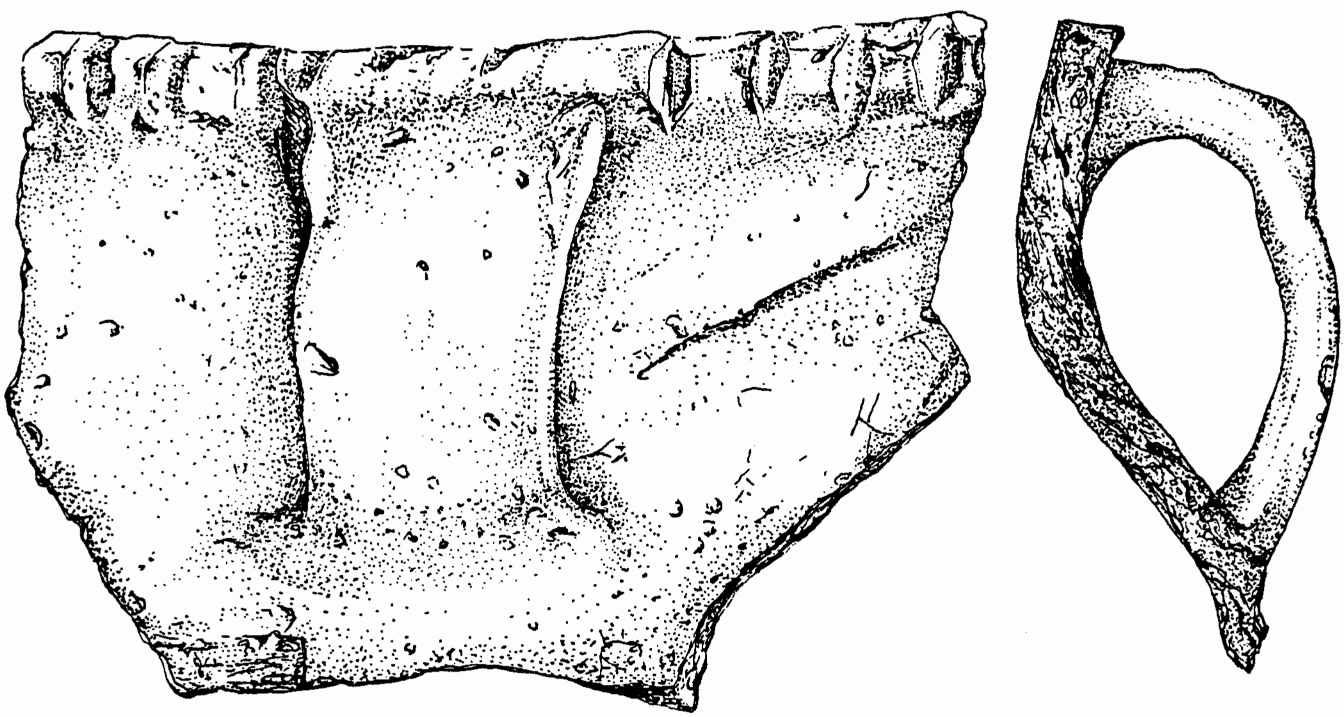

Figure 24-6. Matthews Incised notched rim jar with strap handle.

Appendages and Suspension Holes

Strap handles. Fifty-two strap handles (including those on the complete jar) were recovered at Zebree (Fig. 24-2). Except for six which are on Matthews Incised sherds and two which are red filmed, they are plain and mostly fragmentary. Strap handles concentrate in the same area as rim sherds with notched lips and Matthews Incised.

Most of the handles are very fragmentary. The handle itself is a flat strip extending in a gentle arc from a lip extension to just below the junction of rim and shoulder. Variation in size is from 13 mm to 54 mm wide and from 4 mm to 10mm thick. The average size of 21 Neeley's Ferry Plain examples is 31 mm wide and 7 mm thick.

Two handles have paired vertical nodes at the upper end and three other handles have concave upper surfaces almost to the point of being grooved. An interior red filmed rim sherd has a strap handle with a slightly off-center vertical groove measuring 10 mm wide and 2 mm deep. Two Neeley's Ferry Plain and one Matthews Incised handle have perforations punched into the upper end. On the two plain sherds, the hole is in a prominent, flat rim flange; the other rim flange is not as prominent. On one of the former, the flange extends beyond the handle 5 mm and there are parts of three diverging ridges attached to the lower end of the handle (sometimes called a "crowfoot" handle).

Loop handles. Ten examples of loop handles were found (Fig. 24-2). Seven are red filmed and might belong to the earlier Big Lake phase. Distribution indicates this as well. Three midsections of loop handles exhibit a width of between 13 and 15 mm and would have been on relatively large jars. They are identical to the handle from a red filmed jar with a double row of small conical punctates. Loop handles, riveted into the vessel wall are characteristic of earlier Mississippian complexes and an indication that confidence associated with the blending of strap handles onto the vessel wall has not been achieved fully. Loop handles are gradually superceded by strap handles and are more characteristic of earlier portions of the Lawhorn phase, while some may date to a very late Big Lake phase period.

Lugs. Eleven red filmed plain lugs were recognized as being from bowls and jars. Although most are probably associated with the Lawhorn phase, some may belong to the Big Lake phase occupation. Two lugs are wide flanges, one of which is finely notched along the edge. This latter is red filmed. Another sherd has a double lug. With one exception, the lugs are semicircular extensions of the lip on a horizontal plane (Fig. 24-2 k). The exception is a circular knob just beneath the lip. In general, lugs are rare and often crudely made.

Perforation. A rim sherd from Neeley's Ferry Plain bowl has a perforation 10 mm in diameter located about 15 mm below the beveled lip. The hole is not drilled and was made before the vessel was fired. Presumably this was done to provide for an attachment to hang the vessel. The only other incident of a perforated wall was noted on two Big Lake phase miniature jars.

Effigy. Four crude possible effigy appendages from bowls were recovered. One is plain and the other three red filmed. One of the latter is from Feature 250 and might be a Big Lake artifact.

Bone and Shell

It is more than possible that some Lawhorn phase bone and shell artifacts were described in Chapter 20. This is because the Lawhorn phase concentration was in the area of the richest 1969 Big Lake phase finds. Only definite Lawhorn phase artifacts are described in this section.

Awls. Two splinter bone awls are more extensively worked than those described in Chapter 20. Each is almost stemmed and has a notch in one side (Fig. 24-7 e-f). One has a notch near the almost pointed base and the other midway between base and tip. They are 58 and 54 mm long and made on narrow splinter; both may have been hafted.

On the floor of a house (at point 79R4) a bone awl was found made on the long bone of a bird similar to a swan or egret (Fig. 24-7 g). The proximal end of the bone is not present but the awl may have been worked only where it was pointed. It is 100 mm long.

Turtle shell rattle. Several associated artifacts were recorded which appeared to have been lying on the floor of a house, and thereby belonging to Lawhorn phase (Fig. 24-8). This find was cataloged as Feature 44. It lay 70 cm from a Matthews Incised jar cataloged as Feature 128. A turtle shell lay on its side with small (10 mm in diameter) water-worn pebbles inside and scattered to the east as if the shell had been roughly moved westward across the house floor for a distance of about 40 cm.

A total of 15 pebbles were present consisting of 10 chert, 4 quartz, and 1 rhyolite specimen. The shell is from a Carolina Box turtle and measures about 133 x 103 x 68 mm. The central vertebral laminae is perforated by a hole 11 mm in diameter. An identical hole is immediately below, in the center of the abdominal laminae of the plastrum. Missing from the shell is the pectoral, humeral, and gular section of the plastron.

Conch disc beads. Two sets of shell beads were found with Burial 7. At the right wrist were 55 small disc beads (Fig. 24-7 h). They seemed to be on two strands (or a doubled strand). All measure very close to 7 mm in diameter but range from 2 to 6 mm thick. The biconical perforation on most of the beads is around 2 mm in diameter but ranges from 1 to 4 mm. Eight similar beads were found at the neck, four of which were discovered

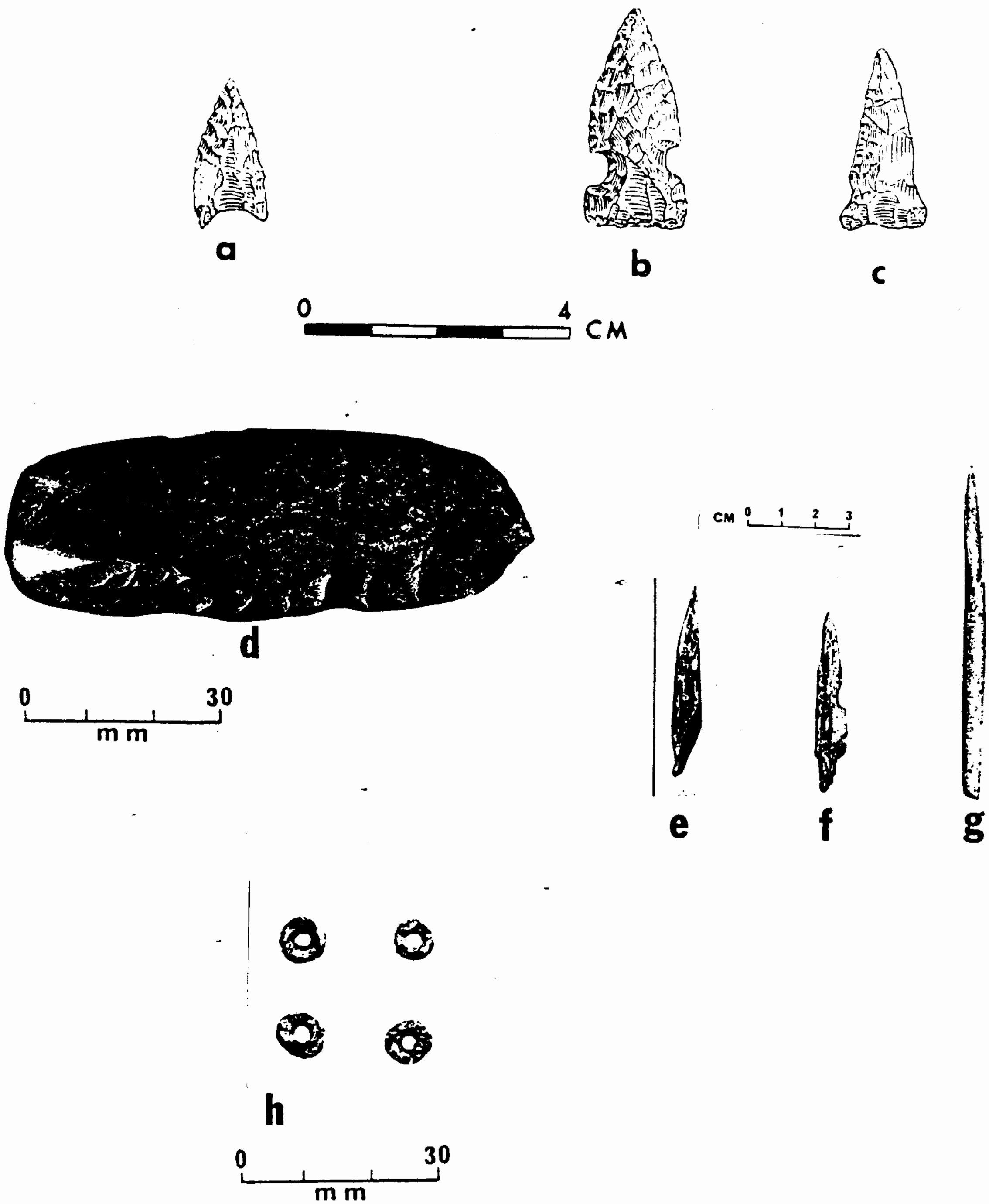

Figure 24-7. Miscellaneous artifacts, Lawhorn phase. a. Maud(?) point; b. Shugtown point; c. possible Schugtown point; d. adze of Dover chert; e-f. splinter awls; g. bird bone awl; h. sample of disc shell beads (Burial 7).

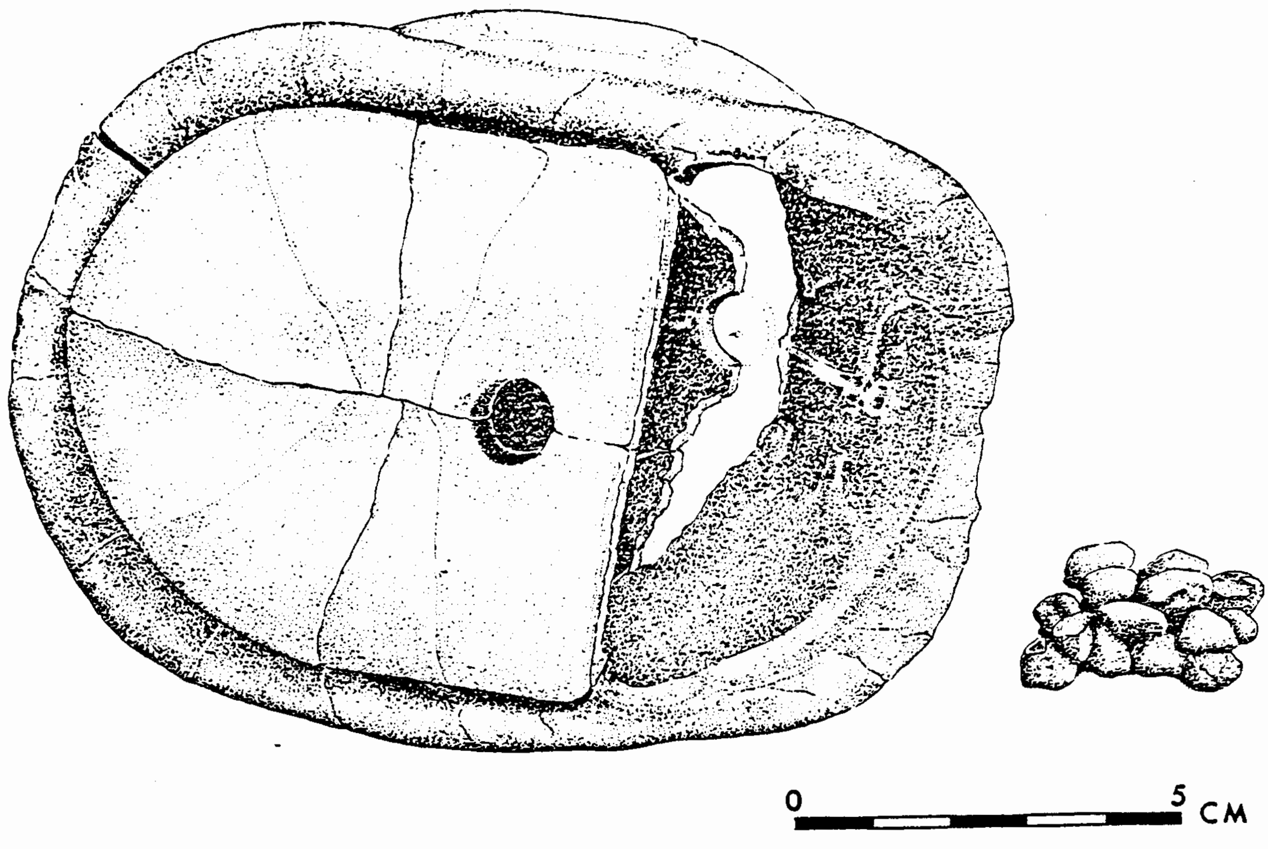

Figure 24-8. Drawing of turtle shell rattle and pebbles, associated with Lawhorn phase house, Zebree site.

while cleaning the skull and adjacent vertebrae.

