BULLETIN 24
SOUTHEASTERN ARCHAEOLOGICAL CONFERENCE

PROCEEDINGS OF THE

THIRTY-SEVENTH SOUTHEASTERN ARCHAEOLOGICAL CONFERENCE

NEW ORLEANS, LOUISIANA
NOVEMBER 13-15, 1980

DEDICATED TO ROBERT STUART NEITZEL

Edited by
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PREFACE

The Thirty-seventh Southeastern Archaeological Conference was held on November 13-15, 1980, in the Fountain Bay Club Hotel in New Orleans, Louisiana. The conference participants sorely missed the presence of Stu Neitzel who died in August. At the business meeting, SEAC President James B. Griffin announced that the conference would be dedicated to Stu and that the honorary position which he had held in the SEAC, Sergeant-at-Arms, was officially retired. During the meeting Steve Williams eulogized Stu; Steve's reflections and reminiscences are published in this *Bulletin*.

Program chairperson for the meeting was Sharon Goad. The Corps of Engineers—New Orleans District and Louisiana State University served as hosts and Tom Ryan was the local arrangements organizer. More than 300 people attended the conference, the largest ever.

The number of people presenting papers at the conference necessitated restrictions on length of the contributions accepted for these proceedings. Participants who planned to submit their papers were urged to present only conclusions or summaries and keep the length to about five pages. This was not always possible. However, all of the symposia organizers who submitted the papers from their sessions took the time to integrate them, eliminating redundancies, etc. I am very grateful to all of the authors and the symposia organizers for their work which has allowed us to publish 40 papers.

Unfortunately, the size of the SEAC bank account did not allow us to publish all of the papers submitted. Some reports on preliminary work were not accepted for publication; authors were urged to publish them as current research elsewhere and to publish results after the work was completed.

I have listed Vernon J. Knight, Jr., as co-editor of this *Bulletin*. Jim did nearly all of the nuts-and-bolts copy-editing and handled nearly all of the correspondence. His valuable contributions should be acknowledged. Also, once again, Annette Fanus of the Florida State Museum did her usual expert job in helping us. The SEAC owes her and the other members of our departmental staff here at the Museum a debt of gratitude.

J. T. Milanich
Editor, SEAC

Table of Contents

PROGRAM OF THE 37th SOUTHEASTERN ARCHAEOLOGICAL CONFERENCE, 1980

Program Chairperson: Sharon I. Goad

THURSDAY, NOVEMBER 9

SYMPOSIUM:
The Cooper River Rediversion Project in South Carolina
Chairperson: J. Pearson

M. D. Rucker (Corps of Engineers—South Atlantic Division): Introducing Cooper River: A Management Overview
P. Brockington (U of Kansas): Reconnaissance and Survey Stages of the Cooper River Rediversion Archeological Project
D. Anderson (Commonwealth Associates, Inc.): The 1979 Excavation at the Mattassee Lake Sites
V. Canouts (U of South Carolina): Middle Late Woodland and Mississippian Subsistence Strategies in the Interior Lower Coastal Plain of South Carolina
K. Derting (U of South Carolina): Functional Diversity in Late Prehistoric Lithic Assemblages
H. Haskell (U of South Carolina): Variability in Vessel Morphology: A Functional Analysis of Two Ceramic Assemblages from the Middle Late Woodland and Mississippian Periods
J. Pearson (U of South Carolina): Variability in Ceramic Composition—Functional Implications for Middle Late Woodland and Mississippian Ceramic Assemblages
P. Garrow (Soil Systems, Inc.): Archeological Investigations of Two Slave Quarter Sites in Berkeley County, South Carolina
T. R. Wheaton, Jr. (Soil Systems, Inc.): Architecture at Yaughan and Curriboo Plantations, Berkeley County, South Carolina
Discussant: R. Dickens (Georgia State U)

SYMPOSIUM:
Poverty Point: 1970-1980
Chairperson: S. I. Goad

J. L. Gibson (U of Southwestern Louisiana): Speculations on the Origin and Development of Poverty Point Culture
W. G. Haag (Louisiana State U): Investigations at Poverty Point, 1972-1975
S. I. Goad (Louisiana State U): Recent Excavations at Poverty Point, Louisiana
D. Woodiel (Louisiana Office of State Parks): Settlement and Subsistence at the Poverty Point Site
P. M. Thomas (New World Research, Inc.): The Peripheries of the Poverty Point Site: Settlement and Subsistence Beyond the Ridge
J. A. Walthall (Illinois Department of Transportation) and C. H. Webb (Schreveport, Louisiana): Poverty Point Galena: Source Location and Analysis
S. A. Bass (Louisiana State U): A Closer Examination of Local Lithic Sources for Poverty Point
M. Giardino (Tulane U) and W. Spencer (Southern Archaeological Research, Inc.): Description of Poverty Point Burials in the Lower Tensas Basin

SYMPOSIUM:
The Tellico Archaeological Project: Some Results and Interpretations
Chairperson: J. Chapman

J. Chapman (U of Tennessee): Introduction and Background
P. A. Delcourt (U of Tennessee): Quaternary Terraces Along the Little Tennessee River, Southeastern Tennessee
J. Chapman (U of Tennessee) and A. B. Shea (U of Tennessee): The Archaeobotanical Record: Early Archaic to Contact in the Lower Little Tennessee River Valley
A. E. Bogan (Academy of Natural Sciences of Philadelphia): Archaeological Evidence for Subsistence Patterns in the Lower Little Tennessee River Valley
R. Polhemus (U of Tennessee) Dallas and Mouse Creek Phase Mississippian Structures: Comments on Form and Function
G. F. Schroedl (U of Tennessee): Structures and Village Pattern at the Historic Overhill Cherokee Towns of Chota and Tanasee
L. R. Kimball (U of Tennessee): A Quantitative Pattern Recognition Model of Temporal Variability in Unifacial Debitage and Blades for Early Archaic Through Historic Cherokee Lithic Assemblages in the Lower Little Tennessee River Valley
W. D. Roberts (U of Tennessee): Lithic Analysis at Chota-Tanasee
R. P. Stephen Davis (U of Tennessee): Probabilistic Sampling in the Lower Little Tennessee River Valley 1979-1980
W. Baden (U of Tennessee): A Solution to the Humpty Dumpty Dilemma in Ceramic Analysis: All the King's Mathematicians Could Have Put Humpty Back Together Again
Discussant: C. S. Peebles (U of Michigan)

SYMPOSIUM:
Late Mississippian/Proto Historic
Chairperson: H. G. Ayers

J. H. Blitz (U of Alabama): The Summerville Mound: A Mississippian Architectural Complex at Lubbub Creek, Alabama
M. L. Powell (Northwestern U): Late Mississippian Mortuary Variability in the Gainesville Reservoir, West Central Alabama
J. A. Brown (Northwestern U): The Falcon and the Serpent: Style Provinces in the Mississippian Southeast
T. Perttula (Southwest Missouri State U): A Model of Caddoan Culture Change: The Contact Archeological Record
N. L. Trubowitz (Arkansas Archeological Survey): Pine Mountain Revisited: Recent Research in the Arkansas Ozarks
H. G. Ayers (Appalachian State U), J. Loucks (Appalachian State U) and B. L. Purrington (Southwest Missouri State U): Excavations at the Ward Site, A Pisgah Village in Western North Carolina

C. Brown (U of Georgia): On the Sexual Identity of Winged Beings on Mississippian Period Copper Plates

SYMPOSIUM:
Problem Oriented Lithic Studies in the Southeastern United States
Chairpersons: A. C. Goodyear and R. W. Jefferies

J. K. Johnson (U of Mississippi): Poverty Point Period Blade Technology in the Yazoo Basin, Mississippi

J. S. Cable (Commonwealth Associates): A Study of Changes in the Organization of Early and Middle Archaic Hunter-gatherer Adaptive Systems in the North Carolina Piedmont

A. C. Goodyear (U of South Carolina), J. L. Michie (U of South Carolina) and B. A. Purdy (U of Florida): The Edgefield Scraper: A Distributional Study of an Early Archaic Stone Tool from the Southeastern United States

C. A. Morrow and E. E. May (Southern Illinois U): A Diachronic Study of Chert Resource Exploitation in Southeastern Illinois

S. R. Claggett (Commonwealth Associates): Chronological and Behavioral Implications of a Bifurcate Tradition Site Occupation in the North Carolina Piedmont

R. W. Jefferies (Southern Illinois/Carbondale): Analysis of Morphological and Functional Variability of Middle Archaic Hafted Endscrapers

L. M. Raab, D. McGregor, and A. J. McIntyre (Southern Methodist U): Toward a "Signature" for Low-Density Lithic Sites

G. T. Hanson (U of South Carolina): Lithic Assemblage Variability and Environmental Variability During the Late Archaic-Early Woodland Transition in the Middle Savannah River Valley

SYMPOSIUM:
Lower Cumberland Archaeological Project
Chairperson: J. D. Nance

J. D. Nance (Simon Fraser U): Lower Cumberland Archaeological Project: Overview and 1980 Fieldwork

B. Clay (Kentucky State Archaeologist): Archaeological Research in Western Kentucky to 1978

G. Conaty (Simon Fraser U): Culture History of the Lower Tennessee/Cumberland

J. D. Nance (Simon Fraser U): Lower Cumberland Archaeological Project Regional Sampling Program

B. Leach (U of Minnesota): Geomorphology and Archaeology on the Lower Tennessee River

T. Gatus (U of Kentucky): Chert Resources of the Lower Tennessee/Cumberland Region

J. Nance (Simon Fraser U): Prehistoric Chert Utilization Patterns in the Lower Tennessee/Cumberland

P. Bobrowsky (Simon Fraser U): The Study of Archaeological Gastropod Assemblages

Discussants: P. J. Watson (Washington U), B. Clay (Kentucky State Archaeologist)

SYMPOSIUM:
The Sixteenth Century Southeast
Chairpersons: M. T. Smith, C. M. Hudson, and C. B. DePratter

P. E. Hoffman (Louisiana State U): European Contacts with the Coastal Tribes of Georgia and South Carolina, ca. 1515-1566

H. H. Tanner (The Newberry Library): The Land and Water Communications System Utilized by Southeastern Indians

C. M. Hudson (U of Georgia), C. B. DePratter (U of Georgia) and M. T. Smith (Cottonlandia Museum): The Route of DeSoto from Apalachee to Coosa

R. Polhemus (U of Tennessee) and M. T. Smith (Cottonlandia Museum): Early Trade Goods from the East Tennessee Valley

G. E. Lankford (Arkansas College) and C. Curren (U of Alabama): The Spanish in Alabama

J. P. Brain (Harvard Peabody Museum): The Sixteenth Century Lower Mississippi Valley

D. and P. Morse (Arkansas Archeological Survey): The Protohistoric in Northeast Arkansas

K. Deagan (Florida State): Spaniard and Indian in 16th Century Florida

E. Reitz (U of Georgia): Sixteenth Century Spanish Subsistence Strategies

H. Dobyns (U of Florida) and W. Swagerty (The Newberry Library): Timucuan Population in the 1560's

CURRENT RESEARCH:
Chairperson: R. Neuman

W. H. McKinney (Memphis State U): Archaeological Investigations at the Rock Creek Complex on the Natchez Trace Parkway in Colbert County, Alabama

D. J. Hally (U of Georgia): Use Alternation of Pottery Vessel Surfaces: An Important Source of Evidence for the Identification of Vessel Function

D. L. Crusoe and S. Brookes (Mississippi Department of Archives and History): The American Formative and the Gulf Formational: An Evaluation and Critical Assessment

J. A. Bense (U of West Florida): The Dead Lake Site (1Mb95) and the Bayou La Batre Culture in the Mobile Bay/Delta

R. S. Dickens (Georgia State U): Introducing Archaeology to the Younger Public: An Example from Georgia

K. H. Fiegel (Frankfort, Kentucky): An Overview of the Archaeological Resources Reconnaisance of the Big South Fork National River and Recreation Area, Kentucky and Tennessee: 1978 and 1979 Field Seasons

T. Logan (Forest Service/Columbia, South Carolina): Cultural Resources Management in the Francis Marion and Sumter National Forests

B. A. Purdy and Sharon Hall (U of Florida): Organic Cultural Remains from Prehistoric Sites in Florida

C. Maurer, D. E. Clark, and B. A. Purdy (U of Florida): Prehistoric Pottery Technology in Florida

FRIDAY, NOVEMBER 14

SYMPOSIUM:
Advances in the Archaeology of Mississippian Fort Walton Societies
Chairperson: J. F. Scarry

J. F. Scarry (Florida Department of State): Fort Walton Culture: A Redefinition

D. S. Brose (Cleveland Museum of Natural History): Notes on the Woodland-Mississippian Developments in the West Florida Gulf Coastal Area

F. T. Schnell (Columbus Museum of Arts and Sciences): The Late Prehistoric Cultural Sequence in the Middle Chattahoochee Valley

G. S. Schnell (Columbus Museum of Arts and Sciences): Early Fort Walton Social Structure in the Lower Chattahoochee Valley

N. M. White (Case Western Reserve U): The Curlee Site (8Ja7) and Fort Walton Development in the Upper Apalachicola-Lower Chattahoochee Valley

L. D. Tesar (Florida Department of State): The DeSoto Entrada and Fort Walton Chronology in the Tallahassee Red Hills

C. Payne (Florida Department of State): A Preliminary Investigation of Fort Walton Settlement Patterns in the Tallahassee Red Hills

B. C. Jones (Florida Department of State): Southern Cult Manifestations at Lake Jackson

V. J. Knight (Florida State Museum): Interregional Relationships and the Study of Fort Walton Mississippian Ceramic Style

J. F. Scarry (Florida Department of State): Subsistence Costs and Information: A Preliminary Model of Fort Walton Development

Discussants: J. P. Brain (Harvard Peabody Museum), J. W. Griffin (Cultural Resource Management, Inc.), C. S. Peebles (U of Michigan)

SYMPOSIUM:
Late Woodland Period Research in North Carolina

Organizer: H. T. Ward
Chairperson: J. L. Coe

J. L. Coe (U of North Carolina): An Overview of Recent Late Woodland—Historic Period Research by the Research Laboratories of Anthropology

J. H. Wilson (U of North Carolina): Excavations at Upper Saura Town, A Siouan Village on the Dan River

P. S. Gardner (U of North Carolina): An Overview of Dan River Ceramics

H. T. Ward (U of North Carolina): Intra-site Spatial Structure at the Warren Wilson Site: Some New Ideas

D. L. Moore (U of North Carolina): Pisgah Ceramic Variation and What it Might Mean

D. S. Phelps (East Carolina U): Carolina Algonkian Ossuaries

B. L. Oliver (U of North Carolina): The Piedmont Archaic: Reflections and Perspectives

Discussant: R. S. Dickens (Georgia State)

SYMPOSIUM:
Recent Man/Land Studies in the Lower Mississippi Valley Region

Chairperson: C. E. Pearson

S. M. Gagliano (Coastal Environments, Inc.): Geomorphology and the Archaeological Record in the Lower Mississippi Valley

B. J. Duhe (Reserve, Louisiana): A Study of Prehistoric Coles Creek-Plaquemine Cultural and Technological Adaptations in the Upper Barataria Basin

I. W. Brown (Harvard Peabody Museum): The Morgan Site: An Important Coles Creek Mound Complex on the Chenier Plain of Southwest Louisiana

W. P. Glander (Professional Analysts) and G. Castille (Coastal Environments, Inc.): Magnetometer Survey Along the Red River, Louisiana

R. A. Weinstein (Coastal Environments, Inc.): Meandering Rivers and Shifting Villages: A Prehistoric Settlement Model in the Upper Steele Bayou Basin, Mississippi

C. E. Pearson (Coastal Environments, Inc.): Geomorphology and Prehistoric Site Distributions in the Red River Valley, Arkansas

S. Shelley (Louisiana State U): The Coles Creek Period Settlement System on Louisiana's Chenier Coastal Plain

W. H. Spencer (Southern Archaeological Research, Inc.) and J. P. Lenzer (J. P. Lenzer and Assoc.): Prehistoric Man-Land Relationships in the Dynamic Lower Tensas Basin, Louisiana

SYMPOSIUM:
Topics in Subsistence and Environment in the Southeastern United States

Chairperson: M. White

R. J. Cochran (Historic Preservation Assoc.): Parkin Paleoeconomics: A Site Catchment Analysis

B. Sigler-Lavelle (Florida State Museum): Economic Anthropology and Archeological Research

N. Borremans (U of Florida): The Role of Mollusks in Shell Midden Analysis, Devils Walking Stick Site, Camden County, Georgia

C. Y. Rock (U of Georgia): An Analysis of Faunal Remains from the Abercrombie Site, Russell County, Alabama

C. T. Shay (U of Manitoba): Aspects of the Paleoethnobotany of Holocene Midwestern North America

M. E. White (Clemson): Early Man and Environment in the Southeastern United States

E. J. Reitz (U of Georgia) and J. K. Koch (Office of Louisiana State Archaeology): The Faunal Material from a First Spanish Period Hospital and Convent in St. Augustine, Florida 1590-1763

SYMPOSIUM:
The Columbia Reservoir Project

Chairperson: J. L. Hofman

J. L. Hofman (U of Tennessee): Test Excavation at a Buried Middle Archaic Component on the Duck River, Middle Tennessee

W. B. Turner (U of Tennessee): Raindrops Keep Falling on My Site, or Some Methodological Considerations of Surface Site Assemblage Variability

J. Mahaffy (U of Tennessee): 1980 Deep Testing Operations in Holocene Alluvial Deposits, Proposed Columbia Reservior, Duck River Tennessee: Methodology, Results, and Preliminary Conclusions

M. A. Smith (U of Tennessee): Analysis of Surface Material from Columbia Reservoir Site, 40Mu272, Maury County, Tennessee

R. F. Entorf (U of Tennessee): Subsurface Surveying at Distinctive Geological Features

D. S. Amick (U of Tennessee): A Preliminary Assessment of Chert Resources in the Columbia Reservoir, Maury and Marshall Counties, Tennessee

SYMPOSIUM:

New Perspectives on the Mound Exploration Division, Bureau of American Ethnology

Chairperson: B. D. Smith

B. D. Smith (Smithsonian Institution): The Mound Exploration Division: A Centennial Retrospective
S. Williams (Harvard Peabody Museum): Wills DeHass and How It All Began
I. Brown (Harvard Peabody Museum): Cyrus Thomas and the Mound Explorations of the Bureau of (American) Ethnology
D. and P. Morse (Arkansas Archeological Survey): The BAE in Northeast Arkansas
M. D. Jeter (Arkansas Archeological Survey): Edward Palmer's 1882 Excavation at Tillar Site (3Drl), Southeast Arkansas
R. C. Godwin, C. J. Utermohle, and M. Lethbridge (Smithsonian Institution): Physical Anthropology of the Tillar Site, A Late Mississippian Cemetery in Southeast Arkansas
M. A. Rolingson (Arkansas Archeological Survey): Contributions to the Toltec (Knapp) Site Research by the Smithsonian Institution
C. H. Chapman (U of Missouri-Columbia): Legacy of the 1880 Thomas Mound Survey: A Missouri Example

SYMPOSIUM:

The Cloudsplitter Rockshelter, Menifee County, Kentucky: A Preliminary Report

Chairperson: C. W. Cowan

C. W. Cowan (Ohio State U): Introductory Remarks
H. E. Jackson (U of Michigan): Geoarchaeological Analysis of the Cloudsplitter Rockshelter: Some Preliminary Results
T. L. Smart (U of Michigan): Analysis of Pollen from Archaeological Deposits in Cloudsplitter Rockshelter
C. W. Cowan (Ohio State U): Plant Remains from the Cloudsplitter Rockshelter
K. M. Moore (U of Michigan): Faunal Remains from the Cloudsplitter Rockshelter
A. A. Nickelhoff (Ann Arbor, Michigan): Lithic Technology at the Cloudsplitter Rockshelter
C. W. Cowan (Ohio State U): Concluding Remarks
Discussants: P. J. Watson (Washington U), R. W. Jefferies (Southern Illinois/Carbondale)

SYMPOSIUM:

Spatial Analysis and Settlement Patterning

Chairperson: M. Wood

J. L. Rudolph and D. B. Blanton (U of Georgia): A Discussion of Mississippian Settlement in the Georgia Piedmont
J. D. Rogers (U of Oklahoma): Social Ranking and the Centralization of Authority in the Spiro Phase
A. I. Ottesen (U of Louisville/Belknap): A Research Design for Studying Settlement Patterns in the Northern Portion of Kentucky's Western Coalfields
A. F. Rogers (Western Carolina U): Surface Distribution of Selected Late Archaic Artifacts
R. B. Lewis (U of Illinois): The Mississippi Gulf Coast Archaeological Project: Research Design for the Bay St. Louis Study
W. M. Wood (Louisiana State U): A Computer Simulation of Settlement Growth and Delineation During the Late Mississippian: An Example from the Piedmont Area of Georgia
K. Robinson, J. Sorensen, and R. Levy (U of Kentucky): A Cultural-Historical Interpretation of the Taylorsville Lake Project Area, Spencer, Anderson, and Nelson Counties, Kentucky
M. Trinkley (South Carolina Department of Highways): Recent Woodland Period Research in Beaufort County, South Carolina
M. Pennington (Lowndesville, South Carolina): Man and His Territory

SATURDAY, NOVEMBER 15

SYMPOSIUM:

The Moundville Archaeological Project: Examination of the Development of Mississippian Society in the Black Warrior River Valley

Organizer: M. Scarry
Chairperson: C. S. Peebles

C. S. Peebles (U of Michigan): Introduction
E. W. Seckinger (Corps of Engineers-Mobile Division) and N. J. Jenkins (U of Alabama/Montgomery): A Plural Society in Prehistoric Alabama
P. D. Welch (U of Michigan): The West Jefferson Phase: Late Woodland Tribal Society in West Central Alabama
T. K. Bozeman (U of California/Santa Barbara): The Evolution of the Moundville Phase Settlement System: Preliminary Results of Intensive Surface Investigations and Test Excavations in the Black Warrior River Valley
C. M. Scarry (U of Michigan): The University of Michigan's Moundville Excavations: 1978-1979
L. Michals (U of Michigan): The Exploitation of Fauna During the Moundville I Phase at Moundville
C. M. Scarry (U of Michigan): Plant Procurement Strategies in the West Jefferson and Moundville I Phases
M. Schoeninger (Johns Hopkins U) and C. S. Peebles (U of Michigan): Nutritional Correlates of Social Status at Moundville
A. Haddy (U of Michigan) and A. Hanson (Brookhaven National Laboratory): Relative Dating of Moundville Burials
V. P. Steponaitis (SUNY/Binghamton): Chronology and Community Patterns at Moundville
M. Hardin (U of Maine): The Recognition of Individual Hands in the Context of Standardized Craft Production: Implications of the Technological and Stylistic Development of Moundville Engraved Ceramics
C. S. Peebles (U of Michigan): The University of Michigan Moundville Archeological Project in Perspective
Discussants: J. B. Griffin (U of Michigan), B. D. Smith (Smithsonian Institution)

SYMPOSIUM:

Lithic Analysis and Interpretation

Chairperson: J. Rafferty

J. Rafferty (Mississippi State U): Projectile Point Typology, Late Archaic Chronology, and Interpreting Settlement Pattern Change

J. Connaway and S. Brookes (Mississippi Archives and History): The Keenan Bead Cache: Lawrence County, Mississippi

D. H. Jurney (Southern Methodist U): Stone Digging Tools: Evidence from the Ozark, Ouachita, and Missouri Valley Regions

E. E. May (Southern Illinois/Carbondale): Archaeological Geology: Problems in the Identification of Chert Types and Source Area

T. H. Guderjan, G. W. Rutenberg, M. O. Baldia, H. A. Smith, and L. M. Raab (Southern Methodist U): Big Rock Shelter: A Preliminary Report

E. T. Hemmings and K. Dinnel (Arkansas Archeological Survey): Analysis of a Quapaw Hunting Camp on the Saline River, Southeast Arkansas

T. H. Guderjan (Southern Methodist U): The Caney Creek Site Complex: Lithic Resource Conservation and Technology

SYMPOSIUM:

Research Reports Lower Mississippi Valley and Gulf Coast

Chairperson: G. Castile

M. J. Kaczor (Arkansas Archeological Survey) and J. Weymouth (U of Nebraska): Magnetic Prospecting: Preliminary Results of the 1980 Field Season at the Toltec Site, 3Ln42

J. E. Price (Southwest Missouri State U): Archaeological Research in the Fourche Creek Watershed on the Ozark Border of Southeast Missouri and Northeast Arkansas

S. Williams (Harvard Peabody Museum): The Murphy Site on the Lower Wabash (Indiana) Reexamined

C. A. Huston and J. W. Stoutamire (Florida State U): Archaic Sites in the Stoney Bayou Pool, St. Marks National Wildlife Refuge

J. S. Belmont (Harvard): Gold Mine: A Troyville Platform Mound in Northeastern Louisiana

J. P. Brain (Harvard Peabody Museum): SIR Survey

J. Ford (U of Mississippi): Time and Temper in the North Central Hills of Mississippi

J. W. Stoutamire and C. A. Huston (Florida State U): Archeology of Naval Live Oaks, Gulf Islands National Seashore

W. F. Limp (Arkansas Archeological Survey): Location Choice in the Sparta Upland

R. H. Lafferty III (Arkansas Archeological Survey): Site Survey and Central Place Hierarchies in the Sparta Mine Area

S. C. Scholtz (Arkansas Archeological Survey): Predictive Models and Survey Strategy in the Sparta Mine Area

J. Lauro (Mississippi Department of Archives and History): Hebe Plantation: Early Archaic in the Bogue Phalia Drainage of the Southern Yazoo Basin, Mississippi

SYMPOSIUM:

Archaeology of the American Bottom and Upper Mississippi Valley

Chairperson: P. Revet

J. W. Porter (U of Illinois/Urbana-Champaign): American Bottom Archaeology: 1960-1980

J. E. Kelly (U of Illinois/Urbana-Champaign): The Emergence of Cahokia

G. R. Milner (U of Illinois/Urbana-Champaign): Preliminary Notes on the Nature and Distribution of Mississippian Mortuary Sites in the American Bottom

R. C. Mainfort (Tennessee Department of Conservation): Pinson Mounds (40Md1): A Middle Woodland Site in West Tennessee

M. J. Lynott (National Park Service): The Grimes Site, An Early Woodland Occupation in Southeast Missouri

M. Weinland (Kentucky Heritage Commission): A Summary of the Rowena Site: A Mississippian Mound, Russel County, Kentucky

Stephen Williams

SOME REFLECTIONS ON THE LONG, HAPPY, AND EVENTFUL LIFE OF ROBERT STUART NEITZEL[1]

I can't think of a more appropriate spot than the Southeast Conference for this; New Orleans was a favorite spot of Stu's, but this isn't an obituary—I'll leave that to others, at other times and places. I'm sure that many will want to try to capture the spirit of this remarkable gentleman—call him Bob or call him Robert, or call him just plain "Stu", as most of his archaeological friends did. It is, instead, a brief journey in rememberance.

Well, who or what was Stu? He was a good field archaeologist and a pretty fair excavator; he could make that old Buff & Buff transit that Jim Ford "borrowed" from the Louisiana Highway Department some time in the late Thirties throw a straight line—if you knew all the tricks—I'm not sure he really liked the instrument as well, after I took it back to its maker in Boston and had it all polished up and realigned.

But let's get one thing straight—he was not, when I knew him, a great jazz musician—I don't think he even thought so himself, but then he was pretty darn humble about most of his accomplishments—except for all those tales of daring and doing when he was young and able—or so he said—a hundred times. But as to the piano; yes, I know there are those who remember the piano being lugged upstairs for a special performance at the Historical Conference at Columbia, and I must confess I never heard him play on a piano that had all its keys working or that was even partially in tune—but like life, he attacked the tunes, made some excuses for the lack of proper accompaniment, and if you didn't listen too closely (and who did late in the evening) it sounded pretty good. It was, after all, the effect that was sought.

He was a damn good reader of profiles and taught all of us in the LMS some of the finer points. Not that I agreed with all his conclusions in "Fatherland Revisted"; perhaps that's a place where some of us failed him. Did we take his archaeological work seriously enough? Maybe we should have argued harder, but who wanted to disagree with Stu on such matters?

His caring for archaeology and anthropology was a special thing—I'm not sure I fully understood it. He liked large questions, some quite deeply philosophical, and he read widely in areas that frequently surprised me—but he was always so affable that it was hard to argue with him too seriously. Besides, many of the discussions were carried on far into the night when the full sense of some of the arguments got lost. But it didn't seem to matter then or even now.

Neitzel anecdotes are legion—I'm sure we all have our own favorites, and they can be found to underscore almost any point. His own self-deprecating stories (almost myths) of the days at the University of Nebraska, where he became a lifelong friend of Loren Eiseley, to graduate study at Chicago with Redfield and the goings-on at Kincaid, and his tales of adventures in Tennessee archaeology—with shots ringing out in the night!

Speaking of shots, one of the high points of the Avery Island LMS Conference in May of 1978 was Stu's bravo performance of "The Hunter" which I saw him do first at Holly Bluff twenty years before. On Avery Island he had a real shotgun—not improvised from a broomstick as before—but the pained and contorted face during the pantomime was the same, as was the smash ending (handkerchief in mouth). As they say, you had to be there to really appreciate it.

But that does bring me to another gun story and his teaching of Harvard students. It was in 1949(?) and Phil Phillips and a very confident Harvard grad student were working in the Lower Yazoo. This particular Cantabrigian (who did not stay in the field) had a special competence in firearms. It was with great interest that he read in the Vicksburg paper that spring that there had been an important discovery in Marksville of an historic Tunica burial in a local farmer's driveway which included a quite well preserved 18th century firearm. The short news spot did not give much detail, but having a weekend free, he decided to take a busman's holiday and he journeyed over for a first-hand look, and perhaps to help with the identification of the rifle

Once in Marksville it was not too difficult to discover the location of the driveway, and he went south of town to talk to the landowner. Upon arrival he was met by the farmer who had been "swamping out" his dairy barn. The student spent some time looking over the driveway find-spot and tried to instill some sense of the importance of the exact context of the find which the farmer had laid up in one of his sheds. The farmer, in manure-covered boots, took it all in, listening somewhat wide-eyed as the young student gave him a basic lecture on the nature of archaeology. The local, with typical Louisiana hospitality, finally invited the young man into his house for a cold refreshment. As he sat in the living room awaiting the delivery of the beverage, he was surprised to see some rather familiar large green bound volumes with gold lettering stretching across the crowded book shelves. Nervously he began to suspect that he might be a little in over his head. Stu let him down easy—was glad to have some details on the flint lock, and the young man returned somewhat less confident to Yazoo City.

But enough of pure anecdote. Here in rough chronological order are my reflections.

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Complex ceremonial events are often not worth the time or trouble but one in 1970 was so fulfilling for all involved that the memories of it are still fresh a decade later. Phil Phillips had his 70th birthday in the late summer of that year and we planned a small volume and a party in September to coincide with the publication of his two-volume work on the Lower Yazoo. Old friends contributed letters and some even took the opportunity to journey to Cambridge. The event was not a too-well-kept secret in its entirety, but parts of it did work well. As I shepherded Phil and his wife through the arcade in a large Cambridge building toward the site of the dinner, we passed a couple of window-shoppers who were intent on the wares that were displayed therein. Just as we passed, the window-shoppers turned and greeted Phil with complete nonchalance; it was Bill Haag and Stu Neitzel. I do think that was a real surprise to Phil, and Stu always loved to evoke the memories of that event.

Stu was a great person to share happy occasions with. His very presence seemed to insure there would be laughter and a sense of comaraderie that could overcome any circumstance. So it is only natural that I should recall with special poignancy a couple of much more recent get-togethers. The first was one under the best of all possible circumstances: a special Avery Island meeting in May of 1979 to honor Bill Haag's retirement. It was a surprise party too, and this time there was no question that Bill was really conned into coming out to the island under false pretenses and that Stu was part of it from the beginning—the end of the party was pure Neitzel too—there had been a gargantuan crawfish feast with plenty of the right fixings, but by the shank of the evening it was down to just six of us sitting around the table—surfeited on great food and with plenty of beer to wash it down. We were down to the basics—just good conversation—the jokes and laughter filled the old Cajun building—all of us who sat around the table that evening with him now recall that occasion with a special sense of loss.

So it is with the last Conference that Stu attended—the Caddo Conference in Texarkana in March. Although Stu had had a few spells of not feeling too well during the fall and winter (he didn't go to the SEAC in Atlanta), he was there in Arkansas with his Louisiana colleague Haag again. As usual, he was in good spirits, with energy enough to go out looking at sites, but still not climbing any mounds like the rest of us fools.

I arrived by car from Fayetteville about 8:30 p.m., and set out to find my Lower Valley colleagues in this Caddo context. Not finding them in their room, I wandered about the motel grounds and ran into the two of them looking for me. Stu was outfitted in the damnedest dark blue two-piece leisure suit topped off with a Greek fisherman's cap—looking for all the world like a portly train conductor somehow lost in a Texarkana motel.

I was especially touched by that search for me—most often people looked for Stu, not the other way around. We had a typical evening of talk over a few drinks. About 11:00 p.m., I discovered that neither of them had had any dinner (I'd gotten mine on the road on the way down there) so I dragged them off to the motel cafe where we caught the last serving with the normal amount of good-natured waitress harassment that was Stu's best shot.

But what of that evening was so special?—not the laughs and shared tales, but an aspect of Stu that many of my good colleagues do not appropriately credit him with—much of the evening was spent in serious discussion of some real problems of a personal nature about which we shared confidences and opinions. Too many saw Stu only as a court jester; his Sargeant-at-Arms title in the SEAC gave ceremonial sanction to that role, and there is no question that he liked to play the clown. Yes, he was always there with a wisecrack and a deep laugh, but there was a serious side to Stu based on an acute ability to judge people.

He may have glad-handed hundreds, but he did not suffer fools gladly. He was restrained in his personal criticism and often wanted to see the best in most; but from that first summer at Lake George, I found his advice on handling students of great value. From the Fifties on he was a strong force in teaching LMS students from Brain, Belmont, and Toth to Brown and Steponaitis, everything from archaeological field techniques to the more important values of life, such as not taking yourself too seriously and learning how to live in a new environment.

The temptation to tell every Neitzel story must be resisted. I must let others have that pleasure too, so I'll close. But I cannot rid my mind of the possibility that at just about dusk on some blistering hot day I will drive my travel-worn field vehicle into a not very elegant motel on the outskirts of a nondescript but vaguely familiar Southeastern town; I'll put my car into the slot for Room 107, and as I get out, my shirt will peel off the sweat-drenched seat. With the slam of the car door, he'll appear in the motel doorway. I'll take in that grizzled and slightly crooked smile, and after a warm handshake I'll make my way to the inevitable fifth of bourbon (probably ol' Sir Sidney brand), pick up the barrel-shaped motel tumbler, fill it with ice from the green plastic bucket, add a modest helping of whiskey and a touch of water from the bathroom tap, then I'll settle down on the edge of the bed and get filled in on all the recent and raucous happenings in Lower Valley archaeology. So this isn't a farewell, Stu—just don't miss that next Conference; wherever *they* decide to have it—it won't be any hotter than the Lower Valley on some of those summer days we shared.

Deborah K. Woodiel

SURVEY AND EXCAVATION AT THE POVERTY POINT SITE, 1978

In 1978 a cultural resources survey and subsequent mitigative excavations were conducted at the Poverty Point site by staff of the Louisiana Division of Archaeology and Historic Preservation. Approximately 400 acres of the site are included within the Poverty Point State Commemorative Area, operated by the Louisiana Office of State Parks. The cultural resources survey concentrated on the second phase of development at the park; this consisted of a museum, a manager's residence, a dormitory, an archaeological laboratory, and a paved tram road through the park (Fig. 1).

This task represented an excellent opportunity to investigate areas of the site which had never been tested and to formulate hypotheses of intrasite habitation patterns. Previous excavations (Ford and Webb 1956, Kuttruff 1975, Haag n.d.) showed that the ridges were largely composed of midden, and although no houses had been discovered, the belief that the ridges were foundations for houses was common among many investigators. Haag's excavation in the plaza area within the ridges also revealed a deep midden as well as numerous large postmolds. Most of the plaza area has been untested.

Outside the ridges, few test excavations have been conducted, except those centering on the two mounds. Thomas and Campbell (1979) reported a specialized activity and habitation area approximately 350 m southwest of Mound A. Surface collections of the cleared field adjacent to Mound B suggested an Archaic rather than Poverty Point context for these artifacts, but no habitation areas associated with them have been found.

Surface surveys, auger holes, posthole tests, and test pits were excavated within the areas of the proposed facilities. These tests were done in a systematic nonrandom way by placing test units at specified intervals within the impact areas. No interval was greater than 5 m for any structure. For the paved tram trail, a Soil Conservation Service survey team aided us by taking solid cores to depths of one and two meters at 30 m intervals along the entire length of the road. The results of these tests confirmed the lack of any midden soils outside of the ridges. Based on this evidence and the low artifact density of these areas, it appears that intensive habitation by Poverty Point peoples was concentrated elsewhere. It is suggested that these mound areas, composing a ceremonial or religious precinct, were not disturbed by ordinary living quarters and domestic activities.

The survey area north of Harlan Bayou also contained no midden and few artifacts. A possible explanation is that this area may also be a specialized activity area, similar to those located by Thomas and Campbell (1979). Webb (1970, 1977) and Gibson (1973) note the relative abundance of gorgets in this area, and an activity area relating to these particular artifacts may have been here.

Within the earth ridges, the distribution of midden ment of Chert Resources in the Columbia Reservoir, Maury and Marshall Counties, Tennessee

SYMPOSIUM:
New Perspectives on the Mound Exploration Division, Bureau of American Ethnology
Chairperson: B. D. Smith

B. D. Smith (Smithsonian Institution): The Mound Exploration Division: A Centennial Retrospective
S. Williams (Harvard Peabody Museum): Wills DeHass and How It All Began
I. Brown (Harvard Peabody Museum): Cyrus Thomas and the Mound Explorations of the Bureau of (American) Ethnology
D. and P. Morse (Arkansas Archeological Survey): The BAE in Northeast Arkansas
M. D. Jeter (Arkansas Archeological Survey): Edward Palmer's 1882 Excavation at Tillar Site (3Drl), Southeast Arkansas
R. C. Godwin, C. J. Utermohle, and M. Lethbridge (Smithsonian Institution): Physical Anthropology of the Tillar Site, A Late Mississippian Cemetery in Southeast Arkansas
M. A. Rolingson (Arkansas Archeological Survey): Contributions to the Toltec (Knapp) Site Research by the Smithsonian Institution
C. H. Chapman (U of Missouri-Columbia): Legacy of the 1880 Thomas Mound Survey: A Missouri Example

SYMPOSIUM:
The Cloudsplitter Rockshelter, Menifee County, Kentucky: A Preliminary Report
Chairperson: C. W. Cowan

C. W. Cowan (Ohio State U): Introductory Remarks
H. E. Jackson (U of Michigan): Geoarchaeological Analysis of the Cloudsplitter Rockshelter: Some Preliminary Results
T. L. Smart (U of Michigan): Analysis of Pollen from Archaeological Deposits in Cloudsplitter Rockshelter
C. W. Cowan (Ohio State U): Plant Remains from the Cloudsplitter Rockshelter
K. M. Moore (U of Michigan): Faunal Remains from the Cloudsplitter Rockshelter
A. A. Nickelhoff (Ann Arbor, Michigan): Lithic Technology at the Cloudsplitter Rockshelter
C. W. Cowan (Ohio State U): Concluding Remarks
Discussants: P. J. Watson (Washington U), R. W. Jefferies (Southern Illinois/Carbondale)

SYMPOSIUM:
Spatial Analysis and Settlement Patterning
Chairperson: M. Wood

J. L. Rudolph and D. B. Blanton (U of Georgia): A Discussion of Mississippian Settlement in the Georgia Piedmont
J. D. Rogers (U of Oklahoma): Social Ranking and the Centralization of Authority in the Spiro Phase
A. I. Ottesen (U of Louisville/Belknap): A Research Design for Studying Settlement Patterns in the Northern Portion of Kentucky's Western Coalfields
A. F. Rogers (Western Carolina U): Surface Distribution of Selected Late Archaic Artifacts
R. B. Lewis (U of Illinois): The Mississippi Gulf Coast Archaeological Project: Research Design for the Bay St. Louis Study
W. M. Wood (Louisiana State U): A Computer Simulation of Settlement Growth and Delineation During the Late Mississippian: An Example from the Piedmont Area of Georgia
K. Robinson, J. Sorensen, and R. Levy (U of Kentucky): A Cultural-Historical Interpretation of the Taylorsville Lake Project Area, Spencer, Anderson, and Nelson Counties, Kentucky
M. Trinkley (South Carolina Department of Highways): Recent Woodland Period Research in Beaufort County, South Carolina
M. Pennington (Lowndesville, South Carolina): Man and His Territory

SATURDAY, NOVEMBER 15

SYMPOSIUM:
The Moundville Archaeological Project: Examination of the Development of Mississippian Society in the Black Warrior River Valley
Organizer: M. Scarry
Chairperson: C. S. Peebles

C. S. Peebles (U of Michigan): Introduction
E. W. Seckinger (Corps of Engineers-Mobile Division) and N. J. Jenkins (U of Alabama/Montgomery): A Plural Society in Prehistoric Alabama
P. D. Welch (U of Michigan): The West Jefferson Phase: Late Woodland Tribal Society in West Central Alabama
T. K. Bozeman (U of California/Santa Barbara): The Evolution of the Moundville Phase Settlement System: Preliminary Results of Intensive Surface Investigations and Test Excavations in the Black Warrior River Valley
C. M. Scarry (U of Michigan): The University of Michigan's Moundville Excavations: 1978-1979
L. Michals (U of Michigan): The Exploitation of Fauna During the Moundville I Phase at Moundville
C. M. Scarry (U of Michigan): Plant Procurement Strategies in the West Jefferson and Moundville I Phases
M. Schoeninger (Johns Hopkins U) and C. S. Peebles (U of Michigan): Nutritional Correlates of Social Status at Moundville
A. Haddy (U of Michigan) and A. Hanson (Brookhaven National Laboratory): Relative Dating of Moundville Burials
V. P. Steponaitis (SUNY/Binghamton): Chronology and Community Patterns at Moundville
M. Hardin (U of Maine): The Recognition of Individual Hands in the Context of Standardized Craft Production: Implications of the Technological and Stylistic Development of Moundville Engraved Ceramics
C. S. Peebles (U of Michigan): The University of Michigan Moundville Archeological Project in Perspective
Discussants: J. B. Griffin (U of Michigan), B. D. Smith (Smithsonian Institution)

SYMPOSIUM:
Lithic Analysis and Interpretation
Chairperson: J. Rafferty

J. Rafferty (Mississippi State U): Projectile Point Typology, Late Archaic Chronology, and Interpreting Settlement Pattern Change
J. Connaway and S. Brookes (Mississippi Archives and History): The Keenan Bead Cache: Lawrence County, Mississippi
D. H. Jurney (Southern Methodist U): Stone Digging Tools: Evidence from the Ozark, Ouachita, and Missouri Valley Regions
E. E. May (Southern Illinois/Carbondale): Archaeological Geology: Problems in the Identification of Chert Types and Source Area
T. H. Guderjan, G. W. Rutenberg, M. O. Baldia, H. A. Smith, and L. M. Raab (Southern Methodist U): Big Rock Shelter: A Preliminary Report
E. T. Hemmings and K. Dinnel (Arkansas Archeological Survey): Analysis of a Quapaw Hunting Camp on the Saline River, Southeast Arkansas
T. H. Guderjan (Southern Methodist U): The Caney Creek Site Complex: Lithic Resource Conservation and Technology

SYMPOSIUM:
Research Reports Lower Mississippi Valley and Gulf Coast
Chairperson: G. Castile

M. J. Kaczor (Arkansas Archeological Survey) and J. Weymouth (U of Nebraska): Magnetic Prospecting: Preliminary Results of the 1980 Field Season at the Toltec Site, 3Ln42
J. E. Price (Southwest Missouri State U): Archaeological Research in the Fourche Creek Watershed on the Ozark Border of Southeast Missouri and Northeast Arkansas
S. Williams (Harvard Peabody Museum): The Murphy Site on the Lower Wabash (Indiana) Reexamined
C. A. Huston and J. W. Stoutamire (Florida State U): Archaic Sites in the Stoney Bayou Pool, St. Marks National Wildlife Refuge
J. S. Belmont (Harvard): Gold Mine: A Troyville Platform Mound in Northeastern Louisiana
J. P. Brain (Harvard Peabody Museum): SIR Survey
J. Ford (U of Mississippi): Time and Temper in the North Central Hills of Mississippi
J. W. Stoutamire and C. A. Huston (Florida State U): Archeology of Naval Live Oaks, Gulf Islands National Seashore
W. F. Limp (Arkansas Archeological Survey): Location Choice in the Sparta Upland
R. H. Lafferty III (Arkansas Archeological Survey): Site Survey and Central Place Hierarchies in the Sparta Mine Area
S. C. Scholtz (Arkansas Archeological Survey): Predictive Models and Survey Strategy in the Sparta Mine Area
J. Lauro (Mississippi Department of Archives and History): Hebe Plantation: Early Archaic in the Bogue Phalia Drainage of the Southern Yazoo Basin, Mississippi

SYMPOSIUM:
Archaeology of the American Bottom and Upper Mississippi Valley
Chairperson: P. Revet

J. W. Porter (U of Illinois/Urbana-Champaign): American Bottom Archaeology: 1960-1980
J. E. Kelly (U of Illinois/Urbana-Champaign): The Emergence of Cahokia
G. R. Milner (U of Illinois/Urbana-Champaign): Preliminary Notes on the Nature and Distribution of Mississippian Mortuary Sites in the American Bottom
R. C. Mainfort (Tennessee Department of Conservation): Pinson Mounds (40Md1): A Middle Woodland Site in West Tennessee
M. J. Lynott (National Park Service): The Grimes Site, An Early Woodland Occupation in Southeast Missouri
M. Weinland (Kentucky Heritage Commission): A Summary of the Rowena Site: A Mississippian Mound, Russel County, Kentucky

Stephen Williams

SOME REFLECTIONS ON THE LONG, HAPPY, AND EVENTFUL LIFE OF ROBERT STUART NEITZEL[1]

I can't think of a more appropriate spot than the Southeast Conference for this; New Orleans was a favorite spot of Stu's, but this isn't an obituary—I'll leave that to others, at other times and places. I'm sure that many will want to try to capture the spirit of this remarkable gentleman—call him Bob or call him Robert, or call him just plain "Stu", as most of his archaeological friends did. It is, instead, a brief journey in rememberance.

Well, who or what was Stu? He was a good field archaeologist and a pretty fair excavator; he could make that old Buff & Buff transit that Jim Ford "borrowed" from the Louisiana Highway Department some time in the late Thirties throw a straight line—if you knew all the tricks—I'm not sure he really liked the instrument as well, after I took it back to its maker in Boston and had it all polished up and realigned.

But let's get one thing straight—he was not, when I knew him, a great jazz musician—I don't think he even thought so himself, but then he was pretty darn humble about most of his accomplishments—except for all those tales of daring and doing when he was young and able—or so he said—a hundred times. But as to the piano; yes, I know there are those who remember the piano being lugged upstairs for a special performance at the Historical Conference at Columbia, and I must confess I never heard him play on a piano that had all its keys working or that was even partially in tune—but like life, he attacked the tunes, made some excuses for the lack of proper accompaniment, and if you didn't listen too closely (and who did late in the evening) it sounded pretty good. It was, after all, the effect that was sought.

He was a damn good reader of profiles and taught all of us in the LMS some of the finer points. Not that I agreed with all his conclusions in "Fatherland Revisted"; perhaps that's a place where some of us failed him. Did we take his archaeological work seriously enough? Maybe we should have argued harder, but who wanted to disagree with Stu on such matters?

His caring for archaeology and anthropology was a special thing—I'm not sure I fully understood it. He liked large questions, some quite deeply philosophical, and he read widely in areas that frequently surprised me—but he was always so affable that it was hard to argue with him too seriously. Besides, many of the discussions were carried on far into the night when the full sense of some of the arguments got lost. But it didn't seem to matter then or even now.

Neitzel anecdotes are legion—I'm sure we all have our own favorites, and they can be found to underscore almost any point. His own self-deprecating stories (almost myths) of the days at the University of Nebraska, where he became a lifelong friend of Loren Eiseley, to graduate study at Chicago with Redfield and the goings-on at Kincaid, and his tales of adventures in Tennessee archaeology—with shots ringing out in the night!

Speaking of shots, one of the high points of the Avery Island LMS Conference in May of 1978 was Stu's bravo performance of "The Hunter" which I saw him do first at Holly Bluff twenty years before. On Avery Island he had a real shotgun—not improvised from a broomstick as before—but the pained and contorted face during the pantomime was the same, as was the smash ending (handkerchief in mouth). As they say, you had to be there to really appreciate it.

But that does bring me to another gun story and his teaching of Harvard students. It was in 1949(?) and Phil Phillips and a very confident Harvard grad student were working in the Lower Yazoo. This particular Cantabrigian (who did not stay in the field) had a special competence in firearms. It was with great interest that he read in the Vicksburg paper that spring that there had been an important discovery in Marksville of an historic Tunica burial in a local farmer's driveway which included a quite well preserved 18th century firearm. The short news spot did not give much detail, but having a weekend free, he decided to take a busman's holiday and he journeyed over for a first-hand look, and perhaps to help with the identification of the rifle

Once in Marksville it was not too difficult to discover the location of the driveway, and he went south of town to talk to the landowner. Upon arrival he was met by the farmer who had been "swamping out" his dairy barn. The student spent some time looking over the driveway find-spot and tried to instill some sense of the importance of the exact context of the find which the farmer had laid up in one of his sheds. The farmer, in manure-covered boots, took it all in, listening somewhat wide-eyed as the young student gave him a basic lecture on the nature of archaeology. The local, with typical Louisiana hospitality, finally invited the young man into his house for a cold refreshment. As he sat in the living room awaiting the delivery of the beverage, he was surprised to see some rather familiar large green bound volumes with gold lettering stretching across the crowded book shelves. Nervously he began to suspect that he might be a little in over his head. Stu let him down easy—was glad to have some details on the flint lock, and the young man returned somewhat less confident to Yazoo City.

But enough of pure anecdote. Here in rough chronological order are my reflections.

It was Arkansas in 1958 when I first saw them working together. In a special way they were a rather odd couple—the tall, serious Mississippian with a burning passion for ever more field work, and the heavy-set, easy-going Nebraskan whose real passion was life itself, without very specific reference to time or place. They (Ford and Neitzel) were at the ends of the earth at the mouth of the Arkansas River—miles from any major town—digging a singularly unimpressive site, following up at the Menard site some earlier LMS survey work and the rather distracted muddlings of their old colleague, Pres Holder. We (Phillips and I) visited them while on a reconnaissance mission.

[1]I started to draft these notes in late August, when I first learned of Stu's death while I was on vacation. In fact, they sort of wrote themselves—memories of great times shared with him came flooding in on the tide to the coral sands. This will not be very good historiography, although I've checked as many of the facts and dates as possible with my field logs. The events did take place; there has been minimal editing.

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Some years later Stu's friendship with Jim was really put to the ultimate test. With Jim terminally ill, Stu would visit him in Florida and try to cheer him up. (Jim had just finished the manuscript of the Formative monograph, which the Smithsonian later published.) Stu's last promise was that they would now take up the long overdue Marksville site report. It was a sentimental gesture, as Jim had only a few days left, but Stu felt good about having been able to be there with that offer.

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I visited him at Fatherland in 1962, when he began his long association with that site, that is not yet completed. The volume on his later work on the site will be published soon. His first excavations there were a follow-up on Moreau Chambers' pre-war activities on the mounds. There were questions to be answered about the location of the previous work that were to plague Stu for a decade or more.

That first summer I was bringing my new wife on a trip of reconnoitering and our visit with Stu at Natchez was warm and heartening. I wanted to show off my good fortune and get his approval too. We had a great visit with some fine times at the site and at the Stradivarius Motel (no kidding).

Complex ceremonial events are often not worth the time or trouble but one in 1970 was so fulfilling for all involved that the memories of it are still fresh a decade later. Phil Phillips had his 70th birthday in the late summer of that year and we planned a small volume and a party in September to coincide with the publication of his two-volume work on the Lower Yazoo. Old friends contributed letters and some even took the opportunity to journey to Cambridge. The event was not a too-well-kept secret in its entirety, but parts of it did work well. As I shepherded Phil and his wife through the arcade in a large Cambridge building toward the site of the dinner, we passed a couple of window-shoppers who were intent on the wares that were displayed therein. Just as we passed, the window-shoppers turned and greeted Phil with complete nonchalance; it was Bill Haag and Stu Neitzel. I do think that was a real surprise to Phil, and Stu always loved to evoke the memories of that event.

Stu was a great person to share happy occasions with. His very presence seemed to insure there would be laughter and a sense of comaraderie that could overcome any circumstance. So it is only natural that I should recall with special poignancy a couple of much more recent get-togethers. The first was one under the best of all possible circumstances: a special Avery Island meeting in May of 1979 to honor Bill Haag's retirement. It was a surprise party too, and this time there was no question that Bill was really conned into coming out to the island under false pretenses and that Stu was part of it from the beginning—the end of the party was pure Neitzel too—there had been a gargantuan crawfish feast with plenty of the right fixings, but by the shank of the evening it was down to just six of us sitting around the table—surfeited on great food and with plenty of beer to wash it down. We were down to the basics—just good conversation—the jokes and laughter filled the old Cajun building—all of us who sat around the table that evening with him now recall that occasion with a special sense of loss.

So it is with the last Conference that Stu attended—the Caddo Conference in Texarkana in March. Although Stu had had a few spells of not feeling too well during the fall and winter (he didn't go to the SEAC in Atlanta), he was there in Arkansas with his Louisiana colleague Haag again. As usual, he was in good spirits, with energy enough to go out looking at sites, but still not climbing any mounds like the rest of us fools.

I arrived by car from Fayetteville about 8:30 p.m., and set out to find my Lower Valley colleagues in this Caddo context. Not finding them in their room, I wandered about the motel grounds and ran into the two of them looking for me. Stu was outfitted in the damnedest dark blue two-piece leisure suit topped off with a Greek fisherman's cap—looking for all the world like a portly train conductor somehow lost in a Texarkana motel.

I was especially touched by that search for me—most often people looked for Stu, not the other way around. We had a typical evening of talk over a few drinks. About 11:00 p.m., I discovered that neither of them had had any dinner (I'd gotten mine on the road on the way down there) so I dragged them off to the motel cafe where we caught the last serving with the normal amount of good-natured waitress harassment that was Stu's best shot.

But what of that evening was so special?—not the laughs and shared tales, but an aspect of Stu that many of my good colleagues do not appropriately credit him with—much of the evening was spent in serious discussion of some real problems of a personal nature about which we shared confidences and opinions. Too many saw Stu only as a court jester; his Sargeant-at-Arms title in the SEAC gave ceremonial sanction to that role, and there is no question that he liked to play the clown. Yes, he was always there with a wisecrack and a deep laugh, but there was a serious side to Stu based on an acute ability to judge people.

He may have glad-handed hundreds, but he did not suffer fools gladly. He was restrained in his personal criticism and often wanted to see the best in most; but from that first summer at Lake George, I found his advice on handling students of great value. From the Fifties on he was a strong force in teaching LMS students from Brain, Belmont, and Toth to Brown and Steponaitis, everything from archaeological field techniques to the more important values of life, such as not taking yourself too seriously and learning how to live in a new environment.

The temptation to tell every Neitzel story must be resisted. I must let others have that pleasure too, so I'll close. But I cannot rid my mind of the possibility that at just about dusk on some blistering hot day I will drive my travel-worn field vehicle into a not very elegant motel on the outskirts of a nondescript but vaguely familiar Southeastern town; I'll put my car into the slot for Room 107, and as I get out, my shirt will peel off the sweat-drenched seat. With the slam of the car door, he'll appear in the motel doorway. I'll take in that grizzled and slightly crooked smile, and after a warm handshake I'll make my way to the inevitable fifth of bourbon (probably ol' Sir Sidney brand), pick up the barrel-shaped motel tumbler, fill it with ice from the green plastic bucket, add a modest helping of whiskey and a touch of water from the bathroom tap, then I'll settle down on the edge of the bed and get filled in on all the recent and raucous happenings in Lower Valley archaeology. So this isn't a farewell, Stu—just don't miss that next Conference; wherever *they* decide to have it—it won't be any hotter than the Lower Valley on some of those summer days we shared.

Deborah K. Woodiel

SURVEY AND EXCAVATION AT THE POVERTY POINT SITE, 1978

In 1978 a cultural resources survey and subsequent mitigative excavations were conducted at the Poverty Point site by staff of the Louisiana Division of Archaeology and Historic Preservation. Approximately 400 acres of the site are included within the Poverty Point State Commemorative Area, operated by the Louisiana Office of State Parks. The cultural resources survey concentrated on the second phase of development at the park; this consisted of a museum, a manager's residence, a dormitory, an archaeological laboratory, and a paved tram road through the park (Fig. 1).

This task represented an excellent opportunity to investigate areas of the site which had never been tested and to formulate hypotheses of intrasite habitation patterns. Previous excavations (Ford and Webb 1956, Kuttruff 1975, Haag n.d.) showed that the ridges were largely composed of midden, and although no houses had been discovered, the belief that the ridges were foundations for houses was common among many investigators. Haag's excavation in the plaza area within the ridges also revealed a deep midden as well as numerous large postmolds. Most of the plaza area has been untested.

Outside the ridges, few test excavations have been conducted, except those centering on the two mounds. Thomas and Campbell (1979) reported a specialized activity and habitation area approximately 350 m southwest of Mound A. Surface collections of the cleared field adjacent to Mound B suggested an Archaic rather than Poverty Point context for these artifacts, but no habitation areas associated with them have been found.

Surface surveys, auger holes, posthole tests, and test pits were excavated within the areas of the proposed facilities. These tests were done in a systematic nonrandom way by placing test units at specified intervals within the impact areas. No interval was greater than 5 m for any structure. For the paved tram trail, a Soil Conservation Service survey team aided us by taking solid cores to depths of one and two meters at 30 m intervals along the entire length of the road. The results of these tests confirmed the lack of any midden soils outside of the ridges. Based on this evidence and the low artifact density of these areas, it appears that intensive habitation by Poverty Point peoples was concentrated elsewhere. It is suggested that these mound areas, composing a ceremonial or religious precinct, were not disturbed by ordinary living quarters and domestic activities.

The survey area north of Harlan Bayou also contained no midden and few artifacts. A possible explanation is that this area may also be a specialized activity area, similar to those located by Thomas and Campbell (1979). Webb (1970, 1977) and Gibson (1973) note the relative abundance of gorgets in this area, and an activity area relating to these particular artifacts may have been here.

Within the earth ridges, the distribution of midden

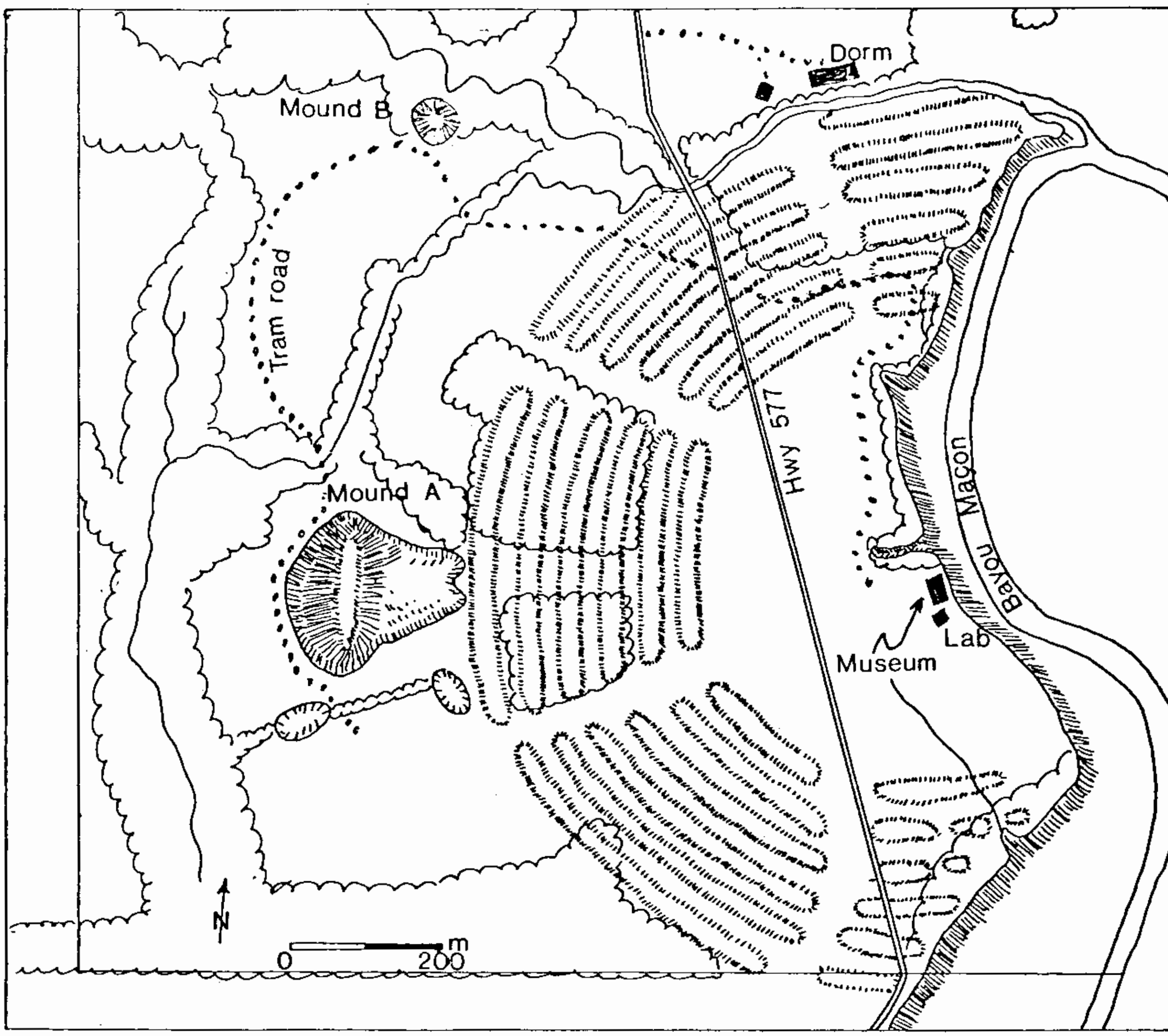

Figure 1. Survey Area. Adopted from Webb (1977).

deposits varies. While Haag's 1975 excavations just east of Ridge 1 uncovered midden soils almost two meters in depth, only the tan Memphis silty clay deposits were located in the vehicle trail route within the ridges. The museum area of the visitor center were also devoid of occupation debris. Two features interpreted as postmolds were discovered in a three meter test unit in the museum area, but expansion of the unit failed to reveal any additional postmolds, other features, or artifacts.

In the area of the laboratory, midden soils were found. While postholes dug in the northwest periphery of the lab area failed to yield any midden deposits, postholes and test excavations dug to the south and east revealed midden deposits as deep as 2.4 m (Fig. 2). The deep deposits were composed of two midden layers separated by a lighter tan sterile zone.

The presence of deep undisturbed midden deposits opened the way for investigation of other issues as yet unresolved at Poverty Point. One is related to the nature of Poverty Point habitation loci themselves. Although a number of large and small postmolds have been excavated on both the ridgetops and in the western portion of the plaza, no patterns indicative of houses have been identified. It was hoped that even in a small area such as that contained in the lab location, some information bearing on this issue could be gained.

One controversy which has received attention in recent years is the subsistence base of Poverty Point. These arguments can be reduced to a subsistence based on domesticated plants, maize in particular, versus one consisting of the exploitation of wild foods and native cultigens. The absence of possible food plants and animal bones from excavated contexts, as well as the lack of pollen in midden soils from Poverty Point accounted for the lack of direct evidence supporting either contention. The present excavations could recover data about these questions.

A third line of investigation could also be pursued, that of internal chronology of the exposed deposits. Heretofore, the almost black midden at Poverty Point could rarely be stratified visually, and the evidence for the relative chronology of artifact types within the site, particularly Poverty Point Object styles, was weak. The investigation of two distinct midden layers entirely separated by a distinct sterile deposit could

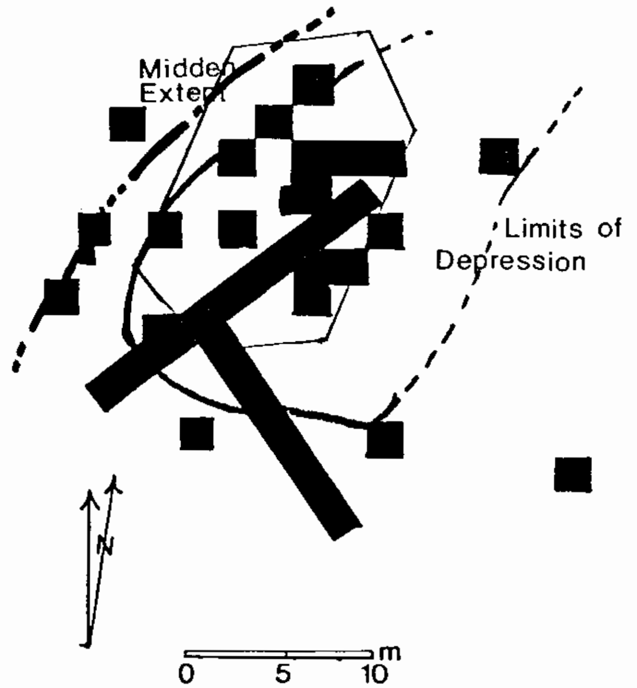

Figure 2. Location of Excavation Units in Laboratory Area.

answer some of these questions of a chronological nature, especially if complemented by radiocarbon dates.

Excavation units and two backhoe trenches in the laboratory area revealed that the lower midden zone and the tan sterile silty clay overlying it were the fill of a shallow oval-shaped depression, 2.4 m deep at the deepest point. Its bottom sloped upward at the western end in the two trenches. The east end was not pinpointed due to the danger of increasing an already rapidly expanding gully some 6 m to the northeast. The bluff edge overlooking Bayou Macon was examined for traces of this feature, but none were found.

Within this depression ten trash pits or shallow concentrations of ash, charcoal, and fragmentary Poverty Point objects (rarely, a stone flake or tool) were found. Most of these features yielded small amounts of charcoal, and the charcoal from one trash pit, analyzed by the University of Georgia, yielded a date of 3065 ± 95 B.P. (UGa-2468). This date is well within the range of dates established for the site so far.

Floral and faunal remains were also found in the trash pits. The former, identified by Andrea Shea, included hickory shells (*Carya* sp.), walnut (*Juglans* sp.), and acorn fragments (*Quercus* sp.). Seeds recovered included persimmon (*Diospyros virginiana*), grape (*Vitis* sp.), and honey locust (*Gleditsia triacanthos*). These all indicate late summer and fall gathering activities. Analysis of cane and wood charcoal indicate the presence of a number of upland hardwoods, especially hickory and sweet gum, and a small amount of pine. Remains of cane, probably employed in a variety of household uses, was also one of the larger components of the wood charcoals. No remains of tropical cultigens were found, nor were any vestiges of weedy plants which could have been native cultigens recovered. The floral samples were too small to support substantially any of the subsistence alternatives proposed so far. Pollen samples, prepared by Texas A&M University, failed to yield countable amounts of pollen.

Very few animal bones were recovered, and those that were are quite small. Identification by Kathleen Byrd indicated use of mud-musk turtle and freshwater fishes, easily obtainable from Bayou Macon.

The artifacts found do not show differences in vertical or horizontal distributions. Poverty Point Object fragments are the most numerous artifact found, and their density in each midden zone is similar. The most common types of Poverty Point Object were the melon and biconical shapes, in equal numbers. Few tools were found; scrapers, points, and bifacial implements make up the collection of about 25 tools. The only difference in artifact assemblages between the two middens observed so far was the number of lithic flakes and chips, which were almost twice as common in the lower midden as in the upper one.

Eleven postmolds of varying sizes and depths were also noted in these excavation units. They occurred both within and outside the midden areas and in the depression. No patterns of arrangement were evident.

Additional cores taken to the south of the excavated area in present drainage areas showed the same type of depositional sequence as in the excavated depression. These data and examination of the strata in the depression indicated that the depression was probably a natural drainage feature which was used by the site's inhabitants as a disposal area and later as an occupation area.

To summarize, these investigations have confirmed the presence and absence of occupation areas both within the earth ridges and outside of them. Probable cause of the unsuitability of the vacant areas lay in their reservation for public use of a ceremonial and/or commercial nature. Also found was evidence of disposal and filling to produce suitable habitation areas inside the earth ridges themselves. The amount of earth moving in aboriginal times, already on a monumental scale, was even more extensive. No houses were discovered, but floral and faunal remains point to the use of wild foods. In view of the limited data available, however, domesticates cannot be conclusively ruled out.

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Mary Lucas Powell

POST-MISSISSIPPIAN MORTUARY VARIABILITY IN THE GAINESVILLE RESERVOIR, WEST CENTRAL ALABAMA

Excavations conducted in 1979 by the University of Michigan Museum of Anthropology at the Lubbub Creek Archaeological Locality near Aliceville, Alabama, yielded the remains of successive Woodland, Mississippian and Protohistoric occupations. Of the 43 human burials recovered, 7 were assigned to the most recent aboriginal component, provisionally dated between A.D. 1500 and A.D. 1700 (Peebles, in preparation).

The latter features displayed more formal variability than did the 36 earlier mortuary features from the Late Woodland (Miller III) and Mississippian (Summerville I-III) occupations. Whereas those burials typically contained single articulated individuals, some interred with artifacts, the 7 later features contained a total of 64 individuals, all but two disarticulated, with no grave goods. A variety of interment modes had been employed, including extended articulated interment (in a single instance), urn burial and single and multiple bundle burials of different skeletal elements.

The contemporaneity of these various modes within the Protohistoric (Summerville IV) component has not been ascertained, and certain formal differences (e.g. the use of nonperishable ceramic urns vs. the use of perishable containers to enclose disarticulated remains) may reflect temporal succession rather than contemporaneous employment within a single mortuary program.

In this brief paper, it is argued that the two largest mortuary features (which contained at least 54 individuals) in the latest component resulted from behavior analogous to that reported ethnographically (Swanton 1931) for the Choctaw Indians who succeeded the Protohistoric inhabitants of that region. This interpretation complements other archaeological evidence from the Lubbub excavations which suggests that the Summerville IV settlement may be viewed as a proto-Choctaw occupation (Peebles, in preparation).

The use of ethnographic analogy in the elucidation of past human behavior fossilized in the archaeological record requires the careful construction of models of expected evidence of the behavior in question, to which the excavated evidence may be compared. As Binford (1972) has cautioned, the investigation should focus on hypothesized functional similarities between the two behavior sets, rather than insisting upon precise correspondence of the data sets.

European travelers in eastern Mississippi and western central Alabama in the late 18th century and early 19th century were intrigued by the mortuary customs of the Choctaw inhabiting these regions, so much so that Swanton (1931:170) commented in *Source Materials for the Social and Ceremonial Life of the Choctaw Indians,* "This feature of ancient Choctaw culture was developed so strikingly that more attention is devoted to it by writers on the tribe than to any other native custom."

The wrapped bodies of the deceased were placed on high scaffolds until preliminary decomposition was accomplished. The bones were then cleaned of flesh by mortuary priests, "A certain set of venerable old Gentlemen who wear very long nails as a distinguishing badge on the thumb, fore and middle fingers on each hand . . ." (Romans, in Swanton 1931:173). The wooden or cane chests containing these remains were stored in the village charnel houses until their final communal deposition in a large pit outside the habitation area of the village.

A model of expected archaeological evidence of such mortuary behavior would include several key elements: large deposits of disarticulated bones interred in pits, whose demographic profile should approximate expected mortality experience (i.e. both sexes and all ages). The bones would not necessarily bear marks of their cleaning, if the mortuary priests' nails were the sole permissable tools for that task. Preservation of their alignment within their perishable containers should aid in identification of discrete individuals within the deposits. The scaffolds would not appear archaeologically except as postmolds containing charred posts. The charnel houses might be distinguishable from other structures by their lack of hearths, domestic rubbish, and containing walls on all four sides.

The portion of the Protohistoric component sampled at Lubbub did not yield any structure identified as a charnel house, but this absence could well be due to sampling error. Numerous random postmolds were noted near the domestic structures discovered, which could have been produced by scaffold supports. Only one articulated extended interment was assigned to this component, the 63 remaining individuals appearing in secondary interments.

Two of the 7 Protohistoric burials bear a strong resemblance to the modeled evidence outlined above. One consisted of a deposit of disarticulated skeletal elements representing a minimum of 43 individuals, arranged in several adjacent compact stacks within a large pit. The long axis of the deposit lay at a right angle to the axes of the long bones which comprised the majority of the deposit. Within each stack, smaller deposits representing separate individuals could be distinguished. The other burial contained the fragmented calvaria of 10 individuals stacked neatly over the bundled postcranial remains of an eleventh person.

Representation of both sexes was approximately equal in the adult segments of both burials. Subadults were underrepresented (10.9% vs. the expected 30%-50%) but mortality within that subsample displayed the expected decline after infancy (Weiss 1973). Poor bone preservation may have obscured marks of processing, if such existed.

Certain aspects of these two deposits had no specific equivalents in the model derived from the ethnographic data. These aspects include the differential selection of skeletal elements for inclusion in each burial, the spatial segregation of a few more completely represented individuals at the base of the stacks in the larger feature, the differential degree of processing involved in the composition of each deposit, and the under-representation of subadults in both. Although no direct evidence links the individuals represented cranially in the smaller deposit with those represented only postcranially in the larger one, the two features do by their natures form logical complements to one another, with respect to the disposition of cranial elements. However, it is also possible that the highly processed nature of the fragmented crania and their association with a single postcranially well-represented individual whose bones display traces of contact with fire (a unique occurrence in the Lubbub sample) reflect an origin distinct from the remains in the larger feature.

Swanton's sources were largely silent on the matter of which skeletal elements were retained for final deposition, although the general implication was that all bones were saved. Differential disposal of subadults was not specifically noted. The observed differences from the model (which was by definition a simplification of reality) may have resulted from interregional variations and/or from minor alterations in the basic regional mortuary pattern in the course of the centuries which separated the Protohistoric inhabitants of Lubbub from their Choctaw successors in the area. These differences do not invalidate the analogy drawn between the Protohistoric and early Historic mortuary behaviors which produced the modeled and the excavated evidence, as such behaviors need not have been identical in every detail, only in their basic functional aspects. In both cases, deposits of disarticulated bones representing significant segments of the population were produced as communal interments, within which discrete individuals could be distinguished.

These deposits differed in several critical formal dimensions from those produced by mortuary activities in the preceeding Woodland and Mississippian periods in the Gainesville Reservoir. Considered collectively, these differences signaled a shift *away* from the separate interment of articulated individuals, frequently accompanied by artifacts of technomic or sociotechnic significance, in the earlier periods *toward* collective interment of processed (and in some cases selectively curated) remains of population segments without distinguishing artifacts in the later periods. This shift has been documented at Lubbub and nearby sites within the Reservoir (Hill 1979, Ensor and Hill 1979, Powell, in preparation) and elsewhere in central Alabama (Sheldon 1974), accompanying the other aspects of the broad social transition from stratified Mississippian chiefdoms to the more egalitarian organization of the Historic Alabama tribes.

Acknowledgement

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Timothy K. Perttula and Ann F. Ramenofsky

AN ARCHAEOLOGICAL MODEL OF CADDOAN CULTURE CHANGE: THE HISTORIC PERIOD

Archaeological considerations of European contact and aboriginal change began in the 18th century with speculations about the mound-builders (Silverberg 1968). Incongruities between European intuitions about the kind of societies required to build mounds, and ethnographic descriptions and population densities of 18th and 19th century Native Americans, led to questions about contact period change. This interest in contact change, however, did not survive the 19th century. With the incorporation of American archaeology into the anthropological discipline, interest focused instead on the search for, and the assumption of, cultural continuities.

The goals of American anthropology framed in the early 20th century set certain precedents in approaches to European contact and native systems which still are evident in our reliance on ethnographic descriptions in building inferences about the past. Boas and his students were not interested in documenting the effects of European contact per se; they wanted to study Native American systems free of European influences (Boas 1888; Swanton and Dixon 1914). This restriction was analytically difficult since by the early 20th century Native Americans had known the effects of contact for ca. 300 years.

To overcome this inherent difficulty, ethnographers relied on a diverse data set which were synthesized into descriptions through the technique of the *ethnographic present.* This technique constructed from this time-transgressive data "as-if" synchronic pictures of ethnographic fact placed just prior to European contact (Kroeber 1939).

In an historical and developmental sense, the Direct Historical Approach (Dixon 1913; Steward 1942) is the archaeological analogue to the concept of the ethnographic present. Its concern for cultural continuities is evident in its purpose to link post-contact tribal histories with pre-contact cultures. Caution has often been expressed about the direct correlation of archaeological and ethnographic units (e.g. Griffin 1943; Mason 1976), but it is fair to say that the belief in continuities is a strong and persistent one (e.g. Brain 1977; Gregory 1980).

To stretch the post-contact fabric to fit pre-contact manifestations, evidence of contact period change, disruptions, and terminations were often overlooked or ignored. While there is general acknowledgement that European contact had a major impact on Native Americans, the contact archaeological record has either not been systematically assessed, or it has been treated as a lumped synchronic unit from utilizing data sets that were conceived as changeless.

A processual consideration of the contact period must be framed so that evidence of change can be abstracted from data whose nature are diachronic. Archaeological data are well suited to diachronic studies (Plog 1977). As Milner notes (1980:40): "Archaeological studies are necessary to document and explain the extent of population reduction and culture change prior to 1700." The remainder of this paper will be concerned then with the study of the contact record in the Caddoan area, and the presentation of one possible explanatory model of the Caddoan historic archaeological record.

Ethnohistorical Background

The Caddoan area encompass a wide swath of land centering on Red River in the states of Texas, Louisiana, Oklahoma, and Arkansas. The term *Caddo* is a convenience in both archaeological and ethnohistorical studies. It is a very diverse archaeological construct during the late prehistoric period (Story 1978). As an ethnohistoric construct it refers to those entities residing within this area who were described in the period of Spanish and French colonization, and grouped together on the basis of certain shared characteristics (Swanton 1942). What we know of the ethnographic record deals primarily with the Caddoan speaking groups living around the Spanish missions and at the French posts of Natchitoches and on Red River in Bowie County. Ethnographic information is extremely limited on the majority of these groups, with some known only by name, and many others disappearing early in the 18th century (Campbell 1976).

There is abundant ethnohistorical evidence (Swanton 1939) that change in demographic profiles and the diffusion of European goods preceded actual colonizing efforts in the Southeast, thus making even the earliest histories descriptions of systems already changing. From an aboriginal perspective European contact involves two variables: people and products. Simply, contact may take three forms: a) products without people; b) people without products; and c) people with products. To encompass all three forms of contact, the historic record defined here begins in the mid-16th century, starting with Cabeza de Vaca's voyage along the Texas Coast and Moscoso's entrada into the interior.

Acute European diseases and introduced products of European technology are primary in the consideration of the Caddoan historic archaeological record. These variables are important initial sources of change because they are movable. They could be dispersed by Native populations independently of Europeans, and the adoption, integration, and adjustment to these variables would be a process unrecorded by Europeans. The model attempts to address the effects these variables had on Caddoan societies, and the form of aboriginal responses.

Diseases of significance include smallpox, measles, and influenza, among others, none of which were present in North America before Europeans (Fenner 1970). Once the disease process was established in a "virgin-soil" population as periodic epidemics, Native American morbidity and mortality figures ranged upward to 100% (Dobyns 1976a; Dobyns 1976b). Ewer's (1973) analysis of the epidemics among the Texas Caddoan populations indicates a population decline between 75-90% as a result of the many epidemics recorded from 1528. The transmission of diseases was dependent on the degree and frequency of inter-settlement contact, and the increased mobility to spread disease from one area to another. The expansion of the fur trade, and the traffic in horses from Santa Fe were the prime vehicles of transmission.

