3-1982

An Examination of the Variability in the Mississippian I and II Lithic Assemblages at the Martin Farm Site (40MR20), Tennessee

Charles Clifford Boyd
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Charles Clifford Boyd entitled "An Examination of the Variability in the Mississippian I and II Lithic Assemblages at the Martin Farm Site (40MR20), Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Gerald F. Schroedl, Major Professor

We have read this thesis and recommend its acceptance:

Jefferson Chapman, Charles H. Faulkner

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Charles Clifford Boyd, Jr., entitled "An Examination of the Variability in the Mississippian I and II Lithic Assemblages at the Martin Farm Site (40MR20), Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Gerald F. Schroedl, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

AN EXAMINATION OF THE VARIABILITY IN THE MISSISSIPPIAN I AND II LITHIC ASSEMBLAGES AT THE MARTIN FARM SITE (40MR20), TENNESSEE

A Thesis

Presented for the

Master of Arts

Degree

The University of Tennessee, Knoxville

Charles Clifford Boyd, Jr.

March 1982

ACKNOWLEDGMENTS

Many persons have provided me with the support I have needed to complete this project. Herein I will mention those persons who have influenced me the most.

First, I wish to thank the members of my committee, Dr. Gerald Schroedl (chairman), Dr. Charles Faulkner and Dr. Jefferson Chapman for their suggestions and criticisms. I have learned a great deal from all of them.

I want to especially thank Bill Baden, Steve Davis and Larry Kimball for their unflagging support. Bill patiently helped me work out many of my analytical problems and provided me with constant friendship and advice, as he has done for the past four years. From Larry I learned all that I know about lithic technology. Larry first suggested that I analyze the Martin Farm lithics, and has been the source of many of the ideas and concepts I have incorporated into this report. Steve has also given me much advice and support. His analysis of the Martin Farm ceramics helped me formulate many of my own conclusions.

Many thanks are due Nancy Bell, Neal Brun, Brett Riggs and Tom Whyte for answering my questions concerning some of the more complex Martin Farm artifacts. Neal was also responsible for drafting the figures in this thesis. Marla Baden entered the data from the 1967 Martin Farm excavations onto the DEC system-10 files.

This research was made possible by several contracts and grants by the National Park Service and the Tennessee Valley Authority for both fieldwork and laboratory research.

I would also like to thank my parents, Mr. and Mrs. Clifford Boyd, Sr.--my gratitude for their patience and assistance is unlimited.

Finally, I want to offer a very special thanks to my wife, Donna. She entered the 1975 Martin Farm excavation data onto the DEC system-10 and she typed the first drafts of this thesis. Most importantly, she provided the moral support I needed to endure.

ABSTRACT

The goal of this study is the examination of the temporal variability between the Mississippian I and II Period components at the Martin Farm site (40MR20) in terms of their lithic assemblages. Lithic artifacts from the 1975 excavations are studied, and only artifacts from well-dated contexts are used for this analysis. These artifacts are compared to the lithics from Feature 325, a Mississippian I feature at Tomotley (40MR5), and to late Woodland III Period Features 20 and 80 from Jones Ferry (40MR76).

A total of 9938 lithic artifacts are analyzed using a nominal categorization of discrete variables. Data produced by this categorization are presented and analyzed using bar graphs and the chi-square test to delineate functional, formal and technological variability in the assemblages studied.

Sixty-five projectile points and 626 flakes are further analyzed using a multivariate coding system for continuous and discrete variables. Data obtained from this coding system are analyzed and compared by means of t-tests, principal-component analysis and cluster analysis. Eleven metric attributes, such as length, width and thickness, on the projectile points and 10 metric attributes on the flakes are analyzed. Seven discrete or non-metric attributes are also noted for both the projectile points and debitage.

Analysis of the projectile points indicates that the Hamilton Incurvate, Madison and incurvate base/straight blade (Mississippian) projectile point types occur in all the assemblages examined with no

significant differences in frequency. This shows that these projectile point types are not the distinctive Woodland or Mississippian temporal markers they were once thought to be.

The bifacial thinning flakes from the earlier Jones Ferry Feature 80 context have smaller platforms and larger bulbs of force than those of the Martin Farm assemblages, but these differences may be due to inadequate sample size. The overall similarity of the assemblages examined, however, supports the model of a gradual, in situ development of Mississippian out of Woodland in eastern Tennessee.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Statement of the Problem

The specific purpose of this study is the definition of lithic assemblage variability in the Mississippian I and II period components at the Martin Farm site (40MR20). A second goal of this research is an examination of the development of the Mississippian period in the Tellico Reservoir area through the analysis of lithic artifacts. For this reason, the Martin Farm assemblages are compared to Feature 325, a Mississippian I feature from Tomotley (40MR5), and Features 20 and 80, Late Woodland III features from Jones Ferry (40MR76). The lithic analysis considers:

1. The comparison of the lithic reduction methods used by the occupants of Martin Farm, Jones Ferry and Tomotley during the Late Woodland III and Mississippian I and II periods.
2. The variation in projectile point forms between the lithic assemblages from these temporal units.
3. The variation in the formal characteristics of the debitage between the assemblages.
4. The identification and comparison of the number of tools and debitage used in the assemblages, and the evaluation of the probable functions of these artifacts.
5. The comparison of the types of lithic raw materials used in the production of lithic artifacts in the assemblages.

6. The variability in the occurrence of heat alteration on the lithic artifacts in the assemblages.
7. The variability in the lithic assemblages from the features, structures and general levels of the Mississippian I and II period occupations at Martin Farm.

The points listed above are addressed in order to examine the functional, formal and technological variability of the assemblages.

Functional variability of the lithic assemblages is examined by comparing the frequencies of functional activity groups. Variation in the frequencies of these activity groups in the Martin Farm, Jones Ferry and Tomotley assemblages could indicate differences in the activities represented by these assemblages. These differences could have contributed to differences in the formal and technological variability of the lithic artifacts.

Formal variability is addressed primarily through the metric analysis of the projectile point and debitage morphology of lithic artifacts from selected Martin Farm and Jones Ferry features. These contexts have secure radiocarbon dates and show little or no post-depositional mixing. In addition, projectile points from non-dated contexts closely associated with the Martin Farm features are similarly analyzed in order to increase the sample size of projectile points for each Martin Farm assemblage.

Technological variability is also addressed through the metric analysis of the debitage and projectile points from the well-dated contexts. In addition, technological variability is examined by comparing the assemblages in terms of the frequencies of nominal technological

artifact categories, the types of raw materials used in lithic artifact production, and the occurrence of characteristics indicating heat alteration in the artifacts.

The analysis of these variables is used to test a proposed model of lithic assemblage variability for the Mississippian I and II periods in the Tellico Reservoir area. The model states that there is no significant variability between the lithic assemblages of these two periods in terms of their functional, formal, or technological characteristics. This is because these periods represent points along a line of gradual, in situ cultural development from a Woodland to a Mississippian lifeway, and this is reflected in their similarity to the Woodland feature assemblages from Jones Ferry. A more conservative subtractive technology, such as lithic tool production, will reflect little change over a short time period, while an additive technology, such as ceramics, will more readily reflect short temporal differences.

Previous Research on the Woodland to Mississippian Transition

Culture change between the Woodland and Mississippian periods in the eastern Tennessee valley has been examined by many researchers (Faulkner 1972, 1975; Lewis and Kneberg 1946; McCollough and Faulkner 1973; Salo 1969:137-141; Schroedl 1973, 1978:192-199). Two explanations have been postulated to account for the change from one to the other:

1. The transition from the Woodland to the Early Mississippian period is the result of the rapid influx of an entirely new cultural group (the Hiwassee Island culture) with new cultural traits, which replaced the previous Hamilton culture (Lewis and Kneberg 1946:9).

2. The transition from the Woodland to the Early Mississippian period is the result of a gradual, in situ evolutionary development out of the local Late Woodland culture (Faulkner 1972; Schroedl 1973).

The first proposition is based on research between 1937 and 1939 at the Hiwassee Island site (Lewis and Kneberg 1946). The results of this research indicated significant differences between the Late Woodland Hamilton and the Mississippian Hiwassee Island components at the site in terms of burial mound use, ceramic typology, projectile point types, community plan and other traits (Lewis and Kneberg 1946: 169-174). These data tended to support a "replacement hypothesis" as a reason for cultural change. This hypothesis was consistent with the prevailing ideas in American archaeology that diffusion and migration were predominant causes of cultural change. Cultural evolution was not a popular explanation for change, due to the negative connotations of evolutionary theory (Willey and Sabloff 1980:181).

Even though the Hamilton culture was defined by Lewis and Kneberg, little is known about Hamilton occupation areas. Since most information concerning Hamilton manifestations is based on the analysis of burial mound contexts, Hamilton may be more accurately characterized as a burial mound complex rather than a culture. Subsequent examination of Late Woodland, transitional Woodland to Mississippian, and Early Mississippian contexts by Schroedl (1978:193-197) and Kimball (1980a: 455-465) indicates that the Hamilton burial mound complex crosscuts all three temporal periods. Because of overlapping radiocarbon dates for these periods, the use of Hamilton burial mounds by the Hiwassee

Island culture, and little Hamilton occupational data, Hamilton cannot be defined as a distinct culture.

The second explanation for the Woodland to Mississippian transition is an in situ development, based on the identification of culturally intermediate components at several sites in the eastern Tennessee valley (Figure 1). The first site where a transitional Woodland to Mississippian component was identified was the Martin Farm site (40MR20) in the Little Tennessee River valley. This site, located southeast of the confluence of the Little Tennessee River and Toqua Creek at 35°34'40" north latitude and 84°10'40" west longitude in Monroe County, Tennessee, was discovered and tested in 1964 and 1966 (Polhemus 1966), excavated in 1967 (Faulkner 1975; Salo 1969), tested again in 1969 (Chapman 1969) and excavated again in 1975 (Schroedl 1975:15-18, 1978:193).

The results of the 1967 excavations at the site provided support for the in situ Woodland to Mississippian transition. Zone 3 and Feature 7 at the site produced evidence of a clearly intermediate occupation, as indicated by limestone, shell and mixed limestone and shell-tempered ceramics. Combinations of limestone tempering with Early Mississippian body and rim shapes and limestone-tempered loop handles were also noted (Salo 1969:105). The combination of Woodland and Mississippian traits led Faulkner to conclude that ". . . the appearance of the Mississippian tradition in the eastern Tennessee valley can be explained largely by internal culture change."