Four large conch shell columella beads were found near the skull during the excavation of Burial 7. These were misplaced somewhere between the field and the lab and no measurements are available. Two were at each side of the skull and may have been part of a headdress or perhaps were ear ornaments.

Lithics

Insufficient undisturbed lithic debris samples were recovered to make definite statements. Dover chert from Tennessee probably was being imported by this time and if Zebree is like other middle period sites nearby, Ozark cherts were in high demand. Above ground storage was probably practiced and this practice would have significantly decreased the chances for the burial of contemporary trash in abandoned pits to preserve undisturbed lithic debris samples.

Points

A triangular point with a deeply concave base is similar to the Maud point (Bell 1958:48-49) (Fig. 24-7a). This resemblance, however, may be coincidental. It is made on a flake of secondary decortication to the extent that all of one edge is cortex. A prominent bulb of percussion at the base was mostly chipped away, hence the deeply concave base. There is only minimum retouch on the rest of the point. It measures 21 x 10 x 3 mm thick.

Madison Points are described in Chapter 20 but may belong to the Lawhorn phase component at Zebree.

A typical Schugtown point (Morse 1969c) is made of a pinkish white chert and measures 32 x 15 x 7 mm (Fig. 24-7b). A crudely side-notched point made of mottled dark red and tan Crowley's Ridge chert (Fig. 24-7c) measures 26 x 13 x 5 cm and may be a crude variant of the Schugtown point.

Other

On the apparent house floor of Feature 263 lay on a horizontal plane a complete adz or chisel made of Dover chert (Fig. 24-7d). It measures 84 x 30 x 13 mm thick. Its identification as an adz or chisel is based on its concave-convex working edge. Since it was kept sharp by its owner, who abraded it almost at a right angle to the expected use orientation, possible wear striations parallel to the long axis and on the convex dorsal face are very indistinct. The orientation and presence of this tool is an important cross check on the identification of the observed feature as a house floor.

CHAPTER 25

HOUSE AND HOUSEHOLD CLUSTERS IN THE LAWHORN PHASE

Dan F. Morse

In 1969, most of a middle Mississippi community at Zebree was excavated, and the work in 1975 and 1976 confirmed the 1969 interpretations. This site now represents one of the very few Mississippian communities to be almost completely excavated in the northern alluvial valley. These data are particularly important because they give insight into our concept of household space within multistructured sites such as Snodgrass (Price 1973). The "household cluster" (Flannery 1976) is a residential structure together with satellite structures, storage/refuse pits, hearths or ovens, post hole clusters possibly indicative of a scaffold, and other support features. A "house cluster" refers to a special grouping of separate residential structures and associated features.

The Zebree Community Pattern

The type of community at Zebree changed drastically with the advent of the third major occupation. Three houses (Features 140, 144, 263), four burials, and a concentrated midden accumulation were found in Area A.(Fig. 25-1). These features together are interpreted as a small Lawhorn phase hamlet or farmstead.

Houses: While the apparent maximum dimensions of Feature 140 are about 5 x 4.2 m, the inside dimensions are about 4.8 x 3.7 m, or 17.8 square meters of actual living space. Wall trenches existed on three sides; however, the southern end is represented only by a partial row of post holes. A Carson Red on Buff bottle (Feature 138) was found situated so that it probably was on the floor of the house and these southern posts are interpreted as a bench or partition within the house. If the house did not extend beyond the row of posts, then it measured 3.9 x 3.7 m for an interior of only 14.4 square meters. The post holes in the eastern 25 cm wide trench averaged 10 cm in diameter and were spaced 3 to 10 cm apart; the wall was probably reinforced. The west trench was wider and posts were placed along the east side of the trench. The final week of our 1969 excavation was oriented toward uncovering as much of the house as possible despite the presence of trees and a large backdirt pile. We were unable to excavate for specific internal features. There were indications of a burned floor at a depth varying between 25 and 30 cm beneath the present ground surface. The house was oriented about 18° east of magnetic north. The wall trenches are not exactly parallel or perpendicular to each other and even the post holes vary up to 8 cm away from a straight line, although usually the variation is only about 3 cm.

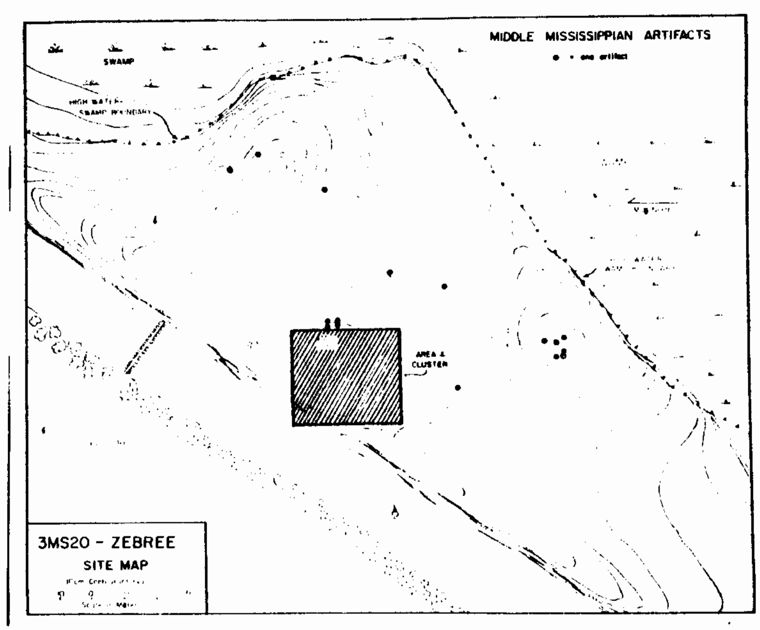

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Figure 25-1. Middle Mississippian features and isolated artifacts, based on all field seasons.

Feature 144 is basically a laboratory reconstruction. Its western wall trench was thought in the field to be a rebuilt wall belonging to Feature 140. When the grid sheets were placed on a master plot, we discovered that a rattle (Feature 44), a Matthews Incised vessel (Feature 128; Fig. 25-2), a bone awl and a large amount of debris (sherds, bone) lay on a plane around 50 cm beneath the present ground surface. In addition, a number of large post impressions which we interpret as interior post supports were discovered beneath this level of apparent house floor midden. Based on these data, the house probably measured about 5.2 x 4.1 m. Inside dimensions may have been as little as 5.0 x 3.6 or about 18 square meters. We infer two houses of similar dimension existing side by side (only about 30 cm apart).

Feature 263 is associated with a hearth, Feature 282, and several post holes. Since overburden was removed with a backhoe and the apparent house floor shovel skimmed, Lawhorn phase artifacts expected in the higher site levels were not recovered. Artifacts, including a Dover chertadz which could be assigned to Lawhorn were lying upon or just within the burned area around the hearth. The size and orientation of this house cannot be reconstructed.

Burials: Some of the scattered human bone found at the site may be associated with this component: however, much of this bone was found in Big Lake phase features. Probably most of the potholes at the sites were dug in the hopes of excavating graves. A right patella in Square 76R2 has a probe hole in it. In Square 78R8, several bones were found which had been disturbed by a pothole. A human bone was also found in pothole 6. Two of the four graves assigned to the Lawhorn occupation were identified on the basis on not being disturbed by aboriginal features. The other two contained burial furniture and were easily assigned to this period.

Burial 1 was a child approximately four years old. The skeleton was extended on-its back and oriented with the skull 10° east of north. It lay at a depth of 30 cm, above a Big Lake phase storage pit (F122) and probably above or upon the house floor of Feature 144. Two microblade cores lay at the right forearm but this association is interpreted as either accidental or a child's toys. Since considerable microlithic debitage is present at this general level, the association is probably accidental.

Burial 4 was badly disturbed by cultivation but careful excavation revealed an extended skeleton on its back with the skull oriented 10° west of south. Sufficient bones were recovered to indicate an elderly male. The burial was over a Big Lake storage pit (F42).

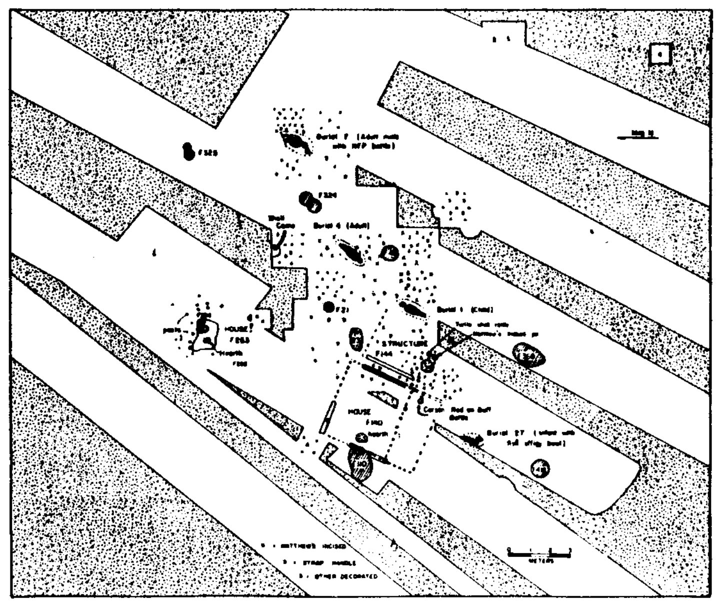

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Figure 25-2. Lawhorn phase features, Area A, Zebree site.

Burial 7 was extended on its back with the skull oriented 10° west of south (Fig. 25-2), and the arms extended along the sides. Grave goods included a Neeley's Ferry Plain bottle south of the skull, shell beads at the neck and on either side of the skull, and a single twisted or double strand of shell beads around the right wrist. The lower portion of the skeleton was destroyed by Feature 125, an early nineteenth century well. The skeleton is a male, aged about 45-49.

Burial 27 consisted of an infant tightly flexed on its right side associated with a fish effigy bowl. It was found while straightening a bulldozer balk during the hectic salvage of 1976 and the vessel and most of the bones were disturbed inadvertently by the excavator. A careful search for in situ bones allowed us to reconstruct the probable burial position. The vessel probably was near the skull and the long axis of the grave oriented toward the southwest.

Other features: Nine other features were identified: 21, 23, 25, 29, 49, 110, 368 and 324-325 (inadvertently mixed together in the laboratory). Feature 49 is significant from the standpoint of associating Matthews Incised with a Schugtown side-notched point and other suspected middle Mississippi artifacts. Most of the Lawhorn phase debris was concentrated near the three houses and within the uppermost arbitrary levels.

Three corn concentrations were recognized. Feature 23 was approximately in the northwest corner of the house floor of Feature 144. Beneath Feature 23 in this same northwest corner was Feature 46 which is interpreted as predating the house, but since the house was not identified in the field, Feature 46 might possibly be associated. The large flotation sample from Feature 23 produced no corn whatsoever (Leonard Blake, personal communication). The field-collected grains measured 6.5 to 7.0 mm wide, larger than the mean of kernels from Features 41, 46 and 47 but within the upper range of this apparent Big Lake phase corn assemblage. Such an increase in size over the Big Lake phase seems to be in accord with the findings of Cutler and Blake (1969).

Pit features in general were irregular, shallow, and difficult to interpret functionally. At least one (Feature 25) contained shell suitable for pottery manufacture (Fig. 25-2). Others may have been storage pits. In the Nodena phase, storage seems to have been above the ground and more centralized as corn cribs, actual wattle and daub structures. In the Powers phase, circular, basin shaped pits adjacent to houses were shallow (Price 1973:72). One contained possible pottery clay but they appeared to Price to not function as storage or cooking pits (1973:72). Price indicates that some of the 90 structures at Snodgrass may have functioned as storage sheds.

Population: Three houses each with a nuclear family of five gives a population estimation of 15. Total space under the roof of around 60 square meters (after Naroll 1962) gives a total population figure of six. The apparent cooking jar size indicates a maximum population of around 15-17. No attempt has been made to estimate the total number of Lawhorn phase vessels at Zebree. However, there are 52 strap handles indicative of at least 26 jars with strap handles, an average of 8 or 9 per house. At the Turner site (Price 1969), where vessel shapes are described as being equally distributed between bowls and jars, there were three complete or nearly complete jars and apparently another five or so jars represented by sherds on one house floor. This seems comparable to the Zebree assemblage. The Turner site is thought to represent a short period of time between initial occupancy and burning completely to the ground. A similar short period of time is also indicated at Zebree since no repair post holes or walls were recognized. At Snodgrass, a maximum population figure of 4-4.5 people per structure (Griffin 1977:488), if applied to Zebree would give a population of 12-14. In summary then, around 15 people inhabited the Zebree site during the Lawhorn phase period for probably no more than a generation (25 years).

The Hamlet Pattern in the Northern Alluvial Valley

The Zebree site during the Lawhorn phase consists of three houses existing for a short period of time. The total square meter area of intensive occupation would appear to be around 400-500 or 30 sq m per person. Interestingly, the 2.5 acre Snodgrass site population estimation is 350-400 (Griffin 1977) which figures to 25-29 sq m per person.