The diffusion of horses after 1600 from Santa Fe (Jacobsen and Eighmy 1980) facilitated the more rapid movement of all native and European goods, as well as increased inter-settlement contact. The Spanish first heard about the "Tejas Kingdom" in the mid 17th century from Jumano middlemen who ranged from the Rio Grande to East Texas carrying goods back and forth. Caddoan access to horses and guns helped them establish a preeminent role in the exchange of these items until at least the mid 18th century. From ethnohistoric records it appears that certainly by 1680 horses were the prime exchangeable commodity of Caddoan societies south of Red River while French guns had a similar role in Caddoan groups on Red River, and nearer to Arkansas Post and Illinois. A brisk trade was already in place when sustained European contact first began.

Responses to Culture Contact

A drastically decreased population base in all regions of the Caddoan area forms the core of the model. Differential aboriginal response by region is dependent upon remaining aboriginal populations and relative position to European settlements.

The first type of aboriginal response is the formation of hybrid population clusters out of disintegrating community and group remnants, and the necessary development of new integrating mechanisms. The mechanisms may be considered to be European derived in nature when the population remnants coalesce around zones of European settlement or access points such as French trading posts. Integrative mechanisms aboriginal in nature are those different in degree but not in kind from inferred precedents, such as the redistributive functions of mounds and fire temples. Inferred aboriginal mechanisms seem to be short-lived in the contact period; the *Gran Xinesi,* the top of the Hasinai elite hierarchy (Wyckoff and Baugh 1980), is paradoxically rarely mentioned in the ethnohistoric literature after the early 18th century. Mound construction and utilization is rare among historic Caddoan populations. It is probably significant that the *calumet* ceremony (Turnbaugh 1979) was adopted first among the Cahinnio, one of the first groups to disappear from the record, and next among the Kadohadacho, a remnant confederacy. The phenomenon of confederacies are common in the ethnographic literature, though their function and development differ greatly.

Among the Kadohadacho and Natchitoches confederacies, both formed in proximity to European settlements, the relative number of historic period sites contemporaneous with these settlements are indicative of a strong interrelationship. The intensity of contact will be high, but the economic situation (access to European goods) and pay-offs will be correspondingly high.

Spanish mission establishments usually followed the procedure of locating in aboriginal population centers. Because the effect of the missions among the Hasinai was not overtly socioeconomic or socioreligious (Bolton 1915:100-1), they were not magnets to population remnants as were the trading post/settlement. A lower population density and a dispersed arrangement of populations around the missions, instead of the compact pattern around European settlements, is expected in the areas administered by the Spanish in East Texas. The Hasinai strategy was dependent less on their insulated position near Spanish missions than upon the frequency of contraband and later official trading, their position with respect to horse exchanges, and the eventual establishment of new subsistence strategies.

The second major response is attempting to maintain the pre-contact adaptation, with settlement numbers and distribution predicted to steadily decline with ever decreasing populations until too small for group survival. These disintegrating groups either join one of the hybrid populations or try to adopt new subsistence strategies. The entire area between the Hasinai and Kadohadacho was emptied, beginning with the first epidemics, and continuing in direct proportion to the frequency of European goods at other regions. Marginal areas will show little post-1700 historic occupations until certain areas were re-occupied and utilized at a later date (post-1760) with expanding fur trade activities.

With environmental conditions permitting, and given due consideration for dependable access to new and more efficient technological items (guns), the third response is the development of new subsistence strategies, mainly fur trading. The response is time-transgressive in that its adaptive advantage is strictly predicated on access to European goods. With the quantity and quality of guns probably variable before aboriginal groups became tied to European economic strategies, the success of the fur trade followed the establishment of dependable supplies. With the continuing collapse and fragmentation of remnant Caddoan groups, the increasing availability of French guns made this strategy more and more advantageous, till by 1760 this was the dominant response throughout the Caddoan area. Recognizable archaeological changes include the development of a specialized lithic technology, different and specialized faunal procurement patterns, and locations in European hinterland areas.

Summary

The simple fact that there are so few Caddoan sites dating after European contact is striking evidence in itself for substantial change. Certain aboriginal responses resulting from European contact have been suggested, each dependent upon a number of interrelated factors, the primary factor being epidemic diseases. The selection of certain strategies is predicated upon each strategy having a probability of survival, one that is time-transgressive in nature. Particular regions each have potentially different contact records, and the contact record is far from being a static one.

The fact that any Caddoan people survived so many generations of uninterrupted disruption is not only an eloquent testimony to their ability to change, but a silent statement of their strength as a people.

Acknowledgements

Dr. Robert C. Dunnell's assistance, support, arguments, nagging, and insights are greatly appreciated. Errors of interpretation are a result of our shortcomings. This is a much revised and shortened version of the paper presented at the 37th Southeastern Archaeological Conference, New Orleans.

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Barbara A. Purdy and Sharon Hall

INVESTIGATIONS AND STABILIZATION OF WOODEN ARTIFACTS FROM FLORIDA WET SITES

Quantities of wooden artifacts have been found in Florida at least since the 1890s when Frank Hamilton Cushing recovered the famous Key Marco specimens. Unfortunately, none of these has been cared for properly. The Florida State Museum has been involved in studies of these important objects for a number of years. In 1977 awareness of the real potential of Florida's wetlands with respect to preservation of cultural remains came when drought conditions caused the watertable to drop and exposed long buried wooden artifacts, especially canoes. The National Science Foundation and the National Endowment for the Arts provided money to retrieve some of this material but the funds ran out before the artifacts could be cared for completely. No investigations were conducted at that time to determine what might be left in the deposits. Two proposals were supported by the National Trust for Historic Preservation and one proposal was funded by Heritage Conservation and Recreation Service to stabilize and study the wooden artifacts already recovered and to conduct a statewide survey of wetlands sites. This paper is a summary of our findings at this time.

Stabilization

There are hundreds of objects needing preservation; most are extremely degraded. Additional specimens should not be retrieved until there is a systematic way to handle the material. Correspondence with wooden artifact preservation researchers around the world and a literature search have been conducted as initial steps in determining the range, advantages, and disadvantages of current preservation procedures. These endeavors have produced a variety of reports and references that will serve as a bibliography of wooden artifact analysis and preservation.

The treatment of waterlogged wood is dependent upon many variables, including the specific type of wood, its degree of degradation, depositional environment, and how the wood has been altered from its natural form. Different types of wood have differing resistance to decay which can significantly affect the rate of their degradation. The degree of degradation in waterlogged wood depends upon the amount of supportive cell wall material (cellulose) lost to biological and chemical action in the depositional context. The degree of degradation directly affects the permeability of the wood, which in turn is affected by the wood species. Generally, degraded softwoods (conifers) are more permeable than hardwoods (broadleaf), though this varies from species to species. The determination of wood species is therefore essential to the selection of preservation methods and has been a primary focus of analysis. Wood species are identified by taking thin sections and examining the microscopic structure. The features displayed in each of three planar surfaces—transverse, radial, and tangential—should be observed for reliable identification. These surfaces are also those along which the cell walls collapse as water evaporates from the artifact. Thus, examination of thin sections allows both species determination and assessment of degradation. Since no comparative collection of thin sections of Florida trees is available, we are creating our own collection for use in this and future investigations. Dr. William Stern, Chairman of the Department of Botany at the University of Florida has provided valuable procedural instructions in the sectioning and mounting of specimens.

The most successful and satisfactory method of waterlogged wood preservation, as indicated in correspondence and publications, is submersion in a solution of polyethylene glycol (PEG) and water at graduated concentrations for successive time periods relative to the size and condition of the artifact. Time periods range from a few weeks to a few years during which time the PEG gradually permeates and stabilizes the deteriorated wood structure. PEG is a white, wax-like chemical that resembles paraffin. Mixed with water, it readily diffuses into the water soaked fine structure of the wood, supports it, and keeps it intact during the final drying process. It also adds weight to a specimen. A biocide may be added to the solution in order to control unwanted and further-degrading bacterial and mold growth.

PEG treatment was initiated previously at the Florida State Museum for two canoes and a large wooden bowl recovered during the drought of 1977. The remaining wooden artifacts in the museum collections are being analyzed for their suitability to this or other preservation measures. In addition, a large quantity of fragmentary wooden remains recovered by salvage methods from a dredged lake site near Naples, Florida were brought to the museum for analysis and treatment. These materials, associated skeletal remains, and the matrix from which they were recovered were radiocarbon dated to 6,500 years B.P. The wooden objects include atlatl spurs, shaft fragments (one with four pairs of incised lines), three notched stick fragments identified as firestarters, and many charred pieces of indeterminate function. The skeletal material, though badly damaged by the method of recovery, permitted a few general inferences concerning the health and cultural practices of the population. Malnutrition is indicated by the presence of abcessed jaws with misplaced worn teeth and by the radiographically visible transverse bone lines representative of periods of starvation rather than to chronic malnutrition. Abnormally developed upper arm and shoulder musculature and arthritic vertebrae indicate heavy physical exertion probably lifting or canoe paddling. Several of the bones exhibit syphlitic tendencies. Dr. William R. Maples, Curator of Physical Anthropology at the Florida State Museum, is preparing a report for publication that will describe the skeletal material in detail.

Statewide Survey

In order to obtain a more comprehensive view of the nature, condition, cultural implications, and location of wooden remains recovered throughout the state, correspondence has been established with Florida museums and other institutions able to provide such information. The compilation of a master site file of Florida wooden artifacts from this and our own data has been undertaken to provide a permanent record and to aid in future investigations and comparative analyses of these materials.

A statewide survey has been underway since the Fall of 1980 to investigate the cultural potential of wetland areas in Florida. Locations were visited where organic materials had been recovered previously in maritime environments in order to determine under what circumstances preservation had occurred. These visits included Hontoon Island on the St. Johns River near DeLand, Belle Glade, Key Marco, the Bay West Site, Little Salt Springs near Venice, numerous lake areas, Atlantic and Gulf Coast sites, and commercial peat operations.

Wetland areas in Florida are very extensive and wooden artifacts have been found in all regions of the state where preservation conditions are favorable, i.e., wetlands. We are presuming, therefore, until demonstrated differently, that every wetland area may contain organic artifacts. Because it is impossible to investigate personally all of the sites during the period of the survey, information was requested from the sixty-eight Florida county agent offices, soil conservation offices, and commercial peat operators listed in the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, 1979. The replies are valuable and are being summarized for future action.

Summary of Current Information

Most of the data being amassed about the history of Florida's wetlands are distressing.

(1) Nearly all of the wooden cultural remains in Florida were discovered by private property owners or during development projects without the benefit of controlled excavation procedures. Valuable information has been lost because these materials were jerked from their provenience and dropped from a bucket and splattered. The specimens have disintegrated because they were not preserved.

(2) Of primary concern is the realization that draining of wetland areas has been extensive and dates in some places to the late 1800s. It has become increasingly clear to individuals working in peat areas that wooden artifacts will be destroyed within a year after the drainage pattern is changed significantly even at a considerable distance from the area where artifacts occur.

(3) Another disturbing discovery is that individuals and organizations are deliberately destroying wooden artifacts or are not informing anyone when cultural material is found in peat deposits because of the fear of having to discontinue development projects, peat mining, or agricultural pursuits. It is imperative that people be informed of the advantages and the rewards of cooperating with individuals and institutions concerned with the preservation of cultural heritage.

(4) The peat deposits in Florida are more extensive than ever imagined. Peat production is second nationwide. Peat land is used for agriculture and peat is sold to nurseries. Peat will be burned most likely in the future as an energy source. One property owner said that his peat deposit alone, about one mile long, one-half mile wide, and twenty-two feet deep, was sufficient to supply energy for two, 100 megavolt plants for 30 years, each of which could supply energy for the population of three Florida counties.

(5) In some areas peat deposits are simply being cleaned out, along with the cultural remains they contain, to create lakes so that developers can sell lakefront property.

(6) Peat deposits are extremely volatile under drought conditions and there is evidence for peat fires prehistorically. Today, peat burning is common because drainage and development activities as well as drought have dried the peat to a hazardous state. Artifacts, of course, are destroyed along with the peat.

The cultural resources from wetlands sites can provide a new dimension to Florida archaeology and new industries and technologies to study. We believe that we have the oldest and largest amount of prehistoric wooden artifacts in the world. We wonder if these resources are present in other states also.

John F. Scarry

INTRODUCTION TO THE SYMPOSIUM: RECENT ADVANCES IN FORT WALTON ARCHAEOLOGY

Gordon R. Willey's *Archeology of the Florida Gulf Coast* was published over 30 years ago (Willey 1949) and remains as the single most important work on the archaeology of the Fort Walton area. Since its publication, the definition of Fort Walton culture contained in this synthesis has colored nearly every investigation of Mississippian phenomena in this area. Despite studies critical of Willey's definition (cf. Sears 1964, 1977; Brose and Percy 1978), the popular image of Fort Walton is as Willey defined it: a chronologically late Mississippian manifestation; peripheral—both in a geographical and in a cultural sense—to the classic Middle Mississippi culture of the interior alluvial valleys of the Southeast. Willey's Fort Walton culture also differed from other Mississippian manifestations because it included numerous coastal components (i.e. Pensacola culture sites).

Research conducted during the past decade has indicated serious flaws in Willey's concept of Fort Walton culture. Fort Walton is not a late phenomenon nor is it peripheral to the general development of Mississippian, at least in a cultural sense. By excluding the Pensacola systems of the Gulf Coast, not only on material culture grounds as Sears has advocated (1964, 1977), but on the basis of significant differences in adaptation, Fort Walton can be recognized as more typically Mississippian—to the extent that something can be typically Mississippian.

The seven papers which follow outline some of the research carried out during the past decade. They clearly indicate that traditional concepts of Fort Walton must be reformulated and they illustrate some of the reformulation that has taken place. Calvin Jones' work at the Lake Jackson site adds that site to the roster of major Southern Cult centers alongside Spiro, Moundville, and Etowah. Lake Jackson clearly was not a peripheral site; it was an important component of the Southern Cult exchange system. We will not understand the operation of the Cult fully until we understand the role of Lake Jackson.

The research outlined in these papers has added greatly to our understanding of Fort Walton. It has resulted in the modification of traditional models of Fort Walton and will contribute to a better understanding of Mississippian phenomena in general.

The papers also indicate some of the problems which still face us. Despite improvements, our definition of Fort Walton is vaguely bounded and we do not have a concensus of what constitutes Fort Walton (i.e. which components are Fort Walton and which are something else). We must refine and agree on our definition. In addition, there are serious problems with the existing ceramic typologies; they do not permit the easy identification of regional and chronological sub-units of Fort Walton nor the study of relationships between different sites. Finally, despite the recent research, there remain large gaps in our data base: (1) we do not know the composition or structure of specific Fort Walton systems; (2) the details of the Fort Walton subsistence procurement system are at best poorly known; and (3) we cannot reasonably discuss relationships among the various Fort Walton components or between Fort Walton and nearby non-Fort Walton components. We have made advances, but we still have a long way to go.

The references cited in the following seven papers are combined and included separately on pages 32-34.

John F. Scarry

FORT WALTON CULTURE: A REDEFINITION

Fort Walton culture was a generalized adaptation, shared by a number of social systems on the Gulf Coastal Plain during the period A.D. 900 to A.D. 1650. This adaptation featured: (1) a subsistence system based on the intensive cultivation of maize and the selective exploitation of large mammals and aquatic fauna; (2) a settlement pattern which was largely focused on circumscribed areas containing agriculturally productive soils and aquatic habitats; and (3) an organizational strategy which included differential

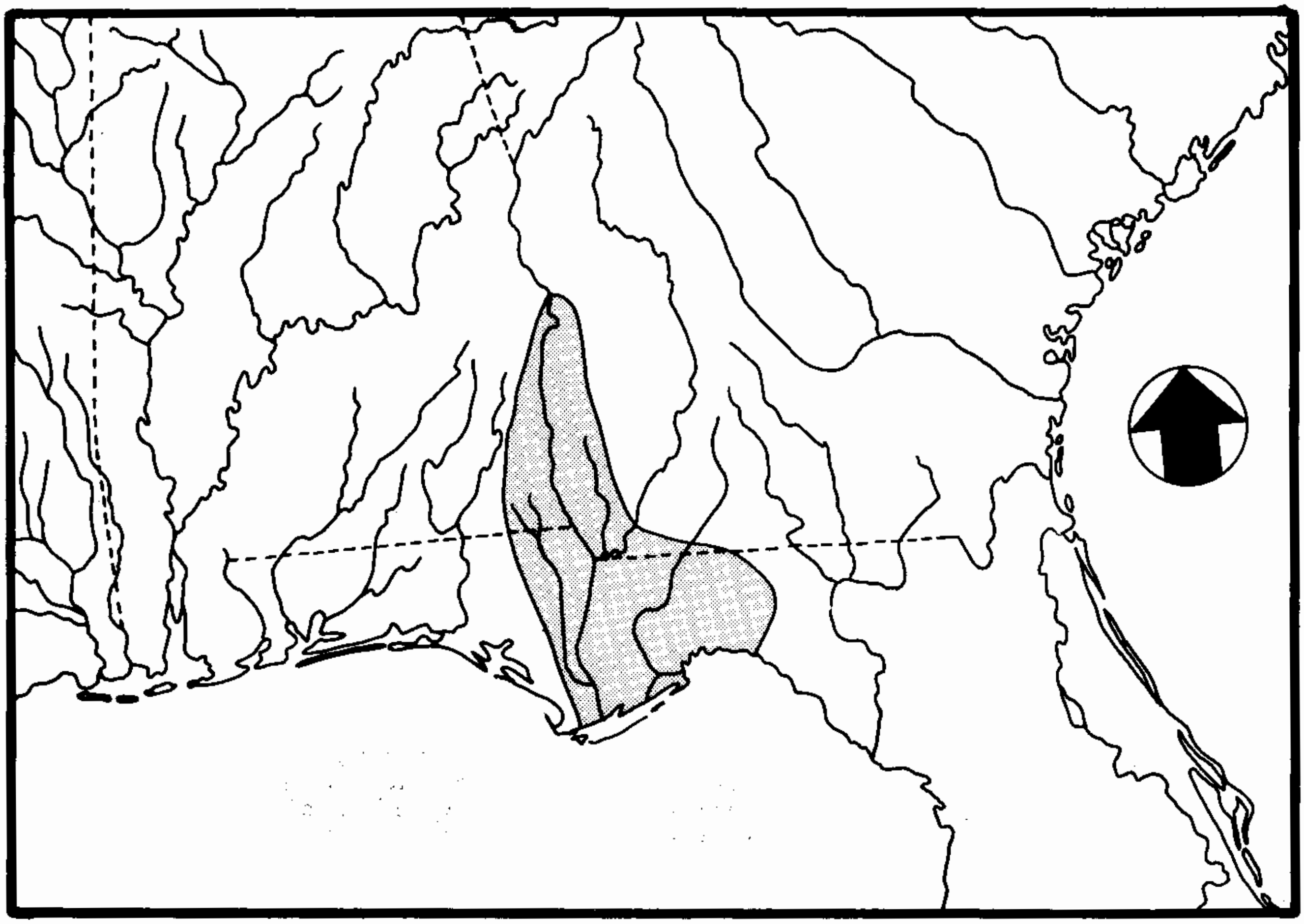

Figure 1. The Fort Walton area.

ranking of individual members of the society and hierarchical decision-making units.

The Fort Walton systems were Mississippian (*sensu* Peebles and Kus 1977), although they do not always conform exactly to Smith's recent definition (B. D. Smith 1978). The Mississippian character of Fort Walton systems has been recognized since the initial definitions of the Fort Walton culture (cf. Willey and Woodbury 1942; Willey 1949), and there is extensive evidence to suggest that Fort Walton systems were actively engaged in exchange networks which involved many other Mississippian systems (cf. Schnell et al. 1979; Williams 1979; Knight 1980). In fact, it is now evident that at least one Fort Walton system, the Lake Jackson, played an important role in the Southern Cult exchange system.

Fort Walton culture was restricted to the Lower Chattahoochee-Apalachicola alluvial valley and several nearby areas of agriculturally productive soils, such as the Marianna Lowlands and the Tallahassee Red Hills of northwest Florida (Fig. 1). Within this general area, several regional variants of Fort Walton culture are discernible on the basis of differences in ceramic assemblages. These regional variants include the Rood and Bull Creek phases of the Lower Chattahoochee, the Waddells Mill Pond variant of the Marianna Lowlands, the Cayson, Sneads, and Yon phases of the Apalachicola Valley, and the Lake Jackson variant of the Tallahassee Red Hills area (Fig. 2). However, while there are material culture differences between these Fort Walton variants, they share a generalized material culture which distinguishes them from other Mississippian systems.

Table 1. Major Fort Walton Ceramic Types.

Alachua Cob-marked	Leon Check Stamped
Andrews Decorated	Marsh Island Incised
Columbia Incised	Nashville Negative Painted, *var. Columbus*
Cool Branch Incised	Nunnaly Decorated
Englewood Incised	Pinellas Incised
Fort Walton Incised	Pinellas Plain
Jefferson Complicated Stamped	Point Washington Incised
Lake Jackson Incised	Rood's Incised
Lake Jackson Plain	Safety Harbor Incised
Lake Jackson Punctated	Wakulla Check Stamped
Lamar Complicated Stamped	

Fort Walton material culture is best known for its ceramics. The "Fort Walton ceramic assemblage" includes established types of the Fort Walton, Lamar, and Leon-Jefferson ceramic series. The major ceramic types associated with Fort Walton sites are listed in Table 1. Like the overall Fort Walton culture, Fort Walton ceramics are recognizably Mississippian in their general character (cf. Knight 1980).

The settlement pattern of Fort Walton systems was hierarchical, with several classes of settlements. Site types include large ceremonial centers, nucleated villages, hamlets, farmsteads, and possibly small, ephemeral extractive stations (Fig. 3, Table 2). Ceremonial centers typically contained one or more pyramidal mounds and other features suggesting organized public construction. In at least one instance, the ceremonial centers themselves appear to have formed a hierarchy (Claudine Payne, this volume).

Fort Walton culture appears to have developed at about the same time as other Mississippian cultures in the Lower Southeast. During the past decade, a num-

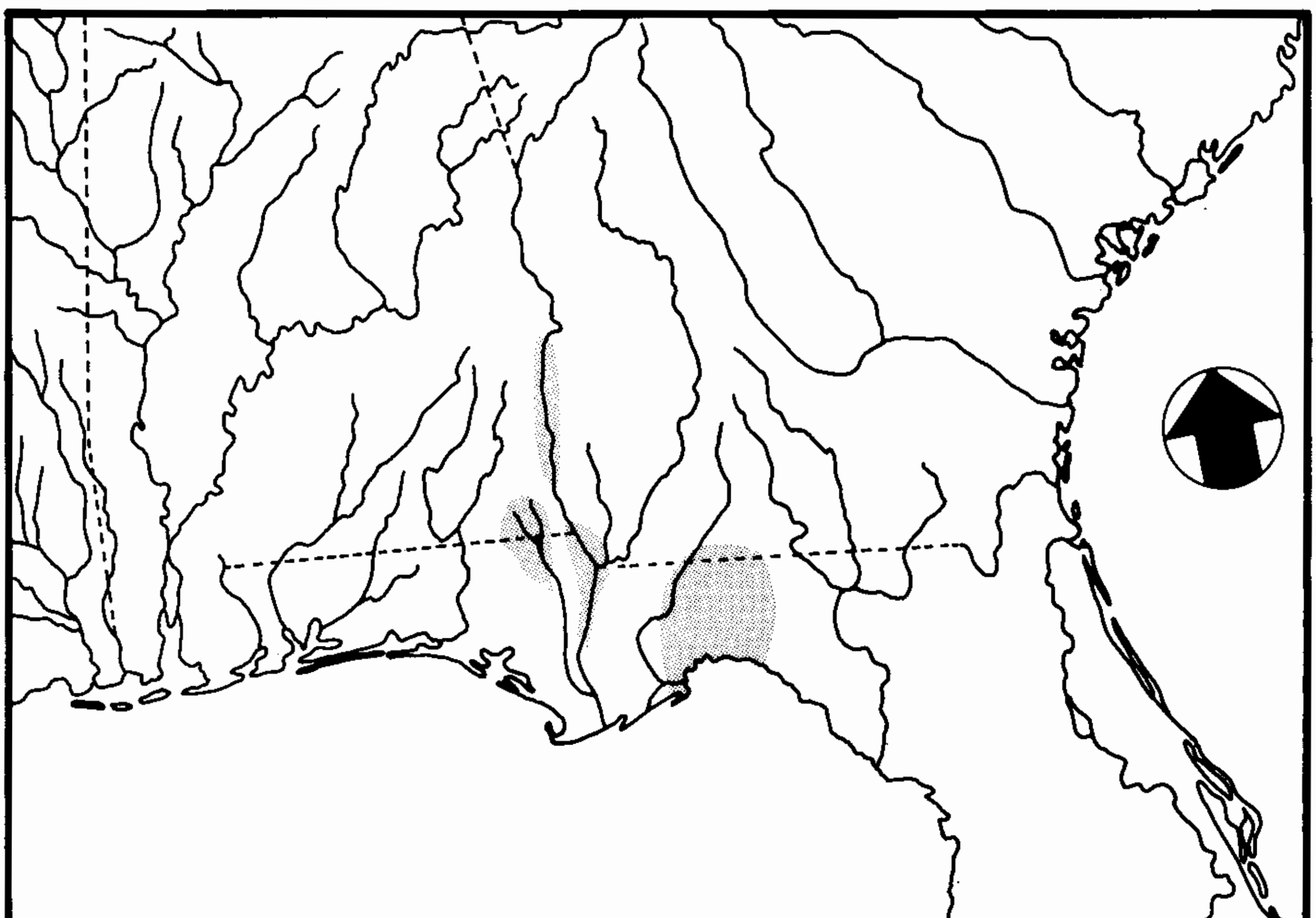

Figure 2. Fort Walton regional variants.

Table 2. Major Mississippian Sites in the Fort Walton Area.

Type of Site	Site
Major Center	Chattahoochee Landing, 8Gd4
	Lake Jackson, 8Le1
	Pierce (?), 8Fr14
	Rood's Landing, 9Sw1
	Singer-Moye, 9Sw2
Minor Center	Abercrombie, 1Ru61
	Cayson, 8Ca3
	Cemochechobee, 9Cla62
	Cool Branch, 9Qu5
	Curlee, 8Ja7
	Engineer's Landing, 9Ce3
	Gary's Fish Pond, 9Qu1
	Jones-Daniel, 8Gu14
	Kolomoki, 9Er1
	Kyle, 9Me3
	Lake Iamonia, 8Le5
	Lake Lafayette, 8Le2
	Letchworth, 8Je337
	Mandeville, 9Cla1
	Nichols, 8Wa3
	Omussee Creek, 1Ho27
	Purcell's Landing, 1He34
	Rollins, 8Le3
	Shorter, 1Br14
	Velda, 8Le44
	Waddell's Mill Pond, 8Ja65
	Yon, 8Li2
	1Br8
Village or Hamlet	Borrow Pit, 8Le170
	Bull Creek, 9Me1
	Coe's Landing, 8Ja137
	High Ridge, 8Le117
	J-2, 8Ja5
	J-5, 8Ja8
	Shearer Road, 8Le213
	Winewood, 8Le164
	9Cla51
Special Purpose	Chipola Cut-off, 8Gu5
	Hornsby's Bluff, 9Dr5
	Ullmore's Cove, 8Wa34
	Wildlife Refuge cemetery, 8Wa15

ber of radiocarbon dates have been obtained from early Fort Walton sites which suggest an origin for Fort Walton culture much earlier than previously believed (cf. Willey 1949; Sears 1964, 1977). These dates (Table 3) indicate that recognizable Fort Walton manifestations appeared at least as early as A.D. 1050 and that the initial appearance of Fort Walton ceramics, and possibly of the Fort Walton cultural adaptation as well, may have been as early as A.D. 900-1000 (Brose et al. 1976; Brose and Percy 1978; Schnell et al. 1979).

The demise of Fort Walton culture appears to have been a result of European intrusion into the Fort Walton area and the subsequent population disruptions. At the time of the earliest Spanish explorations of the area, fully functioning Fort Walton systems were in existence—e.g. the Apalachee of the Tallahassee Red Hills area (cf. Buckingham Smith 1968). With the establishment of the Apalachee missions in A.D. 1633, the aboriginal Fort Walton culture was destroyed in the Tallahassee Red Hills and replaced by the Leon-Jefferson culture of the missionized Apalachee (H. G. Smith 1948a, 1948b, 1951). In other portions of the Fort Walton area, such as the Lower Chattahoochee Valley, Fort Walton culture may have lasted slightly longer, but it does not seem to have continued much past the middle of the seventeenth century anywhere.

This definition of Fort Walton culture does not differ dramatically in content from current concepts of Fort Walton. However, by excluding the Pensacola

Table 3. Radiocarbon Dates from Fort Walton Sites.

Site	Age	Date	Lab Number	Comments
Chemochechobee	395±60	A.D. 1555	UGa 1847	Rood phase
	525±55	A.D. 1425	UGa 1848	Rood phase
	630±125	A.D. 1320	UGa 1946	Rood phase
	720±70	A.D. 1230	UGa 1849	Rood phase
	750±60	A.D. 1200	UGa 1942	Rood phase
	765±55	A.D. 1185	UGa 1941	Rood phase
	790±55	A.D. 1160	UGa 1939	Rood phase
	870±90	A.D. 1080	UGa 2001	Rood phase
	895±55	A.D. 1055	UGa 1945	Rood phase
	940±55	A.D. 1010	UGa 1707	Rood phase
	955±55	A.D. 995	UGa 1995	Rood phase
	960±80	A.D. 990	UGa 1998	Rood phase
	970±55	A.D. 980	UGa 2041	Rood phase
	1005±70	A.D. 945	UGa 1944	Rood phase
	1020±60	A.D. 930	UGa 1943	Rood phase
	1055±65	A.D. 895	UGa 2000	Rood phase
	1100±60	A.D. 850	UGa 1996	Rood phase
	1240±95	A.D. 710	UGa 1997	Rood phase
Cool Branch	660±280	A.D. 1290	SI 261	
	1610±140	A.D. 340	SI 260	erroneous date
Gary's Fish Pond	530±120	A.D. 1420	SI 263	Bull Creek phase
	1240±120	A.D. 710	SI 262	Weeden Island component
Singer-Moye	550±60	A.D. 1400	UGa 357	Bull Creek phase
	680±80	A.D. 1270	UGa 356	Rood phase
J-5	534±100	A.D. 1416	M 392	Sneads phase
Yon	640±70	A.D. 1310	DIC 655	Yon phase
	900±120	A.D. 1050	DIC 95	Cayson phase
	980±105	A.D. 1020	DIC 114	Cayson phase
	1030±105	A.D. 920	DIC 656	Cayson phase
	1110±70	A.D. 840	DIC 658	Cayson phase
Cayson	770±60	A.D. 1180	DIC 46	Cayson phase
	840±65	A.D. 1110	DIC 45	Cayson phase
	900±100	A.D. 1050	DIC 94	Cayson phase
	940±145	A.D. 1010	DIC 44	Cayson phase
	1000±70	A.D. 950	DIC 93	Cayson phase
Lake Jackson	365±80	A.D. 1585	I 9919	top of Md. 3
	715±80	A.D. 1235	I 9920	base of Md. 3
	1025±80	A.D. 925	I 9918	Md. 3
	1035±80	A.D. 915	I 9922	Md. 3
Curlee	760±50	A.D. 1190	DIC 1048	Cayson phase
	1550±85	A.D. 400	DIC 1049	erroneous date

(Bullen 1958; Long and Mielke 1967; Schnell 1968; Mielke and Long 1969; Peebles 1974; Sumodi 1974; Brose et al. 1976; Schnell et al. 1979; White this volume)

culture of the Gulf Coast, it does modify the phenomena subsumed by the rubric Fort Walton. The major change represented by this redefinition is a shift in emphasis. While diagnostic ceramics remain the primary criteria utilized in identifying Fort Walton sites, they are *not* the defining characteristics of Fort Walton culture.

I hope that this definition of Fort Walton will stimulate investigations which emphasize the adaptive aspects of the culture. Only through such studies can

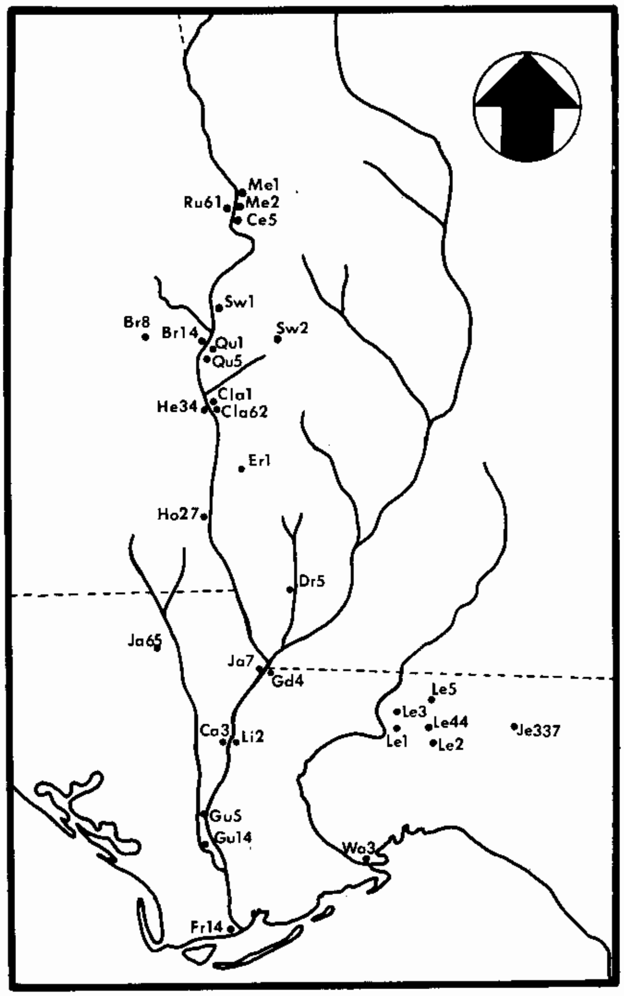

Figure 3. Fort Walton and other Mississippian centers.

we gain an understanding of the culture and the societies which practiced it.

Acknowledgements

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Frank T. Schnell

LATE PREHISTORIC CERAMIC CHRONOLOGIES IN THE LOWER CHATTAHOOCHEE VALLEY

The Lower Chattahoochee River, extending from the Fall Line to the Apalachicola, can be divided into three zones (Fig. 1). The Northern and Central Zones encompass an extending tongue of highlands which effectively projects many piedmont environmental characteristics deep into the Coastal Plain. The differences between the Northern and Central Zones on the one hand and the Dougherty Plain of the Southern Zone on the other are striking. Although the topographic differences between the Northern and Central Zones are not as obvious, there are significant archaeological differences here as well. It is these differences in ceramic complexes during the period A.D. 800 to A.D. 1650 which are the primary subject of this paper.

Recent work suggests that the Kolomoki ceramic complex is primarily a pre-A.D. 800 phenomenon. In the Northern Zone of the Lower Chattahoochee, there is a date of A.D. 730±120 for a Kolomoki-related component at 1Ru58 (Chase 1978:53). McMichael and Kellar (1960:209-10) discuss an "Oliver variant of Late Swift Creek" immediately north of the Fall Line, and there are tentative indications that such a ceramic complex may exist in the Northern and Central Zones of the Lower Chattahoochee as well. This possibility needs further investigation.

At the present time, it appears that the Averett ceramic complex developed ca. A.D. 800 in the Northern Zone. Although Averett components frequently include Rood and Etowah ceramic types (Chase 1963: 49), the development of this complex has not been delineated.

The Wakulla ceramic complex evidently is restricted to the Southern Zone and the lower half of the Central Zone at A.D. 800. At 1Br21 in the Central Zone, a date of A.D. 1000±140 (Mielke and Long 1969:166) is probably associated with a Wakulla component (Huscher 1959b:86; Schnell 1973:25-28).

The Rood ceramic complex consists of a series of types, none of which have been convincingly demonstrated to have been derived from previously existing

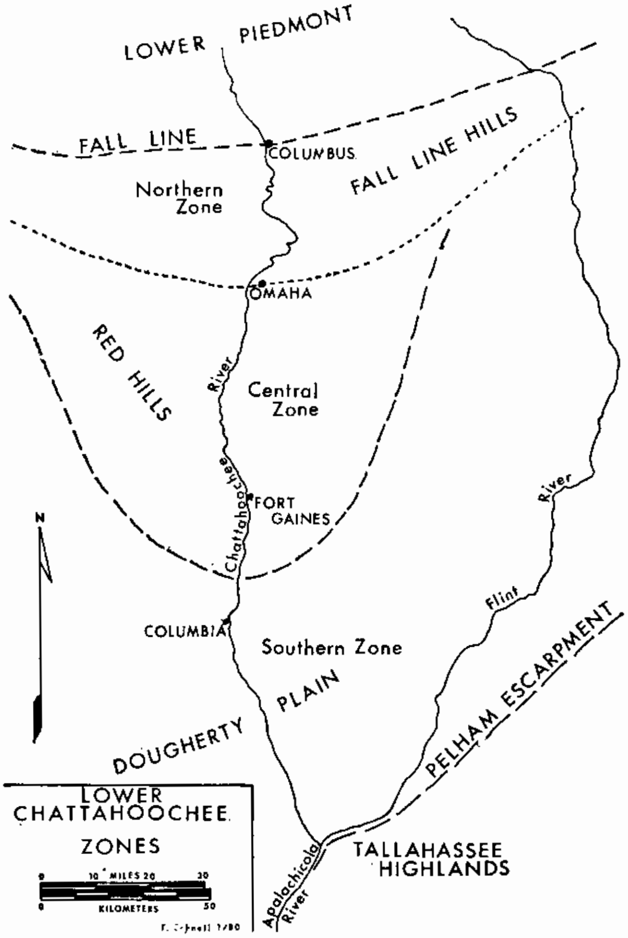

Figure 1. Lower Chattahoochee Valley Zones.

types on the Lower Chattahoochee. The major concentration of site components dominated by the Rood ceramic complex appear to be within the Central Zone of the Lower Chattahoochee. There are no known components dominated by Rood ceramics in the Northern Zone, although types of the complex are present on a number of sites (Chase 1963:49; Columbus Museum of Arts and Sciences files).

The Bull Creek ceramic complex represents the mixing of one series of types (Lamar) with a least one other type from Florida (Fort Walton Incised). It is thought that the majority of components with Bull Creek materials are in the Northern Zone although the best published description is from a site in the Central Zone (Broyles 1962, 1971). Other notable exceptions are the terminal occupation at the Rood's Landing site (Caldwell 1955) and the "Kolomoki-Lamar" component at the Kolomoki site (9Er1) near the southern boundary of the Central Zone (Sears 1951). Although Sears (1956:55) distinguished between "Kolomoki-Lamar" and "Bull Creek-Lamar", current evidence suggests that this separation is not valid.

The Abercrombie ceramic complex (Fairbanks 1955; Hurt 1975:61, 66-68; Schnell 1970) appears to be late prehistoric and early historic. The majority of components with it have not yet yielded trade goods, but at Fort Apalachicola (1Ru101) it does occur in direct association with late seventeenth century Spanish majolica (Kurjack and Pearson 1975:200-222; David W. Chase, personal communication). All known sites with Abercrombie ceramic complex materials are within the Northern Zone and the upper half of the Central Zone, although Nancy M. White (personal communication) has recently recovered materials in the Southern Zone and along the Upper Apalachicola which appear to be very similar to Abercrombie.

Finally, the question of the relationships between these ceramic complexes and the Fort Walton culture should be addressed. The primary problems are conceptual ones. David W. Chase once stated that the Lamar culture "like the omni-present Kudzu vine has grown and expanded and gone all over the place . . ." (1962:70). Perhaps the same must be said of Fort Walton as it has been used in its multiplicity of ways. There are those who, with some justification, would include the Rood, Bull Creek, and Abercrombie complexes within a Fort Walton culture. The ceramic similarities between Rood material and what has been called the "Lake Jackson variant of Fort Walton" ceramics (Fairbanks 1971:38-40), as well as the similarities between Bull Creek material and the ceramics of the Yon phase (Scarry 1980a:41-42) on the Apalachicola are striking. But the question of relationship becomes critical in such peripheral areas as the Northern and Central Zones of the Lower Chattahoochee, geographically located between the supposed Lamar and Fort Walton heartlands.

The Rood, Bull Creek, and Abercrombie phases all show a continuing interaction with Florida Fort Walton in a wide variety of ways—most notably for

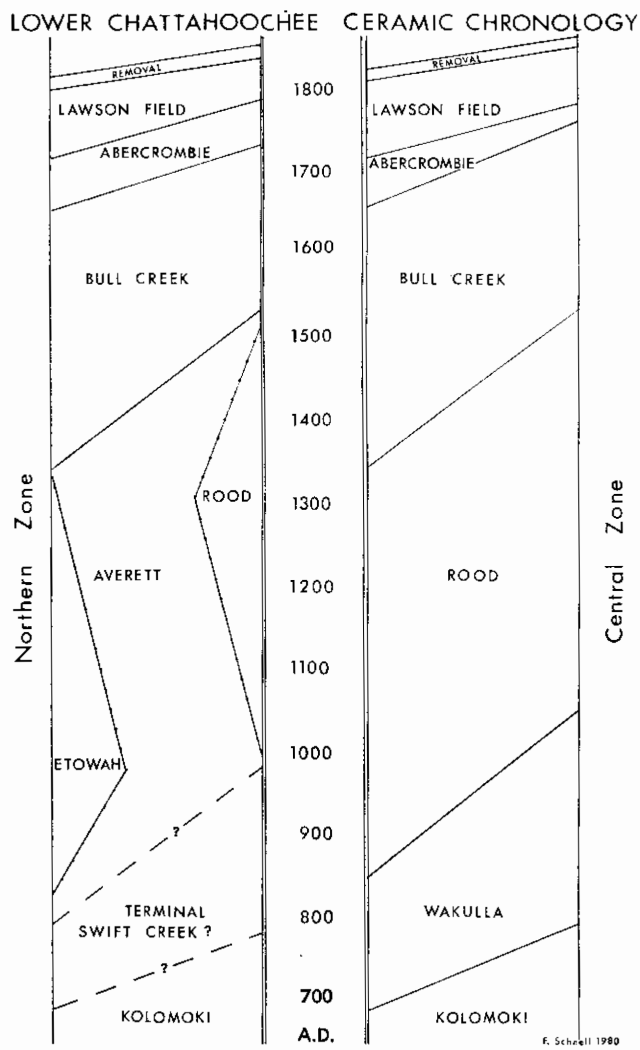

Figure 2. Lower Chattahoochee Valley ceramic chronology.

the purposes of this discussion in terms of ceramics. But does this mean that these phases are a part of a Fort Walton culture? Is the Bull Creek phase, for instance, more a part of a Fort Walton culture than it is of a Lamar culture? Is the Rood phase strongly influenced by the Lake Jackson variant of Fort Walton or vice-versa, or is it mutual interaction? What is the relationship between Abercrombie and Fort Walton—direct interaction or stimulus diffusion through the Alabama River phase? It is beyond the scope of this paper to attempt to go into the multiplicity of differences, similarities, and mechanisms of interaction. Significant comparisons cannot be made in terms of ceramics alone.

Nevertheless, ceramic analysis is still a significant tool for the archaeologist, no more and no less significant than any other cultural characteristics. Much more detailed ceramic analyses are needed and the data need to be mutually comparable. The conclusions in this paper must be considered to be very tentative considering the state of the data available. Figure 2 is a ceramic chronology based upon the data presented above. Although the sequences in this chart (with the possible exception of "Terminal Swift Creek") are considered to be accurate, only a few of the *terminus ad quem* or *terminus a quo* approximations may be considered established.

Cultural chronologies for the Lower Chattahoochee have been proposed in several places (Bullen 1950; Sears 1956; Jenkins 1978; Schnell and Knight 1978; Gibson 1980), but it is apparent that much remains to be done before a reasonably definitive outline may be attempted.

Gail S. Schnell

A PRELIMINARY POLITICAL MODEL FOR THE ROOD PHASE

> The question is, in any one area . . . was the actual shift to a Mississippian culture an invasion and conquest, or to what degree simply the spread of concomitant parts of the total pattern over regional subcultures of dissimilar peoples? (Huscher 1963)

This question must be considered in asking when, why and how a given area was Mississippianized. In the intellectual spiral inevitably involved in trying to answer it, an informal consideration of political organization is a potentially useful approach. The development of a Mississippian culture in the Lower Chattahoochee Valley, which includes the Chattahoochee River Valley from the Fall Line to its confluence with the Flint (F. Schnell, this volume), will now be viewed from this standpoint.

The great number of similarities between Rood phase materials and Fort Walton materials from the Florida panhandle indicate a strong relationship between the two, which may or may not have had political significance. However, the Rood phase does not appear to have been a Fort Walton culture itself, as Fort Walton is traditionally defined (Willey 1949). Considering Rood phase ceramics, its students would probably be more comfortable with a southern identification or affiliation if it had been called "Lake Jackson" rather than "Fort Walton."

From the Columbia Dam north to the Fall Line at Columbus, several surveys have been carried out within the bounds of current reservoirs. These surveys were not statistically random, nor did they include upland areas around the valley itself. They have provided a tremendous amount of information about prehistoric valley occupants, however, and are continuing to do so even now (Caldwell n.d.; Kelly 1950; Bullen 1950, 1958; Huscher 1959a, 1959b, 1963; Kelly et al. 1962; Broyles 1971; Hurt 1975). The data collected by these surveys indicate that the Rood phase was centered in an area of considerable variety immediately prior to its emergence. At about the time the Rood phase became recognizable, however, there was a population gap between Rood phase Central Zone sites and the Fall Line to the north, where a different, but contemporary population represented by Averett and Etowah ceramics was exploiting a very different environment. This gap remains throughout the Rood phase and may well represent a frontier between chiefdoms.

The status positions associated with the control of chiefdoms, as described by Service (1962), were present during this phase and are best documented in the report on the Cemochechobee site (Schnell et al. 1979). Since comparable evidence is lacking from the two largest Rood phase sites, we must extrapolate information about status positions from Cemochechobee (9Cla62), a smaller site, and from evidence gathered by Peebles relevant to the Bessemer and Moundville sites (Peebles 1971, 1978). The association of certain special ceramics with structures on or under platform mounds, structures frequently larger than ordinary house structures, supports the contention that certain persons were "special" in life as well as in death. The occurrence of Andrews vessels within the domiciliary structure on top of Mound B, a platform mound at 9Cla62, is an example of this. A cache of "killed" Andrews vessels in Mound A, the burial mound, on the same site was probably associated with a ceremony of secondary burial of individuals first deposited in a mortuary structure (Schnell et al. 1979).

Knight has recently discussed the changes in tempering and vessel form through time at the Singer-Moye site, 9Sw2 (1979). His data are especially important with respect to the early Rood phase picture. The later Rood phase sites seem to have continued their development within the Lower Chattahoochee River Valley at the same or slightly greater level of complexity indicated for the early portion of the phase. This may be in part due to the narrowness of the Chattahoochee Valley, in part to the overpowering influence of Moundville in its own, broader valley, which might have diverted the attention of lesser chiefdoms from their less demanding neighbors, and finally to a continued strong (possibly political as well as commercial) tie to contemporary Fort Walton manifestations downriver.

The Rood phase chiefdom(s) have a lot in common with the complex chiefdoms described by Steponaitis (1978) though at their climax, they were not nearly as complicated as the political entity that centered around Moundville. The Rood's Landing and Singer-Moye sites obviously stand out over all of the other Rood phase sites with respect to size, complexity and duration. The Cool Branch (9Qu5), Cemochechobee, Omussee Creek (1Ho27), and Mandeville (9Cla1) sites were subsidiary centers, more or less equally spaced apart at any given time (Fig. 1), which owed allegiance to one or the other of the two major Rood phase centers. Perhaps only one of these two main centers was active at a particular time as well. Elite materials and paraphernalia, domestic structures and burial situations are known from those sites where excavations have occurred. These were the centers of local chiefs who dealt with every-day political and religious matters. Under their hegemony were the moundless villages and hamlets occupied by the agricultural populace.

The main center at any given time would in all probability have first access to prestige items, whether locally derived or acquired through trade. This would help place "the beginning of the end" of the Rood phase in perspective. Caldwell's Rood's Incised (1955) looks more like a polished Alabama River phase bowl than a Fort Walton cazuella, and is associated with Bull Creek Lamar materials. For the sake of clarity, it might be expedient to give the last part of the Rood phase a new name, perhaps the Singer phase after the latest occupation of the Singer-Moye site (9Sw2) (Knight 1979). This phase would be represented by a combination of Rood phase and Bull Creek Lamar phase ceramics (F. Schnell, personal communication).

By this time the lesser Rood phase centers had been abandoned. The lack of prestige goods at secondary centers, or the demise of the centers themselves, probably reflects a decline in the hegemony of the main centers and the inability of their most important individuals to command sufficient luxury goods for redistribution away from the main centers themselves. By extension, the reverse would be true for a political entity expanding its hegemony.

The geomorphology of the Lower Chattahoochee probably favored the political confinement of the Rood phase to the Lower Chattahoochee Valley. The lower valley drainage is relatively narrow, but within that drainage are a number of different ecological zones, which, when coupled with easy access to the Gulf Coast, provided just about everything needed and wanted by its inhabitants. Only a few items, like copper and the Columbus variant of Nashville Negative Painted (Williams 1979), needed to be imported. It is, therefore, understandable that the Rood phase data seem to favor Huscher's second suggestion in answer to his question cited at the beginning of this paper.

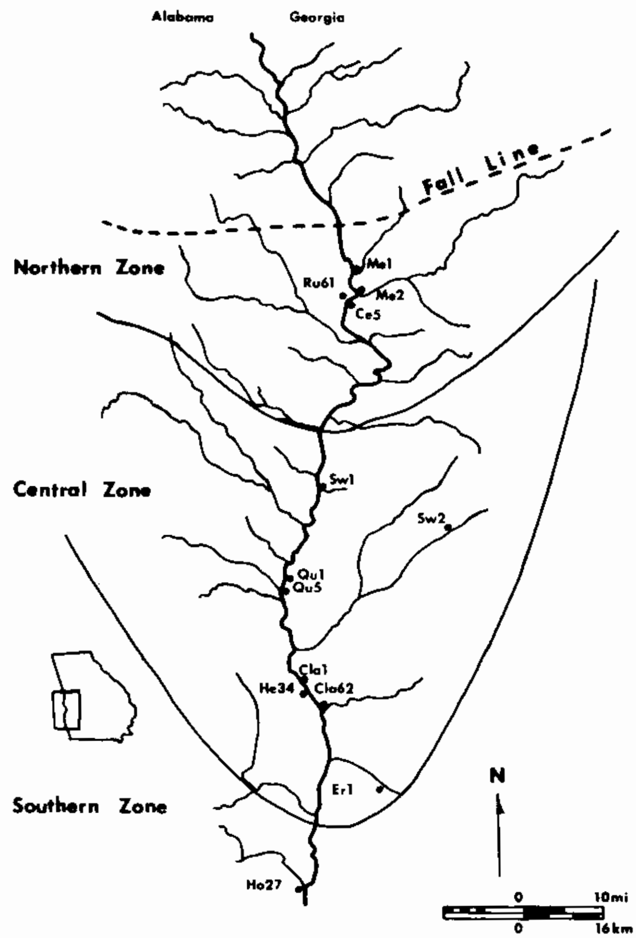

Figure 1. Some Mississippian sites on the Lower Chattahoochee.

Nancy Marie White

THE CURLEE SITE (8JA7) AND FORT WALTON DEVELOPMENT IN THE UPPER APALACHICOLA—LOWER CHATTAHOOCHEE VALLEY IN FLORIDA, GEORGIA, AND ALABAMA

The Curlee site (8Ja7) is located on the Apalachicola River, just below the confluence of the Flint and Chattahoochee (Fig. 1). This early Fort Walton mound-village site was damaged by highway and dam construction in the 1950s, then subjected to severe erosion and artifact collecting. From what was apparently a flat-topped mound, collectors recovered some 50 burials. Most were evidently bundle burials and some were accompanied by ceramic vessels. At the base of the mound were eight extended, supine

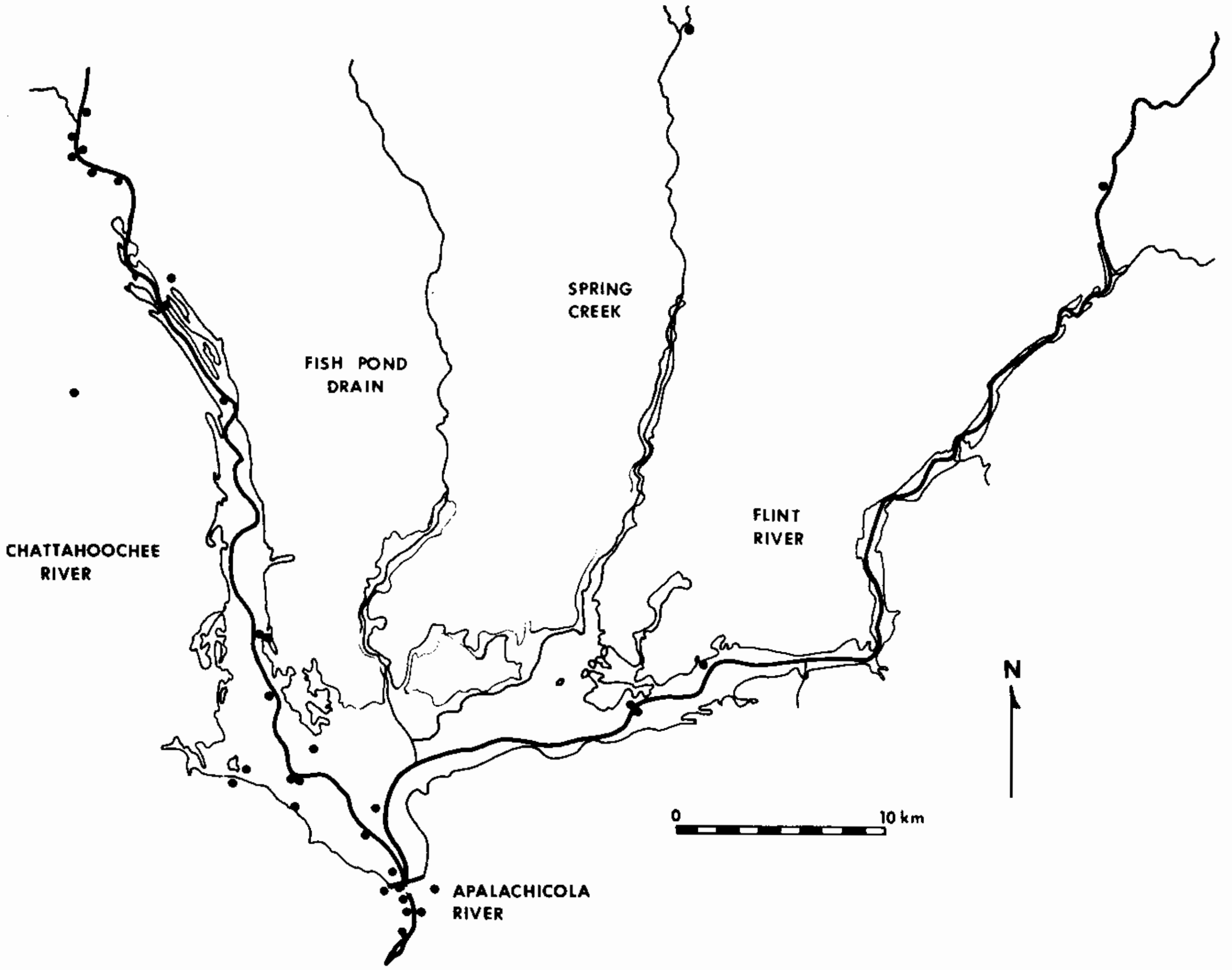

Figure 1. Fort Walton sites in the Lake Seminole area.

adult skeletons, some with pots, including "killed" Fort Walton Incised bowls and a frog effigy bowl. Two of these burials had shell ear pins and several were accompanied by chert tools placed on the chest or to the left of the skull. Also recovered were Wakulla Check Stamped and Lake Jackson Plain vessels, bone tools, greenstone celts, marine shell beads, conch shells, small triangular points, and chunky stones. Some of the long bones were pitted and showed other evidence of trauma. Several skulls had slight frontooccipital deformation.

From a historic aboriginal component in or near the mound charred corncobs and acorns were recovered from pits which were described as always being near a burial. One burial was of a juvenile accompanied by a faceted amber bead, glass beads, metal gun parts and a small, shell-tempered ceramic bowl. Lamar Plain and Complicated Stamped and a few Chattahoochee Brushed sherds from the surface may relate to this component, but most surface sherds are grit-tempered, plain-surfaced (Lake Jackson Plain rims), Wakulla Check Stamped, and Fort Walton Incised.

Excavations were conducted at the Curlee site in 1974, 1975, and 1978 by Case Western Reserve University and the Cleveland Museum of Natural History. By 1974 the mound was gone. In the village area to the north, a rich midden stratum 1m thick was exposed. Our excavation yielded post molds, 15-30cm in diameter and 2m apart, apparently the remains of a circular structure at least 12m in diameter which contained a hearth and a prepared floor of pale gray sand. North of this a portion of a wall trench was found. The black sandy midden contained burned bone, corn, Wakulla Check Stamped and Lake Jackson Plain ceramics, freshwater mollusc shell, and charcoal, a sample of which was radiocarbon dated to 760±50 years B.P.: A.D. 1190 (DIC 1048).

South of the destroyed mound over 20 concentrations of mollusc shell were mapped eroding out of the bank at regular intervals. These may represent refuse from individual households. Test units here revealed the same thick midden, including an underlying 5cm layer of greasy black soil containing large quantities of mollusc shell, deer bone, and predominantly plain and Wakulla Check Stamped ceramics. Charcoal from this midden layer yielded the curious age of 1550±85 years:A.D. 400 (DIC 1049).

In 1978, 1979, and 1980, archaeological surveys were conducted by the Cleveland Museum of Natural History for the Mobile District Corps of Engineers at Lake Seminole (the Jim Woodruff Reservoir) on the Chattahoochee and Flint, and at Andrews Lake (the Columbia Reservoir) on the Chattahoochee (Figs. 1 and 2). Data on the 72 Fort Walton sites located are still undergoing analysis (White 1979). Preliminary results demonstrate a pattern of heavy riverine orienta-

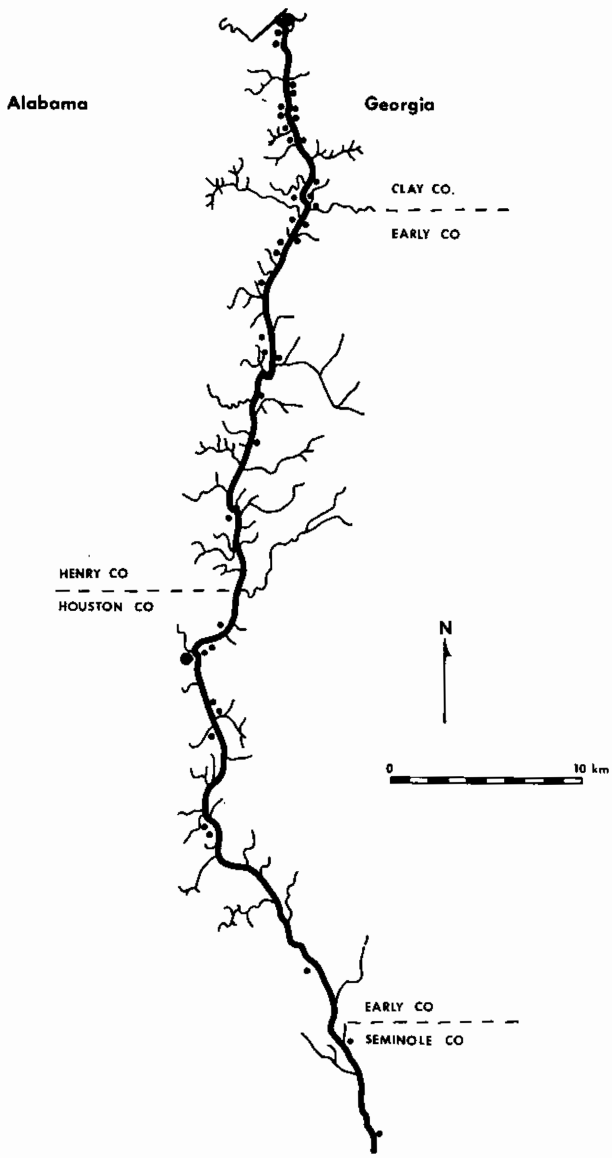

Figure 2. Fort Walton sites in the Andrews Lake area.

tion on the Chattahoochee and Apalachicola, with large mound-village complexes, large and small villages, and small camps. A few small sites were located on the Flint, and very few on smaller tributaries or over 1 km from the river.

Except in the northermost 13-16 km of the survey area, the Fort Walton assemblage usually includes a check stamped type within the range of variation of Wakulla Check Stamped (Willey 1949:437). The size of square checks ranges from 1.5 mm to 5.5 mm, with a mean of 3.5 mm. For the 10% of sherds with rectangular checks, the length increases proportionally to the width. Rims are similar to those of Weeden Island Plain. Over 50% of the sherds have a gritty paste similar to that of Lake Jackson Plain, but there is no correlation between paste and check size. Shell-tempered ceramics occur at most sites; these are always plain and never form more than 5% of the assemblage. Also common are plain sherds with a very fine sandy Weeden Island-type paste. Often the grit is a red quartzite, noted by Miller (n.d.) in Lake Jackson sherds, and also found in Wakulla Check Stamped, Fort Walton Incised, and Chattahoochee Brushed ceramics. Fort Walton Incised is found on most of the sites, but is less common at the northern end of the survey area.

The frequencies of Lamar Plain (Wauchope 1966: 66-87), identified by the notched applique rim strip, and especially Lamar Complicated Stamped decrease as one moves south. Willey includes within his definition of Lake Jackson Plain specimens with notched applique rim strips (1949:459), possibly reducing estimations of the presence of Lamar Plain. Furthermore, Lamar Complicated Stamped as defined is not easily distinguished from Jefferson Ware (cf. Willey 1949: 492 and Plate 60 with Wauchope 1966:79-81 and Figures 228-231). Neither Lamar Plain nor Lamar Complicated Stamped has yet been found in any early Fort Walton contexts.

Out of context, or with small sherds, Point Washington Incised (Willey 1949:463; Sears 1967:38-39; Schnell et al. 1979:21) is hard to distinguish from Lamar Bold Incised (Wauchope 1966:82-86) and Ocmulgee Fields Incised (Wauchope 1966:87-90). Also, relationships of these types with Abercrombie (Hurt 1975:61-66) and Alabama River (Sheldon 1974: 203) types are unclear. All of these types have scrolls, guilloches, and 3- or 4-line incisions below the vessel rim and all may be burnished. The latter two types may have a line of punctations on the vessel shoulder. Ocmulgee Fields Incised has finer, thin-line incisions while Lamar Bold Incised is "boldly" incised. The differences between "protohistoric" (Lamar) and "advanced protohistoric" (Ocmulgee Fields) is unclear in Georgia. In Florida, Point Washington Incised is both early in the Fort Walton sequence and protohistoric and historic. The three types can possibly be sorted by context but, recovered singly, such ceramic specimens are less diagnostic.

This discussion is an extreme simplification, comparing survey and excavation data with little time control. The types were first defined in areas peripheral to the Lower Chattahoochee and are more oriented toward the interior of the three states instead of this border zone. However, there is evidence for change in the Fort Walton assemblages from the Upper Apalachicola to the northern end of Andrews Lake. Lamar types decrease in frequency downriver, occurring on the lowest 40 km of the Chattahoochee only on very late sites.

In the Lower Chattahoochee Valley, the earliest development within the Fort Walton time frame is the Rood phase and then later, the Bull Creek phase (McMichael and Kellar 1960). However, neither of these is defined specifically enough to permit comparisons with Lamar or Fort Walton. On the southernmost portion of the Chattahoochee and on the Upper Apalachicola, early Fort Walton clearly emerges from the indigenous Weeden Island foundation (Brose and Percy 1978). Late Weeden Island sites dominated by Wakulla Check Stamped and plain-surfaced pottery and mollusc shell refuse are extremely common in all microenvironments. The Curlee site and many others contain these same materials together with Lake Jackson and Fort Walton Incised ceramics.

The evidence suggests an early Apalachicola tradition developing in situ, moving upriver to overlap or combine with a Lamar tradition moving downriver in protohistoric times or even in the early historic period. It is probable that early Mississippian groups in the entire region were participating in similar and interacting sociopolitical and economic-subsistence systems, utilizing the river not as a boundary or edge but as the center of a network. Finer discrimination of ethnic or local units awaits the recovery of better data on chronological and stratigraphic relationships.

Note:

Constraints on paper length did not permit the publication of the data on which this paper was based. Those who wish more details regarding ceramic distributions should write the author.

Louis D. Tesar

FORT WALTON AND LEON-JEFFERSON CULTURAL DEVELOPMENT IN THE TALLAHASSEE RED HILLS AREA OF FLORIDA: A BRIEF SUMMARY

This paper is a brief summary of a chronological sequence constructed utilizing data recovered during survey and test excavations in five selected locales in northern Leon County, Florida. The study area was occupied in historic times by the Apalachee who are associated with the Leon-Jefferson culture (H. G. Smith 1948b). The Leon-Jefferson culture of the missionized Apalachee has a clear developmental continuity with the earlier Fort Walton culture. It is suggested that the Apalachee, in response to both internal and external stimuli, evolved through four archaeologically recognizable phases: Early Apalachee Fort Walton; Late Apalachee Fort Walton; Early Leon-Jefferson; and Late Leon-Jefferson.

The de Soto expedition spent the winter of 1539-40 in Anaica Apalachee, the principal town of the Apalachee, and conducted raids in the surrounding territory. In 1633, when the Spanish established the Apalachee missions, noticeable changes had taken place in the culture of the Apalachee. I would argue that, while the Spanish incursion contributed to the rapidity of change in the late sixteenth and early seventeenth centuries, the local system had already undergone considerable change prior to de Soto's arrival and would probably have undergone most of the subsequent changes (except those represented in the last phase) whether or not the Spanish had come.

The four phases described in this paper are primarily defined in terms of changes in the ceramic inventory and settlement pattern. They are considered tentative, and much more research is required before a more definitive statement can be offered.

At the time of the survey, there were 125 Apalachee Fort Walton and 142 Leon-Jefferson sites recorded from the Leon County, Florida area. Of the Fort Walton sites, 47 could not be assigned to either the Early or Late phases, 29 had only Early phase artifacts, and 43 had only Late phase materials. Of the Leon-Jefferson sites, 61 belonged to the Early phase and 22 to the Late phase; the remainder could not be assigned.

There is a marked increase in the number of known sites between the late Weeden Island period and the Early Apalachee Fort Walton phase within the five survey locales (5 to 35 sites). This trend continues through the Late Apalachee Fort Walton and Early Leon-Jefferson phases. There is a marked decrease during the Late Leon-Jefferson phase; however, this decrease is misleading since 50 previously recorded Leon-Jefferson sites not yet identified to phase are located south of the survey locales in the area where Spanish Mission efforts concentrated. Population movements particularly in the later phases must be considered as a biasing factor in any population estimates for this period.

It is suggested that the Early Apalachee Fort Walton phase represents an invasion from the Apalachicola-Flint River drainage system. In addition to population pressures and a need for agricultural land, the cause of this invasion may relate to a need for exotic goods. The Apalachees' role in the Mississippian trade network centers on their control of the north central Gulf Coast shell industry east of the Apalachicola River. The importance of these activities is indicated by B. Calvin Jones's excavations at Mound 3 at Lake Jackson. Lake Jackson is believed to be among the earliest Fort Walton sites in the Leon County area, which is one explanation for its location near the western edge of the Apalachee territory (see Payne, this volume).

Current models generally depict the Early Apalachee Fort Walton settlement pattern as focusing on a single major, multimound ceremonial complex with smaller satellite centers—each with a single mound. Each of these centers was supported by associated villages and scattered farmsteads.

No mound complexes were visited during this survey. Furthermore, with the exception of a single multihectare quarry site, all of the Early Apalachee Fort Walton sites in the study group are small, generally covering 0.5ha or less, and presumably represent individual family farmsteads. They are all associated with Dothan-Orangeburg and Plummer-Rutlege soils, which are considered prime agricultural soils. Ridge crests and ridge projections are the most frequently occupied physiographic features. Nearly 80% of the sites are located around lakes or swamps and most are located within 100m of the associated water source and less than 6m above that resource.

Early Apalachee Fort Walton phase ceramic assemblages tend to be characterized primarily by cazuelas with broadly incised collars and by plain cazuelas with pinched or repeatedly noded rims and near rims (Style 1) (Jones & Penman 1972). Both single and double rim lugs (Styles 2 & 3) and loop handles (Style 4) also occur with some regularity on both plain and incised varieties. Styles 5, 6, 7 and 8 occur infrequently. Beakers are a minority ware. The Lake Jackson Plain and Incised types dominate, with

Fort Walton Incised and Cool Branch Incised being the most frequently represented minority wares. Punctated and brushed wares are infrequent. Vessel surfaces are generally smoothed or brushed, although temper occasionally protrudes through the surface. Temper generally consists of grog of 1-2 mm (or greater) diameter and a noted absence of sand.

Late Apalachee Fort Walton phase ceramics are characterized by a shift in temper to smaller grog and nearly equal amounts of fine grained sand, although the ratio of sand to grog is sometimes greater. The type Fort Walton Incised is less frequently represented than in the Early phase. Vessel surfaces are rougher and only cazuelas are (thus far) represented. There is also less variety in rim styles, except that Style 1, which is restricted to plain vessels, occurs in several subtypes. It is noted that the transition in the ceramic series occurred independently of the factors leading to the socio-political change hypothesized to mark the shift from the Early to Late phases.

It is hypothesized that the transition from the Early to Late Apalachee Fort Walton phase follows the climax of the Southern Cult in this area. It is characterized by the abandonment of the ceremonial mound sites and associated socio-political changes, and by a breakdown in the trade network. Both social stress and environmental factors are suggested reasons for this event.

The Late Apalachee Fort Walton phase settlement pattern is characterized by (1) an absence of sites with mounds; (2) occupation of a wider variety of soil types, although Dothan-Orangeburg and Plummer-Rutlege soils continue to be the most common types; and (3) location of sites at a greater elevation above and distance from the nearest water source. Actually, sites tend to cluster at two elevations during the Late phase. The lower elevation sites range from 1.5 to 11m above the nearest water source and continue the pattern of the Early phase, while the higher elevation sites range from 17-25m above the water source. These two sets of sites have one factor in common; both are associated with prime agricultural lands.

It is suggested that the trend toward occupying higher elevations may reflect defensive considerations in response to growing territorial pressures from more northerly groups. This trend continues into the later Leon-Jefferson phases and precedes the introduction of the complicated stamped Jefferson ware ceramic series into the area.

The Late Apalachee Fort Walton phase represents the Apalachee culture as it was when the Narvaez and de Soto expeditions passed through the area in the early 1500s. While the Narvaez expedition had little effect on the Apalachee, the later de Soto expedition coincides with changes in the culture leading to the Early Leon-Jefferson phase. The fact that neither expedition reported palisaded villages or temple mounds among the Apalachee, while they are reported for other groups, is viewed as supporting the Early to Late phase transition suggested above.

It is hypothesized that the period following the passage of the de Soto expedition in 1540 and prior to the Spanish mission effort in the early 1600s marks the transition from the Late Apalachee Fort Walton to Early Leon-Jefferson phase. It is suggested that the process of this change was already ongoing as a result of population pressures and movement in the Alabama and Georgia area, and that the de Soto expedition served to accelerate rather than precipitate this change. This hypothesis is based on the presumed stress the five month wintering of the de Soto expedition placed on the food resources of the Apalachee and the possibility that the Spanish infected the resident population with communicable diseases to which they had no immunity. These factors would have weakened them to a point where the northern groups could accelerate their southward expansion.

The settlement pattern for both the Early and Late Leon-Jefferson phases is essentially the same, and continues the trend toward ridgecrest and hilltop locations begun during the Late Apalachee Fort Walton phase. While 67% of the Early phase sites are situated on Dothan-Orangeburg soils, a wide range of other fine sandy loam soils suitable for agricultural purposes are also represented. Intensive agriculture, with maize, beans and squash as the dominant cultigens, is documented as the principal subsistence activity of the Apalachee. Soil exhaustion and firewood depletion are documented reasons for village movement and must be considered in population estimates. Village and farmstead sites tend to be equally located near ridge crests and hilltops, and pond and lake shorelines appear to be preferred water sources.

The socio-political system during the Early Leon-Jefferson phase was apparently based on a confederacy of relatively independent villages. While the chief of one village had more authority than the others, this authority was clearly not absolute.

The Early Leon-Jefferson phase ceramic complex is distinguished from that of the Late Apalachee Fort Walton phase primarily by the addition of the Late Lamar Complicated Stamped series from the Flint River drainage area. This is the type described by Hale G. Smith as Jefferson ware. The transition from grog to sand temper continues, and vessel forms reflect Late Lamar influence.

It was during the Early Leon-Jefferson phase that the Apalachee apparently began their southward retreat before their northern and western neighbors—the Apalachicolo, Yuchi or Chisca, and others. It is also to this phase which the Spanish refer during the 1600s when they comment on the "old wa," or discuss the culture of the pagan (non-Christianized) Apalachee.

The Late Leon-Jefferson phase in this paper is essentially the same as the Spanish Mission period Leon-Jefferson culture described by Hale G. Smith some 35 years ago. In its application it is here restricted to the Apalachee whose culture was modified by the Spanish during the latter half of the 1600s. Ethnographic descriptions note the Spanish effort to "reduce" the Apalachee to Christianity and their use as a peasant labor force. Burial customs, dress, and other changes are well documented. However, the changes in the ceramic inventory are the most readily identifiable phase indicators in archaeological contexts.

The Late Leon-Jefferson ceramic complex is essentially the same as that of the Early phase, except for the addition of ceramic traits reflecting direct Spanish influence. Plates and annular rings, along with other changes in form, in imitation of Spanish majolica make their appearance. The temper of such ware consists of fine grained grog and sand, and the ware appears to be fired at higher temperatures. The wares are frequently found in association with Spanish majolica, olive jars and peasant ware. However, it is noted that the latter are only rarely encountered in purely native contexts, and are nearly always associated with Spanish mission and ranchero sites. Indeed, it may be that the items manufactured in imitation of Spanish ceramics were for Spanish usage, and should not be interpreted as indicating native adoption of such ware and associated usage. Also, because of the Spanish policy of resettling northern and western refugee groups near the mission of San Luis in western Leon County, ceramic wares of these peoples make their appearance in archaeological contexts.

As noted earlier the above presentation is tentative and much more research needs to be conducted. The current sample size is small. Furthermore, few multi-component Apalachee Fort Walton or Leon–Jefferson sites have been excavated, and such excavation as has occurred consists of limited testing in which only a partial stratigraphic sample was obtained. Yet, it does have some merit and is worthy of further testing.

Claudine Payne

A PRELIMINARY INVESTIGATION OF FORT WALTON SETTLEMENT PATTERNS IN THE TALLAHASSEE RED HILLS

The region centered around present-day Tallahassee seems to form a discrete unit within the wider area occupied by Fort Walton sites. This paper describes the settlement patterns of this particular area and raises a number of questions about site distribution there.

Using the criterion of density of sites to define the area, the limits of the territory become the Aucilla and Ochlockonee Rivers and the Cody Scarp (however, the existence of about thirty Fort Walton sites south of the scarp should be noted).

The mound centers in this territory appear to fall into two groups (Fig. 1). In this paper, I will deal primarily with the better-known western group, the Lake Jackson system. The eastern or Lake Miccosukee system is considered briefly in the concluding remarks.

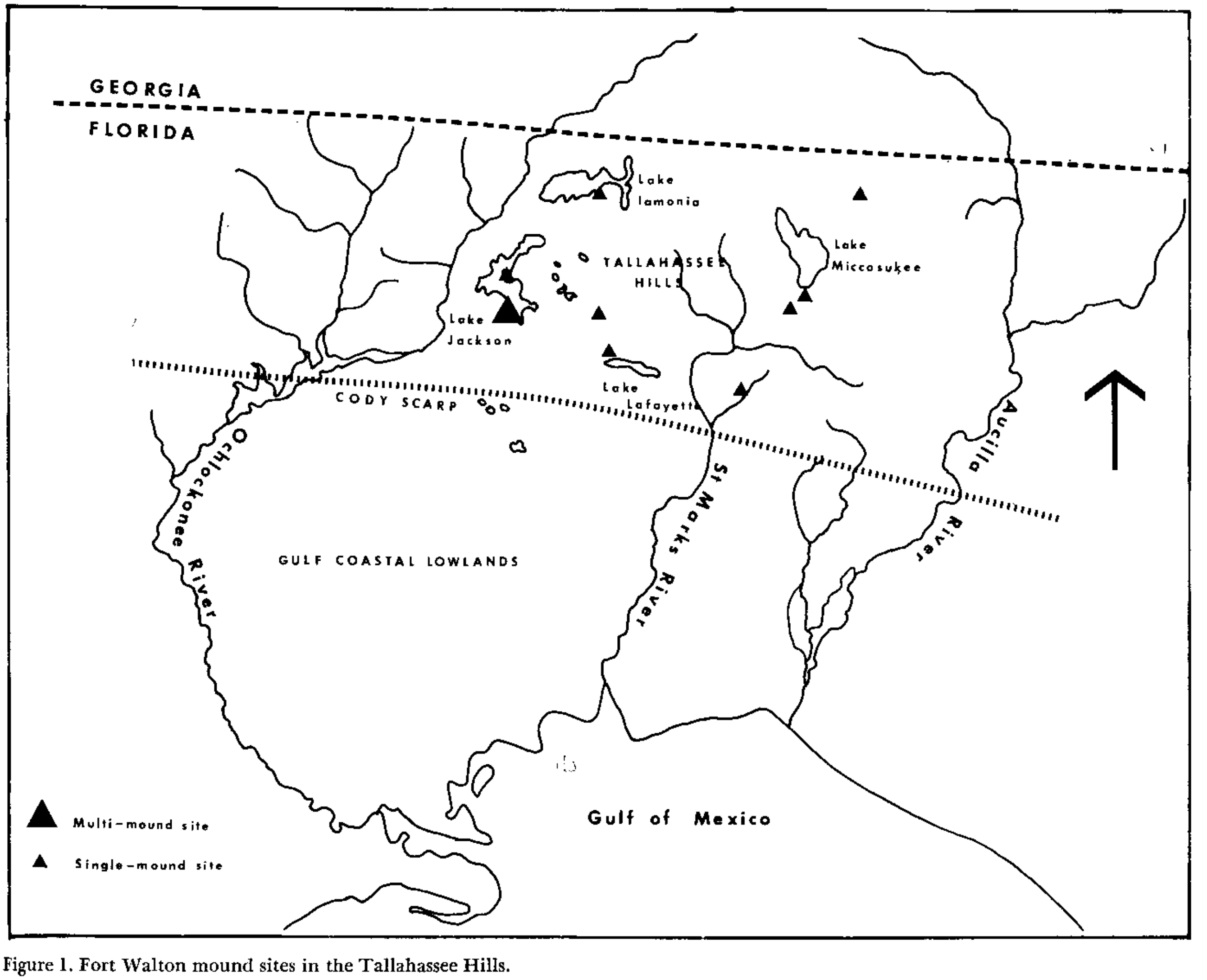

Figure 1. Fort Walton mound sites in the Tallahassee Hills.

The Lake Jackson system contains three types of sites: a multi-mound center; single pyramidal mounds; and farmsteads or hamlets. The Lake Jackson site is the largest in the system and is, in fact, the only multi-mound center in the entire area. There are four single-mound sites in the system. They appear to be surrounded by farmsteads, but this must be checked by further excavation.

In a 1978 paper, Steponaitis presented a center of gravity model for use in studying chiefdoms. As will be seen later, this model raises a number of questions when applied to the Lake Jackson system. (It must be noted that the model deals only with the top levels of the site distribution hierarchy; the numerous farmsteads or hamlets are not considered here.)

The first aspect of the model is that (since they are essentially administrative units) there is little competition between centers of a single chiefdom and consequently, there is no factor favoring equidistant spacing of centers. Therefore, chiefly centers should show a lack of regular spacing. The Lake Jackson system exhibits this irregularity in mild degree (Fig. 1 and Table 1). The distance between adjoining centers varies from 2.9 miles to 8.9 miles.