The 1975 excavations at Martin Farm were conducted to provide additional artifacts from the transitional Mississippian, or Martin

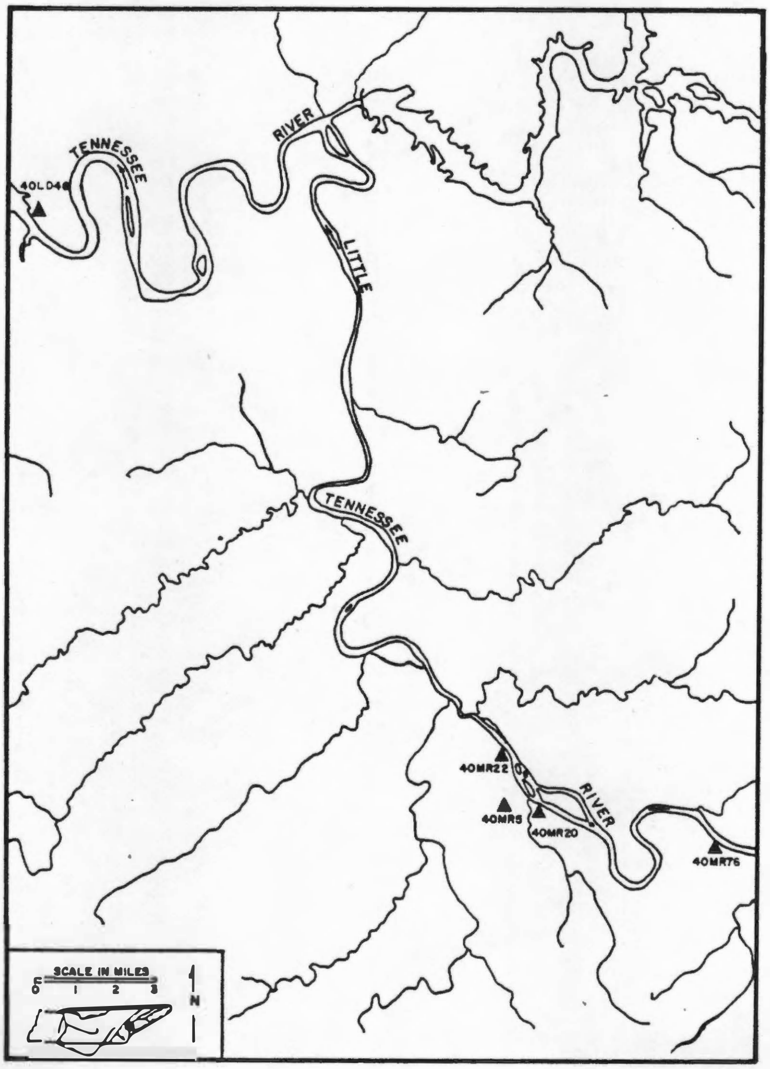

Figure 1. The Locations of 40LD46, 40MR5, 40MR20, 40MR22 and 40MR76.

Phase, component at the site, to examine more clearly the transition between the Woodland and Mississippian components and to define the temporal relationship between the Woodland and Mississippian components (Schroedl 1975:17). These excavations opened up a larger site area than the 1967 excavations and, for the first time, excavated contexts were water-screened.

A second site related to the problem of the Woodland to Mississippian transition was the Doughty site (40LD46) (McCollough and Faulkner 1973:108-123). Excavations at this site revealed limestone and shell-tempered ceramics and a predominance of Late Woodland Hamilton projectile points in Stratum II, indicating the presence of a transitional component at the site.

Also, excavations at Tomotley (40MR5) produced several burial processing pits, at least one feature and several probable structures attributable to an Early Mississippian occupation (Baden 1981:222-223, 235-236; Schroedl 1978:195). One burial contained limestone and shell-tempered potsherds and Hamilton projectile points. These artifacts also indicated a possible transitional Woodland--Mississippian occupation.

Finally, in 1976 and 1979, excavations were conducted at the Jones Ferry site (40MR76) (Chapman 1978:129-139, 1980a; Davis 1981). Features 20 and 80 at the site were originally considered temporally and culturally equivalent to the Martin Phase component at Martin Farm (Chapman 1980a:49, 54). However, a subsequent analysis of the ceramic assemblages from these features places them temporally earlier than Martin Phase (Davis 1981:145), since Feature 80 has no shell-tempered

sherds and Feature 20 contains only 3 percent shell-tempered plain sherds.

The debate concerning the origin of the Mississippian lifeway in eastern Tennessee has focused on the examination of, among other traits, radiocarbon dates, burial mound utilization and ceramics. In terms of the lithic artifacts, only a comparison of projectile point types has been used to examine this question.

Lewis and Kneberg (1946:111-113) described the major projectile point types associated with the Hamilton and Hiwassee Island components at the Hiwassee Island site. They defined the Hamilton Incurvate projectile point type, a small, triangular point with incurvate base and sides, as occurring exclusively in the Late Woodland burials and mound fill at the site. Subsequent identification of these projectile points in transitional Woodland to Mississippian components indicates the probable persistence of this point type into the Early Mississippian (Faulkner 1972, 1975; McCollough and Faulkner 1973; Salo 1969). However, no detailed univariate or multivariate analysis of projectile points or debitage from these Late Woodland, emergent and Early Mississippian components has been conducted.

This study provides the first detailed analysis and comparison of the lithic tools and debitage from selected contexts at Martin Farm, Jones Ferry and Tomotley. For the purpose of this analysis, the lithic materials from Jones Ferry Features 20 and 80 are considered to date to the latter portion of Kimball's (1980a:455) Woodland III Period (A.D. 350-900), based primarily on their ceramic content. Since Hamilton is not recognized as a distinct culture in the Little Tennessee River

valley, these features cannot be categorized as Late Woodland Hamilton. Even so, they are important because they bridge the gap between Middle Woodland and emergent Mississippian, and they are the best contexts that do so in the Tellico Reservoir area.

In terms of the Martin Farm and Tomotley components, the transitional Woodland to Mississippian, emergent Mississippian (McCollough and Faulkner 1973), Martin Farm Phase (Faulkner 1972, 1975) and Martin Phase (Schroedl 1978) designations are replaced with the Mississippian I Period (A.D. 900-1000) (Kimball 1980a:275-276, 450-465). The Hiwassee Island I and II (Schroedl 1978:195) designations are dropped and replaced with the Mississippian II Period (A.D. 1000-1300).

By analyzing the emergent Mississippian I assemblages from Martin Farm and Tomotley, and comparing them to the fully developed Mississippian II assemblage at Martin Farm, the Mississippian aspect of the Woodland to Mississippian transition can be examined. The Woodland aspect of this transition is examined by the comparison of these assemblages to the late Woodland III Feature 20 and 80 assemblages from Jones Ferry.

The functional, formal and technological dimensions of these assemblages are compared using nominal through ratio level data, and univariate and multivariate analyses of these data. By examining these dimensions and their patterning in lithic assemblages spanning the late Woodland through Early Mississippian periods, a clearer picture of the Woodland to Mississippian transition can be obtained.

CHAPTER II

MATERIALS AND METHODS

Contexts Chosen for Analysis

For several reasons, only lithic artifacts from the 1975 excavations at Martin Farm are used in this analysis (Figure 2). First, much of the material from the 1964 and 1966 surface collection and testing, and from the 1969 testing is either lost or lacks adequate provenience. Second, all excavations before 1975 utilized only trowel or shovel sorting as a means of artifact recovery, while in 1975 excavated contexts were systematically water-screened through one-quarter inch mesh. The excavation of different portions of Feature 7 with and without the use of water-screening shows the non-comparability of results produced by different artifact recovery techniques (Table 1).

From the total of lithic artifacts excavated during the 1975 field season, only the artifacts from contexts with secure radiocarbon dates, and other closely associated non-dated contexts are used in this study (Tables 2 and 3). This represents 7011 artifacts, or approximately 30 percent of the total number of artifacts recovered at Martin Farm. Other contexts are not used because of possible mixing of components and absence of absolute temporal controls. No lithic material less than one-quarter inch in size is used in this analysis.

All the contexts from Martin Farm listed in Table 2 were completely analyzed, except for Feature 7. Portions of Features 60 and 7 were mixed in one of the excavation levels from the 1975 field season,

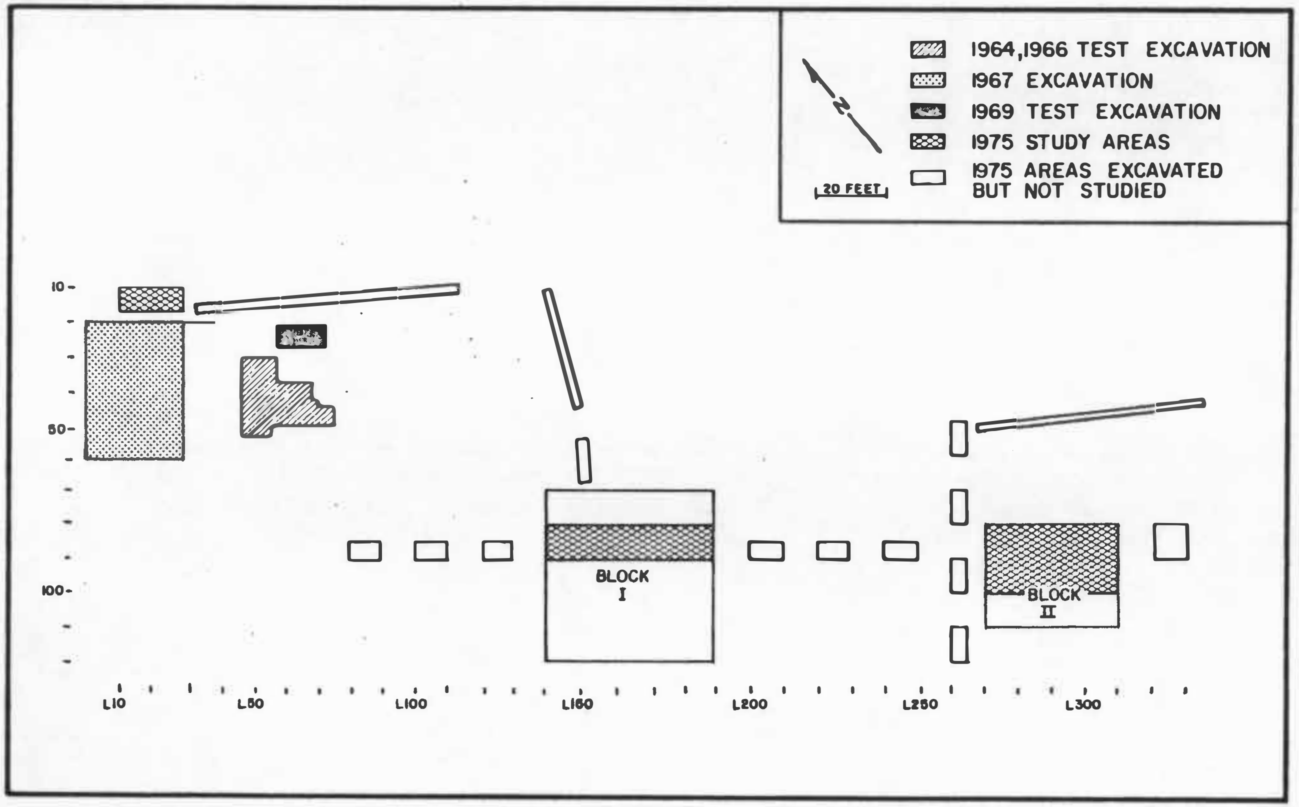

Figure 2. Map of 40MR20 (Martin Farm) Excavations.

Table 1. Feature 7 data--40MR20.

Technological Groups	Excavations[a] 1967 n	1967 %	1975 n	1975 %
Bifacial Tools	10	5.0	61	3.0
Bifacial Debitage	77	38.7	1150	56.3
Bipolar Tools and Debitage	48	24.1	481	23.5
Blades and Blade Cores	9	4.5	89	4.3
Unmodified Chert	29	14.6	245	12.0
Non-Chert	26	13.1	18	0.9
Totals	199	100.0	2044	100.0

[a]In 1967, approximately 108 ft^3 of the feature were excavated. In 1975, approximately 57.75 ft^3 of the feature were excavated.

Table 2. Contexts selected for analysis.

Site/Location	General Levels	Features	Structures
WOODLAND III			
Jones Ferry	None	Features 20, 80	None
MISSISSIPPIAN I			
Martin Farm Test Pit-10-20L10-30	Levels 10, 11	Feature 7	Structure 3, associated postmolds
Tomotley	None	Feature 325	None
MISSISSIPPIAN II			
Martin Farm Block I	Level 4	Features 59, 68, 69	None
Block II	Levels 2, 3, 4	Features 56, 57, 64, 65, 66, 67, 70, 71, 72	Structure 11 associated postmolds

Table 3. Radiocarbon dates for analyzed contexts.