The Wampler Site (3CS118): The site consists of around 225 sq m of sparse middle Mississippian debris superimposed upon and mixed with around 350 sq m of Baytown debris including Coles Creek trade sherds. The site was in a knoll removed for garden fill by the owner and we were able to salvage the complete deposit (Fig. 25- 3). Two structures and 11 possible pit features are present. Structure 1 was probably residential. A hearth was centrally located and a storage/sleeping bench at its southern end is indicated by possible support posts. The doorway was on the east undoubtedly to allow light into the house as early in the morning as possible. Structure 2 probably was not residential; it was relatively small and possibly was built for storage. Both structures had wattle and daub walls but they were abandoned soon after occupation and the walls literally melted leaving collapsed subsoil rings. During the period of decay evidently a hunting party used Structure 2 for shelter several times. A diffused hearth with several layers alternating with layers of subsoil from the collapsing wall was at one end and included in its fill a Schugtown point.

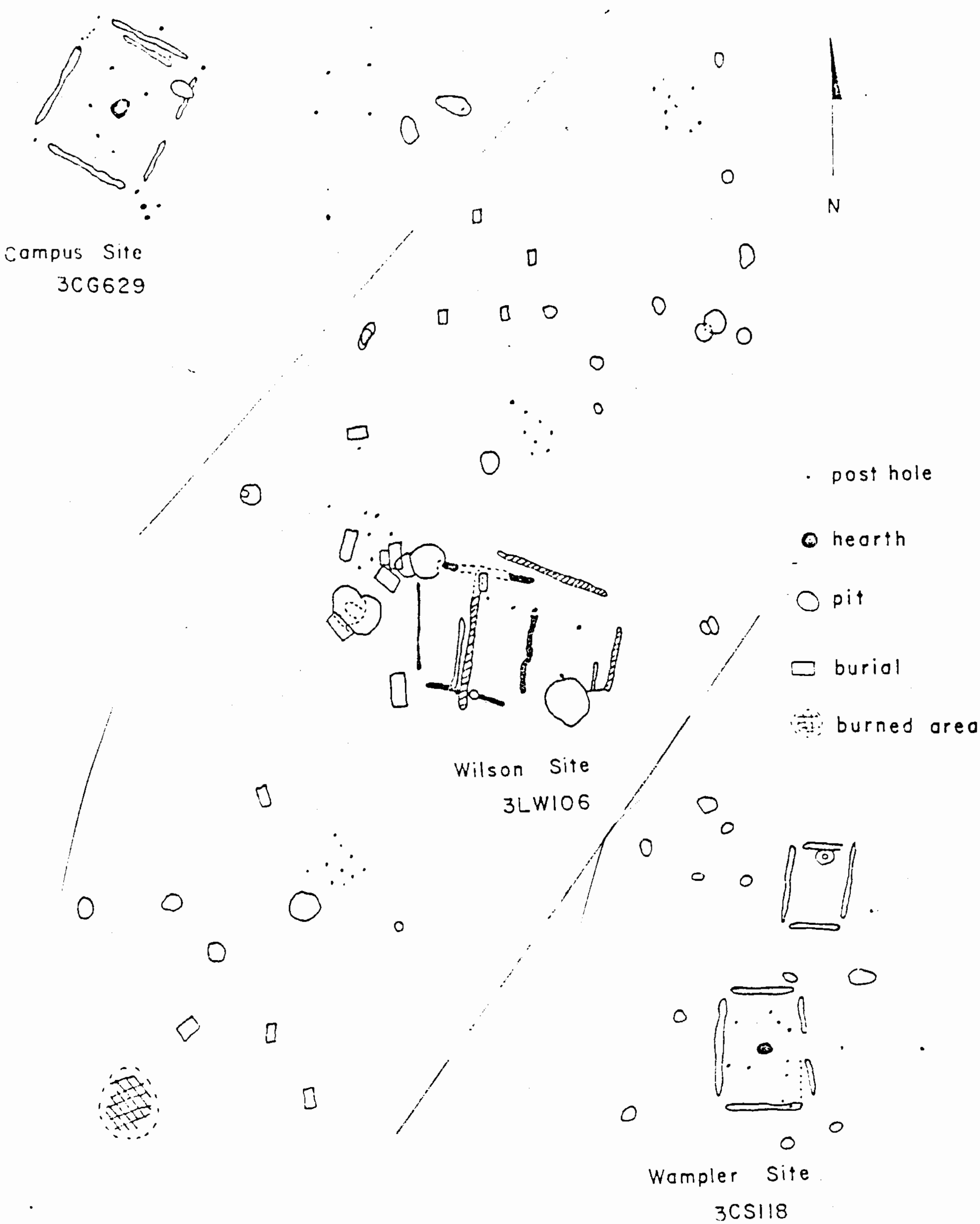

Figure 25-3. Lawhorn phase house and household clusters in northeast Arkansas.

The residential structure was 21.7 sq m in extent while the apparent outbuilding covered an area of 16.6 sq m. The house and debris area indicate a population of 5-9. The jar capacity data are incomplete but a basic jar shape between the "small" and the "medium" sized jar is indicated and a population figure nearer 10 than 5 seems a best guess.

The Wilson Site (3LW106): On a high ridge along the Cache River are a series of small ceramic and lithic scatters thought to be hamlets near a large village. A chance to investigate one of these was presented during some land leveling (Fig. 25-3). A single residential structure, rebuilt twice before abandonment with a wall trench pattern was recorded. Adjacent to it was a small cemetery and a few pit features. Along the ridge in both directions were post hole clusters and in one situation a burned area indicative of a possible structure. The center of a post hole cluster is 8 m to the southwest and a second 20 m beyond that point. To the northeast is a post hole cluster at 13 m and the burned floor is another 18 m beyond. Pit features and burials occur along the ridge in both directions.

Approximately 1000 sq m of debris or a little more is involved. If five houses are represented, at least a maximum of 25 people should be involved. The total area indicates around 30-35 people. Cooking jar size is based on very fragmentary data but one shoulder sherd is apparently from a fairly large jar while other rims seem to fall into medium to medium-large. Some of the ceramics are fairly early looking, with jar profiles similar to Big Lake and several sherds from flat based, Baytown-like bowls. Nevertheless, up to three or more households are indicated.

Since one house pattern was rebuilt twice, it is possible that the same household occupied the other possible house patterns through time. There could be one household through time, over perhaps several generations, or more probably, one, two or three households through time for a century or so as their population increased. The house size increased with rebuilding from 17.6 to 33.6 sq m. This could reflect an expanding household size. This site may be developing into a daughter village before it cuts loose from the nearby large village. However, we are not looking at a natural cluster but at a section of continuous debris on a ridge which was convenient for examination. Our sample is purely intuitive.

The Campus Site (3CG629): Arkansas State University land leveled an agricultural field adjacent to their campus in Jonesboro, and in the process destroyed several archeological sites including a middle Mississippian hamlet. The type of sampling, and apparently the nature of deposit, is similar to the Wilson site situation. Over 200 sq m (290 is the apparent maximum figure) of debris includes one clear structure pattern and a diffused region of post holes 15 m to the east (Fig. 25-3). There could be two houses with nuclear households in the debris area or one house rebuilt slightly to the east or west of an older location. Twenty-seven m to the northwest is a hearth, indicative of another possible house. The site had been graded during the clearing of historic house debris several years earlier and the dirt buggy was digging at a depth below the cultivation zone by the time the first two features, pits, were recognized. The site is adjacent to a stream in Crowley's Ridge along which stretches a mile of good soil for growing crops (Dick Ferguson, personal communication). A corn kernel was found in one of the pit features. A lot of chert debitage but few ceramics were recovered and there is no good data concerning cooking jar size. The house is large, 42 sq m, but has a double north wall, possibly to better insulate against the weather. While this is approaching double the average structure size of the period, there seems to be a lot of allowable variation. An isolated household or house cluster might find it advantageous to have larger household populations.

Gypsy Joint Site: We are indebted to Bruce Smith for preliminary information on this site, located in southeast Missouri, excavated by Bruce Smith under the general supervision of Price and Griffin. The maximum area of debris is around 500 sq m. Two structures, about 21 and 28 sq m respectively, are present on a slight knoll with pit features nearby. Indications are up to 17 people by the 30 m/person formula, and at least 10 if both houses are contemporaneous or five if they are sequential. The situation is somewhat similar to the Wampler site in regard to type of sample. It may be indicative of a house cluster.

Hazel Site: Immediately north of the Hazel site is an apparent satellite hamlet which occupied a low knoll (3PO213), and was eventually graded into oblivion (Morse 1972b). This hamlet was probably contemporaneous with the middle period component at Hazel (3PO6). A pot filled with 1400+ worked and unfinished shell beads were found here. Controlled surface collections gathered evidence of tools expected to be used in manufacturing shell beads. The indication is that a satellite hamlet need not be a farmstead or a developing daughter village still dependent on the parent, but may include specialists, shamans, perhaps "strangers," a personality deviant, or those who did not have clear cut kin relations sufficient to occupy a house locus within the village. Some may be seasonal "country houses" established to guard crops against varmints and birds.

Summary: The household cluster both in a village and independently as a farmstead occupied a consistent space, perhaps 30 sq m per person, perhaps more. The cluster included a residential structure (or perhaps up to four; Swanton 1946), an optional outbuilding, pit features, burials, a cooking hearth, a scaffold and other support features. It was the site of the nuclear family in Mississippian culture. It might be enlarged to accomodate family extensions by birth and marriage. It might segment or bring together close kin into a house cluster which by definition was made up of two or more interacting households represented by separate contemporaneous residential structures. Like the household, the house cluster might exist independently, be close to a support village, or within the village. Villages were well planned in advance, as evidenced by the Snodgrass site (Price 1973) and did not just happen. It was a predictable engineering feat accomplished quickly and at an opportune time in relationship to social economics. When a village filled up, the process began again. This seems to be a persistent pattern in the middle period, as if the population was undergoing a significant increase. This may reflect the ecological and political changes resulting from intensive agriculture.

Relationship of Zebree to the Lawhorn Phase

The Lawhorn phase type site is located on the eastern side of the St. Francis River almost straight west of Zebree (Moselage 1962). Approximately 4 acres are involved (Moselage 1962:89) so the population might have been about 540 people based on the 30 sq m/person formula. Lawhorn is on an east-west line of three sites; Bay, McDuffee, and Armstrong. All of these last three are west of the St. Francis River (Fig. 25-4). What is almost certainly involved is a shifting St. Francis River. Schugtown with four mounds (Thomas 1894) and Bay with two mounds (Morse 1972a) look like short term occupations. Lawhorn and possibly Armstrong look like relatively short occupations based on shallow midden and a general lack of intrusive features. On the other hand, McDuffee and Old Town Ridge have relatively deep, rich and complex middens plus a large number of burials. McDuffee has produced hundreds of vessels for pot hunters (Fig. 25-5). These sites are probably not contemporaneous with each other but must represent two villages shifting because of a shifting river. These river shifts are due to the relict braided channels which allow a meandering stream in an aggrading channel to seek lower beds.

An alternative hypothesis explains why McDuffee and Old Town Ridge are the stable sites but, while near gathering channels of the St. Francis, are away from the major modern channel. Flooding could have chased these villages back from the main channel.

Whatever the reason, the population loci really do appear to have shifted. South of Marked Tree on the St. Francis and north on the Left Hand Chute of Little River, an interesting settlement pattern is indicated. Sites which are Lawhorn phase or which have a significant Lawhorn phase component occupy alternate sides of the river and are

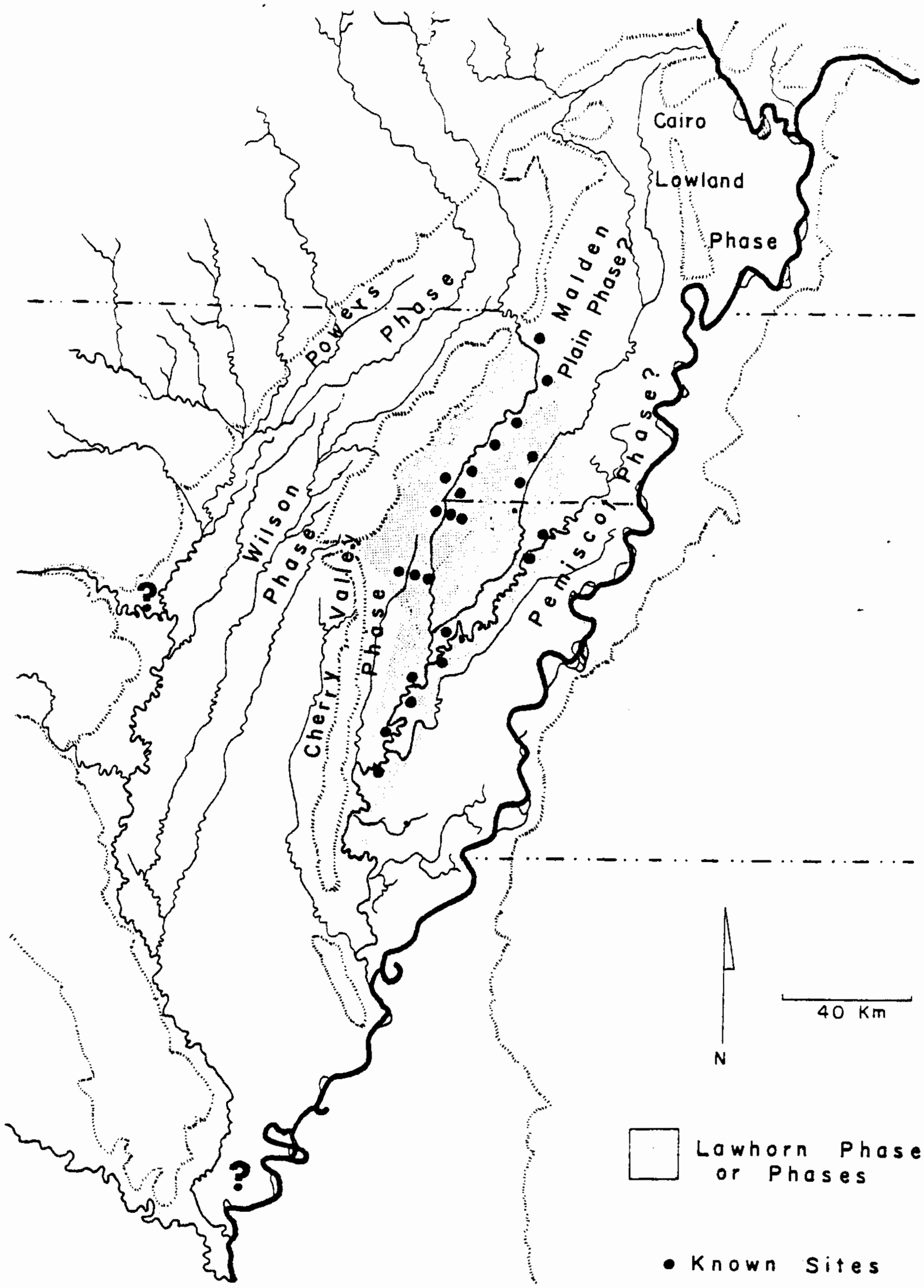

Figure 25-4. Lawhorn phase and related phases.