The second aspect of the model depends on the degree of political centralization in the system. When this is high (as it seems to be at Lake Jackson), the location of the capital is determined by the minor centers in its sphere of influence rather than by population of its own support area. An approximation of the optimal location of the capital can be made by calculating the center of gravity of the minor centers. This is compared to the location of the capital to obtain an index of spatial efficiency (Steponaitis 1978: 428-436). When the index equals 1.0 the location of the capital is ideal. As the efficiency of the capital decreases, the index decreases. The index of spatial efficiency for the Lake Jackson site is .47. The inefficiency of this site can be seen even more clearly when compared to the minor centers. Two of the centers (Velda and Rollins) have higher indices than Lake Jackson (see Fig. 2). However, none of the sites has a very high index. Even the location of Velda, the most efficient site, is not particularly efficient for this system.

Finally, in what Steponaitis calls a "departure from the model", he suggests that the secondary centers closest to the capital would supply a greater amount of tribute and corvee labor, leaving these centers with less labor available for their own public works (e.g., mound building). The secondary centers closest to the capital would then have proportionately smaller mounds than the more distant centers. Table 2 presents estimated volumes of the mounds of the four secondary centers. According to the model, the estimated volume of the mounds ought to increase with distance. This is borne out to some degree. However, the most distant site, Lake Iamonia, which ought to

Table 1. Distances between adjoining mound centers.

Sites	Distances (in miles)
Lake Jackson-Rollins	3.0
Lake Jackson-Velda	5.6
Lake Jackson-Lake Lafayette	6.85
Lake Lafayette-Velda	2.9
Velda-Rollins	7.05
Rollins-Lake Iamonia	8.9
Lake Iamonia-Velda	8.7

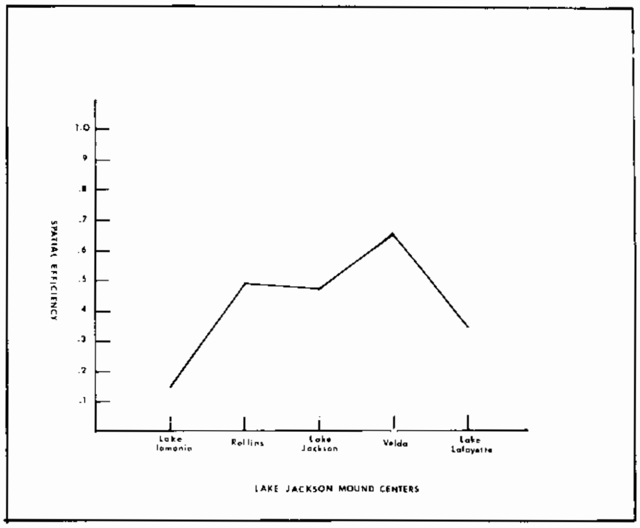

Figure 2. Spatial efficiency of Lake Jackson mound centers.

Table 2. Sizes of mounds at secondary mound centers.

Site	Distance from Lake Jackson (in miles)	Dimensions (in meters)	Est. Volume (in cubic meters)
Rollins	3.0	27 x 25 x 2	1350
Velda	5.6	42 x 25 x 2	2100
Lake Lafayette	6.85	36 x 36 x 4.5	5832
Lake Iamonia	10.65	—	2700

have a greater volume than the others has a relatively low estimated volume.

The Lake Jackson system does fit the center of gravity model in some respects, although never with a high degree of congruity. But it fails in one important detail—the spatial efficiency of the capital. Explanations for this failure fall into two categories. First, as Steponaitis notes (1978:449), there may be factors other than sociopolitical ones involved in the location of chiefly centers. Warfare, for example, might explain the location of the capital at the far western limits of the territory. However, the Lake Jackson system displays no signs of warfare. The capital and secondary centers show no evidence of fortification and the farmsteads are scattered across the countryside in one and two house units (Tesar, this volume). Spanish chroniclers described the area as peaceful, with fields and houses on either side of well-marked roads; the few towns were unfortified (Varner and Varner 1951:182; Tesar 1979).

Location on a trade route might also account for an otherwise inefficient location. The Lake Jackson site is, in fact, not far from the Ochlockonee River, a possible link with the coastal areas. However, the DeSoto accounts stress the multiplicity of good roads in the area and the Spanish, when traveling to the Gulf of Mexico, marched overland along a well-used road (Varner and Varner 1951:187). No mention is made of a river route.

Finally, "locational inertia" is a possible explanation. The location of the capital might remain unchanged even if its sphere of influence expands so that its location is no longer efficient. This explanation could be suggested if the capital proves to be considerably earlier than the secondary centers. In the case of Lake Jackson, this should be considered. According to Tesar (this volume) Lake Jackson is one of the earlier sites in the area. Later the Spanish explorers imply that the capital of Apalachee was located closer to the center of the territory; the Lake Jackson site apparently having fallen into disuse. Tesar (1979: 71), in a discussion of the route of DeSoto's army and the location of Anhayca, the Apalachee capital, suggests central Leon County as a probable location, a more efficient location than Lake Jackson.

The failure of the model could also be accounted for if data about the area are inadequate. For example, the system may not be defined properly. I have considered only the western mound group of this area. Historical accounts describe this region as one territory (Swanton 1922, 1946; Varner and Varner 1951; Smith 1968; Tesar 1979), which resembles the area considered in this paper. Swanton's (1922) definition of Apalachee territory was exactly that region between the Aucilla and Ochlockonee Rivers, although apparently the region southward to the Gulf of Mexico was also considered part of Apalachee. What happens, then, if we include the Jefferson County mounds and treat the whole area as one system? The index of spatial efficiency for Lake Jackson as the capital of the whole area is .35; lower than its index of .47 as capital of the western group only.

At this point, it is worth describing the Lake Miccosukee system. Three of the mounds are similar in nature to the single-mound sites to the west. The other site, Letchworth, is unlike any of the others in the region. The Letchworth Mound is 46 feet high, ten feet higher than the principal mound at Lake Jackson and, although it is pyramid-shaped, it has four flanges or lobes. The size of the Letchworth Mound compared to the other mounds of the eastern group suggests its position as capital of the Lake Miccosukee system. Interestingly enough, the index of spatial efficiency of Letchworth as capital of the system is an extremely high .97. This suggests that two systems operated in this area prior to historic times. By the time of contact, however, the region had become consolidated and the capital apparently moved (see above), possibly to a more central region located between the two former systems (Tesar 1979:71).

Another problem in applying the model is the possibility that all mound centers have not been found. In fact, several other mounds are rumored to exist. A thorough study of Fort Walton settlement patterns in this area must include the identification of these sites. Insofar as the spatial efficiency model is concerned, the locations of these sites (if they are Fort Walton) emphasize, as does the inclusion of the Lake Miccosukee system, the inefficiency of Lake Jackson as the capital.

There may also have been a Fort Walton mound at the mouth of the Ochlockonee River (Willey 1949: 288-289). The location of this site calls into question the exclusion of the area south of the Cody Scarp. The relationship of this mound (and the Fort Walton sites scattered thinly across the Gulf Coastal Lowlands) to the Tallahassee Hills region is unclear.

It is apparent that more work is necessary before the questions raised in this paper can be answered. The following suggestions are areas where further work would be profitable. First, all mound centers in the area should be identified. This includes the gathering of further data on the known mounds as well as identification of unrecorded mounds. The Lake Miccosukee system warrants more intensive investigation. A more exact chronological placement of the mound centers and the outlying farmsteads would be helpful. Tesar (1979) has begun this task, but it needs to be extended to areas not covered by his survey. Additionally, exploration in the area Tesar (1979) suggests as the location of Anhayca would be useful in studies of the later Fort Walton settlement patterns. Finally, a study of the Fort Walton sites south of the Cody Scarp might clarify the relationship of these sites to those in the Tallahassee Hills and provide us with a better definition of the area.

John F. Scarry

SUBSISTENCE COSTS AND INFORMATION: A MODEL OF FORT WALTON DEVELOPMENT

If we define Fort Walton culture as a generalized adaptation and stress its subsistence economy and social organization as defining characteristics (J. Scarry, this volume), any model which seeks to explain Fort Walton development must address these factors. The model presented here seeks to explain the replacement of Woodland culture by the Mississippian Fort Walton by (1) identifying the selective advantages of the Fort Walton subsistence procurement and organizational strategies; (2) identifying changes which affected the relative adaptive value of the Woodland and Fort Walton strategies; and (3) showing how those changes affected the relative value of the two strategies. This latter portion of the model is based on two more general models of culture change—Johnson's information model of organizational change (1978) and Earle's cost model of subsistence change (1980).

The General Model

The selective advantage of intensive maize agriculture is that, while its labor input (cost) requirements are high, it can provide increased yields (cf. Ford 1974, 1977). Strategies which exploit natural populations have much lower initial costs but do not have the ability to supply greatly increased yields. Two factors, however, work to reduce the selective advantage of an intensive agriculture strategy: cost (Hastorf 1980) and agricultural risk (Chmurney 1973; Ford 1974, 1977).

I suggest that the relative selective advantages of the Woodland and Fort Walton subsistence strategies were controlled by two factors: yield required by the system and the cost of obtaining that yield. Intensive agriculture would not have been adopted unless the yield required by the system balanced the labor input required to produce that yield. Change in subsistence procurement strategies in the Fort Walton area could have resulted from (1) change in the yield required by societies or (2) changes in the cost curves of specific resources (cf. Earle 1980).

The hierarchical organization of the Fort Walton systems also had selective advantages partially offset by costs. If the benefits of hierarchical organization are examined (cf. Rappaport 1971:66; Peebles and Kus 1977:430), it is evident that they largely relate to the processing of information. In fact, it can be suggested that the selective advantage of hierarchical social organizations lies in their ability to process information and make decisions efficiently. However, for such an organization to be successful, the benefits it provides to the system must outweigh the increased cost of maintaining the hierarchy (Peebles and Kus 1977).

Organizational change is controlled by the relationship between the support costs and the reduction in information-processing costs accomplished by the organization (Johnson 1978). Where relatively small amounts of information must be processed, hierarchies are not advantageous because of their high maintenance costs. For a hierarchy to become advantageous, there must be an increase in the amount or complexity of information to be processed. In order to explain the appearance of hierarchical social organizations, like the Fort Walton systems, we must seek the sources of information increase which made these organizations effective. Five potential sources can be suggested for Fort Walton: (1) population increase; (2) population aggregation into (a) circumscribed habitats and/or (b) nucleated settlements; (3) intensification of maize agriculture; (4) intersocietal conflict; and (5) intersocietal exchange. I would argue that the development of individual Fort Walton systems was probably initiated by different combinations of these factors. However, the basic cause of organizational change was, in all cases, an increase in information.

The Development of Fort Walton Culture in the Apalachicola Valley: Application of the Cost/Information Model

Fort Walton in the Apalachicola River Valley appears to have evolved from an indigenous Weeden Island base (Percy and Brose 1974; Brose et al. 1976; Brose and Percy 1978; Scarry 1980a, 1980b). The subsistence economies of early Weeden Island systems were based on the hunting and gathering of wild resources; there is evidence for maize but no indications that it played a significant role in the diet. The systems were egalitarian organizations with no evidence of ascriptive ranking.

During the last portion of the Weeden Island period there is evidence of a significant population increase (Percy and Brose 1974) which had profound effects on the Weeden Island system in the Apalachicola Valley. As population grew, the demand for subsistence products increased and costs rose to the point where exploitation of marginally productive areas became cost effective. This point was reached at about A.D. 800 in the Wakulla phase (Scarry 1979, 1980a). Like earlier Weeden Island systems, the Wakulla phase had a hunting-gathering subsistence system which exploited the same spectrum of resources as did the earlier systems. The subsistence system of the Wakulla phase did differ from earlier ones in the environmental zones which were exploited. During the Wakulla phase, the less productive uplands east of the Apalachicola River were extensively exploited. The Wakulla phase was an egalitarian system, possibly tribal in nature (cf. Brose and Percy 1978) and its settlement patterning reflected this egalitarian organization. There were many more sites than there were in earlier Weeden Island phases and they occurred in previously unexploited environments, but they did not differ appreciably from earlier settlements in other ways.

The adaptation of the Wakulla phase, particularly its subsistence procurement and demographic aspects, was a response to population growth. However, it failed as an adaptation because it did not return the system to a state of equilibrium. The costs of subsistence procurement continued to rise and eventually reached a level equivalent to the initial costs of intensive maize agriculture. Once this level was reached, subsequent cost increases resulted in the intensification of agricultural efforts. Agricultural intensification in turn constituted a pressure on the population to aggregate onto the levees along the Apalachicola River.

This stage in the evolution of Fort Walton culture appears to be represented by the Chattahoochee Landing phase (Scarry 1979, 1980a). The adaptation of the Chattahoochee Landing phase evolved as a response to increasing costs of subsistence procurement. It was, in the long run, an unsuccessful response because of the inadequacies of its egalitarian organizational strategy.

The ultimate failure of egalitarian organization in the Apalachicola Valley and its replacement by a hierarchical organization can be attributed to increases in the number and variety of information sources which had to be integrated. Three sources of this increase can be discerned in the archaeological record: (1) aggregation of the population into the bottomlands; (2) intensification of maize agriculture; and (3) increased interaction with other social systems.

As Peebles and Kus note:

> If a cultural system is operating at or near its capacity to process information, and the inputs of critical information from one area of the environment increase beyond the system's capacity to process these inputs, then either: (1) inputs from other areas of the environment will have to be (a) filtered and ignored or (b) buffered for action at a later date; (2) channel capacity will have to be increased either (a) through a change in organization or (b) through a change in the mechanism of information processing; or (3) system overload will take place and homeostasis will cease (1977:429).

In the evolution of Fort Walton culture in the Apalachicola Valley, this point was reached in the Chattahoochee Landing phase. The benefits of information processing cost reductions were sufficient to overcome resistance to vertical specialization (cf. Johnson 1978) and the Chattahoochee Landing phase was succeeded by ranked, fully Mississippian Fort Walton phases such as the Cayson, Sneads, and Yon phases (cf. Scarry 1980a).

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Brian J. Duhe

A STUDY OF PREHISTORIC COLES CREEK—PLAQUEMINE CULTURAL AND TECHNOLOGICAL ADAPTATIONS IN THE UPPER BARATARIA BASIN

By studying the ecology of subsistence within an ecological matrix, some of the functional relationships which couple and regulate man-environment interchanges may be identified and measured. This study attempts to assess, in part, these relationships through the examination of archaeological and geological data derived from the Barataria Basin of southern Louisiana.

Ecosystems such as the Barataria Basin are so complex that only subsystems or particular relationships may be examined with any hope of comprehension. The concern of this study is a single Mississippi River crevasse and an associated archaeological site in St. James Parish, Louisiana. The ecological relationships described are but a small set of those extant in the total Barataria ecosystem (Fig. 1).

Crevasses

A crevasse is a scaled-down version of a delta lobe (Fig. 2) both in size and time.

A crevasse can simply be defined as a break in a levee or stream embankment. The break usually occurs on the cut-bank side of a bend in the river channel (Fig. 3) and during river flood stage, which along the Lower Mississippi normally occurs during the months of April-May, when there is a flow gradient across the levee. A study of modern crevasses by Saucier (1963) from 1849 to 1927 along the Mississippi River revealed that the average crevasse during this period breached the artificial levee for a distance of 500 to 1,000 feet, scoured to a depth of about 12 feet and discharged at an average maximum velocity of about 65,000 cubic feet per second (c.f.s.). Gradient advantage over the main channel is at a maximum during the early constructional phase of growth, thus allowing extremely rapid land formation and natural levee development. It is during this period that the crevasse environment becomes habitable by prehistoric peoples (Fig. 2B). As the original channels prograde, they bifurcate often, producing an increasing network of channels. Some channels remain active through much of the crevasse's life, but most are plugged with sediment at their heads after a short period of activity and are abandoned (Fig. 2C) and left as sloughs or elongated ponds or small lakes. Subsidence of the natural levees and interlevee areas by compaction of underlying unconsolidated clays result in rapid enlargement of sloughs and ponds within the crevasse system (Fig. 2D).

The life span of a prehistoric crevasse is a matter of conjecture; however, data from prehistoric Indian habitation sites, such as the Shellhill Plantation site, 16SJ2, the subject of this study, located on the natural levee of a crevasse distributary, suggests that they may have functioned for a considerable period.

Archaeological evidence based on excavations at the site, ceramic analysis and C-14 dates indicate that the Shellhill Plantation site was occupied as early as 765 A.D. (1185±70 B.P.) and as late as 1720 A.D. (230±60 B.P.).

By its location, the inhabitants of the Shellhill Plantation site had access to several environmental units: the riverine-crevasse system itself, the surrounding plaudal-freshwater swamp, the lacustrine environment and the fresh marsh environment. Brackish marsh areas were also within walking distance of the site.

A crevasse system is a highly productive biological system. As the crevasse discharges less and less water

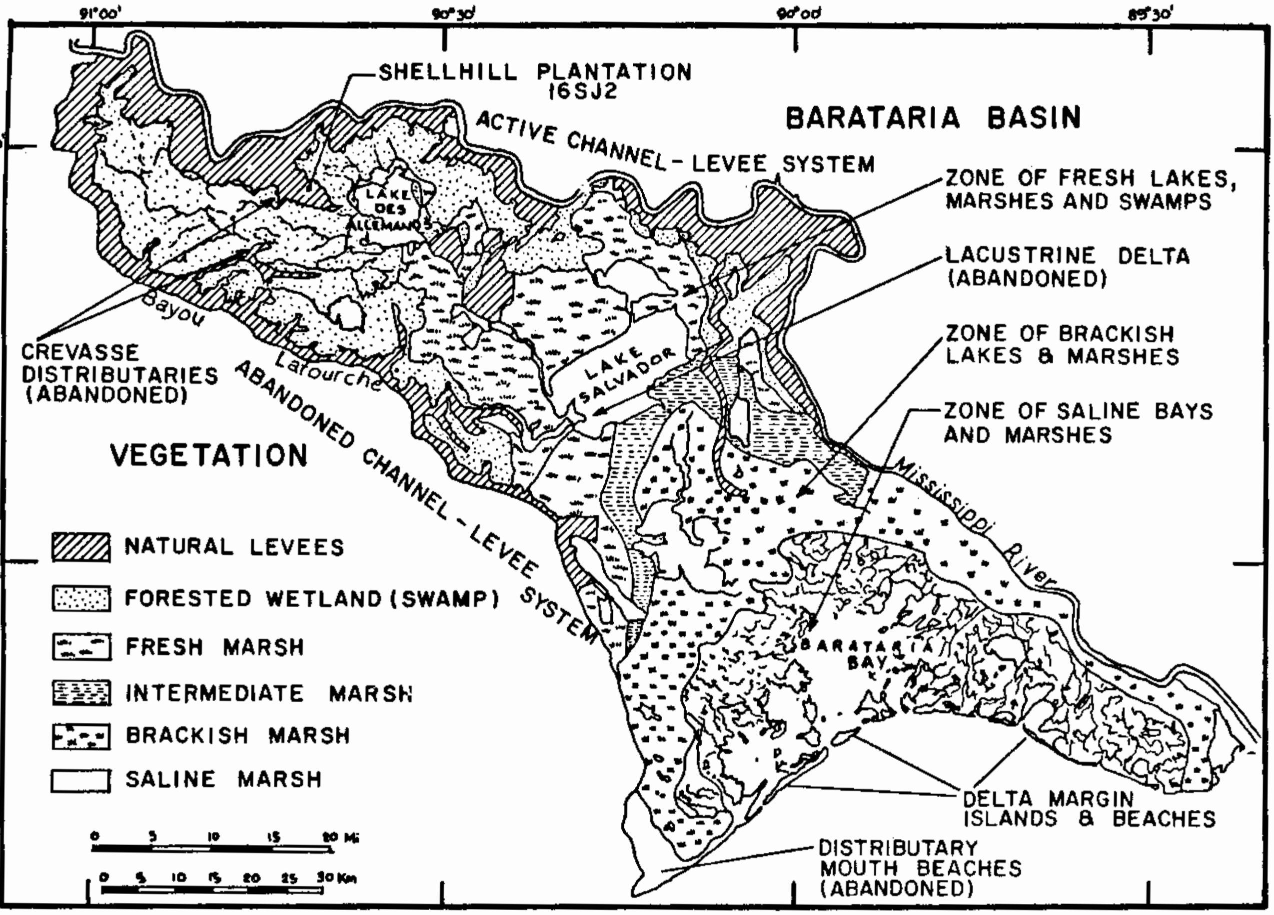

Figure 1. Environmental Units: Barataria Basin (After R. Chabrick, J. T. Joanen, and Q. W. Palmisano. 1968. Photographs 1974)

through the distributary channels, erosion and subsidence become increasingly more important in the crevasse area. As more land is lost, the interface length becomes longer owing to the formation of small ponds and meandering crevasse channels. Since total biotic productivity is a function of both interface length (related to the "edge effect") and total land area, total

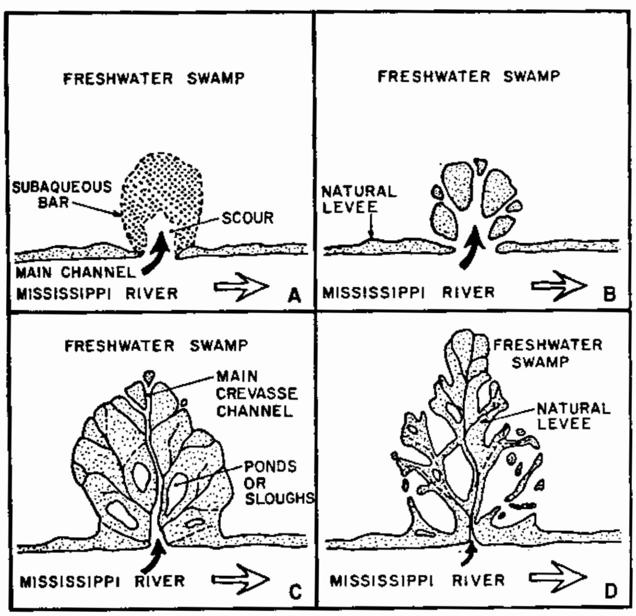

Figure 2. Generalized History of the Crevasse Cycle: (A) The Initial Crevasse; (B) Constructional (Rapid Growth) Phase; (C) Abandonment (Stable) Phase; (D) Destructional (Rapid Deterioration) Phase.

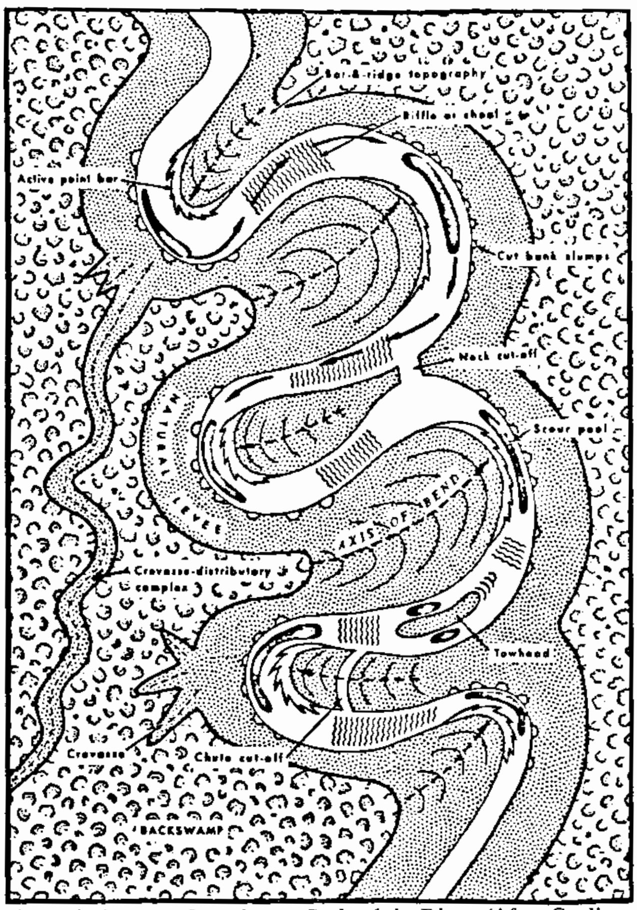

Figure 3. Crevasse Occuring at Cutbank in River (After Gagliano and van Beek 1970:Fig. 31)

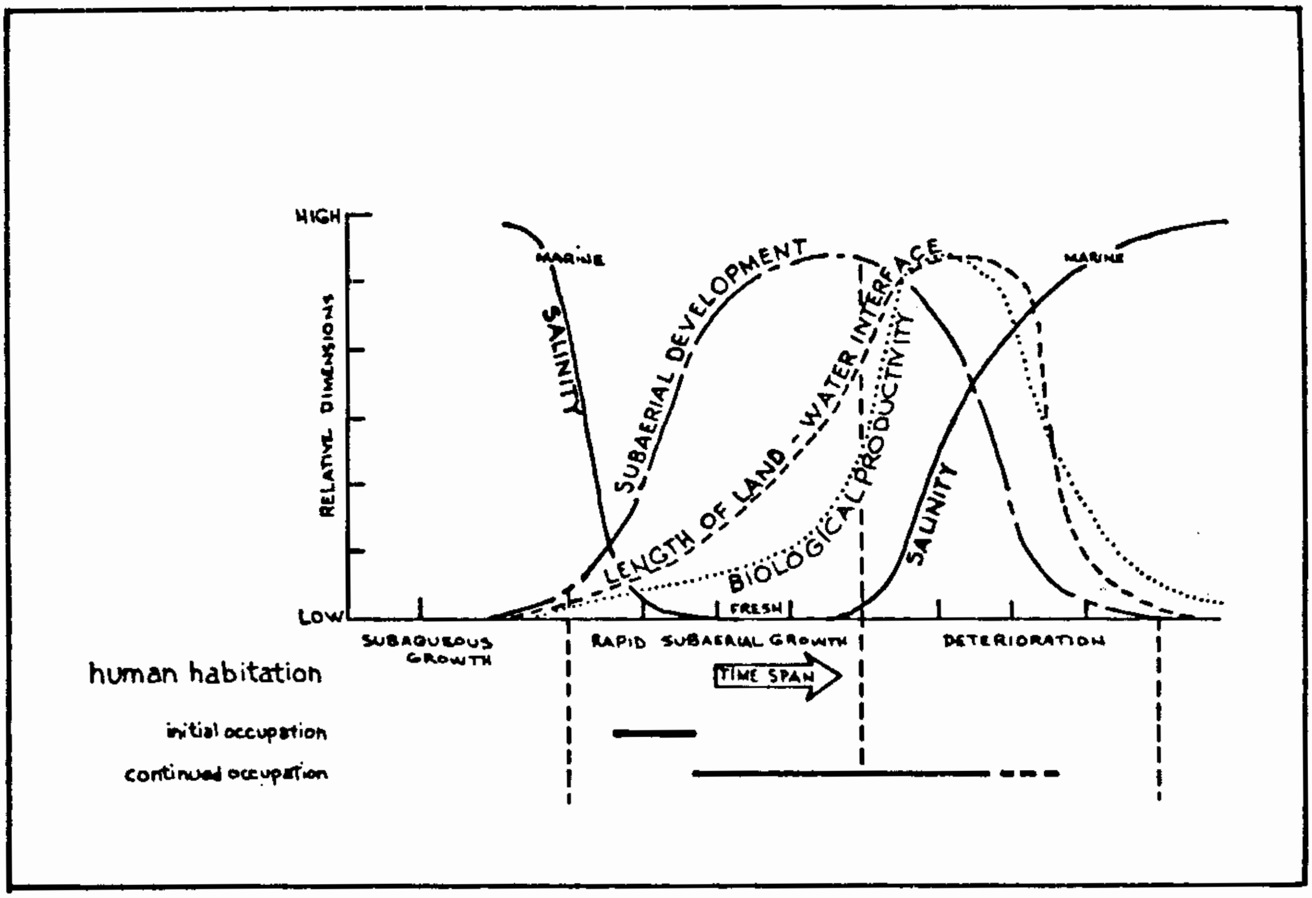

Figure 4. Human Habitation and Biological Productivity as a Function of the Delta Cycle. (After Coastal Environments, Inc., 1977: vol. 1, p. 182)

biological productivity of the area reaches a maximum during the abandonment and deterioration phases of the crevasse system when the interface between land and water is greatest (Fig. 4).

Viosca (1938) and Gunther (1953) observed independently that following the Bonne Carre spillway opening, which is in effect a man-made crevasse above New Orleans, there seemed to be a greater production of shrimp, oysters, crabs and fish in the years following the flood, even if the flood killed off some of the marine organisms initially. We can assume that during prehistoric times, great influxes of fresh water entered the crevasse system in which the Shellhill Plantation is located and apparently stimulated an increase in the crevasse-associated resources in the following years. Because these resources were situated in close proximity to each other (terrestrial and aquatic) in the crevasse system, they could have been (and probably were, based on preliminary evidence from Shellhill) exploited from a single settlement, and seasonal changes in residence would not have been necessary in such a self-maintaining ecological system like the crevasse.

Based on preliminary analysis, most of the meat proteins for the inhabitants of Shellhill Plantation during the Coles Creek—Plaquemine occupations were provided by fish, reptiles, amphibians, and mollusks; these being supplemented with an occasional land manmmal, wild plant edibles and some cultivated plants. It is apparent that the flooded areas could have been used as an aquatic ecosystem by numerous species of fish, amphibians and reptiles.

Ponding of the flooded areas in depressions during low water stage also provided the necessary aquatic habitat to sustain fish populations during dewatering periods. During this period the captured fish population in these ponded areas could have been and probably were mass harvested with nets and traps, or even by hand, by the pre-historic population.

Gregory (1965) noted that he observed some people gather rough fish in sloughs and swales after river overflow with just their bare hands, stating that two men could gather 2000-3000 pounds of fish in a half day. During the summer months when these small lakes, sloughs and ponds gradually evaporated, extensive mud flats would have been created. These mud flats would have provided an ideal habitat for local seed-bearing plants such as Chenopodium, Polygonum, Iva, Amaranthus spp., Smartweed, Lambsquarter, and Marsh elder. These ponds and sloughs were also excellent habitat for such wild edibles as delta duck potato and cattail. In contrast, during high water or flood stage the crevasse system could have also supported certain species of fish which migrated seasonally in the Mississippi River such as the anadromous shad. The prehistoric inhabitants of the coastal areas certainly had the technology necessary to exploit these aquatic resources (Rostlund 1952, Duhe 1976).

Finally it should be pointed out that this basic subsistence system was not unique to Coles Creek—Plaquemine peoples in coastal Louisiana. This same type of subsistence system was present during Tchefuncte times as illustrated at the Morton Shell Mound (Byrd 1974) and possibly even earlier (Gibson 1978). Gibson believes that prehistoric coastal dwellers probably maintained a subsistence tradition established during the Archaic Stage and sees the later cultural periods as a long and relatively homogenous Archaic technological and economic stage, a stage which in later phases saw ceramic styles interfacing in various ways and in various contexts with economic, social and political systems. There is currently sufficient evidence that coastal Coles Creek–Plaquemine culture as manifested archaeologically at the Shellhill plantation site does not fit and lies outside the mainstream of the commonly accepted model of an agriculturally based Coles Creek–Plaquemine culture. Not that the Coles Creek–Plaquemine cultures in the Upper Barataria Basin were any less successful in providing a livelihood, but as Gibson (1978) states, it simply was not integrated on the same level, nor did it apparently embody the same social, political, or economic institutions manifested by inland Coles Creek–Plaquemine groups.

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Richard A. Weinstein

MEANDERING RIVERS AND SHIFTING VILLAGES: A PREHISTORIC SETTLEMENT MODEL IN THE UPPER STEELE BAYOU BASIN, MISSISSIPPI

Although archaeological sites on natural levees of active and abandoned rivers and bayous are plentiful in the Lower Mississippi Valley, there have been relatively few endeavors designed specifically to study the relationship between such sites and the streams along which they can be found. This is particularly true of those sites situated along the banks of abandoned oxbow or cutoff lakes throughout the Lower Valley.

Could, for example, one identify specific factors within a lake's varying biotic zones which would have influenced the rapidity or intensity of prehistoric settlement along its banks? Could such factors be identified in the archaeological record? Could a time scale, whether relative or specific, be established for site occupation on an oxbow lake? These questions, and several additional ones, were asked of the data obtained from a cultural resources survey of the Upper Steele Bayou Basin performed for the Vicksburg District, U.S. Army Corps of Engineers. The original survey report has appeared as Weinstein et al. 1979. This paper is excerpted from portions of that study.

Time-Space Setting

The Upper Steele Bayou Basin is located in the western portion of the much larger Yazoo Basin in west-central Mississippi. Although several smaller rivers and bayous at one time flowed, or are presently flowing, through the region, it is the Mississippi River with which this paper is concerned. Specifically, it is the Modern Mississippi Meander belt, dated to between 2500 years ago and the present (Saucier 1974:Fig. 3). Steele Bayou and its tributaries occupy various abandoned channels and filled cutoff or oxbow lakes within the region. These modern streams are often underfit courses confined within the older natural levees of the Mississippi. Prehistoric sites are situated both along the older, larger Misissippi levee crests and adjacent to the younger underfit streams within the relict Mississippi channels. Sites on the actual Mississippi levees are believed to have developed after the river had abandoned the area and the channel had become an oxbow lake. Sites within the old channel, on the smaller streams, are thought to have formed after the oxbow lake had begun to fill or had filled to a large degree. These sites, therefore, would have been situated along a small watercourse surrounded by swamp and small lakes.

Because a wealth of data is available on cultures and phases in the Yazoo Basin, particularly after the work of Phillips (1970), the present study took advantage of the refined situation and organized its site information around the various culture periods and phases known for the region. Figure 1 is a revised version of the culture-history chart supplied by Phillips (1970). New phases identified by Brain (1969, 1971) and Toth (1977) have been added.

Intraoxbow Settlement Shifts

During the course of the original Steele Bayou survey (Weinstein et al. 1979), several models were developed concerning settlement shifts along individual oxbow lakes and between various oxbow lakes.

STAGE	PERIOD	CULTURE	DATE	PHASES
MODERN	LATE HISTORIC	AFRO-EUROPEAN	PRESENT	AMERICAN
FORMATIVE	EARLY HISTORIC	VARIOUS CULTURES	1800 A.D.	RUSSELL/COLONIAL
	MISSISSIPPI	NATCHEZAN	1700 A.D.	DEER CREEK/LAKE GEORGE/WASP LAKE
		MISSISSIPPIAN	1400 A.D.	MAYERSVILLE/WINTERVILLE
		PLAQUEMINE	1200 A.D.	CRIPPEN POINT
			1000 A.D.	KINGS CROSSING
	COLES CREEK	COLES CREEK	850 A.D.	ADEN
			700 A.D.	BAYLAND
	BAYTOWN	BAYTOWN	550 A.D.	DEASONVILLE
			400 A.D.	PORTER BAYOU/ISSAQUENA
	MARKSVILLE	HOPEWELLIAN-MARKSVILLE	200 A.D.	KIRK/DORR/ANDERSON LANDING
	TCHULA	TCHEFUNCTE	1 A.D.	TUSCOLA
	POVERTY POINT	POVERTY POINT	500 B.C.	JAKETOWN
ARCHAIC	LATE ARCHAIC	ARCHAIC	1500 B.C.	OLD BASIN
	MIDDLE ARCHAIC		3000 B.C.	STILL GIN
	EARLY ARCHAIC		5000 B.C.	GENEILL
PALEO-INDIAN	LATE PALEO	PLANO	6500 B.C.	SHAW
	MIDDLE PALEO		7500 B.C.	BUSEY
	EARLY PALEO	LLANO	9000 B.C.	HELM
	PRE-PROJECTILE POINT	?	10000 B.C.	?
			?	

Figure 1. Cultural periods and phases in the Lower Yazoo Basin area of Mississippi (modified from Phillips 1970:Fig. 2).

The latter settlement changes can be referred to as "Interoxbow Settlement Shifts," while the former changes are known as "Intraoxbow Settlement Shifts." Only the intraoxbow shifts will be examined here. Information on settlement change between different oxbows can be found in Weinstein et al. 1979. One oxbow lake will be the focus of this study simply because both its inner and outer banklines fell within the survey area. This is Swan Lake, a well-preserved oxbow now containing most of the Yazoo National Wildlife Refuge, Washington County, Mississippi. In order to examine the settlement shifts along the Swan Lake oxbow, one major hypothesis was developed. This assumed that an oxbow went through a set number of stages after it had separated from the parent channel. Although these stages did not necessarily occur at the same rate for each oxbow, they still represented phases in the evolutionary process from open channel to filled land. For each stage, a certain position along the lake's banklines would be the most beneficial for settlement. The most economically rich area in the lake was assumed to be the juncture of the open lake and the filling ends or plugs. There, swamp rich in aquatic life nourished by the water's nutrients would be the most favorable of all food collecting locales. (See Weinstein et al. 1979:4-5 to 4-10 for a more detailed discussion of this topic.) Thus, it seemed the sites would be located closest to the boundary between the swamp and open water. According to this model, then, sites of initial, early cultural phase occupation should be located primarily at the lower ends of the lake's channel, while later sites would be found farther

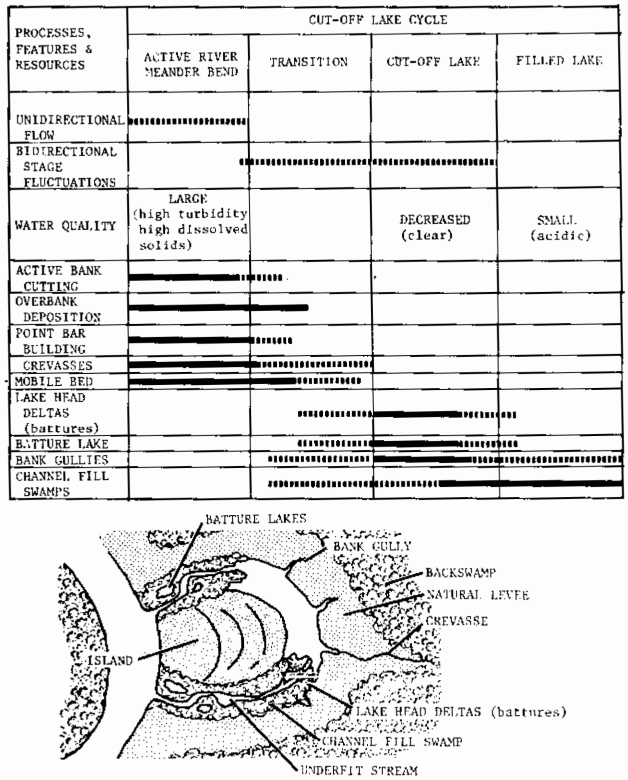

Figure 2. Life cycle of an oxbow or cutoff lake illustrating associated landforms and water bodies (after Weinstein et al. 1979: Fig. 4-1).

up the lake's banklines. Figure 2 and Table 1 provide information relative to the life cycle of an oxbow lake and the various species associated with the different stages of filling.

When sites are plotted by cultural periods along Swan Lake's banks, and then the assumed condition of the lake at the time of occupation is reconstructed, several interesting patterns emerge. Figure 3 shows the sequential development of Swan Lake from open

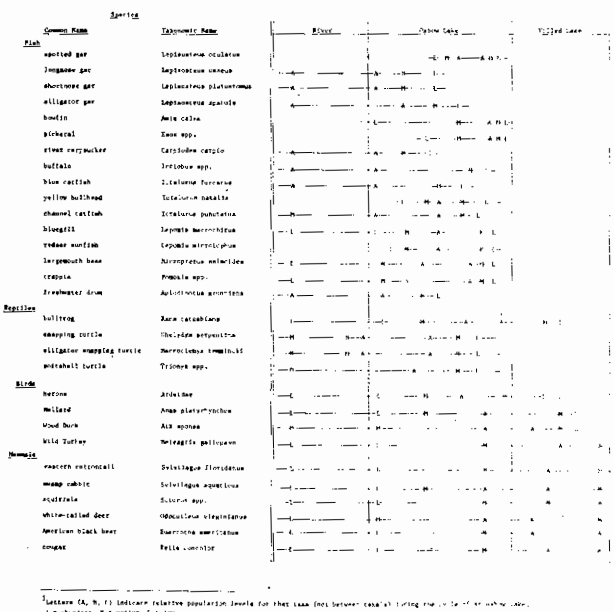

Table 1. List of common game and commercial species with their relative abundance in relation to the life cycle of an oxbow lake and the surrounding area (after Weinstein et al 1979: Tbl. 4-1).

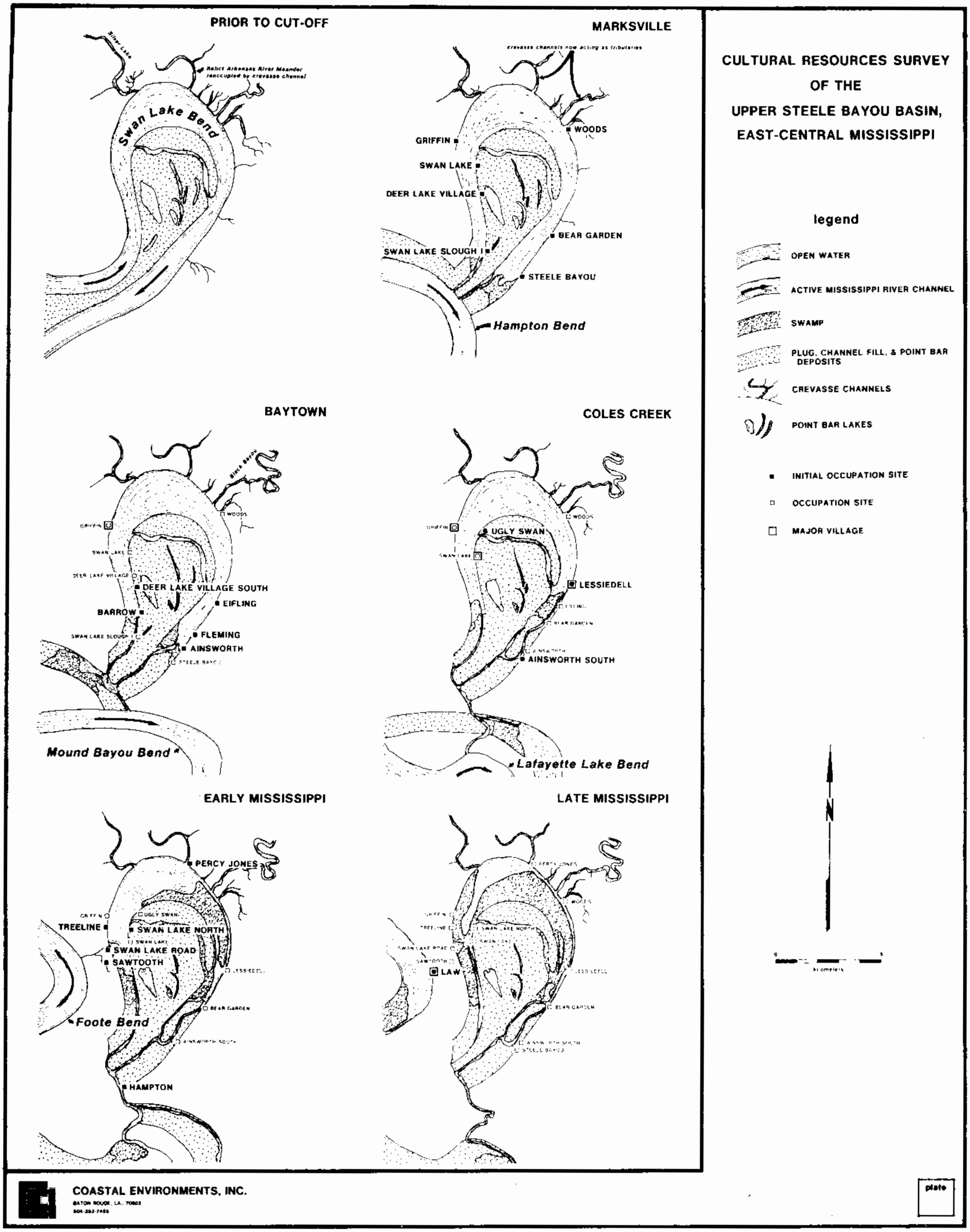

Figure 3. Sequential development of Swan Lake illustrating archaeological sites and morphological changes (after Weinstein et al. 1979: Pl. 10).

Mississippi River channel to a lake bed comprised almost entirely of filled swamp and channel plugs. The channel positions illustrated in the figures are based on Fisk (1944:Pl. 22, Sht. 9), but the sequence is different.

The data suggest that the Swan Lake bend, just prior to cutoff, was advancing in a northerly direction, cutting into a pre-existent Arkansas River meander bend and into Silver Lake, a probable crevasse channel off an earlier Mississippi River bend. These channels most likely received overbank flood waters from the Mississippi and acted as crevasse distributary channels, transporting silt into the nearby lowlands. In addition, other crevasses off the Swan Lake bend were located along its northern and eastern edges; most of these are still clearly visible on aerial photographs.

Following the cutoff, it is assumed that an unknown period of time elapsed during which the Mississippi River cut two successive channels across the arms of the newly formed lake. Silt and alluvial soils were deposited along the mouths of the lake's arms, causing them to fill and establish plugs (battures) or swamps which prograded into the lake itself. Within these plugs, small underfit streams remained open, contributing to the deposition of soil within the lake.

The first site occupied on the recently formed lake was probably a small village or camp at Bear Garden (22 WS 556). The ceramic assemblage points to a time early in the Porter Bayou phase. The Woods site (22 WS 555) may have been occupied at that time, although the evidence for this is sketchy.

After a number of years, perhaps fifty to one hundred, other small-scale hamlets began to spring up around the edges of the lake. Three of these, Swan Lake (22 WS 518), Swan Lake Slough I (22 WS 605), and Swan Lake Village (22 WS 579), were established on the point bar of the old channel. By the succeeding Baytown period, it appears that the Swan Lake area had become a popular place to live. Five new sites were established and the first major village along the lake's bank was initiated at Griffin (22 WS 550).

It is believed that during this period the lake continued to receive fresh Mississippi River water in the form of overbank flooding from the new Mound Bayou bend. Such water replenished the oxygen supply within the lake and allowed aquatic life to continue. Because of the connection to the Mound Bayou channel, the lower ends of Swan Lake's loops also received an added influx of silt, causing a further increase in the land and swamp near the plugged ends. It was this terrestrial growth, in fact, which contributed to the emergence of more diverse environmental zones in the old channel bed, and to the greater productivity of the entire system, eventually allowing a larger and more settled population to develop a major village at Griffin. This is not to say that the productivity within the lake was the sole reason for Griffin's development, as maize agriculture was probably practiced to some degree, but it certainly appears to have had a critical part in the village's founding and growth.

During the following Coles Creek period, Swan Lake provided the Indians along its banks with living conditions similar to those of the previous Baytown period, but probably more conducive to settlement. The battures continued to build lakeward as more silt entered through several minor streams, particularly the embryonic Steele Bayou channel in the eastern plug which received water from the new Lafayette Lake bend situated to the south. Archaeological sites of the preceding period were maintained, while several new settlements, most notably Lessiedell (22 WS 517), developed. Swan Lake became a major village, and Griffin remained active. Undoubtedly this was the time of optimal settlement. The plugs and swamps had extended for several kilometers into the lake bed, most obviously along the eastern arm, and species' habitats expanded. With probable agriculture along the natural levees and point-bar deposits used to supplement the rich hunting and fishing zones, the inhabitants enjoyed an economic base unparalleled until then.

With the advent of the Mississippi period, the economic base of the earlier Coles Creek culture shrank as freshwater influx into Swan Lake was reduced as a result of Mississippi River migration. The southern ends of the oxbow's arms, which until then had served as the gateway for freshwater and nutrients, became isolated from the Mississippi. Thus, the entire eastern side of the lake began to choke with swamp and oxygen-poor water bodies. Only the small amount of flow entering the lake by way of Black Bayou, as it drained the backswamp terrain to the north, brought in new nutrients.

The western arm of the lake was quite different during the early Mississippi period. Unlike the eastern side, it was dramatically influenced by a crevasse channel emanating from a new course of the Mississippi River along the Foote bend. This crevasse brought with it alluvial fill and deposited it in a deltalike fan within the old Swan Lake bed. The crevasse also contributed freshwater, high in oxygen and nutrients, into the western half of the lake. Because of this intrusion of such necessary elements, the western edge of the lake became a preferred habitation locale. Initial occupation sites emerged, almost certainly made possible by the crevasse channel. Particularly noticeable is Swan Lake Road (22 WS 595), located along both banks of the northern branch of the crevasse. In addition to allowing for greater biological productivity in the general area of these new sites, the crevasse also offered a prime route for travel between Swan Lake and the active Mississippi, thus increasing the area's desirability for settlement. It is probable that if the fortuitous crevasse had not occurred, sites along Swan Lake would have dwindled in number and size, approximating their condition in the late Mississippi period.

Finally, during the late Mississippi period, the establishment of new sites along Swan Lake ceased, brought about by the almost total filling, either by swamp or alluvial plugs, of the old lake. Habitation at earlier sites continued in several instances, but the intensity of such occupation was weak. The sites probably took on the guise of special, small-scale activity loci, related to food procurement within the extensive Swan Lake swamp. The major villages and prime habitation sites shifted to newer Mississippi River cutoff lakes, where optimal living conditions were just beginning to form. The Law site (22 WS 549) on the Foote bend of the Mississippi is a case in point.

Summary

Available archaeological and geomorphological data provide a simplified version of the settlement sequence along Swan Lake, a typical Mississippi River oxbow. The overall settlement is tied to the habitat potential and diversity within the lake bed. In a procession, the lake and sites moved through a series of stages, from an open river course with low economic desirability, to a peak of great resource potential and site development, to a low ebb of filled channel and limited economic offering with minimal occupation.

In some cases, it is also possible to trace the filling process within the lake's arms as site occupations "migrated" up a bankline away from a filled end. This sequence is particularly noticeable along the more-quickly-filled eastern arm of Swan Lake, where most later initial occupations are farther removed from the original point of cutoff.

It is hoped that the hypotheses developed and the questions raised concerning oxbow settlement along Swan Lake will act as springboards for future, more in-depth studies of similar alluvial valley settings.

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Steven D. Shelley

THE COLES CREEK PERIOD SETTLEMENT SYSTEM ON LOUISIANA'S CHENIER COASTAL PLAIN

Louisiana's Chenier Plain (Fig. 1) has been experiencing a great deal of land modification from human and natural agents, with a subsequent destruction of archeological sites. Unfortunately, archeological research has been unable to keep pace with this loss, so there exists a pressing need for work that will synthesize the existing data and provide a basis for future work in the area. One such method utilizes settlement pattern analysis conducted within an ecological framework. This study uses this approach to analyze the Coles Creek Period occupation (ca. A.D. 700–A.D. 1000) of the Chenier Plain and provide a model of the settlement system that existed during that time.

In order to understand the settlement system, it is necessary to examine the physical environment in which the system operated. The Chenier Plain is a marginal delta composed of sedimentary deposits laid down in recent times. Salt, fresh, brackish and intermediate marshes vary according to the influx of fresh and salt water they receive. Relief on the Chenier Plain consists of levees, cheniers, and Pleistocene outliers. These raised features provide a variety of habitats for both the floral and faunal communities. The Chenier Plain also contains numerous lakes, bays, bayous, four major rivers, and the Gulf of Mexico (Gosselink et al. 1979).

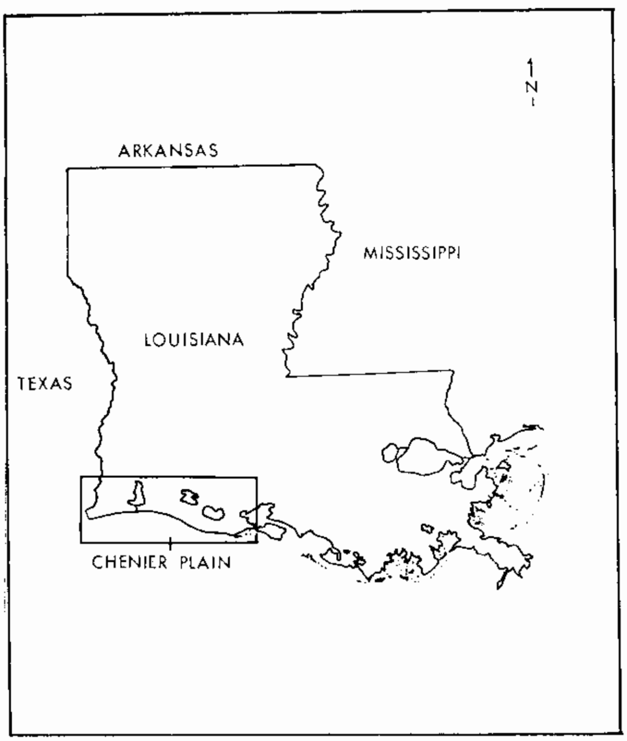

Figure 1. Map showing the location of the Chenier Plain.

Geologically the Chenier Plain is a somewhat unique situation. The shoreline has been undergoing a general seaward advance, with temporary retreats, depending upon the available sediment load from the Mississippi River (Fisk and McFarlan 1955; Gould 1970). The shoreline advanced when the Mississippi's primary flow shifted eastward. The cheniers form during the retreats and are essentially sand and shell beach ridges which are stranded when the shoreline begins to advance again (Fig. 2). The Chenier Plain has a series of cheniers to mark the locations of former shorelines.

Land subsidence is probably the single most important land modification process occurring on the Chenier Plain. It is actually a complex series of processes, but the net result is that the land surface loses altitude relative to sea level. The current rate is 1.75 cm per year, but this may be a greatly accelerated rate brought about by human interference (Gosselink et al. 1979:10). The subsidence rate varies from one landform to another. Marshes tend to subside the fastest due to impaction of the loosely consolidated sediments on which they lie, while uplands such as cheniers subside more slowly. This is a problem because archaeological sites tend to subside, become covered by the marshes, or destroyed by wave action, and are therefore, not readily recoverable by present survey techniques.

The Chenier Plain supports a variety of biological habitats that may have affected the prehistoric settlement pattern. There are 10 habitat types, each with its own particular set of resources. The habitats are: Nearshore Gulf, Inland Open Water, Salt Marsh, Brackish Marsh, Intermediate Marsh, Fresh Marsh,

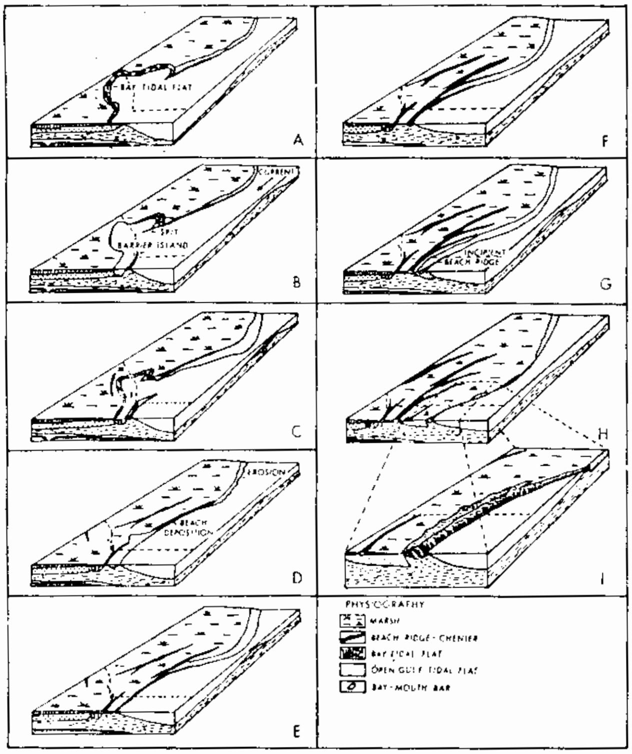

Figure 2. Stages of Chenier development (after Gould and McFarlan 1959:269).

Swamp Forest, Uplands, Ridge, and Beach habitats. The Chenier Plain environment is potentially one of the richest in the world. The marsh-inland water-ridge habitat combination would have provided a great deal of plant, fish and animal resources (Gosselink et al. 1979). Even though they are seasonal in nature they are spaced so that at any given time a fairly high resource base would have been available.

The Chenier Plain region suffers from a lack of data from excavations. Springer (1973) found that at Pierre Clement (16 CM 47) fish were dominant, while mammals, reptiles and a few birds were also present. At the nearby Morton Shell Mound, Byrd (1974) found that squash (*Curcubito pepo* var. *olifera*) and bottle gourd (*Lagenaria siceraria*) were present by Tchefuncte times. It is reasonable to assume that horticulture was also practiced by the later Coles Creek inhabitants, although the generally poor soils on the Chenier Plain may have limited its importance in the overall subsistence strategy. Futch's (1979) analysis of the Coles Creek subsistence at the Morton Shell Mound indicates that the most important paleological habitats to the Coles Creek people were, in order of importance: marsh, swamp, bayou, lake, and stream habitats.

The major analytical unit used in this analysis is classes of sites grouped by size. Settlement size is a measurable attribute common to all sites and provides a reflection of the success of cultural responses to environmental variation (Pearson 1977). It also can be an indication of the number and types of activities carried out at a site (Haggett 1971:115-116). A total of 34 Coles Creek period sites are reported from the Chenier Plain area and were used in analysis. The sites were grouped into clusters using a heirarchial agglomerative clustering technique (Anderberg 1973: 142-154). The result was a three cluster or site class solution. The observed frequency of sites is: 4 Class I (the largest sites), 17 Class II (medium size sites), and 13 Class III (the smallest sites).

Geographers and economists have developed a number of theoretical explanations for regularities in settlement size distributions. The rank-size rule as it is developed by geographers (Berry and Garrison 1958, Dziewonski 1974, Vapnarsky 1969) indicates that there should be more Class III sites than Class II sites, which however is not the case with the Chenier Plain sample. A chi square test of the sample frequency (derived using Simon's (1955) method as modified by Berry and Garrison (1958)) showed a significant difference at an α of .05. This is interpreted as a sampling error created by subsidence and land loss. By looking at the site frequencies and the location of sites on landforms it is evident that 69% of all known Class III sites are located in marsh as opposed to only 33% for the other two classes. Since the marshes suffer the greatest land loss due to differential compaction rates and wave attack (Craig and Day 1977; Morgan 1972) it is reasonable to assume that a greater number of Class III sites would be lost, thereby skewing the sample.

The model derived for the Coles Creek settlement system on the Chenier Plain is based on the relationship of the three settlement size classes and environmental variables. The variables used are biotic habitat, landforms, distance from marsh, water source, nearest major river, and the Gulf of Mexico. Each class was examined for the frequency of occurrance of sites with each of these variables. The result is assumed to be a reflection of the importance of these variables to site activities.

Class I sites are hypothesized to have been the centers of economic, social, and religious activities on the Chenier Plain. Their large size and presence of mounds on three of the sites support this hypothesis. These sites are all located on cheniers, the highest elevations in the area, probably for protection from flooding and possibly to control access to these natural "highways" through the marsh. The cheniers connected Class I sites to distant areas of the marsh, and when they permitted access to one of the major rivers they gave access to the cultural areas in the lower Mississippi Valley and in Texas.

Class II and Class III sites are apparently subsistence oriented sites. Class II sites were typically situated to take advantage of a greater variety of resources from the marsh, aquatic, and ridge habitats than were other sites. Class III site locations were oriented toward exploitation of marsh and aquatic resources. Ethnographic analogy based on the Attakapa indicates that Class II and Class III sites were probably inhabited on a semi-permanent seasonal basis by family groups or single family units (Dyer 1917; Gatschet and Swanton 1932).

The use of site size distributions to develop a site heirarchy seems to have applicability in the analysis of archeological settlement systems. It is particularly useful when very little information is available from excavations. The model of the Coles Creek settlement system presented here is a hypothetical construct and requires a great deal of further testing. More data will allow the model to be refined and adjusted to better fit the data. Even so, the current model is useful as an explanatory mechanism, and it provides a theoretical base from which future study can be done.

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Brenda J. Sigler-Lavelle

ECONOMIC ANTHROPOLOGY AND ARCHEOLOGICAL RESEARCH

The symposium deals in a substantive way with issues in "subsistence" and environment. This paper, however, is a brief review of theoretical and methodological aspects of a research strategy that, while concerned with "subsistence" and environment, focuses on economics as a more rigorously defined dimension and unifying framework for methodological advances in archeological investigation.

An explicit economic approach is preferred over a subsistence focus because of the latter's lack of conceptual clarity and clearly defined operational components which creates inconsistency between investigations. The author views such ill-defined units of analysis as a residual problem of the already discredited general systems approach (see Salmon 1978:174), and they are recognized as a justified criticism of past studies in cultural ecology (see Vayda and McCay 1975:295). Although significant achievements in analytic techniques have been made, these seem to be primarily in service to descriptive models of general cultural evolution which assume "economic" adjustments to be initiating factors in social change through inadequately explicated base-superstructure links.

Definitions of economic involve three approaches: formalists, substantivists, and Marxists. Briefly, the "formalists" (LeClair 1962; Robbins 1935; Burling 1962) study human behavior with respect to allocating scarce means to alternative ends and assume maximization motives. "Substantivists" (Polanyi 1957; Dalton 1971) are more concerned with institutional aspects of production, distribution, and circulation of material goods. Others, while incorporating institutional aspects (Friedman 1975; Godelier 1972; Cook 1973b), seek to explain social form and structures using the concept of "mode of production" (in the broader sense) developed by Marx. In essence, all seek to increase understanding of human economic organization by studying the behavior of the commodities they produce, exchange, and utilize (after Cook 1973a:44).

Economy, as a heuristic device to facilitate data collection and interpretation, is anchored in materiality (see Neale 1964). It consists of events that, through the material focus, can be observed (directly or indirectly), measured, and analyzed. The appropriation and transformation (production) of the material means of existence, plus their distribution and consumption represent an ordered sequence of events which provide structure and constitute social process.

As Godelier (1972:259-269) states, economics forms a domain of activities (production, distribution, and consumption) and a ". . . particular aspect of all human activities that do not strictly belong to this domain, but the function of which involves the exchange and use of material means." What gets produced, distributed, and consumed depends on the nature and hierarchy of needs in a given society. For the archeologist, therefore, a focus on economic activity can be used to get at other institutional information such as political, religious, familial, etc. For example, motives for distribution can be directly or indirectly economic. Shares may be taken from a product to insure continuity of production (replacement fund), or shares may be allocated for social maintenance, e.g., ceremonial fund (Wolf 1966:6-7), which has aspects that can be traced through material flows—something that is already being done in varying degrees, but in eclectic fashion in archeology.

The developmental consequences of relationships between the three components of the economic structure has occupied scholars in the past and present (Marx 1904; Weber 1949; Parsons and Smelser 1956; LeClair 1962; Godelier 1972; Cook 1973b; Smith 1976). These investigations into the material influences on differential development of societies provides both reference and problematic for archeological inquiry.

In an applied sense, an understanding of economic behavior is more than an abstract concern. Effective, comprehensive planning for economic development in nonwestern countries is dependent upon an understanding of reciprocal relationships between economy and environment, the sociopolitical and religious institutions, and the effect of these variables on the "internal rationality" (Godelier 1972:249) of specific cultural adjustments. While it has been suggested that an explicit economic approach could be beneficially incorporated into archeological research, it is not without its problems and is not suggested as a panacea. As Harris (1980:77) notes, only the capacity of a research strategy to ". . . reveal new or unsuspected relationships . . . can justify its existence." And, one cannot expect a single strategy to ". . . provide definitive answers to every conceivable question but tentative answers to important questions. . . ."

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Jack L. Hofman

TEST EXCAVATION AT A BURIED MIDDLE ARCHAIC COMPONENT ON THE DUCK RIVER, MIDDLE TENNESSEE

The Cave Spring site, 40Mu141, was the focus of several phases of investigation during the 1980 fieldwork in the proposed Columbia Reservoir area in central Tennessee (Fig. 1). A controlled surface collection, backhoe testing and limited hand excavations were conducted. The progression of this research and the use of information from one stage in making decisions about subsequent investigations is discussed. Preliminary results of the work are reported and the present direction of site analyses is outlined. This multi-phase research at 40Mu141 has important implications for designing future research at the site and at other sites in alluvial settings in the reservoir area.

The Cave Spring site covers an area of at least 400 m east-west by 250 m north-south on terraces of the Duck River. The full surface extent of the site is presently unknown because surveys of the adjacent fields have not been completed. The site is on the inside of Cheek Bend on the downstream corner. In this location the T_0 or floodplain of the Duck River is very poorly developed and the first major terrace is the Holocene T_1. The prominent T_2 terrace is of Pleistocene age and has the most dense concentrations of surface remains at the site. Materials also occur on the older T_3. The site area is one of deep alluvial sediments and fairly rich soils and would have sponsored a hardwood riverine forest prior to clearing for cultivation. A wide variety and fairly dense population of native plant and animal species occupied this setting in the past.

Surface Collection

The Cave Spring site surface collection was facilitated by establishing a grid of 20 m squares over the entire site area. These 20 m squares, designated by their southwest coordinate, were then collected in 10 m quadrants delineated by a mobile rope grid system. The rope grid consisted of an 80 m length used to define the perimeter of each 20 m square. Two 20 m rope sections were then used to bisect the 20 m units in a perpendicular fashion which resulted in four 10 m quads. These quadrants were lettered A through D (in a clockwise fashion beginning with the southwest quad) and material from each quad was collected separately by walking between each planted row in the field (approximately 1 m intervals).

Results of the surface collection indicated that there was significant variation in the density of cultural material across the site. By plotting those 10 m units which produced 100 specimens or more (density greater than or equal to one item per square meter) we can observe a high correlation between surface density and the edge of the T_2 (Pleistocene) terrace

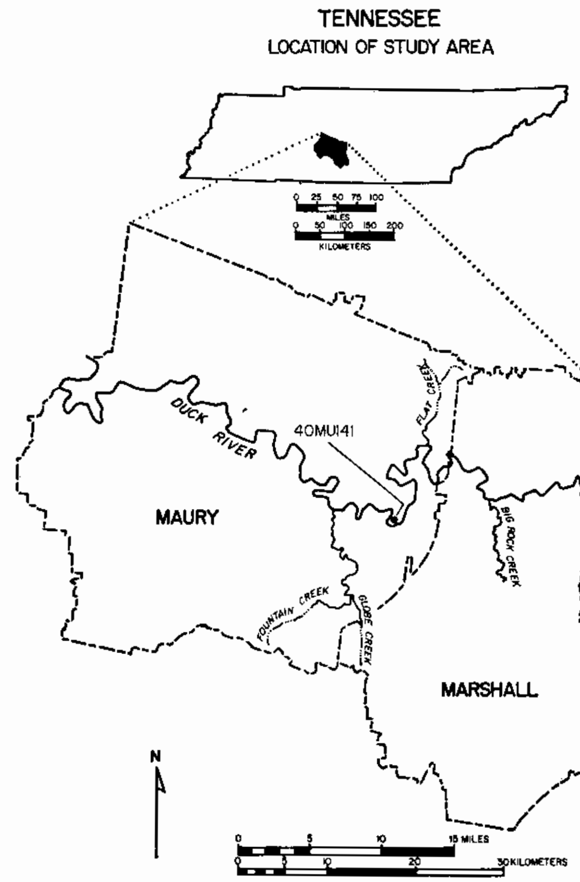

Figure 1.

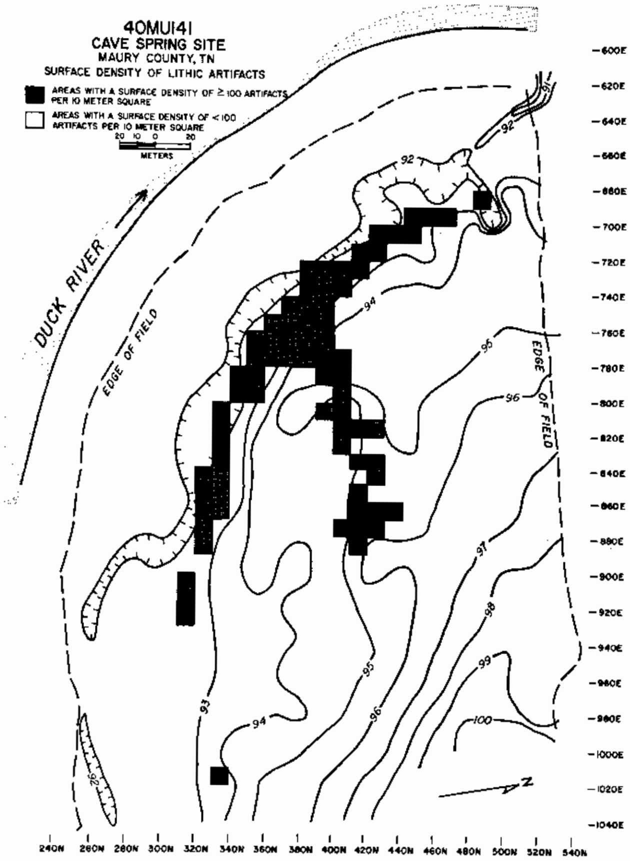

Figure 2.

(Fig. 2). The crest of the T_2 and the T_2 face which slopes down to the T_1 produced the highest density of surface material. The lower T_1 terrace surface produced significantly less materal. This distribution pattern, a high artifact density on the T_2 which decreases dramatically on the T_1, has been recognized at several other sites in the reservoir area. In 1979 preliminary backhoe testing at site 40Mu347, located one mile upstream from Cave Spring, revealed buried components in the T_1 terrace where a similar surface distribution was present. We suspected that a similar situation with buried components in the T_1 terrace might be represented at the Cave Spring site. Thus, we predicted that buried cultural components would be present in the T_1 terrace even though very little archaeological material was found on its surface.

Backhoe Testing

G. Robert Brakenridge (University of Arizona) initiated geomorphological studies in the proposed reservoir area in 1980. In addition to determining the stratigraphic sequence of the terrace system in the reservoir area, we were also interested in dating stratigraphic units within the terraces. Therefore, Cave Spring was selected as one location which might produce datable charcoal samples. By digging a backhoe trench at 40Mu141 two distinct problems could be approached. First, we could evaluate the hypothesis (based on work at 40Mu347) that buried cultural strata were present in the T_1 at Cave Spring. Second, we could expose a potentially datable stratum for geomorphological study.

A backhoe trench 108 m long was excavated at Cave Spring which extended from the levee of the T_1 overlooking the Duck River, to the crest of the Pleistocene T_2 terrace where the dense concentration of surface materials was identified (Fig. 3). Both walls of the trench (Trench 80D) were alternately troweled and pedded in order to observe stratigraphic changes and to search for cultural material. The buried contact between the T_2 and the T_1 was clear and several strata were evident in the T_1. The trench produced evidence of a buried cultural stratum which contained enough charcoal to make radiocarbon determinations possible.

The stratigraphy of Trench 80D was drawn and described by Brakenridge and all cultural items and gravel in the trench walls were mapped in place (Fig. 4). The T_1 terrace probably formed over an old point bar and the resulting stratigraphy is not horizontal. Rather, the strata are arched in the center of the T_1 and slope toward the river and back toward the T_2 terrace. The configuration of this formation is still evident in the T_1 surface which has a notable rise about halfway between the river and the T_2. The buried cultural deposit also conformed to the contour of the T_1 strata. The terrace was not a horizontal surface when the cultural material was deposited.

Interpretation of the cultural stratum posed a problem. Numerous pieces of river gravel were present in the trench profile mixed within the same stratum as the chipped stone artifacts, flakes and charcoal. The problem was whether this gravel was deposited on the old T_1 surface by river action or by cultural activity. It was possible that all of the flakes, artifacts, charcoal and gravel were simply redeposited from overbank flooding of the Duck River. Obviously, determining whether the buried stratum resulted from cultural activity or only redeposition and flood action was very important to decisions about future work and interpre-

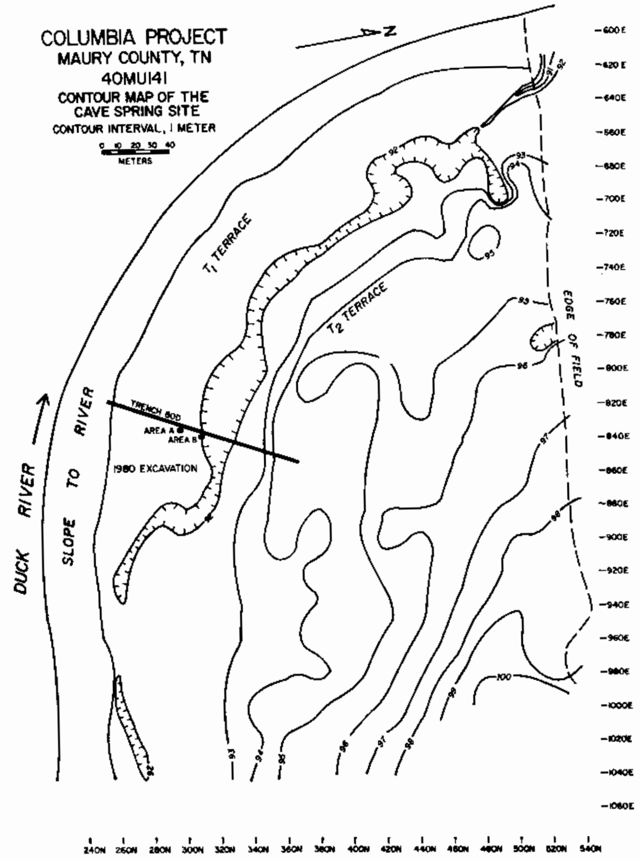

Figure 3.

tations of this component. Therefore, it was deemed necessary to evaluate the two possibilities for the origin of the cultural material in the buried stratum.

Interpreting the Origin of the Buried Component

In order to evaluate the context of the buried stratum which contained cultural material it was necessary to make a controlled hand excavation to supplement what was learned from the backhoe trench. The manual test excavation was restricted to two areas, each 2x3 m in size (Fig. 5). These units were established based on the original 20 m grid used during the surface collection. The excavations were located on the east side of the backhoe trench. Test Area A was placed on the crest of the T_1 terrace where the buried deposit was closest to the surface (about 50 cm deep) and relatively level. Test Area B was placed 10 m further north on the back side of the T_1 slope.

Excavation in both areas was initiated by removal of the plow zone (ca. 0-18 cm) as Level 1 which was waterscreened through 1/4 inch mesh. Level 2 extended from the base of the plow zone to a depth of 35 cm. This matrix was also waterscreened through 1/4 inch mesh. Level 2 was interpreted, based on the profiles of the adjacent backhoe trench walls to be essentially sterile. The excavation of Level 2 was intended to remove the bulk of the "sterile" fill above the cultural stratum. The remaining levels were excavated as 10 cm units and waterscreened through 1/16 inch mesh. A 20 cm square soil sample column was collected from each test area as a basis for phosphate, phytolith, and particle size analyses. A flotation sample was collected from one square in each test area and consisted of an entire 10 cm level. Charred botanical remains from the floated levels were utilized for radiocarbon dating and plant identification. All chipped stone, bone fragments, other possible cultural remains and river gravels larger than one centimeter were mapped as encountered during the excavation. For sake of expediency due to time and personnel limitations, the lower levels of Area B were excavated by quadrants (50 cm squares) instead of mapping all material separately. During excavation of quarter squares only artifacts were plotted in situ with the remaining material, flakes and gravel, simply being bagged by quadrant.

Specific kinds of information were sought during this excavation in order to determine the integrity of the deposit. First, if the chipped stone materials were redeposited and stream rolled for some distance their edges would be expected to be systematically rounded and dulled (Butzer 1971:230-231; Cornwall 1958: 23-24). This proved not to be the case. Overall, the chipped stone specimens exhibited pristine edges which had not been subjected to post-manufacture abrasion. Secondly, if the lithics were waterlain then sorting of specimens by size and shape (large vs. small, round vs. flat) could be expected. No evidence of such

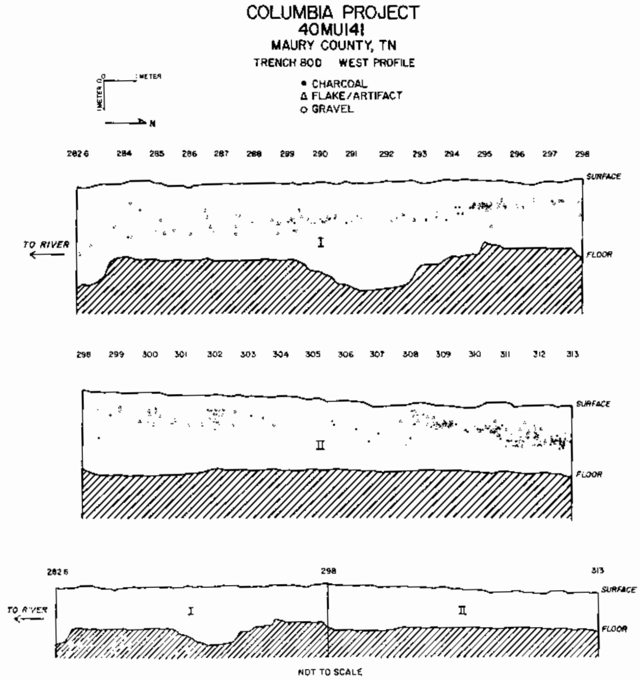

Figure 4.

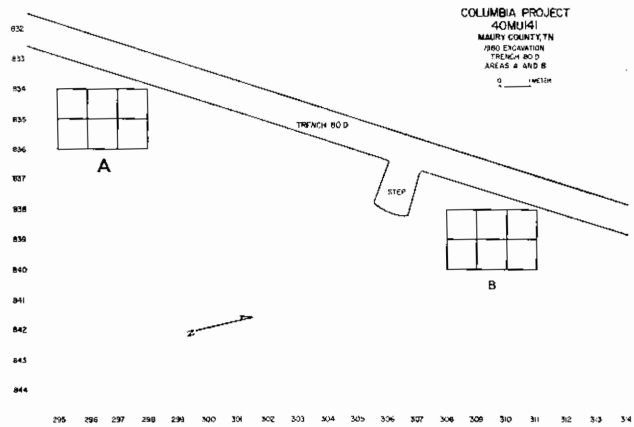

Figure 5.

sorting was defined. Large cores, bifaces and minute retouch flakes were found in close proximity and in patterned arrangements. For example, the only three drills recovered during the excavation were found within a one meter area.

Third, if a primary rather than secondary deposit was indeed represented, we could expect that broken tools might be rematched and that flakes derived from cores or specific retouching episodes would be in close association. This expectation resulted from our being able to refit chipped stone pieces recovered from buried components at site 40Mu347, located in a similar setting to Cave Spring. In fact, we were able to match fragments of a fire broken projectile point and to refit a flake with a nearby core during the excavation at the Cave Spring site. Additional specimens have been refitted in the lab.

Another consideration was the interpretation of the river gravel. The gravel had originally brought into question the integrity of the deposit. If the gravel could be accounted for through cultural processes, then this interpretative problem would be alleviated. Excavation in Test Area B revealed a dense concentration of river gravel and small cobbles of which some appear to have been thermally altered. Around this gravel/cobble concentration, which was designated Feature 1, were numerous artifacts and debris reflecting an area of intensive activity. While the specific function of the gravel and cobbles in the concentration is presently unknown, some heating or cooking activity may be indicated. It is also possible that a secondary deposit is represented such as debris from a cleaned out hearth. Based on the excavation of Feature 1, we have a basis for interpreting a cultural origin for gravel and cobbles in the stratum; most of these may represent disturbed remains of concentrations such as Feature 1.

A final consideration was that if a primary deposit was represented, then the cultural materials might be attributable, on a stylistic basis, to a single homogeneous assemblage. It was also possible, however, that the old T_1 terrace surface was occupied sucessively by different cultural groups. Diagnostic artifacts recovered from the test excavation were primarily projectile points. These specimens were found in close horizontal association, but are not all stylistically similar. The vast majority of specimens can be included in the Eva/Morrow Mountain cluster of the Middle Archaic period (Faulkner and McCoullough 1973:53-54; Lewis and Lewis 1961; Chapman 1977:164-167; DeJarnette et al. 1962; Coe 1964; Long and Josselyn 1965; Walthall 1980:58-62).

The variation within this group of short-stemmed and basally notched projectile point/knives can potentially be accounted for as the result of blade resharpening, reworking and recycling of projectile points within a single biface reduction system (Hofman 1980). In many instances bifacial reduction (resharpening) of blade edges on basally notched Eva points could, if repeated several times, result in a complete loss of barbs on blade shoulders and produce an unnotched end product of typical Morrow Mountain form. A systematic analysis of Eva biface reduction sequences is being conducted and the results of this ongoing study may help to account for variation within these morphological types generally classified as Eva and Morrow Mountain. The significance of intermediate" specimens should also be explicated.. For the present, it is argued that the "Eva" and "Morrow Mountain" projectile points from 40Mu141 represent segments of a single biface reduction system. The large number of small bifacial thinning flakes recovered from fine screening the hand excavation do indicate that a considerable amount of biface tool resharpening occurred at the site, and presumably it was the projectile points/knives which were being resharpened.