Period/Site Context	Uncorrected Date	Corrected Date[a]	Reference
Mississippian I/Martin Farm			
Structure 3 (GX4208)	935 ± 130 B.P.	927 ± 124 B.P. (A.D. 1023)	Schroedl 1978
Feature 7 (GX4213)	960 ± 120 B.P.	950 ± 124 B.P. (A.D. 1000)	Schroedl 1978
Mississippian I/Tomotley			
Feature 325 (GX7732)	985 ± 125 B.P.	974 ± 129 B.P. (A.D. 976)	Baden 1981
Mississippian II/Martin Farm			
Feature 57 (GX4209)	930 ± 140 B.P.	922 ± 143 B.P. (A.D. 1028)	Schroedl 1978
Feature 69 (GX4210)	930 ± 140 B.P.	922 ± 143 B.P. (A.D. 1028)	Schroedl 1978
Feature 64 (GX4211)	755 ± 140 B.P.	761 ± 143 B.P. (A.D. 1189)	Schroedl 1978
Feature 66 (GX4212)	790 ± 130 B.P.	792 ± 133 B.P. (A.D. 1158)	Schroedl 1978
Woodland III/Jones Ferry			
Feature 20 (GX7729)	720 ± 120 B.P.	728 ± 133 B.P. (A.D. 1222)	Davis 1981
Feature 80 (GX7730)	1250 ± 130 B.P.	1228 ± 140 B.P. (A.D. 722)	Davis 1981

[a]Corrected dates are based on formulas and tables in Damon et al. 1974.

and this material was excluded from analysis. Feature 7 was a large ditch which contained most of the Mississippian I artifacts from Martin Farm. Salo (1969:104) considered it man-made and speculated that it might be a moat. However, due to its unique shape and undetermined size, its exact function is still unclear. Regardless of its original purpose, stratigraphic observation shows that it probably last served as a dumping area, since it was filled rapidly.

In terms of the structures analyzed, Structure 3 was a burned wall trench Mississippian I structure. Structure 11 was located in Block II of the 1975 excavations, and represented a single post Mississippian II structure.

The levels were excavated in arbitrary 0.2 foot units, and, based on the radiocarbon dates and the ceramic analysis (Davis 1981), several of these levels are combined to form the Mississippian I and II assemblages. These assemblages are therefore "coarse-grained" (Binford 1980:17), since they represent probable continuous occupations over a comparatively long period of time.

The late Woodland III Features, 20 and 80, from Jones Ferry (Chapman 1980a) have been radiocarbon dated at 728 ± 133 years:A.D. 1222 (GX7729) and 1228 ± 140 years:A.D. 722 (GX7730), respectively (Davis 1981). While the Feature 20 radiocarbon date is much later than either the Woodland III or Mississippian I period dates, the assemblage from this feature is also considered late Woodland III in temporal affiliation based on its ceramic content. A total of 1557 artifacts, comprising approximately 50 percent of the lithic debitage and 100 percent of the

projectile points from each of these features, was analyzed. Both features were large storage pits which were apparently filled very rapidly with refuse, since there was no slumping of the feature strata. In addition, 1370 lithic artifacts, comprising 100 percent of the lithic artifacts from Feature 325, a large bell-shaped Mississippian I pit, at Tomotley (40MR5), which has been radiocarbon dated at A.D. 976±129 (GX7732) (Baden 1981:222), were compared to the Martin Farm and Jones Ferry data. All the Jones Ferry and Tomotley feature fill was water-screened.

Analytical Coding Methods

The artifacts were analyzed using two systems. First, a metric coding system, which notes 20 continuous and discrete variables for projectile points and 21 continuous and discrete variables for debitage, and which was used in the below pool and above pool Tellico Archaeological Survey analyses (Davis 1980a, 1980b; Davis et al. 1980; Kimball 1980b), was used to analyze samples of projectile points and debitage from securely dated feature contexts and other directly related contexts from Martin Farm. Furthermore, samples of the debitage and projectile points from the Jones Ferry features were examined using this system. Only complete flakes and blades and complete or nearly complete projectile points were analyzed. None of the artifacts from Feature 325 at Tomotley were analyzed using this system. The second analytical system, applied to all the lithic artifacts examined in this study, is identical to the nominal coding system used in the Tellico surveys (Davis et al. 1980), with the exception that the presence or absence of heat alteration of each artifact is also noted.

The Grouping of the Data for Analytical Purposes

Functional variability. The initial step in the activity analysis of the artifacts is the definition of functional activity groups, which are formed by combining the nominal working edge attribute states of tools used in the performance of a single task into a single working edge category which defines that task, following Kimball (1981) (Table 4). The frequency of these task-specific working edge categories is then determined for each component.

The use of ethnographic and archaeological analogies in defining the activity groups is based on the assumption that tools with similar working edges were used in the same manner. While in most cases, a direct correlation between the function of an artifact and the wear patterns or damage on that artifact cannot be proven (except by experimentation and microwear analysis, Keeley 1980), the material correlates for ethnographic and archaeologically determined functions presented below at least provide a starting point from which more detailed functional analyses and experiments can proceed.

Some of the activity groups outlined in Table 4, such as the Hunting, Fishing and Shelter Construction groups, are self-explanatory in terms of the working edge categories used in their definition. However, the other groups are more complex and are discussed below in greater detail.

The Food Preparation/Consumption activity group includes artifacts used in the preparation or consumption of both animal and plant foods. Plant and animal food preparation and consumption are

Table 4. Functional activity groups (modified after Kimball 1981).

Activity Group	Expected Activity Residues
Hunting	Straight and serrated projectile points, projectile point fragments.
Fishing	Netsinkers.
Food Preparation/ Consumption	Chopper/scraper, knife, milling stone, mano, steatite vessel, utilized edges on flakes and tools.
Lithic Tool Manufacture	Pitted cobble, hammerstone, tested nodule of utilizable lithic material.
Hideworking	Endscraper, side scraper, perforator, utilizable mineral.
Wood Tool Manufacture	Drill, steeply retouched edges on tools and flakes, spokeshave, denticulate, abrader, utilized obtuse edge.
Bone Tool Manufacture	*Pièce esquillée*, graver.
Shelter Construction	Ground celt.
Decorative/ Ceremonial	Drilled pebble, stone pipe, bar gorget, earspool, polished pebble.

combined, since many artifacts showing utilized edges could have been used in the processing of both food categories. As Gould (1980:131-132) notes for the Western Desert Aborigines of Australia, "flake knives," or flakes used as cutting tools due to their sharp edges, are used for a variety of cutting tasks by men and women, especially in processing game animals. Chopper/scrapers are equivalent to the "Kaotah" used by the Nunamiut in scraping bones before breaking them and eating the marrow (Binford 1979:264-265). Milling stones and manos are used particularly in seed grinding and in the processing of other plant foods (Gould 1980:72; O'Connell 1977:274, 280). Steatite vessel fragments are probably portions of a vessel or vessels used in cooking and carrying food. A major problem in accurately defining the frequency distribution of artifacts of this activity group is that the actual medium worked by a flake or tool is often difficult to identify without the aid of microwear analysis (Keeley 1980), and many flakes which appear unutilized under a low-magnification may have been utilized briefly, or on a substance which produced no obvious use damage (O'Connell 1977: 273-274; Gould 1977:167).

The Lithic Tool Manufacture group includes hammerstones which, while probably being used for a variety of purposes, are assumed here to be principally diagnostic of stone tool production. Pitted cobbles as defined by this analysis are distinct from nutting stones in that the former were anvils on which nodules or fragments of lithic resources were placed in order to be reduced by the bipolar method (Crabtree 1972:40, 42), and the latter were used in nut processing. However, it is recognized that pitted cobbles could have also been used as nutting

stones. Tested nodules are also indicative of the initial selection process for obtaining a suitable lithic resource for tool production. These artifacts are included in the Lithic Tool Manufacture category because they are utilized for or tested (in the case of the nodules) specifically for the production of stone tools. Flakes, cores and shatter fragments, while providing evidence for lithic tool manufacture, are by-products of that manufacture, unlike the above categories.

The Hideworking category includes end and side scrapers, perforators and pigments. Through the use of microwear analysis, Cahen et al. (1979:663) have shown that "endscrapers" from the Upper Paleolithic Meer site in Belgium were indeed used to scrape dry hides. Also, Keeley (1980:164) notes that artifacts assumed to be side scrapers from the Lower and Upper Industries at Hoxne were used in hideworking. Tools from the assemblages examined in this report are defined as end and side scrapers based on the presence of intentional retouch (uniform flake scars greater than 2 mm in length) and polish along their working edges. Keeley (1980:52) discusses the use of a piercing or boring implement in piercing hides, and notes that while bone and wood awls perform this task more efficiently, a retouched, pointed flake, or perforator, can also be used. Finally, Keeley (1980:170-172) notes the use of red ocher in hideworking by the Magdalenians. Thus, the probable rubbing of pigments, such as hematite, into hides is the reason utilizable minerals have been associated with the hideworking activity group.

The Wood Tool Manufacture activity group includes artifacts showing steep, obtuse retouch and abraders used in sharpening wood tools.

Hayden (1977:184-187) notes the use of retouched flakes, denticulates, "notched flakes" or spokeshaves, and flakes with strong obtuse edges in woodworking by the Australian Aborigines of the Western Desert. O'Connell (1977:276-277) and Gould (1980:127-129) also report the use of steep edged scraping tools in heavy wood chopping and "flakescrapers" or retouched flakes in spear sharpening. Finally, Australian Aborigine women have been observed using sandstone abraders to sharpen digging sticks and to smooth wooden bowls (Hayden 1977:185). It is recognized, however, that abraders could be used to sharpen or smooth many other materials.

The grouping of pièce esquillée and gravers into the Bone Tool Manufacture activity group is based primarily on the discussion of the Debert site tool functions by MacDonald (1968:85-90, 112). He states that pièce esquillée served as wedges or slotting tools to break bone, antler, and other hard substances, and cites several Old World archaeological examples of associations between these tools and bone. Gravers are assumed to have been used in incising bone. Hayden (1980: 2-7) has recently criticized the interpretation of pièce esquillée as wedges; he considers them primarily exhausted cores from the production of bipolar flakes. The flakes, instead of the pièce esquillée, were the tools sought by the flintknappers because of their sharp edges. However, in this analysis, pièce esquillée have been defined as having a rectangular shape, crushing and multiple bipolar removals along the edges, and a thin cross-section produced by multiple blows. On the basis of this definition (which distinguishes them from bipolar cores

showing random bipolar flake scars), they have been retained as a bone working tool.

Finally, the Decorative/Ceremonial activity group is represented by such personal use items as stone pipes, earspools and gorgets. Also included in this activity group is a discoidal or possible "gaming" stone (Lewis and Kneberg 1946:122) and a polished triangular stone of unknown but possibly decorative function.

Stylistic or formal variability. The study of formal variability in the projectile points and debitage is primarily accomplished by the analysis of the data from the metric coding system. This analysis provides quantitative measures of the size and shape of the projectile points and debitage categories for each assemblage. Assemblages are then compared using this quantitative data. Nominal projectile point types are also compared across assemblages. The projectile point type categories used in this comparison are defined in Kimball (1980a:86-106), and assemblages are compared in terms of the frequencies of projectile point types.