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Figure 25-5. Pothunteres at the McDuffee site, 3CG21.

spaced about 8 km apart (Fig. 25-4). The pattern seems to hold up from Parkin (Rose Mound; Phillips, Ford and Griffin 1951) to Dell (Thomas 1894). North of Dell the pattern jumps across Big Lake to the Right Hand Chute of Little River. South of Rose is a very complex series of relict meander channels which need to be sorted out.

The Powers phase is the most intensively investigated of the middle Mississippian period complexes while the Cairo Lowland phase is the most impressive in terms of large mound sites. In Powers there is an obvious hierarchy of sites with Powers fort clearly being the regional center since it is largest and the only mound site. In the Lawhorn phase, there is an embarrassing richness in mound sites but at the present moment not a single one stands out. A possible candidate for a regional center is the Langdon site near Hornersville, Missouri (8P3). This site is reported to be "approximately 27 acres" in extent (Williams 1954:179). Six mounds and two possible mounds are present. Vessels, now stored at Columbia, Missouri, could be Lawhorn phase (Carl Chapman, personal communications). No other Lawhorn phase site even comes close to this size and it is located near the Zebree site which appears to have been the regional center for the Big Lake phase. In addition, this puts the regional center in the middle of the St. Francis River valley as it stretches from those important upland resources to the point where the St. Francis joins with the Mississippi. The Lawhorn hamlet at Zebree could have been a satellite to Langdon or to the other nearby village sites such as Dell, Big Lake, or even Old Town Ridge.

South from Marked Tree some impressive sites appear, possibly later in time, and constitute some of the major Parkin phase sites after about AD 1400. A southward shift seems to begin to take place as the Powers phase moves away from the upper Black drainage and the Cairo Lowland phase pulls out of the Little River Lowlands.

CHAPTER 26

THE FORGOTTEN PIONEERS

Phyllis A. Morse

During the final salvage efforts at the Zebree site in August, 1976, artifacts were recovered giving new data on an unstudied cultural period in northeast Arkansas. This was a pre-Civil War Euro-American occupation indicated by a 4 m deep cypress lined well, Feature 395. A gunflint and a minie ball had been described by Morse in the 1969 excavation report (Morse 1975b). These may be from an even earlier French or Indian hunting expedition, but are expected artifacts in the early 19th century. The first real clue to this early 19th century occupation found in 1976 was a blue shell-edged pearlware sherd found in a newly bulldozed road cut from the main Datum. Daily surface collections turned up hand painted pearlware and salt glazed stoneware. Bulldozing to expose features uncovered a pit, which when excavated revealed the well. There should have been a house and outbuildings associated with the well, but these were not located.

The well itself actually was located in 1969, but it was thought to be an outhouse. Burial 7, a middle Mississippian burial complete with a Neeley's Ferry Plain water bottle and shell beads, was completely cut away below the pelvis by the initial well excavation (Fig. 26-1). Miscellaneous human bone debris and small bits of sherds and shell beads were found during the 1976 well excavation.

The well first appeared in the bulldozer trench as a crudely circular disturbance about 1½ meters in diameter. A square outline appeared at 140 centimeters below the original ground surface (Fig. 26-2). A thick ash lens containing burned hardened clay and brick fragments was found at the 210-220 cm level at the base of Level 1. Shoring posts, 3 x 3 inches in size of hand-hewn cypress were located at the start of Level 2. Wooden braces held apart the 3 x 3 corner posts. These braces were pegged into augered mortise holes. The sides were lined with cypress shoring boards about ½ inch thick and 8 inches wide (Fig 26-3). Square nails and nail holes in the wood show that the lumber for the well was recycled from a pre-existing structure in turn made of sawed lumber. It is felt that the clay cap at the base of Level 1 helped keep water in the well at all times, preserving the wood. Loose white sand lined the well between the shoring boards and wall.

The fill of the well itself was of a highly mottled clay. The well was approximately 70 cm square and went down to a depth of almost 400 centimeters. The cypress posts and shoring continued down to the base of the well. The preserved posts were 170 cm. in length.

Fig. 26-1 1969 excavation showing Burial 7 (Feature 135) cut by historic well excavation at right. (Neg. 692684)

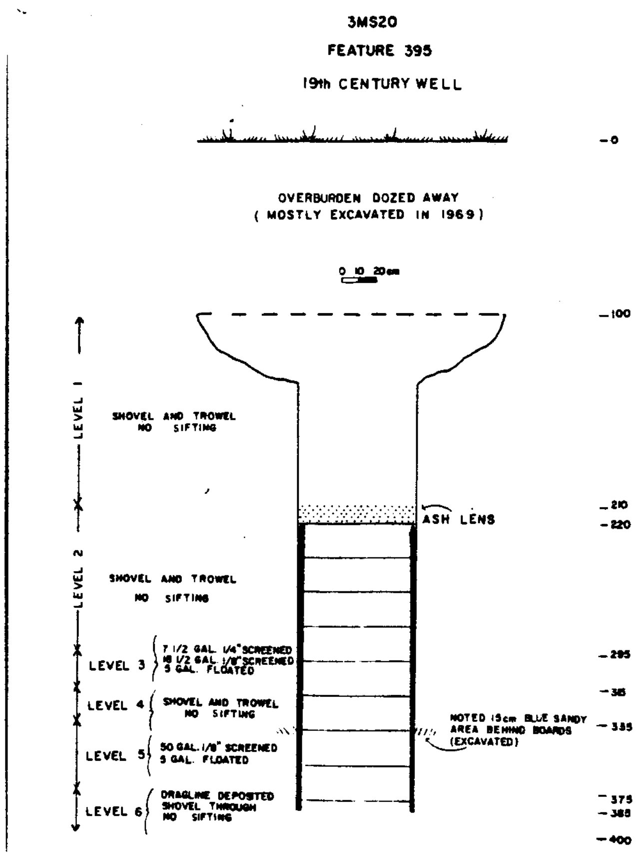

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Fig. 26-2. Stratigraphy of Feature 395, the historic 19th century well.

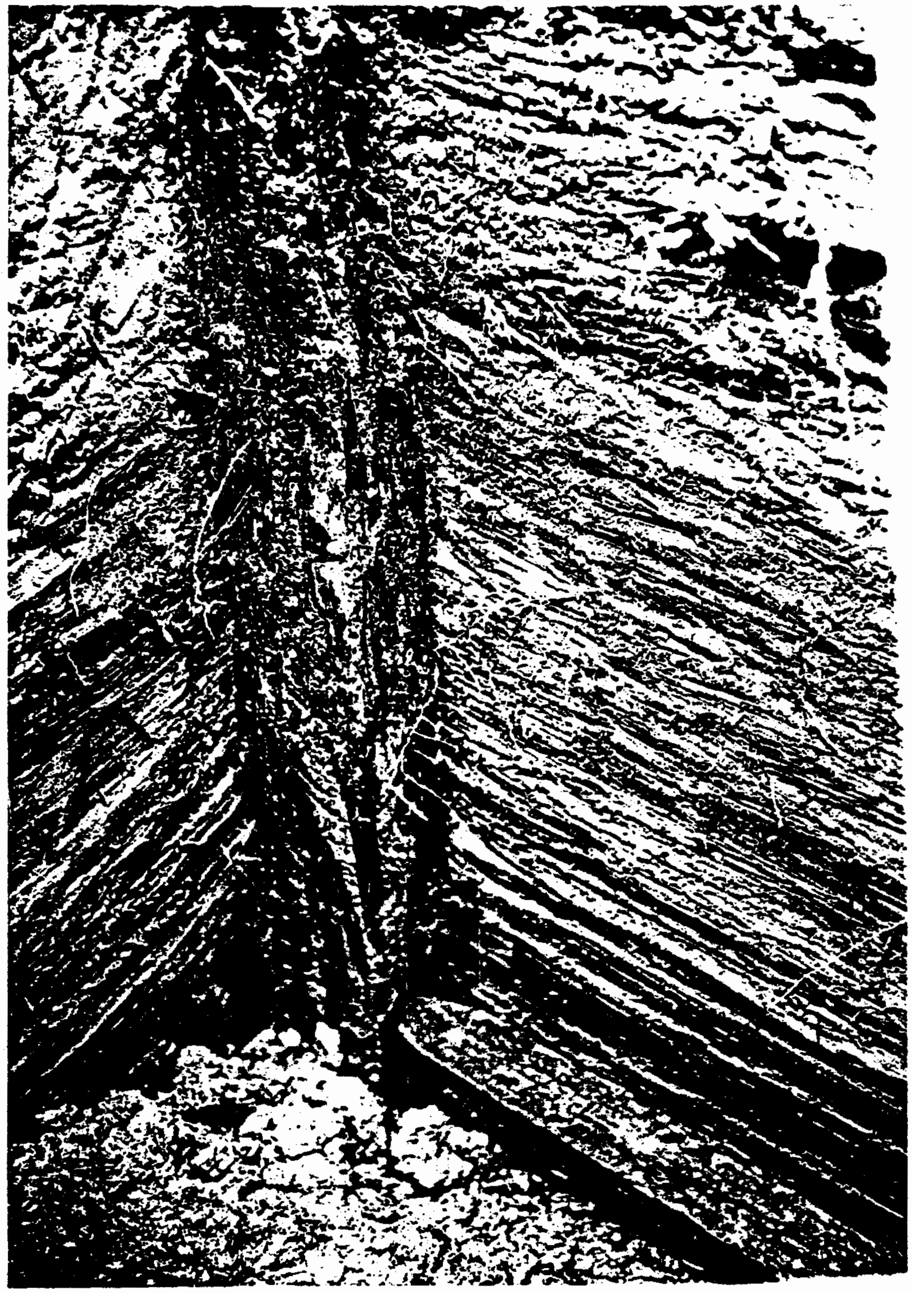

Figure 26-3. Interior of Feature 395 showing the cypress posts and boards. (Neg. 764005)

Level 2 was excavated by shovel and trowel. Level 3 was a concentration of organic matter about 20 cm. thick. This layer was scooped as muck and waterscreened through 1/8 inch screen. A large flotation sample was also collected and floated. Quicksand-like soil made excavation difficult and the buckets, turned upside down to stand upon in order to excavate, sank out of sight. The posts and shoring were removed at this point with the aid of a skidder because it was felt that the well excavation would have to be closed. The bulldozer could cut no deeper without extensive dirt removal, very viscous mud made standing in the hole impossible, and the sides of the excavation were ready to collapse.

The contractor, however, kindly moved the dragline forward in order to cut a hole beside Feature 395 so further excavation became possible. Level 4, about 20 cm thick, was dug with shovel and trowel. From Level 5, another obvious concentration, a 50 gallon 1/8 inch screening sample was taken as well as another 5 gallon flotation sample. The base of the well, Level 6, was again too deep and muddy for excavation by normal means. The dragline deposited this level on the ground surface and it was troweled through after this deposition.

Artifacts from the Zebree well will be described as being from one occupation unit rather than discussed by levels. It is assumed that no more than 10 to 20 years of deposition is involved. The presence of similar ceramics from the base of Level 1 and 4 influenced this decision. Shell beads from Burial 7 were also evenly distributed in the fill. Flotation and fine screening of over 40 percent of the contents of the well produced much data in the form of seeds and small artifacts which would not otherwise have been recovered. Pollen samples taken from along selected boards proved negative.

Ceramics

Pearlware is usually distinguished by one major attribute: the blue glaze gathers in footrims, handles and other crevices. It is the most common class of ceramic found on early 19th century sites, with a peak of popularity from 1790-1820 (Noel Hume 1969:129-131). Pearlware theoretically was popular because the cobalt included in the lead glaze made items decorated with blue painting and transfer printing look like porcelain (Noel Hume 1973:233). The common tableware was usually undecorated except for a blue or green shell-edge. Underglaze handpainting and transfer printing are also common decorative techniques.