Several projectile points representing Early Archaic styles (Kirk cluster) were recovered in association with the Middle Archaic Eva assemblage. These specimens, however, are all heavily patinated or waterworn. The presence of these specimens in the component can be attributed to their collection and use by Middle Archaic people. Some specimens exhibit obvious reworking which removed portions of the original patinized surfaces. Two unifacial blade tools also of earlier origin, had been incorporated into the Middle Archaic assemblage and had been marginally reworked exposing fresh unpatinated chert.

In summary, I have argued that the buried stratum at 40Mu141 represents a primary cultural deposit. This argument is based on the lack of horizontal sorting or stream rolling of the lihtics, the presence of chipped stone specimens which can be refitted, patterned occurrences of tool types, a cultural explanation for the occurrence of river gravel in the deposit, and a possible explanation which accounts for the morphological variability of the projectile points/knives which occur in the stratum.

A final problem which must be addressed is the vertical dispersion of the cultural material. No significant or interpretable vertical separation of diagnostic artifacts has been recognized. However, the cultural stratum varies from 30 to 50 cm thick. The vertical distribution of chipped stone from all excavated squares is highly peaked and unimodal in form. This suggests the possibility that there was one primary depositional surface and that considerable vertical displacement has taken place. The dense occurrence of soil disturbances evidenced by root molds, rodent and insect burrows in the T_1 terrace represent mechanisms by which vertical post-depositional displacement might have occurred (Wood and Johnson 1978). If this vertical distribution actually reflects disturbance of a single surface, then it should be possible to refit chipped stone elements which are vertically separated (Cahen and Moeyersons 1977; Van Noten et al. 1978, 1980). The presence of limited surface material, apparently the result of Archaic and Woodland occupations, may serve to further confuse the stratigraphic situation.

Ongoing research with the Cave Spring site materials is aimed at clarification of two primary questions. These are as follows: (1) the relationship between the basally notched (Eva) and unnotched (Morrow Mountain) short-stemmed projectile points found in co-occurrence in the deposit, and (2) evaluation of vertical displacement and the degree to which it has mixed the assemblage(s). Refitting analysis will form part of the research intended to define the extent of vertical and horizontal displacement. An analysis is being made of the overall biface reduction system(s) which are represented.

One of the primary implications of the research at Cave Spring concerns the correlation of surface materials and buried archaeological deposits. It is obvious from the available information that deep site investigations should go hand in hand with geomorphological investigations. We cannot just dig where there are high densities of surface debris. Furthermore, we cannot assume that buried components will be free of depositional and/or post-depositional disturbances. The integrity of stratified deposits must be demonstrated.

Acknowledgements

Archaeological research in the Columbia Reservoir area is under the direction of Walter E. Klippel, Project Director, whose continued support, stimulus, and insights throughout the work at Cave Spring have been of fundamental importance. W. B. Turner and G. R. Brakenridge provided especially critical input. The efforts of C. Fowler, A. Grubb, R. F. Entorf, D. S. Amick, L. G. Ferguson, S. R. Johnston, H. Haygood, K. Moneyhun, C. O'Hare, W. W. Love, A. Lefever, M. Williams, H. Lanham, P. M. Hofman, M. A. Smith, N. Fitzgerald, D. F. Morey, B. L. Manzano, C. Faulkner, S. Faulkner, M. Butler, T. Jackson, C. Martino, D. M. Turner, W. Hines, and J. Mahaffey are greatfully acknowledged. Special thanks is extended to Terry Faulkner for drawing the figures. The research at Cave Spring was conducted under Tennessee Valley Authority Contract TV-49244A.

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Daniel S. Amick

A PRELIMINARY ASSESSMENT OF CHERT RESOURCES IN THE COLUMBIA RESERVOIR, MAURY AND MARSHALL COUNTIES, TENNESSEE

This study represents investigations of the geological resource base in the Columbia Reservoir area of the Duck River. Using an explicitly ecological/environmental framework, it is believed that an accurate definition of the parameters of the natural resource base is essential to meaningful investigations of raw material selection and procurement systems (Ahler 1977:133). Chert procurement is assumed to be primarily a localized phenomenon (Blakeman 1971, 1977; Leonoff 1970) operating under the principle of least effort and embedded in basic subsistence and settlement schedules (Binford 1979; Gramly 1980). Consequently, environmental studies are focused on local geologic and geographic parameters. The geologic and geographic model developed can then be integrated with cultural data to determine influence on prehistoric site selection and raw material preferences through time and across space (Klippel 1977:3-6).

A series of 7.5 minute Geologic Quadrangles, available from the Tennessee Division of Geology, were used to accurately delineate geologic formations (e.g. Hardeman 1963). The Geologic Quadrangles display topographic features and geologic formation distributions. Survey and collection of 45 historic quarries and roadcuts produced a controlled collection of chert types by geologic formation for comparative purposes. The large variety of chert types and depositional situations in the Columbia Reservoir area indicates an exceedingly complex geologic environment, therefore, more specific studies of these depositional settings are being initiated as illustrated by the river gravel study in this report.

The proposed Columbia Reservoir is located on the Duck River in south-central Tennessee (Fig. 1), physiographically recognized as the Inner Central Basin (Bassler 1932). The local Ridley and Carters Formations contain significant amounts of localized chert concretions of epigenetic origin (Biggs 1957). Although their textural quality does not equal chert of syngenetic origin (Biggs 1957), they are tractible and readily available within the Inner Central Basin. The Ridley Formation occurs in the center of the basin and primarily in the upper end of the reservoir. The Carters Formation is found primarily in the lower reservoir. The Outer Central Basin Bigby-Cannon and Brassfield Formations contain high quality chert, but matrix sources are distant and isolated respectively. Mississippian Fort Payne chert is naturally and culturally the most prevalent type found in the Columbia Reservoir. Massive beds and residuum blocks of Fort

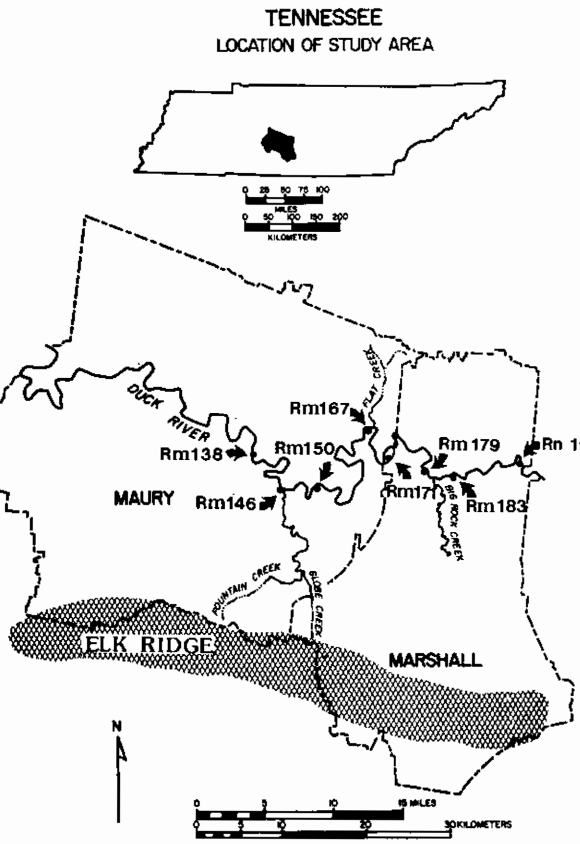

Figure 1. Location of study area and river cobble collection stations.

Payne chert cap Elk Ridge, a narrow winding spur 24 km south of the Duck River. Fort Payne is also available 24 km to the southwest and west on the Western Highland Rim.

Chert sources in the Columbia Reservoir area are from two general settings: primary context of *in situ* outcrops and secondary context of redeposited materials. All of the above mentioned chert-bearing formations may have been exploited from primary context, however the most significant source of matrix material is probably the Fort Payne chert. Secondary deposits take two forms: residual and alluvial. The Ridley and Carters cherts are particularly abundant as surface residual in upland and valley slope areas. Alluvial deposits occur in two settings, first in upland and valley slope areas as strath deposits and secondly in the active river gravels. The strath deposits probably date to the late Pliocene or early Pleistocene on the Duck River and appear to contain significantly higher amounts of Bigby-Cannon chert than the active river gravels.

Although it has long been recognized that river gravel deposits constitute a readily available chert source, little work has been done on determining the specific nature of this resource. Therefore, a river gravel collection methodology was implemented to investigate distribution, composition, and abundance patterns within the Columbia Reservoir river gravels.

The proposed reservoir will affect approximately 80 km above the dam axis at Duck River mile 138. Controlled gravel collections were made at systematic intervals from river miles 192-138 (86.4 km). The first gravel bar past each river mile was collected by transect sampling; a meter tape was extended in a downstream direction, parallel to the stream flow in the area of lowest vegetational cover. One meter diameter units were defined at 10 meter intervals along the transect line. All chert cobbles larger than 5 cm in length were gathered from the surface of the units, bagged and labeled by provenience. Approximately 8000 cobbles (total weight: 1000 lbs or 454 kg) were collected, from this collection a sample was selected for laboratory analysis along certain meaningful parameters. Six gravel bars were chosen based on location in relation to the three major tributaries influencing gravel content; Big Rock Creek at river mile 180.5, Flat Creek at mile 167, and Fountain Creek at mile 146. A gravel bar above and below the confluence of each of these creeks was selected to monitor the relative chert gravel contributions of each of these tributaries to the Duck River (Fig. 1).

The sample selected for study consisted of 1282 cobbles (total weight: 200 lbs or 90.8 kg). Each cobble was identified by provenience and specimen number then weighed to the nearest tenth of a gram. Length, width, and thickness measurements were made to the nearest millimeter. Size and density-index statistics were computed from these measurements.[1] After measuring, each cobble was broken open by hard hammer percussion, and the material type determined macroscopically based on comparative collections. Overall, the chert gravels are 94% Fort Payne in origin with the local Ridley and Carters cherts represented in minor amounts.

Each one meter diameter collection unit contained approximately 50 cobbles greater than 5 cm in length. The 5 cm cut-off is an arbitrary sample restriction based on technological considerations. The average cobble size is 61.9 cm^3, slightly smaller than a tennis ball; average cobble weight is 66.5 g; the resulting average density-index is 1.1 g/cm^3. These statistics illustrate the generally small size of river cobbles in the Columbia area of the Duck River. These measurements are considered useful because formal and/or functional considerations for utilization may be related to certain dimensional characteristics of specific chert types (McIlhany 1978).

Distributional studies of these chert gravels indicate patterns of abundance, composition, and quality change along the river. An abundance measure was calculated as the average number of cobbles collected from a one meter diameter area at each collection station. Abundance patterns suggest that surface cobbles are more abundant above major tributary confluences (Fig. 2).

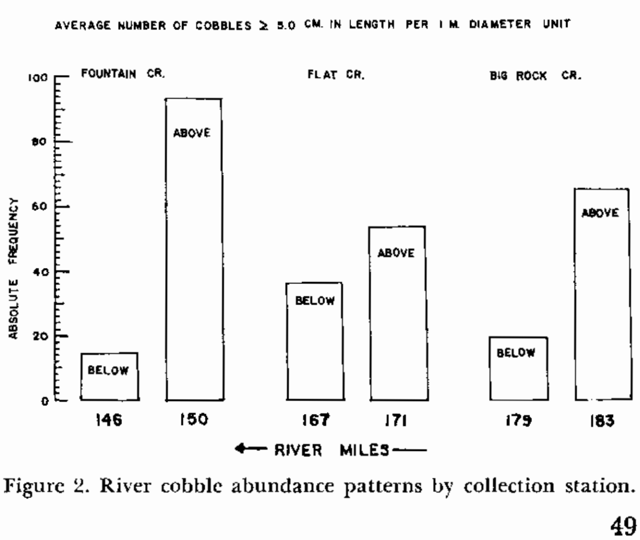

Figure 2. River cobble abundance patterns by collection station.

A comparison of the relative frequencies of Fort Payne, Carters, and Ridley cherts at each collection station indicates changing compositional patterns downstream (Fig. 3). Below the Big Rock Creek confluence, the gravel is primarily Fort Payne wth some Ridley. Considering Ridley bedrock in the area, this is not surprising, but the lack of Carters is unusual. Some Carters would be expected from the base of Elk Ridge approximately 24 km away. However, Carters chert appears to weather very rapidly; 64% of all Carters gravel collected was rotted to a chalky desilicified state.

In the Flat Creek area, the Carters formation is only 8 km away, consequently Carters chert becomes a larger constituent of the gravel below Flat Creek. Even with this shorter distance to bedrock source, half of the Carters gravel at this station is desilicified. Since this tributary does not cross the Fort Payne Formation, only Carters and Ridley cherts are contributed, thereby lowering the relative percentage of Fort Payne chert to 75% on the gravel bar below Flat Creek. Downstream movement appears to weather the grainy Ridley and Carters replacement cherts more rapidly then the fine-grained syngenetic Fort Payne chert. Gravel composition above each tributary tends to illustrate this phenomenon. Below the Fountain Creek confluence, the Carters frequency increases due to the close proximity of bedrock source in the area. Fountain Creek does not cross the Ridley Formation resulting in the continued downstream decrease of Ridley chert below Flat Creek.

The major variety of Fort Payne present in the river gravel is a tan variety comprising 74% of all cobbles. This variety was further divided on the basis of qualitative change in grain-size with weathering. The fresh fine-grained tan weathered to a medium- and/or coarse-grained phase which further decomposed to a white and yellow chalky desilicified state. Downstream movement farther from the parent source of this material indicates an increase in the more weathered phase of this variety while the fine-grained phase decreases (Fig. 4). The fine-grained material increases again below Fountain Creek, a Fort Payne-bearing tributary.

Certain initial propositions may be offered concerning chert type distributions and utilization patterns by prehistoric populations in the Columbia Reservoir:

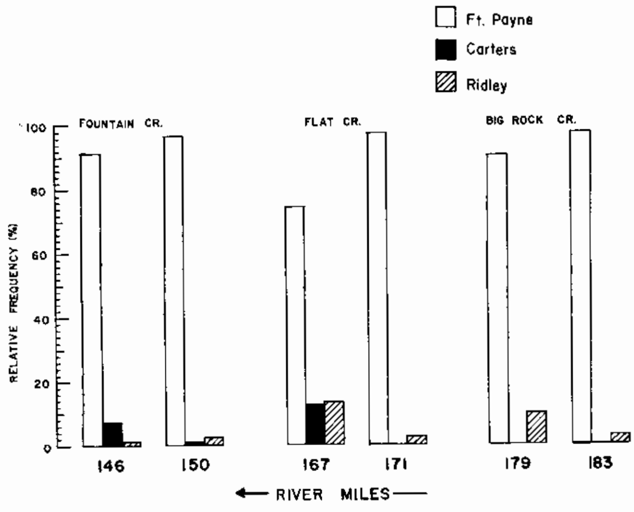

Figure 3. River cobble compositional patterns by collection station.

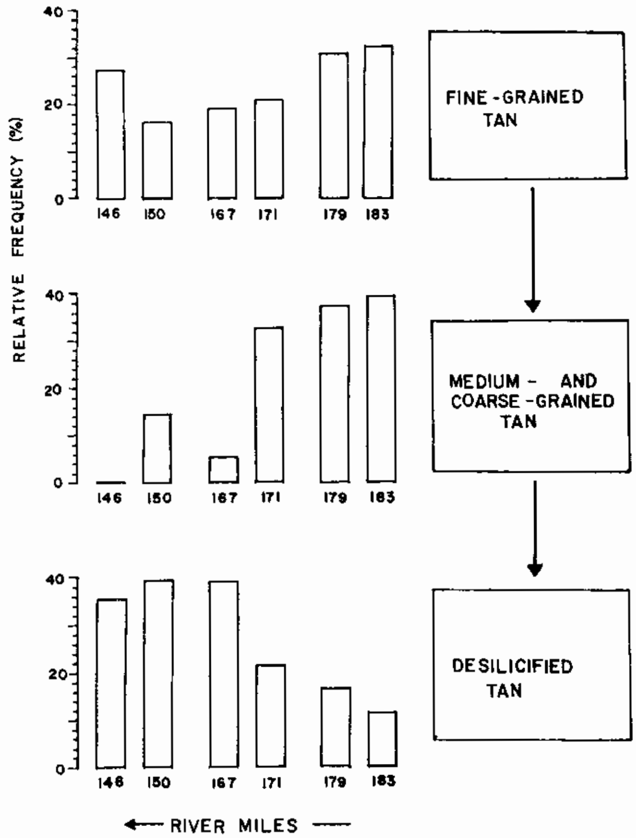

Figure 4. Fort Payne (tan variety) qualitative weathering change patterns by collection station.

(1) The vitreous high-quality Bigby-Cannon chert will be differentially selected for as a desirable material. Not a single piece of this chert type was observed in a river gravel sample of almost 1300 pieces, although it appears to be fairly abundant on the strath terraces of the area. This would indicate strath terraces as the most reliable local source of this material.

(2) The Ridley and Carters cherts are comparable in nodule size and quality. These cherts are locally abundant, although generally poor grade. They are not expected to be preferred for artifacts that require "high energy expenditure" (Ebert 1979:68) such as bifacial assemblages. Therefore, they are expected to be used primarily in "expedient" rather than "curated" assemblages (Binford 1977:35-6; 1979:263). Also since Ridley and Carters distributions are geographically discontinuous, it is expected that their utilization frequencies will have an inverse relationship with each other.

(3) The small size of local river gravels may require chert procurement closer to the parent source. This will be particularly evident in large biface manufacture. Fort Payne chert predominates among bifacial tools and may have been quarried or gathered from Elk Ridge or the Western Highland Rim about 24 km to the south and west. Finally, through comparison of natural and cultural raw material occurrences, the notion that raw material procurement is embedded in basic subsistence and settlement schedules (Binford 1979:259) may be tested.

Acknowledgements

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Footnote:

[1]Size = length × width × thickness; Density-index = weight/size.

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Bruce D. Smith

THE DIVISION OF MOUND EXPLORATION OF THE BUREAU OF (AMERICAN) ETHNOLOGY AND THE BIRTH OF AMERICAN ARCHAEOLOGY[1]

On February 24th, 1881, Congress earmarked five thousand dollars of the Bureau of (American) Ethnology appropriation to go for the exploration of prehistoric mounds (Rhees 1901:863). John Wesley Powell, the Director of the BAE, initially appointed Wills DeHaas to head the newly formed Division of Mound Exploration, but replaced him within a year with Cyrus Thomas. Under the direction of Thomas, research was carried out through the 1880s, with a final report appearing in 1894 (Thomas 1894).

Historians of American archaeology have consistantly recognized the Division of Mound Exploration as playing a prominent role in the development of American archaeology (Hallowell 1960:84; Jennings 1968:33; Willey and Sabloff 1974:48). These authors emphasize the results of the mound survey, the resolution of the identity of the mound builders issue, as their reason for marking it as the first beginnings of modern archeology. While I would certainly agree that the resolution of this stubborn issue was of great importance, I think that it was the methodology employed by Thomas in formulating and carrying out the mound survey that in fact sets it apart as the first modern archeology carried out in eastern North America.

Problem Orientation

The research of the Division of Mound Exploration was from the start explicitly problem oriented. John Wesley Powell identified the primary goal of resolving the mound builder debate, and Thomas provided an interrelated set of four secondary objectives. These were: (1) To identify the full range of variation in the form or external shape of prehistoric mounds, and develop a comprehensive mound classification system; (2) To investigate and accurately describe the mode of construction of mounds of various types; (3) To establish a system of regional archeological districts that reflected the geographical range of the various mound types; (4) To obtain representative artifact assemblages from prehistoric mounds, not only for distinguishing various mound categories and archeological districts, but to also allow subsequent taxonomic analysis of the various classes of artifacts.

In addition to these problem oriented goals, Thomas established another, equally important goal—he was determined that the work of the Mound Exploration Division would result in a detailed and objective data base that would be available and of value to future generations of archeologists.

Research Design ("Plan Adopted")

The research design or data recovery plan of the Division of Mound Exploration was a logical extension of the Powell and Thomas problem orientation, and can be seen to have been carefully and deliberately tailored to obtain information relevant to the research questions that had been defined. It was formulated entirely by Thomas, and included the following important aspects: (1) A sampling strategy which was on the one hand designed to obtain systematic geographic coverage of mounds in the eastern United States, and was, at the same time, stratified in an attempt to obtain a representative sample of mounds from each of the various general "classes" or taxonomic categories of mounds; (2) Procedures of data recovery were standardized, and involved detailed descriptions and plans of mound sites, descriptions and section drawings of the internal composition of mounds, and descriptions of the location of recovered materials; (3) Collections management procedures involved the field numbering and cataloging of recovered specimens, followed by their rapid shipment to Washington, where a detailed project catalog was maintained.

Field Operations

In setting up the field operations of the Division of Mound Exploration, Thomas faced a variety of problems. The most obvious problem involved the sheer size of the defined geographical study area—it stretched from the Dakotas to Florida and from Texas to New York.

One way to approach this vast expanse of territory that needed coverage would have been to engage for short periods of time a variety of local researchers to investigate nearby mound sites. Thomas did in fact do this to a rather limited degree, but this approach had the obvious drawback of having to deal with, and rely upon, individuals of varied qualifications, levels of competence, and trustworthiness.

Largely for this reason, I suspect, Thomas channeled most of the funds and research efforts of the Division into the three permanent field assistant positions that he established. Table 1 lists the different individuals who filled, at one time or another one of the three permanent field assistant positions. Also listed are those individuals who were temporarily engaged by the Division of Mound Exploration.

Except for an occasional foray into the field, Thomas stayed in Washington, and directed the activities and movements of the three field assistants by mail.

To judge from the correspondence between Thomas and his men in the field, he was not exactly an easy man to work for. His outgoing letters invariably contain comments, corrections, and admonitions concerning the last batch of artifacts or mound descriptions received from a particular field assistant, as well as instructions as to where the field assistant should next proceed. The incoming letters from field assistants similarly share several common themes: responses to Thomas' most recent comments concerning the quality of their work; explanations as to why they were not proceeding as quickly as Thomas wanted; and requests for both the "vouchers" and money owed them. Thomas was clearly tight-fisted with the funds of the Division, sending out the field assistants' salaries on a month by month basis, and making it clear that next month's check was dependent on continuing adequate performance. He was constantly pushing the field assistants to keep more detailed and accurate mound description and excavation records, to find more and better artifacts, and to cover more territory in a shorter period of time. This "stick and carrot" relationship between Thomas and his field assistants is, I think, the key to understanding their astounding accomplishments.

There are a number of ways of unraveling the movements of the field assistants, one of which is shown in Table 2. By going through the Division of Mound Exploration's artifact ledger, I was able to determine the geographical source of collections sent in by the different field assistants on a year by year basis. Table 2 does not tell the whole story, however, since field assistants often visited and described sites without sending back artifacts to Washington.

If you look under the 1882-1883 column of Table 2, you will see that in a twelve month period, Edward Palmer sent back specimens from Alabama, Arkansas, Georgia, Indiana, Mississippi, North Carolina, South Carolina, and Tennessee. During the same fiscal year, P. W. Norris visited Arkansas, the Dakotas, Kentucky, Iowa, Minnesota, Missouri, Ohio, Texas, West Virginia, and Wisconsin. Clearly Thomas did not allow his field assistants to dawdle too long in one place.

The bottom row of Table 2 lists the total number of catalog numbers assigned each year, and provides a rough index of the level of activity of the field assistants. The number of assigned catalog numbers drops almost in half after the first two years, and then to almost nothing after the spring of 1886. This clearly indicates that in terms of excavation and collection acquisition the Division of Mound Exploration was active only during the four year span 1882-1886. Although some mounds were excavated after 1886, mostly to fill in obvious gaps in their geographical coverage, field assistants in these later years (Middleton and Reynolds) were primarily engaged in mapping mound sites and rechecking the accuracy of previous descriptions.

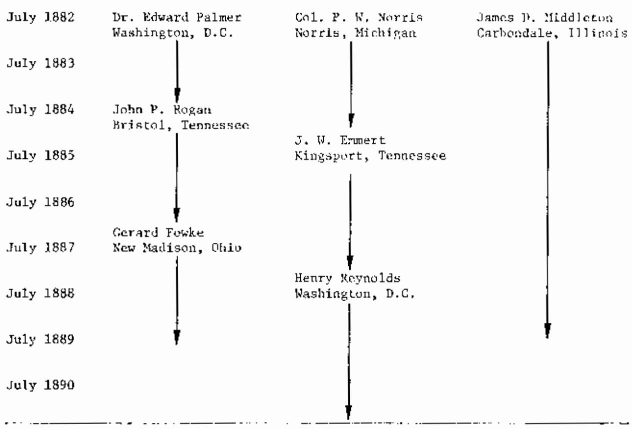
Figure 1 shows the 130 counties within which over 2,000 mounds were explored, and from which over 40,000 specimens were obtained by the Division of Mound Exploration, and provides a general picture of the geographical coverage of their excavation activities.

Discussion

If the work of the Division of Mound Exploration is analyzed within the conceptual framework of present day archeology, it turns out to be surprisingly modern, even though it was carried out almost a century ago.

It was a long term regional research program and

Table 1. Division of a Mound Exploration
Regular Field Assistants
Duration of Employment



Individuals "engaged for short periods"
Rev. W. M. Beauchamp, Baldwinsville, New York
F. S. Earle, Cobden, Illinois
Gerard Fowke, New Madison, Ohio (became a regular field assistant)
William McAdams, Otterville, Illinois
Rev. J. P. McLean, Hamilton, Ohio
Rev. Stephen D. Peet, Clinton, Wisconsin
Henry L. Reynolds, Washington, D.C. (became a regular field assistant)
John P. Rogan, Bristol, Tennessee (became a regular field assistant)
L. H. Thing, Cobden, Illinois

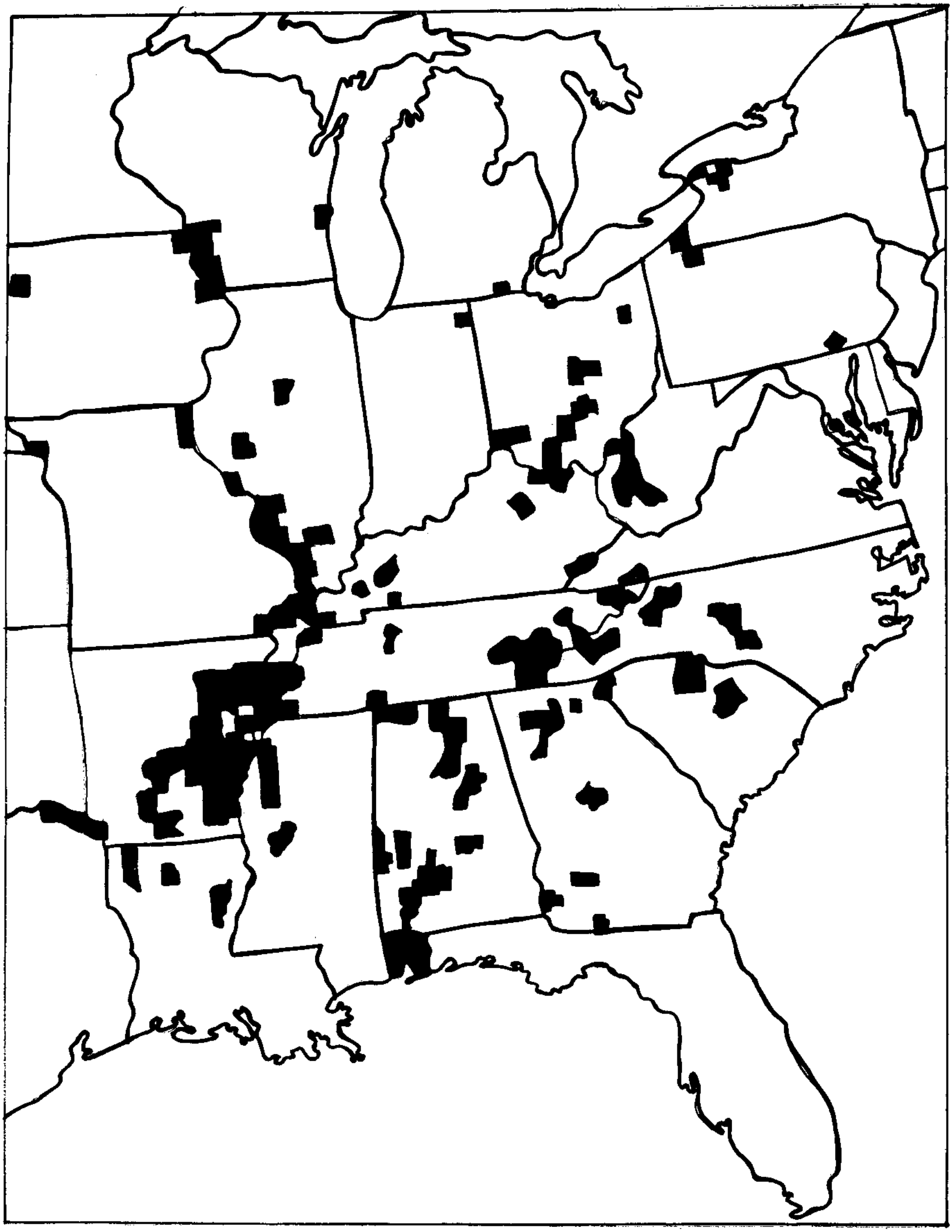


Figure 1. The counties in which collections were made by field assistants of the Division of Mound Exploration.

had a larger regional focus than any subsequent archeological undertaking in North America.

It was explicitly problem oriented, and the research questions that were addressed were among the most important ones facing eastern North American archeology in the nineteenth century.

There was also a clear and direct relationship between this problem orientation and the research design developed by Thomas. The sampling strategy for selecting sites to be investigated and the kinds and

	July to June 1882 1883	July to June 1883 1884	July to June 1884 1885	July to June 1885 1886	July to June 1886 1887	July to June 1887 1888	July to June 1888 1889	July to June 1889 1890
Alabama	Palmer L. C. Jones	Palmer Norris	Burns Rogan Johnson Thibault					
Arkansas	Palmer Norris Thing Middleton	Palmer	Thing Middleton Norris Derositt	Derositt				
Dakotas	Norris	Norris						Reynolds
Florida	Rogan	Rogan	Babcock					
Georgia	Rogan Palmer	Rogan Palmer	Rogan	Rogan	McGlasham (collection)			Reynolds
Kentucky	Norris	Norris				Middleton Fowke	Middleton	
Louisiana								Smith Waddell
Illinois	Thing Middleton			Middleton		Fowke	Middleton	
Indiana	Palmer							Reynolds
Iowa	Norris							Reynolds
Michigan	Allis							
Minnesota	Norris							
Mississippi	Palmer		Smith			Rogan		
Missouri	Thing Baird Norris							
New York						Reynolds		
North Carolina	Palmer Emmert Rogan Spain Hour	Palmer Rogan						
Ohio	Norris	Norris	Rogan Smith Middleton			Fowke	Reynolds Fowke	
Pennsylvania			Thomas	Smith				
South Carolina	Palmer			J. W. Earle				Reynolds
Tennessee	Palmer Emmert Middleton	Palmer	Middleton Emmert Rogan	Emmert Rogan	McGill (collection)	Emmert	Emmert	
Texas	Norris	Norris						
West Virginia	Norris	Norris	Norris (Death 1-85)					
Wisconsin	Norris Middleton	Norris		Emmert Middleton				
Number of catalog numbers assigned	2168	2164	1175	1153	296	144	376	127

Table 2. The states in which collections were made by field assistants, on a year by year basis.

level of specificity dictated by Thomas' plan of standardized data recovery were carefully tailored to produce the information relevant to the research questions being addressed.

Footnote:

[1]The original, longer version of this paper is available from the author.

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Ian W. Brown

CYRUS THOMAS AND THE MOUND EXPLORATION OF THE BUREAU OF (AMERICAN) ETHNOLOGY

In February of 1881, Congress appropriated $5,000 for the investigation of the prehistoric mounds of North America. The Mound Exploration Division was set up as an adjunct of the Bureau of Ethnology. Cyrus Thomas was not the initial head of the Division, but he has come to be the one individual most associated with the mound research. In this paper I will be examining Cyrus Thomas' role in what has turned out to be the most extensive archaeological survey ever conducted in North America.

For a man who was to lead such an ambitious archaeological project, Thomas had a rather inauspicious beginning. He was born in Kingsport, in the northeast corner of Tennessee on June 26, 1825. He continued to live there for the next 24 years, receiving a rather minimal educational background at the nearby academy at Jonesboro. Although initially apprenticed to a doctor, Thomas soon switched to law. He moved to Illinois and continued in the legal profession until 1865. Thomas must not have felt comfortable in law, because, at the age of 40, he again changed his vocation. For the next two or three years, he was put in charge of the schools of De Soto in Jackson County, Illinois. Still not finding his niche in life, he subsequently joined the ministry of the Evangelical Church. Thomas abandoned his religious calling several years later.

One interest which Thomas developed very early in his career was the study of natural history. He helped found the Illinois Natural History Society in 1858, and his doctorate, received from Gettysburg College, was apparently in the natural sciences. In 1869 he was made an assistant in entomology for the U.S. Geological and Geographical Survey of the Territories. Four years later he was appointed Professor of Natural Science at the Southern Illinois Normal University. He held this last post until 1877 when he became State Entomologist of Illinois. Finally, in 1882, at the age of 57, he was put in charge of the mound survey of the Bureau of Ethnology. His job with the Smithsonian was his last professional position (Anon. 1910; Keel 1970).

Thomas replaced Wills de Hass, the first director of the Mound Exploration Division. He accused de Hass of having no comprehensive plan of operations (Thomas 1894:19), but, according to Williams (1980), de Hass did indeed set up a strategy for the operation of the survey. After all, de Hass was instrumental in getting Congress to allocate money to set up the mound investigations in 1881 (Powell 1894:XL-XLI), and he certainly had a great interest in seeing the work carried out. There is some suggestion of political intrigue in the replacement of de Hass by Thomas, and John Wesley Powell appears to have been the major force in the transition of power.

Powell's own influence in Washington's scientific circles is a fascinating subject in and of itself. However, I will deal here only with his role concerning Thomas' career. Powell became Director of the Bureau of Ethnology in 1879. His appointment may in part have been the result of an association with General John A. "Black Jack" Logan of Illinois. During the Civil War Major Powell served under Logan at the siege of Vicksburg (Goetzmann 1966:533). After the war, Logan was National Commander of the Grand Army of the Republic, and also a freshman Congressman from Illinois. Logan had very close contacts with Spencer F. Baird, Secretary of the Smithsonian Institution. Together, they were largely responsible for getting the various government-sponsored surveys out of the War Department, where the information was top secret, and into the Department of the Interior (Howard 1975:182-183, 185, 221). As Powell had previously held professorial positions at Illinois Wesleyan College and Illinois Normal University at Bloomington, it is probable that he was quite familiar to the Congressman from Illinois. Logan undoubtedly had some influence in Baird's decision to appoint Powell Director of the Bureau of Ethnology.

Powell may have thanked Logan by appointing Thomas head of the Mound Exploration Division. Powell already knew Thomas, as they had both taught in Illinois, and they were both involved in the various surveys of the Territories. The primary factor supporting Thomas' appointment may, however, have been his close personal relationship with John A. Logan. Thomas' first wife, Dorothy, was the sister of this very influential Congressman (Anon. 1910:338). It is well known that Thomas became a member of the geological survey of Nebraska in 1867, because he was John Logan's relative (Goetzmann 1966:495-496, 514). Perhaps this same relationship contributed to his receiving the directorship of the Mound Exploration Division.

Powell may have found it difficult to push de Hass immediately to the side, as de Hass had played such an integral role in the founding of the Mound Division, but within a year Thomas was in and de Hass was out. Powell (1894:XL-XLI) claims to have been amazed by the act of Congress appropriating money for the mound investigations, but knowing Powell's interest in archaeology (*Ibid.*:XXXIX-XL), and his obvious inclination to political intrigue, it is highly unlikely that the action of Congress was a true surprise. But for some reason, Powell obviously did not want the creation of the Mound Division to be attributed to him.

Cyrus Thomas may not have been the most appropriate choice for such an important position as Director of the Mound Exploration Division, but there can be no question that he did an excellent job in running the organization. He did have some background in archaeological fieldwork (Thomas 1873; 1884), but Thomas was, for the most part, an armchair archaeologist. The actual fieldwork conducted by the Mound Exploration Division was performed by Thomas' permanent and temporary assistants. It is quite clear from his correspondence that Thomas was in strict control of the activities of these assistants. He often wrote weekly to his staff telling them that their reports were sloppy, more detail was needed, or that their budget was not in order. Strong organization was absolutely necessary to complete the goals of the project (Norris 1882; Thomas 1887a-b).

As the area of mound distribution was so large, and the mounds themselves so numerous, Thomas decided to obtain as wide a coverage as possible. Even as early as the late 19th century, site destruction was a constant threat. Mounds were being destroyed daily by agricultural activities and various commercial enterprises (Thomas 1894:20), including, in many areas, vast pot-hunting endeavors (*Ibid.*:183). As a result, Thomas decided that thorough investigations of a single area or even a single site should be left for the future. The purpose of the mound survey was to make as extensive an archaeological study as possible by examining typical structures throughout the East.

Particular attention was given to the mode of mound construction and, more specifically, to the methods of burial in the conical tumuli (*Ibid.*:23). Thomas was a stickler for accuracy. Most of the Ohio section of *Annual Report* 12 is a detailed listing of measurements, essentially correcting the inaccuracies of Squier and Davis' earlier survey (*Ibid.*:481-482). Thomas demanded the same excellence for detail from his staff. He wanted full and complete reports on the various sites investigated. Condensed reports were inadequate, and Thomas did not hesitate to speak of his dissatisfaction in such cases (Thomas 1887c). He wanted to be able to publish the reports verbatim, if need be. We know that Thomas was guilty to some extent of nepotism, but being a relative did not necessarily insure a permanent position. John Rogan, a "cousin" to Cyrus Thomas, did not write a good report on his work in East Tennessee. He therefore suffered a salary cut, an action which eventually forced him to resign from the staff (Rogan 1886a-e).

Those who could not, or would not, shape up, eventually left. Thomas was on an extremely limited budget and he had no time for individuals who were getting in the way of the project's objectives. He was constantly concerned with money and how it was being spent (Thomas 1887b; 1888b). Thomas himself did not receive a salary while he was on assignment, but he was reimbursed for travel expenses (Judd 1967:13). A considerable portion of the Bureau of Ethnology's total expenses under Powell's tenure was taken up by railway passes (*Ibid.*:20), suggesting that the areas surveyed by the Mound Division members may, to some extent, have been affected by the railroad routes of the period. The lack of adequate funding necessitated small crews (Brose 1973:88; DeRositt 1885) and extremely mobile assistants. The assistants rarely stayed in any one place for long periods of time (Smith 1980).

As an able administrator, Thomas was severe to those who were not doing their job, but their principal task was not simply one of finding artifacts, as suggested by some of the Bureau's critics (Peet 1883: 333). Artifacts were indeed important, as they provided visible proof to the public of the archaeological investigations (Thomas 1894:22-24), but as long as his assistants did the best work they could, Thomas seems to have been satisfied.

> I know that the results of your examination in Michigan and the northwest were, as a rule, negative, nevertheless it is necessary to know the area hunted over and the efforts made in order to determine the value of this negative testimony (Thomas 1887c).

Although Thomas made use of his assistants' reports in their original form, he does not appear to have been overly protective of publication rights. It is clear from his correspondence that Thomas had no real objection to his assistants writing independently on their fieldwork and artifact studies. He even encouraged it, but he was concerned about the waste involved in duplicating published information. Thomas also insisted that the Bureau of Ethnology was given full credit for sponsoring the work (Thomas 1887d; 1888a).

Overall, he was quite proud of both his staff and the Mound Division, as indicated in the following letter asking Fowke to accompany him at a meeting:

> . . . I would be glad to have you with me as I propose to give the people a taste of the "New Archaeology" of the Bureau, and wish a witness on hand whose character "for truth & veracity" is unimpeachable (Thomas 1888c).

It should be noted that new archaeology is capitalized, in quotes, and underlined in the above passage. For its day, the mound survey certainly was the new archaeology (Jennings 1974:39). Eastern North American archaeology still has not dealt adequately with the vast amount of data produced by the Bureau between 1881 and 1890. Although the contributions were many, Thomas felt that one of the main benefits of the survey for future archaeology was the correct description of the various mounds, including the numerous figures and diagrams. Thomas even visited a number of the larger sites in 1888 to recheck the observations of his assistants (Reynolds 1888a-b). The 40,000 artifacts collected by the Division were also obviously of immense value to future archaeological investigations in Eastern North America (Thomas 1894:22).

The main contribution of the mound survey was putting to rest the notion that a mythical race was responsible for the mounds. Thomas' report was the final confirmation that the ancestors of the historic Indians were responsible for the construction of the mounds of Eastern North America. With such an immense accomplishment, one might have thought that Thomas, at the ripe age of 69, would have retired. However, the last years of his life were spent writing three books and over a dozen articles (Brown and Williams 1980).

When Thomas died on June 26, 1910, at the age of 85, the scientific community lost one of its major figures. He is most remembered for his archaeological work in North America, but it must not be forgotten that Thomas also made vast and outstanding contributions to entomology and to the study of Maya hieroglyphs in his long and eclectric career. The following passage is from his obituary:

> Dr. Thomas' career was typically American, but of a kind which will scarcely find future duplication. The complete story of his life and times would throw an interesting light on the upgrowth of higher education and modern science on purely American soil (Anon. 1910:339).

I can think of no finer epitaph for the man who destroyed the Myth of the Mound Builders.

Acknowledgements

This paper has profited from numerous discussions with Stephen Williams. I would also like to thank Bruce D. Smith, of the Smithsonian Institution, for generously loaning me copies of Thomas' correspondence.

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Marvin D. Jeter

EDWARD PALMER'S 1882 EXCAVATION AT THE TILLAR SITE (3DR1), SOUTHEAST ARKANSAS

Edward Palmer, who was born in England about 1830 or 1831 and died in 1911, was primarily a field botanist. From 1881 to 1884, though, he was the principal field investigator of archeological sites in Arkansas for the Mound Exploration Division of the B.A.E.

In late 1882, Palmer excavated a mound at the Tillar site in southeast Arkansas, and found at least 58 burials, 23 ceramic vessels, and other grave goods. Most of this material has been stored at the Smithsonian Institution since 1883, and the artifacts have not been analyzed until now. This paper will present a brief analysis of the ceramic artifacts (20 vessels and 3 pipes) and will place the Tillar site in a regional context. A related paper, by Goodwin and others at the Smithsonian, presents an analysis of the human skeletal material (24 crania) which Palmer recovered.

Palmer never published a final report on his investigations, but they were summarized by Cyrus Thomas in his 1891 and 1894 preliminary and final reports on the Mound Survey. Also, some informal notes by Palmer were published posthumously in 1917. During the 1881 and 1882 seasons, Palmer was assisted by H. J. Lewis, a self-educated former slave from Mississippi. Lewis made a number of sketches in the field, which are available in the National Anthropological Archives at the Smithsonian.

The Setting of the Tillar Site

The precise location of Palmer's Tillar mound is not certain, but a very close approximation can be derived from his notes and from land ownership records for the 1880s. The site was in the immediate vicinity of Bayou Bartholomew, in northeastern Drew County. The "meander belt" presently occupied by this bayou was probably abandoned by the Arkansas River around A.D. 1000, or several hundred years before Palmer's Tillar burials were interred.

The site was on or very near an old natural levee of the Arkansas River, with well-drained, naturally fertile soils adjacent, and several oxbow lakes or swamps in the vicinity. A short distance to the west, uplands of Pleistocene age mark the western edge of this Holocene "delta" country. A short distance to the east is the more ancient Bayou Macon meander belt. Farther to the east, just across the Mississippi River, is the very large Winterville site. To the northeast, just across the Arkansas River, is the Menard site, which James A. Ford (1961) identified as the historic Quapaw village of Osotouy.

Palmer's 1882 Excavation

Palmer's excavation at Tillar took place in late 1882. In Palmer's words:

> As the iron probe indicated there was something below, I commenced on one side so as to dig over the entire mound. At one foot below the surface I commenced to find pottery, remains, etc. This deposit of bodies deepened to two feet toward the center. They were without any definite order of deposit, nor did they face any one direction . . . (1917:395).

Referring to an unpublished plan view sketch made by Lewis, Palmer's notes state that "The drawing gives a fair idea of the irregular way in which things were mixed up." The notes and the sketch both give the impression of a mass deposit of skeletal material, ceramic vessels, and other grave goods.

According to Thomas, Palmer recovered 23 whole vessels and "a number of pipes" from Tillar. "Stone spades" were also found. The writer has located and examined 20 vessels, 3 pipes, and a single stone "spade" or hoe at the Smithsonian. Of the 20 vessels, 5 are bottles, 3 are bowls, and 12 are jars. With one possible exception, they are all shell-tempered. A tentative type-variety classification has been attempted, but most of these vessels were classed as *"variety unspecified"* of one type or another (Table 1). The classic definitions of Lower Valley types and varieties essentially omitted southeast Arkansas materials. The ceramic modes and attributes found here frequently occur in combinations that are not known in adjacent regions.

The three ceramic "elbow" pipes have obvious resemblances to pipes found in late Mississippi period contexts from northeast Arkansas to northeast Louisiana and western Mississippi. The final artifact is a stone "spade" or "hoe". One end is missing, but the other has a definite polish. It was originally about a foot long. The lithic material is apparently Mill Creek Chert from southern Illinois, which was widely distributed during the Mississippi period. Similar specimens have been found slightly south of Tillar, at the Winterville site and in Ashley County, Arkansas.

All of the artifactual evidence is consistent with a Mississippi period placement for Palmer's assemblage from Tillar, and the bulk of the ceramic evidence suggests a very late prehistoric or protohistoric dating. It is likely that the skeletal material and artifacts from Tillar represent a single depositional event: the final ceremony, during the A.D. 1500s, in the history of a charnel house which may have been in use for a generation or more.

Summary: "The Big Picture"

Ultimately, Tillar and related sites can furnish information on late prehistoric to historic social organization, demography, human biology, exchange, and perhaps population movements. Some initial steps have recently been taken or suggested in our report on the nearby Kelley-Grimes site (Jeter, Kelley and Kelley 1979).

Two late Mississippi period mortuary complexes may be tentatively defined in this region. Sites of the "Hog Lake Complex", on the Bayou Macon meander belt, were first reported on in 1937 by Lemley and Dickinson, and were summarized in the Kelley-Grimes report. The "Tillar Complex" sites on the Bayou Bartholomew meander belt, have been extensively mined for artifacts, but not intensively studied and reported on until now. We are still attempting to document the private collections from them.

Comparative studies indicate that Palmer's Tillar site was on the middle to upper levels of the contemporary mortuary site hierarchy. However, there is no evidence for intra-site status differentiation, let alone "elite" status. Here, as at Kelley-Grimes, there is artifactual evidence for exchange or interaction with groups in the Yazoo Basin, and both upstream and downstream in the Lower Valley. More than at Kelley-Grimes, the slightly later Tillar assemblage also suggests interaction with groups to the west, in the Caddoan area.

Finally, Brain (1978) has made the interesting suggestion that the decline of Winterville was part of a general process of population movement away from the Mississippi River, beginning in the A.D. 1400s and culminating in the protohistoric period. The data presently at hand, while admittedly inadequate, do appear to support this suggestion. There are obvious overlaps of artifactual diagnostics of the 1400s in both the Hog Lake and Tillar Complexes, but so far there definitely appear to be more protohistoric materials in the Tillar Complex sites. This also suggests that research on the Tillar Complex will contribute to closing

Table 1. Summary of selected attributes of ceramic vessels from the Tillar site (3DR1) in the Palmer collection at the Smithsonian Institution. Measurements are in centimeters.

Bottles:

Vessel	Smith. #	Type and Variety	Height: Entire	Height: Neck	Diameter: Rim	Diameter: Neck/Body	Diameter: Body
A	71258	Winterville Incised, *var. unspecified*	27.2	12.8	4.9	7.9	17.8
B	71260	Untyped incised ("connected arches")	21.8	6.8	4.5	5.3	17.4
C	71259	Leland Incised, *var. unspecified*	20.8	9.2	6.9	5.4	15.5
D	71257	"Tillar Engraved" (informal type)	22.0	8.3	4.5	6.7	20.2
E	71256	Mississippi Plain. *var. unspecified* ("neckless")	23.0	—	3.7	—	15.9

Bowls:

Vessel	Smith. #	Type and Variety	Height	Rim Diameter
F	71272	Mississippi Plain, *var. unspecified*	8.0	16.7
G	71271	Bell Plain, *var. unspecified* ("German helmet")	8.5	17.0
H	71273	Mississippi Plain, *var. unspecified* (compound)	6.3	8.5 to 9.0 for individual bowls

Jars:

Vessel	Smith. #	Type and Variety	Height	Diameter: Rim	Diameter: Neck	Diameter: Body
I	71270	Winterville Incised, *var. unspecified*	8.5	9.0	8.2	9.8
J	71311	Winterville Incised, *var. unspecified*	13.0	12.5	11.5	15.0
K	71267	Barton Incised, *var. unspecified*	9.6	9.5	8.6	10.5
L	71269	Barton Incised, *var. unspecified*	9.7	10.6	9.1	10.5
M	71263	Untyped incised-punctated	14.4	15.2	14.0	15.7
N	71266	Untyped incised	11.3	12.7	12.0	13.5
O	71264	Mississippi Plain, *var. unspecified*	9.2	11.6	10.9	11.2
P	71268	Mississippi Plain, *var. unspecified*	12.0	10.4	9.9	13.2
Q	71262	Mississippi Plain, *var. unspecified*	13.5	13.0	11.8	15.0
R	71261	Mississippi Plain, *var. unspecified*	14.0	12.6	11.5	12.6
S	71265	Mississippi Plain, *var. unspecified*	13.2	12.8	10.9	12.7
T	71245	Mississippi Plain, *var. unspecified*	9.4	9.1	8.6	11.6

the gap between prehistoric archeology and the remains of the Quapaw or other historically documented groups in southeast Arkansas.

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Carl H. Chapman

LEGACY OF THE 1880 THOMAS MOUND SURVEY: A MISSOURI EXAMPLE

This paper is a direct result of the Smithsonian-Lower Mississippi Survey Conference and some of the data included in it were gathered during the conference. The conference not only offered the opportunity to become familiar with the research materials and data at the Smithsonian, but also acted as a catalyst stimulating further research on various aspects of the Cyrus Thomas Mound Survey inaugurated 100 years ago. This first large archaeological survey supported by federal funds had a great impact on the archaeology of the Eastern United States. Here only a small part of the legacy of the Thomas survey will be discussed: a brief and selective history of the archaeological surveys in the State of Missouri.

To initiate the research on archaeological surveys, the archives of the Missouri Historical Society in St. Louis were visited. The results were gratifying, for the original detailed notes and sketch maps of L. M. Bean were located. They demonstrated that the first major state-wide archaeological survey of Missouri was conducted in 1904-1905. This was just ten years after the publication of the Thomas 1894 report on the Mound explorations of the Bureau of American Ethnology. It is probable that this survey, sponsored by Louis Houck for inclusion in volume one of his *A History of Missouri,* published in 1908, was stimulated by the Thomas survey. This was the most outstanding state survey of the time. Houck had employed L. M. Bean and D. L. Hoffman to conduct the work. It seems that a good choice was made, for 28,000 mounds were located. The only problem was that nearly two thirds of them were natural.

Immediately following this broad survey of the state, another more limited mound survey was conducted by Gerard Fowke, who had been one of the members of the original Thomas team in Mississippi, Illinois, Kentucky and Ohio until 1889. After continuing work in Ohio, Fowke came to Missouri in 1905 to work with the Missouri Historical Society in St. Louis where he aided in the excavation of the Montezuma Mounds in the Illinois River Valley. He was not very happy with the archaeology in the area, for in November of that year he wrote W. H. Holmes at the Bureau of American Ethnology as follows: "My excavations at Montezuma and the American Bottoms opposite St. Louis have been the most absolutely barren I have ever made. It disgusts me and I am afraid it will have the same effect on the society. It wants relics" (Letters Received, National Anthropological Archives, Smithsonian Institution).

In spite of his fears, Fowke's work was well received for in 1906-1907, in concert with the Missouri Historical Society, he was hired under the auspices of the Archaeological Institute of America to conduct an extensive survey and excavation of mounds in the central and southeastern parts of Missouri. Fowke maintained his ties with the Bureau of American Ethnology through publication of the results of his survey in *Bureau of American Ethnology, Bulletin* 37 in 1910, and that of his continued "Archaeological Investigations" in *Bulletin* 76 in 1922 and the 44th *Annual Report* in 1928.

It was not until the 1930's that Federal support was available on a broad basis for archaeological surveys and excavation. The Great Depression brought with it government programs that included support for archaeological work. In Missouri, the Civil Works Administration in 1933 was approached by two University of Missouri professors, Brewton Berry and Jesse Wrench, for support for a two-week trial archaeological survey of the state—which was granted. This survey was so successful that it was continued in 75 counties under the Federal Emergency Relief Administration in 1934; although it only lasted until November, Berry and Wrench had found a core of people interested in Missouri Archaeology and in December invited them to the University at Columbia to form a State Archaeological Society, one major purpose of which was to continue the Archaeological Survey of the state. The Society was formed and became active in 1935.

From 1935 to 1938 another federal program, the National Youth Administration, was tapped for funds by Berry and Wrench and an intensive survey was made of Boone County, in which the University is located. *The Missouri Archaeologist* was initiated in 1935 as the official publication of the Society and carried some of the results of the surveys as it still does, and aided in obtaining others to work on the survey of the state. By 1937 enough interest had been generated that the state legislature for the first time bought an archaeological site to be preserved in a state park, the old fort in Van Meter State Park, and set up a fund through the university specifically for archaeological surveys, the *Archaeological Research Experiment Station Fund,* which still supports the Archaeological Survey of Missouri at the University today. The first use of the fund was to survey the Wappapello and Clearwater Reservoir areas, the beginning of the river basin surveys in the state which have been a major focus of archaeological research since that time.

The federal programs such as the Works Progress Administration (WPA) gave the field of archaeology a big boost throughout much of the United States. In Missouri, the Academy of Science of St. Louis and Missouri Resources Museum of Jefferson City sponsored the WPA work in Jefferson, Ste. Genevieve and New Madrid Counties. Surveys and excavations were conducted during the period 1939-1942.

With the advent of World War II, the WPA ceased and archaeological research by the University and the State Society declined.

Shortly after World War II, in 1946, the University of Missouri created the position of Director of American Archaeology to continue archaeological research in the state and to work with the state society on the Archaeological Survey of Missouri. A major emphasis of the work was the investigation of areas to be affected by the building of dams. The Society, the University, and the Missouri Resources Museum joined in this Reservoir Survey work from 1947-1950.

In 1950 F. H. H. Roberts of the Bureau of American Ethnology again involved the Smithsonian Institution in a nation-wide river basin survey program, and asked those working on such projects for coordination with that institution. The University and Society complied.

There were also surveys by other institutions located outside Missouri. The Lower Mississippi Alluvial Valley Survey of 1940-1947 and the Central Mississippi Valley Survey begun in 1949 are two examples.

During the 1950's and 1960's when funds became available for reservoir salvage surveys and excavations through the National Park Service, the University of Missouri participated by furnishing more than half the cost, and added personnel and equipment needed to conduct the archaeological research. Archaeological investigations were made in two major reservoirs in the state.

Archaeological surveys and excavations were more adequately funded in the 1970's with the passage of the Historic Sites Act of 1966, the Environmental Protection Act of 1969, and the Archaeological Conservation Act (Moss-Bennett) of 1974. With the better funding and the necessity of mitigating impacts on cultural resources threatened by federally sponsored projects, other institutions and private organizations joined in the archaeological surveys of the state.

There are presently about 20,000 site locations recorded in the Archaeological Survey of Missouri files. Most of the data have been computerized to speed up the process of supplying researchers and federal and state agencies with site data needed for cultural resource management. Among the earliest information in the Survey files is that from the Cyrus Thomas Mound Survey.

Today, the American Archaeology Division of the Department of Anthropology, University of Missouri-Columbia and the Missouri Archaeological Society still have as a major interest the archaeological survey of Missouri, an emphasis traceable in part to the Thomas Mound Survey 100 years ago.

Acknowledgements

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C. Wesley Cowan, H. Edwin Jackson, Katherine Moore, Andrew Nickelhoff, and Tristine L. Smart

THE CLOUDSPLITTER ROCKSHELTER, MENIFEE COUNTY, KENTUCKY: A PRELIMINARY REPORT

During the late 1920s and early 1930s archaeologists from the University of Kentucky excavated a number of rock shelter sites in the rugged mountains of eastern Kentucky. In secluded overhanging cliffs in the Licking, Kentucky and Red River drainages they discovered a wealth of well-preserved cultural materials that caught the attention of the eastern North American archaeological community. Woven fiber slippers, fiber bags filled with nuts, wooden tools, and other items of material culture were recovered in quantity, preserved through the millennia by the dry microclimates of the interiors of these overhangs (Funkhouser and Webb 1929, 1930; Webb and Funkhouser 1936).

In the intervening years the limited amount of data recovered from these sites has gained considerable prominence. Remains of cultivated plants retrieved from the shelters have been used to formulate hypotheses concerning the development of horticulture in eastern North America (Yarnell 1972; Struever and Vickery 1973). All of these studies have, however, suffered from the lack of rigor that the early excavators employed during their field operations. Invariably, recent conclusions are couched in terms of "if these remains are such in such in age, then such and such can be stated."

Recognizing the vast potential that sites of this type hold for answering these and other important anthropological questions, the University of Michigan Museum of Anthropology returned to the so-called "rock shelter" area of eastern Kentucky during the summer of 1978. Through financial support from the National Science Foundation extensive excavations were conducted at the Cloudsplitter Rock Shelter (15Mf-36) in Menifee County and Haystack Shelter (15Po-47) in Powell County, Kentucky (Fig. 1). The goals of this undertaking were to excavate shelters that contained well-preserved cultural and biological data in order to answer the following questions: (1) What was the nature and complexity of the ecosystem within which the prehistoric human occupants interacted? (2) How did they adjust to the natural changes in the long-run composition and short-term productivity of their environment? (3) How did human cultural disturbance, especially as these populations planted and cultivated their crops, affect or alter the local environment? (4) How did these groups utilize the perishable artifacts made from local raw materials to articulate with the particular plant and animal species which contributed to their livelihood? These problems remain the focus of ongoing laboratory analyses. After two years of analysis of the Cloudsplitter materials, however, the following preliminary results can be reported. Publication of a more complete report is anticipated in the near future.

Cloudsplitter Rock Shelter

The Cloudsplitter Rock Shelter is situated beneath a westerly facing sandstone cliff (Fig. 2). The protected portion of the overhang is approximately 40 meters long and varies from 4 to 5m in width. Massive sandstone ceiling blocks form a barrier across the entire

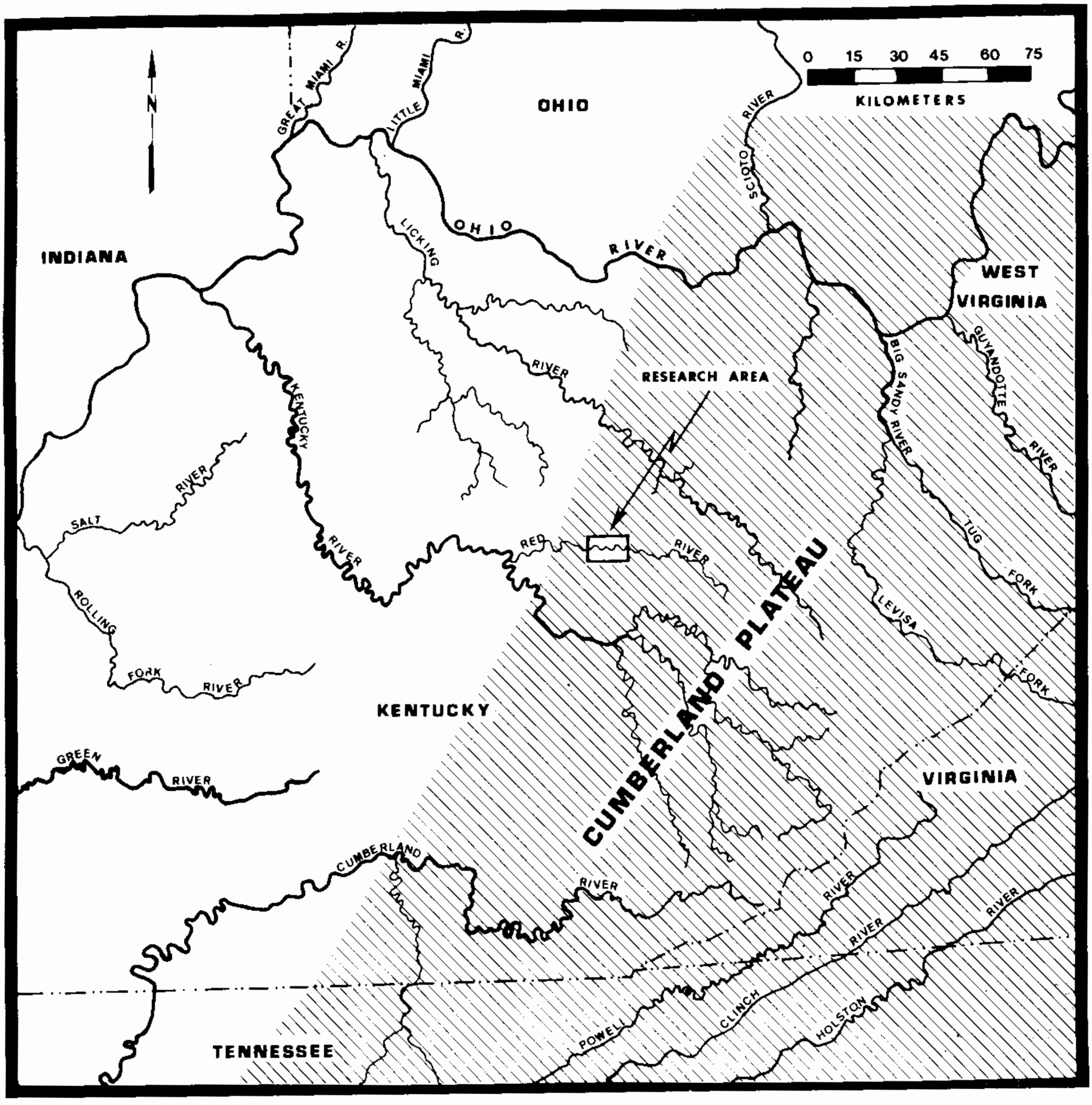


Figure 1. Location of the Cloudsplitter Shelter in the Ohio Valley.

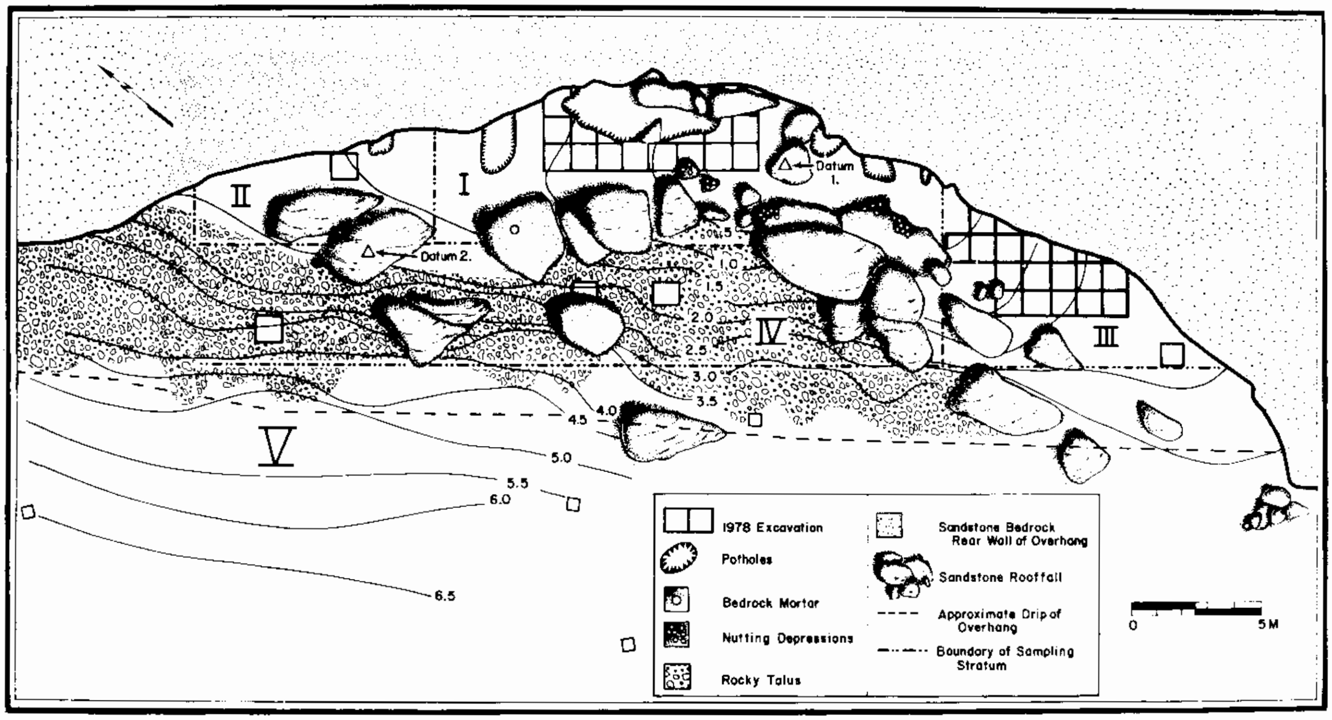


Figure 2. The Cloudsplitter Shelter showing areas excavated, sampling strata, and various natural and cultural features.

front of the overhang, effectively defining between 160-180 m² of potentially inhabitable floor space.

Prior to the commencement of the actual excavation of the site, the area beneath the overhang and its surroundings were divided into five artificial sampling strata (Fig. 2). Within the overhang, four sampling strata were delineated on the basis of major breaks in topography, and presence of roof fall. Sampling Strata I, II, and III were all located in areas where the surface of the overhang was relatively free of roof fall. Sampling Stratum IV included the rock strewn talus slope downhill from the actual floor of the overhang, and Sampling Stratum V included the wooded area outside the overhang.

A one m² grid system was established over the entire surface of the overhang, with each unit having as its basic reference point the southwest corner stake. Excavation proceeded in natural levels, and when uniform deposits were encountered that exceeded five cm in thickness, the deposit was excavated in arbitrary 5 cm levels. With the exception of a few thick ash deposits, most units of excavation were considerably less than five cm.

All deposits were excavated with four inch pointing trowels and dustpans. Deposits were dumped into three gallon plastic pails, and notes were maintained concerning the volume of each excavated deposit. Soil was passed through nested screens; the top screen consisted of one quarter inch hardware cloth that overlay a lower box lined with window screen. All materials trapped by this system were retained for future analysis. A standard two liter sample for fine sieve screening was taken from each deposit and cultural feature encountered. Over 100 radiocarbon samples were collected from each of the major deposits and cultural features. Pollen samples were also collected from each feature, and from several columns within the overhang. Geologic and PO_4 samples were also collected from various areas within the site. Because of the careful control maintained concerning size and volume of each of the deposits, as well as a virtual total recovery of the cultural and biological materials they contained, an excellent record of the contents of the site was produced.

Description of the Deposits and Radiocarbon Dates.

The depositional history of the site is now being synthesized. As indicated by a 2 m long section from the deepest area of the site, the stratigraphy was quite complex (Fig. 3). Numerous micro-lenses were present, and were often interrupted by cultural features. In many areas of the site, occupation surfaces were almost entirely obliterated by later cultural activities such as fire and pit building. In addition, the majority of Sampling Stratum I was found to be underlain by a massive sandstone roof fall that apparently fell before the initial occupation of the site. In the main occupation zone, only one small area was free of these blocks. Early Archaic occupation began on this surface, with the surrounding roof fall acting as an effective barrier against occupation in other areas. As the overhang filled in with domestic residue and naturally eroding sand grains, step by step, the uneven, underlying roof fall became buried, making new surfaces available for utilization. This process seems to have taken place quite slowly and because of this it is difficult to relate spatially isolated deposits over different areas of roof fall. This problem is, of course, compounded by a plethora of cultural features which have cut through and often displaced earlier deposits. In addition, because the deposits are quite varied in their content from place to place with the overhang, it was generally impossible to follow single deposits over any appreciable horizontal distance. This was a particularly severe problem for the upper deposits in the overhang.

Roof fall was conspicously absent in the majority of Sampling Stratum III. Here the floor was composed of sterile, well cemented deposits that were in places overlain by stratified cultural sediments. In this re-

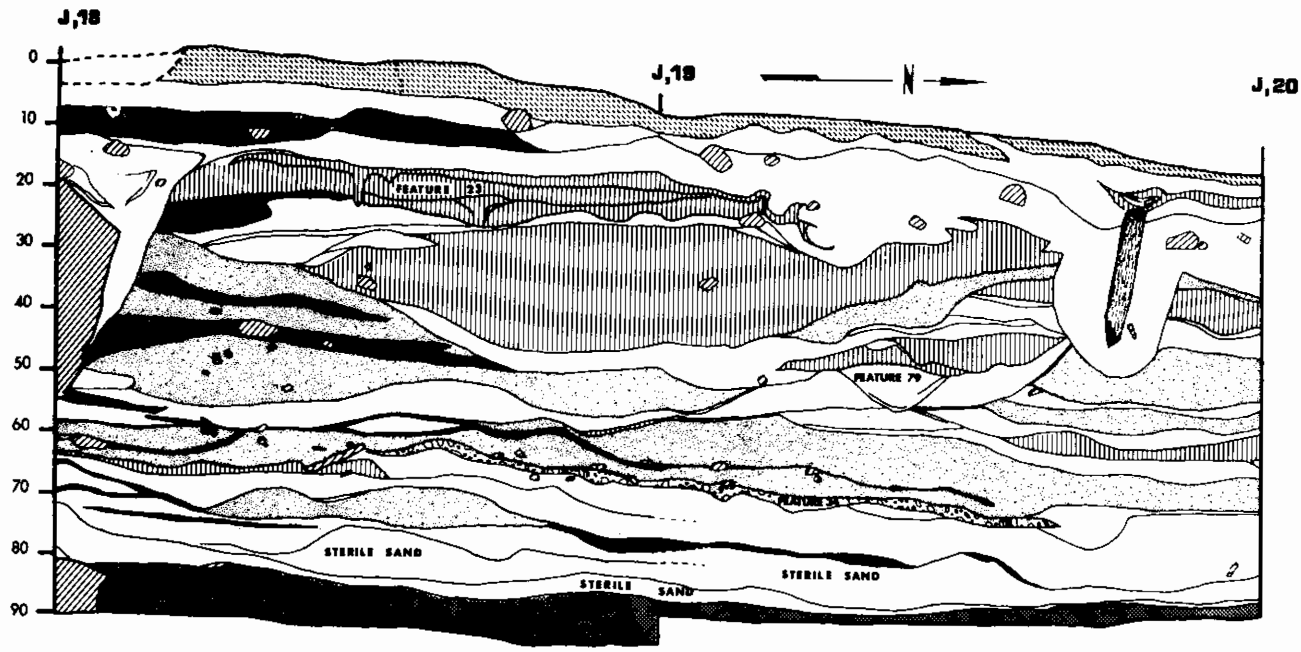
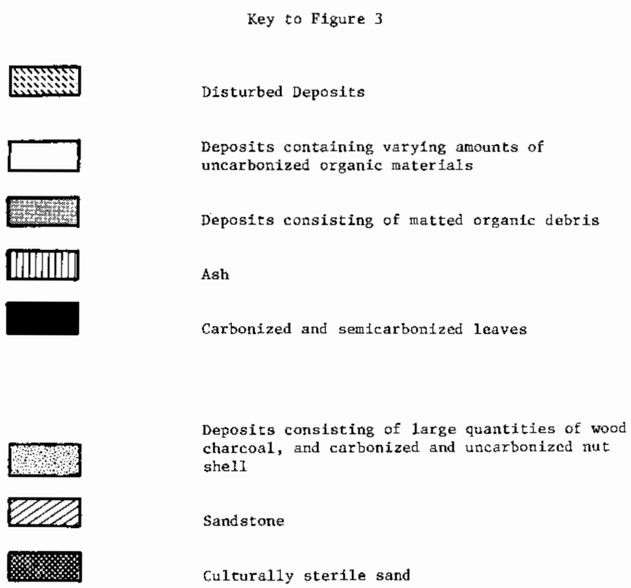


Figure 3. Representative profile from Cloudsplitter showing the complexity of the rockshelter sediments.



spect, Stratum III was uniquely suited for the construction of a series of large, Early Woodland storage pits. Most of these features were placed in areas that never served as habitation zones.

Besides these pits, some 75 additional cultural and natural features were discovered at the site. Seventy-one percent of these were associated with the deposits in Sampling Stratum I. Other features included ash lenses of varying sizes, several types of hearths, small organic filled pits, and a rock-lined storage cyst. Most of these were associated with the Early Woodland occupations.

On the basis of our present knowledge, the initial occupation of Cloudsplitter began sometime prior to 9000 yrs ago. At this time the floor of the overhang was covered with a thick mat of hemlock needles. This hemlock needle layer was best preserved in Sampling Stratum III and was present in traces in the deepest portions of Sampling Stratum I. A few postmolds and surface hearths mark this earliest occupation. Early Archaic cultural materials include 2 Kirk-like corner-notched dart points, a single LeCroy bifurcate base point, and an untypeable notched point. A single radiocarbon date of 8200 ± 225 B.P. (GX-5874) is available for one of the Early Archaic deposits in Sampling Stratum I. While culturally diagnostic materials are absent in Stratum III, radiocarbon dated hearths of 9228 ± 100 B.P. (UCLA-2313) and 11, 278 ± 200 B.P. (UCLA-2340I) suggest that humans were entering the site at an even earlier date (Tables 1 and 2).

Curiously, the site does not seem to have been utilized during the Middle Archaic. In fact, only three radiocarbon samples have yielded dates falling between 6000 and 4000 B.P. (UCLA-2313A, UCLA-2313B, UCLA-2340M). On the basis of available stratigraphic information, two of these (UCLA-2313A, UCLA-2340M) should have yielded much later dates. No Middle Archaic cultural materials were found associated with *any* deposit.

Late Archaic occupation of the site seems to have begun as early as 4500 years ago, and terminated around 3000 B.P. Five radiocarbon dates fall within this time range, and are associated with a wide variety of deposits. Although infrequent, diagnostic artifacts include cultural materials typical of the Central Ohio Valley Archaic (e.g., a stemmed McWhinney point reworked into an endscraper, and a Merom/Trible notched point) (Vickery 1980; Winters 1969).

Early Woodland occupations commenced shortly after 2700-2800 years ago, and lasted for nearly 500 years. Four radiocarbon dates are so far available for this time range (UCLA-2313A, UCLA-2313F, UCLA-2340C, UCLA-2313D). The Early Woodland deposits are markedly different from those of earlier periods. Post 3000 B.P. deposits are consistently quite ashy, and are riddled with cultural features. At least two areas delineated by wooden posts and post-molds seem to have been the sites of windbreaks in Sampling Stratum I. Two extensive ash deposits, Lens C and the Buff Ash, each covering areas 3-4 m^2 are also present in Early Woodland contexts. Both contain large quantities of incinerated chert flakes, animal bones and mussel shell, suggesting they resulted from some large

Table 1. Radiocarbon Determinations from Sampling Stratum I as of November 10, 1980.

Provenience	Age in Radiocarbon Yrs 5568 half-life	Age in Radiocarbon Yrs 5730 half-life	Uncorr. Date	MASCA Corr
surface of I,16	505 ± 60 (UCLA-2313B)	520 ± 60	A.D. 1429	A.D. 1400
Feature 60, I,19	2710 ± 60 (UCLA-2313A)	2791 ± 60	841 BC.	910 B.C.
Feature 62, I,18	2710 ± 60 (UCLA-2313F)	2791 ± 60	841 BC.	910 B.C.
Feature 55, J,13	2615 ± 60 (UCLA-2313C)	2693 ± 60	743 B.C.	810 B.C.
Feature 71, I,17	2440 ± 80 (UCLA-2340C)	2513 ± 80	563 B.C.	690-710 B.C.
		1945 ± 130* (GX-5872)	A.D. 5	A.D. 70-90
organic deposit, I,16	2370 ± 60 (UCLA-2313D)	2441 ± 60	491 B.C.	470 B.C.
Feature 24, J,19	740 ± 100 (UCLA-2340B)[1]	242 ± 80	A.D. 1708	A.D. 1630
above Ash Lens C, I,18	235 ± 80 (UCLA-2340N)*	762 ± 100	A.D. 1188	A.D. 1220-1230
Ash Lens C-B, I,18	3550 ± 60 (UCLA-2313J)	3656 ± 60	1778 B.C.	2070 B.C.
Buff Ash Lens, I,13	3060 ± 60 (UCLA-2313H)	3151 ± 60	1201 B.C.	1380-1400 B.C.
Feature 59, J,13	5790 ± 400 (UCLA-2340M)*	5963 ± 400	4013 B.C.	4610 B.C.
brown sand below Buff Ash, I,13	3370 ± 100 (UCLA-2340N)	3471 ± 100	1420 B.C.	1520 B.C.
nut lens 1, I,16		3060 ± 80 (GX-5871)	1110 B.C.	1270-1300 B.C.
brown sand w/nuts, I,18	3620 ± 80 (UCLA-2313K)	3728 ± 80	1778 B.C.	2070 B.C.
Feature 34, I,18	4570 ± 100 (UCLA-2340H)	4707 ± 100	2757 B.C.	3380 B.C.
lower middle Lens E, J,19		8200 ± 225 (GX-5874)	6250 B.C.	

[1]Provisional, R. Berger, personal communication.
*Inconsistent with stratigraphic position of sample.

fire. Neither contains large quantities of wood charcoal, however, and the exact origins of these deposits remains obscure.

Crude limestone-tempered plain ceramics and a few stemmed dart points are the only culturally diagnostic materials that were recovered from Early Woodland contexts. The dart points are typical Early Woodland forms for the Red River Basin; the pottery, although crude, seems atypical of Early Woodland forms in the Ohio River Drainage.

There are no Middle or Late Woodland deposits at the site, but a few triangular arrow points and shell tempered ceramics suggest that the site was frequented on occasion after A.D. 1100 by Fort Ancient visitors. Evidence of their activities are limited to the upper few cm. of Sampling Stratum I, and are generally interspersed with the latest Early Woodland materials. A single radiocarbon date of A.D. 1429 (UCLA-2313B) marks the final abandonment of the site.

Geoarchaeological Analysis

A study of the sediments in Cloudsplitter rockshelter was undertaken to address several problems, including the developmental history of the deposits, potential environmental changes which might be reflected in varying sediment compositions, and to aid in the identification and interpretation of specific cultural features encountered during excavation. The rockshelter, situated 370m above the present Red River floodplain, was formed in the bluff face of the Corbin Member of the Lee Formation (Early and Middle Pennsylvanian). Formation of the overhang appears to have been initiated by ground water seepage along a bedding plane and enlarged through attrition from the roof, resulting in a steeply sloped ceiling protecting a long, but shallow niche. Bedrock is composed of quartz sands and pebbles, with minor amounts of muscovite, hematite, and other minerals, weakly cemented by pressure solution of individual sand-grain surfaces.

Deposits. Deposits are of undetermined depth; large roofblocks prevented excavation to bedrock. The deposits consist of: (1) bedrock roof fall, ranging in size from small pebbles to large (4 m or longer) blocks; (2) individual sand grains, derived from grain-by-grain attrition of the ceiling and from *in situ* weathering of roof fall; and (3) cultural materials. While a determination of the timing of major roof fall events has not been possible, most of the largest blocks appear to have fallen prior to occupation, based on stratigraphic relationships with cultural deposits and the alteration of several blocks for use as mortars and nutting stones.

Table 2. Radiocarbon Determinations from Sampling Stratum III, the Cloudsplitter Rockshelter.