Technological variability. Technological variability, like functional variability, is an area discussed primarily in terms of the nominal data. As with the working edge attribute states, the technological attribute states are combined into technological groups in order to determine the frequencies of the various lithic technological systems utilized at the site (Table 5).

The Bifacial Reduction group includes the tools and debitage produced by the use of a bifacial percussion reduction technology.

Table 5. Definitions of technological groups.

Technological Groups	Technological Products and By-Products
Bifacial Reduction	Products Projectile points, preforms, bifaces By-Products Primary and secondary decortication flakes, bifacial thinning flakes
Blade Reduction	Products Blades with prominent and diffuse bulbs of force By-Products Blade cores, core rejuvenation flakes, assumed blades (without striking platforms)
Bipolar Reduction	Products Pièce esquillée, bipolar flakes By-Products Bipolar cores
Other Non-Diagnostic Chert	By-Products Amorphous cores, interior flakes, manuports, shatter fragments Unmodified Chert Chert nodules
Non-Chert Reduction	Products Steatite bowl fragments By-Products Non-chert spalls, cobbles, shatter fragments

The particular elements of this group are described and illustrated by Crabtree (1972:37-38, 85, 86-87, 94, 96) and Muto (1971: Figures 6, 9, 14, 15).

The Blade Reduction group includes blade cores, core rejuvenation flakes (Crabtree 1972:89), and blades with prominent or diffuse bulbs of force. As indicated by Crabtree (1974:44), a pronounced bulb indicates that the blade was removed using a hard hammer percussor, while a diffuse bulb indicates the use of a soft antler or wood billet and probably indirect percussion. In terms of this analysis, blades are defined as having parallel sides, flat striking platforms, and lengths twice their widths. Also, a blade will have dorsal scars, indicating previous removals from the same direction, running parallel along the length of the blade.

The Bipolar Reduction group includes all bipolar tools, cores and flakes. These artifacts are usually easy to identify because of their well-defined compression rings emanating from the point of impact of the percussor and, usually, from the distal end of the artifact as well. In addition, both ends of the artifact show crushing or battering (Crabtree 1972:41). Based on experimentation by the author, however, cortex removed from a nodule by the bipolar method can resemble bifacially removed primary decortication flakes, and could be misidentified for this reason. Many of the non-diagnostic shatter fragments grouped into the Non-diagnostic Chert category discussed below are probably the result of bipolar reduction of nodules of poor quality, containing many incipient fracture planes and weathered surfaces.

The Other Non-diagnostic Chert technological group includes all core, flake, and nodule blank categories for which no clear technological reduction method can be determined, such as shatter fragments, interior flakes and amorphous cores. Finally, the Non-chert Reduction group contains artifacts produced by methods other than the reduction of chert lithic resources. These include ground slate or shale celts and gorgets, modified cobbles and steatite vessel fragments.

Other technological elements primarily considered by the nominal analysis include lithic raw material selection and heat alteration. The raw material attribute states used in this analysis are those identified and described for the Tellico Reservoir area by Kimball (1980a:183-198). The categories of lithic raw materials include local chert resources, non-local chert resources, sedimentary lithics other than chert, metamorphic lithics and igneous lithics (Kimball 1980a:166). The distinction between local and non-local chert resources is based on the proximity of the Martin Farm site to a major chert outcrop (40MR22) at Rock Crusher Bluff (Figure 1, page 6) (Chapman 1980b). This source area, located approximately one mile from Martin Farm, produces Knox black and black-banded chert along with smaller quantities of Knox light gray-banded and porcellaneous cherts, Knox chert residuum and Knox black-banded/oolitic (a variety of black-banded) (Kimball 1980a:207).

These cherts, along with the heated varieties Knox light gray chert (raw material category 39) and dark gray chert (raw material category 40), are considered local. This chert dichotomy is maintained in the analysis of the Jones Ferry artifacts, since they are compared to the Martin Farm assemblages.

The heat alteration of the lithic artifacts chosen for study is noted in order to investigate the possible use of this technique to improve the quality of a lithic resource. The attribute states used to identify heat alteration include incipient potlids and potlids, increased luster, sugary surface in retouched areas, crenated fracture, crazing and color change (Purdy 1975:133-141; Crabtree 1964:1-3).

The metric analytical system notes the presence of the heat alteration attribute states on each artifact. The nominal system, however, simply notes the presence or absence of heat alteration, based on the above criteria. This less detailed coding method is used for the majority of the artifacts because more experimentation with heat treating lithic materials, especially those located in the Tellico Reservoir, must be performed before the characteristics distinguishing _intentional_ as opposed to _unintentional_ heat alteration (Anderson 1979:221-250) can be clearly identified.

Statistical Methods Used in the Analyses

Nominal level techniques. The first technique used to describe and analyze information obtained by the nominal coding system is the bar graph (Thomas 1976:45-46), which expresses the frequencies of certain nominal variables in terms of their percentages. In this analysis, the frequency percentages of the functional groups, technological groups and raw material and heat alteration variables are presented for each assemblage and are compared across all assemblages. Also, subassemblages of material solely from features, structures, and general levels are formed and compared in order to examine variability between the

assemblages in terms of contextual differences. The bar graphs thus provide a visual rather than statistical comparison between assemblages in terms of the variables in question.

A statistical test which is useful in the comparison of nominal data is the chi-square test (Thomas 1976:264-291). The chi-square statistic is used to compare two populations on the basis of the frequency distribution of classes of objects. In this analysis, the "populations" are the lithic assemblages from well-dated components from the sites in question, and the "objects" are the functional, formal and technological variables. This statistic is calculated using the formula:

$$X^2 = \frac{\Sigma_{i=1}^{k} (O_i - E_i)^2}{E_i}$$

where O_i are the observed frequencies and E_i the expected frequencies for the Kth class (Thomas 1976:265). Some assumptions of the chi-square test are a nominal level of measurement for the data, independent random sampling and adequate sample size. This report examines complete populations of lithics from the contexts examined, and the expected frequencies in all tests are of adequate size.

Before this test can be performed, a null (Ho) and an alternative (H1) hypothesis must be stated. These hypotheses, which indicate different relationships between the populations, are tested by the chi-square calculation. The null hypothesis usually states that the two populations are not different in terms of the variables examined, while the alternative hypothesis states that they are different.

Before testing these hypotheses, a statistical level of significance must be chosen. This indicates the probability that the results obtained from the test are erroneous; the commonly accepted level of significance, or α, of .05 (five chances in 100 of accepting incorrect results) is used for all chi-square tests in this report.

After stating the hypotheses and selecting an α level, the observed frequencies for the variables in question are listed in rows and columns and the X^2 is calculated using the above formula. The formula (Rows-1) (Columns-1) is then used to calculate the degrees of freedom for the test. The degrees of freedom, in combination with the α level, determines the critical region for the chi-square test; a X^2 greater than or equal to the value indicated for the critical region (the values are listed in a X^2 distribution table) results in the rejection of the null hypothesis.

The chi-square test is used to compare the archaeological assemblages from the sites examined in terms of the heat alteration of the artifacts, the functional and technological groups represented by the artifacts, and the lithic raw materials used to produce these artifacts. In addition to these attributes, the distributions of projectile point types in these components are compared. All chi-squares were calculated by hand.

A limitation of the chi-square test is that it does not measure the <u>degree</u> of similarity or difference between the components examined. It only indicates that there <u>is</u> a similarity or difference.

A more serious limitation is that with large sample sizes, a large X^2 is almost always computed. This often results in a Type-I

error--"the incorrect rejection of a true null hypothesis" (Thomas 1976:213). To avoid this error, a phi coefficient (Thomas 1976:419-420) is calculated by the formula:

$$\sqrt{\frac{X^2}{n}} = \sqrt{\phi^2} = \phi$$

This coefficient corrects X^2 when a large sample size is involved and has values ranging between negative 1 and positive 1. A positive or a negative value for this coefficient denotes a correspondingly strong relationship (i.e., a significant difference) between the components while a value of 0 indicates no significant difference. A phi coefficient can only be calculated for 2x2 contingency tables, so most of the chi-square tests in this analysis are organized as four-celled tests.

Some of the attributes coded in the metric analysis, such as stem and base preparation on projectile points, are also nominal, or discrete, in character and are analyzed and compared by examining the frequencies of these variables. Metric, or continuous, attributes examined in the metric analysis, including ratio level measurements such as length, width and weight are analyzed and compared using both univariate and multivariate techniques.

Univariate metric techniques. In order to examine the differences between the Mississippian I and II lithic assemblages at the Martin Farm site, and the differences between these assemblages and the assemblages from the features at Jones Ferry, the sample means for the metric attributes for these assemblages are compared by means of a t-test computed by the SPSS and SAS routines (Barr et al. 1979; Nie et al. 1975).

The means for these metric measurements are considered sample means, representing the population means of the assemblages analyzed. The population means, or μ_1 and μ_2, and the common variance, or σ^2, for the populations are unknown, so the sample means and a pooled estimate of the population variance must be used to calculate t. Based on the assumption that the population variances for the two populations are the same, the pooled sample variance is found by the equation:

$$s^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{(n_1-1) + (n_2-1)}$$

where $s_1{}^2$ and $s_2{}^2$ are the variances for the two sample means. The sample variance for the difference of the sample means is found by the equation:

$$s_{\bar{d}}{}^2 = \left(\frac{s^2}{n_1} + \frac{s^2}{n_2} \right)$$

and $\sqrt{s_{\bar{d}}{}^2}$ or the sample standard deviation for the difference of sample means is used to calculate $t_{\bar{d}}$:

$$t_{\bar{d}} = \frac{(\bar{x}_1-\bar{x}_2) - \mu_1 - \mu_2}{s_{\bar{d}}}$$

The null hypothesis tested by the t statistic is that the population means of the two groups are equal, and the alternative hypothesis is that they are different. This form of the t-test, called a two-tailed test, is used in all the comparisons of sample means in this analysis.

The degrees of freedom for the t-test are calculated by the formula $(n_1 + n_2 - 2)$, and, using $\alpha = .05$, this information is used to

determine whether or not the calculated t statistic falls within the region of rejection. A t score with a probability smaller than .05 would result in the rejection of the null hypothesis.

In the analysis of the metric data for the debitage, the means for the metric attributes are first grouped by blank category, and then compared in terms of the three components from which debitage was selected and analyzed--the Mississippian I and II components at Martin Farm and Feature 80 at Jones Ferry. Such an analysis indicates any significant differences between the assemblages from these components not only in terms of technological category, but also in terms of the metric attributes of that technological category and in terms of assemblages in general.

Due to the small sample sizes of individual projectile point types from the Mississippian I and II assemblages at Martin Farm and from the features at Jones Ferry, individual projectile point types from different assemblages are not compared by the t-test. Instead, group means for all the projectile points are calculated and compared for each assemblage.

Multivariate metric techniques. Multivariate data analysis techniques used in this study include factor analysis and cluster analysis. There are many forms of factor analysis and many reasons for performing such an analysis (Kim 1975:469; Rummel 1967:448; Hair et al. 1979:218-283); for the purpose of this study, factor analysis is used as a data reduction technique. In other words, the set of variables used to define a group of objects (in this case, flakes and projectile

points) is factor analyzed, and a new and smaller set of composite variables (or factors) is defined. This calculation of the correlation between variables is defined as R-mode factor analysis, as opposed to a Q-mode analysis, which determines the correlation between the objects measured by the variables, and which is used in cluster analysis.