Underglazed Hand Painted Pearlware

Three sherds appear to be from the same set of tableware (Fig. 26-4a-c). A plate sherd, with a base footrim showing the typical

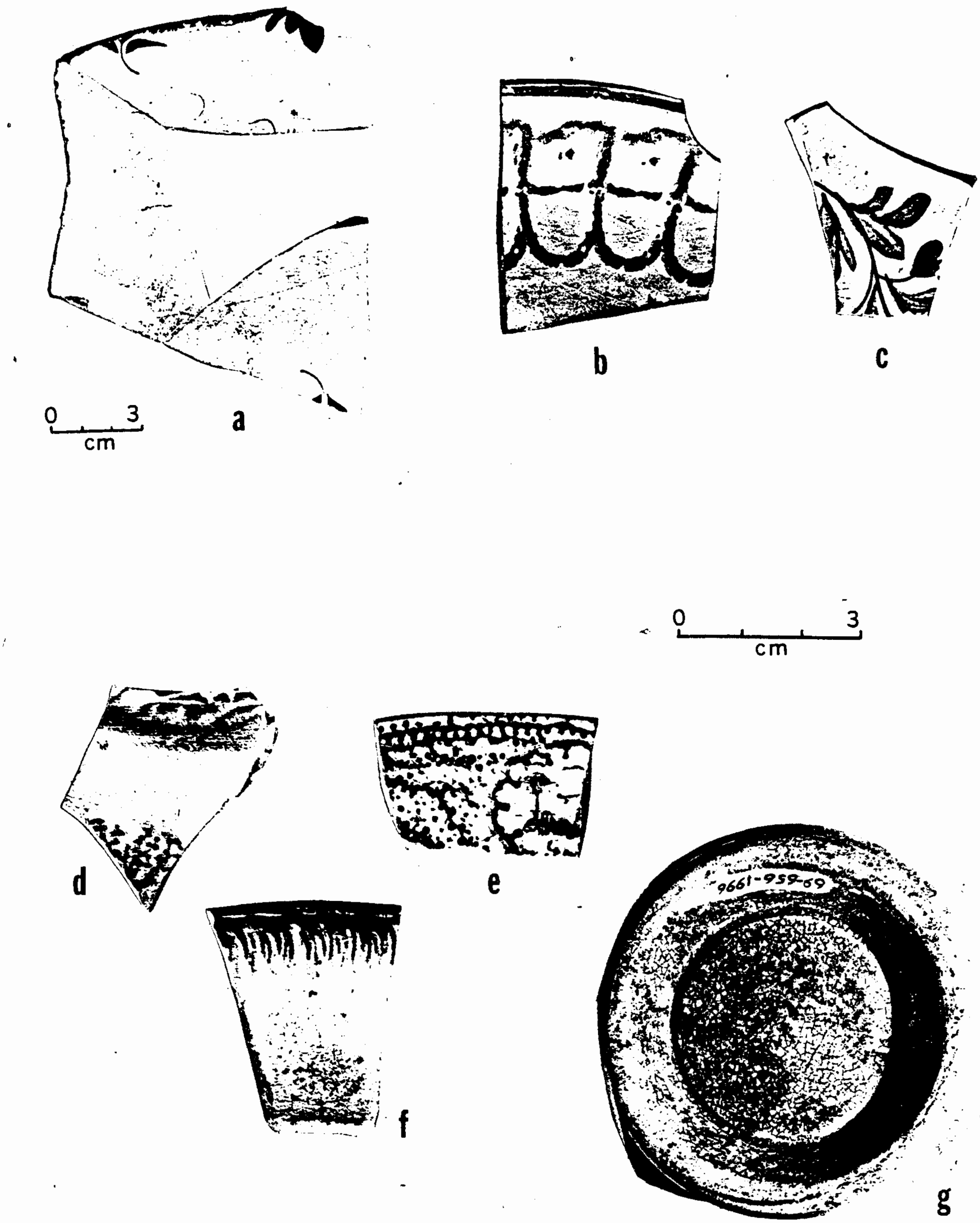

Fig. 26-4. Ceramics from historic well: a-c; Handpainted Polychrome Pearlware platter, plate, and cup; d-f; Blue transfer print, and blue shell-edge pearlware; g; Yellowware bowl with ring base.

blue glaze gather, came from the ash lens layer at the base of Level 1. It has a floral motif with bright parrot green leaves, burgundy and light blue flowers, and black stems connecting the flowers. A bowl or cup rim sherd from Level 4 has the same parrot green and burgundy colors in a crudely handpainted design of connected circles lines, and dots (Fig 26-4c). This was identified as the double chain design by Michael Archer, deputy curator at the Victoria and Albert Museum, London. This design is more commonly found on spongeware (Greaser 1973:134). A sherd of a small cup or bowl from the surface near the well has a burgundy line along the interior and exterior rims and the parrot green double chain on the exterior.

A 16 inch platter base fragment has no foot rim, but blue glaze gathered in the "16" stamped on the back. The body curves up gradually from the base. Traces of handpainted large burgundy and medium and deep blue flowers and forest green leaves are present. There may have been a garland of flowers and leaves on the inner rim and one flower in the center. A plain platter base sherd found on the surface south of the well is probably from the same vessel. Another thick base sherd from the surface has reddish and green bands paralleling the outer rim of the base. This sherd has been burned, but its colors look similar to the deep green and burgundy colors of the above platter.

Another pattern is represented by a small sherd with finely drawn small medium blue flowers and dark green leaves. Still another sherd is painted solely in two shades of blue. One rim sherd has a black line bordering the interior rim, and a curved black line on the exterior body. This may or may not be a polychrome motif.

Spongeware

Spongeware or spatterware is an antique-dealer term for articles decorated with small thickly placed dots of color which appear to be applied with a sponge. A representative sample of the range of types is shown in Greaser (1973), spanning over 100 years in time. Sponging will have to be regarded as an attribute which is not precise enough to denote a time period, but must be combined with other attributes in analysis. Sponging appears on creamware, handpainted underglazed polychrome and blue pearlware (Noel Hume 1973:237), and on stoneware.

In Feature 395, three spongeware sherds are present which appear to be from the same table service. Fine light blue sponging was covered over in part with dark green sponging. These appear to be bowls. One is decorated on the interior and two on the exterior. A thicker sherd from a larger vessel has light blue sponging on the interior. A deeper blue sponge pattern is present on a sherd found on the surface near the well. None of these sherds had areas where glaze could gather thickly so they cannot be positively identified as pearlware. Walker dates spatterware from 1800 to 1860 (1971:134).

Transfer Print

The upper level of the well produced one definite pearlware medium blue transfer print base sherd, probably of a plate (Fig. 26-4d). Not enough detail is present to tell anything about the particular motif. Tree branches with small dots for leaves edge the rim and the interior of the plate probably had one overall transfer scene. Ten other blue transfer print sherds are from the surface near the well. One of them is a rim sherd with the same pattern, with tree branches and small dots for leaves. A cartouche is partly present with a small house and tree shown within it (Fig. 26-4e). The other nine sherds are small and often split. Three are of the same pattern of geometric arches along the rim. None of these surface sherds can definitely be called pearlware. One small rim sherd from inside the well is a blurry red print which is badly weathered. Blue transfer printing was popular from 1790 through 1850 (Walker 1971:116).

Shell Edge

Only one blue shell-edge rim sherd was present at the well area (Fig. 26-4f). This type is often considered as a horizon style in the southeast, indicating a late 18th and early 19th century date (Walker 1971:108). The sherd from Zebree is from the surface near the well. It is neatly decorated with the shell edging brushwork following down the impressed lines from the rim, going from true cobalt on the rim to medium blue.

Undecorated Sherds

One thick rim sherd from the well is a pearlware soup plate or shallow bowl. The body on the interior has been pressed into a mold to create a sectioned appearance like the Queens pattern. No evidence of decoration is present. Eight other plain sherds are from the well. Two are bases with foot rims, and both are definitely pearlware. The others are small body sherds.

Fifty-one plain white sherds were found on the surface near the well. Ten were basal sherds and of these three are pearlware plates with blue glaze on the footrims. Three are flat with no footrims. Four may be ironstone or hard white plate sherds. Of the other sherds, 15 are small and split, 7 are rims, and 25 are body sherds. Many of these sherds may be from a later occupation.

Two other surface sherds may also be from a later occupation. One has curved half-moon punctates painted with gold in the interiors. Another has a clouded gray glaze on both sides.

Stoneware

Utilitarian ceramics for food storage and preparation were also found in the well. Three sherds have pale gray salt-glazed exteriors and reddish-brown slipped interiors. Two of these appear to be from the same vessel, a storage crock with a flattened everted lip. The paste is a creamy beige. A fourth sherd is slipped with a dark brown salt-glazed Albany-like slip on both surfaces. The paste is a dark gray. Albany slip began to be used by stoneware potters in a widespread area after 1800 to glaze the interior of salt-glazed wares. This slip allowed the ware to hold liquids much better. After 1840, Albany slip was used throughout the country (Guilland 1971:85).

Two yelloware sherds were found in the 1969 excavation. One is an outcurved rim of a bowl. It has a yellow glaze and yellow to buff paste. The other is a yellow glazed bowl base with a white slipped interior and a pronounced footrim (Fig. 26-4g). Yellowware was fired at a temperature over 2000 degrees F and is more finely textured than earthenware. Manufacture in the United States began in 1828 (Ketchum 1971:97).

Stoneware sherds from the surface near the well included four salt-glazed brown slipped stoneware sherds. One was the base of a large crock or churn, two are thin walled and would be from small storage crocks, bowls, or preserve jars. The fourth is from another large crock. Paste ranges from gray to buff colored. One gray salt-glazed rim sherd has an outflaring curved rim and is probably a bowl. One sherd may be true yellowware, with yellow slip and buff colored paste. One thick crock sherd has a gray exterior and brown interior and is badly weathered. A green lead-glazed majolica-like sherd is from a shallow vessel like a cream pan. The paste is yellow.

Metal Objects

Bucket

Scraps of a thin metal bucket were found in the 295-315 cm level of the well. The base is fairly intact and is exactly 6 inches in diameter. The upper rim is formed on a narrow wire which had the body of the bucket attached to it. The bucket was a straight-sided cylinder at least 6½ inches deep. It is a galvanized thin metal, 1 mm thick. A thin strip was added along the side on the exterior to join the wall together, which ends in a wider piece on the rim which probably held a ring for the handle. A metal fragment of two rivets attaching one piece of metal to another probably riveted the other handle to the bucket. Fragments of an even thinner metal (0.5 mm) container from a higher level may be the remains of a tin can, with a fine metal rim strip attached.

Knife

A complete bone handled knife was found in the 335-375 level of the well, near the base (Fig. 26-5a). The blade is similar in shape to one illustrated in an 1816 Sheffield catalog (Smith 1975:156). The Smith catalog offers these knives with blades from 6 to 12 inches long. The Zebree knife is the 6 inch size, with the handle 3 inches long.

The knife has a rounded tip and dorsal ridge on the inner part of the blade like Noel Hume's round-ended scimitar shape (Noel Hume 1969:180). The well preserved bone handle has three brass rivets. One rivet in the center of the upper side may be a repair, as it is 6 mm in diameter while all others measure 1.2 mm. Sheffield cutlery was one of the main imports from England to the United States during the early 19th century, with St. Louis and New Orleans being major distribution centers.

Lead Stock

One strip of lead bar stock weighing 111.15 gm was found in the 295-315 cm level of the well. It was obviously cast in a mold, with one end still rounded and the other end has been cut off (Fig. 26-5b). Definite filing marks are present on the cut end. Three stamp marks are are visible on one surface, an ovoid with an undeterminate symbol in the center which could be an 8, a large C, G, or 6, and another large symbol. The end with most of the identifiable symbols was already used. On the steamboat Bertrand, sunk in 1865, lead bar stock in 2 ounce bars packed 144 to the case was discovered (Petsche 1974:70). The Zebree bar was 12 mm wide, 6.5 mm thick and over 170 mm long. It may have been an 8 ounce bar of lead, used for making bullets.

Draw Knife

A slightly curved sharpened steel or iron blade came from the 335-375 cm level. It is 3 5/8 inches or 92 mm in length at the blade end (Fig. 26-5c). Maximum depth is 1½ inches or 36 mm. It is sharpened on the inner curved surface. The blade was snapped off on the upper edge. This is probably a cooper's draw knife blade (Sloan 1964:39). Often the early tools had steel working edges which were feathered onto iron and then set into a handle.

The more technical term for this type of draw knife is a Coopers Jigger Drawing Knife (Salaman 1975:Fig. 266a). It has a specialized small working area for cutting the chime or the rim of a cask for chamfering and howeling. A specialized tool such as this usually belongs only to a cooper.

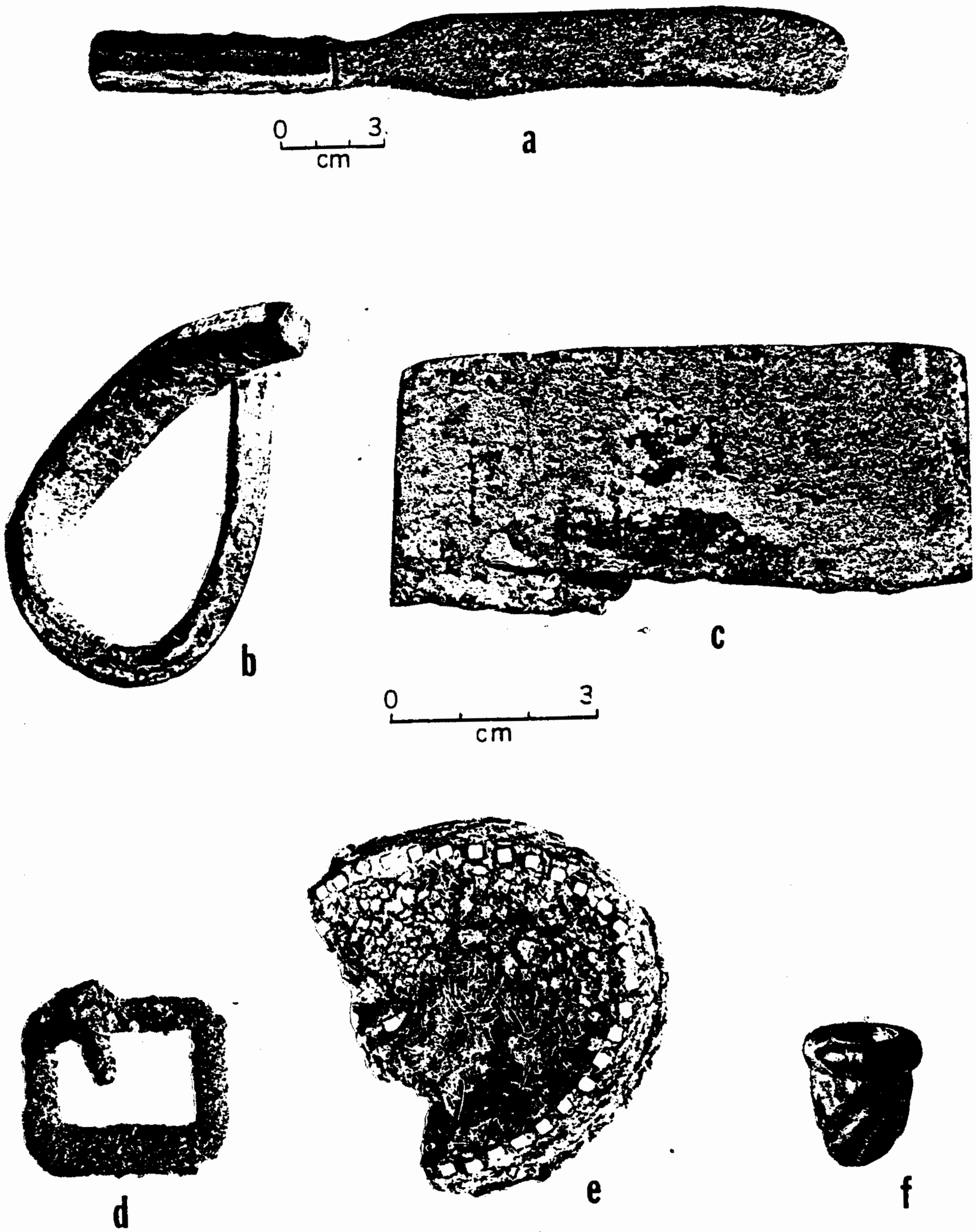

Figure 26-5. Artifacts from 19th century well: a, Sheffield knife; b, lead bar; c, draw knife blade; d. harness buckle; e. pegged shoe heel; f. pottery pipe stem.