Provenience	Age in Radiocarbon Yrs 5568 half-life	Age in Radiocarbon Yrs 5730 half-life	Uncorr Date	MASCA Corr
Feature 65, storage pit	2760 ± 100 (UCLA-2340D)	2842 ± 100	892 B.C.	810 B.C.
	1550 ± 80 (UCLA-2313E)	1596 ± 80	A.D. 430	A.D. 353
E,4 SE quad, directly above Feature 11	12,000 ± 400 (UCLA-2340L)	12,360 ± 400	10,360 B.C.	
E,4 Feature 11, directly on top of hemlock layer	8950 ± 100 (UCLA-2313I)	9228 ± 100	7278 B.C.	
E3,E,4, SW quad, Feature 13 directly on top of hemlock needle layer	10,950 ± 200 (UCLA-2340I)	11,278 ± 200	9328 B.C.	
F,4 hemlock needle layer		9215 ± 290 (GX-5785)	7265 B.C.	

Stratigraphic Units. Two major stratigraphic units were identified during the excavation. The uppermost unit is composed of unconsolidated Holocene-aged strata with cultural material, and radiocarbon dated as early as 12,000 B.P. These strata overlie either large roofblocks or early Holocene-Late Pleistocene aged deposits. These older deposits, constituting the lower major unit are completely devoid of cultural and botanical material and have not been chronometrically dated. In the southern portion of the site, Pleistocene strata are overlain by only a thin veneer of Holocene deposits, having not been as intensively occupied as other parts of the site. These Pleistocene deposits are lightly cemented, and in profile have a laminae-like appearance, with alternating bands of white or gray and light yellowish brown (10YR6/4, dry) sediments.

Analysis. Analytical techniques utilized in the present study include grain size analysis of both fine and coarse sediment fractions following methods outlined by Farrand (1975); determination of pH; and the determination of organic matter and carbonate content using the loss-on-ignition method (Dean 1974). Only the results of the grain size analysis of the fine sediment fraction (less than 2 mm) and the determination of organic matter and carbonate content are reported here; for results of other analytical procedures, the reader is referred to Jackson (1980).

Column samples from Holocene occupation deposits and Pleistocene deposits were subjected to sieve analysis to determine sediment size composition. Samples from Holocene deposits (Fig. 4) exhibit a relatively uniform composition, with coarse and medium sands comprising 88.1-94.6% of the sediments. Modal peaks occur in either the .5-.25 mm or the .25-.125 mm size fraction. Fine sands, silts and clays constitute only 5.11-11.9% of the samples. In sum, deposits appear to reflect the composition of the bedrock with no sediments added from external sources.

Each laminae-like layer from the Pleistocene deposits was also analyzed (Fig. 5). These sediments are also unimodal, with distribution peaks in the .5-.25 mm size range. In contrast to the Holocene-aged deposits, they are more poorly sorted. Very fine sands, silts and clays range between 5 and 25%. The greater percentage of coarse sand is probably attributable to a changing facies of the sandstone bedrock sediment source. The relatively higher percentage of silts and clays may be the product of eolian deposition associated with late glacial conditions. The white laminae-like lenses correspond to relatively higher percentages of silts and clays, and also percentage of carbonates (Fig. 5), suggests the concentration of carbonate in finer grained deposits to produce the alternating white and light yellowish brown lenses. Increased water percolation may have produced this configuration through the translocation of carbonates, pointing to moister climatic conditions prevailing during the Late Pleistocene.

Organic matter and total carbonate content was determined for both column samples and for feature sediment samples. Organic matter in feature sediments was generally higher than in stratigraphic units. Carbonate content was quite variable, with several ash filled deposits mixed with burned and fragmented mussel shell having up to 10% carbonates by weight.

Visual similarities noted by the excavators which provided the criteria for grouping kinds of features and deposits were evaluated by plotting organic matter against carbonate content (Fig. 6). Several clusters can be differentiated by these parameters: these clusters correspond to features grouped together by morphological and functional characteristics. Ash beds (Cluster A), with large quantities of ash as well as shell and bone exhibited relatively high percentages of carbonates and low percentages of organic matter. Other features (Cluster B) with greater amounts of charcoal,

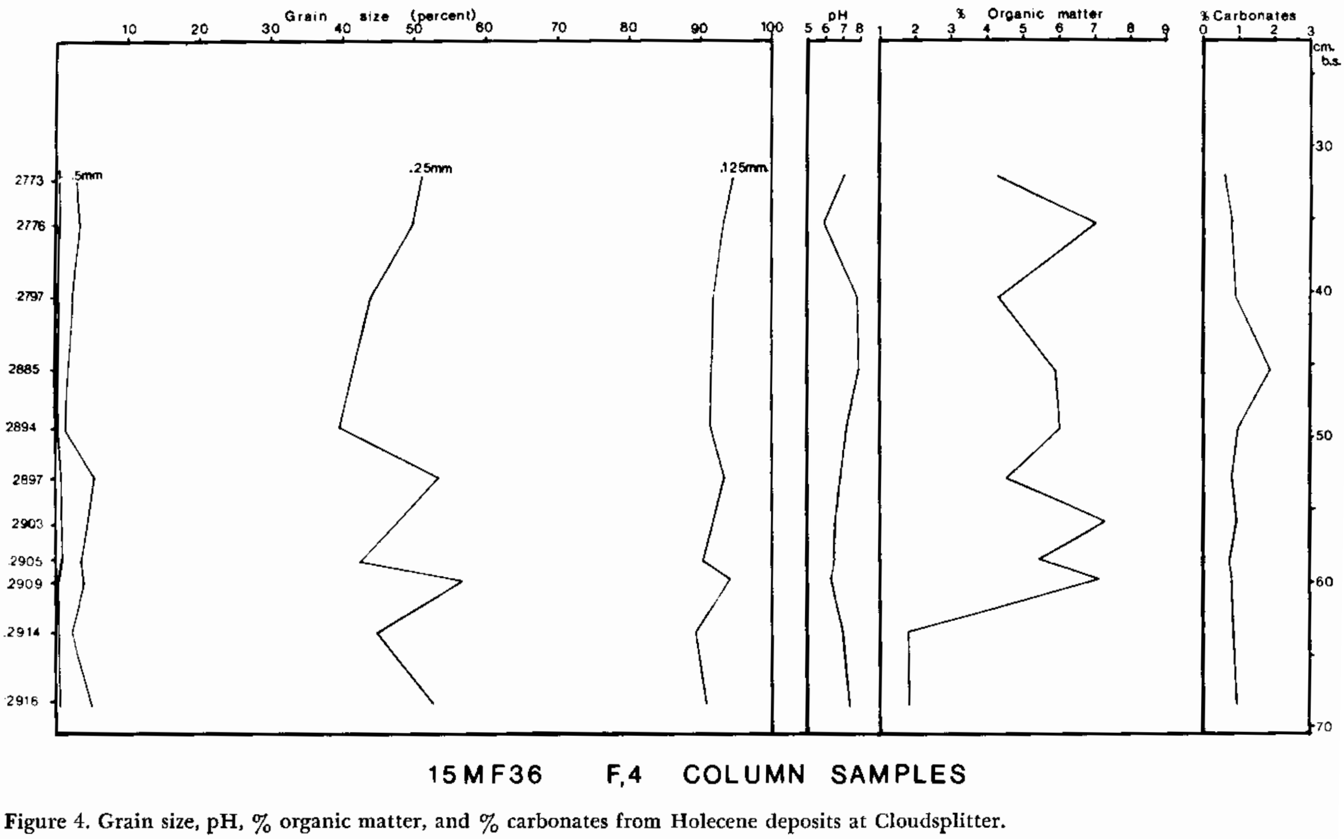
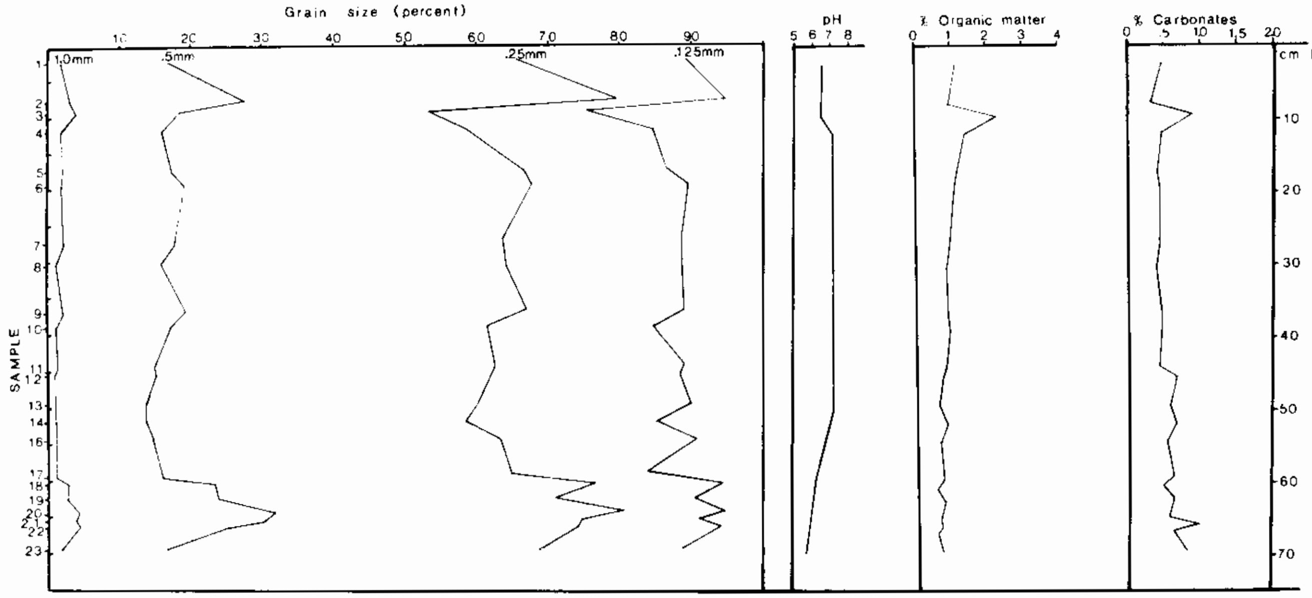


Figure 4. Grain size, pH, % organic matter, and % carbonates from Holecene deposits at Cloudsplitter.



15MF36 C.2 COLUMN SAMPLES

Figure 5. Grain size, pH, % organic matter, and % carbonates from Pleistocene deposits at Cloudsplitter.

cluster with high organic matter and low carbonate values. Features interpreted as postmolds cluster between A and B (Cluster C). Holocene occupation strata are represented in Cluster D and Pleistocene strata by Cluster E.

In general, it has been demonstrated that chemical parameters including organic matter and carbonate content are useful for distinguishing between archaeological deposits. Less conclusive is the ability of present sedimentological methods to monitor paleoenvironmental fluctuations in deposits derived from sandstone bedrock. Late Pleistocene-Holocene environmental changes are evidenced in the different grain size compositions between Pleistocene and Holocene strata. However, minor fluctuations, if they occurred during the Holocene, would not be expected to be recorded by grain size composition, which instead directly reflects the composition of the bedrock from which sediments are derived.

A more promising, though unevaluated, approach involves the use of morphology and size distribution of stone-sized clasts (Jackson 1980). However, due to very slow rates of deposition and the significant contribution of culturally introduced organic material to deposit volume (up to 75-80%) much larger sediment samples are required than are normally taken for geoarchaeological analysis. Volumetric data on deposits are essential for determining deposition rate. These new sampling requirements necessitate increased cooperation between the archaeologist and geologist in the planning and implementation of excavation design. However, the preliminary results obtained from the analysis of Cloudsplitter deposits suggests that significant information can be recovered, and with proper sampling procedures the problems stemming from large quantities of botanical material and slow rates of deposition can be overcome.

Pollen Analysis

During the excavation at Cloudsplitter rockshelter, approximately 200 samples of the archaeological deposits were collected for pollen analysis. For this preliminary analysis, nine samples from excavation unit I,18, located in Sampling Stratum I, were examined along with one sample from the surface of the shelter. These samples included four Early Woodland deposits, two deposits associated with the Late Archaic, one Early Archaic deposit from the base of the cultural deposits, and two culturally sterile deposits from the bottom of the excavation unit.

In this analysis, 200 pollen grains from each sample were counted, or two whole slides, whichever came first. Each slide was examined in transects that were spaced widely enough so that pollen that moved on the slide was not likely to move into the next transect.

The condition of the pollen grains in all the samples below the surface was fair to poor. Most of the grains were collapsed and in many cases folded or covered with debris. This resulted in a fairly large number of unidentifiable grains. These unidentifiable grains were not included in the 200 grain count.

A tablet containing a known quantity of *Eucalyptus* pollen was added to each sample during processing. This enables us to estimate the total number of native pollen grains in the sample. The amount of pollen in the deposits at Cloudsplitter varied considerably (Table 3). The surface and the uppermost Early Woodland deposit contained similar amounts of pollen. However, three Early Woodland samples, collected from a thick ash lens, contained practically no pollen at all. This suggests that this thick, ash layer is not the result of a slow accumulation of deposits. The Archaic deposits do contain pollen, but in smaller quantities than in the upper levels. For example two slides did not reach 200 grains. These smaller amounts of pollen may be due to more rapid deposition in the earlier cultural levels and perhaps to some extent to preservation. The greatest concentration of pollen occurs in the deepest deposit analyzed, a culturally sterile layer containing hemlock needles and other plant macro-remains. This high concentration of pollen suggests an extremely slow rate of sedimentation in this pre-cultural deposit. The other culturally sterile

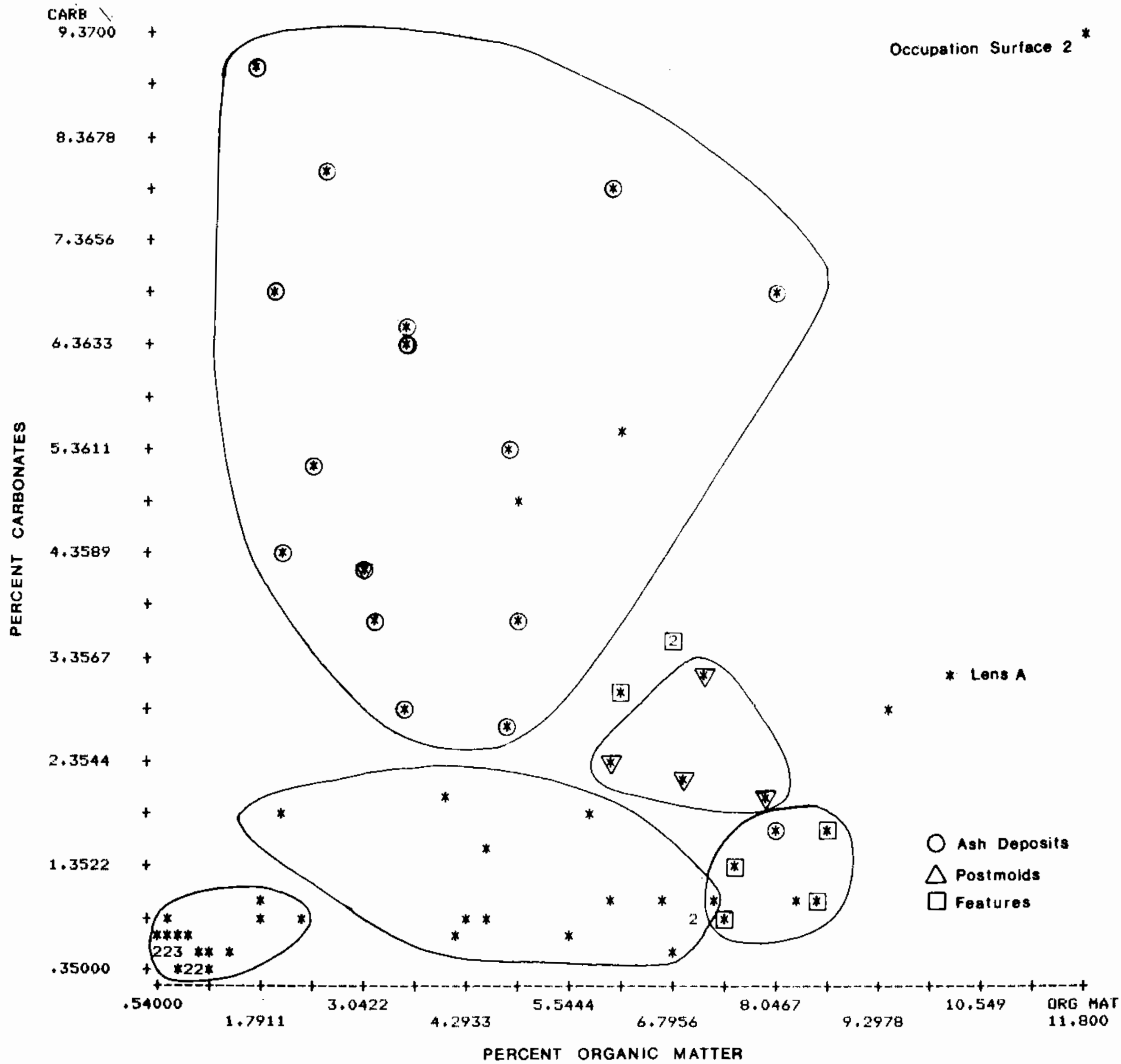


Figure 6. Scatterplot of relationship between carbonate and organic matter content and various types of Cloudsplitter deposits.

deposit that was analyzed contained very little pollen. This was due to the fact that the sample was actually part of a decaying sandstone deposit that was breaking down during the excavation (Katherine Moore, personal communication).

As a first step in this analysis, pollen counts from the surface sample were compared with vegetation census information from the Cloudsplitter area which was collected during the 1978 field season (Nancy Weintrub, n.d.; Table 4). The results of this comparison indicate that the pollen count includes some but not all of the vegetation types located in and immediately around the shelter and also includes plant types that first occur midway down, or at the base of Cloudsplitter ridge. A few plant types that were not found on Cloudsplitter but occur elsewhere in the Red River Gorge were also present in the surface pollen count. Based on this comparison, we can be fairly confident that the pollen from the deposits in the shelter reflects the general vegetation on Cloudsplitter ridge with a small contribution from elsewhere in the Gorge.

Because of the small amounts of pollen in some of the samples, only six can be used in analyzing the vegetation history at Cloudsplitter (Fig. 7). The sterile "Decayed Vegetation and Hemlock Layer" provides an indication of what the vegetation was like prior to occupation at the site. As the name suggests, the pollen spectrum from this sample is dominated by hemlock (*Tsuga*) pollen, although there is a substantial amount of pine (*Pinus*) pollen and smaller percentages of deciduous tree types including oak (*Quercus*), tulip popular (*Liriodendron*), elm (*Ulmus*) and some members of the birch family (Betulaceae). One grain of spruce (*Picea*) pollen was identified from this level. Pollen from the shrubby blueberry family (Ericaceae) and the herbaceous composite family (Asteraceae) is also present. The tremendously large percentage of hemlock pollen suggests that a dense stand of hemlock was present in front of the shelter at this time. Today, mature hemlock first occurs midway down the slope from the site. Hemlock prefers cool and moist conditions (Fowells 1965:704) which suggests that the en-

Table 3. Estimated Total Number of Pollen Grains in Unit I, 18 and Surface Deposits at Cloudsplitter Rockshelter.

Cultural Period	Deposit	Total Number Pollen Grains per 1 ml Sample
Modern	Surface Sample C-1	279,683
Early Woodland	Mottled Gray & Brown Sand Above Lens C 30 cm	200,044
Early Woodland	Lens C-A 28-29 cm	62 289
Early Woodland	Pink Lens C-B 36-40 cm	25
Late Archaic	Brown Sand with Nuts 47-50 cm	92,226
Late Archaic	Lens E-Medium Brown Sand Above First Leaf Lens 61-63 cm	25,122
Early Archaic	Lower Member Lens E on Top of Sterile 75-78 cm	7,405
Sterile	Decayed Vegetation & Hemlock 75 cm	459,108
Sterile	Pink Sterile 60 cm	1,913

vironment was slightly more mesic near the rockshelter at this time. Unfortunately, because such a great percentage of the pollen count consists of hemlock little information is available concerning the deciduous components of the forest. The spruce pollen from this level indicates that a few remnants of the Pleistocene vegetation in the area were still present at this time.

Caution must be used in evaluating the pollen spectrum from the Early Archaic because the actual amount of pollen counted was below 200 grains. In general, the results are quite similar to the culturally sterile "Hemlock Layer" with an extremely large amount of hemlock pollen and smaller amounts of pine, oak and tulip poplar. Shrubs from the blueberry family and composites are also represented. However, the low amount of pollen actually contained in this deposit suggests the possibility that the hemlock grains were introduced into this deposit from below. People walking around the site could easily have served as a mechanism for mixing pollen from earlier levels into the deposits. The presence of chestnut (*Castanea*), butternut (*Juglans cinerea*), black walnut (*Juglans nigra*), and hickory (*Carya*) nut shells from the site during the Early Archaic (see the following section) indicates that these trees were present in the forest at this time even though they were not found in the pollen counts.

The earliest deposit from the Late Archaic also has a pollen count under 200 grains and so must be considered with caution. In this level, the amount of hemlock pollen has fallen off sharply, and pine reaches a maximum. The percentage of oak has increased in this

Table 4. Comparison of surface pollen counts from Cloudsplitter Rockshelter with local vegetation.

	Surface Pollen Count from Shelter	Rough Veg. Census-Inside & In front of Shelter	Tree Census Slope Below Shelter	Tree Census Midway Down Slope	Tree Census Base of Slope
Trees					
Oak	72	3	11	9	14
Pine	42	6	6	2	6
Chestnut	21				
Hickory	11			5	2
Birch	6	2	1		
Beech	4			3	2
Elm	2				
Hemlock	2			2	
Ironwood/Blue Beech	2				
Walnut	1				
Sassafras		21	3		
Black Gum		12	4	4	1
Holly		7		1	
Maple		2	9	15	14
Magnolia		1	5	2	2
Dogwood			1	8	12
Tulip Poplar			1	1	1
Ash				1	1
Pea Family	1				4
Subtotal Trees	164	54	41	53	59
Shrubs					
Blueberry Family	33	27	ca.1000	57	
Sumac		1			
Witch Hazel		1	26		
Viburnum			80	105	7
Pawpaw			8	1	107
Hazelnut					4
Choke Cherry					2
Serviceberry					1
Devil's Walking Stick					1
Subtotal Shrubs	33	29	ca.1114	163	122

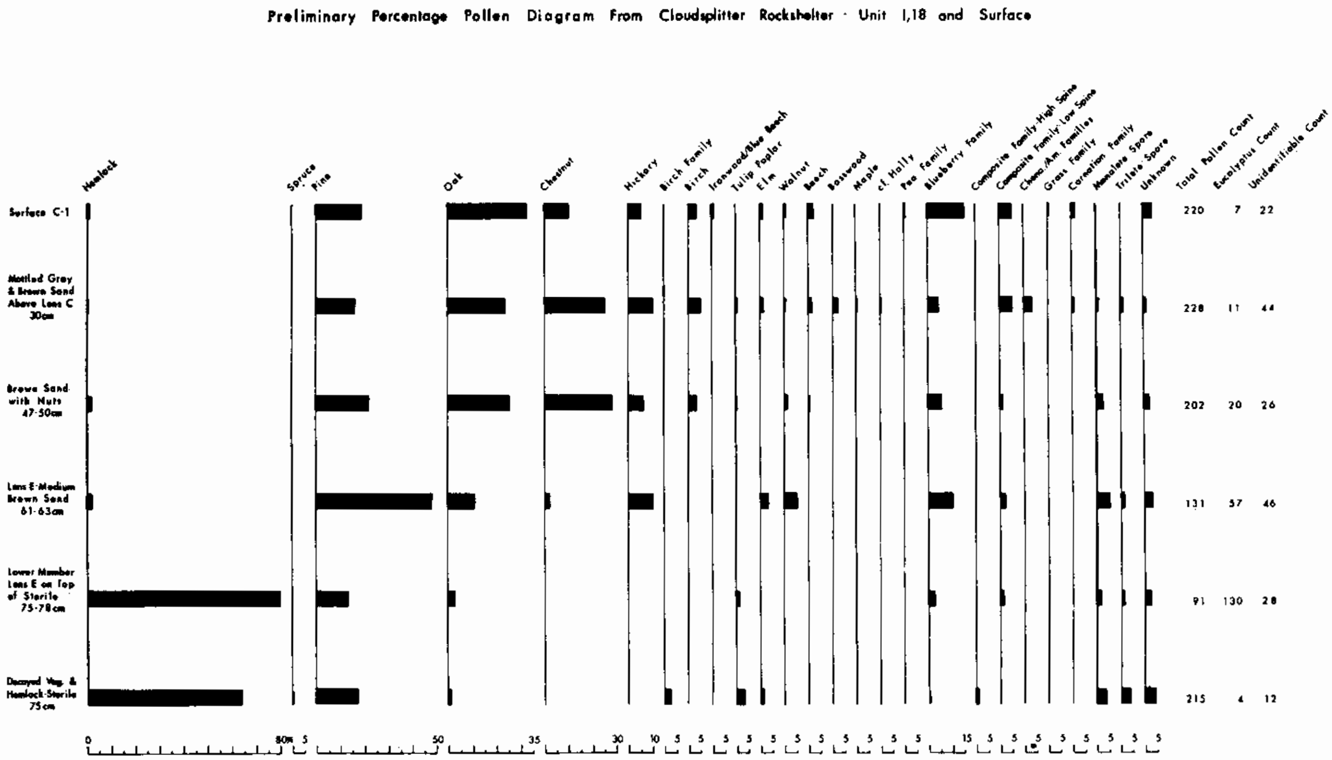


Figure 7. Preliminary pollen diagram from Cloudsplitter.

level, and chestnut, hickory and walnut appear in the pollen record for the first time. The domination of the pollen spectrum by pine is unique to this level. Unfortunately, we do not have Middle Archaic deposits to determine whether or not this higher percentage of pine pollen is characteristic of that time period as well. Pitch and Virginia pine (*Pinus rigida, Pinus virginiana*) first entered the Shenandoah Valley at around 5000 B.P. (Craig 1969). It is possible that this high percentage of pine pollen is related to the migration of these pine species into the area.

The upper Late Archaic deposit, the Early Woodland deposit, and the surface sample all have similar pollen spectra, indicating that there has been little change in the vegetation in the area since about 3700 B.P. These levels can be characterized as having high percentages of pine, oak, chestnut and hickory with smaller amounts of a number of other deciduous types. Higher percentages of composite pollen and the first occurrence of pollen of the Cheno/Am type in the Early Woodland is possibly related to the utilization of the "Eastern Agricultural Complex" at this time or at least represents an increase in the amount of disturbed habitat in the area. The decline in the percentage of chestnut pollen in the surface sample is a reflection of the effect of the chestnut blight in the area. It is interesting to note that there is not a great increase in composite pollen and other herbaceous plant types in this surface sample as one generally finds as a result of European settlement and forest clearing. This tends to emphasize the fact that the pollen deposited in Cloudsplitter Rockshelter is a reflection of vegetation of the Cloudsplitter ridge area and not the region as a whole. The increase in pollen from the blueberry family in the surface sample may indicate an increase in this shrubby vegetation due to the logging which occured in the area in recent times (Nancy Weintrub, personal communication).

Changing Subsistence Strategies as Revealed Through Plant Fossils

Plant food remains are distributed throughout the cultural deposits at Cloudsplitter, and record significant changes in the basic subsistence strategies of the Early and Late Archaic, and Early Woodland groups who utilized the shelter.

Not unexpectedly, uncarbonized and carbonized nut fragments represent the single most common class of plant food debris. Black walnut (*Juglans nigra*), butternut (*Juglans cinerea*), several species of hickory (predominately *Carya tomentosa*), chestnut (*Castanea dentata*) and hazelnut (*Corylus americana*) shells are amply represented, although not all species are present throughout the history of the site.

Nuts were analyzed in terms of their frequency by weight, their ubiquity (e.g., the percentage of deposits containing a particular species) and their density (eg., weight in gms/liter of deposit) per deposit screened. Distinct patterns of nut utilization *seem* to be associated with each of the three periods of occupation the site experienced.

During the Early Archaic (ca. 9500-8000 B.P.), nuts are scarce in the deposits. Butternut and black walnut dominate in terms of both their weight, ubiquity and density/liter screened (Figs. 8 and 9, Tables 5 and 6). Hickory and chestnut occur in low amounts; hazelnut shell is entirely absent.

From about 4500 B.P., to 3000 B.P., or roughly Late Archaic contexts, hickory and chestnut rise in importance, and hazelnut first appears. Butternut declines sharply in terms of its frequency (Figs. 8-9, Tables 5-6).

After 3000 B.P., hickory and walnut remains common constitutents of the Early Woodland deposits, but chestnut and hazelnut experience tremendous in-

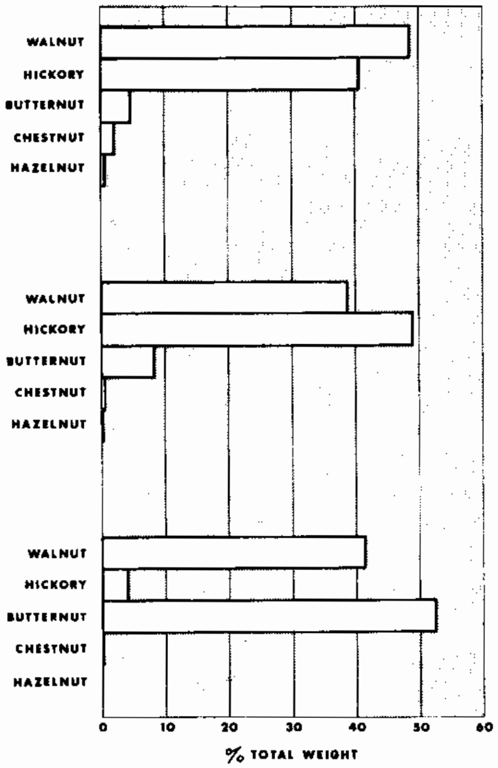


Figure 8. Comparison of Nut Frequency by Weight at the Cloudsplitter Rockshelter.

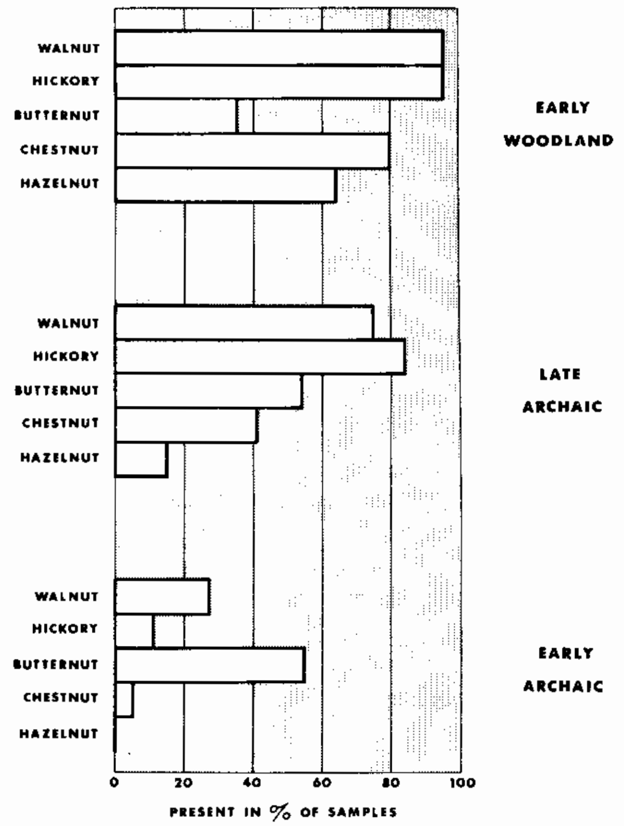


Figure 9. Comparison of Nut Ubiquity at the Cloudsplitter Rockshelter.

creases in terms of their weight, ubiquity and density (Figs. 8-9, Tables 5-6).

The significance of these patterns is difficult to evaluate. Percentage data, for instance, do not lend themselves to statistical manipulation, but when average nut densities/liter screened are compared via a one-way multivariate analysis of variance (MANOVA), the resultant F statistic indicates no significant differences in the nut density distributions between the Late Archaic and Early Woodland. Early Archaic samples could not be included in the analysis because they were not uniformly distributed across the site.

Besides nuts, three wild plant species appear to have been intentionally collected. Honey-locust (*Gleditsia triacanthos*) seeds and pod fragments are absent in Early Archaic deposits, scarce in Late Archaic contexts, and become fairly frequent in those of an Early Woodland age. In terms of its distribution within contemporary plant communities in the Red River drainage, honey-locust is restricted to deep alluvial or limestone derived soils.

Segments of the fruiting pods (technically loments) of beggars-tick (*Desmodium nudiflorum*) follow a sim-

Table 5. Nut Weights and Percentage of Total Nut Weight for Various Occupations at the Cloudsplitter Rockshelter, Menifee County, Kentucky.

	Walnut		Butternut		Chestnut		Hazelnut		Hickory		Unid. Juglandaceae	
	wght/gms	%	wght/gms	%	wght/gms	%	wght/gms	%	wght/gms	%	wght/gms	%
Early Woodland	858.08	48.5	83.69	4.7	39.72	2.2	15.54	.8	717.23	40.5	54.16	3.0
Late Archaic	390.29	38.7	82.98	8.2	6.98	.7	3.98	.4	493.10	49.0	30.35	3.0
Late Archaic Nut Lens	160.79	10.9	3.72	.2	.36	.02	0.00	0.0	1289.81	87.7	14.44	.9
Early Archaic	12.82	41.1	16.32	52.4	.16	.05	0.00	0.0	1.30	4.1	.54	1.7

Table 6. Mean Nut weight (gms)/liter of screened deposit for Various Species at Cloudsplitter Rockshelter.

	Walnut gms/liter	Butternut gms/liter	Chestnut gms/liter	Hazelnut gms/liter	Hickory gms/liter	Unid Juglandaceae gms/liter	Total liters screened
Early Woodland	2.27	.23	.10	.04	1.90	.14	376.47
Late Archaic	1.18	.35	.02	.01	1.49	.09	329.13
Early Archaic	.11	.14	.001	0.00	.01	.004	110.72

ilar, though not identical pattern. Although infrequent in Late Archaic and Early Woodland deposits, hundreds of pod fragments were found concentrated in the fill of a stone-lined Early Woodland storage cyst along with large quantities of cultivated plants.

Pawpaw (*Asimina triloba*) seeds occur only in Early Woodland deposits, but are present in extremely low amounts. Nonetheless, their temporally restricted distribution suggests that they were occasionally eaten by humans.

The Appearance of Cultigens and their Subsequent Significance

Up to this point a pattern of wild plant utilization has been discussed that is typical of the paleoethnobotanical record in Eastern North America from about 9000 years ago until the advent of maize agriculture. Nuts dominate these records, and although other plant foods were probably eaten in large quantities, their macrofossils are infrequently found in archaeological contexts. In spite of excellent preservation, Cloudsplitter is no exception to this general rule.

The Cloudsplitter plant assemblage is, however, different in an important respect from the vast majority of paleoethnobotanical collections in the East. Because of the lack of moisture in the deposits, a controversial, but well-preserved assemblage of cultivated plants is available for study. Not only are seeds and other reproductive structures preserved, but such delicate parts as sunflower (*Helianthus annuus*) disk fragments, *Chenopodium* inflorescences, stalks and roots, and maygrass (*Phalaris caroliniana*) inflorescences occur with some regularity.

Dessicated squash (*Cucurbita pepo*) rind is present in a Late Archaic deposit with an associated radiocarbon date of 3728 ± 80 B.P. (UCLA 2313-K), and occurs sporadically thereafter throughout the Late Archaic and Early Woodland deposits. Gourd (*Lagenaria siceraria*) does not appear until after 3000 B.P., but its absence in Late Archaic contexts is probably due to sampling error.

Without exception, the cucurbit rinds from Cloudsplitter originated from small fruits with thick woody shells. There is no trend towards decreasing rind thickness through time, and it is assumed that the fruits were grown mainly for their seeds and value as containers.

The seeds and achenes of the so-called Eastern Agricultural Complex—sunflower (*Helianthus annuus*), cultivated sumpweed (*Iva annua* var. *macrocarpa*), goosefoot (*Chenopodium bushianum*), maygrass (*Phalaris caroliniana*) and erect knotweed (*Polygonum erectum*) are sparse to absent in Late Archaic levels, occurring at a rate of about .1 item/liter of screened deposit. In several cases, in fact, these Late Archaic occurrences might be attributed to contamination from later contexts.

After 3000 B.P. all members of the Eastern Complex undergo a sudden and dramatic increase in the rate at which they were being deposited in the site. In contrast to their paucity prior to this time, more than 14 items/liter of screened deposit are present in Early Woodland levels. This may be indicative of a wholesale introduction of the complex into the region at this time.

Unfortunately, human coprolites are scarce in the Cloudsplitter deposits, and it is not possible to measure the dietary contribution of the Eastern Complex in the same fashion as was done at Salts and Mammoth Caves (cf. Yarnell 1969, 1974; Marquardt 1974; Stewart 1974). Certainly at this early period cultivated foods were probably no more than supplements to an otherwise mixed diet of wild plant and animal species.

Once again, the Late Archaic and Early Woodland inhabitants of Cloudsplitter seem to have followed a similar trajectory in cultivated plant usage experienced in several other river drainages in the East. Cucurbits, presumably introduced from Mexico, appear first, and are followed in time by cultivation of small-seeded annuals. There are additional data from Cloudsplitter, however, that point to an alternative model.

As noted in the introduction to this paper, the basal deposit at Cloudsplitter was at least in places composed of a thick layer of dessicated hemlock needles. A single radiocarbon determination of 9215 ± 290 B.P. (GX-5873) is available for this deposit in Sampling Stratum III. Immediately on top of, and burned into this deposit were three small surface hearths. Two of these features have yielded dates of 9228 ± 100 B.P. (UCLA 2313-I) and 11,278 ± 200 B.P. (UCLA 2340-I). The remaining hearth has yet to be dated.

During the course of excavation of these hearths, a single, small dessicated cucurbit seed was found lying on top of the hemlock needle layer between the two dated hearths. Another was found moments later as the top of the hemlock needle layer was being screened.

Three other radiocarbon samples have been submitted to the UCLA radiocarbon laboratory from overlying deposits, but at this time, only one has been dated. A thin deposit of charcoal and other debris overlying the hearths has produced a date of 12,350 ± 400 B.P. (UCLA 2340-L). More radiocarbon determinations will be needed to help solve this obviously critical problem. Even so, it should be noted that mixing of younger and older charcoal should have produced a quite different date.

From a morphological standpoint, the cucurbit seeds are quite small when compared with seeds from later contexts at Cloudsplitter. They compare most favorably with the seeds of *Cucurbita texana*, the Texas gourd—a wild, small-fruited squash endemic to several river valleys draining the Edwards Plateau of Central Texas. Only two other wild squashes occur in Eastern North America—the buffalo gourd, *Cucurbita foetidissima*, and the Okeechobee gourd, *Cucurbita okeechobensis*—neither of which produce seeds that resemble those from Cloudsplitter.

For years there has been considerable disagreement concerning the taxonomic status of the Texas gourd. In the past, many botanists felt that *C. texana* was simply a naturalized variety of *Cucurbita pepo* (Whitaker and Bemis 1965). Other botanists have questioned this assertion, suggesting that there are no known populations of domesticated squashes that have escaped from cultivation and continued to thrive in the wild (cf. Heiser 1980). Most botanists today believe that *C. texana* is indeed a truly wild squash, separate from, but genetically closely linked to cultivated varieties of *pepo* squash (Heiser 1980; Rhodes et al. 1968).

The implications of this taxonomic placement are clear. The North American *pepo* squashes need not have diffused into the East or Southwest via some Mexican connection; they might have evolved in situ from some distinctive North American stock. As such, this evolution might have left traces in the archaeological record.

If the Cloudsplitter seeds are really 9000 years old (or older), we are still faced with a frustrating problem —an almost 5000 year gap in the paleoethnobotanical record. While a number of sites have produced cucurbit remains that cluster around 4500 B.P. (e.g. Carlston Annis and Bowles, Kentucky (Chomko and Crawford 1977), and Phillips Spring, Missouri (Kay et al. 1980), no earlier cucurbits have been reported. Recent discoveries in the Lower Illinois River Valley may alter this picture.

Carbonized cucurbit rinds have been reported from Helton Phase deposits at both the Koster and Napolean Hollow sites dating between 7500 and 6000 B.P. (Asch and Asch 1980, Asch personal communication). These specimens effectively bridge the gap between the Cloudsplitter and other Late Archaic squashes.

While we find the possibility of 9000 (or even 7000) year old squash in Eastern North America a tantalizing prospect, until we can directly date both the Kentucky and Illinois cucurbits through the accelerated C14 technique now under development, the evidence for Early and Middle Archaic squash cultivation will remain controversial.

Faunal Analysis

The rugged terrain of the Red River valley provides a heterogeneous environment with a great deal of vertical relief and botanical diversity. Prehistoric animal resources would have included large game animals such as deer, bear and elk, as well as small game mammals, birds, and turtles. Aquatic habitats in this region are not as productive or varied as they are in the larger, higher order streams of the Southeast with their associated swampy floodplains and meander belts. The fish fauna are diverse but many of the species are too small to be considered food fish. No waterfowl would have been numerous enough to have been either a seasonal or perennial resource for aboriginal hunters.

Analysis of Prehistoric Faunal Remains. In analyzing the different types of faunal remains, great care was taken to consider the variety of depositional and post-depositional events that have resulted in a complex and sometimes confusing assemblage. In addition to bone and mussel shell, hair, feathers, fish scales, eggshell, the chitonous skeleton of insects and crayfish, feces, and occasional strands of connective tissue and tendons or bone were also collected from Cloudsplitter.

The excavation units selected for analysis included all of those considered in the botanical analysis and one additional unit, K-20, which was located along the back wall of the shelter and was subject to decay of organic matter due to moisture. Material from the top (1/4") screen from all of these deposits was analyzed as well as some of the larger features. The fraction of bone that was not identifiable to vertebrate class amounted to from 10% to 12% in these samples. No quantified data on the 1/16" screen samples appear in this paper, partly because relative proportions are skewed by differential rates of deposition. They are discussed below in the context of the non-cultural occupation of the site. Top screen data are summarized in Table 7.

In the first part of Table 7, percentages of identified taxa are compared in terms of weight of identifiable bone. In the second part, proportions by weight are expressed in terms of the total volume of deposit from which they were recovered, producing densities per liter that can be used to compare plant and animal food remains through time and across the site. Weights of bone fragments rather than counts are presented here as a more reliable approximation of the importance of each animal. A list of identified taxa is given in Table 8.

The variables that affect the interpretation of the relative quantities of various species include the differential degree of fragmentation of bone through time (primarily a cultural process), and the changing rates of accumulation of deposit (a natural process affected by cultural occupation). Large game, including deer and bear, provided the most animal food throughout the occupation of the site, but the ratio of deer to other, unidentifiable large mammal remains changes over time. Count:weight ratios suggest that a decreasing degree of fragmentation of bone resulting in less identifiable pieces, rather than a decreasing ratio of deer to other game taken, produces these results. Densities of all types of fauna dropped during the Late Archaic, probably because these deposits contained a high proportion by volume of perishable organic matter. Early Woodland and Early Archaic deposits have been concentrated by burning and rotting, thus our inferences about changing proportions of animals through time are based primarily on percentages.

When the percentages of identifiable bone are ranked for each period, large mammal and deer account for about 80% of the bone in each case. Variability over time is seen in the assortment of animals that complemented this reliance on large mammals. In the Early Woodland, the next three catagories are

Table 7. Ratio of Identifiable Bone by Weight, Cloudsplitter Rockshelter (15 Mf 36).

Taxa	Percentage Ratios			Density Ratios		
	Early Woodland	Late Archaic	Early Archaic	Early Woodland	Late Archaic	Early Archaic
Large Mammal	48.9	59.7	63.3	40.5	11.8	31.6
Deer	33.3	19.6	14.3	22.0	4.1	27.0
Bear	3.3	0	0	2.7	0	0
Beaver	0	0	2.8	0	0	2.3
Medium Mammal	0.2	3.9	0.9	0.3	0.9	0.4
Small Mammal	0.4	2.8	0.6	0.4	0.6	0.2
Large Bird	7.4	3.4	7.8	4.3	0.4	7.2
Turtle	5.2	10.5	1.8	2.7	2.2	0.2
Sample Count	990	166	292			
Sample Weight	492.9g	73.5g	159.1g			
Sample Volume				387 liters	263 liters	177 liters

Table 8. Identified Vertebrate Taxa from Cloudsplitter.

Blarina brevicauda	Short-tailed Shrew
Cryptotis parva	Least Shrew
Chiroptera	Unidentified bat
Sciurus carolinensis	Grey Squirrel
Sciurus niger	Fox Squirrel
Sciuridae (*Tamias* or *Glaucomys*)	Unidentified small squirrel
Neotoma floridana	Eastern Packrat
Cricitidae	Unidentified small mice
Microtus sp.	Unidentified vole
Erethizon dorsatum	Porcupine
Castor canadensis	Beaver
Sylvilagus floridanus	Cottontail Rabbit
Canis cf. *familiaris*	Dog
Procyon lotor	Raccoon
Ursus americanus	Black Bear
Cervus canadensis	Elk (Wapiti)
Odocoileus virginianus	White-tailed Deer
Meleagris gallopavo	Turkey
Buteo sp.	Hawk
Strigidae	Unidentified owl
Passeriformes	Unidentified songbirds
Kinosternidae	Mud turtles
Terrepene carolina	Eastern Box Turtle
Trionyx sp.	Softshelled Turtle
Lacertilia	Unidentified small lizards
Natrix sp.	Water Snake
Heterodon platyrhinos	Hognosed Snake
Coluber sp.	Racers
Elaphe sp.	Rat Snakes
Moxostoma sp.	Redhorse
Ictalurus sp.	Unidentified Catfish
Notorus sp.	Unidentified Madtom
Centrarchidae cf. *Poxomis*	Crappie
cf. *Lepomis*	Sunfish

large bird, turtle, and bear. In the Late Archaic, large mammals are followed by turtle, medium mammal, and large birds. In the Early Archaic, deer and large mammals are followed by large bird, beaver, and turtle. Elk was identified from Early Archaic deposits in several units that were not included in this sample.

While it is not easy to resolve these small shifts into a picture of changing hunting patterns through time, it is clear that a full range of animals and the skills to exploit them were available from the Early Archaic, including the utilization of what scant aquatic resources were present. The shift from Late Archaic to Early Woodland as it is bracketed in these deposits is represented by a much greater change in botanical remains than in faunal remains. Animal use seems to be characterized by an emphasis on large game from the beginning. The importance of medium to small mammals in the Late Archaic is replaced by the importance of turkey and bear, perhaps more productive resources, in the Early Woodland. Overall, the picture is one of relatively stable exploitation of resources that do not lend themselves to manipulation by humans in the manner that some plant resources have.

Different animal processing activity areas may also account for some observed variability in the fauna. The bone in Sampling Stratum I, associated with post holes, features, and quantities of processed plant remains was food scrap sized; small fragments of long bone shafts and turtle shell dominate this assemblage. One extensive Early Woodland deposit, Lens C, seemed to represent rapid deposition of specialized animal procurement and processing, containing up to 80% large bird bone by weight, with turkey the only identified species. Outside the central ring of breakdown blocks, there was less finely fragmented bone, less bird bone, and more large pieces of deer, bear and elk bone that appeared to be butchering and hide processing refuse.

Analysis of Non-Cultural Faunal Remains. In addition to finely crushed bone from larger human prey, remains caught in the 1/16″ mesh included bats, shrews, mice, salamanders, lizards, birds, snakes, and fish. Many of these do not seem to be human prey, as the bones are complete, and the animals in life weigh only from 3 to 10 grams. At least some of this bone resulted from the roosting of raptorial birds over the site, evidenced by an amphibian vertebra that was stuffed with mouse fur. These animals are not part of our model for human subsistence; rather they are a sample of small animals from the site to which other data on prehistoric climates and vegetation can be compared. The use of owl and hawk roosts to study paleoecology is well established in the Southeast (Guilday et al. 1978). Though the small fauna recovered from the site do not relate to the human subsistence base or the immediate vegetation of the site, they provide evidence to reconstruct vegetational communities in the aboriginal catchment area. No distinctively Pleistocene fauna appear in the cultural levels of the site. The fauna from the Early Archaic levels in Sampling Stratum I, dated to 8200 B.P. ± 255 (GX 5874) are only slightly different than the late prehistoric and early modern samples. One interesting identification from an Early Archaic level was the mandible of the least shrew, *Cryptotis parva*. This tiny insectivore prefers brushy or open areas to tree cover, which might indicate some nearby open or disturbed area that would have been favorable habitat for other game species, including deer and turkey.

The small sample size of faunal remains and human activity at this site do not permit a reconstruction of changing subsistence patterns for the entire settlement system. We have good data for studying the role of climate change, for offering evidence of subsistence remains missing in open sites, and for comparing the proportions of animal and plant food waste generated by a series of cultural occupations. We are still challenged to reconstruct actual subsistence practices from this evidence for plant and animal exploitation.

Lithic Analysis

In comparison to biological remains, the Cloudsplitter lithic assemblage is small, and dominated by a single class of materials—debitage. Because of this fact, the lithics from the site cannot readily be used for the more common morpho-functional analyses that dominate today's literature. Instead, the waste from the manufacture and maintenance of chipped stone implements is available for examination.

As has been indicated in the previous sections, the occupational context of Cloudsplitter—a short term, special activity camp—has important repercussions in terms of the lithic assemblage that could be expected to have been produced. Theoretically there should be less evidence of lithic manufacture *per se* and more evidence of curation of finished tools than one might expect at a long-term, multifunctional "base-camp". This assumption can be evaluated from several perspectives.

The relative volume of lithic waste material (e.g. non-utilized debitage)—99.2% of the Cloudsplitter sample—supports the basic assumption that curation of already existing tools rather than production of new ones was the focus of lithic activities at Cloudsplitter.

This may be further illustrated by comparing the finished tool-to-debitage ratio of Cloudsplitter with other floodplain and shelter sites in the Red River drainage (Table 9). Note the higher tool-to-waste ratios for the Anderson and Shepard sites, two large, multicomponent bottomland sites.

A typology of debitage based on platform type and amount of cortex on the flake surface was constructed which resulted in 12 flake classes. A series of measurements were next collected from 75 Archaic flakes (the combined total for Early and Late Archaic samples from Sampling Stratum I) and 462 Early Woodland flakes. A comparative study of these two samples has yielded some encouraging preliminary results.

First it is obvious that Archaic lithic activities were almost exclusively limited to maintenance of already existing tools. No cores were found in Archaic contexts, and flakes seem to have been produced by the rejuvenation of bifacial implements. Almost 25% of the tools and flakes originated from sources outside the Red River drainage.

Early Woodland debitage presents an entirely different picture. Exhausted cores are present in the deposits, and 84% of all tools and debitage originated from locally available sources. If numbers of flakes may be equated with amount of lithic activity, then over 5 times as much occurred during the Woodland versus the Archaic (185 items/unit volume of deposit versus 56 items/unit volume of deposit).

The differences observed in the lithic population almost certainly relate to the changes in site utilization through time. It has already been suggested that the site experienced a more intensive occupation during the Early Woodland, and the debitage seems to bear this out.

Summary

Each of the sections in this paper are highly synthesized accounts of longer papers. Analyses of the Cloudsplitter shelter materials are still on-going, although we doubt if this basic outline will change substantially. Our work over the last two years has provided us with a good outline of the history and mechanisms of deposition of cultural and natural materials within the overhang; a perspective on change and stability in local and regional floristics; and insights into patterns of plant, animal and lithic procurement strategies. Perhaps at this point we might take stock of this knowledge, and attempt to place our work at Cloudsplitter into a somewhat more cohesive integrated framework.

At the time Early Archaic people came to Cloudsplitter they were faced with a still-evolving postglacial landscape. Preserved Pleistocene sediments at the site suggest that the late Wisconsin period may have been somewhat cooler and moister than today. Both pollen and macrofossil evidence from the Early Holocene deposits seem to reflect the waning effects of the continental ice sheets on local floristics. While a number of deciduous plant species indicate that a broadleaf forest was already established by 10,000 years ago, its composition was somewhat different than we see today. Hemlock trees grew immediately in front of the overhang as late as 9200 years ago. Red spruce, completely absent in the Red River drainage today, probably existed in scattered patches on the highest portions of the plateau, occurring as remnants of the formerly extensive Wisconsin-aged boreal forest that dominated higher elevations in the Appalachians.

The Early Archaic occupants of the site were clearly already well adapated to the Early Holocene flora and faunal resources of the drainage. Economic decisions were based on the seasonal availability of nuts, white-tailed deer and a variety of lesser mammalian and aquatic fauna at this early period. At this early date Cloudsplitter seems to have served as a temporary, fall-season camp, perhaps being occupied for only a few days and nights before resource availability dictated movement. Our knowledge of the size of the group utilizing the site is incomplete, but large roof blocks littered much of the floor of the overhang, and probably only a few nuclear families could comfortably have been accomodated within the interior.

Unfortunately, Cloudsplitter did not contain a Middle Archaic record of human occupation. This hiatus is mirrored in other areas of the drainage at this time period also. In spite of the fact that over 200 archaeological sites have been recorded for the Red River area, Middle Archaic manifestations are exceedingly scarce.

By 4,500 years ago Cloudsplitter once again began to serve the needs of local populations. Survey and excavation work on the valley floor downstream from Cloudsplitter have established that a sizeable Late Archaic population was present in the drainage by this time. While the dynamics of Archaic population growth in the East are poorly understood, a similar phenomenon can be observed in the Green, Wabash, Ohio, and Illinois River valleys farther to the west. Changes in population went hand in hand with changes in local floristics.

A mixed broadleaf and coniferous forest was by now firmly established in the Red River drainage. Hemlock populations had retreated downslope from Cloudsplitter giving way to the dry, upper slope communities of oaks, chestnut and hickory that typify the floristic pattern of today. As the composition of the forests in the drainage stablized, so did Late Archaic subsistence-settlement strategies. The deposits at Cloudsplitter reveal what appears to be an increasing utilization of hickory and chestnut during the fourth and

Table 9. Tool:Debitage Ratios for Various Red River Sites.

Site	Type	Occupation	N	Tool:Debitage
Cloudsplitter	rockshelter	short-term, Early Archaic, Late Archaic, Early Woodland	1,251	1.129.4
Haystack	rockshelter	short-term, early Late Woodland	980	1:121.5
Anderson	floodplain	large settlement, Early Woodland, Middle Woodland	685	1:22.3
Shepard	floodplain	large settlement, Archaic, Woodland, Ft. Ancient	2,455	1:11.0

third millennia; faunal exploitation remains essentially unchanged, with deer, small game, and minor amounts of aquatic resources dominating the assemblage. Squash was definitely being grown by the Late Archaic populations in the drainage and provides evidence that the Red River area, in spite of its remoteness, was hardly isolated from innovations that were taking place elsewhere in the Midcontinent at this time.

The large sandstone blocks on Cloudsplitter's floor were still placing limits on the size of the population that could have utilized the site at any one time. Again it appears that the site was functioning as a small camp for a few nuclear families. The abundance of nut shells in the deposits suggests that these peoples made repeated visits to the site in the fall of the year, taking advantage of locally available crops of mast. Still, their visits remained of short duration; when the nuts had been harvested in the vicinity of the overhang the families moved on to yet another favorable locality. The regularity at which Late Archaic groups made use of the site, soon built up the floor with domestic residue, and by 3000 years ago, rooffall no longer dictated which area of the shelter could be utilized.

Early Woodland populations likewise made use of the overhang. Their hearths, pits, and extensive ash deposits riddle the post 3000 B.P. deposits at Cloudsplitter, and suggest a changing function for the site. Although we can detect little change in the utilization of wild plants and animals, a variety of cultivated weedy annuals make a sudden, and dramatic appearance in the site. Only a few hundred years separate the latest Archaic and Early Woodland occupations, leading us to believe that these horticultural transformations took place quite rapidly. None of the wild relatives of the Eastern Agricultural complex are present in harvestable quantities in the Red River basin today; almost certainly the Complex was introduced as a "package" during the Early Woodland.

We are still not certain what selective pressures were operating that would have made it advantageous for Late Archaic hunters and gatherers to begin cultivating these plants. It is probably no coincidence that evidence of storage technology appears concomittantly with the introduction of the Eastern Complex plants. The large storage pits we have described as occurring in Sampling Stratum III are capable of holding upwards of 30,000 hickory nuts, and may signal a fundamental change in the Early Woodland population's perception of the security of their environment. We have found no evidence to suggest any broad-scale change in the floristics of the area at this time horizon, and perhaps changing social relations with neighboring bands may have provided the stimuli that led to these transformations. A regularization of territorial boundaries, coupled with decreased access to alternative collecting and hunting locales is one such hypothesis that needs to be explored.

In spite of the potential for increasing residential stability that cultivation would seem to have afforded, Cloudsplitter remained a temporary extractive camp for a small group of Early Woodland peoples. Spatially isolated posts and postmolds and other features within Sampling Stratum I probably reflect a continuation of use by nuclear families. All evidence again points to a fall occupation; there are no large ovens or hearth features that would have provided warmth during the Eastern Kentucky winters. Although the site may have been utilized for longer periods of time during the Early Woodland, it must be concluded that seasonal abandonment took place.

After about 2400 B.P. the shelter was no longer utilized by local Woodland populations. Sporadic, probably overnight visits were made to the site during the late prehistoric period, but these activities left little tangible records in the overhang.

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William Michael Wood

A COMPUTER SIMULATION OF SETTLEMENT GROWTH AND DELINEATION DURING THE LATE MISSISSIPPIAN: AN EXAMPLE FROM THE PIEDMONT AREA OF GEORGIA

During the past few years there has been an increasing number of settlement pattern studies done in the Southeastern United States (Lee 1976; Smith 1978). An entire book was recently devoted to settlement pattern studies in and around the Southeastern Region during the Mississippian Period (Smith 1978). This volume included an article that presented a model of settlement patterning for societies at the chiefdom level of social development that was tested against the archaeological data from the Moundville area in Alabama (Steponaitis 1978). Thus it appears that settlement patterns are now, more than ever, being used to help understand societal growth and development.

The approach used by the present author is to use a computer simulation in studying settlement patterns and social expansion. Preliminary analysis of the data on a regional scale has been conducted using a modified version of Steponaitis' E index, and is reported elsewhere (Wood 1980). The data base being utilized is survey data on over 600 Lamar sites, gathered by the University of Georgia in the floodpool area of the Wallace Reservoir along the Oconee River in Central Georgia. The use of this data set was provided by Dr. David Hally of the University of Georgia.

The use of a simulation, both as a heuristic tool, and an instrument of analysis, must be done with care. Various problems can and do arise in quantifying and integrating all of the different functions and variables needed to represent a societal unit and its actions. And even if the simulation model fits the data, it cannot be used as the final answer. Its use should be more in the area of generating possibilities that can hopefully be tested through further research. It provides one possible answer, not necessarily *the* answer to any given problem.

The simulation by itself cannot stand on its own right, but must be checked against the archaeological record to ascertain its ability to predict or copy the observed pattern. Because of this reason the above mentioned data set was chosen for use. Its large number of sites should allow for a fine tuning of the developed model. Previous work has been done in the area. Lee (1976) has studied the relationship between soil types and topography and the patterning of Lamar sites in the area. Smith and Kowalewski have included the study area as part of their tentative prehistoric province (Smith and Kowalewski 1979).

The program itself is being written in FORTRAN, and run on an IBM 3033 computer, using IBM's H-extended compiler for maximum flexibility within the program. SYMAP is being used to map out both the base data set and the generated data set produced by the simulation.

Two basic assumptions must be made. The first is, that the climate of today is representative of the climate during late prehistoric times; the second, that information recorded by early explorers and their companions give valid and accurate descriptions of actions and customs of the aboriginal peoples who they contacted. Lacking dendrochronological and palynological data for the area, all climatological information will be drawn from modern sources. As to the use of ethnographic sources, they will be kept to a minimum. What has been attempted is the use of as many hypothesized functions as possible from other archaeological research, such as Ford's (1977) work in the Midwest and Smith's (1978) research. It is not possible, nor advisable, to totally ignore the usefulness of ethnographic sources, but as Fish and Fish (1976) point out, great care must also be exercised in their use.

The first step in constructing the simulation was to establish the probable political level of the study group. I have used the multilineal evolutionary model as developed by Sanders and Webster (1978). Using their three main factors hypothesized to regulate the tempo and direction of evolutionary growth, and comparing them to work done by archaeologists concerning Southeastern United States political organization, the chiefdom or ranked level of society is assumed to be the operational stage of development. It should be noted here that in Sanders and Webster's (1978) evolutionary scheme ranked and stratified societies are treated as two separate levels of development. The main differences between the two are that stratified societies have differential access to major subsistence resources and are socially stratified as compared to being ranked. Peebles and Kus (1976) list equal access to basic subsistence resources as one of their "markers" of a ranked society, which excludes them as being stratified societies as far as this research is concerned.

By assuming a chiefdom level of development, social, economic, and settlement rules hypothesized to operate at this level of social development can be used in the simulation. Additionally, other archaeological work dealing with similar societies at this level of development can also be applied to the model.

Time in the simulation is incremented on a seasonal basis to allow for the maximum use of climatological variables and their possible effect on the growth and spread of the settlements. The climatological data used is drawn from that given in the U.S.D.A. (1965, 1976) soil survey reports for the study area. A uniformly distributed pseudo-random number is used to produce the seasonal climate for the area. The climate data is then used to modify yields of seasonal food resources and maintained to be used in calculating overall yield from horticulture. These data are then used to either slow down, maintain, or accelerate the population growth.

Two different methods of population growth are being used within the simulation. The first, and simplest method, is the one used by Zubrow (1975) in his Hay Hollow study of carrying capacity. This method uses a single equation to calculate the rate of growth for the population. The second method is a cohort analysis method using the formulations of Weiss (1973) from his demographic models study. This analysis is a series of equations that use varying data from different age cohorts to calculate population growth.

Location rules for the establishment of new settlements from the one or two starting settlements are based on Lee's (1976) work. Available soil type, topography and group size are utilized to establish the location and type (i.e. farmstead, temporary, etc.), of site. The availability of local natural resources such as water are also calculated into the formula.

The simulation is currently in the last stages of de-bugging and initial running, but we are hopeful of the results. Problems and questions still have to be resolved and analyzed. Future analysis of the site data will hopefully help to establish a pattern of contemporaneity of the sites. The simulation will generate a pattern that will be a continually growing data set. The stopping point will be given by a certain number of years, or a point when the resource potential of the area is exceeded.

The purpose of the simulation is also to help in the delineation of possible societal groups within the Southeastern United States. At this point it covers only a part of the hypothesized "province". Future research is geared towards increasing the program to encompass the entire region and attempt to pick up changes in settlement patterns that could possibly indicate boundaries between groups. An effective limit to the sphere of control of local and major centers could be developed that would also help in delineating boundaries between cultural groups.

The work that is being done is the base for future research, that can hopefully help add to our understanding of cultural growth and the rules and properties that affect it.

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Christopher S. Peebles

ARCHAEOLOGICAL RESEARCH AT MOUNDVILLE: 1840-1980

Continuity of research and conservation of the data produced by this research have been the hallmarks of archaeological investigations at Moundville from their beginning in 1840 to the present. During these 140 years, neither indiscriminate vandalism, mean commercialism, nor misguided scholasticism have had significant harmful effects on either the Moundville site itself or on most of the other sites of the Moundville phase. Such good fortune sets these sites off from those of almost any other archaeological phase in the Southeast. To a person, the individuals who worked at Moundville during the formative era of research there, that is from 1840 to 1940, were exceptional natural historians and scholars. Their research transcended that of most of their contemporaries by several orders of magnitude. To a family, for the last 140 years, the owners of the lands on which these sites are located have been conscious and active agents in their conservation. Only minor destruction has come to these sites through plowing. However, changes in the course of the Black Warrior River have swept away two mounds; one village has been lost to industrial expansion; and a mound within the city limits of Tuscaloosa was said to have been leveled by that city's authorities in the 1820s or 30s (Maxwell 1876:74). Only two breaches of curatorial trust, one in the first quarter of the twentieth century, the other in the last, have diminished the collections made at these sites by five generations of scholars.

The papers below are testimony to an unbroken line of research that binds us to past generations of archaeologists who worked at Moundville. There is not a single question, proposition, or paper here that does not use directly the materials and observations handed down to us from the past: the prehistoric past of the tenth through sixteenth centuries; the scholarly past of the nineteenth and twentieth centuries. It is the interplay of these two pasts that will form the substance of this paper.

Research at Moundville: 1840 to 1900

The earliest archaeological work at Moundville was conducted in the spirit of the "natural history circle" that influenced American scholarship from the time of the Bartrams and Jefferson in the eighteenth century to that of Lewis and Clark, Catlin, and Schoolcraft in the nineteenth century (see Savage 1979). Thomas Maxwell, who conducted the first archaeological work at Moundville, was definitely a member, albeit a provincial one, of this circle. In 1840 he dug a trench in Mound B and noted the stratification and features inclusive to this mound. He traced the earthen embankment that circled the site and described various other features found near the mounds. For the next 36 years he chronicled the discoveries made by the landowners and others at Moundville. He published his Moundville work as part of a larger history of Tuscaloosa in 1876 (Maxwell 1876). His conclusions about Moundville embraced Aztecs, bloody warfare, lost tribes, and arcane knowledge, all of which showed familiarity with the natural historical writings of his day.

Between 1840 and 1869 a trench was cut into Mound G by someone, perhaps Maxwell, a "Giant" was found by Mr. Hezekiah Powell near the base of Mound B (Maxwell 1876:70), and other features and artifacts continued to erode out of deposits near the bases of the mounds and the earthen embankment. During this period brief mention of Moundville was included in *Ancient Monuments of the Mississippi Valley* (Squier and Davis 1848) and in the *History of Alabama. . . .* (Pickett 1851). No excavations have been reported, however, between those of Maxwell in 1840 and Nathaniel T. Lupton in 1869.

Lupton was the first person to conduct a systematic examination of the Moundville site, as well as the first scholar to conduct "sponsored research" there. Born in 1830 in Virginia, Lupton was to become a renowned scientist. He was a graduate of Dickenson College and studied under Bunsen in Germany. He was—in sequence—a professor of chemistry at Randolph-Macon College then at Southern University; a chemist with the Niter and Mining Bureau of the Confederate States of America; President of the University of Alabama; professor of chemistry at Vanderbilt University; and he concluded his distinguished career as professor of chemistry at the Alabama Polytechnic Institute (Auburn). He died at Auburn in 1893 (Sellers 1953:314-315).

At the end of the Civil War, Lupton returned to his post at Southern University, Greensboro, Alabama. At some point thereafter, he was contacted by Joseph Henry, Secretary of the Smithsonian Institution and asked to explore the Indian Mounds of Alabama. On May 31, 1869, Henry authorized funds for him to explore the Indian Mounds on the Black Warrior River. Lupton, after a delay caused by illness and university duties, began fieldwork at Moundville in September, 1869. He and a crew of five workers spent four days mapping the site and excavating a trench in Mound O. His notes on this excavation were sufficiently detailed for a contemporary reconstruction of the mound's stratigraphy and the location of the features therein (Steponaitis laboratory notes). Lupton's map of the site as a whole was complete, accurate, and was drawn to scale. He correctly located the mounds, showed the course of the earthen embankment south of the plaza, and noted therein that Mound G had been "opened about 36 years since." He shipped his Moundville materials to Washington by Railway Express and after a delay of several months they reached the Smithsonian in March, 1870. The total bill for Lupton's work, exclusive of the freight charges, was $29.85.

Subsequent to Lupton's work, the Smithsonian Institution became involved one more time in field archaeology at Moundville. After Cyrus Thomas had been appointed director of the newly formed Mound Exploration Division of the Smithsonian Institution in 1881, he sent one of his assistants, James D. Middleton, to work at Moundville. Although Middleton's brief stay at Moundville in 1882 did add to the collections of the U. S. National Museum, his field observations and notes were far below the standards set by Lupton. Some of Middleton's maps of individual mounds can be matched to existing mounds, but his map of the site bears no relationship to reality (National Anthropological Archives: #2400-Box 11; Steponaitis 1980a:9). No matter which way this map is turned, stretched, and transformed, it cannot be made to fit the locations of the mounds that existed in 1869 and that exist today.

Research at Moundville: 1900 to 1929

Between 1882 and 1905 no organized fieldwork took place at Moundville, but the work of Lupton and Middleton was incorporated into the archaeological publications of the day (see Steponaitis 1980a: 9-10). It was not until Clarence B. Moore ordered the steamboat *Gopher* tied up at Prince's Landing in the spring of 1905 that archaeological exploration was resumed at Moundville. Moore, a graduate of Harvard College, a ne'er-do-well world traveler, and an independently wealthy young man, gave up the continental transhumance of the rich for archaeological fieldwork and scholarship (see Thomas 1979:30-33). In that vocation he was no dilettante. Moore's fieldwork, if somewhat crude by today's standards, was a model of excellence for the Southeast in 1905. As H. Newell Wardle observed:

> For more than a decade the attention of this eminent archaeologist has centered in the mounds of our southern coast. In his steam-yacht, bearing every necessary appliance, including an efficient force of experienced diggers, he has explored every navigable stream and inlet from the Carolinas round to Alabama . . .

> Here [at Moundville], as elsewhere, the enforcement of Mr. Moore's rule that no digging shall be done without his actual presence assured an accurate record of each find and its relation to other objects in the grave. (Wardle 1906:201-202).

Moore and his crew spent two one-month seasons at Moundville, one in 1905, the other in 1906. The results of his work were impressive. He placed "trial-holes" in most of the mounds and in almost every other area of the site. His is still the only data we have for features in the mounds. He made a very accurate map of the site, and he located his excavation units in relation to this map. He had some sense of the importance of the associations among artifacts, so he cataloged burials and their artifacts together. Moore and his crew recovered 801 burials, several hundred vessels, and an impressive array of "Southern Cult" artifacts. From these artifacts and his notes he produced two detailed and lavishly illustrated monographs (Moore 1905, 1907). These two volumes have been (and always will be) a valuable foundation for research at Moundville.

Moore's collections were accessioned initially by the Academy of Natural Sciences, Philadelphia, but they were transferred later to the Heye Foundation, Museum of the American Indian. At some point between excavation and accession by the Museum of the American Indian, the vessel collection was "high-graded" and the coarse, plain vessels were discarded (Steponaitis 1980a:18-19). In addition, the entirety of Moore's skeletal collection was dispersed. The Nassau County Museum literally salvaged Moore's coastal Georgia and Florida skeletal material, but the Moundville series is still lost.

Research at Moundville: 1929 to 1941

The year the market crashed, 1929, was also the year archaeological research began once again at Moundville. Although these two events of vastly different magnitude were unrelated in the beginning, the state of the economy and the archaeology of Moundville soon became partners in the effort to pull the nation out of the Great Depression. The federally funded works projects—WPA, CCC, TVA—supported archaeological investigations of unprecedented scope in the Southeast. Among these various state programs, the conspicuous success of the Alabama investigations can be attributed to the vision of Walter B. Jones and the archaeological skill of David L. DeJarnette. It is of note that these two scholars along with one other, Eugene A. Smith, form an unbroken intellectual chain of research at Moundville that begins with the earliest work at the site and extends up to today. One hundred and forty years of experience can be bridged in three scholarly lifetimes.

Smith was the founder of the lineage. He received an AB from the University of Alabama in 1862, earned a PhD at Harvard in 1868, and returned to the University of Alabama as an instructor of geology in 1869. Smith was son-in-law to one president of the University, brother-in-law to a second, and close friend to a third, President Lupton (Sellers 1953:374). These two men, Lupton and Smith, shared a deep interest in the geology and prehistory of Alabama, and Lupton accompanied Smith on several geological field trips during his years as president. In addition to his teaching duties, Smith was appointed State Geologist in 1873, and he founded and was appointed the first director of the Alabama Museum of Natural History in 1910. Jones, who studied with Smith during the World War I years, received his AB and MA from the University of Alabama in 1918 and 1920 respectively. He went on to earn a PhD from Johns Hopkins University in 1924. In that same year he was appointed Assistant State Geologist of Alabama. Upon the death of Smith in 1927, Jones was appointed State Geologist and director of the Alabama Museum of Natural History. The youngest of the three, DeJarnette, served as an assistant in the museum during the time he was an undergraduate in the College of Engineering. In 1929, when he received his BSEE, he joined the museum staff as a full-time archaeologist. These three men, whose careers overlapped completely in the early 1920s, were all naturalists in the best possible sense of that word. In addition to their academic specialities, they were all serious students of the world around them. Moreover, it was their common commitment to Moundville that led to the research and preservation of that site.

At its inception, the work begun at Moundville in 1929 had two goals: first to conserve the site by bringing it into public ownership; and second to show that the site had great historic value and had not been "milked dry" by Moore 25 years earlier. Both goals were part of Smith's intellectual legacy to the museum, and both were met through the efforts of Jones and DeJarnette by 1932. Public donations to the museum provided most of the funds to purchase parts of the site as they came onto the market. However, when funds were short and lands were up for sale, Jones mortgaged his house to buy them (Walthall 1977:4). As the land was purchased test excavations were undertaken to explore the new acquisitions. These excavations showed that most of the site was intact and that Moore had removed only a very small part of the whole. Once the potential had been demonstrated and preservation had been assured, the next goals were to improve the quality of the excavations and to put together a long term research program for the site. To these ends, DeJarnette spent the summer of 1932 working with Fay-Cooper Cole and the University of Chicago field school in Fulton County, Illinois. When he returned there was a radical change in excavation and recording techniques as the lessons taught by Cole were adapted to a large Mississippian ceremonial center (Peebles 1979).

In 1933 the Alabama Museum of Natural History received aid from the Emergency Conservation Work Program for excavation and preservation at Moundville, and this federal support continued in various forms until 1941. The general supervision of the project fell to Jones, and DeJarnette directed the fieldwork. However, when David DeJarnette was working with Major Webb in the Tennessee Valley, his tasks at Moundville were assumed by his brothers Tom and James DeJarnette, Steve Wimberly, and Maurice Goldsmith. By the fall of 1941 over 44,000 m^2 had been excavated in various parts of the site. This area yielded more than 2250 burials, a minimum of 1,000 whole vessels and 200,000 sherds, more than 75 structures and 100 firebasins, several palisade segments, and a wide variety of other artifacts and features. In total, approximately 14% of the most intensively occupied portions of the site and 4% of the site as a whole had been explored. The threat of war halted the work, and only the most preliminary conclusions resulted from the fieldwork.

Jones and DeJarnette (n.d.) had recognized a "Moundville Culture" from the beginning of their research. However, this concept was not given precision of definition until DeJarnette and Wimberly (1941) made it part of an unnamed aspect of the Mississippian pattern. Otherwise the well documented but unanalyzed materials from Moundville were put away for the duration. The staff was scattered to various theatres of the war and DeJarnette served as an officer with MacArathur's army in New Guinea.

Research at Moundville: 1941 to 1960

During the war years Mr. E. H. Chapman, an assistant in the museum, inventoried the collection and saw to its safe storage. After the war DeJarnette returned to Alabama and wrote several articles on work he completed before the war (see especially DeJarnette 1947, 1952). In 1948 he became the first curator of the Museum of Atomic Energy in Oak Ridge. He remained there until 1951 when Jones offered and he accepted the curatorship of Mound State Monument. From 1951 to his retirement in 1975 he concentrated on strengthening the museum exhibits and other public aspects of Mound State Monument, curating the collections, and aiding others in their research. He received an MA in anthropology from the University of Alabama, was appointed to the faculty, and trained several generations of very productive archaeologists.

Research at Moundville: 1969 to 1980

The first major research project at Moundville that did not have its roots in the 1930s was undertaken by Douglas H. McKenzie, a graduate student in anthropology at Harvard University. McKenzie spent two months each at Mound State Monument and at the Museum of the American Indian studying the Moundville collections. One part of his dissertation (1964; see also 1966) defined the Moundville phase on the basis of ceramic, lithic, and other traits. A second part assessed the spatial and temporal place of this phase in the context of Southeastern culture history. It is unfortunate that McKenzie did not have more time to work with the records and collections at Moundville, because his general conclusions based on a cursory examination of these materials were largely correct. The ceramic markers he defined—Moundville Filmed Incised (now Carthage Incised), Moundville Filmed Engraved (now Moundville Engraved), and Moundville Incised—serve to define the phase. However, the chronological limits set by McKenzie, A.D. 1250 to 1500, turned out to be too short; his chronological limits now encompass only the last one-half of the Moundville phase. Moreover, the spatial boundaries he drew, the Tennessee River to west central Alabama, seem now to be too extensive. A strict definition would limit the Moundville phase to the Black Warrior River Valley from Tuscaloosa to Akron, Alabama (Peebles n.d.). Finally, because of a fundamental misunderstanding of the Moundville excavation records, McKenzie's analysis of the features and his sociological models are badly flawed.

My own involvement with Moundville began in 1963, in a seminar at the University of Chicago led by Lewis Binford. The paper written for that seminar (Peebles 1971) explored the variation in mortuary ritual at Moundville and several Mississippian sites in the Tennessee River Valley. The data for this paper came from published sources, and, as it turned out they were sufficient to establish the basic dichotomy between a few high status individuals and the remainder of the burials. They were also rich enough to demonstrate the use of infants and skulls as ritual artifacts in the construction of mounds and "public" buildings and in the mortuary ritual of some high status adults. This paper, and several others that had their genesis in the seminar, were published several years later, after they were presented at a Society of American Archaeology meeting (Brown 1971). Over the next three years, my interest in research at Moundville grew as a direct result of encouragement by Charles H. Fairbanks and Albert C. Spaulding. At their suggestion, I wrote David DeJarnette and asked if there were data from his excavations in the 1930s that might serve as the basis for an analysis of the burials. He replied in his classic, understated way that there were some data in the records that might be of interest to me.

In 1967, with support from the National Science Foundation (GS 2837), I went to Moundville to work with the burial records. From McKenzie (1965), I expected to find approximately 500 burials in the collection. It turned out that there were more than 2,250 burials. It also became evident that any analysis of the burials must take into account their archaeological context. Because of the magnitude of the field records —eight file drawers of primary records and several times that mass of administrative and other documents —and my limited funds, it was clear that the few weeks were not sufficient to master them. A solution was provided by the Xerox Corporation who donated one of their copiers to the project. In two weeks the primary records were duplicated. Their reconstruction took the greater part of the next five years.

A score of the largest excavations conducted by the Alabama Museum of Natural History between 1929 and 1941 were chosen for analysis and description. A report on these excavations was completed in 1973 and published by the University of Michigan Press in 1979. Because of the length of this manuscript, 1212 pages, it was published in microfiche rather than in book form (Peebles 1979). A sample of 1917 burials was analyzed for its latent information about social organization, and the result of this work was accepted as a doctoral dissertation in June, 1974 (Peebles 1974). The basic, two-dimensional structure—a few superordinate individuals set off from the mass of subordinate individuals—was clarified and given much greater precision by this analysis. A general summary of research at Moundville was prepared for a School of American Research Seminar on the Mississippian (Peebles n.d.), an analysis of Moundville phase settlement organization was written (Peebles 1978), and an examination of the use of Service's (1971) chiefdom level of socio-cultural complexity in archaeology was finished (Peebles and Kus 1977).

To the extent these analyses contributed to understanding the social and settlement organization of the Moundville phase, so they also brought into bold relief the gaps in the data and the analyses that were yet to be done. The most critical problem was the lack of an internal chronology. The Moundville phase at this point in the research was an undifferentiated span of several hundred years. The second problem was lack of precise information on the size, variety, and chronological position of the sites other than Moundville, ilar, though not identical pattern. Although infrequent in Late Archaic and Early Woodland deposits, hundreds of pod fragments were found concentrated in the fill of a stone-lined Early Woodland storage cyst along with large quantities of cultivated plants.

Pawpaw (*Asimina triloba*) seeds occur only in Early Woodland deposits, but are present in extremely low amounts. Nonetheless, their temporally restricted distribution suggests that they were occasionally eaten by humans.

The Appearance of Cultigens and their Subsequent Significance

Up to this point a pattern of wild plant utilization has been discussed that is typical of the paleoethnobotanical record in Eastern North America from about 9000 years ago until the advent of maize agriculture. Nuts dominate these records, and although other plant foods were probably eaten in large quantities, their macrofossils are infrequently found in archaeological contexts. In spite of excellent preservation, Cloudsplitter is no exception to this general rule.