The particular method of factor analysis used is principal-component analysis. This method produces defined factors which express the interrelationships between the variables without assuming anything about the underlying structure of the variables. The factors formed by such an analysis provide the best summary of these interrelationships. The model for principal-component analysis is as follows:

$$z_j = a_{j1}F_1 + a_{j2}F_2 + \ldots a_{jn}F_n$$

where F_1, F_2 . . . F_n are the factors which are defined in terms of the linear combination of the original variables (Kim 1975:470-471) and where z_j is the variable j in standardized form and a_{jn} is the factor loading of variable j on factor n.

After a factor solution is obtained, it should be rotated in order to provide a meaningful interpretation of the factors. There are several methods of factor rotation; however, the simplest and least controversial methods are the orthogonal rotations. In an orthogonal rotation, the axes defining the factors maintain a 90° angle during rotation, signifying that the factors are assumed to be uncorrelated. In this study, a varimax orthogonal rotation is used.

The factor analyses are used herein to reduce the complexity of the data of the projectile points and the debitage. The variables used

are metric and at the ratio level of measurement. No nominal variables are examined, since the variables used in a factor analysis must be at least interval in scale (Kim and Mueller 1978:73). All factor analyses are computed using the SPSS routine (Kim 1975).

As an extension of the factor analysis, factor scores, which are composite measurements of the factors representing each artifact, are computed using SPSS (Hair et al. 1979:246-247; Nie et al. 1975:487-489). These factor scores are used as primary data to combine individual artifacts and contexts into like groups. In this report, cluster analysis, which involves the grouping of objects on the basis of some measure of similarity (Johnson 1967:241; Hair et al. 1979:221), is used.

The various processes involved in performing a cluster analysis include the comparison of the objects to be clustered by the computation of similarity measures for each pair of objects, the grouping of these objects, the selection of the most independent object clusters and, finally, the interpretation of these clusters (Tryon 1958:490-492). In the present study, the clustering method used is a hierarchical clustering algorithm of SAS (Johnson 1967; Barr et al. 1979:157-161), wherein each individual object starts out as a cluster, from which subsequent clusters are formed based on a distance measure of similarity. This process continues until all the objects are contained in a single "strong" cluster. A plotting of the maximum distances within the clusters for each hierarchical group enables the selection of the relevant number of clusters by the Scree-test (Kim and Mueller 1978: 44-45).

Through an examination of the contexts and their temporal associations contained within each cluster, the relationships between the lithic assemblages from the Mississippian I and II components at Martin Farm and the components from Jones Ferry are determined. All the artifacts examined in this metric analysis are principally from feature contexts. Thus, analysis proceeds from the examination of ratio level univariate and multivariate data in order to test the proposal that little variation exists between the lithic assemblages from these Woodland and Early Mississippian components.

CHAPTER III

RESULTS OF THE NOMINAL DATA ANALYSIS

In the nominal data analysis, the complete Mississippian I and II lithic assemblages from Martin Farm are visually and statistically compared to each other, and both assemblages are visually compared to the Jones Ferry and Tomotley assemblages. The Mississippian I assemblage contains 4045 artifacts, the Mississippian II assemblage contains 2966 artifacts, the Jones Ferry Feature 20 assemblage contains 536 artifacts, the Feature 80 assemblage contains 1021 artifacts and the Tomotley Feature 325 assemblage contains 1370 artifacts.

Also, the subassemblages from the general levels, structures and features at Martin Farm are compared. The Martin Farm Mississippian I general level subassemblage contains 864 artifacts, the structure subassemblage contains 574 artifacts, and the feature subassemblage contains 2607 artifacts. The Martin Farm Mississippian II general level subassemblage contains 1395 artifacts, the structure subassemblage contains 590 artifacts and the feature subassemblage contains 979 artifacts.

Finally, the Mississippian I and II feature subassemblages from Martin Farm are compared to the artifacts from the Jones Ferry and Tomotley features.

Technological Variability--Martin Farm Assemblages

A comparison of the relative frequencies of the lithic reduction methods in the Mississippian I and II assemblages at Martin Farm (Figure 3) shows that a very small percentage (0.62 percent for

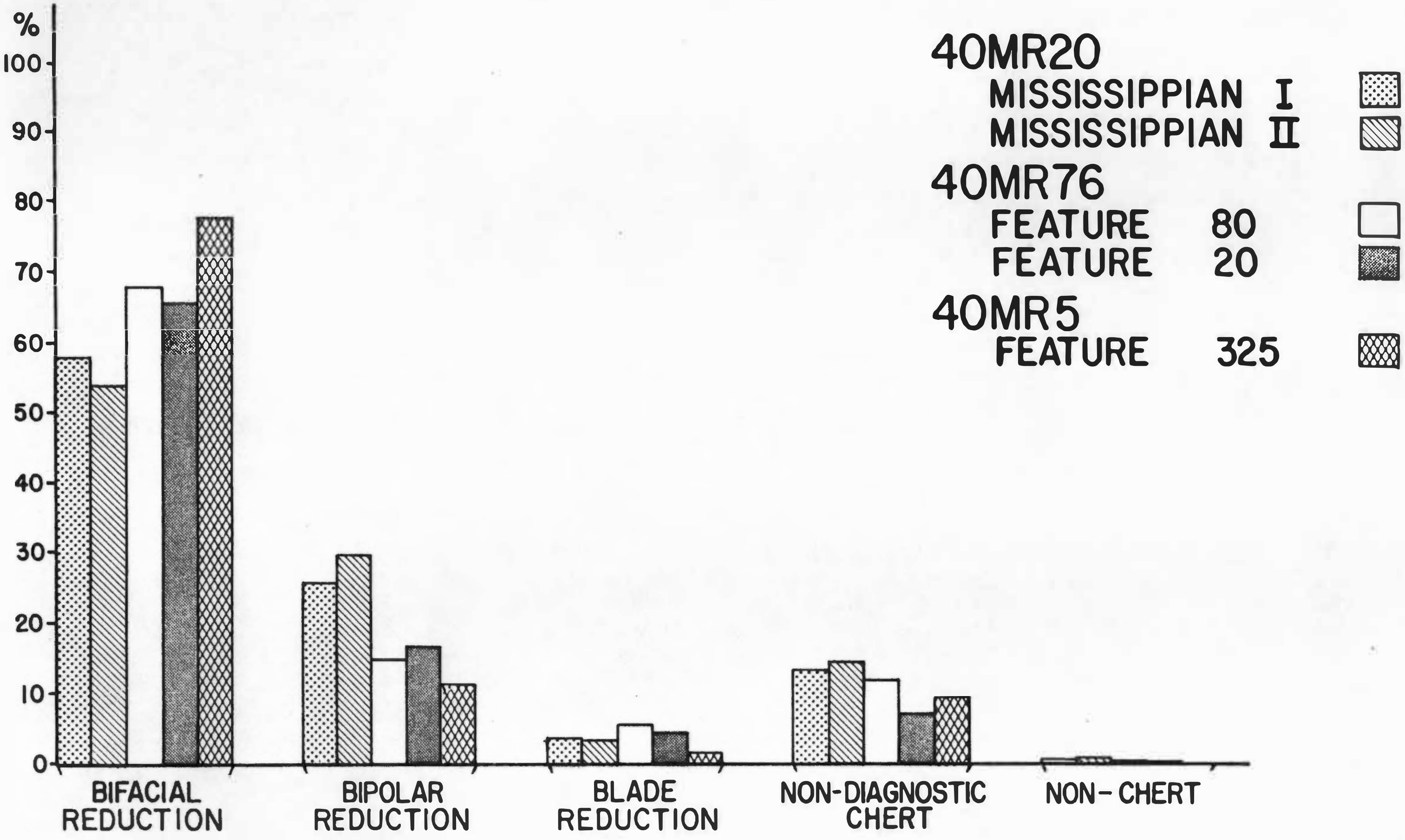

Figure 3. Percentages of Technological Categories Across Assemblages.

Mississippian I and 0.71 percent for Mississippian II) of the assemblages is composed of the non-chert reduction group. The percentages of chert artifacts non-diagnostic as to reduction method is fairly large, but comparable, for both assemblages (13.18 percent for Mississippian I and 14.13 percent for Mississippian II).

The remaining artifacts can be grouped into one of the three major reduction strategies found throughout all time periods in the Tellico Reservoir: the bifacial, blade and bipolar methods. Bifacial reduction products comprise 57.4 percent of the Mississippian I assemblage and 52.5 percent of the Mississippian II assemblage. The artifacts resulting from blade production comprise 3.54 percent of the Mississippian I assemblage and 3.27 percent of the Mississippian II assemblage. Finally, bipolar reduction products comprise 25.3 percent of the Mississippian I assemblage and 29.4 percent of the Mississippian II assemblage.

The hypotheses for a comparison of the distribution of these reduction strategies are:

H_0: There is no difference between the components in terms of the frequencies of the products of the bifacial, blade and bipolar reduction methods.

H_1: There is a significant difference between the components in terms of the reduction strategies used.

A chi-square value of 18.697 was obtained, far exceeding the critical value of 5.99 for a six-celled test at the .05 confidence level (Table 6).

Table 6. Comparison of technological groups--Mississippian I and II, Martin Farm.

Assemblages		Technological Groups	
	Bifacial	Blade	Bipolar
Mississippian I			
O_i	2322	143	1022
E_i	(2248.9)	(139.2)	(1098.9)
Mississippian II			
O_i	1556	97	873
E_i	(1629.1)	(100.8)	(796.1)
			X^2=18.697

An examination of the observed and expected values indicates that the blade frequencies of both assemblages are not significantly different. Based on this, the test was reduced to a 2x2 celled test, using only the frequencies of the bifacial and bipolar artifacts. From this test (Table 7), a X^2 = 18.47 was obtained, which is significant at the .05 level for one degree of freedom. An examination of the observed and expected cell frequencies shows that the relationship between the two assemblages is positive, with the Mississippian I assemblage possessing greater than expected bifacial products, and the Mississippian II assemblage possessing more bipolar products. The phi coefficient for this test is 0.056, indicating a slight positive relationship, but one that is not nearly as significant as the X^2 indicates. Thus, the differences in the frequencies of reduction methods between the two assemblages is so slight, that it is probably due to sampling error.

Table 7. Reduced comparison of technological groups--Martin Farm assemblages.

Assemblages		Technological Groups: Bifacial	Technological Groups: Bipolar
Mississippian I			
	O_i	2322	1022
	E_i	(2246.3)	(1097.7)
Mississippian II			
	O_i	1556	873
	E_i	(1631.7)	(797.3)
			$X^2 = 18.47$

In terms of the frequencies of particular classes of artifacts within the three major technological groups, bifacial tools, pièce esquillée and blade cores are the least frequent artifacts. As expected, bifacial and bipolar debitage and blades are the most frequent artifacts found in each assemblage (Figures 4, 5, and 6).

Formal Variability in Projectile Points--Martin Farm

In the Mississippian I assemblage, there are 68 projectile points or point fragments, and in the Mississippian II assemblage there are 44 projectile points and fragments. As can be seen in Table 8, the predominant projectile point types in both assemblages are the Hamilton Incurvate (Lewis and Kneberg 1946), the incurvate base/straight blade triangular (Kimball 1980a), the Madison (Cambron and Hulse 1969:53) and the probable Mississippian projectile point fragment.