Buckle

One metal buckle was found, which is probably a harness buckle of some sort (Fig. 26-5d). It is 30 mm long and 26.5 mm wide. The corners are rounded. The tongue is 27.5 mm long. It would have fit a strap up to 20 cm or 3/4 inch in width.

Shot

Two small lead pellets were recovered from the flotation sample in Level 3. One pellet weighed 0.145 g; the other was smaller and weighed 0.01 g.

Hook and Eye

One eye was recovered in the flotation sample in Level 3. It is two metal loops connected by a continuously twisted wire, which twists four times between the loops. It is about 1.5 cm in length.

Iron Skillet

The 1969 test produced a rim and base fragment of an iron skillet. The metal is thin, 3 mm thick at the rim and 1.9 mm thick at the base. The base is reinforced with a thicker metal casting which makes it 6.8 mm thick. The container is 49 mm deep. This is either a frying pan or a top to a Dutch oven (Franklin 1976:78).

Nails

Thirty-three square cut iron nails and tacks were found in the well. None of these have the waisted appearance of the 1790-1820 square nail (Noel Hume 1969:253). They look most like the illustrations of the Common Nail of the late 1830s to present (Nelson 1968). Most of the unbroken nails range in overall length from 2 to 2 3/8 inches (52 to 60 mm) in length or are six penny and seven penny in size. These nail sizes are most often used for clapboarding, light framing and level siding. This size nail was also the most common found at Walker's Bank site excavation at Arkansas Post (Walker 1971:70).

At the base of the well, at the 335-375 cm level, an anomaly occurs. Two small square-headed tacks 9/16 inch in length were found in the 1/8 inch screened sample. One modern round wire nail was also found in this sample. This looks like a common nail, dating from after 1850. Due to the conditions of excavation of the lowest levels of the well, this probably is an accidental intrusion.

Other Artifacts

Buttons

Two complete and one partial buttons were present. The two complete specimens are small four-holed milk glass buttons. The broken one is of bone and is incomplete. The glass buttons are small, being 10.2 mm and 9.5 mm in diameter. These resemble Smith's type 11 found at the Hermitage (Smith 1976:196) and South's type 23 from Brunswick Town (South 1964:122). South states that these buttons became a major type between 1837 and 1865.

Leather Strips

Two long narrow leather strips were from the fourth level. They are crudely cut, ranging from 7.2 mm to 9.5 mm wide along the same strip. One is about 300 mm long, the other about 420 mm long. The longer strip has three perforations near the center. These strips could have had many domestic functions.

Pontil Base Bottle

One small blue bottle base with an obvious pontil mark 1.3 mm deep was found at the 100-120 cm level. The base is 168 mm in diameter. The base and general proportions look like the medicine vials found by Smith under the south cabin of the Hermitage (Smith 1976:172). The Hermitage bottles still contained mercury, and Smith concluded that the original content was calomel, a commonly used medicine which contained mercurous chloride. The Hermitage south cabin occupation probably dates from 1802 or 1813 to 1856 (Smith 1976:287), when it was moved.

Marbles

Four stone marbles were found distributed in the well. These are one of the most common indications of games found on 19th century sites (Smith 1976:188; Walker 1971:184), often played by young adults. The Zebree marbles measure 17.3 mm, 19.4 mm, 15.1 mm and 16.5 mm. One is white, two are tan and gray, and one is white with blue and green streaks. Two exhibit a flat facet caused by the manufacturing process (Randall 1971:102). Marbles were exported to the United States all during the 18th and 19th centuries.

Pipe Stem

The broken stem end of a short-stemmed clay pipe was present in the well (Fig. 26-5f). These pipes were smoked with a reed stem. The paste is dark gray. The exterior is a mottled red and black in color. It was made in a two-part mold. The end is made of a ring of clay and is 16.5 mm in diameter. Geometric curving lines begin after this ring from each half of the mold, meeting in the center. This pipe resembles types GD-20 most closely in Thomas and Burnett's article on a pipe factory at Point Pleasant, Ohio (1972). This factory was probably in existence from 1833-1890. Similar pipes were made in the Pamplin, Virginia, area (Hamilton and Hamilton 1972) both as a home and factory industry. The home industry began about 1740 and lasted until 1953. The factory existed from 1878 to 1951.

Shoe Heel

The heel of a shoe pegged with small carved square wooden pegs was recovered in 1969 (Fig. 26-5e). A row of 25 small pegs .6 mm in diameter and 4.2 mm long circle the outside edge of the heel. Layers of leather are held together by these pegs. One layer still has hairs on it. Larger pegs are found on the inner surface, 1.5 mm in diameter and 10.5 mm long. The heel is 55 mm wide and is broken off on the inner surface towards the sole of the shoe. It is oval in shape and looks like a heel for a high-heeled boot or a child's or small woman's shoe.

Glass

Surface sherds of glass were located south of and near Feature 395. Two small blue-green sherds look like pepper sauce or other condiment containers. Two flat greenish window glass fragments are 1.3 mm and .9 mm thick. Window glass this thin usually dates from sites occupied prior to 1845 (Walker 1971:78).

Bricks

Four broken chunks of brick were found in several levels near the top of the well. None were complete. Thickness is the only possible measurement that can be made. The bricks measure from 45.4 mm to 51.2 mm in thickness or 1 3/4 - 2 1/16 inches. They are fired a gray color and are handmade. This thickness is less than any of the brick mentioned by Walker (1971:54-55). The Zebree brick was probably made right on the site and the deviation from the usual 2¼ inch thickness may be due to an individual idiosyncracy. This was probably used as curbing around the top of the well.

Wood Scraps

Well preserved wood was found in all the levels of the well below 220 cm. The main posts and shoring were in good condition when recovered. These are being curated by Lynne J. Bowers, Louisiana State University, who is a dendrochronologist specializing in cypress. Numerous small shavings and whittlings of wood were recovered both by trowels and in the flotation samples. Knife marks are obvious on some long thin wooden branches found in the 295-315 cm level especially. No specific purpose or use can be given to the whittled sticks, which range from 250 cm to 97 cm in length. Five or six long knife cuts were made along these sticks to pare them down and remove the bark. These are called "pegs" by whittlers.

Hundreds of small bits of wood were recovered from the well. Much of it may be deteriorated shoring boards from the decomposed upper levels. No definite carved wooden artifacts were found other than the shoring, well posts, and one wooden shingle. The shingle is made of cypress and shows definite striations across the grain of the wood, where it was split with a froe. It is broken, and measures at least 310 mm x 130 mm in size and is 2.5 mm thick.

Plant Material

Flotation of selected samples from the well produced an interesting array of plant material. The 19th century Anglo-American material includes corn cobs, peach and plum pits, watermelon seeds, muskmelon seeds, and a peanut shell. Other uncarbonized seeds include grape seeds, hickory nut shells, and a hackberry seed. A cockleburr was also found. The occupation of the area associated with the well had to be a mininum of four years, when peach trees begin to bear fruit.

Faunal Remains

In 1969 Guilday and Parmalee identified one left adult pig maxilla and six pig vertebra cut with metal tools from Feature 125. Hog jowls and pork chop remains were apparently tossed into the well during the beginning of its use. Additional pig bones and chicken remains were tentatively identified from the 1976 excavations by Ray Medlock of the Arkansas Archeological Survey.

Many large eggshells were recovered from the flotation samples. These also reveal the presence of chickens at the site.

19th Century Artifacts at Other Loci

A few other traces of this occupation are present at the site in other areas. In the 0-20 cm level of Square 80R8 a gunflint of a honey-colored translucent flint was found. This is probably a French gunflint. It measures 17.2 x 15 x 5 mm thick. One historic sherd was found in Feature 192. This is a yellowware Mocha bowl, with yellow slipped interior, brown and yellow exterior with black and white bands, and a black seaweed decoration. A blue shell-edge pearlware sherd was found in Backhoe Trench 3.

Comparisons and Dating

A well, similar in construction techniques, was found by a University of Arkansas and Arkansas Archeological Survey excavation at Arkansas Post (Martin 1971:125, Fig. 8). This was cypress-lined, constructed of 3 x 3 inch corner posts and 1 x 6 inch boards, located behind Jacob Bright's trading post. Brick rubble at the top formed curbing for the Arkansas Post well, which was excavated down 18 feet. It may have been over 40 feet deep. The Arkansas Post square shaft measured 2.5 feet on a side whereas the Zebree shaft measured 2.3 feet. The mean ceramic date of the Arkansas Post well was 1809.89. There was a lot of creamware as well as pearlware present. This particular location of Arkansas Post had been occupied since 1778 and was the first capitol of Arkansas in 1819. A tavern and trading post near the well and a population of over 300 people in 40 houses could potentially discard items down this well, in contrast to the one family deposition postulated for the Zebree well.

It was assumed that the cypress lining was constructed above ground and slid down into the Arkansas Post well, while soil was removed at the bottom (Martin 1971:125). This provided shoring for those digging the well. Similar construction techniques must have been used at Zebree. A tradition of using cypress, a wood unlikely to rot in water; 3 x 3 inch corner supports and an ideal well size of 2.3 - 2.5 feet is obviously present in Arkansas in the early 1800s. Wells of brick and stone are representative of an earlier French tradition, such as one described from Fort Conde, Alabama, built between 1717 and 1763 (Harris 1971). The Conde well was 15.7 feet deep, rounded, built of brick and sandstone blocks on a wooden curbing and measures 3.5 feet in diameter. The use of cypress as the lower lining at Arkansas Post and Zebree may reflect either a lack of suitable stone in the area or a different cultural tradition.

It will probably never be known who built the Zebree well, how long they stayed there, or why they chose that precise location but much more can be learned about these forgotten pioneers through archeological techniques than through standard historical procedures. No tax records, titles, censuses, or wills are on file for the area before 1855. Much data, particularly county records were destroyed by the Civil War.

An American pattern of dispersed settlements is typical of the early 1800s (Kniffen 1971). Single families cleared fields for farming and built cabins in widely dispersed locations. There was usually someone within a days journey on foot, but self-sufficient isolation was a common settlement pattern. Schoolcraft describes many such families in his Journal of 1818 and 1819 (Park 1955). Many hunting families lived in one-room log cabins surrounded by corn fields although they moved frequently to better hunting grounds. Horses, cows, pigs, and chickens foraged for food. Tanned skins on drying frames surrounded the cabins. Beaver, otter, raccoon, deer, and bear skins were taken to trading keel boats on the White and Black rivers and exchanged for salt, iron pots, axes, knives, rifles, and blankets. Often these hunters did not even plant a kitchen garden. Cabins may have been widely spaced to facilitate hunting.

Schoolcraft did stay with some families who appeared more permanently settled (Park 1955:81). Outbuildings such as a smokehouse and fences were present. The effort required to dig and line the Zebree well implies the presence of at least one cabin and other structures such as barns, sheds, smokehouse, and outhouse. Flotation and fine screening of gallons of dirt from the well produced evidence for both a kitchen garden, with melons, and an orchard with peach and plum trees. Pigs and chickens were also present.

Enough contact with the outside world trade networks existed to procure English cutlery and ceramics. A minimum of 10 different patterns of pearlware are present in the well, judging from the sherds. Yearly contact with trading boats down the St. Francis, assuming new merchandise was acquired each year, could account for the diversification of patterns and types. No porcelain or elegant tea ware was present; only plates, platters, and bowls or cups. The Sheffield knife is representative of the vast quantities of cutlery shipped to St. Louis and then further west in the early 1800s. Non-local American made products are also present. The lead bar probably came from the Missouri lead mines. Metal objects such as nails and buckets could have been acquired from trading boats also. Hooks and eyes from dresses and the pegged shoe heel also show dependence on extra-local resources. The hunter families clad in buckskin seen by Schoolcraft did not live at Zebree. The clay tobacco pipe also indicates a dependence on supplies of tobacco grown elsewhere.

A saw mill may have been within reach of the Zebree pioneers. The shoring wood from the well was sawn. Either an animal powered or water powered saw mill could have been in the area. The presence of a specialized coopers tools in the well indicates the possible presence of another specialist craftsman.

In dating the contents of the well, a number of factors can be considered. Of the English ceramics from the well itself, not including the surface deposits, eight are definitely pearlware. According to South's formula (1977:217), a date of 1818.12 is derived. Handpainted polychrome pearlware is the most common type in the well, and was most popular in the 1820s to 1840s. The Albany slip on utilitarian wares began to be used in 1800 and increased in popularity until is was almost universally used in the United States by 1840.

The Sheffield knife is of a type used in 1816, but the same patterns were sold for years both before and afterward. The button popularity peaks from 1837 to 1865. The clay pipe is of a type manufactured from 1833 to 1890 in Ohio. The machine cut nails date from after 1830. The window glass dates from before 1845. Yellowware earthenware of American origin dates after 1828. A deposition date of around 1830 to 1845 fits the evidence best. The well could have been constructed slightly before this time, with the 1830 to 1845 range being when articles were lost or discarded into the well.