The Cloudsplitter plant assemblage is, however, different in an important respect from the vast majority of paleoethnobotanical collections in the East. Because of the lack of moisture in the deposits, a controversial, but well-preserved assemblage of cultivated plants is available for study. Not only are seeds and other reproductive structures preserved, but such delicate parts as sunflower (*Helianthus annuus*) disk fragments, *Chenopodium* inflorescences, stalks and roots, and maygrass (*Phalaris caroliniana*) inflorescences occur with some regularity.

Dessicated squash (*Cucurbita pepo*) rind is present in a Late Archaic deposit with an associated radiocarbon date of 3728 ± 80 B.P. (UCLA 2313-K), and occurs sporadically thereafter throughout the Late Archaic and Early Woodland deposits. Gourd (*Lagenaria siceraria*) does not appear until after 3000 B.P., but its absence in Late Archaic contexts is probably due to sampling error.

Without exception, the cucurbit rinds from Cloudsplitter originated from small fruits with thick woody shells. There is no trend towards decreasing rind thickness through time, and it is assumed that the fruits were grown mainly for their seeds and value as containers.

The seeds and achenes of the so-called Eastern Agricultural Complex—sunflower (*Helianthus annuus*), cultivated sumpweed (*Iva annua* var. *macrocarpa*), goosefoot (*Chenopodium bushianum*), maygrass (*Phalaris caroliniana*) and erect knotweed (*Polygonum erectum*) are sparse to absent in Late Archaic levels, occurring at a rate of about .1 item/liter of screened deposit. In several cases, in fact, these Late Archaic occurrences might be attributed to contamination from later contexts.

After 3000 B.P. all members of the Eastern Complex undergo a sudden and dramatic increase in the rate at which they were being deposited in the site. In contrast to their paucity prior to this time, more than 14 items/liter of screened deposit are present in Early Woodland levels. This may be indicative of a wholesale introduction of the complex into the region at this time.

Unfortunately, human coprolites are scarce in the Cloudsplitter deposits, and it is not possible to measure the dietary contribution of the Eastern Complex in the same fashion as was done at Salts and Mammoth Caves (cf. Yarnell 1969, 1974; Marquardt 1974; Stewart 1974). Certainly at this early period cultivated foods were probably no more than supplements to an otherwise mixed diet of wild plant and animal species.

Once again, the Late Archaic and Early Woodland inhabitants of Cloudsplitter seem to have followed a similar trajectory in cultivated plant usage experienced in several other river drainages in the East. Cucurbits, presumably introduced from Mexico, appear first, and are followed in time by cultivation of small-seeded annuals. There are additional data from Cloudsplitter, however, that point to an alternative model.

As noted in the introduction to this paper, the basal deposit at Cloudsplitter was at least in places composed of a thick layer of dessicated hemlock needles. A single radiocarbon determination of 9215 ± 290 B.P. (GX-5873) is available for this deposit in Sampling Stratum III. Immediately on top of, and burned into this deposit were three small surface hearths. Two of these features have yielded dates of 9228 ± 100 B.P. (UCLA 2313-I) and 11,278 ± 200 B.P. (UCLA 2340-I). The remaining hearth has yet to be dated.

During the course of excavation of these hearths, a single, small dessicated cucurbit seed was found lying on top of the hemlock needle layer between the two dated hearths. Another was found moments later as the top of the hemlock needle layer was being screened.

Three other radiocarbon samples have been submitted to the UCLA radiocarbon laboratory from overlying deposits, but at this time, only one has been dated. A thin deposit of charcoal and other debris overlying the hearths has produced a date of 12,350 ± 400 B.P. (UCLA 2340-L). More radiocarbon determinations will be needed to help solve this obviously critical problem. Even so, it should be noted that mixing of younger and older charcoal should have produced a quite different date.

From a morphological standpoint, the cucurbit seeds are quite small when compared with seeds from later contexts at Cloudsplitter. They compare most favorably with the seeds of *Cucurbita texana*, the Texas gourd—a wild, small-fruited squash endemic to several river valleys draining the Edwards Plateau of Central Texas. Only two other wild squashes occur in Eastern North America—the buffalo gourd, *Cucurbita foetidissima*, and the Okeechobee gourd, *Cucurbita okeechobensis*—neither of which produce seeds that resemble those from Cloudsplitter.

For years there has been considerable disagreement concerning the taxonomic status of the Texas gourd. In the past, many botanists felt that *C. texana* was simply a naturalized variety of *Cucurbita pepo* (Whitaker and Bemis 1965). Other botanists have questioned this assertion, suggesting that there are no known populations of domesticated squashes that have escaped from cultivation and continued to thrive in the wild (cf. Heiser 1980). Most botanists today believe that *C. texana* is indeed a truly wild squash, separate from, but genetically closely linked to cultivated varieties of *pepo* squash (Heiser 1980; Rhodes et al. 1968).

The implications of this taxonomic placement are clear. The North American *pepo* squashes need not have diffused into the East or Southwest via some Mexican connection; they might have evolved in situ from some distinctive North American stock. As such, this evolution might have left traces in the archaeological record.

If the Cloudsplitter seeds are really 9000 years old (or older), we are still faced with a frustrating problem —an almost 5000 year gap in the paleoethnobotanical record. While a number of sites have produced cucurbit remains that cluster around 4500 B.P. (e.g. Carlston Annis and Bowles, Kentucky (Chomko and Crawford 1977), and Phillips Spring, Missouri (Kay et al. 1980), no earlier cucurbits have been reported. Recent discoveries in the Lower Illinois River Valley may alter this picture.

Carbonized cucurbit rinds have been reported from Helton Phase deposits at both the Koster and Napolean Hollow sites dating between 7500 and 6000 B.P. (Asch and Asch 1980, Asch personal communication). These specimens effectively bridge the gap between the Cloudsplitter and other Late Archaic squashes.

While we find the possibility of 9000 (or even 7000) year old squash in Eastern North America a tantalizing prospect, until we can directly date both the Kentucky and Illinois cucurbits through the accelerated C14 technique now under development, the evidence for Early and Middle Archaic squash cultivation will remain controversial.

Faunal Analysis

The rugged terrain of the Red River valley provides a heterogeneous environment with a great deal of vertical relief and botanical diversity. Prehistoric animal resources would have included large game animals such as deer, bear and elk, as well as small game mammals, birds, and turtles. Aquatic habitats in this region are not as productive or varied as they are in the larger, higher order streams of the Southeast with their associated swampy floodplains and meander belts. The fish fauna are diverse but many of the species are too small to be considered food fish. No waterfowl would have been numerous enough to have been either a seasonal or perennial resource for aboriginal hunters.

Analysis of Prehistoric Faunal Remains. In analyzing the different types of faunal remains, great care was taken to consider the variety of depositional and post-depositional events that have resulted in a complex and sometimes confusing assemblage. In addition to bone and mussel shell, hair, feathers, fish scales, eggshell, the chitonous skeleton of insects and crayfish, feces, and occasional strands of connective tissue and tendons or bone were also collected from Cloudsplitter.

The excavation units selected for analysis included all of those considered in the botanical analysis and one additional unit, K-20, which was located along the back wall of the shelter and was subject to decay of organic matter due to moisture. Material from the top (1/4″) screen from all of these deposits was analyzed as well as some of the larger features. The fraction of bone that was not identifiable to vertebrate class amounted to from 10% to 12% in these samples. No quantified data on the 1/16″ screen samples appear in this paper, partly because relative proportions are skewed by differential rates of deposition. They are discussed below in the context of the non-cultural occupation of the site. Top screen data are summarized in Table 7.

In the first part of Table 7, percentages of identified taxa are compared in terms of weight of identifiable bone. In the second part, proportions by weight are expressed in terms of the total volume of deposit from which they were recovered, producing densities per liter that can be used to compare plant and animal food remains through time and across the site. Weights of bone fragments rather than counts are presented here as a more reliable approximation of the importance of each animal. A list of identified taxa is given in Table 8.

The variables that affect the interpretation of the relative quantities of various species include the differential degree of fragmentation of bone through time (primarily a cultural process), and the changing rates of accumulation of deposit (a natural process affected by cultural occupation). Large game, including deer and bear, provided the most animal food throughout the occupation of the site, but the ratio of deer to other, unidentifiable large mammal remains changes over time. Count:weight ratios suggest that a decreasing degree of fragmentation of bone resulting in less identifiable pieces, rather than a decreasing ratio of deer to other game taken, produces these results. Densities of all types of fauna dropped during the Late Archaic, probably because these deposits contained a high proportion by volume of perishable organic matter. Early Woodland and Early Archaic deposits have been concentrated by burning and rotting, thus our inferences about changing proportions of animals through time are based primarily on percentages.

When the percentages of identifiable bone are ranked for each period, large mammal and deer account for about 80% of the bone in each case. Variability over time is seen in the assortment of animals that complemented this reliance on large mammals. In the Early Woodland, the next three catagories are

Table 7. Ratio of Identifiable Bone by Weight, Cloudsplitter Rockshelter (15 Mf 36).

Taxa	Percentage Ratios: Early Woodland	Percentage Ratios: Late Archaic	Percentage Ratios: Early Archaic	Density Ratios: Early Woodland	Density Ratios: Late Archaic	Density Ratios: Early Archaic
Large Mammal	48.9	59.7	63.3	40.5	11.8	31.6
Deer	33.3	19.6	14.3	22.0	4.1	27.0
Bear	3.3	0	0	2.7	0	0
Beaver	0	0	2.8	0	0	2.3
Medium Mammal	0.2	3.9	0.9	0.3	0.9	0.4
Small Mammal	0.4	2.8	0.6	0.4	0.6	0.2
Large Bird	7.4	3.4	7.8	4.3	0.4	7.2
Turtle	5.2	10.5	1.8	2.7	2.2	0.2
Sample Count	990	166	292			
Sample Weight	492.9g	73.5g	159.1g			
Sample Volume				387 liters	263 liters	177 liters

Table 8. Identified Vertebrate Taxa from Cloudsplitter.

Blarina brevicauda	Short-tailed Shrew
Cryptotis parva	Least Shrew
Chiroptera	Unidentified bat
Sciurus carolinensis	Grey Squirrel
Sciurus niger	Fox Squirrel
Sciuridae (*Tamias* or *Glaucomys*)	Unidentified small squirrel
Neotoma floridana	Eastern Packrat
Cricitidae	Unidentified small mice
Microtus sp.	Unidentified vole
Erethizon dorsatum	Porcupine
Castor canadensis	Beaver
Sylvilagus floridanus	Cottontail Rabbit
Canis cf. *familiaris*	Dog
Procyon lotor	Raccoon
Ursus americanus	Black Bear
Cervus canadensis	Elk (Wapiti)
Odocoileus virginianus	White-tailed Deer
Meleagris gallopavo	Turkey
Buteo sp.	Hawk
Strigidae	Unidentified owl
Passeriformes	Unidentified songbirds
Kinosternidae	Mud turtles
Terrepene carolina	Eastern Box Turtle
Trionyx sp.	Softshelled Turtle
Lacertilia	Unidentified small lizards
Natrix sp.	Water Snake
Heterodon platyrhinos	Hognosed Snake
Coluber sp.	Racers
Elaphe sp.	Rat Snakes
Moxostoma sp.	Redhorse
Ictalurus sp.	Unidentified Catfish
Notorus sp.	Unidentified Madtom
Centrarchidae cf. *Poxomis*	Crappie
cf. *Lepomis*	Sunfish

large bird, turtle, and bear. In the Late Archaic, large mammals are followed by turtle, medium mammal, and large birds. In the Early Archaic, deer and large mammals are followed by large bird, beaver, and turtle. Elk was identified from Early Archaic deposits in several units that were not included in this sample.

While it is not easy to resolve these small shifts into a picture of changing hunting patterns through time, it is clear that a full range of animals and the skills to exploit them were available from the Early Archaic, including the utilization of what scant aquatic resources were present. The shift from Late Archaic to Early Woodland as it is bracketed in these deposits is represented by a much greater change in botanical remains than in faunal remains. Animal use seems to be characterized by an emphasis on large game from the beginning. The importance of medium to small mammals in the Late Archaic is replaced by the importance of turkey and bear, perhaps more productive resources, in the Early Woodland. Overall, the picture is one of relatively stable exploitation of resources that do not lend themselves to manipulation by humans in the manner that some plant resources have.

Different animal processing activity areas may also account for some observed variability in the fauna. The bone in Sampling Stratum I, associated with post holes, features, and quantities of processed plant remains was food scrap sized; small fragments of long bone shafts and turtle shell dominate this assemblage. One extensive Early Woodland deposit, Lens C, seemed to represent rapid deposition of specialized animal procurement and processing, containing up to 80% large bird bone by weight, with turkey the only identified species. Outside the central ring of breakdown blocks, there was less finely fragmented bone, less bird bone, and more large pieces of deer, bear and elk bone that appeared to be butchering and hide processing refuse.

Analysis of Non-Cultural Faunal Remains. In addition to finely crushed bone from larger human prey, remains caught in the 1/16″ mesh included bats, shrews, mice, salamanders, lizards, birds, snakes, and fish. Many of these do not seem to be human prey, as the bones are complete, and the animals in life weigh only from 3 to 10 grams. At least some of this bone resulted from the roosting of raptorial birds over the site, evidenced by an amphibian vertebra that was stuffed with mouse fur. These animals are not part of our model for human subsistence; rather they are a sample of small animals from the site to which other data on prehistoric climates and vegetation can be compared. The use of owl and hawk roosts to study paleoecology is well established in the Southeast (Guilday et al. 1978). Though the small fauna recovered from the site do not relate to the human subsistence base or the immediate vegetation of the site, they provide evidence to reconstruct vegetational communities in the aboriginal catchment area. No distinctively Pleistocene fauna appear in the cultural levels of the site. The fauna from the Early Archaic levels in Sampling Stratum I, dated to 8200 B.P. ± 255 (GX 5874) are only slightly different than the late prehistoric and early modern samples. One interesting identification from an Early Archaic level was the mandible of the least shrew, *Cryptotis parva.* This tiny insectivore prefers brushy or open areas to tree cover, which might indicate some nearby open or disturbed area that would have been favorable habitat for other game species, including deer and turkey.

The small sample size of faunal remains and human activity at this site do not permit a reconstruction of changing subsistence patterns for the entire settlement system. We have good data for studying the role of climate change, for offering evidence of subsistence remains missing in open sites, and for comparing the proportions of animal and plant food waste generated by a series of cultural occupations. We are still challenged to reconstruct actual subsistence practices from this evidence for plant and animal exploitation.

Lithic Analysis

In comparison to biological remains, the Cloudsplitter lithic assemblage is small, and dominated by a single class of materials—debitage. Because of this fact, the lithics from the site cannot readily be used for the more common morpho-functional analyses that dominate today's literature. Instead, the waste from the manufacture and maintenance of chipped stone implements is available for examination.

As has been indicated in the previous sections, the occupational context of Cloudsplitter—a short term, special activity camp—has important repercussions in terms of the lithic assemblage that could be expected to have been produced. Theoretically there should be less evidence of lithic manufacture *per se* and more evidence of curation of finished tools than one might expect at a long-term, multifunctional "base-camp". This assumption can be evaluated from several perspectives.

The relative volume of lithic waste material (e.g. non-utilized debitage)—99.2% of the Cloudsplitter sample—supports the basic assumption that curation of already existing tools rather than production of new ones was the focus of lithic activities at Cloudsplitter.

This may be further illustrated by comparing the finished tool-to-debitage ratio of Cloudsplitter with other floodplain and shelter sites in the Red River drainage (Table 9). Note the higher tool-to-waste ratios for the Anderson and Shepard sites, two large, multicomponent bottomland sites.

A typology of debitage based on platform type and amount of cortex on the flake surface was constructed which resulted in 12 flake classes. A series of measurements were next collected from 75 Archaic flakes (the combined total for Early and Late Archaic samples from Sampling Stratum I) and 462 Early Woodland flakes. A comparative study of these two samples has yielded some encouraging preliminary results.

First it is obvious that Archaic lithic activities were almost exclusively limited to maintenance of already existing tools. No cores were found in Archaic contexts, and flakes seem to have been produced by the rejuvenation of bifacial implements. Almost 25% of the tools and flakes originated from sources outside the Red River drainage.

Early Woodland debitage presents an entirely different picture. Exhausted cores are present in the deposits, and 84% of all tools and debitage originated from locally available sources. If numbers of flakes may be equated with amount of lithic activity, then over 5 times as much occurred during the Woodland versus the Archaic (185 items/unit volume of deposit versus 56 items/unit volume of deposit).

The differences observed in the lithic population almost certainly relate to the changes in site utilization through time. It has already been suggested that the site experienced a more intensive occupation during the Early Woodland, and the debitage seems to bear this out.

Summary

Each of the sections in this paper are highly synthesized accounts of longer papers. Analyses of the Cloudsplitter shelter materials are still on-going, although we doubt if this basic outline will change substantially. Our work over the last two years has provided us with a good outline of the history and mechanisms of deposition of cultural and natural materials within the overhang; a perspective on change and stability in local and regional floristics; and insights into patterns of plant, animal and lithic procurement strategies. Perhaps at this point we might take stock of this knowledge, and attempt to place our work at Cloudsplitter into a somewhat more cohesive integrated framework.

At the time Early Archaic people came to Cloudsplitter they were faced with a still-evolving postglacial landscape. Preserved Pleistocene sediments at the site suggest that the late Wisconsin period may have been somewhat cooler and moister than today. Both pollen and macrofossil evidence from the Early Holocene deposits seem to reflect the waning effects of the continental ice sheets on local floristics. While a number of deciduous plant species indicate that a broadleaf forest was already established by 10,000 years ago, its composition was somewhat different than we see today. Hemlock trees grew immediately in front of the overhang as late as 9200 years ago. Red spruce, completely absent in the Red River drainage today, probably existed in scattered patches on the highest portions of the plateau, occurring as remnants of the formerly extensive Wisconsin-aged boreal forest that dominated higher elevations in the Appalachians.

The Early Archaic occupants of the site were clearly already well adapated to the Early Holocene flora and faunal resources of the drainage. Economic decisions were based on the seasonal availability of nuts, white-tailed deer and a variety of lesser mammalian and aquatic fauna at this early period. At this early date Cloudsplitter seems to have served as a temporary, fall-season camp, perhaps being occupied for only a few days and nights before resource availability dictated movement. Our knowledge of the size of the group utilizing the site is incomplete, but large roof blocks littered much of the floor of the overhang, and probably only a few nuclear families could comfortably have been accomodated within the interior.

Unfortunately, Cloudsplitter did not contain a Middle Archaic record of human occupation. This hiatus is mirrored in other areas of the drainage at this time period also. In spite of the fact that over 200 archaeological sites have been recorded for the Red River area, Middle Archaic manifestations are exceedingly scarce.

By 4,500 years ago Cloudsplitter once again began to serve the needs of local populations. Survey and excavation work on the valley floor downstream from Cloudsplitter have established that a sizeable Late Archaic population was present in the drainage by this time. While the dynamics of Archaic population growth in the East are poorly understood, a similar phenomenon can be observed in the Green, Wabash, Ohio, and Illinois River valleys farther to the west. Changes in population went hand in hand with changes in local floristics.

A mixed broadleaf and coniferous forest was by now firmly established in the Red River drainage. Hemlock populations had retreated downslope from Cloudsplitter giving way to the dry, upper slope communities of oaks, chestnut and hickory that typify the floristic pattern of today. As the composition of the forests in the drainage stablized, so did Late Archaic subsistence-settlement strategies. The deposits at Cloudsplitter reveal what appears to be an increasing utilization of hickory and chestnut during the fourth and

Table 9. Tool:Debitage Ratios for Various Red River Sites.

Site	Type	Occupation	N	Tool:Debitage
Cloudsplitter	rockshelter	short-term, Early Archaic, Late Archaic, Early Woodland	1,251	1.129.4
Haystack	rockshelter	short-term, early Late Woodland	980	1:121.5
Anderson	floodplain	large settlement, Early Woodland, Middle Woodland	685	1:22.3
Shepard	floodplain	large settlement, Archaic, Woodland, Ft. Ancient	2,455	1:11.0

third millennia; faunal exploitation remains essentially unchanged, with deer, small game, and minor amounts of aquatic resources dominating the assemblage. Squash was definitely being grown by the Late Archaic populations in the drainage and provides evidence that the Red River area, in spite of its remoteness, was hardly isolated from innovations that were taking place elsewhere in the Midcontinent at this time.

The large sandstone blocks on Cloudsplitter's floor were still placing limits on the size of the population that could have utilized the site at any one time. Again it appears that the site was functioning as a small camp for a few nuclear families. The abundance of nut shells in the deposits suggests that these peoples made repeated visits to the site in the fall of the year, taking advantage of locally available crops of mast. Still, their visits remained of short duration; when the nuts had been harvested in the vicinity of the overhang the families moved on to yet another favorable locality. The regularity at which Late Archaic groups made use of the site, soon built up the floor with domestic residue, and by 3000 years ago, rooffall no longer dictated which area of the shelter could be utilized.

Early Woodland populations likewise made use of the overhang. Their hearths, pits, and extensive ash deposits riddle the post 3000 B.P. deposits at Cloudsplitter, and suggest a changing function for the site. Although we can detect little change in the utilization of wild plants and animals, a variety of cultivated weedy annuals make a sudden, and dramatic appearance in the site. Only a few hundred years separate the latest Archaic and Early Woodland occupations, leading us to believe that these horticultural transformations took place quite rapidly. None of the wild relatives of the Eastern Agricultural complex are present in harvestable quantities in the Red River basin today; almost certainly the Complex was introduced as a "package" during the Early Woodland.

We are still not certain what selective pressures were operating that would have made it advantageous for Late Archaic hunters and gatherers to begin cultivating these plants. It is probably no coincidence that evidence of storage technology appears concomitantly with the introduction of the Eastern Complex plants. The large storage pits we have described as occurring in Sampling Stratum III are capable of holding upwards of 30,000 hickory nuts, and may signal a fundamental change in the Early Woodland population's perception of the security of their environment. We have found no evidence to suggest any broad-scale change in the floristics of the area at this time horizon, and perhaps changing social relations with neighboring bands may have provided the stimuli that led to these transformations. A regularization of territorial boundaries, coupled with decreased access to alternative collecting and hunting locales is one such hypothesis that needs to be explored.

In spite of the potential for increasing residential stability that cultivation would seem to have afforded, Cloudsplitter remained a temporary extractive camp for a small group of Early Woodland peoples. Spatially isolated posts and postmolds and other features within Sampling Stratum I probably reflect a continuation of use by nuclear families. All evidence again points to a fall occupation; there are no large ovens or hearth features that would have provided warmth during the Eastern Kentucky winters. Although the site may have been utilized for longer periods of time during the Early Woodland, it must be concluded that seasonal abandonment took place.

After about 2400 B.P. the shelter was no longer utilized by local Woodland populations. Sporadic, probably overnight visits were made to the site during the late prehistoric period, but these activities left little tangible records in the overhang.

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William Michael Wood

A COMPUTER SIMULATION OF SETTLEMENT GROWTH AND DELINEATION DURING THE LATE MISSISSIPPIAN: AN EXAMPLE FROM THE PIEDMONT AREA OF GEORGIA

During the past few years there has been an increasing number of settlement pattern studies done in the Southeastern United States (Lee 1976; Smith 1978). An entire book was recently devoted to settlement pattern studies in and around the Southeastern Region during the Mississippian Period (Smith 1978). This volume included an article that presented a model of settlement patterning for societies at the chiefdom level of social development that was tested against the archaeological data from the Moundville area in Alabama (Steponaitis 1978). Thus it appears that settlement patterns are now, more than ever, being used to help understand societal growth and development.

The approach used by the present author is to use a computer simulation in studying settlement patterns and social expansion. Preliminary analysis of the data on a regional scale has been conducted using a modified version of Steponaitis' E index, and is reported elsewhere (Wood 1980). The data base being utilized is survey data on over 600 Lamar sites, gathered by the University of Georgia in the floodpool area of the Wallace Reservoir along the Oconee River in Central Georgia. The use of this data set was provided by Dr. David Hally of the University of Georgia.

The use of a simulation, both as a heuristic tool, and an instrument of analysis, must be done with care. Various problems can and do arise in quantifying and integrating all of the different functions and variables needed to represent a societal unit and its actions. And even if the simulation model fits the data, it cannot be used as the final answer. Its use should be more in the area of generating possibilities that can hopefully be tested through further research. It provides one possible answer, not necessarily *the* answer to any given problem.

The simulation by itself cannot stand on its own right, but must be checked against the archaeological record to ascertain its ability to predict or copy the observed pattern. Because of this reason the above mentioned data set was chosen for use. Its large number of sites should allow for a fine tuning of the developed model. Previous work has been done in the area. Lee (1976) has studied the relationship between soil types and topography and the patterning of Lamar sites in the area. Smith and Kowalewski have included the study area as part of their tentative prehistoric province (Smith and Kowalewski 1979).

The program itself is being written in FORTRAN, and run on an IBM 3033 computer, using IBM's H-extended compiler for maximum flexibility within the program. SYMAP is being used to map out both the base data set and the generated data set produced by the simulation.

Two basic assumptions must be made. The first is, that the climate of today is representative of the climate during late prehistoric times; the second, that information recorded by early explorers and their companions give valid and accurate descriptions of actions and customs of the aboriginal peoples who they contacted. Lacking dendrochronological and palynological data for the area, all climatological information will be drawn from modern sources. As to the use of ethnographic sources, they will be kept to a minimum. What has been attempted is the use of as many hypothesized functions as possible from other archaeological research, such as Ford's (1977) work in the Midwest and Smith's (1978) research. It is not possible, nor advisable, to totally ignore the usefulness of ethnographic sources, but as Fish and Fish (1976) point out, great care must also be exercised in their use.

The first step in constructing the simulation was to establish the probable political level of the study group. I have used the multilineal evolutionary model as developed by Sanders and Webster (1978). Using their three main factors hypothesized to regulate the tempo and direction of evolutionary growth, and comparing them to work done by archaeologists concerning Southeastern United States political organization, the chiefdom or ranked level of society is assumed to be the operational stage of development. It should be noted here that in Sanders and Webster's (1978) evolutionary scheme ranked and stratified societies are treated as two separate levels of development. The main differences between the two are that stratified societies have differential access to major subsistence resources and are socially stratified as compared to being ranked. Peebles and Kus (1976) list equal access to basic subsistence resources as one of their "markers" of a ranked society, which excludes them as being stratified societies as far as this research is concerned.

By assuming a chiefdom level of development, social, economic, and settlement rules hypothesized to operate at this level of social development can be used in the simulation. Additionally, other archaeological work dealing with similar societies at this level of development can also be applied to the model.

Time in the simulation is incremented on a seasonal basis to allow for the maximum use of climatological variables and their possible effect on the growth and spread of the settlements. The climatological data used is drawn from that given in the U.S.D.A. (1965, 1976) soil survey reports for the study area. A uniformly distributed pseudo-random number is used to produce the seasonal climate for the area. The climate data is then used to modify yields of seasonal food resources and maintained to be used in calculating overall yield from horticulture. These data are then used to either slow down, maintain, or accelerate the population growth.

Two different methods of population growth are being used within the simulation. The first, and simplest method, is the one used by Zubrow (1975) in his Hay Hollow study of carrying capacity. This method uses a single equation to calculate the rate of growth for the population. The second method is a cohort analysis method using the formulations of Weiss (1973) from his demographic models study. This analysis is a series of equations that use varying data from different age cohorts to calculate population growth.

Location rules for the establishment of new settlements from the one or two starting settlements are based on Lee's (1976) work. Available soil type, topography and group size are utilized to establish the location and type (i.e. farmstead, temporary, etc.), of site. The availability of local natural resources such as water are also calculated into the formula.

The simulation is currently in the last stages of de-bugging and initial running, but we are hopeful of the results. Problems and questions still have to be resolved and analyzed. Future analysis of the site data will hopefully help to establish a pattern of contemporaneity of the sites. The simulation will generate a pattern that will be a continually growing data set. The stopping point will be given by a certain number of years, or a point when the resource potential of the area is exceeded.

The purpose of the simulation is also to help in the delineation of possible societal groups within the Southeastern United States. At this point it covers only a part of the hypothesized "province". Future research is geared towards increasing the program to encompass the entire region and attempt to pick up changes in settlement patterns that could possibly indicate boundaries between groups. An effective limit to the sphere of control of local and major centers could be developed that would also help in delineating boundaries between cultural groups.

The work that is being done is the base for future research, that can hopefully help add to our understanding of cultural growth and the rules and properties that affect it.

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Christopher S. Peebles

ARCHAEOLOGICAL RESEARCH AT MOUNDVILLE: 1840-1980

Continuity of research and conservation of the data produced by this research have been the hallmarks of archaeological investigations at Moundville from their beginning in 1840 to the present. During these 140 years, neither indiscriminate vandalism, mean commercialism, nor misguided scholasticism have had significant harmful effects on either the Moundville site itself or on most of the other sites of the Moundville phase. Such good fortune sets these sites off from those of almost any other archaeological phase in the Southeast. To a person, the individuals who worked at Moundville during the formative era of research there, that is from 1840 to 1940, were exceptional natural historians and scholars. Their research transcended that of most of their contemporaries by several orders of magnitude. To a family, for the last 140 years, the owners of the lands on which these sites are located have been conscious and active agents in their conservation. Only minor destruction has come to these sites through plowing. However, changes in the course of the Black Warrior River have swept away two mounds; one village has been lost to industrial expansion; and a mound within the city limits of Tuscaloosa was said to have been leveled by that city's authorities in the 1820s or 30s (Maxwell 1876:74). Only two breaches of curatorial trust, one in the first quarter of the twentieth century, the other in the last, have diminished the collections made at these sites by five generations of scholars.

The papers below are testimony to an unbroken line of research that binds us to past generations of archaeologists who worked at Moundville. There is not a single question, proposition, or paper here that does not use directly the materials and observations handed down to us from the past: the prehistoric past of the tenth through sixteenth centuries; the scholarly past of the nineteenth and twentieth centuries. It is the interplay of these two pasts that will form the substance of this paper.

Research at Moundville: 1840 to 1900

The earliest archaeological work at Moundville was conducted in the spirit of the "natural history circle" that influenced American scholarship from the time of the Bartrams and Jefferson in the eighteenth century to that of Lewis and Clark, Catlin, and Schoolcraft in the nineteenth century (see Savage 1979). Thomas Maxwell, who conducted the first archaeological work at Moundville, was definitely a member, albeit a provincial one, of this circle. In 1840 he dug a trench in Mound B and noted the stratification and features inclusive to this mound. He traced the earthen embankment that circled the site and described various other features found near the mounds. For the next 36 years he chronicled the discoveries made by the landowners and others at Moundville. He published his Moundville work as part of a larger history of Tuscaloosa in 1876 (Maxwell 1876). His conclusions about Moundville embraced Aztecs, bloody warfare, lost tribes, and arcane knowledge, all of which showed familiarity with the natural historical writings of his day.

Between 1840 and 1869 a trench was cut into Mound G by someone, perhaps Maxwell, a "Giant" was found by Mr. Hezekiah Powell near the base of Mound B (Maxwell 1876:70), and other features and artifacts continued to erode out of deposits near the bases of the mounds and the earthen embankment. During this period brief mention of Moundville was included in *Ancient Monuments of the Mississippi Valley* (Squier and Davis 1848) and in the *History of Alabama. . . .* (Pickett 1851). No excavations have been reported, however, between those of Maxwell in 1840 and Nathaniel T. Lupton in 1869.

Lupton was the first person to conduct a systematic examination of the Moundville site, as well as the first scholar to conduct "sponsored research" there. Born in 1830 in Virginia, Lupton was to become a renowned scientist. He was a graduate of Dickenson College and studied under Bunsen in Germany. He was—in sequence—a professor of chemistry at Randolph-Macon College then at Southern University; a chemist with the Niter and Mining Bureau of the Confederate States of America; President of the University of Alabama; professor of chemistry at Vanderbilt University; and he concluded his distinguished career as professor of chemistry at the Alabama Polytechnic Institute (Auburn). He died at Auburn in 1893 (Sellers 1953:314-315).

At the end of the Civil War, Lupton returned to his post at Southern University, Greensboro, Alabama. At some point thereafter, he was contacted by Joseph Henry, Secretary of the Smithsonian Institution and asked to explore the Indian Mounds of Alabama. On May 31, 1869, Henry authorized funds for him to explore the Indian Mounds on the Black Warrior River. Lupton, after a delay caused by illness and university duties, began fieldwork at Moundville in September, 1869. He and a crew of five workers spent four days mapping the site and excavating a trench in Mound O. His notes on this excavation were sufficiently detailed for a contemporary reconstruction of the mound's stratigraphy and the location of the features therein (Steponaitis laboratory notes). Lupton's map of the site as a whole was complete, accurate, and was drawn to scale. He correctly located the mounds, showed the course of the earthen embankment south of the plaza, and noted therein that Mound G had been "opened about 36 years since." He shipped his Moundville materials to Washington by Railway Express and after a delay of several months they reached the Smithsonian in March, 1870. The total bill for Lupton's work, exclusive of the freight charges, was $29.85.

Subsequent to Lupton's work, the Smithsonian Institution became involved one more time in field archaeology at Moundville. After Cyrus Thomas had been appointed director of the newly formed Mound Exploration Division of the Smithsonian Institution in 1881, he sent one of his assistants, James D. Middleton, to work at Moundville. Although Middleton's brief stay at Moundville in 1882 did add to the collections of the U. S. National Museum, his field observations and notes were far below the standards set by Lupton. Some of Middleton's maps of individual mounds can be matched to existing mounds, but his map of the site bears no relationship to reality (National Anthropological Archives: #2400-Box 11; Steponaitis 1980a:9). No matter which way this map is turned, stretched, and transformed, it cannot be made to fit the locations of the mounds that existed in 1869 and that exist today.

Research at Moundville: 1900 to 1929

Between 1882 and 1905 no organized fieldwork took place at Moundville, but the work of Lupton and Middleton was incorporated into the archaeological publications of the day (see Steponaitis 1980a: 9-10). It was not until Clarence B. Moore ordered the steamboat *Gopher* tied up at Prince's Landing in the spring of 1905 that archaeological exploration was resumed at Moundville. Moore, a graduate of Harvard College, a ne'er-do-well world traveler, and an independently wealthy young man, gave up the continental transhumance of the rich for archaeological fieldwork and scholarship (see Thomas 1979:30-33). In that vocation he was no dilettante. Moore's fieldwork, if somewhat crude by today's standards, was a model of excellence for the Southeast in 1905. As H. Newell Wardle observed:

> For more than a decade the attention of this eminent archaeologist has centered in the mounds of our southern coast. In his steam-yacht, bearing every necessary appliance, including an efficient force of experienced diggers, he has explored every navigable stream and inlet from the Carolinas round to Alabama . . .

> Here [at Moundville], as elsewhere, the enforcement of Mr. Moore's rule that no digging shall be done without his actual presence assured an accurate record of each find and its relation to other objects in the grave. (Wardle 1906:201-202).

Moore and his crew spent two one-month seasons at Moundville, one in 1905, the other in 1906. The results of his work were impressive. He placed "trial-holes" in most of the mounds and in almost every other area of the site. His is still the only data we have for features in the mounds. He made a very accurate map of the site, and he located his excavation units in relation to this map. He had some sense of the importance of the associations among artifacts, so he cataloged burials and their artifacts together. Moore and his crew recovered 801 burials, several hundred vessels, and an impressive array of "Southern Cult" artifacts. From these artifacts and his notes he produced two detailed and lavishly illustrated monographs (Moore 1905, 1907). These two volumes have been (and always will be) a valuable foundation for research at Moundville.

Moore's collections were accessioned initially by the Academy of Natural Sciences, Philadelphia, but they were transferred later to the Heye Foundation, Museum of the American Indian. At some point between excavation and accession by the Museum of the American Indian, the vessel collection was "high-graded" and the coarse, plain vessels were discarded (Steponaitis 1980a:18-19). In addition, the entirety of Moore's skeletal collection was dispersed. The Nassau County Museum literally salvaged Moore's coastal Georgia and Florida skeletal material, but the Moundville series is still lost.

Research at Moundville: 1929 to 1941

The year the market crashed, 1929, was also the year archaeological research began once again at Moundville. Although these two events of vastly different magnitude were unrelated in the beginning, the state of the economy and the archaeology of Moundville soon became partners in the effort to pull the nation out of the Great Depression. The federally funded works projects—WPA, CCC, TVA—supported archaeological investigations of unprecedented scope in the Southeast. Among these various state programs, the conspicuous success of the Alabama investigations can be attributed to the vision of Walter B. Jones and the archaeological skill of David L. DeJarnette. It is of note that these two scholars along with one other, Eugene A. Smith, form an unbroken intellectual chain of research at Moundville that begins with the earliest work at the site and extends up to today. One hundred and forty years of experience can be bridged in three scholarly lifetimes.

Smith was the founder of the lineage. He received an AB from the University of Alabama in 1862, earned a PhD at Harvard in 1868, and returned to the University of Alabama as an instructor of geology in 1869. Smith was son-in-law to one president of the University, brother-in-law to a second, and close friend to a third, President Lupton (Sellers 1953:374). These two men, Lupton and Smith, shared a deep interest in the geology and prehistory of Alabama, and Lupton accompanied Smith on several geological field trips during his years as president. In addition to his teaching duties, Smith was appointed State Geologist in 1873, and he founded and was appointed the first director of the Alabama Museum of Natural History in 1910. Jones, who studied with Smith during the World War I years, received his AB and MA from the University of Alabama in 1918 and 1920 respectively. He went on to earn a PhD from Johns Hopkins University in 1924. In that same year he was appointed Assistant State Geologist of Alabama. Upon the death of Smith in 1927, Jones was appointed State Geologist and director of the Alabama Museum of Natural History. The youngest of the three, DeJarnette, served as an assistant in the museum during the time he was an undergraduate in the College of Engineering. In 1929, when he received his BSEE, he joined the museum staff as a full-time archaeologist. These three men, whose careers overlapped completely in the early 1920s, were all naturalists in the best possible sense of that word. In addition to their academic specialities, they were all serious students of the world around them. Moreover, it was their common commitment to Moundville that led to the research and preservation of that site.

At its inception, the work begun at Moundville in 1929 had two goals: first to conserve the site by bringing it into public ownership; and second to show that the site had great historic value and had not been "milked dry" by Moore 25 years earlier. Both goals were part of Smith's intellectual legacy to the museum, and both were met through the efforts of Jones and DeJarnette by 1932. Public donations to the museum provided most of the funds to purchase parts of the site as they came onto the market. However, when funds were short and lands were up for sale, Jones mortgaged his house to buy them (Walthall 1977:4). As the land was purchased test excavations were undertaken to explore the new acquisitions. These excavations showed that most of the site was intact and that Moore had removed only a very small part of the whole. Once the potential had been demonstrated and preservation had been assured, the next goals were to improve the quality of the excavations and to put together a long term research program for the site. To these ends, DeJarnette spent the summer of 1932 working with Fay-Cooper Cole and the University of Chicago field school in Fulton County, Illinois. When he returned there was a radical change in excavation and recording techniques as the lessons taught by Cole were adapted to a large Mississippian ceremonial center (Peebles 1979).

In 1933 the Alabama Museum of Natural History received aid from the Emergency Conservation Work Program for excavation and preservation at Moundville, and this federal support continued in various forms until 1941. The general supervision of the project fell to Jones, and DeJarnette directed the fieldwork. However, when David DeJarnette was working with Major Webb in the Tennessee Valley, his tasks at Moundville were assumed by his brothers Tom and James DeJarnette, Steve Wimberly, and Maurice Goldsmith. By the fall of 1941 over 44,000 m² had been excavated in various parts of the site. This area yielded more than 2250 burials, a minimum of 1,000 whole vessels and 200,000 sherds, more than 75 structures and 100 firebasins, several palisade segments, and a wide variety of other artifacts and features. In total, approximately 14% of the most intensively occupied portions of the site and 4% of the site as a whole had been explored. The threat of war halted the work, and only the most preliminary conclusions resulted from the fieldwork.

Jones and DeJarnette (n.d.) had recognized a "Moundville Culture" from the beginning of their research. However, this concept was not given precision of definition until DeJarnette and Wimberly (1941) made it part of an unnamed aspect of the Mississippian pattern. Otherwise the well documented but unanalyzed materials from Moundville were put away for the duration. The staff was scattered to various theatres of the war and DeJarnette served as an officer with MacArathur's army in New Guinea.

Research at Moundville: 1941 to 1960

During the war years Mr. E. H. Chapman, an assistant in the museum, inventoried the collection and saw to its safe storage. After the war DeJarnette returned to Alabama and wrote several articles on work he completed before the war (see especially DeJarnette 1947, 1952). In 1948 he became the first curator of the Museum of Atomic Energy in Oak Ridge. He remained there until 1951 when Jones offered and he accepted the curatorship of Mound State Monument. From 1951 to his retirement in 1975 he concentrated on strengthening the museum exhibits and other public aspects of Mound State Monument, curating the collections, and aiding others in their research. He received an MA in anthropology from the University of Alabama, was appointed to the faculty, and trained several generations of very productive archaeologists.

Research at Moundville: 1969 to 1980

The first major research project at Moundville that did not have its roots in the 1930s was undertaken by Douglas H. McKenzie, a graduate student in anthropology at Harvard University. McKenzie spent two months each at Mound State Monument and at the Museum of the American Indian studying the Moundville collections. One part of his dissertation (1964; see also 1966) defined the Moundville phase on the basis of ceramic, lithic, and other traits. A second part assessed the spatial and temporal place of this phase in the context of Southeastern culture history. It is unfortunate that McKenzie did not have more time to work with the records and collections at Moundville, because his general conclusions based on a cursory examination of these materials were largely correct. The ceramic markers he defined—Moundville Filmed Incised (now Carthage Incised), Moundville Filmed Engraved (now Moundville Engraved), and Moundville Incised—serve to define the phase. However, the chronological limits set by McKenzie, A.D. 1250 to 1500, turned out to be too short; his chronological limits now encompass only the last one-half of the Moundville phase. Moreover, the spatial boundaries he drew, the Tennessee River to west central Alabama, seem now to be too extensive. A strict definition would limit the Moundville phase to the Black Warrior River Valley from Tuscaloosa to Akron, Alabama (Peebles n.d.). Finally, because of a fundamental misunderstanding of the Moundville excavation records, McKenzie's analysis of the features and his sociological models are badly flawed.

My own involvement with Moundville began in 1963, in a seminar at the University of Chicago led by Lewis Binford. The paper written for that seminar (Peebles 1971) explored the variation in mortuary ritual at Moundville and several Mississippian sites in the Tennessee River Valley. The data for this paper came from published sources, and, as it turned out they were sufficient to establish the basic dichotomy between a few high status individuals and the remainder of the burials. They were also rich enough to demonstrate the use of infants and skulls as ritual artifacts in the construction of mounds and "public" buildings and in the mortuary ritual of some high status adults. This paper, and several others that had their genesis in the seminar, were published several years later, after they were presented at a Society of American Archaeology meeting (Brown 1971). Over the next three years, my interest in research at Moundville grew as a direct result of encouragement by Charles H. Fairbanks and Albert C. Spaulding. At their suggestion, I wrote David DeJarnette and asked if there were data from his excavations in the 1930s that might serve as the basis for an analysis of the burials. He replied in his classic, understated way that there were some data in the records that might be of interest to me.

In 1967, with support from the National Science Foundation (GS 2837), I went to Moundville to work with the burial records. From McKenzie (1965), I expected to find approximately 500 burials in the collection. It turned out that there were more than 2,250 burials. It also became evident that any analysis of the burials must take into account their archaeological context. Because of the magnitude of the field records —eight file drawers of primary records and several times that mass of administrative and other documents —and my limited funds, it was clear that the few weeks were not sufficient to master them. A solution was provided by the Xerox Corporation who donated one of their copiers to the project. In two weeks the primary records were duplicated. Their reconstruction took the greater part of the next five years.

A score of the largest excavations conducted by the Alabama Museum of Natural History between 1929 and 1941 were chosen for analysis and description. A report on these excavations was completed in 1973 and published by the University of Michigan Press in 1979. Because of the length of this manuscript, 1212 pages, it was published in microfiche rather than in book form (Peebles 1979). A sample of 1917 burials was analyzed for its latent information about social organization, and the result of this work was accepted as a doctoral dissertation in June, 1974 (Peebles 1974). The basic, two-dimensional structure—a few superordinate individuals set off from the mass of subordinate individuals—was clarified and given much greater precision by this analysis. A general summary of research at Moundville was prepared for a School of American Research Seminar on the Mississippian (Peebles n.d.), an analysis of Moundville phase settlement organization was written (Peebles 1978), and an examination of the use of Service's (1971) chiefdom level of socio-cultural complexity in archaeology was finished (Peebles and Kus 1977).

To the extent these analyses contributed to understanding the social and settlement organization of the Moundville phase, so they also brought into bold relief the gaps in the data and the analyses that were yet to be done. The most critical problem was the lack of an internal chronology. The Moundville phase at this point in the research was an undifferentiated span of several hundred years. The second problem was lack of precise information on the size, variety, and chronological position of the sites other than Moundville, especially the single mound centers. Third, because floral and faunal materials were not recognized as significant, they were not collected by the 1930s fieldwork, and therefore there were few data on the subsistence system for the Moundville phase. Fourth, there was a series of behavioral propositions that could be tested with either the data in hand or with data which could be recovered with a minimum of excavation. These propositions ranged from the development of craft specilization, to the diet of the elite, to the evolution of horticultural systems. Moreover, all these questions could be tied, in one way or another, to the development of social complexity.

With the advice and active collaboration of Margaret Scarry, Margaret Schoeninger, and Vincas Steponaitis, I wrote a draft of a grant application to the National Science Foundation that would support the research to answer some of these questions. The draft circulated among us, was criticised and rewritten, and was submitted with myself as principal investigator and Scarry, Schoeninger, and Steponaitis as co-investigators. We proposed four interrelated research projects:

1) An analysis and seriation of ceramic vessels recovered from secure contexts at Moundville; an analysis of the organization of ceramic production to yield information on craft specialization; and identification of non-local ceramics to provide data on the role and range of exchange systems.
2) An archaeological survey and testing program at Moundville phase sites in the Black Warrior Valley to yield measures of site size, age, and variety.
3) Excavations in areas of stratified deposits at Moundville designed to recover floral and faunal remains and a stratified ceramic sample with which to cross-check the results of the ceramic seriation.
4) A trace element analysis of human bone from the skeletal collection that would measure the relative proportion of meat in the diet of various social groupings, including status, age, and sex.

Our application was accepted and funds were awarded in the spring of 1978 (NSF BNS 78-07133-01). As the research progressed, the partnership was increased by two co-investigators, Tandy Bozeman and Paul Welch, and we were joined also by our colleagues Margaret Hardin and Sander van der Leeuw. In addition, Alice Haddy and Lauren Michals saw aspects of the data that could be analyzed for honors theses. They too joined the project. The extent to which we have succeeded in answering the questions we originally posed can be judged from the papers which follow.

Acknowledgements

As an expression of our gratitude, this symposium is dedicated to our predecessors at Moundville. Without their excellent work, particularly that of David DeJarnette, the Moundville project would not have been possible. The major funds for the project were provided by a two-year grant from the National Science Foundation (BNS 78-07133-01). Throughout the project, we have benefitted from the aid and advice of our colleagues at the University of Alabama and the Office of Archaeological Research. Special thanks are due to Dr. Richard Krause, Dr. Joseph Vogel, Carey Oakley, Ned Jenkins, and Lawrence Alexander. Although they are too numerous to name here, the cooperation and enthusiasm of the land owners and our field crew have made work on the project a pleasure. Finally, our colleagues at Michigan, staff and students, have given of their time unstintingly, offering both criticism and encouragement (and in some cases hard labor). The success of the project is in part due to all of the above. The responsibility for it, however, rests on our shoulders.

Note:

Bibliographic references for this and the following ten papers are combined and included separately on pages 110-112.

Paul D. Welch

THE WEST JEFFERSON PHASE: TERMINAL WOODLAND TRIBAL SOCIETY IN WEST CENTRAL ALABAMA

This paper briefly outlines the West Jefferson phase, a Terminal Woodland manifestation in west central Alabama. The phase occupied the valley of the Black Warrior River immediately prior to the Moundville phase, thereby coming under study by the University of Michigan Moundville Project and by several other investigators (Jenkins 1976, 1979:263-273; Seckinger and Jenkins 1980). Rather than discussing the relationship between the West Jefferson and Moundville phases, I describe the settlement and subsistence pattern of the West Jefferson phase and argue that our current knowledge of the Terminal Woodland sociopolitical setting must be greatly enhanced before we can adequately explain subsequent developments.

The West Jefferson phase was defined by Jenkins and Nielsen in 1974 and in more detail by Jenkins in 1976. At the time of the Jenkins paper (1976) the data base consisted of five or six excavated components from near Birmingham, Alabama, radiocarbon dated to A.D. 900-1050. All of the sites were apparently seasonally occupied, limited activity settings for one or a few dwellings (O'Hear 1975; Ensor 1979; Schaffield 1975, 1977; Jenkins 1976). Preliminary ethnobotanical analysis suggested that there was some, but not much, reliance on cultigens, specifically maize (Jenkins and Nielsen 1974:159-162).

The Moundville Project supplemented this data base by surface collecting roughly a dozen West Jefferson phase 0.5 to 1.0 ha villages on the floodplain of the Black Warrior River below the Fall Line at Tuscaloosa, and by completing the ethnobotanical analysis of pit fills from one of the small West Jefferson sites excavated by Jenkins and Nielsen (1974). Currently, the continuing analysis of these materials (see papers by Scarry and by Bozeman, this volume) suggests a subsistence and settlement schedule roughly as shown in Figure 1. The floodplain villages were occupied from late spring through early fall, gardens cultivated and harvested, and locally available wild foods collected and hunted. Coinciding with a switch to dependence on nuts and fauna obtained outside the floodplain zone, these villages were partially abandoned in late fall. Population dispersed to small sites such as those known from the Birmingham area (see above).

Taking into account the seasonal mobility and the relatively small size of the population (2-5,000 for the villages on the Black Warrior floodplain below Tuscaloosa), West Jefferson society was most likely tribally organized, in Service's sense (1971). This is not to say that the West Jefferson phase can be equated with *a* West Jefferson tribe. To investigate the nature of interaction among West Jefferson communities and between West Jefferson communities and those surrounding them, we can turn to the extensive data on ceramic distributions.

My use of ceramic variability as an indicator of patterns of social interaction is primarily based on Wobst's theory of style (1977). In part, Wobst (1977: 328-330) argues that the use of style to convey messages about social group affiliation is more likely in some contexts than in others. One relevant factor is visibility, the likelihood of a variable being a 'message carrier' decreasing with decreasing visibility to the individual or groups to whom the message is addressed. In the case of the Alabama Terminal Woodland, ceramic tempering agent would not be a 'message carrying' variable, since sand and grog, the two principle tempers, are not readily visible in a complete pot. For a different reason, vessel surface treatment is another variable which does not seem to carry a message about social group affiliation. The two principal treatments, smoothed and cordmarked, tend to occur on different vessel shapes and sizes (compare Jenkins 1979:107-109 with Jenkins 1979:127), and thus seem to reflect vessel function rather than social affiliation. If neither the tempering agent nor the surface treatment were selected by Terminal Woodland potters as carriers of messages about social group affiliation, then the geographic distributions of these two variables must be the result of other factors (see Figs. 2 and 3, based on data from Jenkins and Nielsen 1974; Bozeman personal communication; Nielsen et al. 1973; Dickens 1971; Jeter 1977; Sheldon et al. 1980; Jenkins 1979; Blakeman et al. 1977; Futato 1977; Heimlich 1952; Griffin 1939; Haag 1940; Nielsen et al. 1971).

To explain the geographic distributions of these ceramic attributes, I use an approach complementary to Wobst's theory of style. Called the 'learning theory' approach (for exposition of the logic, see Plog 1978: 150-153; Voss 1980:89-115), it indicates that in the absence of other controls (such as Wobst's 'message carrying') the geographic distributions shown in Figs. 2 and 3 directly reflect long-term patterns of residential stability and social interaction. I interpret the ceramic distributions as showing greater homogeneity within major drainages than across drainage divides, implying that over the long run there was greater movement and contact of individuals within drainages than across drainage divides.

The conclusion that social interaction over the long run was patterned by drainage divisions is specifically a conclusion about the movement and communication of individuals. According to the logic of my argument, the ceramic variables I have used do not directly carry information about political or ethnic groupings. The nature and geographic boundaries of such groupings must be determined by other analysis. Such analysis must have a theoretical base more sound than an implicit equation of ceramic types with social groups, since patterns of political alliance and conflict can shift very rapidly relative to changes in material technology (see, for example, Heider 1970). The es-

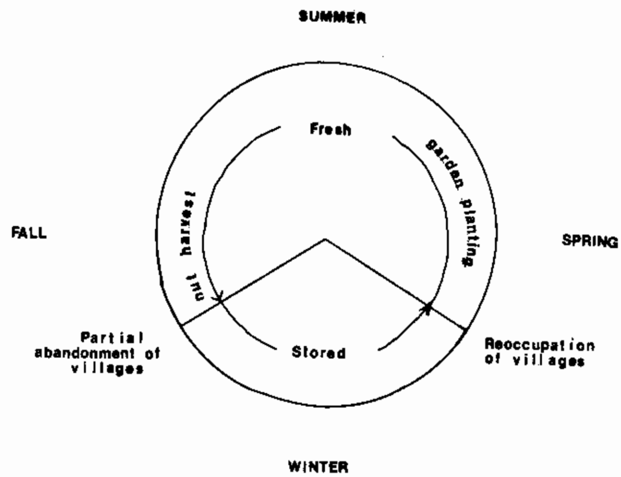

Figure 1. West Jefferson phase subsistence, settlement cycle.

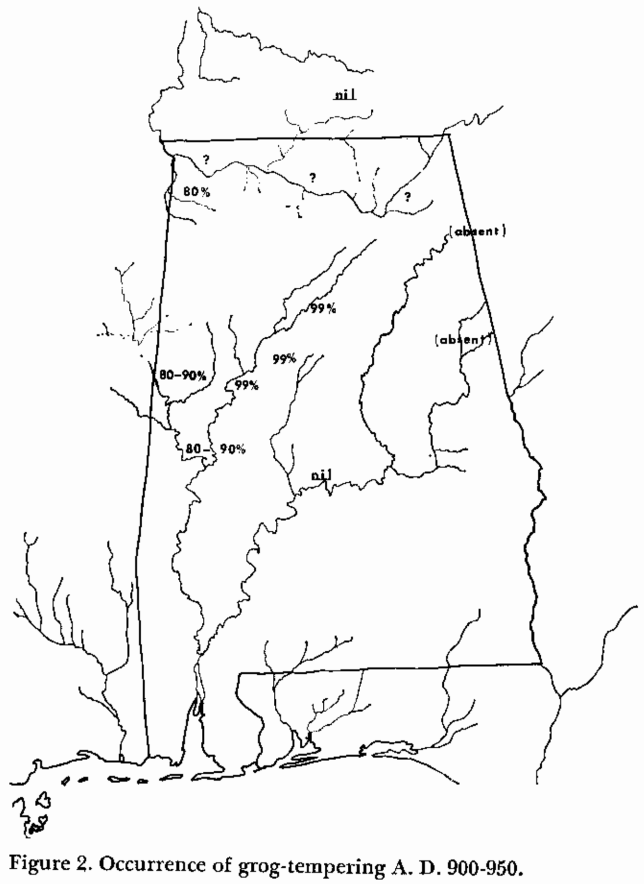

Figure 2. Occurrence of grog-tempering A. D. 900-950.

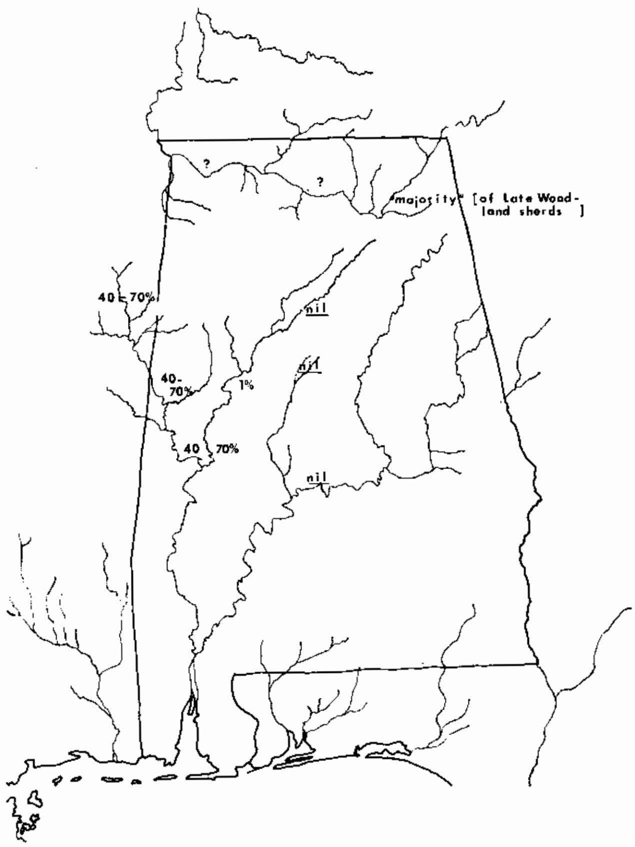

Figure 3. Occurrence of cord-marking A. D. 900-950.

sential point here is that the character of the interactions between villages or groups of villages in the West Jefferson phase, and the relations between West Jefferson and non-West Jefferson groups, must be determined by analysis of *appropriate* variables. Unlike the ceramic variables I have used, examples of appropriate variables would, for instance, have the characteristics outlined by Wobst (1977) for stylistic expressions of social group affiliation.

While I cannot yet offer such an analysis, I suggest that a useful first step is to determine the character of interactions between social groups. Available evidence indicates that there was intergroup warfare possibly within a context of shifting political alliances. The warfare is indicated by the high incidence of arrow wounds in a mortuary assemblage apparently of West Jefferson derivation (Oakley 1971). The shifting nature of political alliances is not positively documented but is plausible given the demographic effects of warfare on small social groups.

Clearly we do not yet have an adequate understanding of the social and political processes operating in the West Jefferson phase. The University of Michigan Moundville Project has contributed significantly to knowledge of the subsistence economy and settlement pattern of the phase, and for these aspects we can outline the differences between the West Jefferson and Moundville phases. However, understanding the origin of the Moundville chiefdom must await a much more thorough knowledge of the sociopolitical milieu within which it developed. For this reason the West Jefferson phase remains a subject of importance to archaeologists interested in the Terminal Woodland–Mississippian interface in the Southeast.

Tandy K. Bozeman

MOUNDVILLE PHASE SITES IN THE BLACK WARRIOR VALLEY, ALABAMA: PRELIMINARY RESULTS OF THE UMMA SURVEY

One of the major goals of the Moundville project was to measure the distribution, variety, and chronological position of the Mississippian communities in the Black Warrior Valley. The accomplishment of this goal was dependent upon the successful construction of a fine-scale ceramic chronology for the Moundville site. Recently completed (Steponaitis 1980a), the chronology (Table 1) has proven to be applicable to other Moundville phase sites in the valley and provides the temporal control essential to the investigation of variability and change in the Moundville system. This paper presents some preliminary results of two seasons of site survey and test excavations by the University of Michigan Museum of Anthropology (UMMA) crews at the Moundville phase sites which lie along the Black Warrior River some 25 km to the north and south of the great Mississippian ceremonial center at Moundville, Alabama.

Prior to the UMMA survey, our knowledge of Moundville phase sites in the Black Warrior drainage was highly limited. The only sites, other than Moundville itself, for which there was detailed information were Bessemer (DeJarnette and Wimberly 1941), and Snow's Bend (DeJarnette and Peebles 1970). Other Mississippian sites in the valley were mostly known from brief survey reports compiled in the 1930s by Dr. Walter B. Jones. Subsequent surveys by Nielsen et al. (1973) in Hale and Green Counties, and by Walthall and Coblenz (1977) at the mouth of Big Sandy Creek, were restricted in area or limited in scope.

Our research in the Black Warrior Valley, together with current research by the University of Alabama, has begun to dramatically change this picture. During the 1978-1979 field seasons, the Michigan survey team conducted controlled surface collections and test excavations at most of the recorded Moundville phase sites in the Black Warrior Valley from Tuscaloosa in the north, to Akron, Alabama in the south. In addition, several new sites, at least one a minor civic-ceremonial center, were discovered and investigated. In all, the two-year survey collected 402, 20 m^2 surface units on 13 different sites; placed from 1 to 3 test excavations into each of 10 platform mounds; and recovered material from an additional 24 West Jefferson and Moundville phase hamlets and villages.

The locations of the major sites included in the UMMA survey are shown in Figure 1, while Table 2 presents a summary of the tentative chronological positions assigned to these sites. It should be noted that the majority of the off-mound surface collections contained some West Jefferson (or earlier) material. Nevertheless, West Jefferson is noted in Table 2 only when material from this time period constitutes the principal archaeological component at a site.

At each of the village sites where a controlled collection was feasible, the following procedure was employed. The entire surface of the site was divided into 20 m^2 collection units, and all visible material on the surface was collected and tagged by unit. Each artifact collected within a particular collection unit was considered to be located at the center of that unit. We anticipated that the 20 by 20 m units would be small enough to recover meaningful artifact distribution information, and yet not turn the surface collection of any site into a cataloging nightmare. The count, weight, and collection unit coordinates for each artifact class were entered into a line file in the University of Michigan computer. These data were, in turn, introduced into Michigan's Surface II computer map program.

Table 1. Steponaitis Chronology for the Late Prehistory of the Black Warrior Valley.

Period	Phase	
Mississippian	Alabama River	AD 1550
	Moundville III	AD 1400
	Moundville II	AD 1250
	Moundville I	AD 1050
Late Woodland	West Jefferson	AD 900

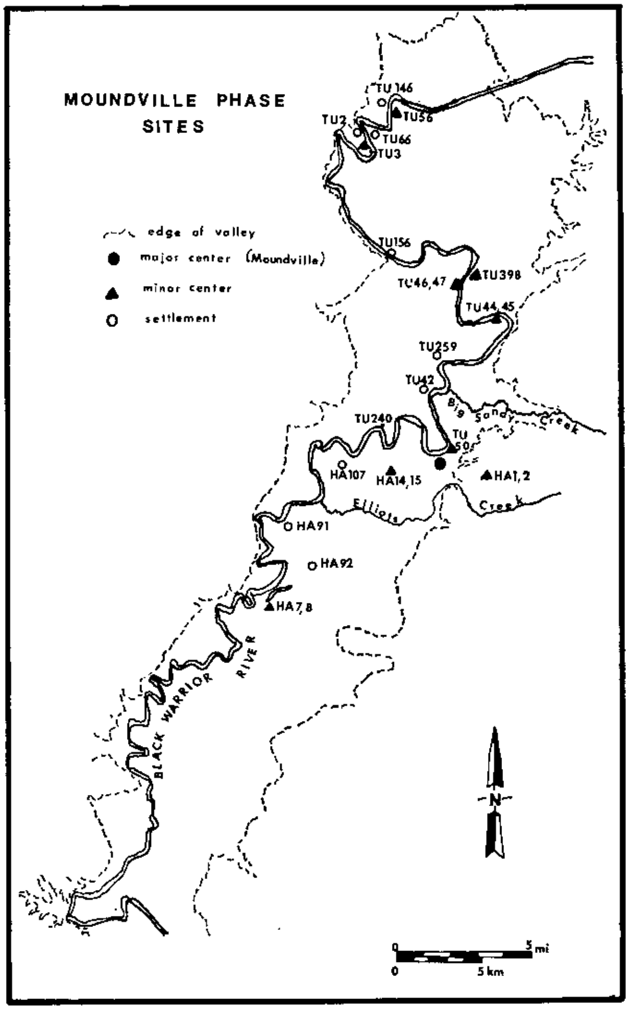

Figure 1. Moundville phase sites in the Black Warrior River Valley.

Table 2.

CHRONOLOGICAL POSITION OF UMMA SURVEY SITES IN THE WARRIOR VALLEY

SITE		PHASES: West Jefferson	Moundville I	Moundville II Early	Moundville II Late	Moundville III Early	Moundville III Late	Alabama River
Tu 56	(mound)	—	—					
Tu 66		—			—	—	—	—
Tu 2						—	—	
Tu 3	(mound)			? ? ? —	—	—		
Tu 398	(mound)			—	—	? ? ?		
Tu 46	(mound)					—	—	
Tu 47					—	—	—	
Tu 44	(mound)		—					
Tu 45		—	—					
Tu 259							—	—
Tu 42						—	—	—
Tu 50	(mound)		—					
Ha 1	(mound)			(insufficient data)				
Ha 2				(insufficient data)				
Ha 14	(mound)					—	—	
Ha 15						—	—	
Ha 240	(mound?)			(insufficient data)				
Ha 107		—			—	—	—	
Ha 91				—	—	—	—	
Ha 92				—	—	—	—	
Ha 7	(mound)					—	—	
Ha 6						—	—	

Surface II (Sampson 1978) is a computer software system for the creation of displays of spatially distributed data. The basic form of display produced by Surface II is a contour map, a plot of two coordinates (X and Y) on which the values of the third variable (Z) are defined by lines of equal value. Although traditionally employed to display lines of equal ground elevation, the procedure can more generally be used for any display in which the values of one variable can be "located" at coordinates defined by the other two variables. The only requirements that must be met are: (1) the coordinate variables be orthogonal and (2) the mapped variable be single-valued (Sampson 1978:1).

The use of contour maps as an aid in the analysis of the spatial relationships of archaeological data has obvious potential. It is generally agreed that different types of artifacts found within different areas of an archaeological site provide clues to the centers of activity when the site was inhabited (Sampson 1978: 18). To the extent that a site is intensively and systematically collected, contour maps of the artifacts recovered can be a powerful tool for determining the internal structure of the site.

The first run of Surface II maps of artifact distributions on the Moundville phase sites in the UMMA survey has already given us cause to reassess the importance of the hamlet as an essential element in the Moundville phase settlement system. The maps clearly show highly localized distributions of Moundville phase material on many of the Black Warrior Valley sites. For example, compare the broad spread of grog-tempered ceramics on 1 Ha 92 (Fig. 2) with the highly localized distribution of shell-tempered ceramics on the same site (Fig. 3). Highly restricted distributions of shell-tempered ceramics are evident on other sites; a pattern which suggests that many of the Moundville phase sites in the Black Warrior Valley, long thought to be large Mississippian villages, in fact, are large

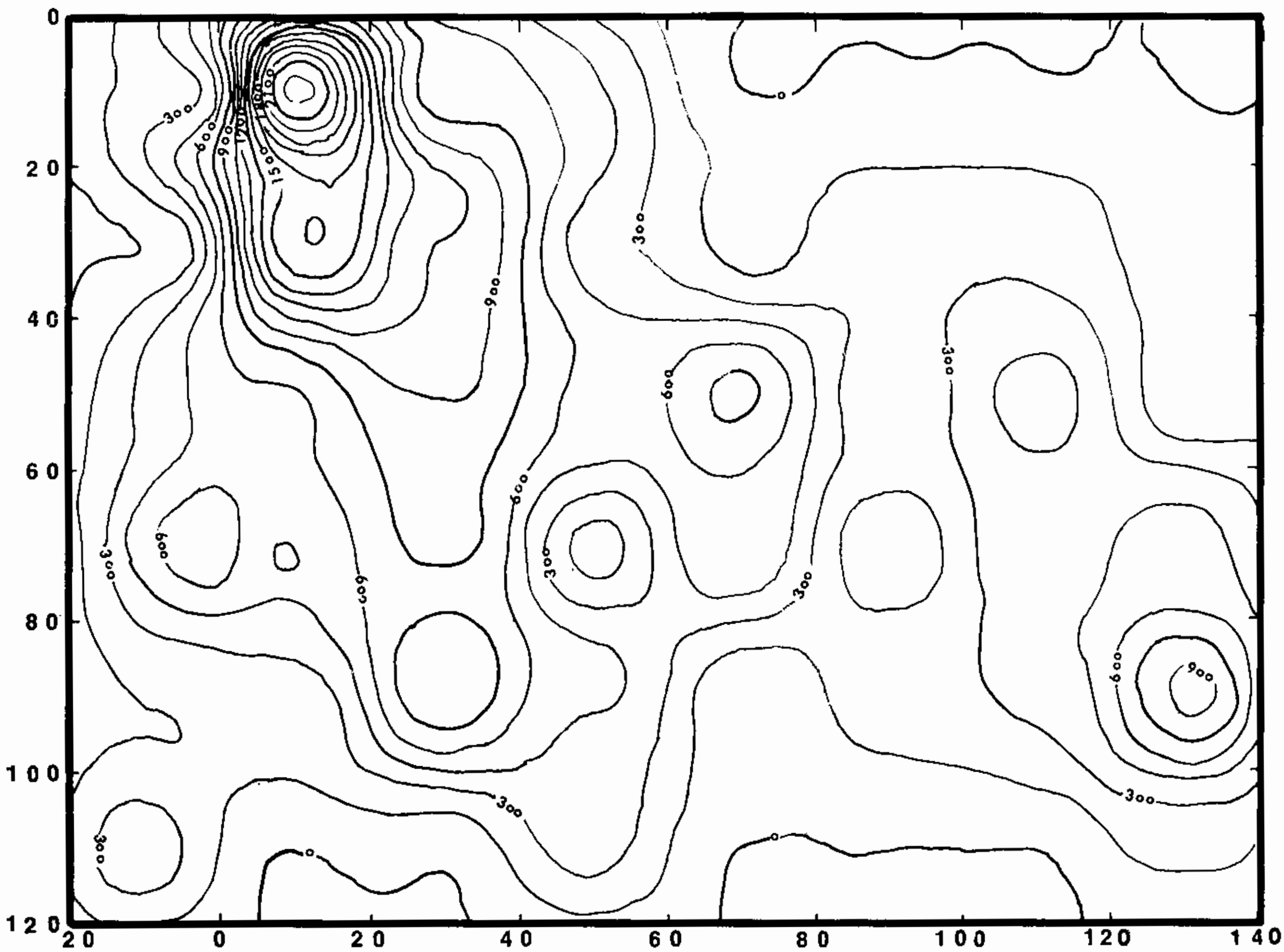

Figure 2. 1Ha92: Distribution of grog-tempered ceramics by weight in grams—contour interval: 10 grams.

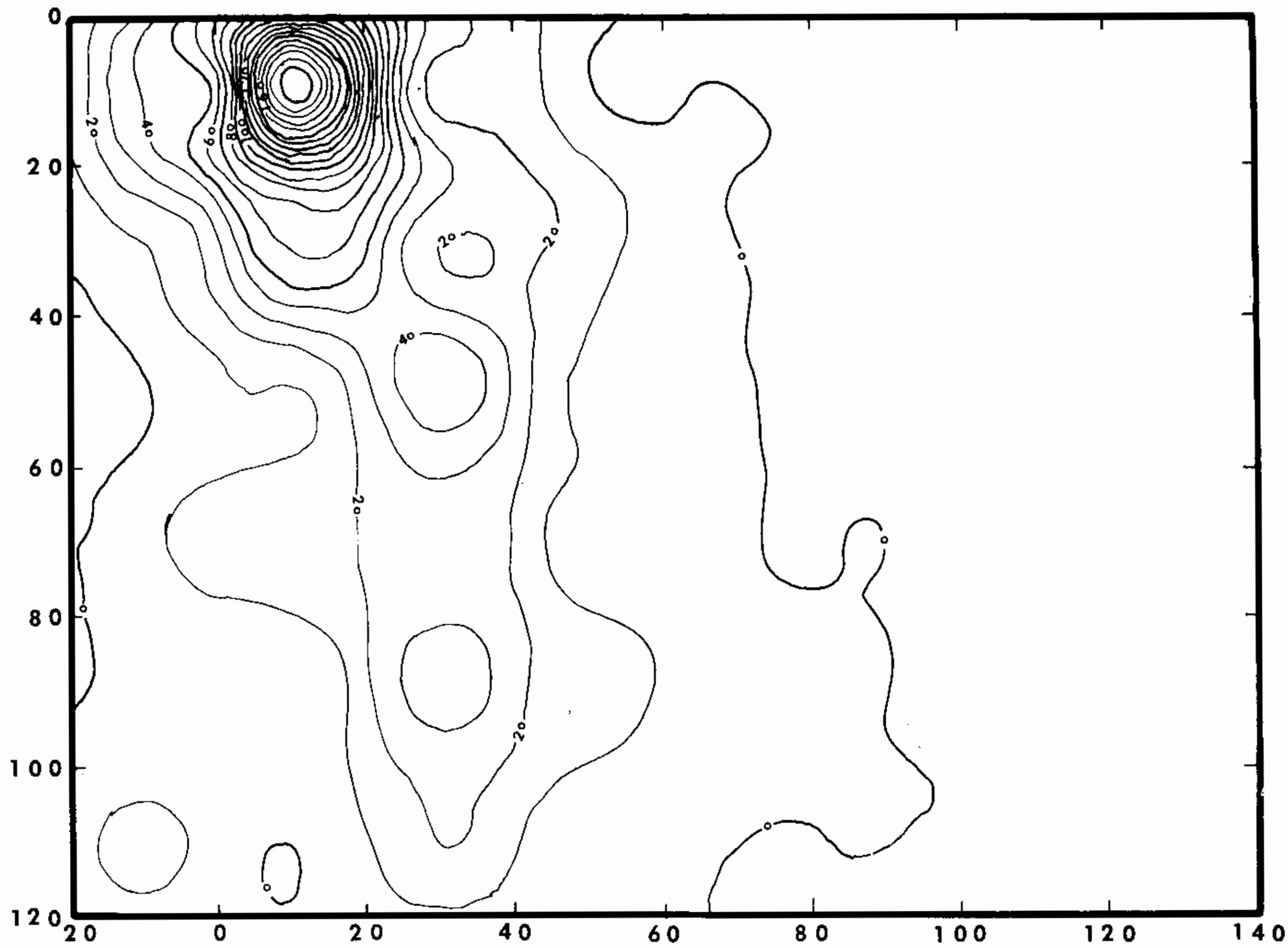

Figure 3. 1Ha92: Distribution of shell-tempered ceramics by weight in grams—contour interval: 10 grams.

West Jefferson villages underlying a later and smaller Moundville phase settlement. There is no evidence for sizeable Moundville phase villages until late in the period: late Moundville II or early Moundville III times.

The paucity of previously reported hamlets for the Moundville phase can be explained by their low visibility and by the general lack of intensive survey in the Black Warrior floodplain. During Walthall's limited but intensive survey at the mouth of Big Sandy Creek (Walthall and Coblenz 1977), he discovered two Moundville phase sites of hamlet size within 6.5 km². In addition, the UMMA survey team discovered a number of Moundville phase hamlets while attempting to relocate larger sites reported in the 1933 survey.

During the second field season, the UMMA survey attempted to obtain some measure of the occurrence of Moundville phase hamlets in the Black Warrior floodplain. Paul Welch and his field crew searched a number of large fields by walking transects 20 to 40 m apart. Within a 4 km² survey area, 18 light artifact scatters 10 to 20 m in diameter were discovered and collected. All of these small sites produced Moundville phase material. These sites, together with the steadily growing number of hamlet-size settlements reported for other areas of the floodplain, strongly suggest that the hamlet was a fundamental element in the Moundville phase settlement system.

In addition to establishing the importance of the hamlet as a settlement type, the new data produced by the UMMA survey, when viewed against the temporal framework provided by Steponaitis's chronology (1980b:47), are allowing us to better understand both the distribution of Moundville phase settlements in the Black Warrior Valley, and the nature of change in that distribution over time. For example, it appears that settlements north of Moundville are generally earlier than those to the south. Further, not only are the Moundville phase sites clustered in the valley as suggested by Peebles (1978), Peebles et al. (1979), and Steponaitis (1978); but also, there is growing evidence that these clusters may well represent bounded areas which contain only one minor civic-ceremonial center from each time period, and which maintain some integrity over the 500 years of the Moundville phase.

It is, perhaps, wise to end these remarks on a note of caution. The analysis of the UMMA survey data has just begun, and the results presented here are preliminary and certain to be revised and refined. Nevertheless, it should be evident that our work in the Black Warrior Valley is transforming the Moundville phase from a static atemporal cultural block to a settlement system model with temporal depth and a finer spatial pattern (Peebles et al. 1979). Never before, in the long history of archaeological investigations at Moundville and related sites in the Black Warrior Valley, have we been so well equipped to assess the Moundville phase in terms of a dynamic cultural system interacting over time and space with its natural and social environments.

C. Margaret Scarry

THE UNIVERSITY OF MICHIGAN MOUNDVILLE EXCAVATIONS: 1978-1979

In 1978 and 1979, small scale, intensive excavations were conducted at Moundville. These excavations were designed to maximize retrieval of subsistence remains, and to collect a ceramic sample from a stratified context. The focus of the excavations was an area north of Mound R, although additional test pits were excavated south of Mound I and south of the Conference Building (Fig. 1).

The field methods chosen maximized stratigraphic control and data recovery. All excavating was done by trowel. Where natural strata existed, they were used to define excavation levels; where there was no clear stratigraphy, 10 cm arbitrary levels were employed. Features were pedestaled during the excavation of each level. Upon completion of a level, the features were cross-sectioned and their profiles were drawn. If a feature continued for more than one level, the process was repeated. To maximize retrieval of subsistence remains, both flotation and water-screening were employed. Three liter control samples were floated from every excavation level, and feature contents were floated in entirety. Any dirt from level contexts which was not floated was water-screened through 6.4 and 1.6 mm nested screens.

The area north of Mound R was selected for excavation because previous work had indicated that it contained the type of data required by the project. In 1905, C. B. Moore excavated a ridge north of Mound R. He described the deposit as a dwelling site; noting his workers had encountered charcoal, pottery, and deer bones (Moore 1905:220). He also described burials in pits intruding into the midden. In 1973-1974, the area north of Mound R was again the focus of excavations; this time by a field school directed by David DeJarnette. These excavations disclosed a stratified deposit 2 m in depth. Traces of structures, and numerous pits and post molds were encountered within the deposit. Large quantities of ceramics were recovered and, though neither fine-screening nor flotation were employed, both floral and faunal remains were recovered.

As part of our project, two, 2 m² units were excavated adjacent to DeJarnette's pit north of Mound R. The depositional sequence was extremely complex (Fig. 2). In both units, the upper portion of the deposit was midden. At 30 to 45 cm below ground surface, traces of sand floors were encountered; associated with the floors were post molds and wall trenches. The positions of the wall trenches and floors suggested that the floors in the two units represented separate structures. A layer of daub was encountered at 75 cm below ground surface. Under the daub, was a series of superimposed sand floors divided into three sets separated by shallow midden deposits. The close correspondence between the series in the two units indicated that both units were within a single structure. Beneath the third set of floors in one of the units, a portion of a semi-subterranean, rectangular wall trench structure was encountered. Three floors and two adjacent wall trenches were associated with this structure. In the second unit, refuse pits were encountered at a depth corresponding to that of the "pit house".

In all, the excavation of the 2 units encompassed 28 levels per square and a total of 201 Mississippian features including: 123 post molds; 8 wall trenches; 19 ash or burn lenses; and 51 pits.

The ceramics from the excavations have been analyzed by Steponaitis, and the results have been integrated into his study of the vessels from extant Moundville collections (1980a). Steponaitis reports (personal communication) that all of the phases he defined (Steponaitis 1980b) are represented in the deposit north of Mound R. The stratigraphic order of the sample supports the chronological sequence he postulated. However, the phases are not equally represented in the deposit. Below the daub layer, the assemblage is pure Moundville I; immediately above the daub, the predominant ceramics associated with the floors are also Moundville I. Moundville II and III ceramics seem to be confined to the upper midden zone. It is significant that not only is the assemblage below the daub pure Moundville I, but that there are no discernible changes in the ceramics associated with the floors.

The function of the area north of Mound R changed through time. The structure floors clearly indicate that the area was residential during the Moundville I phase. While the evidence suggests that the area was continuously occupied during Moundville I, it appears that house sites shifted through time. During the Moundville II phase, the area seems to have been little used; while some of the upper midden zone may have been deposited at this time, the function of the area is uncertain given the available data. The majority of the upper midden zone appears to date to the Moundville III phase; and the area may have served, in part, as a refuse dump at that time. Steponaitis's analysis of vessels from burials, found in prior excavations north of Mound R, indicates that the use of this area for interment dates to the Moundville II and III periods (Steponaitis this volume). Although Moore (1905:220) tested Mound R, he recovered no diagnostic artifacts; thus, we do not know when the mound was constructed, nor how it relates to the excavation area.