In Table 9, the Mississippian I and II assemblages are compared in terms of the frequencies of these types (the point fragments are not

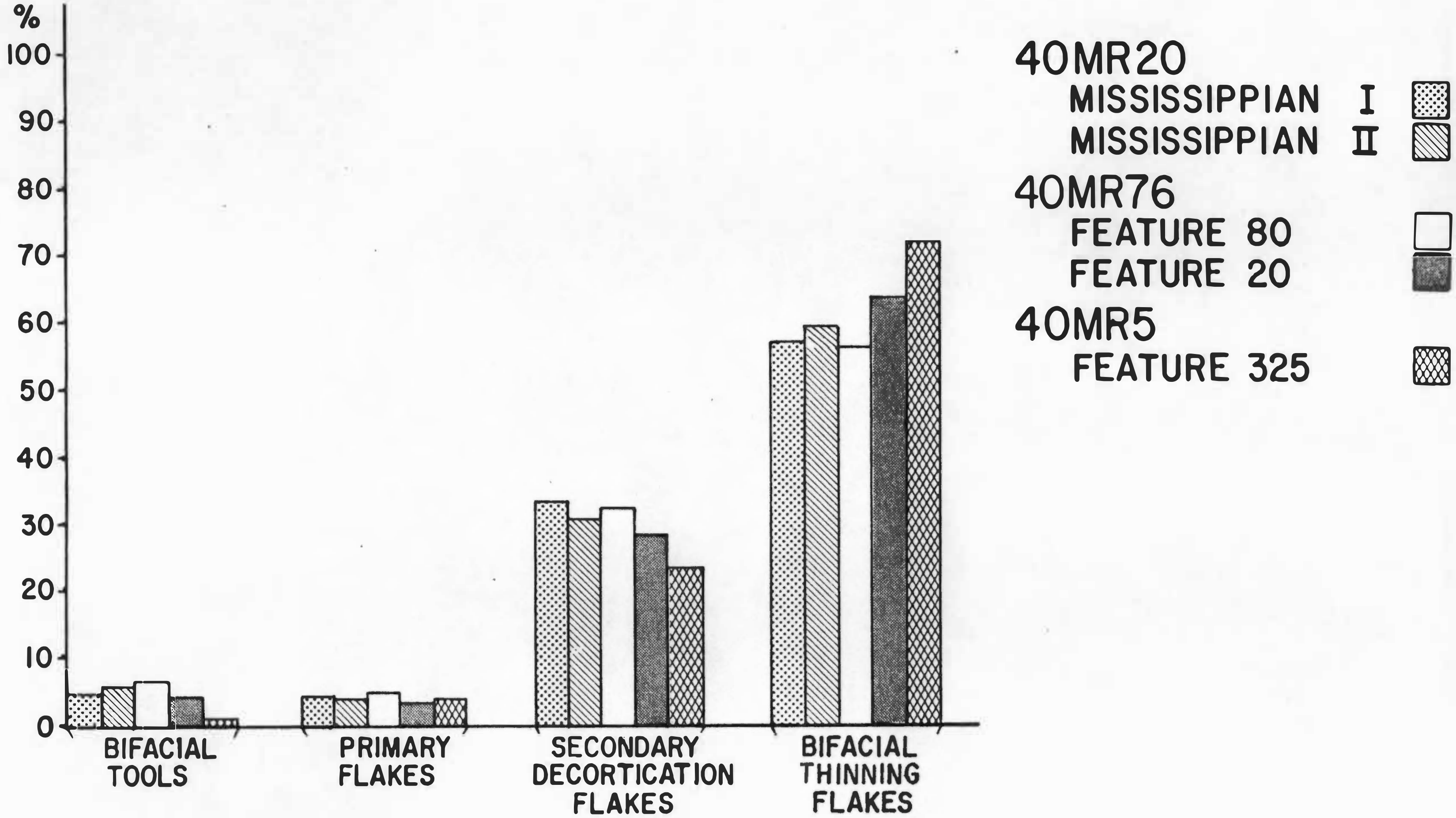

Figure 4. Percentages of Bifacial Tools and Debitage in Bifacial Reduction Group Across Assemblages.

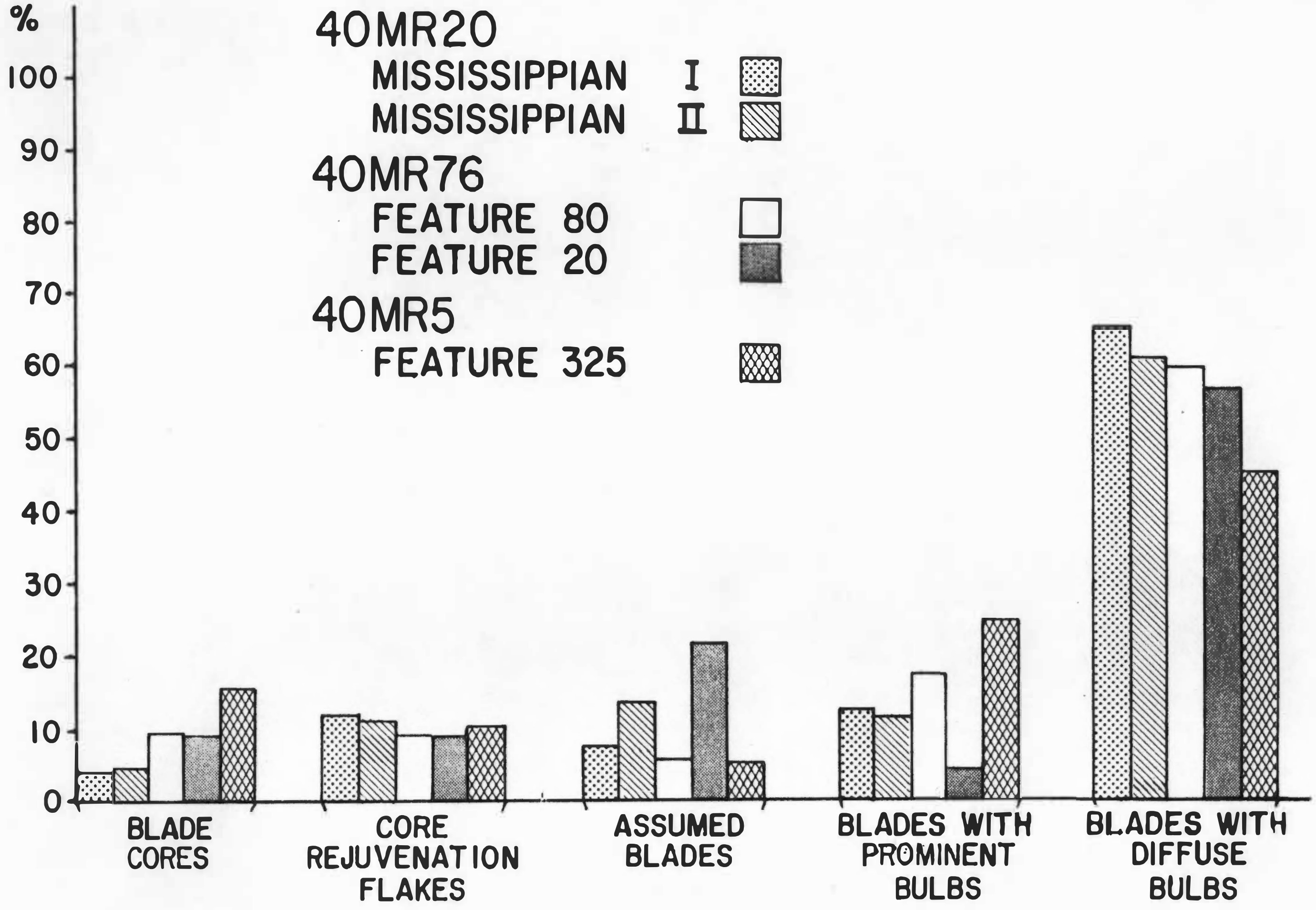

Figure 5. Percentages of Blade Cores and Blades in Blade Reduction Group Across Assemblages.

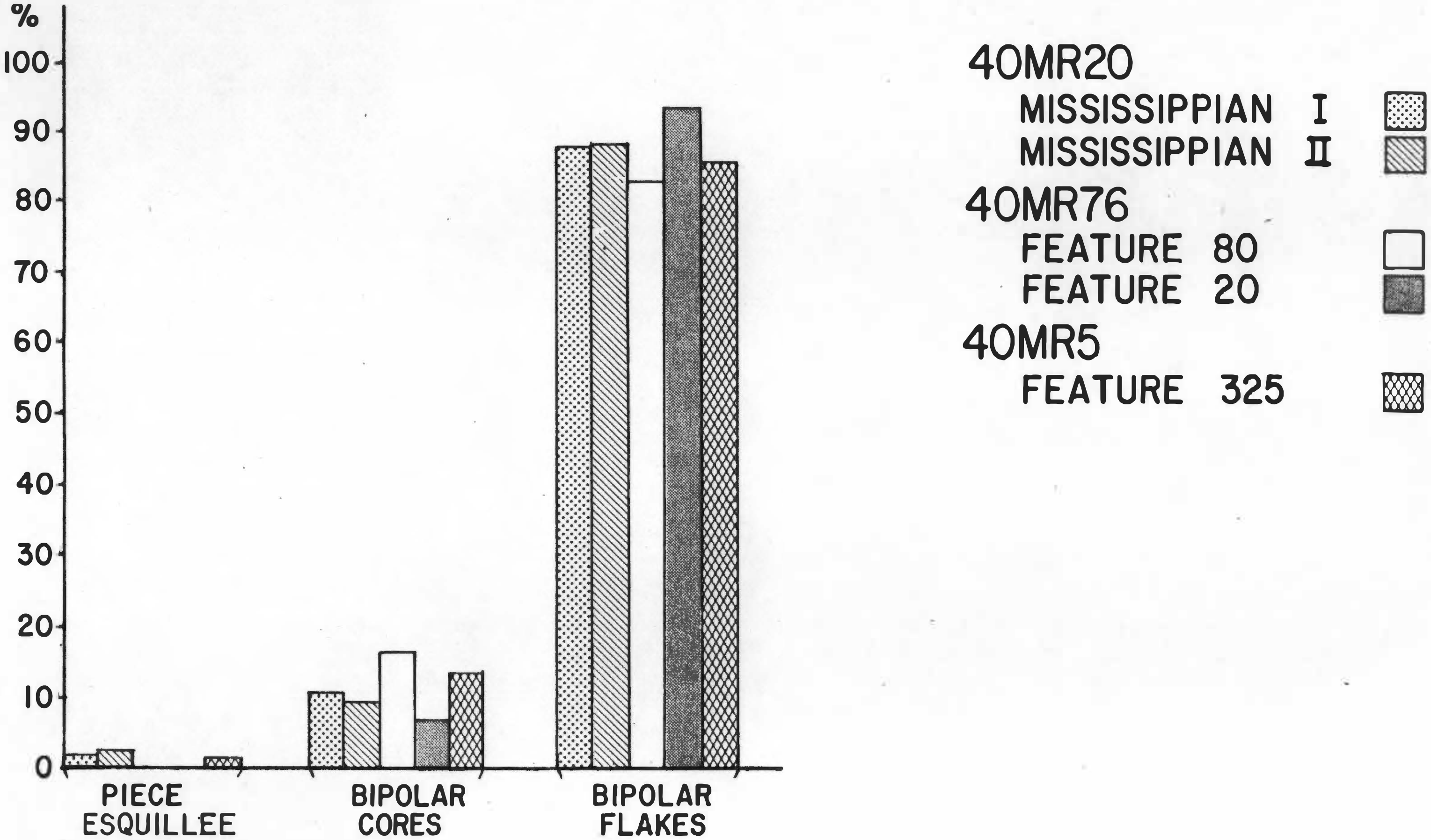

Figure 6. Percentages of Bipolar Tools, Cores and Flakes in Bipolar Reduction Group Across Assemblages.

Table 8. Frequency of projectile point types by assemblage.