Euro-American settlement actually began in Arkansas with the establishment of Arkansas Post in 1689. Arkansas Post was controlled alternately by the French and Spanish until the Louisiana Purchase of 1803. Actual white settlement into Arkansas was sparse before this time. It is estimated that only 2,000 people lived between New Madrid, Missouri, and the Arkansas River in 1803 (Kniffen 1971:49). Most of these lived on the higher levees along the Mississippi and Arkansas Rivers, the main arteries of trade and transportation. Settlement by American citizens was discouraged by the French and Spanish. One had to swear allegiance to their king and become a Catholic to settle in their territory. After 1803, migration to Arkansas took place mostly by water. Some families did enter by foot or by using horses or oxen. Preferred areas for settlement were in the uplands and foothills of the Ozarks. Land in the floodplain of the larger rivers was settled later, when flood control ditches and levees could be constructed, often by slaves. In 1823, a settlement in southern Mississippi County is shown on a General Land Office Survey map. Twelve separate fields and associated houses are shown near Frenchmans Bayou. One owner even has "Negroe houses" on his land. The General Land Office survey map shows no one living on the Zebree site in 1848. Only a path from Osceola to Grand Prairie, Missouri is shown going near the site on this map. Bounty warrants given out after the War of 1812 encouraged settlement in Arkansas. By 1840, a census shows 900 white and 510 slaves living in Mississippi County.

The closest occupation shown on the 1848 map is Braham's field on the Missouri border. Below this, no occupation is shown until Rice Landing, 5 miles down the lake. A mill and two fields are indicated here, by a prominent point into the lake. The owners of the well were near two sources of transportation, the Little River and the path to Missouri.

The forgotten pioneers who dug the Zebree well, built a cabin, established an orchard, and lived by Big Lake will probably never be known by name. It is interesting that the location chosen is the same as that picked by three aboriginal groups, on a relatively high point near the waters of the Lake. How much influence the seasonal presence of ducks and geese on the lake had on this choice is not known. The Zebree pioneer settlement appears well-fed and prosperous. The variety of goods in the well suggests the production of some desirable items to use in trade. This small excavation is the only record which will ever be available of the existence of this family.

CHAPTER 27

LATER HISTORIC SETTLEMENT ALONG BIG LAKE

Phyllis A. Morse

The concentration of white settlement in Mississippi County was first along the Mississippi River, on the higher natural levees. By 1837, the General Land Office map shows forty separate holdings in the Osceola area and a nine block plot of the town itself. The riverine orientation reflects the economic importance of this means of transportation. Selling cord wood to steamboats was a major occupation. In 1840, 900 whites and 510 slaves resided in the county. Census data of 1850 shows 63 large holdings and 865 slaves present (Walz 1953). An unknown number of persons resided in the interior portion of the county, neither recording ownership of land nor paying taxes.

Settlement of the southeast Missouri-northeast Arkansas region may have been temporarily discouraged by the New Madrid earthquake of 1811-1812. The United States government gave exchange land grants to those who could prove damage by the earthquake for compensation. These were in the interior of Missouri, in Howard County (Gerlach 1976:16).

A study of the Zebree land abstract shows registration of ownership going back to 1850. This was a Swamp Land Grant transaction transferring title to the State of Arkansas. Proceeds from the sale of swamp and overflow lands by the state were to be used for drainage and levee building (Harrison and Kollmorgen 1947:369). A minimum price of fity cents per acre was decided upon, and swamp land scrip representing quarter sections was used to pay officials administering the lands. Determining which areas were actually swamp lands caused many resurveys of the original General Land Office maps. In Mississippi County, 746,160 acres were considered swamp land in 1852. A Henry L. Jones got title to the NE½ of Section 28 T 16N R 9E in 1855, which includes the Zebree site. No evidence of actual settlement on the land at that time is present.

The Civil War caused a great disruption of settlement in northeast Arkansas. The Missouri-Arkansas border lands held guerillas, bushwackers, and jayhawkers, who preyed on citizens with both northern and southern sympathies (Huff 1965). Most families with isolated holdings moved away during this time, either to towns or away from the entire area. Protection by the United States or Confederate forces against these guerillas was intermittent. In September, 1863, a Northern force was sent to Big Lake from Camp Lowry, Missouri. Two hundred men and one gun sought a rebel force unsuccessfully, but killed or captured 43 guerillas (Scott et al 1888a: 616), A more detailed description exists of a punitive excursion from New Madrid, Missouri, to Osceola and Pemiscot Bayou to raid guerrilla band camps made in April, 1864 (Scott et al 1888b:872-874). Pemiscot Bayou is immediately to the east of Big Lake. The Second Missouri Artillery with 200 men followed a road north from Osceola through swampy country covered with canebrakes and heavy timber. The water was from 1 to 3 feet deep. The first house was 12 miles from Osceola. They were attacked during the night and carried their wounded through the swamps until they located some teams they could press. The teams indicate the presence of at least one more farmstead in the area between Pemiscot Bayou and Blytheville. Civil War guerilla camp sites are undoubtedly one potential type of site to be located around Big Lake.

Some Indians still lived around Big Lake after the Civil War. Names recorded include Big Knife, Keshettee, Corn Meal, John East, Moonshine, Chuck-a-Lee and Sam Hector (Edrington 1962:29). These may be Delaware, Shawnee, Cherokee, or members of other remnant groups who did not resettle in Oklahoma Indian territory. Sam Hector was a chainer and blazer for the GLO surveyor, B. L. Owens, in 1847 and owned land in Pemiscot Bayou. His farm is pictured in a publication by the St. Francis Levee Board to show how attractive Mississippi County would be for settlement (Fox 1902:54-57). Hector claimed to be the last Indian around Big Lake. His land contained the Pemiscot Bayou Mound, reported by the Bureau of American Ethnology in 1881.

After the war, economic development of the Big Lake area remained slow. Levees built before the Civil War had to be redone. No successful effort to create an area-wide coordinated plan for levees and drainage of land was accomplished until the creation of the St. Francis Levee Board in 1893 (Burke *et al* 1945). Again, the lands near the Mississippi River were developed first and actual settlement in the interior of the county was sparse. The Pemiscot Bayou Drainage District east of Big Lake was organized in 1905. Before this, vast amounts of land were used for pasture instead of agriculture. Melvin Cude of Leachville recalls living on the Rawls place on Buffalo Creek, helping run a stock farm in 1907. Over 100 head of cattle, sheep, and goats were run on the farm. Supplementary agriculture grew corn and hay for stock feed plus some cotton. The cattle grazed on prevalent wild grasses in the winter. Settlement such as this around Big Lake, particularly from Missouri, intensified in the early 1900s. Small communities such as Box Elder grew up, with a school and store surrounded by farmsteads within walking distance (Melvin Cude, personal communication).

The area of the Zebree site was sold for taxes or to settle estates several times from 1860-1895. J. W. Stewart recorded the purchase of this land in 1895. Leonard Sebree of Arbyrd, Arkansas, remembers that

Stewart had built a house on this land. Stewart signed over the house and lands to A. J. and Mary Atkinson in return for nursing care while he lived. The Sebrees moved there in 1895, and occupied the house and took care of Mr. Stewart. A lawsuit determined that the parties who purchased the land from the Atkinsons were the legal owners and I. M. Sebree legally purchased the land in 1906 for a total of $555.00. Inness M. Sebree had moved to the Zebree homestead site from Sebree, Kentucky. Local pronunciation of the Sebrees' name led to the spelling used for the Zebree aboriginal site. The Sebree house was located approximately in Area B. It was on a high rise of ground with the back porch overlooking the high water mark of the Little River. The house itself was on high blocks and of board and batten construction. A living room ran along one whole side of the house from the front to the back porch. A kitchen was entered from the front porch through a separate door. Behind it was a large bedroom with three or four beds. Hunters were put up here from as far away as St. Louis and Chicago. Inness Sebree had blinds built around Big Lake and brought in up to 500 ducks per day (Leonard and Pearl Sebree, personal communication). Forty to fifty acres were cleared for cultivation. Boats were tied up behind the house. A rose garden, orchard, and flower gardens were present.

The Sebree occupation was mainly oriented toward exploitation of the lake resources, both for food and for cash. Use of the land to grow corn for animals, food and vegetables and fruits for food for themselves and the hunters put up there was secondary in economic importance. This lake orientation is paralleled by the other settlements on the landings along Big Lake, at the State Line (Coles Dock) Sebree Point, Bucks Point or Buckeye Landing, and Rice Landing.

Ditching of the first levee brought up human bone. This may have been the location of the main prehistoric cemetery. The land was acquired by the U.S. Fish and Wildlife Service in 1940 as part of the Big Lake National Wildlife Refuge.

A metal detector survey by James and Cindy Price of the University of Missouri (Fig. 27-1) at the beginning of the 1975 field season was done to determine the location of the Sebree homestead and the extent of disturbance caused by the Sebrees on the aboriginal site. Marker flags were put out whenever the detector indicated the presence of metal and were later excavated. The survey indicated the dumping of trash in the swampy area behind the Zebree homestead and around the house. Evidence of domestic use (South's kitchen pattern, 1977) includes tin cans, canning jar lids with porcelain interiors, two metal trunk lid corner braces, a stove lid lifter for a wood burning stove, three pieces of the stove itself, a dutch oven sherd, three portions of bed rail (bedroom pattern?) and a small pair of scissors. Agricultural activities (the barn pattern) are indicated by items

Figure 27-1. Dr. James E. Price locating Sebree deposits with a metal detector. (Neg. 752565)

such as an iron bar made from a 2 inch wagon tire band, a gooseneck hoe, a bridle bit, an iron file, a draw knife, a buggy brace, a wagon harness loop, and a hatchet head. Steel bands from a wooden barrel and the bung from a metal barrel are present, as well as a brass lead for feeding a coal oil heater or stove. Fishing and hunting activities are evidenced by lead sinkers for both lines and seining nets, shells of various calibers and a buckle from a pair of waders patented in 1909. A very large gig handle was probably used to land large catfish or gar. Logging is indicated by a raft shackle. The most interesting artifact of all is a leg shackle from the ball and chain type of restraint.

Historic items were recovered from the upper levels of many random squares and features (Fig.27-2). The majority of these are probably results of the Sebree occupation. At least fourteen different brown salt-glazed crocks and canning jars are present. Some of these are gray on the exterior. The ceramic inventory shows mostly plain white ironstone sherds. One plate rim is scalloped and has four sprays of pink flowers and green leaves around the rim. A hen on nest bowl is represented by a blue and white glass chicken head. One fragment of porcelain has a trace of gilding. One elaborate cup handle is also present.

The Sebree artifacts show a focus on farming with mule or horse drawn equipment. Other activities such as hunting, fishing, and logging are also indicated. Very little trace of the major Sebree economic focus, the occupation of Inness Sebree as a guide for duck hunters, is present. Lead shot does show up in some of the flotation samples.

In 1902, only five percent of the Mississippi County was under cultivation, mostly near the higher natural levees (Simonson 1946: 264). The parallel developments of levee and drainage with the building of railroads opened up the area for more intensive settlement. The Big Lake area was reached by the Jonesboro, Lake City, and Eastern Railroad by 1902. Towns sprang up along the railroad, concentrating on the exploitation of timber resources. Loggers and sawmill operators moved in. Smaller spur railways took the logs to the main line. Cross tie, bridge timber, shingle, stave, box, spoke, header, and handle plants were established in towns along the railroad (Dew 1968:27). After the timber was cleared, the lumber companies sold the land for farming. By 1913, most of the accessible timber was cleared out. The railroad began an active campaign to attract farmers to the Buffalo Island area, between the St. Francis and Little rivers. Land was sold for $25 to $30 an acre by a land agent employed by the railroad. Cotton prices rose during World War I and drainage efforts increased. After the war, land prices boomed. Small farmers purchased

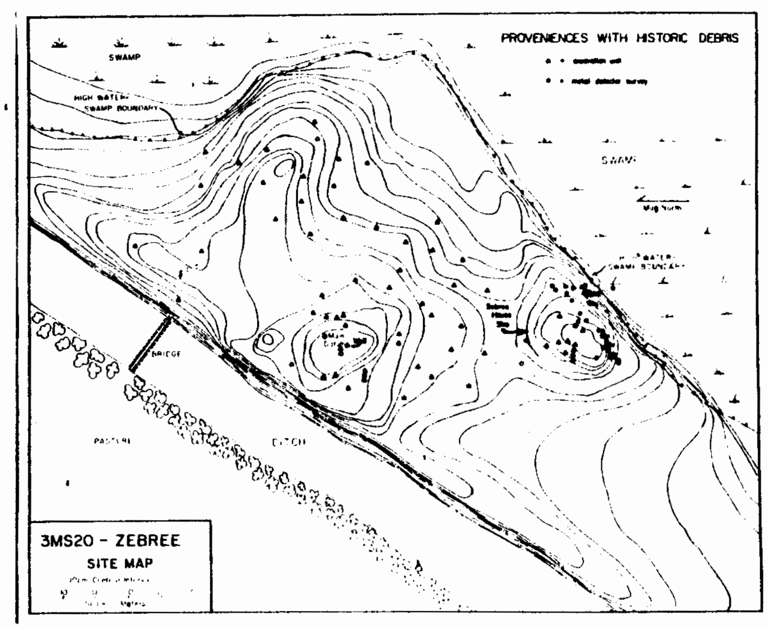

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Figure 27-2. Locations of historic artifacts at Zebree.

20 to 80 acre tracts, and size of farms was limited by how much cotton one family could weed and pick by hand (Dew 1968:31). Some larger plantations using mechanized farming or numerous tenant farmers were present in southern and eastern Mississippi County. Agricultural depression and floods took place, but complete clearing of forests and thorough agricultural exploitation of the land was complete by the 1930s.

The 15 mile transect between the St. Francis and Little Rivers reflects the historic pattern of settlement in the Big Lake area. Near the rivers, on the higher ground of natural levees, older settlements are present with material remains such as blue spongeware and blue and gray mixing bowls, elaborately impressed white ironstone, saltglaze crockery and moss rose type dinnerware as typical artifacts. Inland, where the land had to be timbered and cleared, the remains of many small holdings are present showing where farmhouses had been located on small tracts of land. Some of these houses are still present and are being occupied or used for storage. Most have been removed so the land could be reused for farming. Material remains such as clear, pink, yellow, and green depression glass and brightly colored tableware in "Fiesta" colors of turquoise, orange, and green reflect this time period.

Today most of the farms are much larger due to the cost demands of modern agribusiness, particularly expensive machinery needed to run these businesses. The small farmer and tenants have left, starting in the 1940s and 1950s. Recent growth of manufacturing in the small towns of Arkansas has reversed the trend of depopulation. Preservation of the few remaining wetlands and forest lands, such as the creation of the Big Lake National Wildlife Refuge, leaves an isolated example of the dense forest vegetation and floodlands present during aboriginal times.