While the deposit north of Mound R produced a wealth of data, it is a limited sample of the Moundville site. In 1979, an effort was made to locate midden deposits elsewhere on the site. The need for subsistence data dictated a non-random selection of areas for testing. Field notes from previous excavations were used to identify promising areas. From the notes, five areas were selected for investigation.

A power auger was used in the initial testing for midden deposits. Intervals between auger tests were determined by the shape and topography of each area. Paired holes, 1 m apart, were used to aid in determining whether deposits were localized features or general accumulations. After each hole was drilled, its profile was drawn and the soil was screened.

In two cases, the auger tests detected deposits worth investigating. Previous excavations south of Mound I had uncovered residential structures. The auger tests in this area located a midden deposit ap-

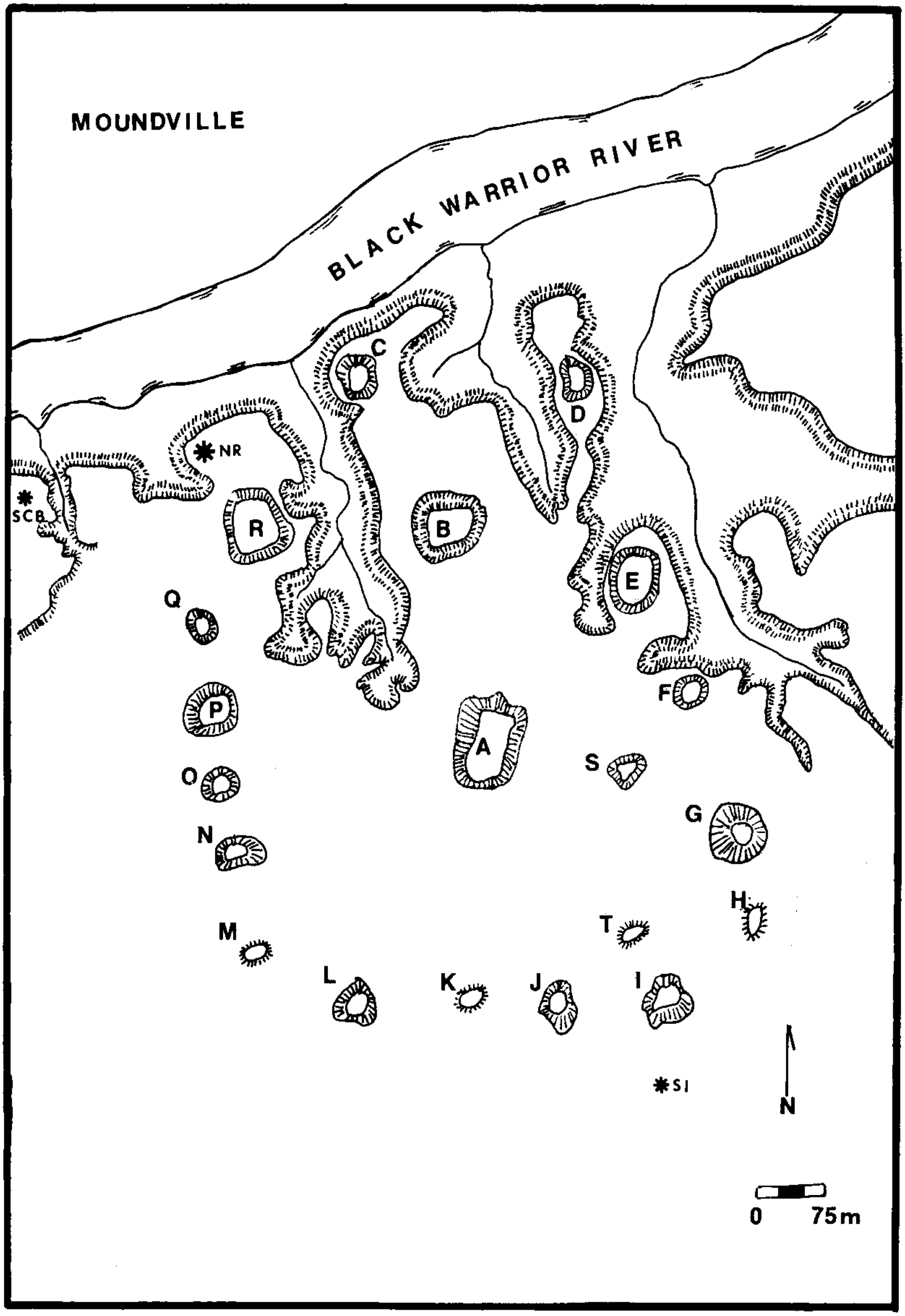

Figure 1. Locations of University of Michigan excavations. (* = Locations of excavated deposits).

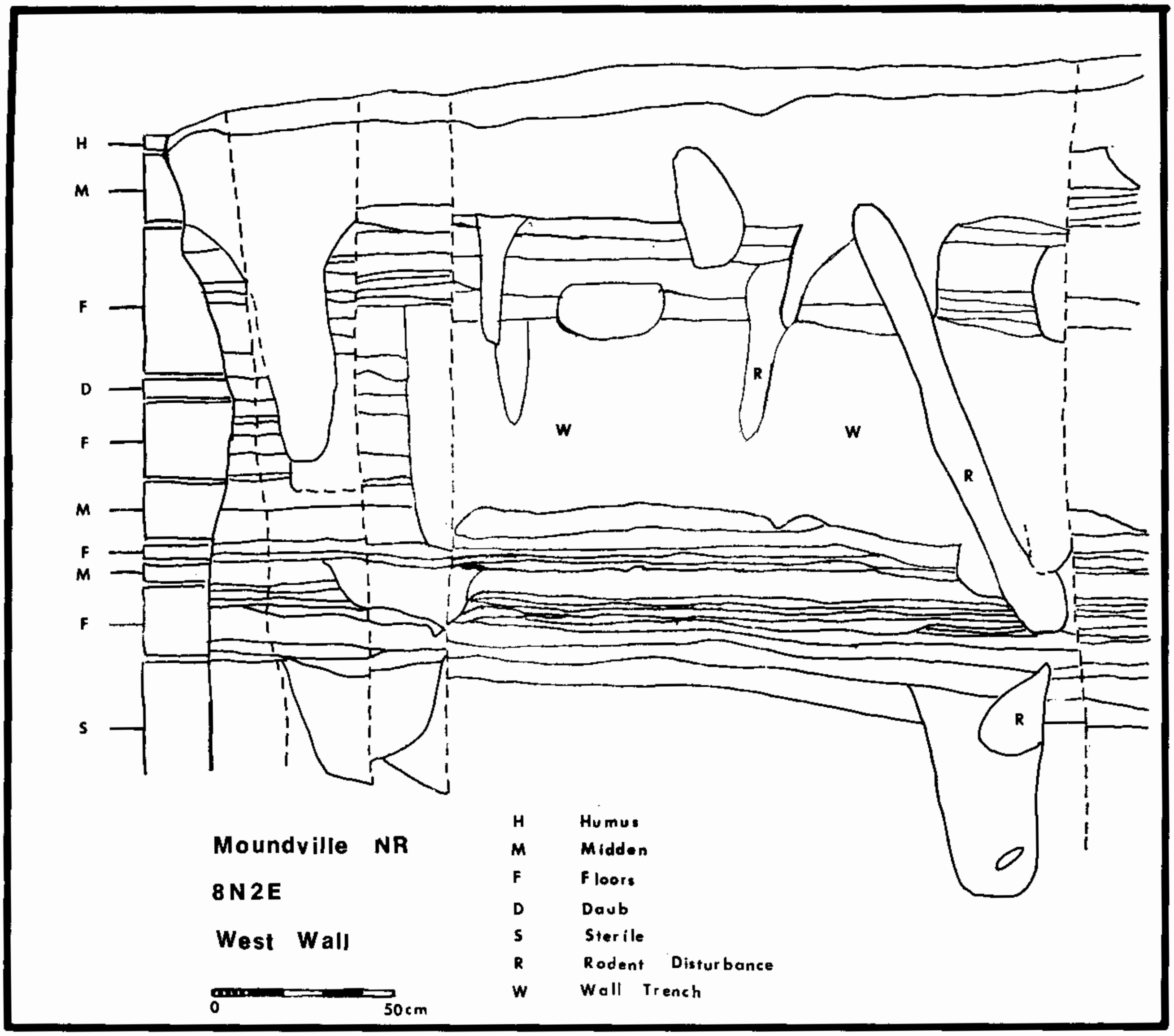

Figure 2. Stratigraphic profile of the west wall of square 8N2E north of Mound R.

proximately 1 m in depth. Subsequent excavation of a 2 m^2 test pit revealed a hearth; a wall trench, which post-dated the hearth; and a line of post molds, not clearly associated with either of the features. Although artifact density was low, small samples of sherds and plant remains were recovered. On the basis of the ceramic sample, the deposit has been provisionally assigned to the Moundville I phase (Steponaitis personal communication).

The second deposit located by the auger tests was in the northwest section of the site, in an area which had seen little previous work. The tests indicated a midden deposit 60 cm deep. Two, 2 m^2 units were excavated in this area. The deposit consisted of a 10-15

Table 1. Dates from the University of Michigan Museum of Anthropology Excavations at Moundville.

Location	Provenience	Type	Laboratory	Date
N. of Mound R	8N2E L8	Radiocarbon	Dicarb 1243	A.D. 1260±60
	8N2E L26 F394	"	Beta 1105	A.D. 820±105[a]
	8N2E L17	"	Beta 1106	A.D. 940±80[b]
	6N2W L14	"	Beta 1289	A.D. 1285±65
	6N2W L25 F258	"	Beta 1290	A.D. 1020±80
	6N2W L28	"	Beta 1485	A.D. 960±55
S. of Conference Bldg.	Test Unit D L3	Radiocarbon	Beta 1107	A.D. 1075±80
	Test Unit A F9	Archaeomag.	Oklahoma	A.D. 1230±23
	Test Unit A F10	"	Oklahoma	A.D. 1120±46
	Test Unit A F24	"	Oklahoma	A.D. 1140±15

[a]This date is considered too early and is out of sequence.
[b]This date is out of sequence.

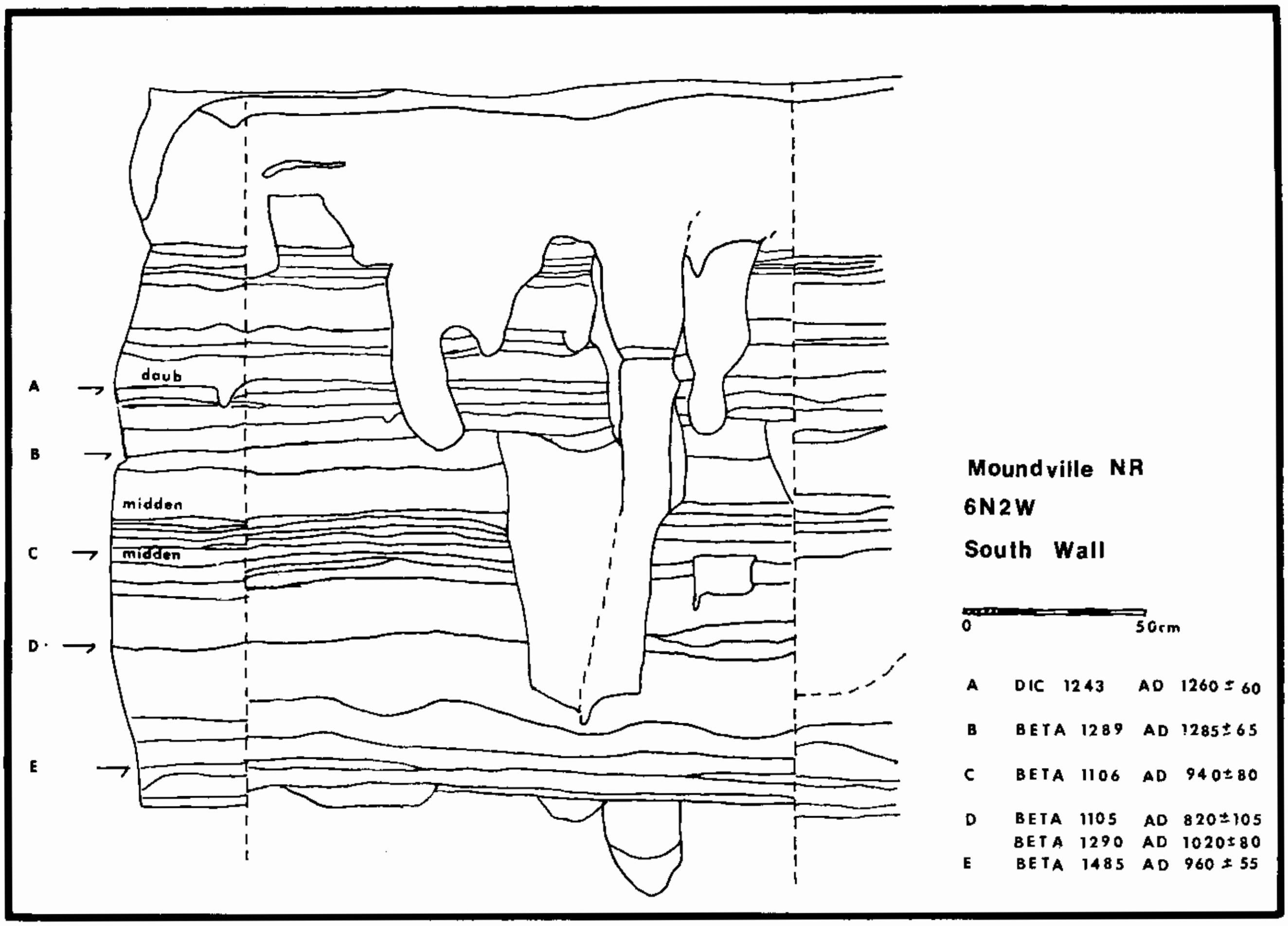

Figure 3. Stratigraphic profile of the south wall of square 6N2W north of Mound R. Letters indicate strata from which Radiocarbon dates were obtained.

cm plow zone, followed by 25 cm of midden. Beneath the midden, two superimposed floors were encountered; associated with the floors were three clay hearths. The vast majority of the sherds in the deposit were Moundville I types. Steponaitis (personal communication) suggests that most are early Moundville I types similar to those found at the Bessemer site.

The majority of the deposits excavated can be assigned to the Moundville I phase. Steponaitis (1980b: 47), on the basis of ceramic criteria, has provisionally dated this phase to A.D. 1050 to A.D. 1250. Radiocarbon and archaeomagnetic determinations on samples from the excavations basically support this temporal placement; though they suggest the phase may have begun slightly earlier (Table 1 and Fig. 3).

While the excavations at Moundville were limited in scope, they produced an abundance of data pertaining to the Moundville I phase. The ceramic sample complements the extant collections, in which the Moundville I phase was poorly represented. Since subsistence remains were not systematically collected in earlier excavations, the floral and faunal remains add a new dimension to the collections. We hope that the analyses of these materials will build a better understanding of the development and operation of the Moundville system.

Acknowledgements

The excavations described in this report were funded by the National Science Foundation (grant BNS 78-01733-01). I would like to thank Dr. Richard Krause, Chairman of the Department of Anthropology University of Alabama; Dr. Joseph Vogel, Director of the Alabama Museum of Natural History; and the staff at Mound State Monument for their cooperation throughout the project. Thanks are also due to my colleagues on the Moundville project. Though I have not always taken it, their advice has been of great help. Special thanks are due to Vin Steponaitis for his analysis of the ceramics recovered from the excavations.

Lauren Michals

THE EXPLOITATION OF FAUNA DURING THE MOUNDVILLE I PHASE AT MOUNDVILLE

I have partially analyzed the faunal remains from the 1978-1979 excavations at Moundville in an attempt to answer three questions pertaining to the Mississippian subsistence adaptation:

1) Which environmental zones were exploited by the inhabitants of Moundville?
2) What was the general subsistence of the population as indicated by the faunal species present in the sample, and by the butchering patterns implied by the remains?
3) Was there population pressure on the inhabitants of Moundville and their food supply which is reflected in the types and quantities of faunal remains recovered?

The remains used in my study were recovered at Moundville from the University of Michigan excavations north of Mound R (Scarry this volume). Of the 41 features determined to be sufficiently intact to warrant investigation, 21 were analyzed. All but two of these features are from the Moundville I phase; the remaining two date to the Moundville III phase. The Moundville I features were associated with stratified house floors, while the Moundville III features were cut into the midden in the upper portions of the excavated units (Scarry this volume). The features themselves were all pits; wall trenches and post molds were not included because of their potentially mixed contents.

In respect to the interpretation of the analysis and the results, it must be stressed that the faunal remains are from only one area of a large site and from mainly structural contexts. This latter factor would severely limit the recovery of faunal remains from processing stages, since most processing would probably have been done outside of the structures. Also, if differential access to and distribution of foods was taking place at the site, the faunal remains recovered from north of Mound R may not be representative of the site as a whole.

For the purposes of the analysis, the features were treated as independent units. Thus, the minimum number of individuals was calculated by feature to derive a total for the sample as a whole. It should be noted that the bird remains have only been partially analyzed, and that fish remains have been looked at only to determine general species present rather than the number of individuals.

Table 1. Fauna of the Region.

Species	Habitat	
Ursus americanus black bear	Heavily wooded areas in flatwoods, swamps, scrub oak ridges, bayheads, and hammock areas.	
Odocoileus virginianus white-tail deer	Most common in big wooded swamps and timbered areas.	present
Lynx rufus bobcat	In the lowlands in swamps and bushy thickets; areas with heavy forest cover, e.g. timbered swamps and secondary growth.	
Canis lupus grey wolf	Wilderness forests and tundra.	present
Canis latrans coyote	Prairies, open woodlands, and brushy or boulder-strewn areas.	present
Castor canadensis beaver	In and along streams, rivers, marshes and small lakes.	
Didelphis marsupialis opossum	Timber regions either in swamp bottomlands or drier upland woods, and in the ravines among the hills.	present
Procyon lotor raccoon	In hardwood timberlands, timbered swamps, and river bottoms; forages extensively along the banks of streams.	
Mephitis mephitis striped skunk	Forest borders, open grassy fields broken by wooded ravines and rocky outcrops, near permanent water.	
Spilogale putorius spotted skunk	Chiefly about cultivated lands, the borders of bushy swamps, and in waste lands; generally not in wet swamps or heavy timber.	
Sylvilagus aquaticus swamp rabbit	Found in river swamps and ranges up along the small streams to the foot of the mountains.	present
Sylvilagus floridanus eastern cottontail	Open brushy or forest bordered areas with generous amounts of shrubby vegetation and small open areas.	present
Sciurus carolinensis grey squirrel	In moist bottomlands and swamps where there is an abundance of nut bearing trees; a true deep forest species; not in pine timber.	present
Sciurus niger fox squirrel	Dry pine forests and edges of bottomlands; never in the low bottomlands.	present
Meleagris gallopavo wild turkey	Can be found from Northern hardwood timberland to Florida palmetto and pine forests; near abundant cover and plentiful water.	present

Environmental Utilization

In order to look at the environmental zones utilized by the inhabitants of Moundville, Tables 1 and 2 have been constructed to give a basic outline of the faunal species commonly found in the area in historic and recent times. By comparing these tables with the species represented in the faunal remains (Tables 3 and 4) it is possible to determine which environmental zones were exploited.

The large number of grey squirrels (*Sciurus carolinensis*) versus the number of fox squirrels (*S. niger*) represented in the remains is the most important determinant for zone utilization. Although both species inhabit the same types of zones, they very rarely overlap in habitat when both are present. The predominance of grey squirrels (13 individuals) in the sample

Table 2. Fish of the Region.

Species	Habitat	
Lepisosteus sp. gar	Prefer quiet stagnant water, most often found in lakes, ponds, bayous, oxbows, and the backwaters of streams and rivers with abundant vegetation.	
Amia calva bowfin	Found typically in sluggish water of bayous and the backwater of rivers that are often choked with aquatic vegetation.	present
Ictalurus furcatus blue catfish	Mostly a big river fish found in swift chutes and pools with noticeable currents.	present
Ictalurus punctatus channel catfish	Found typically in large streams with low or moderate gradients.	present
Aplodinotus grunniens freshwater drum	Found in the muddy bottom and silty water of large rivers and lakes.	present
Family		
Castomidae suckers	Primarily inhabit the quiet water of lowland lakes and the backwater pools of large streams.	present
Centrarchidae sunfishes	Found in all aquatic environments.	present
Percidae perch	Mostly inhabit large lakes and streams.	present

indicates an exploitation of the zone directly around the site—the moist bottomlands—rather than the uplands several kilometers away where the fox squirrel would be the dominant species.

By looking at Table 2, where the habitats of the various fish species are presented, it can be seen that the Moundville population was predominantly exploiting large river fish such as the drum (*Aplodinotus grunniens*) and catfish (*Ictalurus* spp.), rather than those most often found in backwater drainages. However, the presence of suckers (*Castomidae*) in the remains does imply that other areas such as the man-made lakes around the site, may have been used in addition to the main river channel.

Subsistence

Considering general subsistence patterns, it can be seen from Table 3 that there appears to be a clear-cut preference for certain species. The dominant species in the remains appear to be the white-tail deer (*Odocoileus virginianus*), grey squirrel, and the wild turkey (*Meleagris gallopavo*). In addition, fish remains were present in every sample.

Based on figures obtained from Smith (1975), in terms of meat yields for the species identified, the white-tail deer seems to have been the most important species; it was present in almost all of the features. Although in any given feature it is likely that only part of one individual rather than an entire deer was present, even one limb from a deer would contribute more meat than a squirrel (at .45-.65 kg per individual) or a wild turkey (at 4.0 kg per individual).

The presence of two domestic dogs suggests their possible utilization as a food source, although this is not conclusive evidence, since only a small fragment from each individual was present. Swanton's ethnographic work on Southeastern Indians (1946:299) indicates a ceremonial usage of dogs, which may explain why only two are represented.

Table 3. Species Represented in Moundville I Samples.

Species	Minimum Number of Individuals	Projected Meat Yield (in kg)
Sciurus carolinensis grey squirrel	11	5.0
Sciurus niger fox squirrel	2	1.36
Sylvilagus aquaticus swamp rabbit	2	2.72
Sylvilagus floridanus eastern cottontail	4	3.63
Didelphis marsupialis opossum	1	3.86
Canis familiaris domestic dog	2	7.26
Canis lupus timber wolf	1	13.61
Canis latrans coyote	1	
Odocoileus virginianus white-tail deer	13	
Meleagris gallopavo wild turkey	6	24.50
Snake		
non-poisonous	3	
poisonous	3	
water	1	
water/poisonous	4	
Turtle unidentified	4	

Table 4. Species Represented in Moundville III Samples.

Species	Minimum Number of Individuals	Projected Meat Yield (in kg)
Sciurus carolinensis grey squirrel	2	.91
Sciurus sp. grey/fox squirrel	1	.57
Sylvilagus aquaticus swamp rabbit	2	2.72
Sylvilagus sp. cottontail/swamp rabbit	1	1.13
Didelphis marsupialis opossum	1	3.86
Odocoileus virginianus white-tail deer	2	
Meleagris gallopavo wild turkey	1	4.08
Snake non-poisonous	1	
Turtle unidentified	2	

The presence of snake vertebrae, 11 individuals from 9 features, may represent a utilization of snakes as a food source. This possibility is supported by the fact that some of the vertebrae were burnt, ruling out a fortuitous presence of the individuals.

Although the bird remains have only been partially analyzed, the wild turkey appears to make up the majority of the remains. There is no evidence for extensive exploitation of migratory waterfowl. It must be noted that, unlike the sites investigated by Smith (1975), Moundville is not located directly on a major flyway; this may explain the lack of such species in the remains.

A butchering pattern can be seen from the deer remains. Table 5 shows the elements of the 15 deer which were present in the samples. From this it can be seen that ribs, thoracic and lumbar vertebrae, femurs, and tibias are the most commonly found elements. The lack of cervical vertebrae and cranial elements may be due to: (1) differential access to and/or distribution of food within the site; (2) transportation of deer from areas some distance away; and/or (3) hunting practices. The predominance of lower back, rib and posterior limb bones (Table 5) indicates that those parts which possess the best and most meat are those which are most represented. This implies that either the inhabitants of this area were receiving choice cuts of meat, reflecting an elite status, or that transporting meat was forcing the abandonment of the lesser cuts in favor of the meatier areas of the body. The presence of only two cranial fragments in the entire sample may be a result of hunting as well as butchering practices. Swanton (1946:313) reported that almost all of the Southeastern tribes used deer heads as hunting decoys.

Table 5. *Odocoileus virginianus* white-tail deer. Anatomical Parts Present.

Elements	MNI
ribs	10
vertebrae	
thoracic	7
lumbar	6
thoracic/lumbar	4
sacrum	2
innominates	3
scapula	1
cranium	2
humerus	2
radius	2
ulna	1[a]
femur	6
tibia	4
metapodial	1
tarsal	2

[a]Modified—awl.

Population Pressure

One of the applications of my results is to determine if, during the assumed growth of the site from Moundville I to Moundville III (Steponaitis this volume), pressure was put on the food supply causing the exploitation of different species, more species, and/or other parts of the animals.

Inspection of the number of individuals, and the types of species present from Moundville I and III samples (Tables 3 and 4) indicates there is no apparent change; the figure of one deer per feature and one to two squirrels per feature remaining the same throughout. The types of bone present, such as cranial versus post-cranial, and limbs versus body parts, also do not appear to change. Since neither a change in species nor in anatomical parts is present in the remains, it can tentatively be concluded that there was no pressure on faunal resources, assuming that no dried, pre-boned meat was being imported.

Conclusions

In comparison with the three faunal groups identified by Smith (1978) as being of primary importance to Mississippian populations, several significant variations can be seen in the Moundville samples. First, the fish remains tend to imply a utilization of the main river channel rather than backwater zones; this is probably a function of Moundville's location directly on a main river channel. Second, migratory waterfowl do not appear to be present in the remains; this may be a function of Moundville's location outside of the major flyways. Third, in regard to the terrestrial trinity of white-tail deer, turkey, and raccoon (*Procyon lotor*), the raccoon appears to be totally absent from the Moundville remains. Instead, the squirrel appears to have taken the raccoon's place of importance in the diet. Deer and turkey do appear to be as important in the diet at Moundville as they were at other Mississippian sites.

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C. Margaret Scarry

PLANT PROCUREMENT STRATEGIES IN THE WEST JEFFERSON AND MOUNDVILLE I PHASES

It is generally agreed that the subsistence adaptations of the Late Woodland and Mississippian cultures were different. Late Woodland systems were based upon intensive collection of a variety of plants and animals, supplemented by small scale cultivation (Ford 1974:403; Struever 1968:305-310). Mississippian systems were based on intensive maize agriculture, although there was a continued use of wild food resources.

While the general nature of the subsistence systems seems to be established, the transition between the two is not fully understood. This paper presents preliminary results of an analysis of plant remains from West Jefferson and Moundville I contexts. Using these data, a model is proposed which accounts for the intensification of agriculture and the changes in wild food utilization observed to occur with that intensification, and which suggests other changes we might expect to observe when more samples are analyzed.

Data Base

The Late Woodland data are drawn from nine features from five West Jefferson phase sites in the Black Warrior Valley. Seven of these features are from the three West Jefferson Steam Plant sites (1Je31, 1Je32, 1Je33) 120 km northeast of Moundville (Jenkins and Nielsen 1974). The remaining two features are from sites 1Ha39 and 1Tu346, both of which are located on the floodplain within 15 km of Moundville.

The Mississippian data were collected from Moundville during the University of Michigan excavations (C. M. Scarry this volume). Only data from pure Moundville I contexts have been used. The samples include: 8 pits, and 20 samples from floor and midden contexts from the deposit north of Mound R; and 1 pit from the deposit south of the Conference Building.

Results

The plant food remains from the West Jefferson sites form a typical Late Woodland assemblage. All samples contained hickory shell (*Carya* sp.), acorn shell (*Quercus* sp.), and maize kernels (*Zea mays*); maize cupules were present in all but one sample. In addition, a variety of seeds were identified including: pigweed (*Amaranthus* sp.); goosefoot (*Chenopodium* sp.); persimmon (*Diospyros virginiana*); maygrass (*Phalaris caroliniana*); portulacca (*Portulacca* sp.); sumac (*Rhus* sp.); grape (*Vitis* sp.); pokeweed (*Phytolacca americana*); and wild bean (*Strophosteles* sp.).[1]

Percentages, calculated by dividing the weight of a resource by the weight of plant food remains, have been used to compare the quantities of hickory, acorn, and maize in the samples (Table 1). While these figures do not necessarily reflect the importance of the foods in the diet, they do serve as a relative measure for comparing samples. Hickory accounts for more than 69% of the plant food remains in all samples except that from 1Tu346. Acorn represents less than 10% of the plant foods in six samples and less than 20% in two samples. The only sample in which there is more acorn than hickory is that from 1Tu346. Maize accounts for less than 10% of the plant food remains in seven of the nine samples; it represents 26% of the plant food remains in Feature 18 from 1Je33 and 34% from the pit at 1Tu346. It is apparent from these figures, that the pit at 1Tu346 is significantly different from the other West Jefferson samples.

Table 1. Proportionate Representation of Hickory, Acorn, and Maize in West Jefferson Phase Features.

Provenience	Hickory *Carya* sp.	Acorn *Quercus* sp.	Maize *Zea Mays*
1Je31 Feat 4 Bell Pit	90%	8%	2%
1Je31 Feat 8 Bell Pit	90	7	3
1Je31 Feat 12 Bell Pit	93	5	2
1Je32 Feat 20 Cylindrical Pit	80	18	2
1Je33 Feat 3 Bell Pit	79	15	6
1Je33 Feat 18 Basin Pit	69	4	26
1Je33 Feat 36 Bell Pit	91	4	5
1Ha39 Feat 1 Bell Pit	90	8	2
1Tu346 Feat 1 Bell Pit	25	41	34

The number of seeds of any one species in the samples is quite low, and it is not clear whether their presence represents utilization. However, the constant presence of persimmon seeds in the samples suggests the fruit were utilized. Likewise, the quantities of maygrass seeds in the samples from 1Tu346 and 1Je31 Feature 8, and the quantity of sumac seeds in the sample from 1Je33 Feature 3 suggest their utilization.

The Moundville I samples clearly show the effects of intensified agriculture when compared to the West Jefferson samples. While the spectra of plant food remains overlap considerably, the proportions of the resources change significantly (Tables 1-3). Hickory, acorn, and maize, the dominant plants in the earlier samples, also dominate the Moundville assemblage and were found in all samples. However, additional cultigens—beans (*Phaseolus vulgaris*), squash seeds (*Cucurbita pepo*), and sunflower seeds (*Helianthus annuus*)—were identified in the Moundville samples. The spectrum of seeds from wild plants was similar to that in the West Jefferson samples, but included four types—elderberry (*Sambucus canadensis*), blueberry (*Vaccinium* sp.), blackberry (*Rubus* sp.) and cane (*Arundinaria* sp.)—not found in the Terminal Woodland assemblage.

The shift in the proportions of plant food resources is clearly evident from inspection of Tables 1 through 3. In the Moundville samples, maize and acorn increased relative to the West Jefferson samples, while hickory decreased. Perhaps the most dramatice of these changes was the increase in the proportion of maize remains. While the decrease in the representation of hickory is, in part, a function of the increase in the other two resources, it is clear that there was a change in the importance of the two nut types.

It is unclear whether the presence of small seeds in the Moundville samples reflects their utilization. The presence of persimmon in most of the samples suggests that it was used, and the quantities of goosefoot seeds in Feature 108 and pokeweed seeds in Feature 5

Table 2. Proportionate Representation of Hickory, Acorn, and Maize in Moundville I Phase Features.

Provenience	Hickory *Carya* sp.	Acorn *Quercus* sp.	Maize *Zea mays*
NR Feat 95 Cylindrical	10%	13%	77%
NR Feat 108 Cylindrical	7	7	86
NR Feat 150a Cylindrical	40	40	21
NR Feat 150b Cylindrical	14	61	25
NR Feat 156 Cylindrical	20	34	46
NR Feat 226 Basin	38	50	12
NR Feat 230 Cylindrical	30	24	45
NR Feat 368 Cylindrical	18	29	53
SCB Feat 5 Conical	40	4	56

suggest that their inclusion in the samples reflects utilization. While the evidence is slim, the presence of berry seeds in only the Moundville I samples may indicate an increase in the use of successional resources.

The sample from 1Tu346 is more like the Moundville I samples than it is like the other West Jefferson samples. While it may be an anomolous or mixed sample (though we have no reason to suspect contamination, it should be noted that 1Tu346 is a multicomponent site), it may also be an indication that the intensification of agriculture preceded the development of other Mississippian traits.

Discussion

The intensification of agriculture and the concomitant changes in wild food utilization can be explained by reference to economic and ecological factors. Earle (1980) has proposed an economic model which explains how subsistence systems change. The basic assumption of his model is that cultural systems attempt to minimize subsistence costs. Procurement strategies have different costs relative to their outputs. These costs vary according to the quantity of a resource being exploited; ultimately costs are subject to the law of diminishing returns, they increase more rapidly than do yields. Subsistence systems are combinations of procurement strategies which can be pursued at roughly equivalent costs, and which fullfill subsistence needs at the lowest possible cost.

If subsistence demands increase, a system can either diversify or it can intensify existing strategies. Because costs generally increase with increasing exploitation, diversification is usually the lower cost option. Thus, when possible, new strategies will be added to existing ones to meet increasing demands. Intensification is the second option. Hunting and gathering strategies have low initial costs, but intensification of such strategies results in sharply rising costs. Agriculture, on the other hand, has high initial costs, but, since yields are expandable, costs increase more slowly as agricultural endeavors are intensified. Where diversification is not an option, intensification efforts will soon focus on agriculture.

Table 3. Proportionate Representation of Hickory, Acorn, and Maize in Moundville I Phase Levels North of Mound R.

Provenience	Hickory *Carya* sp.	Acorn *Quercus* sp.	Maize *Zea mays*
6N2W L 8 Floor	29%	2%	68%
6N2W L 9 Daub	8	1	90
6N2W L 10 Floor	20	4	76
6N2W L 11 Floor	28	8	64
6N2W L 12 Floor	47	7	46
6N2W L 13 Floor	29	10	61
6N2W L 14 Floor	42	11	47
6N2W L 15 Midden	33	10	57
6N2W L 16 Floor	32	16	52
6N2W L 17 Clay	27	8	65
6N2W L 18 Floor	41	28	31
6N2W L 19 Floor	24	41	34
6N2W L 21 Floor	31	17	52
6N2W L 22 Midden	44	12	44
6N2W L 23 Floor	10	30	60
6N2W L 24 Floor & Midden	29	14	71
6N2W L 25 Fill	8	58	34
6N2W L 26 Fill	17	15	67
6N2W L 27 Fill	24	12	64
6N2W L 28 Pit House Floor	10	20	70

Both ecological and scheduling factors affect the mix of procurement strategies. Land clearance, a byproduct of agricultural intensification, decreases the availability of climax plant resources and may also increase the availability of successional resources (Ford 1974:404). These changes in the ecosystem alter the costs of procurement strategies. Since planting and harvesting are labor intensive activities, scheduling conflicts may occur with agricultural intensification (Flannery 1968). Thus, resources whose availability coincides with such activities may be neglected.

In the Terminal Woodland period, the Black Warrior Valley witnessed population growth, warfare, and changing demographics (Welch personal communication). These conditions could have resulted in a population-to-resource imbalance which created stress on the subsistence economy. If the West Jefferson population was already using the full range of natural resources, then diversification would not have been a viable option. Attempts to intensify procurement of wild resources would have resulted in sharply increasing costs. The point would soon have been reached where, despite its high initial costs, intensified agriculture was cost effective.

Clearance of large areas of bottomland for fields may have altered the availability of wild plant resources. It is possible that land clearance affected the availability of hickory nuts more than that of acorns. If so, this would account for the changes in nut utilization between the West Jefferson and Moundville I phases. Land clearance might also have enhanced the production of successional fruits.

The harvest period would have coincided with the maximum availability of seeds from pioneer annuals. Such a scheduling conflict would have been resolved in favor of agricultural activities, producing a decrease in the use of pioneer annuals. Unfortunately, the number of samples analyzed is not sufficient to detect such a trend.

With the exception of those resources affected by land clearance or scheduling conflicts, the initial intensification of agriculture would not have impinged heavily on the use of wild resources and a diverse assemblage of plants would have continued to be exploited.

Footnote:

[1]Due to limitations of space, the data on which this paper is based are not presented here. More detailed information is available upon request to the author.

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Christopher S. Peebles and Margaret J. Schoeninger

NOTES ON THE RELATIONSHIP BETWEEN SOCIAL STATUS AND DIET AT MOUNDVILLE

The touchstone of research at Moundville is the collections. Over the last 15 years these data, a few concepts, and some analytical methods have been combined to add to our knowledge of Mississippian societies in the Southeast. They have provided the foundation for a detailed ceramic chronology and served as the basis for models of social, political, and economic organization of the Moundville phase. They also have posed more questions than they have answered, and they have generated new implications from the answers to old questions. One such set of implications leads from social ranking, established in the analysis of the burials; to sumptuary rules and diet; to the amount of strontium deposited in human bone. The sketch which follows gives a description of our initial attempts to forge the links in this chain of reasoning. Our results must be considered preliminary, and the statistical measures must be taken as indicative of significant trends rather than expressing statistically significant differences.

1. The analysis of the Moundville burials (Peebles 1971, 1974; Peebles and Kus 1977) has shown patterned differences among individuals. At its most fundamental, this pattern separates a small group of persons of all ages and both sexes, who are buried with elaborate artifacts in or near mounds, from a much larger group of persons, whose grave goods differentiate among them by age and sex, and who are buried in cemeteries and residential areas. The argument developed from the analysis is that the small group of burials represents the remains of a chiefly lineage, and that the occupants of ritual and political offices were drawn from the adults of this lineage. The remainder of the burials represent the bulk of society, in which age, sex, ability, and idiosyncratic elements account for all the variety in mortuary ritual.

2. Summary analyses of ethnographic data from chiefdoms (Service 1971, 1975; Fried 1967) show that such societies have sumptuary rules which set off and validate the status of the elite. These rules assure the chief and his lineage a qualitatively and quantitatively superior diet. In the Southeast, for example, Pénicaut observed among the Natchez:

> It is ordinarily the great chief who orders the Great Sun, if he is present, or that one he has succession, more or less, in all the villages of his dominion. These feasts are ordinarily undertaken when the great chief has need of provisions, such as flour, beans, or other such things, which they place at the door of his cabin in a heap the last day of the feast (Pénicaut in Swanton 1911:121).

Further among the Natchez, DuPratz reported:

> Having seized the deer, they present it to the Great Sun, if he is present, or that one he has sent to give him this pleasure. When he has seen it at his feet and has said "It is good," the hunters cut open the deer and bring it back in quarters to the cabin of the Great Sun, who distributes it to the leaders of the band who have gone on this hunt (Swanton 1911:71).

If the observations about the Natchez can be generalized, then the diet of the elite in the Southeast was varied, high in meat, and supplies were replenished by every hunt and on demand.

3. Some aspects of diet are reflected in the elemental and isotopic composition of human bone mineral. Certain domesticated plants, in some circumstances, leave isotopic "signatures" that can be measured by an isotopic ratio mass spectrometer (DeNiro 1977; Bumsted 1979). The proportion of meat to vegetable food, given proper controls, can be measured by analysis of the amount of strontium (Schoeninger 1979, 1980; Szpunar 1979; Gilbert 1975). In brief, if strontium-concentrating organisms like molluscs (Schoeninger and Peebles n.d.) and marine animals are not part of the diet, then there is an inverse ratio between the amount of meat in a diet and the amount of strontium in bone. Conversely, the greater the contribution of vegetable foods to a diet, the greater the amount of strontium in bone.

Because meat seems to have comprised the major qualitative difference between the diet of the elite and commoners, and because confidence can be placed in the analytical techniques used to measure strontium, this element was chosen for analysis. The proposition to be tested was: the elite stratum of society at Moundville had significantly more meat in their diet than did commoners; therefore, the skeletons of the elite stratum would contain relatively less strontium than those of the commoners.

4. The authors, with the kind aid of Clark Larsen, collected 669 bone samples which comprised 580 individuals from the Moundville collection of ca. 1500 skeletons. In the process, we recorded ages for 558 and sex for 233 of these skeletons. This sample was chosen so that it represented all social strata implied by the cluster analysis of mortuary practices at Moundville. To date, 136 of these bone samples have been analyzed: 114 by neutron activation analysis and, with some deliberate duplication between techniques to serve as controls, 54 by atomic absorption analysis. (See Schoeninger 1980 for a complete discussion of the techniques employed.)

5. The difference in strontium between adults in the elite stratum (represented by Clusters I and II in Peebles and Kus 1977: Figure 3), and adults in the remainder of the burials (Clusters III-X, ibid.), both of which were drawn from the later part of the Moundville sequence (late Moundville II to late Moundville III, see Steponaitis 1980a, 1980b), was in the direction predicted (Table 1). It seems, therefore, that there was a positive relationship between elite status and the amount of meat in an individual's diet at Moundville. Note, however, that the sample size is not sufficiently large in relation to the standard deviation to make the difference in sample means statistically significant.

There is an additional difference in strontium levels worthy of note. It is between males and females (Table 2). Given the fact that males were the hunters, and that some parts of the kill were consumed before it was brought back to the settlement, more meat in the diet of males than females should be expected.

Table 1. Comparison of bone strontium of adults classified by social strata.

Strata	Technique	Strontium (ppm) N	$\bar{X}$	S
Elite	Neutron Activation	6	607	225
	Atomic Absorption	1	404	—
Other	Neutron Activation	26	718	245
	Atomic Absorption	22	658	189

Table 2. Comparison of bone strontium of adults classified by sex.

Sex	Technique	Strontium (ppm) N	$\bar{X}$	S
Male	Neutron Activation	18	679	215
	Atomic Absorption	9	581	223
Female	Neutron Activation	15	763	219
	Atomic Absorption	10	763	195

Our analysis of the bone samples will continue as time and funds permit. The trends established thus far certainly warrant the effort, and the standard error of the sample mean must be reduced. At some point, we would like to add an analysis of the C^{12}/C^{13} ratio to explore the relative amount of maize in the diet among social strata and through time.

Alice Haddy and Albert Hanson

RELATIVE DATING OF MOUNDVILLE BURIALS

A large group of human bones was excavated during the 1930s from Moundville burial sites. If dates could be assigned to them, the bones might provide a guide to the changes which took place as Moundville flourished. Since all bones were treated with the preservative Alvar, the trade name for polyvinyl acetate, radiocarbon dating is not possible. In this preliminary study, bones from 15 individuals were analyzed for nitrogen and fluorine, since the concentrations of these elements might provide relative dates for the bones.

Nitrogen dating is based on the fact that buried bones and teeth lose nitrogen as bone protein decomposes over time (Ortner et al. 1972; Garlick 1969). Fluorine dating is based on the irreversible accumulation of fluorine in bone by replacement of hydroxide ions in the mineral hydroxyapatite ($Ca_{10}(Po_4)_6(OH)_2$) portion of bone (Hoskins and Fryd 1955:85). Both processes are dependent on environmental factors, such as temperature, soil pH, ground water content, and soil composition (Ortner et al. 1972:514; Garlick 1969; Hoskins and Fryd 1955:85; Hagen 1973:259). In order to assume that the bones were exposed to the same environmental factors, which is a necessity for both nitrogen and fluorine dating methods, samples must be from the same vicinity.

Another assumption made in both of these dating methods is the comparability of bone types. Variations in nitrogen and fluorine concentrations are to be expected between bones of different thickness or density. Ideally, this variable should be kept constant, but this is not always feasible in practice.

Sample Preparation

Ulnas and tibias were the most common bones analyzed, but some odd bones such as clavicles and ribs were also analyzed. Each sample was ground with a porcelain mortar and pestle to a fine powder. For fluorine analyses, the ground samples were pressed into aluminum planchets at 105.5kg/cm^2 pressure, forming a disk 2.6 cm in diameter and 2 mm thick.

Analytical Methods

Nitrogen analyses were carried out using the micro-Kjeldahl technique as developed by Von Endt (Ortner et al. 1972). Approximately 10 mg of ground bone was digested in boiling sulfuric acid solution. The digested sample was then neutralized and analyzed using a Nessler's reagent. Nitrogen was quantified spectrophotometrically by comparison with a standard using a McPherson double beam spectrophotometer, model EU-700.

Fluorine analyses were done by a recently developed technique, proton inelastic scattering (Shroy et al. 1978:313), using the reaction:

$$F\text{-}19(p,p')F\text{-}19^*$$

The samples were bombarded with a 3.4 MeV proton beam from a 3.5 MeV Van de Graaff accelerator. The gamma rays were counted at a 90° angle with a teflon free Ge(Li) detector. Data were analyzed with a Nuclear Data 6660 analyzer and minicomputer. The glass sample holder was lined with mylar to reduce the number of gamma rays from fluorine contamination within the system. The contamination gamma ray yield was less than 0.1% of the yield from the samples. Absolute fluorine calibration was performed by comparison with National Bureau of Standards certified phosphate rock.

Results

Results of nitrogen and fluorine analyses are presented in Table 1. For nitrogen, two to three analyses were done. For fluorine, one to four analyses were done. The average standard deviations for repeat nitrogen and fluorine analyses were usually less than 4%. When powdering the bone, the Alvar had a tendency to remain in flakes for samples on which it was relatively thick. This caused inconsistencies that resulted in a higher statistical error for those particular samples.

As expected our data indicate the importance of choosing comparable bone types. We found that thinner bones may accumulate average fluorine at a faster rate than thicker bones. Thin bones may be incomparable with thicker ones for nitrogen analyses as well.

Among the 15 samples, 11 were analyzed for both nitrogen and fluorine. A rank correlation between the two methods was performed for these samples. Using Spearman's method for rank correlation (Yule and Kendall 1965), the rankings were found to be statistically significant at a .05 confidence level.

Tibia 1647 and ulna 1423 show the largest discrepancies in their relative rankings. A likely source of disagreement is the Alvar content. Although Alvar does not interfere chemically with either analysis, it does add extraneous weight to the sample. Extra total weight will make a sample appear older by nitrogen dating and younger by fluorine dating.

Discussion

Table 2 presents data classified by mound association. Possible relative ages have been assigned based on nitrogen and fluorine amounts, with classifications ranging from "early" to "late". The bone samples from the vicinity of Mound D fall in a moderate to late time period. Ceramic analysis places them in a period between late Moundville II and late Moundville III (Steponaitis personal communication). The individuals from the vicinity of Mound E show a much wider age separation. Samples 1647 and 1648 were from burials found in a single pit, and by ceramic analysis have been classified together as late Moundville II or early Moundville III. On the basis of chemical dating 1648 is by far the oldest sample analyzed. On the other hand, 1647 is a much younger sample. According to these data, the pit may have been dug for one burial, and later may have been re-opened to accomodate the other.

Table 1. Nitrogen and Fluorine Concentrations.

Sample	Nitrogen (%)	Fluorine (ppm)
1648 tibia	1.07 ± 0.07	775 ± 26
1587 ilium	—	669 ± 14
2417 rib	—	608 ± 12
1515 metatarsal	—	548 ± 23
1515 tibia	1.39 ± 0.05	494 ± 24
1840 tibia	1.52 ± 0.01	—
2417 ulna	1.59 ± 0.08	496 ± 4
1788 femur	1.78 ± 0.11	324 ± 4
1647 tibia	1.87 ± 0.01	166 ± 6
1065 tibia	1.93 ± 0.01	432 ± 2
1647 ulna	1.94 ± 0.23	—
1563 ulna	2.03 ± 0	186 ± 4
1800 ulna	2.10 ± 0.03	217 ± 4
1423 ulna	2.47 ± 0.04	493 ± 10
839 clavicle	2.85 ± 0.01	262 ± 5
1539 ulna	2.86 ± 0.01	311 ± 8
1183 clavicle	—	272 ± 3
1183 ulna	—	240 ± 17
1496 metatarsal	(0.83 ± 0.09)	266 ± 2

Table 2. Comparison of Gravelots by Mound.

Mound	Sample	N (%)	F (ppm)	Relative Date
Mound D	1496S	(0.83)	226	late
	1539S	2.86	311	mod. late-late
	1563S	2.03	186	moderate-late
	1423S	2.47	493	moderate-mod. late
	1515S	1.39	494	early-moderate
		—	548	
Mound E	1648N	1.07	775	early
	1647N	1.87	166	moderate-late
		1.94	—	
	1587N	—	669	early
	1183E	—	240	late
		—	272	
Mound G	1788SW	1.78	324	mod. early-mod. late
	1800SW	2.10	217	moderate-late
Mound I	839E	2.85	262	late
Mound P	2417W	1.59	496	mod. early-moderate
		—	608	
Mound R	1065W	1.93	432	moderate
Mound W	1840N	1.52	—	mod. early

Only one sample analyzed, 839, was classified as Moundville I by ceramic analysis. There is no doubt that it is the earliest sample ceramically (Steponaitis personal communication), but by chemical dating it is one of the most recent samples. It has 2.85% nitrogen and 262 ppm fluorine. It is likely that the Moundville I vessel and the individual were not buried together, which suggests that the sample cannot be taken as representative of Moundville I. It is uncertain at this time what concentrations of nitrogen and fluorine are to be expected in a Moundville I sample.

Besides the fact that the two dating methods cross-checked, the most notable results from the data are the broad ranges of the nitrogen and fluorine concentrations. Nitrogen content changes almost threefold from 1.07% to 2.86% and fluorine content changes almost fivefold from 166 to 775 ppm. This indicates the methods have a good sensitivity for the time span over which the burials took place.

We can assume that all of the bones started with the same amount of nitrogen, 5%. It has been shown by investigators such as Ortner and Von Endt that the amount of nitrogen decreases exponentially over time (Ortner et al. 1972). Therefore, the rate of nitrogen loss also decreases over time. Following this line of reasoning, a bone with 1% nitrogen would be more than twice as old as a bone with 3% nitrogen. If this is true, it indicates that the oldest bone in this study, 1648, is probably at least twice the age of the newest, putting it in the Moundville I period.

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Vincas P. Steponaitis

CHRONOLOGY AND COMMUNITY PATTERNS AT MOUNDVILLE

The Moundville site on the Black Warrior River in west-central Alabama is one of the largest Mississippian sites in eastern North America. The site contains at least 20 artificial mounds, most of which surround a large rectangular plaza. The plaza itself covers some 32 ha, and the site as a whole some 100 ha (Moore 1905; Peebles 1978, 1979).

Despite the fact that Moundville is a well-known site with a long history of investigations, many aspects of its internal chronology have, until recently, remained obscure. Previous workers generally were forced to deal with Moundville in a static framework, as though all the remains seen archaeologically pertained to a single moment in time. This synchronic outlook did not stem from a lack of interest in diachronic patterns, but rather from a lack of fine chronological control. The "Moundville phase", as it was previously defined, encompassed a 500 year span within which no temporal distinctions were recognized (e.g., McKenzie 1966). As long as this block of time remained undivided, developmental studies could not proceed.

My own recent work at Moundville has been directed especially toward solving this problem. Based on a seriation of whole vessels and on a stratigraphic analysis of sherds, it has been possible to subdivide the "Moundville phase" into three shorter units—Moundville I, Moundville II, and Moundville III (Steponaitis 1980a, 1980b). Adding these three new units to the two previously-defined phases which come before and after (West Jefferson and Alabama River), the entire late prehistoric sequence now consists of five phases spanning the period from A.D. 900 to 1700. Using this new chronology, it is now possible to trace how the size and configuration of the Moundville site changed through time.

Changes in Community Patterns through Time

All the evidence we have suggests that people at Moundville were usually buried in close proximity to residential areas—in the floors of dwellings, just outside the dwellings' walls, or in cemeteries nearby (Jones and DeJarnette n.d.:3; Peebles 1978:375-381, 1979: passim). Burials also occur in many of the mounds. Therefore, by plotting the distribution of dated burials and vessels for each time period separately, it should be possible to get at least a rough idea of when different parts of the site were occupied, and when various mounds were built.

The present discussion of community patterns is based on a series of maps, each showing the distribution of burials and unassociated vessels belonging to a particular phase of occupation (Figs. 1-5). To assure reliability, only the most narrowly-dated vessels and burials are plotted—those which could be securely assigned to a range that spanned no more than two adjacent time segments (e.g., Moundville I/early Moundville II, early Moundville II/late Moundville II, late Moundville II/early Moundville III, etc.). Thus, one should keep in mind that the number of vessels/burials plotted on these maps actually represents a minimum, since numerous vessels and burials which lacked sufficiently diagnostic features are excluded (for further details, see Steponaitis 1980a:232-268).

West Jefferson Phase (ca. A.D. 900-1050). This component, unlike the others, cannot be defined by plotting the spatial distribution of burials, since West Jefferson gravelots have never been found to contain pottery (see Ensor 1979:12-15). There are literally thousands of burials without ceramics reported at Moundville, but for now it is impossible to tell which ones are West Jefferson and which ones are later.

The principal evidence for a West Jefferson component at Moundville exists in the form of sherds, mostly from excavations which took place in the 1930s. Although these collections have never been fully analyzed, a number of preliminary reports indicate that most of the West Jefferson pottery was recovered from the western periphery of the site, in the area to the west of Mounds O and P (Wimberly 1956:18-19; Walthall and Wimberly 1978:122-123). Walthall and Wimberly (1978:123) recently estimated that the West Jefferson occupation was a village of approximately .5-1.0 ha in size; judging from the position of the excavations which produced the greatest number of grog-tempered sherds, this village was located within the area shown on Figure 1.

Moundville I Phase (ca. A.D. 1050-1250). The greatest concentration of Moundville I burials and vessels occurs in the western part of the site, showing considerable continuity in location from the previous phase (Fig. 2). The core of the site at this time appears to have consisted of at least a single mound, an early stage of Mound O. Immediately to the west of this mound was a cluster of burials—probably a small cemetery. The overall distribution of burials also suggests scattered occupation to the north, south, and east of the mound, especially in the areas along Carthage Branch. It is difficult to tell whether the absence of burials and vessels in the central portion of the map represents an actual lack of occupation, or merely the paucity of excavations in the area that was later to become the plaza.

The pattern evident in Figure 2 is quite intriguing,

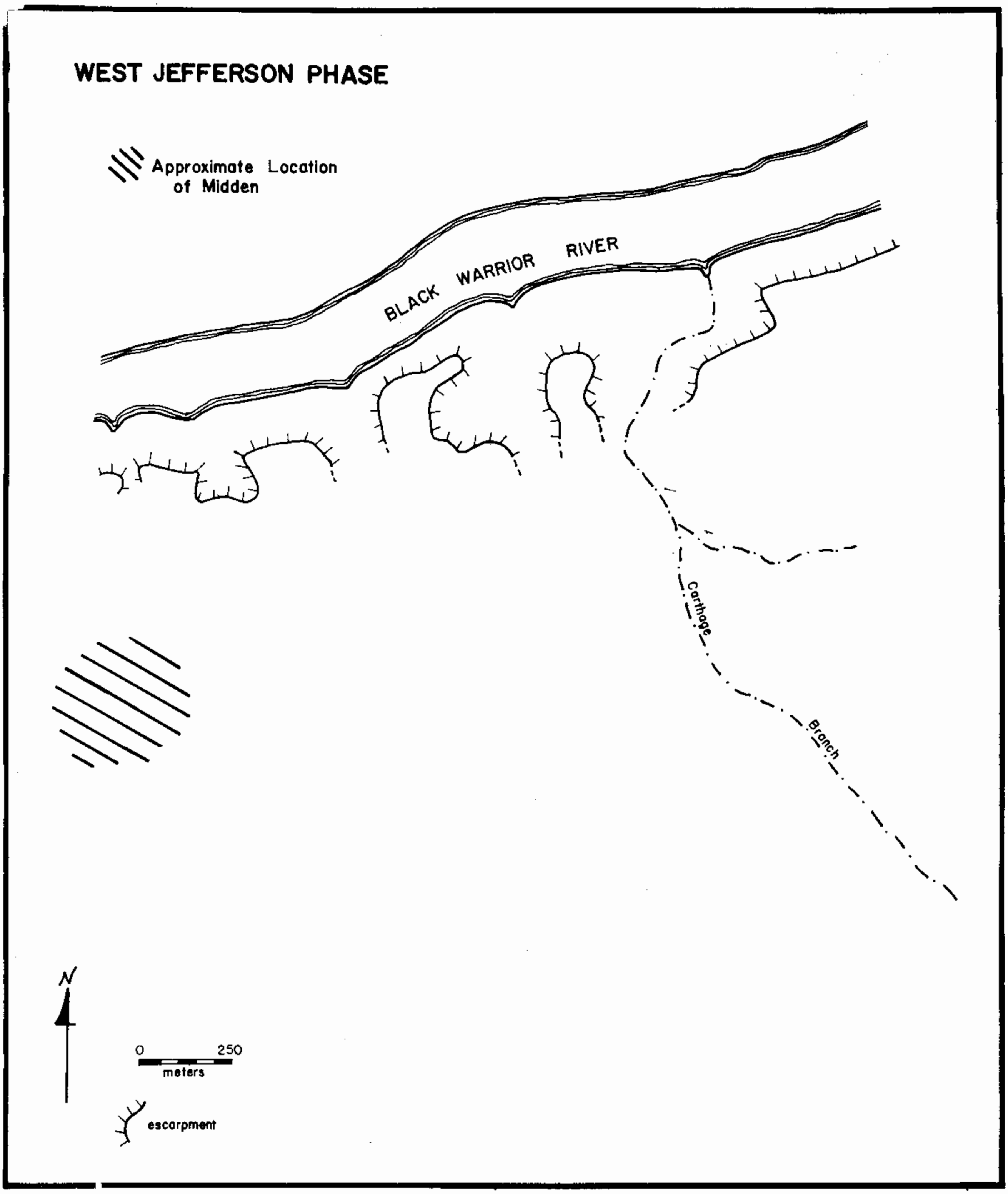

Figure 1. Approximate location of West Jefferson phase component. CORRECTION—Meters scale should read 0-125.

for it seems to be consistent with patterns found elsewhere in the Warrior valley at the same time. Recent surveys have indicated that during this phase, Moundville was one of a series of small, more or less equivalent political centers, each with a single mound, and a number of small hamlets or farmsteads scattered in its immediate vicinity (Peebles et al. 1979; Bozeman, personal communication). The elaborate three-level settlement hierarchy, which many of our previous models took for granted (e.g., Steponaitis 1978), clearly had not developed by this time.

Moundville II Phase (ca. A.D. 1250-1400). In Moundville II times, the situation changed dramatically as Moundville grew to become a major political center (Fig. 3). There were considerably more burials dating to this phase at the site, probably indicating a much larger population. Moreover, the evidence suggests that this was a time when a considerable amount

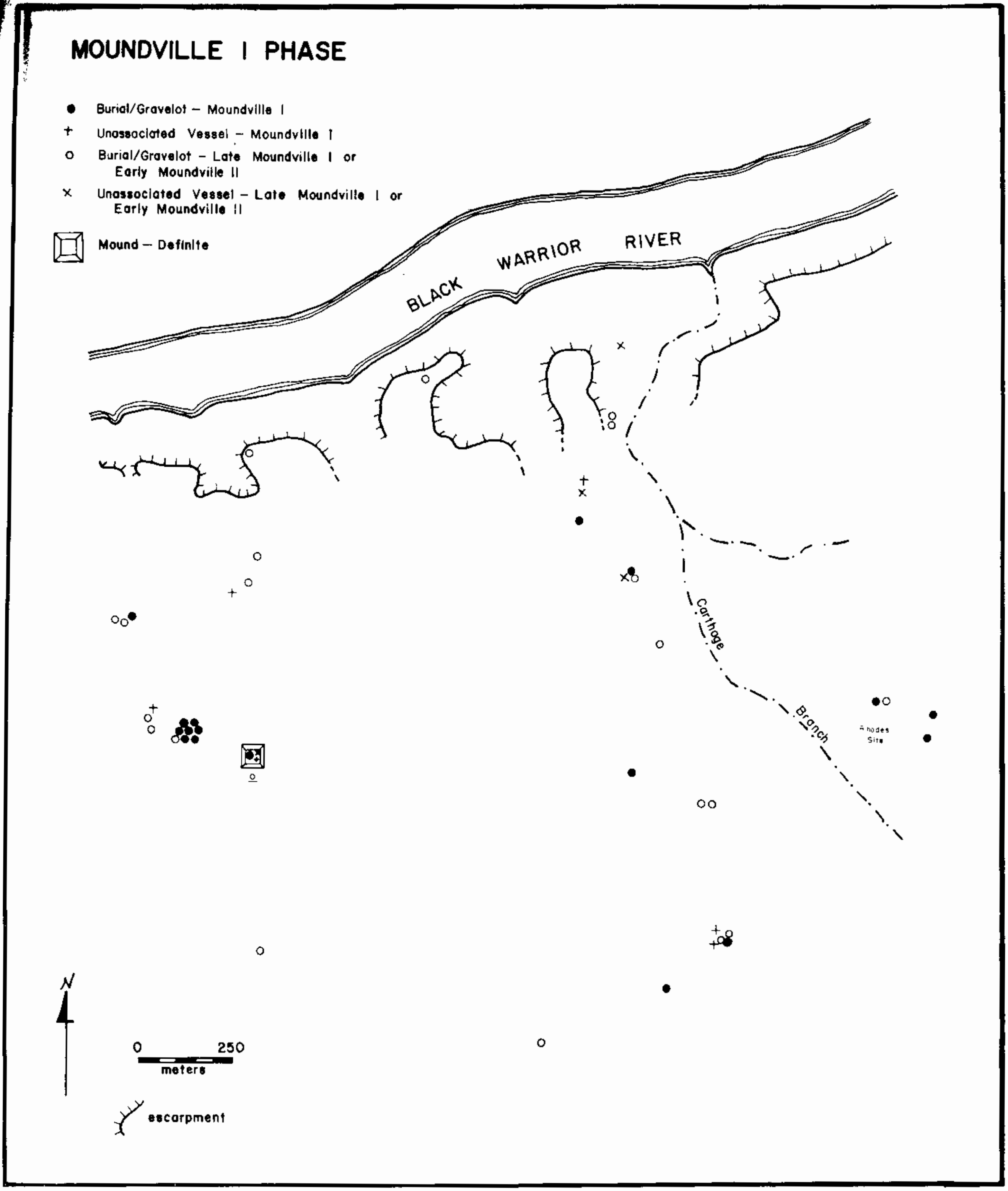

Figure 2. Spatial distribution of burials and unassociated vessels, Moundville I phase (some possibly early Moundville II). CORRECTION—Meters scale should read 0-125.

of public labor was mobilized to build mounds. There is definite evidence in the form of inclusive pottery vessels that at least five mounds (C, D, F, H, O) were standing by the end of this phase. Moreover, given that the securely-dated mounds occur at both the northern and southern extremities of the site, it seems likely that early stages of many of the intervening mounds, from which we have no datable artifacts, were standing as well.

Mortuary activity during this phase continued in the area west of Mound O, and large burial concentrations also began appearing elsewhere on the site, mainly to the east and north. Especially prominent were burial concentrations north of Mound R, southwest of Mound M, and (late in Moundville II) the large cemetery areas near Mounds D and E.

Moundville III Phase (ca. A.D. 1400-1550). Most of the patterns established in Moundville II times con-

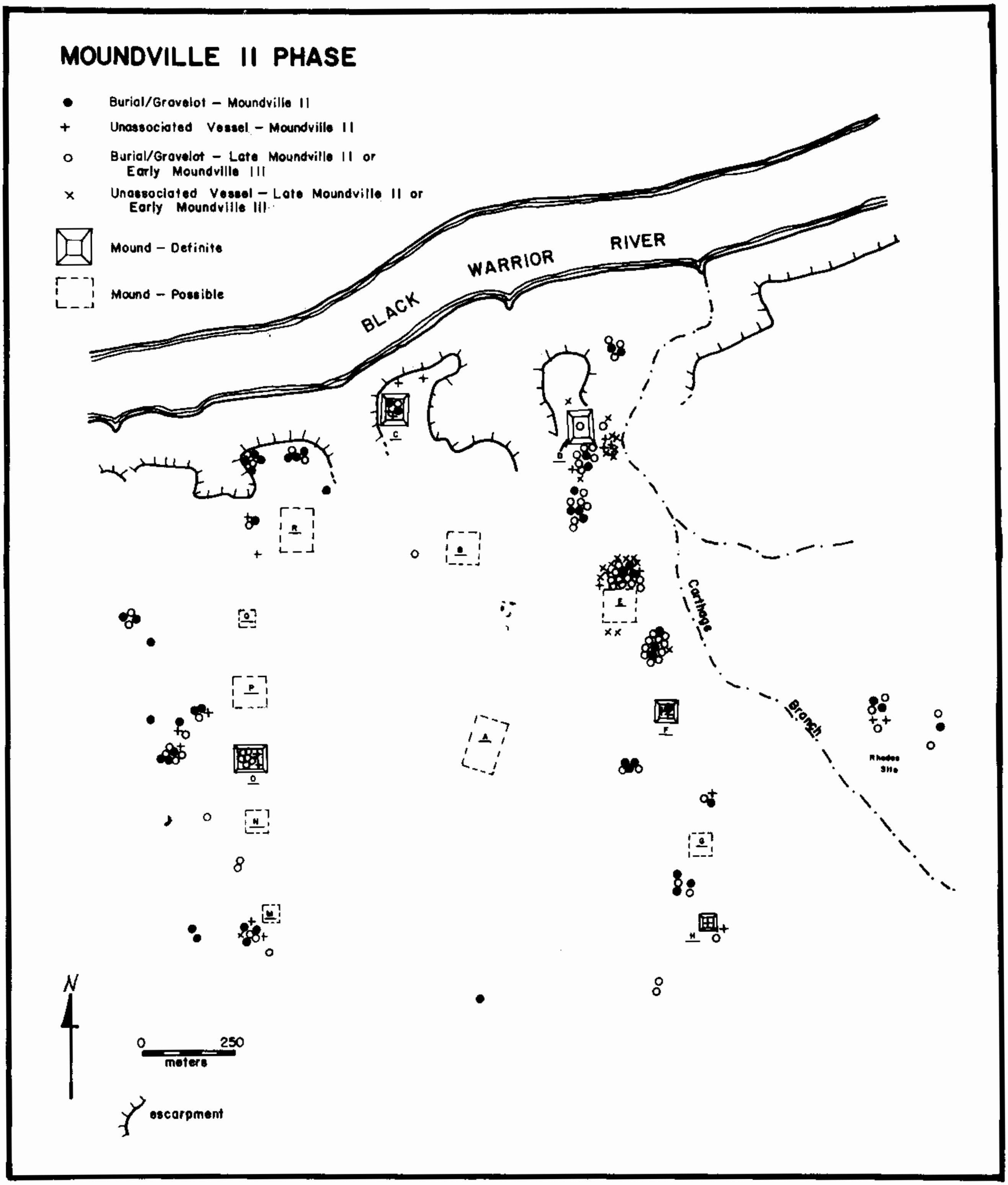

Figure 3. Spatial distribution of burials and unassociated vessels, Moundville II phase (some possibly early Moundville III). CORRECTION—Meters scale should read 0-125.

tinued into Moundville III (Fig. 4). Judging from the distribution of burials, the area of settlement may have expanded somewhat farther to the west. Again, the largest concentrations of dated burials occurred in the vicinities of Mounds D and E, with smaller concentrations southwest of Mound G, southwest of Mound M, west of Mounds O and P, west and north of Mound R, and on the Rhodes site east of Carthage Branch. Mound building must have continued apace, with vessels definitely of this phase occurring in Mounds B, D, and O. Without a doubt, all the mounds reached their final configuration by the end of Moundville III, because by the succeeding Alabama River phase, the site had been virtually abandoned.

Alabama River Phase (ca. A.D. 1550-1700). That a proto-historic component did exist at Moundville is indicated by the presence of diagnostic vessels and sherds; yet it is abundantly clear that the component

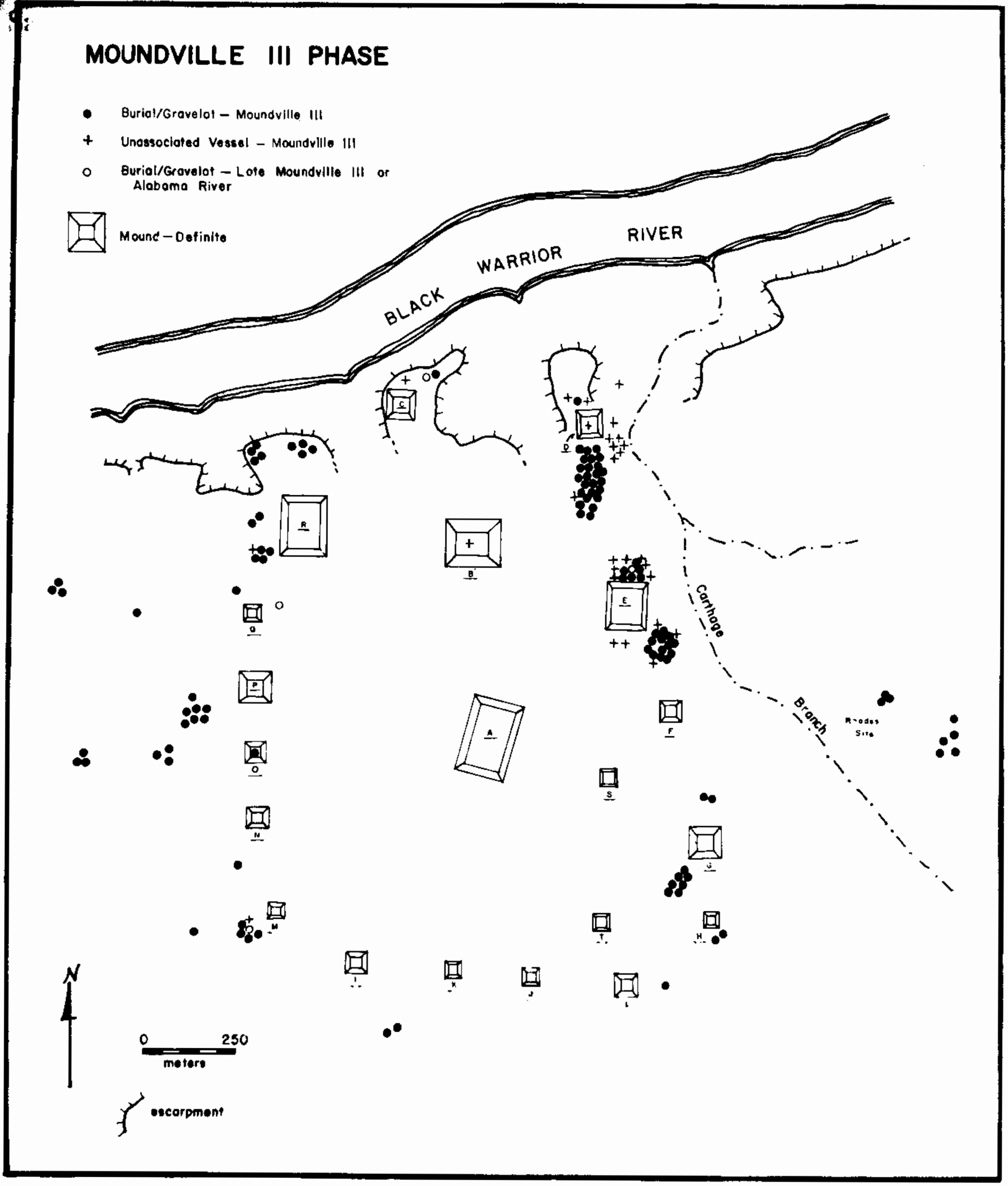

Figure 4. Spatial distribution of burials and unassociated vessels, Moundville III phase (some possibly early Alabama River phase). CORRECTION—Meters scale should read 0-125.

was miniscule compared to those which preceded it (Fig. 5). Evidence of mortuary activity is minimal, with one burial southwest of Mound G, another north of Mound R, and two unassociated vessels (which probably came from burials) north of Mound B. Also possibly dating to this phase are two "urn-burials of infants," which Moore reported finding south of Mound D (1907:342-343). All in all, this sparse representation is suggestive of nothing more than a few farmsteads or hamlets, scattered over what was once an enormous site.

Summary and Discussion

Summing up the evidence just presented, it appears that Moundville underwent a gradual development through time. The site began as a small nucleated village in the West Jefferson phase, then became

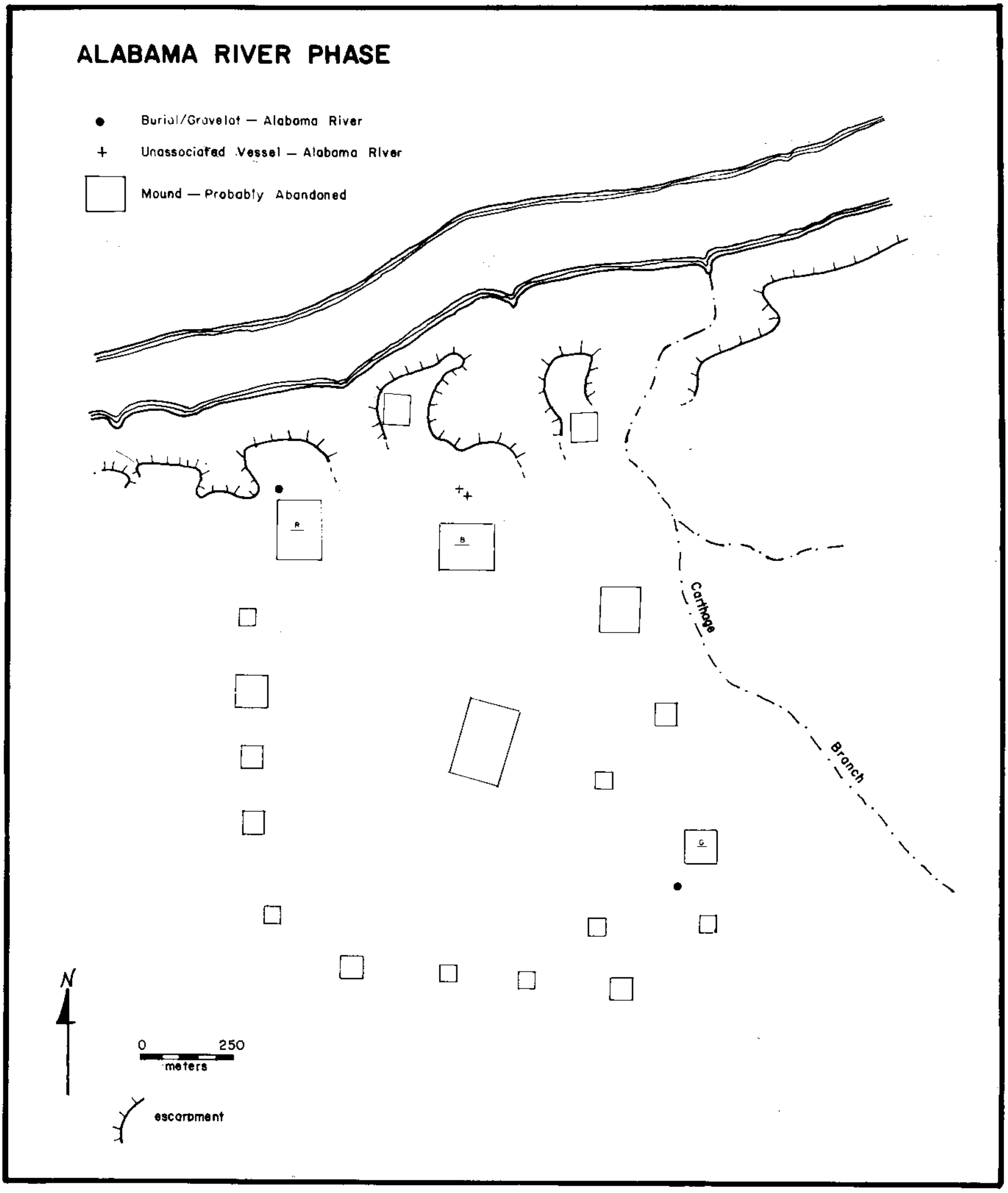

Figure 5. Spatial distribution of burials and unassociated vessels, Alabama River phase.
CORRECTION—Meters scale should read 0-125.

a small local center with a single mound in Moundville I, and finally evolved into a large regional center during Moundville II and Moundville III. Decline became evident only in the Alabama River phase, by which time the site had lost its political importance, and was left with only a trace of its former population.

Overall, the sequence is marked by strong continuities in settlement location from one phase to the next, especially notable in the transition from West Jefferson to Moundville I. These continuities, together with certain continuities in ceramic style (Steponaitis 1980a:221-225), are fully consistent with the notion that the Moundville phases I-III—and the socio-political complexity they represent—evolved locally from the indigenous West Jefferson base, and were not the result of any migrations into the valley from outside (for a contrasting opinion, see Jenkins 1976).

Sander E. van der Leeuw

PRELIMINARY REPORT ON THE ANALYSIS OF MOUNDVILLE PHASE CERAMIC TECHNOLOGY

The following remarks are a preliminary report on an analysis of Moundville ceramic technologies. The analysis is based upon vessels from the collection at Mound State Monument. In 1979, part of the collection was studied in detail; additional vessels were examined, though much less thoroughly, in 1980. To date, the results are consistent with the hypotheses presented below.[1, 2]

In reading these remarks, a few considerations should be kept in mind. First, the vessels from Moundville are burial materials; they may not be representative of the total ceramic production. Second, the Moundville vessels come from the site at the top of the hierarchy and may not be representative of the whole system. Third, at the time of these analyses, Steponaitis's (1980a:28-83) investigation of the nature of the raw materials was not yet complete. This limited our knowledge of the properties of the raw materials involved. Further, we lacked an independent means of distinguishing workshops.

We can distinguish three different potmaking traditions in the materials: 1) a coiling tradition which built pots upon a rest, i.e. some tool which enabled the potter to rotate the vessel fairly evenly; 2) a coiling tradition which did not use a rest, but which possibly used the hammer-and-anvil technique; and 3) a slab-building tradition which was responsible for the rectangular vessels.

Coiling with a Rest

Much of the black filmed, burnished pottery (i.e. Bell Plain, Carthage Incised, and Moundville Engraved (Steponaitis 1980a)) seems to have been constructed by variants of the coiling with a rest technique. The variation within this tradition consisted, among other things, of the diameter of the coils used, the nature of the rest upon which the vessel was placed during manufacture, and the sequence of manufacture.

For better understanding, it is necessary to summarize some of the problems involved in this kind of manufacture. Coiling requires that the potter work on all sides of the pot consecutively. If the pot does not turn easily, this can only be done in interrupted movements or with one hand. If the vessel rotates with ease, the force applied in joining the coil to the pot will also propel the pot; thus, the potter can work uninterruptedly *and* with both hands.

Coiling also requires squeezing the clay. In some traditions, the coils are shaped into flat bands before they are added to the pot. In the Moundville tradition, such was not the case. The coils were squeezed into shape as they were added to the pot. Squeezing makes the clay move in *all* directions. As a consequence, simple squeezing would cause the profile of the vessel to splay. This problem may be circumvented by: 1) leaving the coils thick, letting the vessel dry, and scraping the surfaces after drying; 2) squeezing the coils against something which can contain the total circumference (e.g. a mold, or a leather strip or piece of string wound around the vessel); 3) using extremely thin coils which require no squeezing; or 4) fastening the coils with a special movement of the fingers (van der Leeuw 1976:332), adding the coil on the inside where the vessel stands out and on the outside where it bends in.

In the Moundville collection, we find evidence among the pottery built on a rest that the second, third, and fourth solutions were used. The following summary arguments may be presented to argue that the tradition is nevertheless one and the same. Once the rest was used, the potters must have realized that it determined the shape of the base (Figs. 1-6). In some cases, a small shallow bowl served as a rest. The base was constructed by placing a slab of clay into the basin, and squeezing it against the sides. On top of the base, the potter would then begin to build his pot by coiling (pedestal-base vessels, see Figs. 1-3). Some of the vessels have a low center of gravity and therefore slope sharply outward from the central axis (Figs. 2, 3). In order to squeeze coils at such an angle, the potter must have had room to move his fingers between the vessel wall and the surface upon which the vessel stood. This was guaranteed by the pedestal system. If the potter eliminated the pedestal, he must have either rested the vessel on a high (kabal-like) rest, or shaped the lower part of the vessel against something. It was only natural to begin shaping in a somewhat larger dish (i.e. mold) the shape of the lower vessel (Figs.