	Sites/Assemblages[a]				
	Martin Farm		Jones Ferry		Tomotley
Projectile Point Types	MISS I	MISS II	F.20	F.80	F.325
Upper Kirk	2				
St. Albans	1				
Morrow Mountain			1		
Iddins	2	1			
Probably Archaic	1			1	
Bradley Spike	1				
Camp Creek	2				
Connestee	1				
Triangular Corner-Notched	2				
Hamilton Incurvate	12	9	5	5	3
Incurvate Base/Straight Blade	17	8	2	11	
Madison	10	6	2	6	
Straight Base/Incurvate Blade		1			
Dallas	1	2			
Pentagonal		1			
Probably Mississippian	16	16	2	5	2
Totals	68	44	12	28	5

[a]MISS I and II are the Mississippian I and II assemblages from Martin Farm. F.20 and F.80 are Features 20 and 80 from Jones Ferry. F.325 is Feature 325 from Tomotley.

Table 9. Comparison of projectile point types--Mississippian I and II, Martin Farm.

Assemblages		Projectile Point Types: Hamilton	Incurvate Base/ Straight Blade	Madison
Mississippian I				
	O_i	12	17	10
	E_i	(13.2)	(15.7)	(10.1)
Mississippian II				
	O_i	9	8	6
	E_i	(7.8)	(9.3)	(6.0)
				X^2=0.585

used, because they are typologically non-diagnostic). The hypotheses tested are:

H_0: There is no difference between the Mississippian I and II assemblages based on the frequencies of the major Mississippian point types.

H_1: There is a significant difference between the assemblages, reflecting cultural and/or temporal differences.

The test resulted in a $X^2 = 0.585$, indicating that, based on these samples, the null hypothesis of no difference between the assemblages cannot be rejected. Thus, the two assemblages are shown statistically to be similar in terms of their frequencies of the major projectile point types.

It can be seen that the majority of the pre-Mississippian point types occur in the earlier Mississippian I assemblage (Table 8). A possible explanation for this is the recycling and reuse of these earlier

points by the Mississippian I inhabitants of the site. However, an examination of these points indicates no extensive or obvious reworking or reuse. Thus, the more probable explanation for the occurrence of these points is the slight mixing of some Mississippian I contexts with earlier components.

Functional Variability--Martin Farm Assemblages

The majority of the lithic artifacts from both assemblages show no signs of utilization (86.38 percent for Mississippian I and 82.37 percent for Mississippian II) (Figure 7). Of the activities represented by the utilized artifacts, food preparation/consumption is the most prevalent, comprising 9.77 percent of the total Mississippian I assemblage and 12.98 percent of the Mississippian II assemblage. In both assemblages, the majority of the artifacts in this activity group is utilized flakes.

Inspection of the percentages shows significant variation between the functional groups of Mississippian I and II assemblages (Figure 7) in terms of the unmodified and food preparation/consumption groups. In Table 10, this difference is examined by testing the following hypotheses:

H_0: There is no difference between the two assemblages in terms of the frequencies of the unmodified and food preparation/ consumption functional groups.

H_1: There is a significant difference between the assemblages in relation to these groups.

The resultant $X^2 = 19.06$ far exceeds the critical value of 3.84 for a test with $\alpha = .05$ and one degree of freedom.

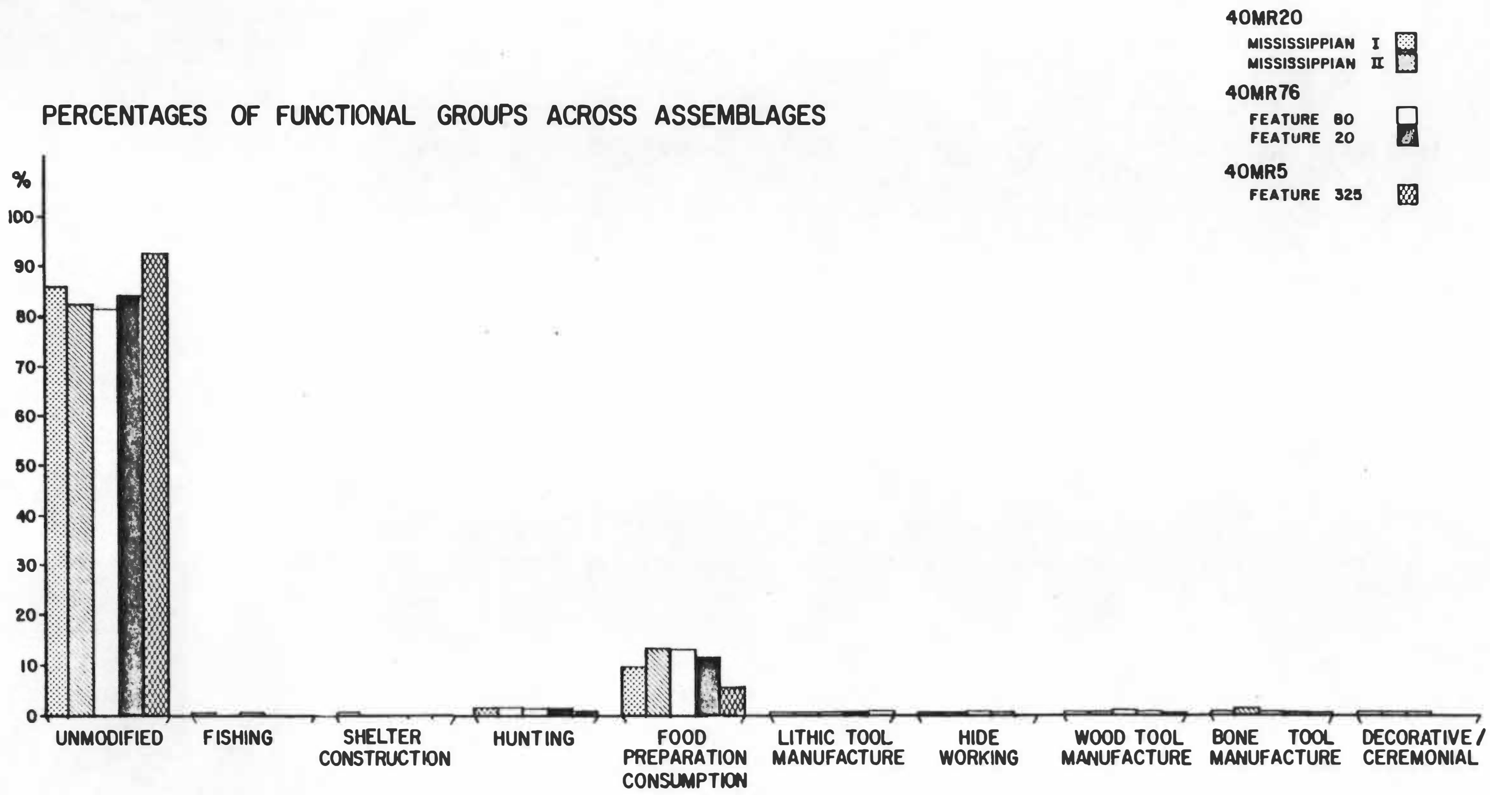

Figure 7. Percentages of Functional Groups Across Assemblages.

Table 10. Comparison of unmodified and food preparation/consumption groups--Mississippian I and II.

Assemblages		Functional Groups: Unmodified	Functional Groups: Food Preparation/ Consumption
Mississippian I			
	O_i	3494	395
	E_i	(3437.4)	(451.6)
Mississippian II			
	O_i	2443	385
	E_i	(2499.6)	(328.4)
			X^2=19.06

The differences between the observed and expected cell frequencies indicate a positive relationship, with significantly more than expected unmodified artifacts in the Mississippian I assemblage, and significantly more than expected artifacts in the food preparation/ consumption group (principally utilized flakes) in the Mississippian II assemblage. However, the phi coefficient of 0.053, while supporting a slight positive relationship, indicates that the high X^2 value is probably due to the large sample size. Thus, there is probably no significant functional difference between the assemblages.

Raw Material Selection and Heat Alteration--Martin Farm Assemblages

The most frequently used raw materials in the production of lithic artifacts in both assemblages at the Martin Farm site include Knox black chert, Knox black-banded chert, heated light gray chert (category 39) and dark gray chert (category 40) (Figures 8 and 9).

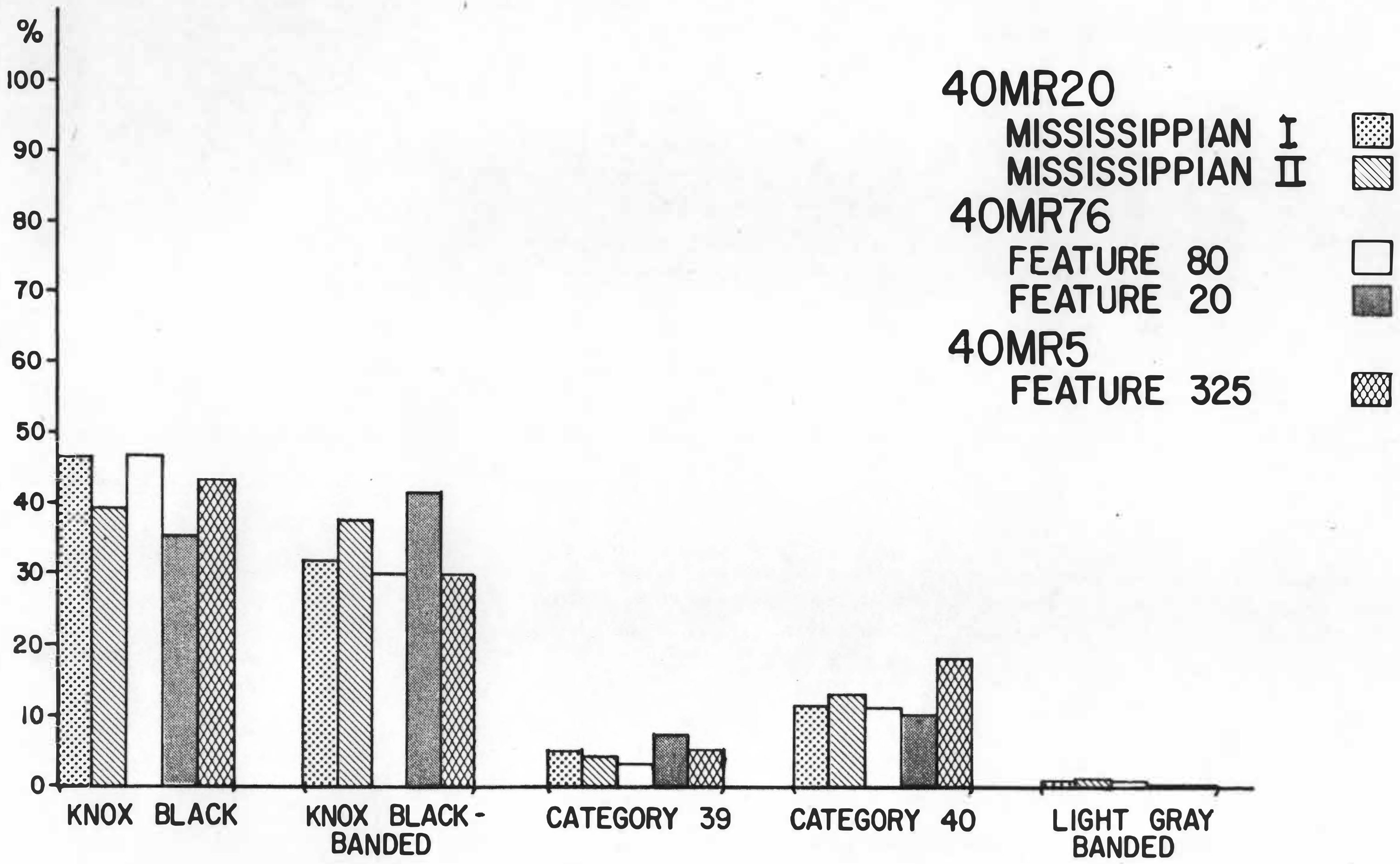

Figure 8. Percentages of Raw Material Categories Across Assemblages--Local Source Cherts.