Federal refuges were not a common practice until after 1934. The first Federal Refuge was Pelican Island off the east coast of Florida. It was established in 1903 by a presidential proclamation (T. Roosevelt). On August 2, 1915, presidential Executive Order 2230 (W. Wilson) established the Big Lake National Wildlife Refuge. Most of the 11, 038 acres of Big Lake were included at that time.

In 1929, authority was provided for land purchases by the Migratory Bird Conversation Act. But it was not until 1934 when actual funding for purchase was provided by allowing the selling of duck stamps. A few hundred acres were then added to the Big Lake Refuge which included the Zebree site. Another 1155 acres was added by the US Corps in the 1970's.

Hunting seasons are established by the state within a Federal framework. Although game laws were being formalized in this country as early as the early 17th century, enforcement is primarily a 20th century phenomenon. The Arkansas laws date from 1875. Many laws in the US constituted little more than a nuisance, however, until 1900 when the Federal Lacey Act, which regulated interstate commerce in game (mostly deer), was passed. The Migratory Bird Treaty Act between the United States and Great Britain was signed August 16, 1916, and ratified by Congress in 1918 to break up the market hunting of ducks. Until then no real regulation of duck hunting seems to have been practiced.

CHAPTER 28

SUMMARY AND CONCLUSIONS

Dan F. Morse

To summarize the preceding is difficult in the sense of choosing a format. If we do it by period, we will be accused of foisting yet another cultural-historical scheme upon the archeological public. But the whole essence of the investigation is the tremendous amount of cultural change which took place and there is no other scale but time by which to measure it.

The scenario was set in southern Illinois near the confluence of the Mississippi and Missouri Rivers, upriver from the mouth of the Ohio. This setting is located almost exactly in the center of the Eastern United States, halfway for example between important deposits of copper in northern Michigan and the whelk or conch off the Florida Gulf Coast (Fig. 28-1). Yet most of the materials necessary to the Cahokia lifeway occur within around 100 km of the site. This includes cherts from Mill Creek, Crescent Quarries, and the Burlington Formation; granites and basalts along with red ocher and galena from Missouri; and crop land and fauna habitats in the American bottoms and the nearby loess-covered bluffs. Most of the exotic items and materials are southern-oriented and it is to the South where lies Griffin's "Middle Mississippi" (1967: Fig. 5). The reason for Cahokia's rise is as mysterious as its apparent collapse centuries later along with much of the northwestern frontier of Middle Mississippi (Williams 1977). Collapses in Mesoamerica and in Mesopotamia immediately prior to the formation of state organization (Wright 1977) will need to be reviewed in relationship to what appears to have been a major demographic disturbance in the center of the eastern United States around AD 1350-1500. The demographic collapse takes place almost precisely where Mississippian seems to have developed.

Events in southern Illinois after about AD 500 must have contributed to the beginnings of the Cahokia chiefdomship system based on intensive agriculture. One explanation has been population pressure (Morse 1977b after Meyers 1971), since population increase is to be expected once domestication began in earnest perhaps 1000 years earlier. It has also been suggested that once populations began to exploit the American Bottoms exclusively and to trade with other societies exploiting other niches, the stage was set for the beginning of the chiefdom (Morse 1977b). But population increases with intensive agriculture, not necessarily because of it. Furthermore, while intraregional flow of goods is basic to Mississippian, the potential for help in case of disaster rather than the need for

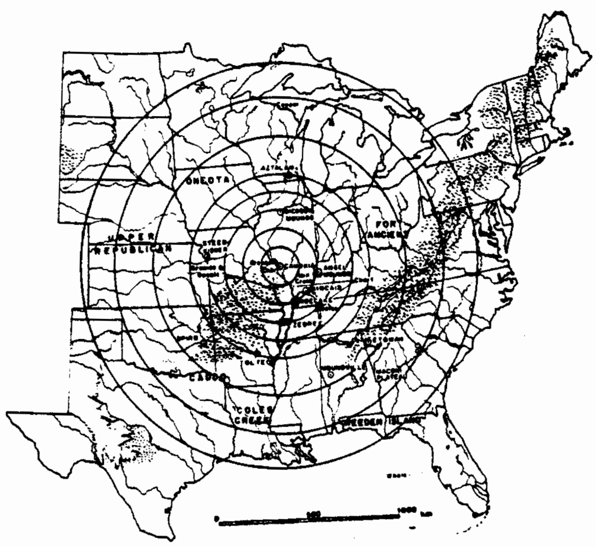

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Figure 28-1. Cahokia in the eastern United States continual reciprocity is a result, not necessarily the cause, of central control. Central control taps the household economy and provides a surplus for administration. A third explanation of the beginnings of the chiefdom sees warfare due to the depletion of arable land (Larson 1972; Ford 1974) as the primary impetus. However, current studies are clearly indicating that the potential productivity of a particular catchment basin is generally more than sufficient for the estimated population of a site even in the final stages of Mississippian.

At Zebree, indications of abundance are reflected in all of the faunal and floral procurement and storage data. Also at Zebree, there was a substantial dog population, surely an indication of relative abundance since none of the dogs seem to have been eaten. In addition, in spite of the fortified villages, there is still little evidence of actual warfare until the disruptions of historic times, long after the societies in question came into being. Distance between major villages, such as the 8 km noted for the Big Lake and Lawhorn phases, would appear to be a social rather than a technological distance. The dogs at Zebree may have served as sentinels, but whether to warn against varmints after stored foods, the weakly politically structured indigenous Barnes population, or other Mississippians is not known.

The Zebree investigation, besides dampening some of the enthusiasm for one or more of the explanations for the Cahokia chiefdom beginnings, has also narrowed the spacial limits of origin from between "the Cahokia area around St. Louis on the north to the Vicksburg area on the south" (Griffin 1967:189), to between St. Louis and the southern end of the Cairo Lowland. The origin of the intensive-agriculturally-based Mississippian societies south of the Cairo Lowland is two-fold. One avenue for their occurrance was by site intrusion, such as happened when the Big Lake phase intruded into a Barnes region for control of the St. Francis River, which allowed access to important stone resources distinct from those exploited by the mother phase in the Cairo Lowland. This avenue also allowed direct access to Cahokia. This intrusion may have been merely an effort by a lesser ranking independent chiefdom to find a new niche, but it seems to have been a well-planned and executed intrusion. The Zebree site probably was constructed in a very short period of time, (possibly two weeks--Chapter 21) building some 28 houses and a palisade system around a 1.15 hectare area. It backed up to a lake, which had just been formed, important for resources, particularly ducks, fish, and plants from which to manufacture salt. Storage pits based on the respiration of grain to produce CO_2 to preserve the majority of the sealed grain, held an average of 2 metric tons and a maximum of 4 metric tons. Houses were small but probably held five individuals, also reflected by the presence of an average 3.5 liter small cooking jar. The houses were clustered into groups of possibly two to six in specific midden concentration, medium-sized cooking jars ranged from 8-20 liters in size and there were up to four observable house patterns in each midden concentration defined by feature clusters and computer density maps based on a 1% probabilistic sample. There were apparently at least seven such midden clusters at the Zebree site.

No actual village specialization except for administration was evident. The microlith industry, producing tools to work bone and shell, is characteristic of each midden. Saltmaking may be centrally located in the site, but elements of the industry, particularly the pottery funnel (Wickliffe Thick) and to a greater degree the salt pan, are widely distributed within the site. The chunkee stones, mostly made of pottery, and the 52 liter large (cooking?) jars imply pan-village activity, as does the erection of the site itself, probably constructed from a model skewed to fit the Zebree topography, with corners apparently triangulated from a central pit identified as Feature 127. The area furthest from the water, on the west side of the site, may have been the locus of a ranked lineage. This is a common theme in later Mississippian villages (Price 1973; Chapman 1976). This area at Zebree is notable because of its relative richness in material goods, but this richness does not involve exclusive use of certain artifacts, as far as the results of this excavation indicate. One trait apparently more characteristic of this locus than others at the site is the consumption of the white-tailed deer. Deer are rare in this region and apparently consumed by this area's elite occupants. This is supported in part by trace element analysis for strontium in human bone which indicates that the usual Zebree inhabitant did not eat significant amounts of red meat.

The Big Lake phase dates between AD 750 and 950, earlier than had been expected based on extrapolation from the developed Fairmount phase at Cahokia, but early enough to allow Mississippian culture in the central portion of the eastern United States to participate in the rise of intensive agricultural chiefdoms, at the time of or before similar developments elsewhere. Advocates of the Caddoan and Oneota areas as centers of origin can no longer claim primacy with the same confidence as before; futhermore, the Big Lake phase is an example of site intrusion after the inception of practically all of the traits thought to be characteristic of Mississippian come into being.

The technological advances over the previous Barnes occupation are clear and doubtless represent significant changes. Pottery is exceptionally superior. A revolution in paste manufacture involved the realization that calcium carbonate, in the form of burned mussel shell, added to the clay changed it drastically. No longer did heavy-paste jars have to be built on their side, thus creating the conical base so cumbersome to its function as a cooking vessel. A globular, stronger, more efficient and lighter jar could now be made. Furthermore, the setting was established for a revolution in vessel form carried almost to its ultimate in later stages of Mississippian. The efficiency of stone tools, including the large spade or hoe and various heavy cutting tools, as well as the microliths, are considerably beyond anything in Barnes society. The bow and arrow is another example of technological superiority.

The socio-political organization involving central control of a population and of individual villages is superior to a large degree over Barnes. The apparent maximum Barnes social fusion is the seasonal winter village which may have involved up to almost 50 individuals, as indicated by four to five middens of extended households of around ten people apiece; this is also reflected by cooking jar sizes. Baytown phases to the north, south, east, and possibly west were more strongly structured and encroaching upon Barnes territory. Barnes apparently was destined to become, directly or indirectly <u>via</u> a short-lived Baytown amalgamation, part of the expanding Mississippian chiefdom system.

Baytown, on the fringes, was also changing to the new order. Site surveys of a probabilistic nature indicate that Baytown is thrusting up the Western Lowlands along the Ozark escarpment toward Missouri. The Baytown-Barnes groups in the Western Lowlands amalgamate with Mississippian fairly quickly, possibly not as a result of direct site intrusion but as a reaction to the nearby location of the Mississippian groups. The origin of Mississippian in the Cairo Lowland may have occurred the same way, as a response to the development at Cahokia or it may be due to a site intrusion as occurred at Zebree.

Whatever happened, the middle period Mississippian sites in all three areas (along the Mississippi River, along the St. Francis River, and in the Western Lowlands) share a similar material culture, but based on site size they are ranked in order of their development. A Lawhorn phase farming hamlet consisting of three houses is present at Zebree and is probably a satellite of a large site just to the north. It dates to around AD 1150. After around AD 1350, there are drastic shifts in Mississippian settlement patterns in the northern alluvial valley. The Nodena phase in Arkansas is a result of a drastic shift southward from the Cairo Lowlands along the Mississippi River.

The Parkin phase is a result of a drastic shift of the regional center southward along the St. Francis River. The Greenbrier phase may be a result of a combination of previous phases mostly moving southward and westward on the White River above its confluence with the Black River. This apparently is a period of intensive fortification and warfare. But the reason does not appear to be soil or fauna depletion since productivity still seems higher than the possible site population. This would appear to be a political phenomenon.

Two historic components were recovered at Zebree. One is representative of the early 19th century pioneer stage in the northern alluvial valley, a stage virtually forgotten by historians and citizens of the region. A substantial house must have stood at Zebree made of sawed lumber with outbuildings, a well, orchards, and fields. This component seems to have been one of several dispersed farmsteads oriented around a mill and other specializations. Imported English ceramics are characteristic of the period.

The second historic component was the Sebree occupation of 1895-1940, representative of the second and post-Civil War wave of immigration into the northern alluvial valley. With this occupation came wide-spread lumbering and eventually the drainage projects allowing intensive market agriculture (Fig. 28-2).

The Zebree site thus reflects in considerable detail the culture-history of the last 25 centuries in northeast Arkansas including population hiatuses. It also represents an important test of the shift to intensive agriculture in the areas most characteristic of Mississippian.

Important as we feel all this is, the major contributions of this volume involve the testing of recovery techniques and how the data thus recovered pertains to past human behavior. Screen experiments demonstrate clearly that bias exists in all archeological data and that efforts to control or be knowledgeable about these biases must be exercised more prudently by our colleagues. Also emphasized is the need for clearly constructed problems before and during the field work for these problems should dictate the kinds of recovery techniques to be employed. The multiple disciplinary approach is an absolute necessity to any modern archeological investigation, but must begin before the field program and stay intact through the final report.

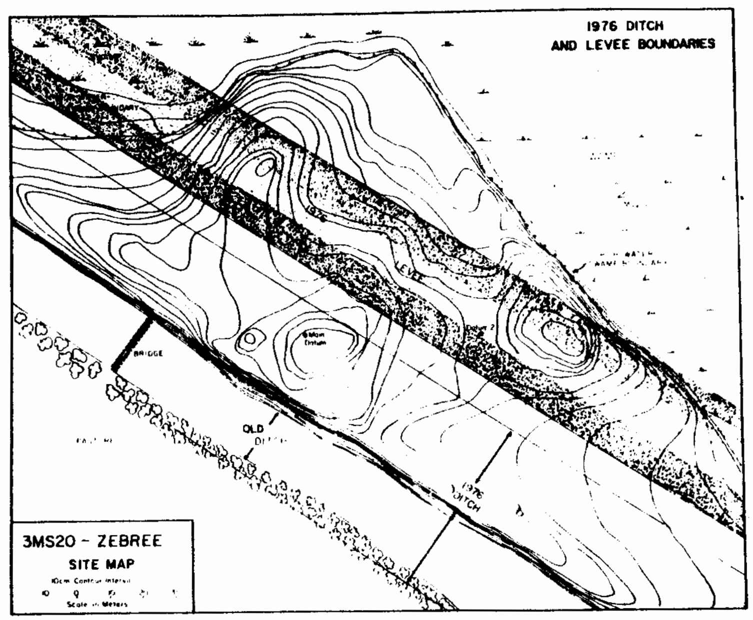

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Figure 28-2. Relationship of the Zebree site to the 1976 ditch and levee.

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