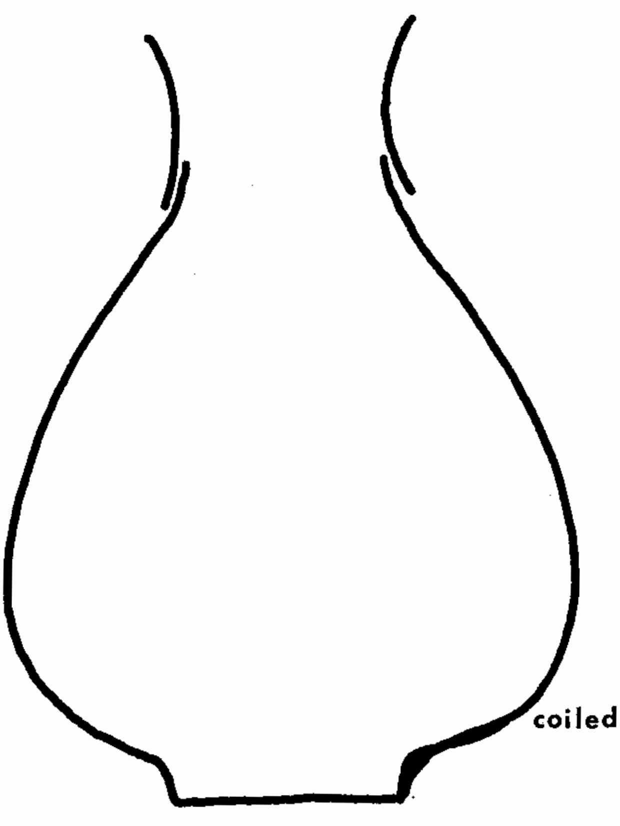

Figure 1. Slender ovoid pedestaled bottle. Moundville Engraved *variety Elliots Creek*, RW43.

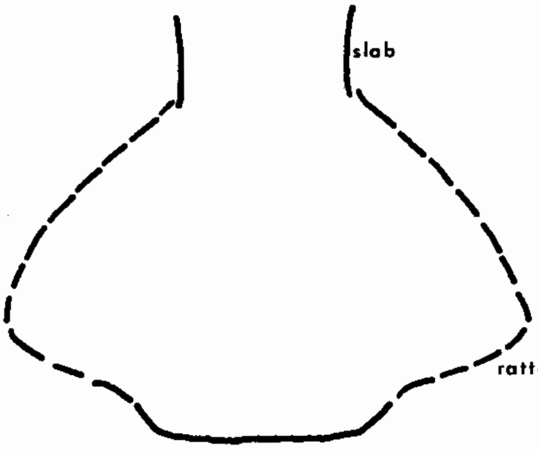

Figure 2. Subglobular bottle with pedestal base. Moundville Engraved *variety Northport,* NR100.

4-5). This also would have solved the problem of having to use fairly thin coils (a laborious process) by allowing the potter to use thicker ones. As the size of the molds grew, their limits became the greatest circumference of the vessels to be made in them (Figs. 4-5). The potter also profited from molds by constructing parts of the wall by shaping slabs or balls of clay in them (Fig. 5). The final step would seem to have been that the potter shaped both the lower part of the vessel and the shoulder in molds and then joined the halves to form the vessel (Fig. 6). An orifice was then cut for the neck.

Coiling with Hammer-and-Anvil Finishing

Most, if not all, of the reddish, round-based, highly tempered jars (e.g. Moore 1905:170, 230) and the flaring rim bowls (e.g. Moore 1905:150) seem to have been made using a hammer-and-anvil technique (e.g. Mississippi Plain, Moundville Incised). This is undoubtedly partly due to the fact that the use of jars

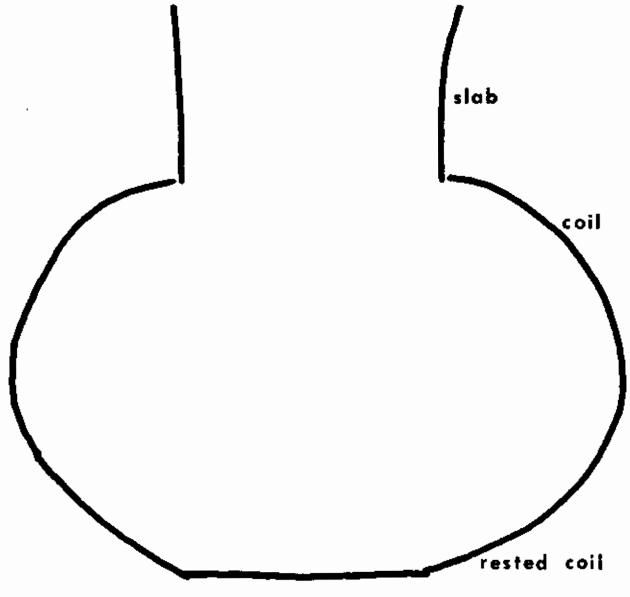

Figure 4. Subglobular Bottle with slab base. Moundville Engraved *variety Taylorsville,* EI15.

for cooking required more and larger grained temper to absorb thermal shock. The temper would have made the clay considerably leaner than the paste used for the finer category of vessels. Hence, it was much less malleable. On the other hand, it was less likely to sag or collapse during construction. Throughout the Moundville period, these vessels seem to have been made in the same manner, i.e. by coiling without the use of a rest. After roughly shaping the pot, the potter would iron-out irregularities by beating it with a paddle, supporting the inside with an anvil. The paddle used was flat and smooth.

The evidence for this hypothesis basically comes from the surface treatment of the vessels: faceted sur-

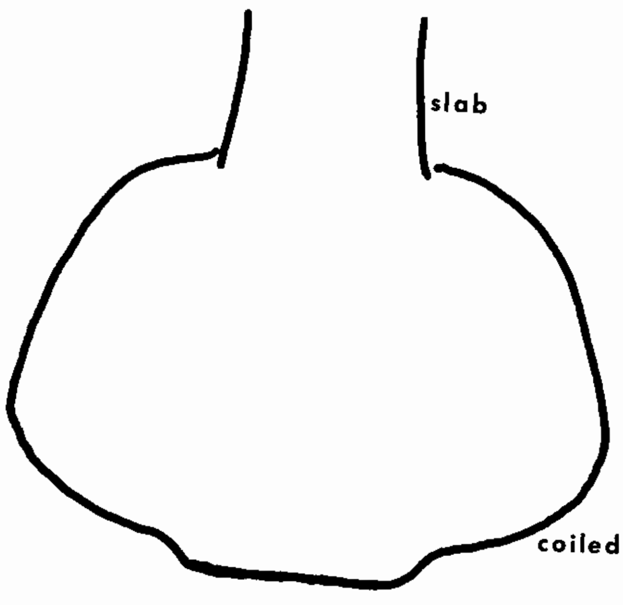

Figure 3. Subglobular bottle with pedestal base. Moundville Engraved *variety Tuscaloosa,* NR162.

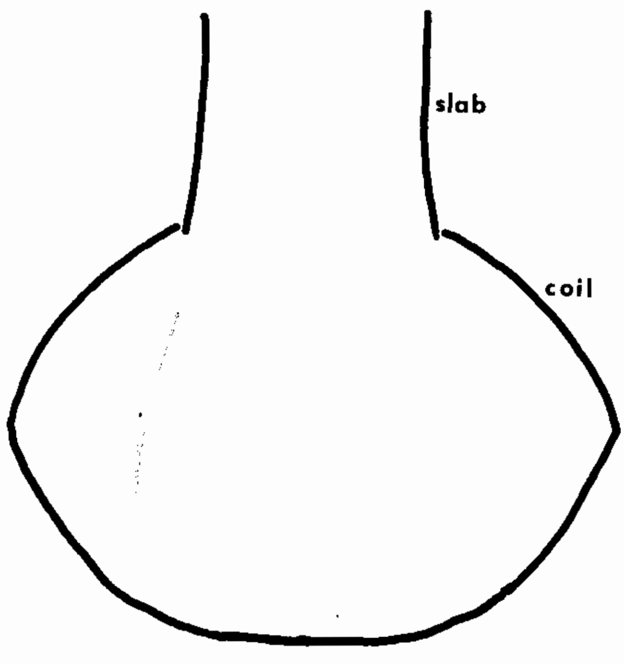

Figure 5. Subglobular bottle, lower portion mold-made. Moundville Engraved *variety Hemphill,* SD87/M7.

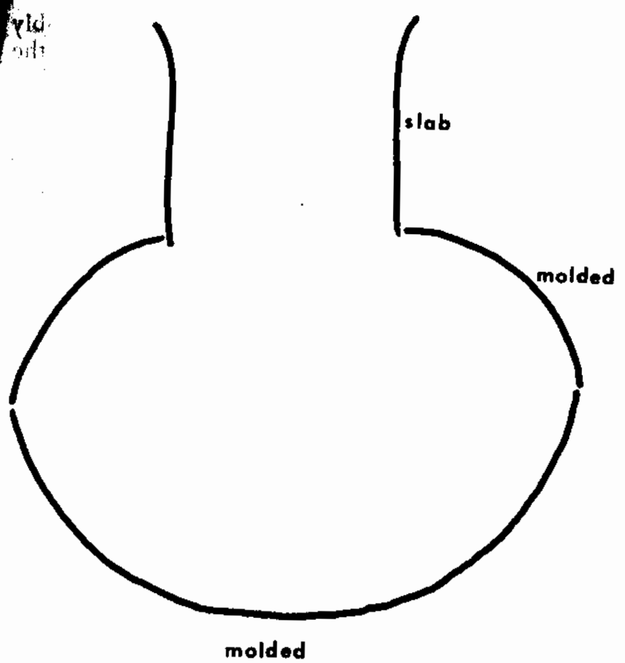

Figure 6. Subglobular bottle, lower portion and shoulder mold-made. Moundville Engraved *variety Hemphill,* SWM15A/M7.

faces which, after smoothing or polishing, have a hammered appearance. Moreover, the shapes of all of these vessels are fundamentally similar, and in my experience, similar to such varied hammer-and-anvil products as vessels from the Phillipines and Nigeria. Typical is the slight contraction above the widest part of the vessel. This much contraction, no more and no less, may be created by the proposed system. The uppermost part of the vessel was added as a coil, and squeezed out, with the thumb on the outside.

It is important to realize that many of the flaring rim bowls were made with this technique. Quite a few of these seem to have served as molds for the complex pottery-making tradition discussed above. Thus, these molds serve as a means of tying the traditions together. The same is true of hand-modeled imitations of the complex pottery which occur throughout the Moundville phase.

Slab-Building

The tradition which manufactured the rectangular or part-rectangular vessels in the collection (e.g. Moore 1907:357-358) is quite separate from the coiling tradition, at least in conception. The technique is one of rolling out slabs of paste, cutting these into desired shapes, joining them at the edges, and then assembling the whole vessel. More than one surface may be constructed out of a slab by bending it at right angles, if the clay is coherent enough to support such an action. In the collection, there is one vessel which unites the slab-building technique to the usual Moundville approach. It has a rectangular body built upon a pedestal of the usual size and shape and a cylindrical neck. The possibility must be considered that this class of vessels comes from elsewhere, or that some of its members come from other areas and led to local imitations. This would seem to tally with the fact that two of the ovoid pedestaled bottles do not fit in the local manufacturing tradition. In the case of the bottles, imported ones such as these may well have triggered the manufacture of bottles as a whole, or of the pedestaled bottles in particular.

Concluding Remarks

It seems important to generate a few hypotheses concerning the potters and their products, which can serve as a guide for future research. The ceramic tradition at Moundville may have had its roots at a much earlier period than the Mississippian. It was a very simple tradition known throughout the Southeast, Southwest, and adjacent areas and basically consisted of coiling. At the time that the sequence we have studied began, the local potters may have had two energy saving devices in their traditional baggage: a simple round disk upon which they could rotate vessels during construction; and a hammer-and-anvil set with which they could even out some of the irregularities in their cooking jars. Whether these tools were indeed at their disposal at the beginning of the sequence can only be determined by means of a much more detailed chronological framework. Vessels made with such tools, together with vessels which were manufactured without them, are included in the materials from the Moundville I phase. Technologically it is probable that the introduction of such tools implies an incipient split in the tradition between potters making cooking wares and those making fine wares. Each technique developed its own means of rationalization to cope with the specific requirements of the clays used.

Needless to say, this specialization does not necessarily imply complete personnel specialization; potters could have used the two techniques in making the two kinds of pottery. But as the volume of production grew, it would have been along such lines that specialists would emerge.

At some point, both traditions started developing individually. The cooking-jar tradition developed toward accelerated production and more standardized shapes (less intra-pot and intra-product variability and possibly a series of more or less standardized shapes).

The fine-ware tradition, under the influence of imported materials, developed techniques which could cope with the shapes the imports had. Moreover, through the introduction of the rest and later the mold, and through the use of rattail techniques instead of thicker coils, standardization and efficiency were considerably furthered. It seems as if this technique in particular was in the hands of specialists. There was a considerably higher degree of skill involved, and a much greater volume of information-processing was required, especially when decoration was added to the vessels. The fact that pots which were decorated by a single individual also seem highly similar in shape (Hardin 1979; this volume), would indicate that there was no horizontal differentiation within the workshops.

At the latest, specialization seems to occur during the early Moundville II phase. One should be aware, however, that when really needed, potters in one tradition could have made the pottery of the other, albeit less proficiently. Also there is a possibility that a number of amateurs continued to make pots every now and then, and certainly a number of less-than-standard pots continued to be made.

Summary

At Moundville, pottery making developed locally and independently, based technologically on the coiling technique. In all probability, there were no specialists at this point. The intra-product variability seems high, possibly indicating a limited amount of information flow and a low level of organization. Prototypes from a more highly developed tradition of ceramic manufacture may have led to imitations. Original imports and imitations can be distinguished because the technology involved differs considerably. Imitation required adaptation of the local techniques, leading to the introduction of, among other things, molds. Growing production and the inherently greater information flow must have led to more standardization, specialization, and organization. Later vessels show a notably lower degree of intra-product variability, while the number of different products grows.

Footnotes:

[1]This paper is an excerpt from a first and very preliminary report based on the author's activities as a consultant to the Lubbub Archaeological Project. The full report may be obtained from the author at the following address: S. E. van der Leeuw, Institute for Pre- and Protohistory, University of Amsterdam, Singel 453, Amsterdam, Holland.

[2]All of the figures were drawn by Margaret A. Hardin and represent her interpretations of specific vessels in the rest/mold developmental sequence. I am grateful for her permission to use these drawings.

Margaret Ann Hardin

THE IDENTIFICATION OF INDIVIDUAL STYLE ON MOUNDVILLE ENGRAVED VESSELS: A PRELIMINARY NOTE

Moundville Engraved ceramics, particularly those varieties assigned by Steponaitis (1980a, 1980b) to Moundville II and III contexts, are the focus of this paper. It deals in turn with two related problems. First, it argues that individual styles may be recognized in the decoration of these ceramics. Stylistic attributes provide criteria for grouping vessels engraved by the same artisan. Second, independent corroboration of the identification of these individual style sets is provided by examining other attributes shared by the vessels in each set. Here the argument focuses on strategies of vessel construction.

Individual Style in Moundville Engraved Decoration

The argument for individual style at Moundville rests upon the recognition of sets of vessels decorated by the same potter. Vessels grouped into these individual style sets share exceptional similarities in the organization and execution of engraved design which set them off from other vessels with decorations of the same kind. All of the vessels involved are Moundville Engraved. Because major differences in the structure of engraved design are used to define the varieties of this type, the varieties of Moundville Engraved provide convenient and clearly defined stylistic contexts within which to identify sets of vessels by the same hand. There are actually very few points of stylistic comparison between designs that fall into different varieties; thus, demonstrating the existence of individual style sets that cross-cut variety boundaries would be a much more difficult and uncertain exercise. To explain more precisely, in these materials one looks for identical, or nearly identical, attributes at three levels in the structure of variation of design: (1) motif; (2) structural options in constructing motif; and (3) technique in rendering motif.

Moundville Engraved *variety Wiggins* vessels provide an example of how this procedure may be used to identify the work of a particular engraver. By definition, the motif which characterizes *variety Wiggins* is a continuous horizontal scroll of two to five lines in width (Steponaitis 1980b:50). Most commonly, the motif occurs on subglobular bottles, on which it repeats four times. One exceptionally consistent set of nine bottles has been isolated within the corpus of *variety Wiggins* vessels. Features marking the work of the Wiggins engraver may be seen by comparing designs on vessels from the set of nine (Figs. 1-2) with those found on other Wiggins bottles (Figs. 3-5).

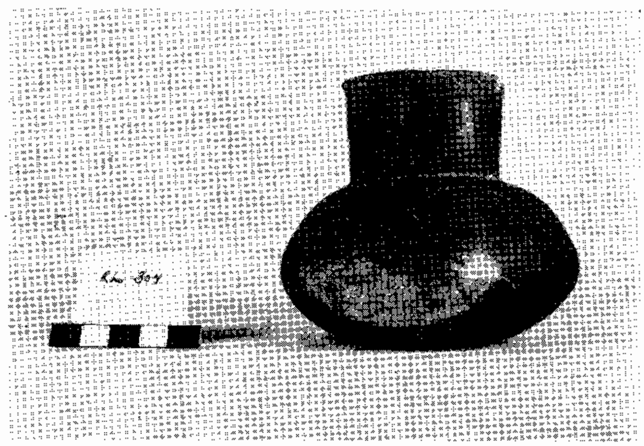

Figure 1. Moundville Engraved *variety Wiggins*. Rho304. First example of 9 vessel set by the Wiggins Engraver.

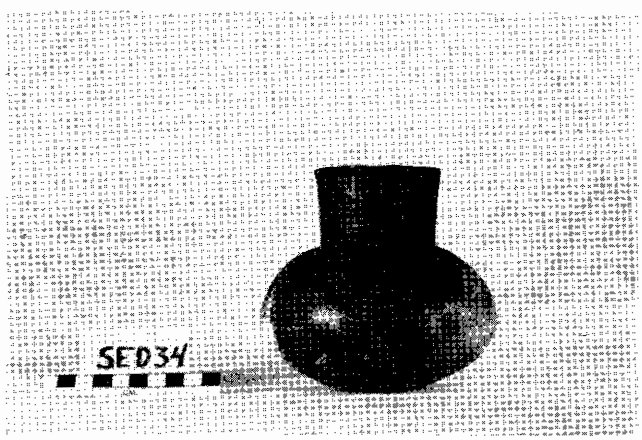

Figure 2. Moundville Engraved *variety Wiggins*. SED34. Second example of 9 vessel set by the Wiggins Engraver.

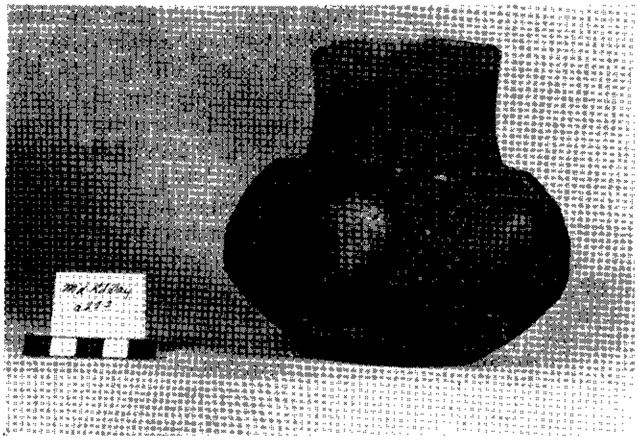

Figure 3. Moundville Engraved *variety Wiggins*. RW227. First vessel contrasting with those of Wiggins Engraver.

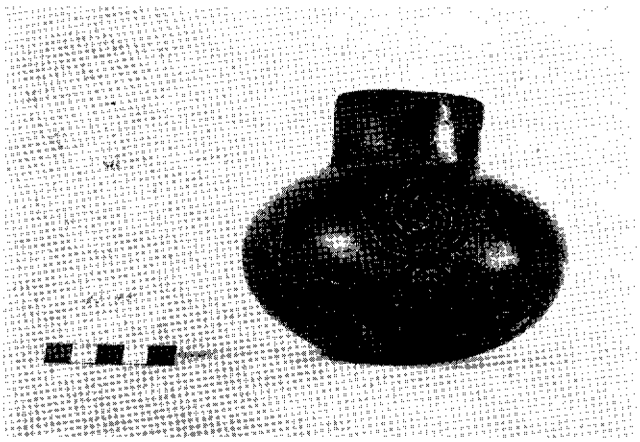

Figure 4. Moundville Engraved *variety Wiggins*. E178. Second vessel contrasting with those of Wiggins Engraver.

Choice of major structural options in motif construction provide a sufficient basis for distinguishing the work of the Wiggins engraver (Fig. 6) from the other vessels (Figs. 7-9). One of the contrasting vessels has a five line scroll but no fin-like appendages (Fig. 7). "Fins" embellishing scrolls on the other vessels (Figs. 8, 9) differ in size or number from those found on the set of nine (Fig. 6). More specific attributes of the triangular appendages form an additional series of distinctive features. All of the vessels in the set of nine have three small, slightly concave hatched "fins" attached to both top and bottom of the scrolls (Fig. 6). One contrasting vessel has larger cross-hatched fins on

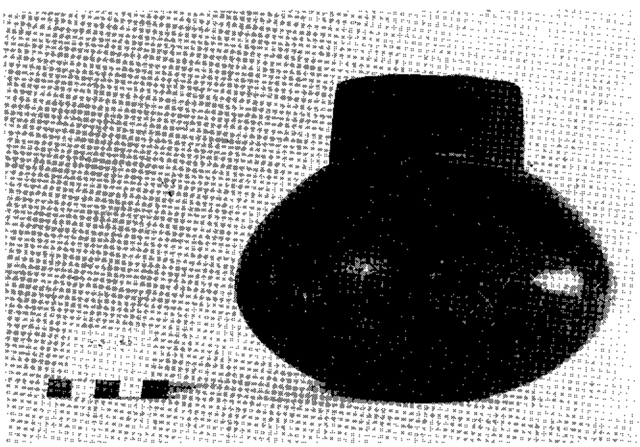

Figure 5. Moundville Engraved *variety Wiggins*. SD30. Third vessel contrasting with those of Wiggins Engraver.

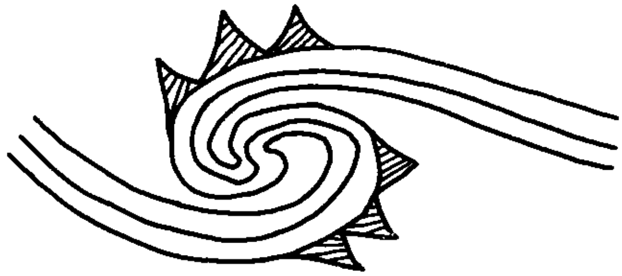

Figure 6. Schematic summary of salient features of Wiggins motif on the nine vessel set (— indicates continuous lines).

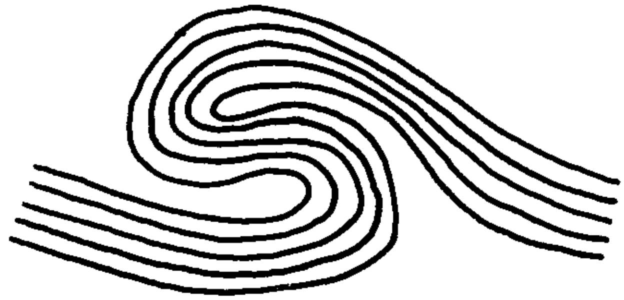

Figure 7. Schematic summary of salient features of Wiggins motif on RW227. (— indicates continuous lines).

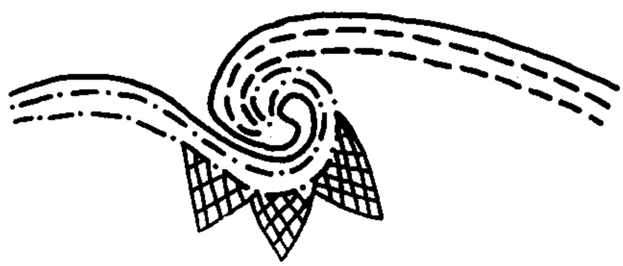

Figure 8. Schematic summary of salient features of Wiggins motif on E178. (— indicates continuous lines; - - - lines which turn back upon themselves; - · - lines which terminate in the center of the scroll).

the bottom only (Fig. 8). The other has large continuous fins, occurring on both the top and bottom of its scrolls (Fig. 9). The fins' hatched fill changes orientation abruptly.

More subtle differences marking individual style involve variation in details of technique used to render the scroll motif. The most telling differences involve the ways the lines actually turn and meet in the centers of the scrolls. The lines in the nine vessel set are all continuous; they circle relatively little but then turn abruptly, producing distinctive "points" in the center

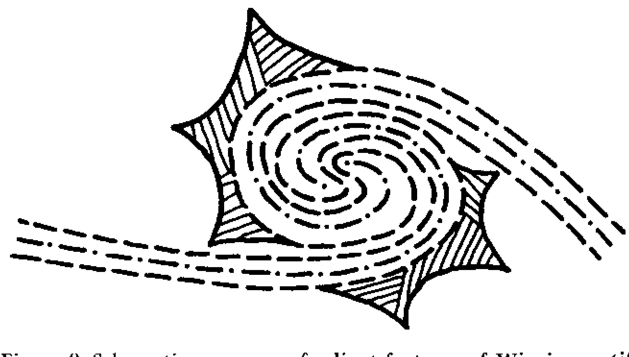

Figure 9. Schematic summary of salient features of Wiggins motif on SD30. (- - - indicates lines which turn back upon themselves; - · - lines which terminate in the center of the scroll).

of the circular pattern (Fig. 6). The scrolls on the first contrasting vessel are very loosely curled (Fig. 7). The lines on the second contrasting vessel circle fairly tightly; however, their paths vary, some turning back upon themselves and others terminating abruptly in the center of the scroll (Fig. 8). On the third contrasting vessel the exterior lines turn back upon themselves while the interior lines terminate in the center of the scroll (Fig. 9). These differences in the ways lines stop or proceed provide an example of how individual style is based not only on differences of technique but also on differences of strategy in constructing the motif. That is, the basis of individual style in Moundville Engraved ceramics is in part cognitive.

Technological Correlates of Individual Style Sets

Sets of vessels decorated by the same hand occur within at least three varieties of Moundville Engraved: (1) *variety Taylorsville;* (2) *variety Hemphill;* and (3) *variety Wiggins. Taylorsville* vessels from Moundville contain one large internally complex set of uncertain size as well as one clear pair. A second pair of *Taylorsville* vessels is of particular interest. One of the bottles was found at the Rhodes Site, a part of the Moundville complex, while the other bottle was found at Snow's Bend. Five small sets of two to four vessels are found among the Hemphill vessels. The exceptionally consistent set of nine vessels discussed above is found within the *variety Wiggins* vessels.

Independent corroboration of the stylistic identification of sets by the same hand was provided by similarities of vessel form, surface texture (probably reflecting clay, surface treatment and firing conditions), and building technique used for vessel bodies. Of these, similarities of building technique are the most obvious and easily described. The nine *Wiggins* vessels constitute the most salient case. In form they are similar—round bottom, somewhat "squashed" body. All nine were constructed in the same way: (1) the tops and bottoms were molded separately as bowl-shaped pieces; (2) a neck-hole was cut out of one piece; (3) the two halves were joined, leaving a horizontal seam at the vessel's maximum circumference; and (4) the necks, which are separately slab-built cylinders, were added.

The isomorphism between individual style sets and technologically defined sets strongly suggests that these Moundville engraved vessels were made and decorated in the same social context. At this point in the study, however, it is not reasonable to make any claim about the number of artisans involved in the production sequences.

Individual Style Sets as a Reflex of Increasing Standardization: Some Tentative Conclusions

The bottle forms are difficult to construct. At Moundville these ceramics give evidence of a long sequence of problem solving, beginning in Moundville I and continuing into Moundville III (Hardin 1979; van der Leeuw, this volume). If technique of vessel construction and resultant vessel form are used as temporal indicators (Steponaitis 1980b:47) the various individual style sets are seen to occur from late Moundville II to Moundville III. It is useful to consider the decorations engraved on the individual style sets as standardized designs. These sets occur during that segment of the developing bottle-building strategy in which "efficient" vessel construction techniques are achieved. Further, most of the designs are of a particular kind, being easily produced once mastered conceptually and technically. The kind of variation that marks the Taylorsville and Wiggins sets is reminiscent of the patterns of individual stylistic variation artificially created by James N. Hill in his Mexican experiments (1977) and is also quite like one pattern of individual style observed ethnographically within a traditional Tarascan cottage industry (Hardin 1977: 115-116). Each individual style set isolated in the Moundville ceramics may represent a worker's repetition of the same effective and easily produced design. Relatively little effort was being put into decoration, perhaps because the main focus of the potters' problem solving lay in technology, specifically, in building strategy.

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Ernest E. May

ARCHAEOLOGICAL GEOLOGY: PROBLEMS IN THE IDENTIFICATION OF CHERT TYPES AND SOURCE AREAS

Chert exploitation is characterized by three activities: selection, acquisition, and distribution. Thus defined, exploitation studies are important to models that account for group movement and contact, raw material preference, and exchange and redistribution (cf. Bell 1943). Three kinds of information are fundamental to exploitation research. First, the analyst must be able to identify regionally available cherts. This can be done on the basis of visual and tactile observations, or on a technological basis such as trace-element analysis. Secondly, the analyst must know where these cherts outcrop in the natural landscape, and which of these outcrops were prehistorically exploited. Thirdly, the analyst must know the location and spatial distribution of particular source area workshops, as well as the temporal affinities pertaining to those workshops (cf. May 1977, 1980).

Those aspects of exploitation research I am concerned with here are the ability to identify prehistorically utilized cherts, and the ability to locate those outcrops where they were exploited. This research requires a methodology that combines elements of both geological and archaeological description and interpretation. In essence, it is a methodology that synthesizes observations of both natural and cultural phenomena (Taylor 1948:93-110). The inherent differences between a natural science and a social science make it necessary to distinguish between geological and archaeological definitions of 'chert type' and 'source area', and to examine how similarities and discrepancies between those definitions contribute to a synthetic method for understanding chert exploitation.

Definitions

Geologists define chert as a fine-grained stone composed mainly of silica, which is usually associated with limestone deposits. The silica in chert may take several forms, including chalcedony, opal, cryptocrystalline or microcrystalline quartz, cristobalite, or some combination of these forms (Heinrich 1965:135). Chert is by definition 97-99% silica and silicon dioxide, with the admixture of water and small amounts of aluminum, calcium, iron, and magnesium oxides, calcium and magnesium carbonates, and carbon dioxide (Shepard 1972:29, 32; Tarr and Twenhofel 1961:529). The more common impurities in chert include carbonaceous material, detrital quartz, pyrite, chlorite, siliceous sponge spicules, radiolarian capsules, and other microfossils such as conodonts, foraminifera, brachiopods, bryozoans, ostracods, crinoids, and spores. Less common impurities include limonite, sericite, feldspar, clay, glauconite, silicified calcite crystals, and unreplaced calcite or dolomite (Frondel 1962:220-221; Spielbauer 1976:149-150).

Geological chert types are intended to reflect natural reality: a geological chert type should include only that chert which originates in a particular limestone formation. An advantage of this definition is that the presence of the limestone indicates the potential presence of its associated chert, and the presence of the chert indicates the necessary presence of the parent limestone, except in cases where erosion and/or redeposition have occurred.

Following from this definition of chert type, a geological source area is any place where chert outcrops or is otherwise exposed by any natural process. Chert may outcrop in an exposed section of the parent limestone, in the scree on an eroded slope, or in the gravel floor of a streambed.

Archaeologists would agree with the geological definition of chert as a fine-grained stone composed mainly of silica, and which is usually associated with limestone deposits. However, the only types of chert that interest archaeologists are those amenable to a predictable reduction strategy through the application of flintknapping techniques. These cherts are highly siliceous, relatively free of noncrystalline inclusions and fractures, have not been exposed to extensive weathering, *and* yield archaeological evidence of cultural exploitation.

Following this line of reasoning, an archaeological source area is any place where chert naturally occurs *and* is accompanied by evidence of prehistoric exploitation. Such evidence is indicated by the presence of workshops in the vicinity of the source, or by high frequencies of the chert in assemblages from the immediate area.

Convergence and Discrepancy

Within this context, differences between geological and archaeological definitions of chert type and source area are clear. Simply stated, archaeological definitions of these phenomena are more restricted. This restriction reflects the archaeological imperative to have demonstrated evidence of cultural exploitation associated with particular cherts and source areas. The implications of this restricted definition are twofold. First, where geological and archaeological interests converge, geological data and analytical techniques form a useful base for modeling episodes of prehistoric exploitation. Secondly, where there are discrepancies between the needs and capabilities of geological and archaeological research, it is necessary to reformulate pertinent geological data within a framework amenable to archaeological inquiry. Instances of convergence and discrepancy are best illustrated by example.

Geologists describe reality as accurately and completely as possible. Thus, the objective of a geological survey is to locate all chert exposures and describe the physical qualities of each chert type in detail. In many instances it is ideal for an archaeological chert type to be isomorphic with a geological type. Isomorphism enables the archaeologist to distinguish different cherts on the basis of their physical attributes, and to know the range of outcrops where they could potentially have been exploited by prehistoric populations. This exemplifies how convergence in chert type definitions provides useful information for archaeological analysis.

Although it is frequently ideal for geological and archaeological chert types to be isomorphic, this is not always possible or desirable. One reason why it is sometimes impossible to correlate chert types is that the visual, textural, and physical properties of more than one geological type overlap. It is therefore often difficult or impossible for geologists to distinguish between two or more natural chert types, and out of the question for an archaeologist working on the basis of macroscopic analysis. This is an example of discrepancy between what is archaeologically preferred and what is geologically feasible.

Another discrepancy arises during artifact analysis. It is sometimes impossible to discern one geological type from another because many chert specimens are too small to exhibit their full range of visual and textural variation. In many instances, if the specimens were larger, a proper macroscopic identification could be made. In some cases both the geological problem of overlap and the archaeological problem of specimen size compound the difficulty of accurate chert identification.

Other discrepancies between geological and archaeological definitions of chert types are desirable. In some cases several geological types share certain qualities that were prehistorically selected for. In those instances, an analytical type is constructed to demonstrate that certain attributes were selected for, rather than the geological type *per se*. This is not to say that the geological types become irrelevant in such a framework, but rather that mutually shared traits of these types are motivating the selection of each (cf. Goodyear 1979). Other analytical types are constructed to evaluate the differential selection and acquisition of nonlocal as opposed to local cherts. These types include all of the prehistorically exploited cherts found within a region or subregion, and enable contrast between these types and similar types from areas outside the region.

There are also useful instances of convergence in source area studies. Archaeologists can use geological descriptions of extant source areas to indicate the most profitable places to search for unidentified prehistoric sources. This can be done at several levels of survey, including regional and subregional searches, or simply in the interest of verifying whether or not a specifically described source was prehistorically exploited. Convergence in this context also extends to the geological identification of cherts, since geologists usually identify the limestone(s) producing the material at any given outcrop.

There are also discrepancies between geological and archaeological definitions of source areas. First, the presence of a geological source area does not guarantee that it was prehistorically exploited. Secondly, the presence of a modern source area does not necessarily mean that chert was available at that source in prehistoric times. Thirdly, some archaeologists use geological maps to locate limestone formations, and assume the presence of associated cherts on this basis alone. This is a dangerous procedure because the subsurface presence of a limestone does not necessarily mean it outcrops in a given area. If it does outcrop, it may not be chert bearing in that particular area. And even if it is chert bearing, archaeologists cannot assume the chert was available in sufficient quality and quantity for prehistoric exploitation.

Discussion

This simple overview has examined basic assumptions linking geological and archaeological research, and has pointed to this relationship's strengths and weaknesses for understanding prehistoric chert exploitation. I realize this discussion may be moot in areas with few exploited chert sources, or in areas where most of the lithic materials were imported. However, this is not the case in geologically complex regions, where exploited chert sources are numerous, and diversity and overlap among these materials is considerable. The logical relationships between geological data and techniques on the one hand, and the archaeological need to identify exploited cherts and their sources on the other hand, are fundamental for understanding significant aspects of prehistoric assemblages.

I will conclude by discussing three issues. First, it is necessary to understand not only the blessings afforded by trace element analysis, but also its shortcomings and inappropriate applications. Second, the value of comprehensive source area surveys must be considered. And third, the frequently overlooked power of artificially constructed typologies should also be mentioned.

The demonstrated and potentially useful applications of trace element analysis are well documented in archaeological literature (cf. Sieveking *et al.* 1972; Ives 1975; Spielbauer 1976; Luedtke 1978; Nance 1979). This technique is particularly powerful when the analyst's goal is to obtain isomorphic relationships between geological and archaeological chert types. It is also useful for differentiating between exploited and nonexploited source areas for chert deriving from one limestone, for determining the relationship between macroscopic and microscopic identifications of the same chert type, and its amenability for comparing the physical properties of geologically distinct cherts that appear to have been exploited for similar purposes.

On the other hand, archaeologists must understand the considerable sample size necessary for adequate trace element evaluation, and its cost. They must understand that analytical results for a portion of an assemblage do not necessarily reflect relationships within the remainder of that assemblage. Hard data demonstrate that many "successful" trace element analyses yield no better than high-powered probability statements (Sieveking *et al.* 1972:163, 164; Ives 1975: 29; Luedtke 1978:413, 420). Finally, in areas where the depositional environment was homogeneous over long periods, trace element analysis may well distinguish modes of variation, but instances of overlap in this variation may be sufficiently great to minimize the statistical significance of these distinctions.

In addition to trace element analysis, archaeologists should also understand the value of comprehensive source area survey. This is a particularly useful tool in regions containing numerous sources, since knowledge of one source for a particular chert does not preclude the presence of others. Although considerable spatial area may be involved, this can be efficiently reduced by stratifying survey coverage to concentrate efforts in locales with high outcrop potential.

Finally, the zealous embracing of techniques for precise chert identification has overshadowed simple, yet powerful taxonomic means for studying resource utilization. Typologies that arbitrarily cross-cut and group natural chert types are useful for addressing a range of hypotheses. These hypotheses include comparison of groups of cherts consistently selected for particular tool types; comparison of spatially adjacent source areas with those found in more distant places; and comparison of cherts sharing similar aesthetic qualities with other groups sharing different attributes.

Although geology contributes considerable information useful in archaeology, we must realize that sometimes these data and techniques must be manipulated and reformulated. This will permit us to address a wider range of hypotheses than is possible by adhering solely to distinctions found in natural reality.

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Thomas H. Guderjan

THE CANEY CREEK SITE COMPLEX: LITHIC RESOURCE CONSERVATION AND TECHNOLOGY

It is extremely difficult, in many cases, to determine site function or how a particular site fits into a larger settlement pattern. This is especially true for Archaic sites, as this period is often believed to be characterized by seasonal scheduling of activities to geographically different nodes or sites. In the absence of other forms of data and because stone artifacts are so ubiquitous a data resource, archaeologists have turned to various forms of lithic analysis to deal with site function.

This paper presents the results of analysis of stone artifacts from three sites, two Caddoan and one Archaic, and the application of that analysis to the question of site function. The analysis is typological, based upon processes of lithic reduction. The central concept of this approach is that the variability found among sites is indicative of the variability in activities and access to resources. Rather than dealing with variability among particular classes or categories of artifacts, this accounts for the variability in the entire configuration of the assemblages. Admittedly, this is an old approach to an old problem. However, it will be demonstrated that the approach may be efficaciously used.

The sorts of analyses generally used to interpret site function deal with the process of lithic reduction. Commonly, these analyses take the form of classifying lithic debitage into primary, secondary and tertiary flakes based upon the amount of cortex on the dorsal side. Then, if Site A has predominantly primary flakes, it may be a base camp. Site B, however, being more removed from the resources and only an extraction site, exhibits a lesser range of variability. There are variations on this theme. For instance, it has been attempted to identify stages of biface reduction. Then, these stage-of-reduction types such as "blanks, preforms and finished tools" are incorporated into the analysis (e.g. Skinner 1971).

Also, Raab, Cande and Stahle have identified flake length and platform angle of non-cortical flakes as attributes related to the process of reduction in the Ozarks (1979). By graphing these attributes, "debitage graphs" are constructed which show the trajectory of debitage at a site. Graphs of several sites may then be compared to each other to determine the relative range of activities at the various sites. For instance, a base camp graph will show greater variability than an extraction site graph.

During the summer of 1980, the Forest Grove Archaeological Project located a series of sites along Caney Creek, a small eastern tributary in the middle Trinity River basin about 90 miles southeast of Dallas, Texas. Two Caddo sites, the Watt Site #1 and the Geddie Site, were located. The Watt Site #1 is located on the bank of Caney Creek and has been exposed due to modern erosion from the filling of Cedar Creek Reservoir. The Geddie Site is located further upstream and is a small Caddo midden covering approximately 400 m². The final site to be examined is Archaic, the Watt Site #2. This site is situated on a high, flat, upland terrace and was located only by shovel testing. The lithic assemblages from these sites are derived from testing conducted in 1980.

Lithic Raw Materials

The Caney Creek area may be characterized as "stone-poor." The only lithic resources in the uplands are occasional quartzite cobbles and petrified wood eroding out of the underlying Wilcox formation. Most such materials have eroded due to modern land use and erosion and probably were not exposed prior to 1900. In the bottomlands of the Trinity basin, however, major exposures of the Uvalde gravels are found. These are found at the confluences of Caney Creek with Cedar Creek and Cedar Creek with the Trinity River, several miles downstream. These gravels exhibit a great range of variability in size and structure, with quartzites and cherts of various grades found together. The Uvalde gravels also are the raw material source for the Caney Creek sites.

Archaic and Caddo Adaptations

The Archaic occupation of the Trinity River is generally regarded as a system with a seasonal base camp with various extraction sites. Large midden sites near the river are regarded as base camps. The ubiquitous shell lenses and upland scatters, such as the Watt Site #2, are believed to be short-term camps (Richner and Bagot 1978).

The Trinity basin is the far western periphery of the Caddo area and very few sites are known. In the Neches valley to the east, small midden sites similar to the Geddie site appear to represent permanent hamlets (Anderson 1972). As so much of the Watt Site #1 is buried by alluvial and colluvial overburden, it is difficult to compare it to other known sites.

Archaic and Caddo Lithic Technologies

There are basic differences between Archaic and Caddo lithic reduction technologies. The Archaic is characterized by a dual bifacial and flake core technology. The bifacial reduction strategy is oriented around the manufacture of core tools, such as large dart points and bifacial tools. The debitage and debris from this strategy are by-products. The remaining nucleus is the intended product, the tool. The by-products may be separated into debitage and debris, a distinction which will be discussed shortly. The flake core reduction strategy differs in that the intended product is debitage while the exhausted core is a by-product. This is not to say that flakes removed in the bifacial strategy cannot be later modified. Flake core technology is clearly more efficient for the production of flakes. Bifacial reduction produces less suitable debitage and a greater debris to debitage ratio.

Debitage differs from debris in that it consists of those artifacts suitable for further modification for tools, or tool blanks. Debris is not suitable for further modification. Broadly, this distinction is based upon size. The smallest tool of an assemblage defines the lower parameter for debitage.

It is also possible to distinguish between the two strategies at various stages. Abandoned cores exhibt quite different approaches to reduction of the pebble.

Biface thinning flakes are characteristic of the biface strategy, while core trimming elements, although rare, result from the flake core strategy. It is also possible to occasionally distinguish the source strategy of non-cortical flakes.

Shafer has analyzed a large assemblage from the Caddoan George C. Davis site in Texas (1974). His findings there, confirmed at many other Caddo sites, indicate an orientation around small tool production based on a flake core reduction strategy. The large bifaces, characteristic of the Archaic are no longer incorporated into the Caddo lithic repertoire.

The Lithic Analysis

The lithic analysis of the Caney Creek sites was based upon understanding of these processes. Twelve artifact categories were used; four debitage categories, three debris categories, four tool categories and cores.

Primary Flakes are debitage with greater than 50% cortex on the dorsal side.

Flakes are debitage with less than 50% cortex on the dorsal side.

Core Trimming Elements are flakes which show the remnants of dysfunctional platforms on the dorsal side. Core trimming elements result from the rejuvenation of platforms on flake cores.

Biface Thinning Flakes are pieces of debitage which are generally very thin with complex dorsal ridge patterns and multifacetted, lipped platforms.

Cores are the remnant nuclei from the flake core strategy.

Chips are the debris counterpart of flakes. They are defined as being less than 13 mm long.

Retouch Chips are distinguished from chips on the basis of platforms. Retouch chips have dihedral platforms indicative of intentional removal of a ridge from a face of a tool.

Biface Thinning Chips are the debris counterpart of biface thinning flakes, being less than 13 mm in length and usually less than 10 mm.

Marginally Retouched Pieces are debitage which have undergone minor edge modification. It is not clear whether this is intentional modification or the result of use.

Unifacial Tools, Bifacial Tools and *Projectile Points* clearly need no explanation.

Table 1 presents the results of the analysis. This is presented graphically in Figure 1. It is noteworthy that the numbers of artifacts in the debris types are limited by the collection technique. All excavated material was screened through 1/4" mesh hardware cloth. This clearly is a collection bias towards large artifacts, but the bias is consistant through the samples. Table 1 and Figure 1B were constructed by adjusting the frequencies. Since the category "chips" included such a large percentage, it was removed and the frequencies recalculated accordingly. This was done to better illustrate the differences among the assemblages.

Figure 1B shows that the general nature of the assemblages are quite similar. This is reasonable and expected. It cannot be forgotten that these assemblages are all the results of quite similar processes. Variability in the lithic reduction process will never be so great as to produce unrecognizably different graphs. Looking at Figure 1B, it is apparent that flakes, biface thinning flakes, retouch chips, and biface thinning chips are all large categories. Specialized categories, core trimming elements, cores and the various tool categories are poorly represented in all assemblages. Again, this is expectable. The core:debitage ratio is necessarily quite low. As core trimming elements are removed only after several previous flakes, the core trimming element: debitage ratio is also low by necessity.

Table 1.

A. Relative Frequencies

	Watt Site #1		Watt Site #2		Geddie Site	
Primary Flakes	22	6.4%	11	9.0%	44	13.0%
Flakes	60	17.5%	17	13.9%	58	17.1%
Biface Thinning Flakes	36	10.5%	15	12.3%	11	3.2%
Core Trimming Elements	1	.3%	3	2.5%	2	.6%
Cores	1	.3%	3	2.5%	1	.3%
Chips	176	51.5%	34	27.9%	153	45.1%
Retouch Chips	23	6.7%	22	18.0%	32	9.4%
Biface Thinning Chips	23	8.2%	9	7.4%	19	5.6%
Marginally Retouched	2	.6%	8	6.6%	3	.9%
Unifaces	1	.3%	0	0%	2	.6%
Bifaces	1	.3%	0	0%	5	1.5%
Projectile Points	1	.3%	0	0%	9	2.7%
Totals	354	102.6%	122	100.1%	339	100.0%

B. Adjusted Relative Frequencies

	Watt Site #1		Watt Site #2		Geddie Site	
Primary Flakes	22	12.5%	11	12.5%	44	23.7%
Flakes	60	34.1%	17	19.3%	58	31.2%
Biface Thinning Flakes	36	20.5%	15	17.0%	11	5.9%
Core Trimming Elements	1	.6%	3	3.4%	2	1.1%
Cores	1	.6%	3	3.4%	1	.5%
Retouch Chips	23	13.1%	22	25.0%	32	17.2%
Biface Thinning Chips	23	15.9%	9	10.2%	19	10.2%
Marginally Retouched	2	1.1%	8	9.1%	3	1.6%
Unifaces	1	.6%	0	0%	2	1.1%
Bifaces	1	.6%	0	0%	5	2.7%
Projectile Points	1	.6%	0	0%	9	4.8%
Totals	186	103.6%	88	99.9%	186	100%

Several points (A-D) are labelled on Figure 1B and are of interpretive importance. These will be discussed, moving from left to right across the graph.

A-Flakes. Clearly a distinction may be made between the percentage of flakes at the Archaic Watt Site #2 and the two Caddo sites. It is also noteworthy that the Caddoan Geddie Site exhibits a high percentage of primary flakes, while the Watt Site #1 exhibits a very high percentage of flakes. This pattern may be viewed as a result of lesser initial stone working at the Archaic site, large pieces of debitage not being present.

B-Biface Thinning Flakes. The frequency of biface thinning flakes at the Geddie Site is much lower than that of the other two; biface thinning flakes generally present the last stages of tool manufacture or early stages of tool rejuvenation. The low frequency at the Geddie Site may indicate that little need existed for rejuvenation of tools because of good access to resources. Looking back to the primary flake frequencies, where the Geddie Site has a high frequency, this is even more reasonable. The high frequency of biface thinning flakes at the Watt Site #1, also a Caddo site, coupled with the high frequency of flakes at that site reflects the existence of a wide range of reduction activities at the site. On the other hand, the high biface thinning flake frequency at the Archaic Watt Site #2, considered with the low flake frequency, indicates an emphasis on tool finishing and rejuvenation.

FIGURE 1

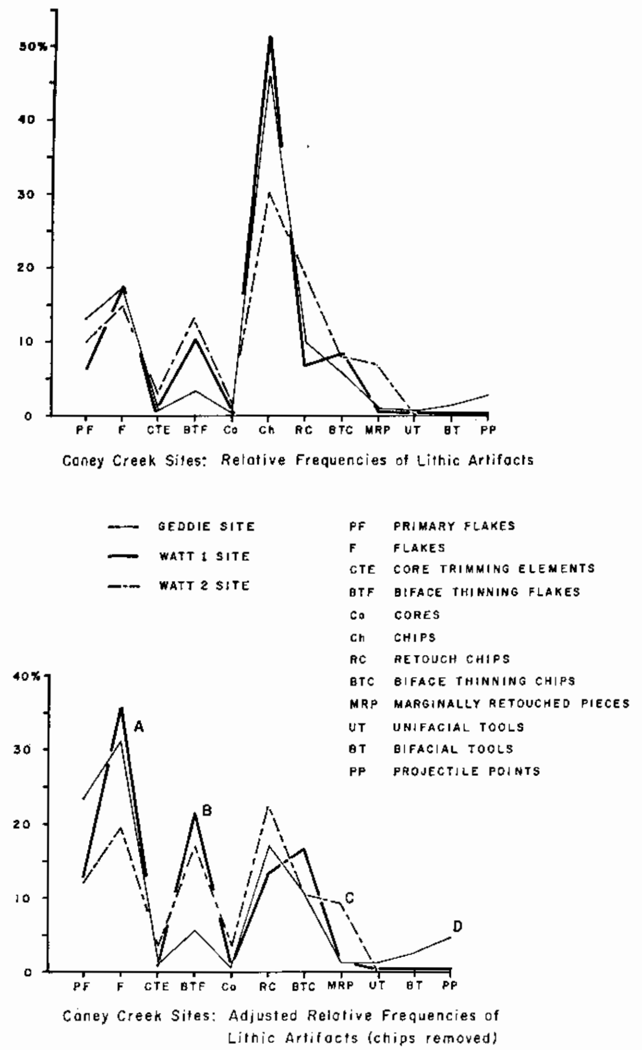

Figure 1.

C-Marginally Retouched Pieces. Both the Caddo sites have very low frequencies, while the Archaic Watt Site #2 has a high frequency. This indicates a high level of resource conservation at the Watt Site #2, where tools are being manufactured on smaller pieces than if the lithic resource was abundant.

D-Projectile Points. The Geddie site exhibits a high frequency of projectile points, while the other two sites are uniformly low. Most of these points were broken during manufacture, indicating on-site manufacture. Table 2 summarizes the cogent points of the analysis.

Interpretive Summary

The Geddie Site. This is a small Caddo midden and the site furthest upstream along Caney Creek. Importantly, it is the most distant from the Uvalde gravels of the Trinity River. Similar sites have been considered permanent hamlets in the Neches River (Anderson 1972).

The lithic analysis indicates a high frequency of debitage from the early stages of reduction and a low frequency of the later stages, especially of bifacial reduction. There is a high frequency of complete projectile points and bifacial tools. This assemblage is interpreted as being a reflection of activities of a permanent site which has constant access to raw materials, regardless of the distance to the source. This site may have interacted in a network of scattered hamlets.

The Watt Site #1. This is a small Caddo site, approximately half as far from the Uvalde gravels as the Geddie Site. No analogies to other Caddo sites could be found. The site exhibits a wide range of lithic activities with high frequencies of flakes and biface thinning flakes. This indicates that although access to raw materials was good, it was also limited. Peripheral short-term occupations would be expected to yield this pattern if, initially, adequate material was transported to the site, but later, conservation of resources became necessary. Certainly, no constant access to the resource is indicated.

The Watt Site #2. This is an upland Archaic site, with a dispersed scatter covering several acres. The lithic assemblage exhibits low frequencies of the initial stages of reduction, but a high frequency of biface thinning flakes. It is predictable that many biface thinning flakes would be found, because of the dual reduction strategies of the Archaic. When this is high, to the exclusion of primary flakes and flakes, it is indicative of tool rejuvenation rather than manufacture. This is also reflected in the high frequency of marginally retouched pieces. The Watt Site #2, then, had low access to resources and high degree of lithic conservation. This is interpreted as a specialized activity site which had very limited access to resources. Further occupation was of such duration that conservation of lithic resources was necessary.

Table 2. Summary of Lithic Analysis.

	Geddie	Watt #1	Watt #2
Flakes	High	High	Low
Biface Thinning Flakes	Low	High	High
Marginally Retouched Pieces	Low	Low	High
Projectile Points	High	Low	Low

Conclusion

This analysis has been presented to demonstrate that stone artifact assemblages constitute data which lend themselves to aspects of behavior. Specifically, economic behavior related to lithic technology and conservation may be understood. Such analyses may also be used as confirming or disconfirming evidence for settlement related hypotheses. For instance, the Geddie Site, being similar to Neches River hamlets, may be postulated to also be a permanent hamlet. The lithic evidence confirms this interpretation.

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Michael J. Kaczor and John Weymouth

MAGNETIC PROSPECTING: PRELIMINARY RESULTS OF THE 1980 FIELD SEASON AT THE TOLTEC SITE, 3LN42

The Toltec site, 3LN42, consists of a multiple mound complex of over 100 acres enclosed by an earthen embankment. Several culture periods are represented, although ceramics (Stewart-Abernathy 1979) from excavations to date indicate that major occupation and mound construction occurred during the Late Baytown and Coles Creek periods, roughly A.D. 600 to 1000[1] (Belmont 1979; Phillips 1970:7).

Geographically, the site is located some 15 miles southeast of Little Rock within the Arkansas River Lowland. Entrenched and meandering streams are typical of the area, and the Toltec site is situated on the cutbank levee side of one of these abandoned channels. Local water well records indicate that a graded sequence of fine-grained Late Quaternary alluvium exists to a depth of over 100 ft. Three different alluvial strata of variable thicknesses are present at Toltec (Kaczor 1979). Within the uppermost, Stratum 3, three soil horizons have developed differentially along the overbank slope gradient. Artifacts and cultural features recovered thus far have been primarily restricted to the uppermost part of Stratum 3, and are generally contained within the A, A/B horizon interface, or are intrusive into the B horizon.

Due to the paucity of prior field work, the initial stage of archeological research has focused on determining the nature and extent of the site's physical and cultural deposits. One major aspect of this investigation has been the excavation of 1 x 2 m unaligned, stratified random test units (Rolingson 1978) within a designated Random Sample Area (RSA). During the 1978/79 field seasons 32 RSA units were excavated for 0.75% sample. Thus projected, it could take as much as a decade to produce a 1% sample of the entire site, including perhaps many areas of negligible aboriginal activity. The key problem then is to quickly identify the activity areas present within Toltec's enormous spatial dimensions and sample them with a proportionally larger number of units without causing any unwarranted damage to a preserved National Landmark site.

At the close of the 1979 field season it was decided that in planning for additional site sampling, a remote sensing technique was needed that would allow us to locate discrete activity areas, such as house floors, storage pits, mound remnants, and middens. Geophysical prospecting methods such as resistivity, proton magnetometry, and ground penetrating radar have been successfully used at other sites to determine the location and depth of archeological features (Aitken 1974; Bevan 1975; Tite 1972; Vickers 1979; Weymouth and Nickel 1977).

Several environmental and physical factors all need to be considered before implementation of a subsurface survey (Breiner 1973; Scollar 1969; Nickel 1979). Although several survey methods show potential for use at Toltec, the selection of proton magnetometry was primarily based on: (1) the type and stratigraphic layout of the cultural and natural soil deposits and their potential for showing differences in magnetic susceptibility; and (2) the greater relative amount of work that has been done with magnetometry and the reliable results that have been attained (Black and Johnston 1962; Weymouth and Huggins 1979).

The 1980 magnetometer survey at Toltec was a pilot feasibility study with survey coverage limited to selected areas of the site (Fig. 1). Nine test blocks were laid out in areas that would yield information on a variety of archeological and soil contexts—some known, others unknown. The survey was divided into three phases. Phase I consisted of surveying each block and a 10 m area around it with a metal detector. This enabled us to screen the locations of historic metal trash as well as the potential anomalies produced by this material.

Phase II consisted of some experimental work with a differential mode gradiometer based on the design of Steponaitis and Brain (1975). Our success with this instrument, however, was primarily limited to the relocation of our old, 1978/79 excavation units, and was, at best, inconclusive.

Phase III of the magnetic survey consisted of a 1½ day survey contract by a team under the direction of Dr. John Weymouth of the University of Nebraska Physics Department. Block priorities were established and a grid interval of 1 m was selected. Two Geometric (Model G816) proton magnetometers with digital readout capacity were used at a sensitivity interval of ¼ gamma. Due to certain time restrictions and field conditions, only 7 of the original 9 blocks were surveyed for a total of 1550 m². Upon completion of the survey, all of the data were punched on cards for manipulation and magnetic map printouts of computer programs developed by the Nebraska Center for Archaeophysical Research (NEBCAR).

After reviewing the SYMAP contour maps and such factors as crew personnel and duration, four magnetometer blocks were selected for excavation in 1980. Within each block, trenches and units were selected and ranked according to a multiple set of objectives. These objectives included testing both similar and different kinds of magnetic anomalies, clarifying previous soil stratigraphic data, confirming mound remnant construction, suspected features, and attaining additional artifact samples. The blocks selected were 5, 7, 8, and 9 at the base of Mound B, Mound E, RSA-B (Mound S), and Mound G, respectively.

Block 5, Mound B Base

In Block 5 at the base of Mound B, several subtle low and high monopolar anomalies and one dipolar anomaly were detected (Fig. 2). In order to test one low region a 2 x 2 m unit was centered over the N400E400 coordinate where a datum was to have been emplaced previously but stopped because of a charcoal concentration. Another 1 x 2 m unit was put in to cut across this same low area and adjacent area of higher magnetic value.

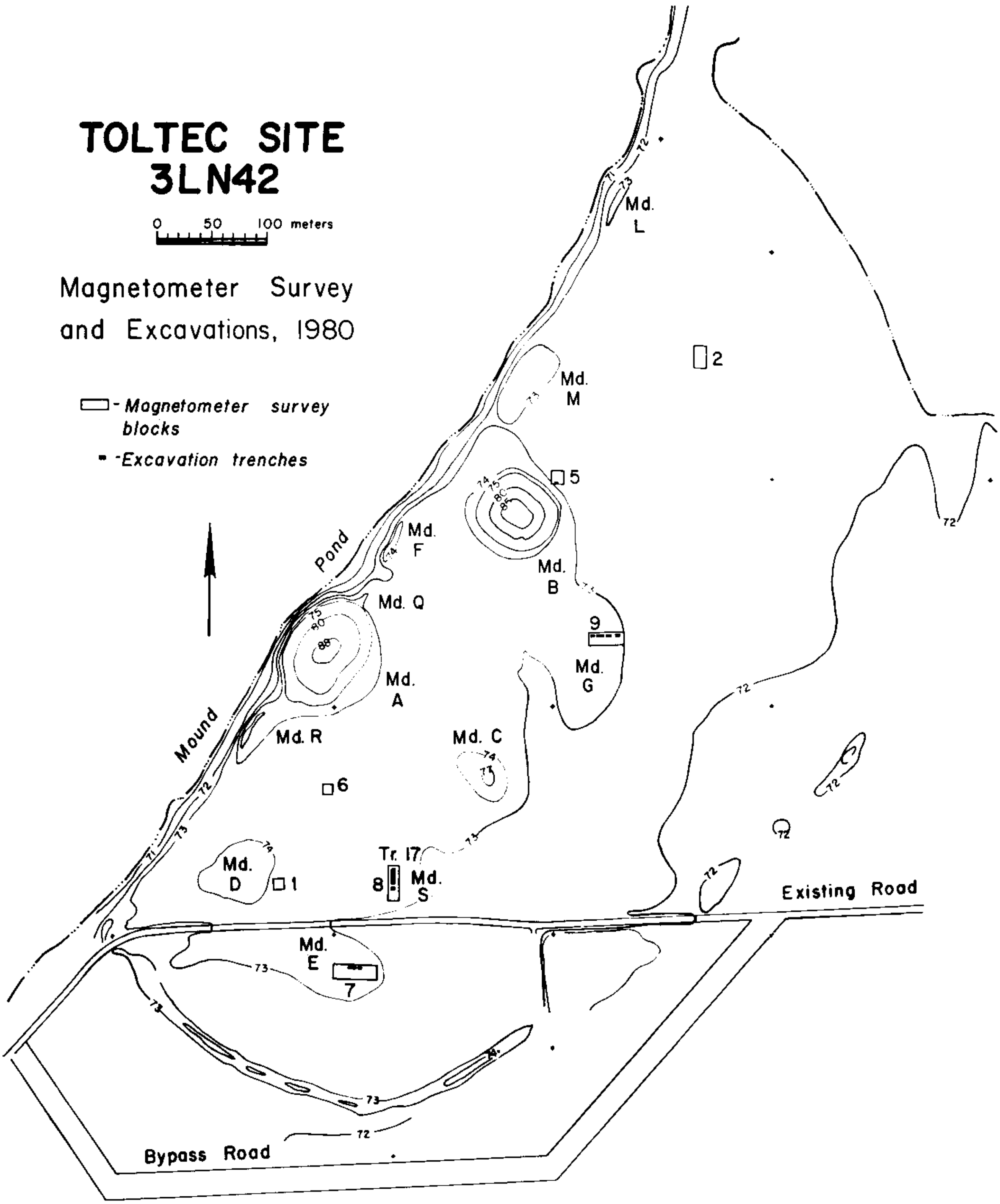

Figure 1. Map of Toltec site showing location of 1980 test blocks for magnetometer feasibility study.

The soil sequence in both excavation units was somewhat simplified and very weathered. Here, the B horizon is within 26-30 cm of the surface, and the plowzone is thin and rests on an apparently truncated A horizon. Three associated features consisting of ash and charcoal were broken out in N399E399. The primary feature (B-5) was a small basin shaped hearth approximately 35 cm below surface.

The magnetic trends in the excavation area show that the hearth and associated ash and charcoal features did not register in the survey. This is perhaps explainable by the lack of baked soil, and the presence of the large soil mass in Mound B nearby and *above* the ground. A more subtle magnetic trend can be directly correlated, however, between the higher, positive gamma readings and the artifact density/degree of A horizon development. The eastern half of unit N398E401 displayed higher relative readings on the

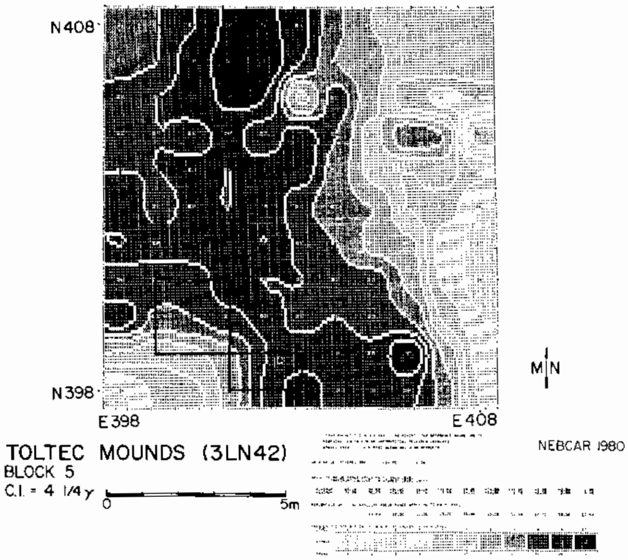

Figure 2. Magnetometer SYMAP contour map with excavation units at Mound B base test block.

order of 9-16 gammas. This correlated very well with the increased intra-unit density (2:1 ratio) distribution of artifacts and observed A horizon enhancement. The same held true for the 4-5 positive gamma difference in the NE corner of N399E399 where an even more dramatic correlation between the magnetic contour and artifact density was observed.

Block 7, Mound E

The magnetic trends in Block 7 on Mound E consist of several, variably sized monopolar anomalies of both high and low values (Fig. 3). A total of three aligned 1 x 2 m units were excavated. Two of these were continuous and partially covered a roughly 5 x 8 m anomaly of high gamma value while the other unit was put in to investigate a portion of a rather distinct dipolar anomaly.

The soil sequence consists of a thin plowzone, construction loading, submound midden A horizon, A3 and B horizons. The construction loading is of variable thickness, but is most prominent (by about 30 cm) in the two continuous units. Within these units, the loading could be broken out into primary A horizon silts overlapped in a lateral extension by primary B horizon silts. The submound A horizon surface is particularly well developed with lots of cultural debris.

A total of seven features and soil stain/post molds were excavated. Most of these originated in the middle zone of the A horizon, and except for Feature E-1 midden, appear to have had no effect on the survey and were either too subtle or deep and/or masked by loaded soil overburden.

The high magnetic region tested was apparently influenced by both the staging and type of loaded soil. In the westernmost part, the high gamma readings were influenced by a neutral or slightly positive A horizon loaded soil and underlying culturally developed A horizon. A comparison of the two continuous units by artifact density and soil development showed no significant difference, yet one has much lower positive readings. This apparently is due to the B horizon loading which is strongly masking the magnetic intensity of the underlying A horizon surface.

The magnetic values in unit S31E221 can be attributed to Feature E-1, an off-mound midden interfaced between the plowzone and submound surface. These higher positive values coincide almost precisely with the horizontal mapping of Feature E-1's extent in this unit, as well as the 1979 excavation unit where a particularly dense artifact concentration was recovered (Fig. 4).

Block 8, RSA-B TR-17/Mound S

The magnetic trends in Block 8 in RSA--B (now also Mound S) show several dipolar anomalies in addition to two distinct "high" regions (Fig. 5). The excavations in this block consisted of a 1 by 14 m long trench (TR-17) that cut into one of the two magnetic high regions between our old excavation units, and a 1 by 2 m unit just 2 m south of the trench to investigate a smaller dipolar anomaly.

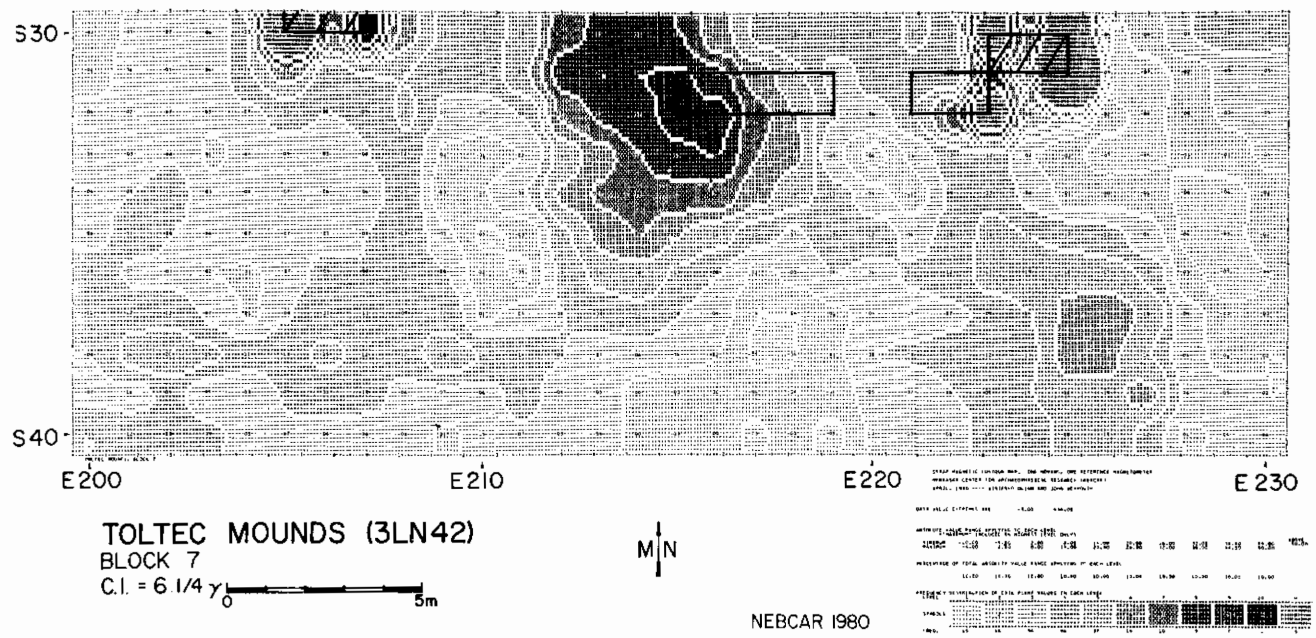

Figure 3. Magnetometer SYMAP contour map with excavation units on Mound E test block. Hatched units indicate 1979 excavations.

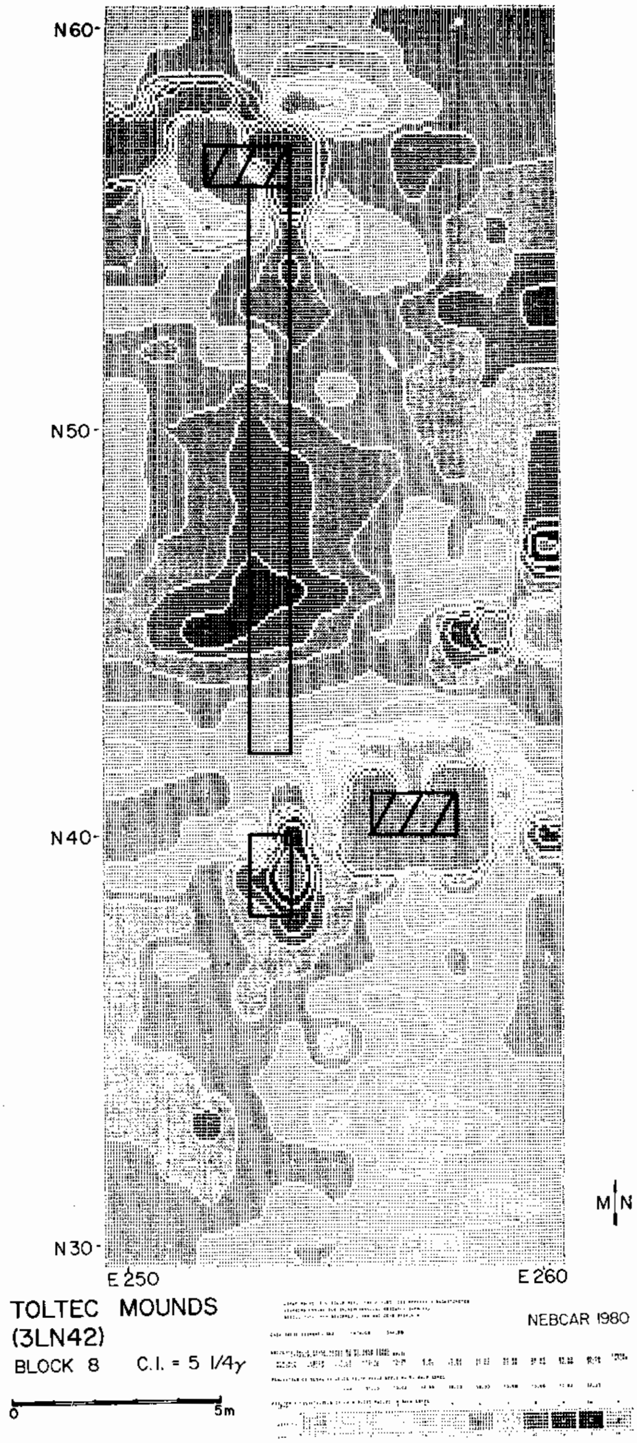

Figure 4. Mound E unit with Feature E-1 midden artifacts distributed along magnetic contour of very high gamma values.

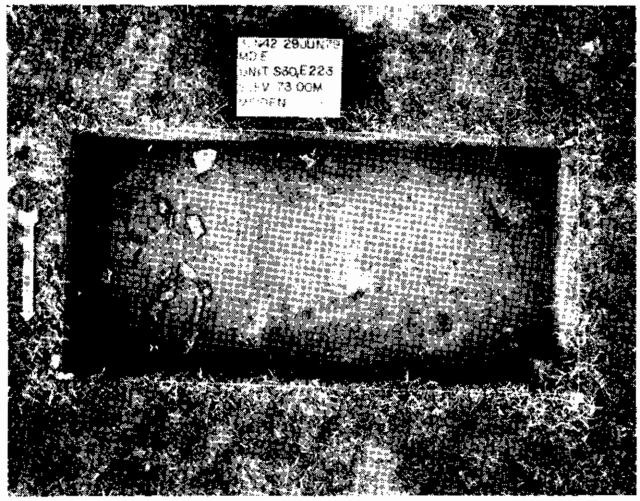

Figure 5. Magnetometer SYMAP contour map with excavation units in Mound S test block. Hatched units indicate 1979 excavations.

Stratigraphically, the area consists of a plowzone (Ap), loaded soil, and A and B horizon silts. The plowzone extends to a depth of about 22 cm and the loaded zone consists primarily of badly weathered A horizon material ranging from 15-30 cm thick. The underlying A horizon is somewhat more compact and contains all of the in situ midden artifacts.

Four features were identified and excavated within TR-17. The dipolar anomaly situated at the south end of TR-17 is obviously a result of Feature 3, a historic trash pit. In the northern part of TR-17, Features 1 and 2 did not show up when mapped at the 1.25 gamma interval. Feature 1, a post mold, was apparently too small and deep to produce a visible anomaly, while Feature 2, a small ovoid pit, produced only an undetected one gamma "inflection". However, when re-run at a finer 0.63 gamma interval, the magnetic contour showed Feature 2 clearly.

The high monopolar anomaly centered at the middle part of TR-17 was not as dramatically obvious as the dipolar anomaly representing Feature 3. Field observations indicated that the magnetic influence was a sherd concentration at the N46E253 coordinate, in addition to a thin, discontinuous zone of midden soil and debris within this area. A more subtle correlation exists, however, between the relative magnetic values of each trench unit and the density (by weight) of artifacts recovered from the submound A horizon surface, as can be seen in the following:

TR-17 Unit	N42	N44	N46	N48	N50	N52	N54
Avg. Magnetic Point Value	5γ	15γ	27γ	21γ	20γ	9.5γ	17.5γ
Artifacts/unit	298g	467g	1139g	784g	658g	413g	621g

Block 9, Mound G

The magnetic trends in Block 9 on Mound G are much more generalized, showing a very low central region flanked by two higher or more positive areas (Fig. 6). Five discontinuous 1 by 2 m units covering all three areas were excavated along a single trench line across the northern part of the block.

As tested, this remnant portion of Mound G contains a typical stratigraphic sequence of plowzone, 15-35 cm thick loaded stage of A (80%) and B (20%) horizon silts, in situ artifact-bearing A horizon, and B horizon.

Nine features, including post molds and small pits were excavated along with 8 other amorphous soil stains and 2 artifact clusters. Most of these originated in the middle-lower part of the A horizon and extended down into the B horizon. Only two features appear to have influenced the magnetic readings. Feature G-1, a small basin shaped pit, gives a one point anomaly of 2-3 gamma, as does Feature G-9, another small pit filled with midden debris. In general, the eliptically shaped core area of very low magnetic values corresponds well with the remnant soil construction staging containing variable amounts of A and B horizon silts. To the east the complex of small monopolar anomalies

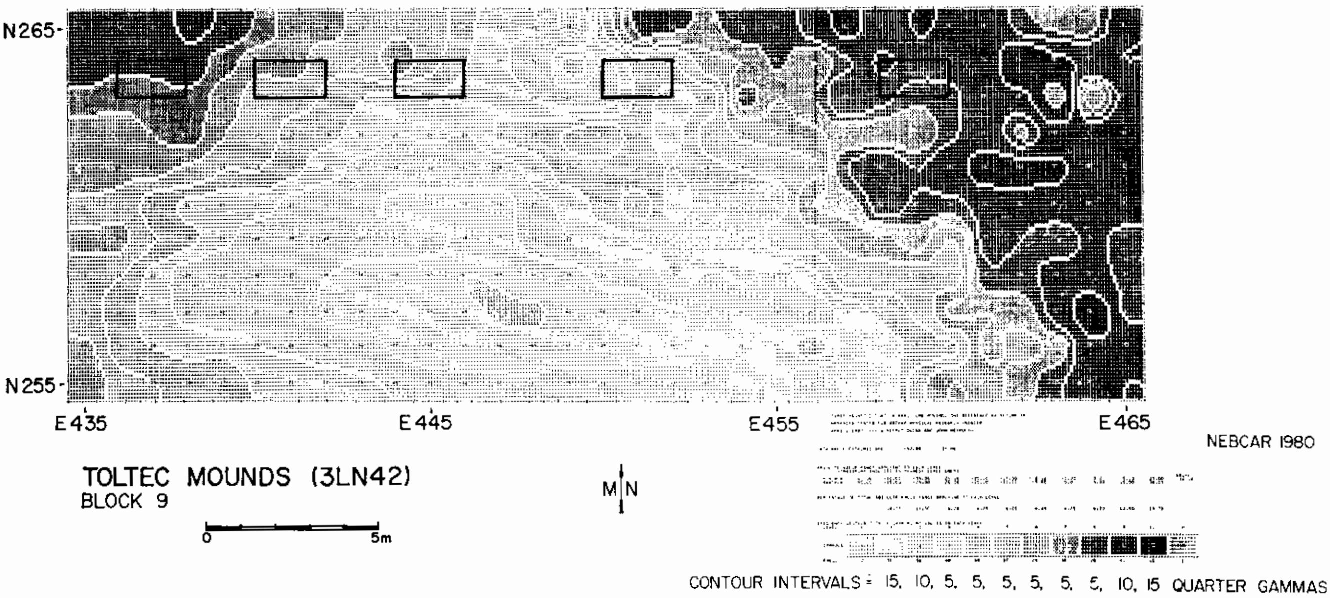

Figure 6. Magnetometer SYMAP contour map with excavation units in Mound G test block.

of higher gamma values is due primarily to the presence of pushed over mound debris, as well as a notable increase in historic material and metal objects.

Summary

Overall, the excavation data point to several trends in the magnetic values and contour maps generated by this magnetometer survey. Briefly, these are:

(1) The checkered patterning of extreme low and high values in mound areas is due to the construction loading of A and B horizon silts. A horizon soils reflect high magnetic values, while the B horizon reflects very low positive or negative values.
(2) Depending on thickness, B horizon soils utilized in construction loading will mask the potential values of underlying middens, floors, or features.
(3) The degree of positive gamma values can be correlated with the relative cultural enhancement of the A horizon and density of artifacts. In Blocks 7, 8, and 9, 15 out of the 16 units excavated showed a direct correlation between the number of artifacts by weight recovered in the submound midden/A horizon surface and the relative degree of higher or positive gamma values.
(4) Off-mound areas in Blocks 5 and 7 show a very precise correlation between the magnetic contour and mapped distribution of artifacts within a midden soil.
(5) Some but not all pit features will show, although finer gamma filtering and mapping may produce these sometimes ephemeral features.
(6) Several monopolar and dipolar anomalies correlated with features recorded from excavations.

While all of the data have yet to be analyzed completely, the preliminary results clearly show the potential for the magnetic prediction of artifact densities and features within occupation activity areas, as well as denoting non-activity areas across the site. More work is anticipated for the 1982 field season which will be used to test some of the predictive concepts generated by the 1980 results.

The success of this pilot study also demonstrates the potential applications for magnetometer survey at other sites within eastern Arkansas as well as the entire Southeast where analogous alluvial soil and geomorphic conditions also exist.

Footnote:

[1]One radiocarbon date (treering calibrated) of A.D. 805 ± 71 (SMU-832) has been determined from Feature B-1 on Mound B. Feature 1 is located about halfway up the 12+ m high platform mound.

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