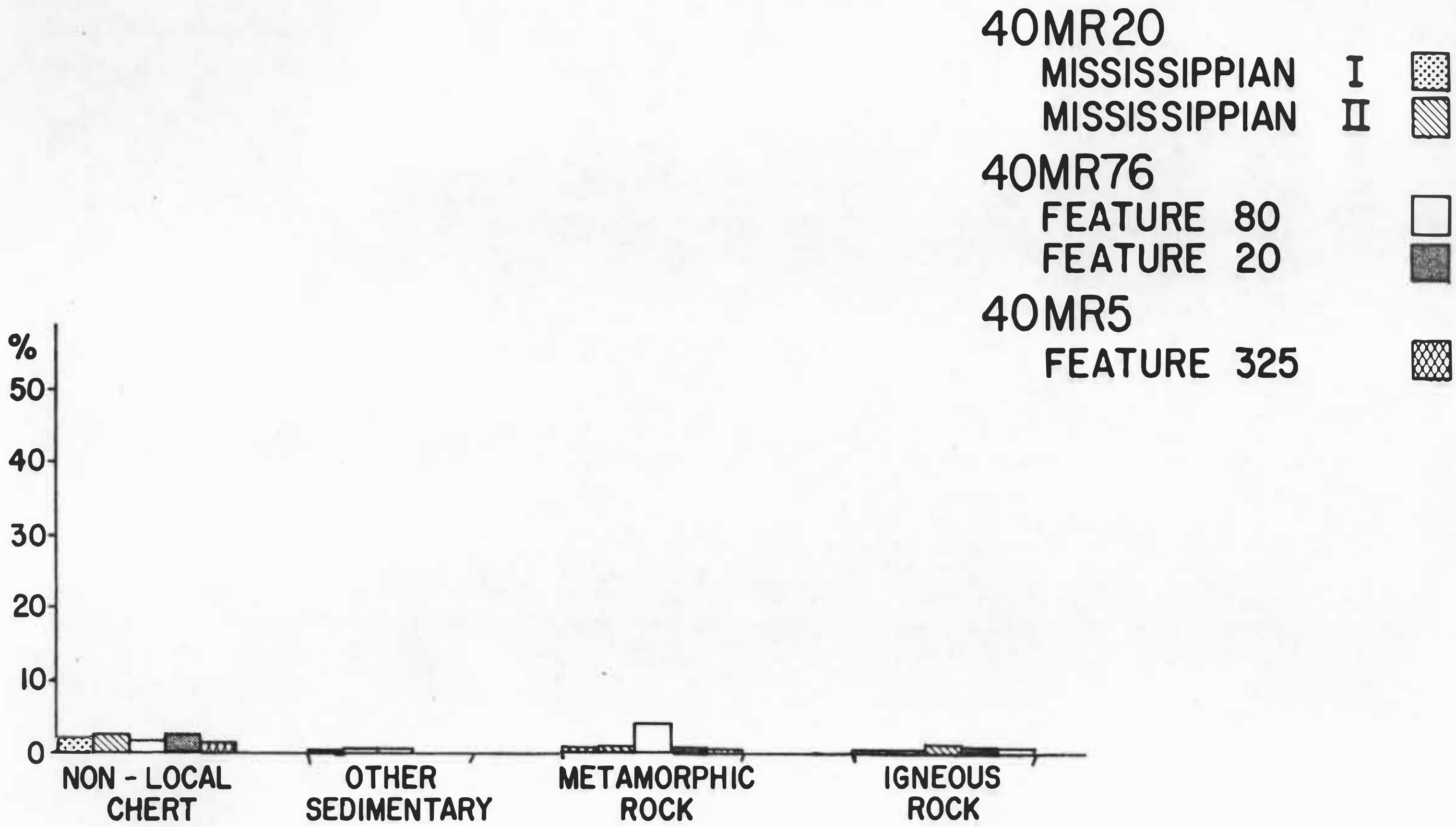

Figure 9. Percentages of Non-Local Cherts and Non-Chert Across Assemblages.

In the Mississippian I assemblage, 95.38 percent of the lithic artifacts are produced from these raw materials, as are 94.94 percent of the artifacts from the Mississippian II assemblage. While there is no apparent significant difference in the use of raw material categories 39 and 40 between assemblages, there is a difference in the percentage of Knox black and Knox black-banded chert.

The hypotheses tested in a comparison of these assemblages (Table 11) are as follows:

H_0: There is no difference between the assemblages based on their frequencies of Knox black and black-banded chert.

H_1: There is a significant difference between the two assemblages, in terms of these chert varieties, indicating differential use.

Table 11. Comparison of Knox black and Knox black-banded chert frequencies--Mississippian I and II.

Assemblages		Chert Types	
		Knox Black	Knox Black-Banded
Mississippian I			
	0·	1892	1290
	1	(1781.4)	(1400.6)
Mississippian II			
	0·	1172	1119
	1	(1282.6)	(1008.4)
			X^2=37.27

A X^2 = 37.27 was obtained from this test. However, even though this value shows that the null hypothesis should be rejected, a ϕ = .08 indicates that the positive relationship is very weak. Thus, once again, a large sample size has artificially inflated the X^2, and there appears to be no difference in the raw material use between the two components that could not be attributed to sampling error.

The percentages of identifiably heated artifacts are 30 percent for the Mississippian I assemblage and 34 percent for the Mississippian II assemblage (Figure 10). The following hypotheses are used to compare these assemblages (Table 12):

H_0: There is no significant difference in the occurrence of heated and unheated artifacts between the two assemblages.

H_1: There is a significant difference in the frequencies of heat altered and unheated artifacts between assemblages, indicating technological differences.

Table 12. Comparison of unheated to heated lithics--Mississippian I and II.

Assemblages	Heat Alteration	
	Unheated	Heated
Mississippian I		
O_i	2831	1214
E_i	(2759.6)	(1285.4)
Mississippian II		
O_i	1952	1014
E_i	(2023.4)	(942.6)
		X^2=13.74

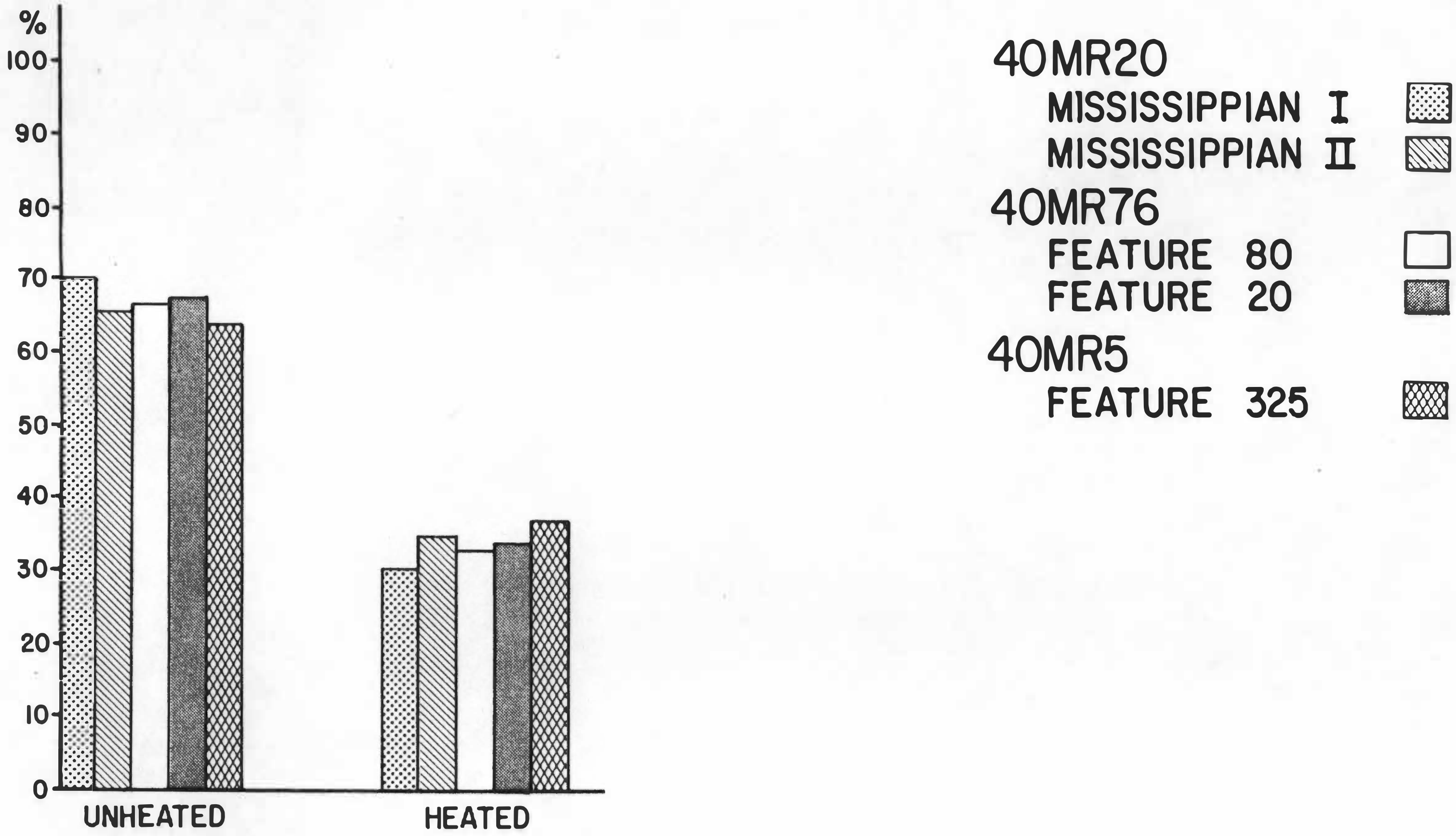

Figure 10. Percentages of Heat Alteration Across Assemblages.

The resultant $X^2 = 13.74$, while indicating a significant difference between the assemblages, again appears to be artificially inflated by the large sample size, because $\phi = 0.044$. Thus, any differences in the frequency of heat altered artifacts are so slight that they are probably due to random error.

Variability in the Martin Farm Lithic Subassemblages

The Mississippian I and II assemblages are also examined in terms of their general level, structure and feature subassemblages, so that comparisons can be made between similar contexts. The most notable difference between the technological groups of the subassemblages is the much lower percentage of bifacial artifacts and higher percentage of bipolar artifacts in the structure subassemblages, as compared to the feature and general level subassemblages (Figure 11). The other technological groups exhibit no striking variability between contexts.

Variability in the contextual distribution of the functional activity groups is more complex (Figure 12). The Mississippian I features contain the largest percentage of unmodified artifacts, while the Mississippian II general levels contain the most unmodified artifacts. The highest percentage of modified artifacts in the food preparation/consumption category is found in the general levels of the Mississippian I assemblage (13 percent) and the features of the Mississippian II assemblage (15.7 percent).

The highest percentages of Knox black chert are found in the features of both the Mississippian I and II assemblages (Figure 13). Knox black-banded chert is most prevalent in the general levels of both

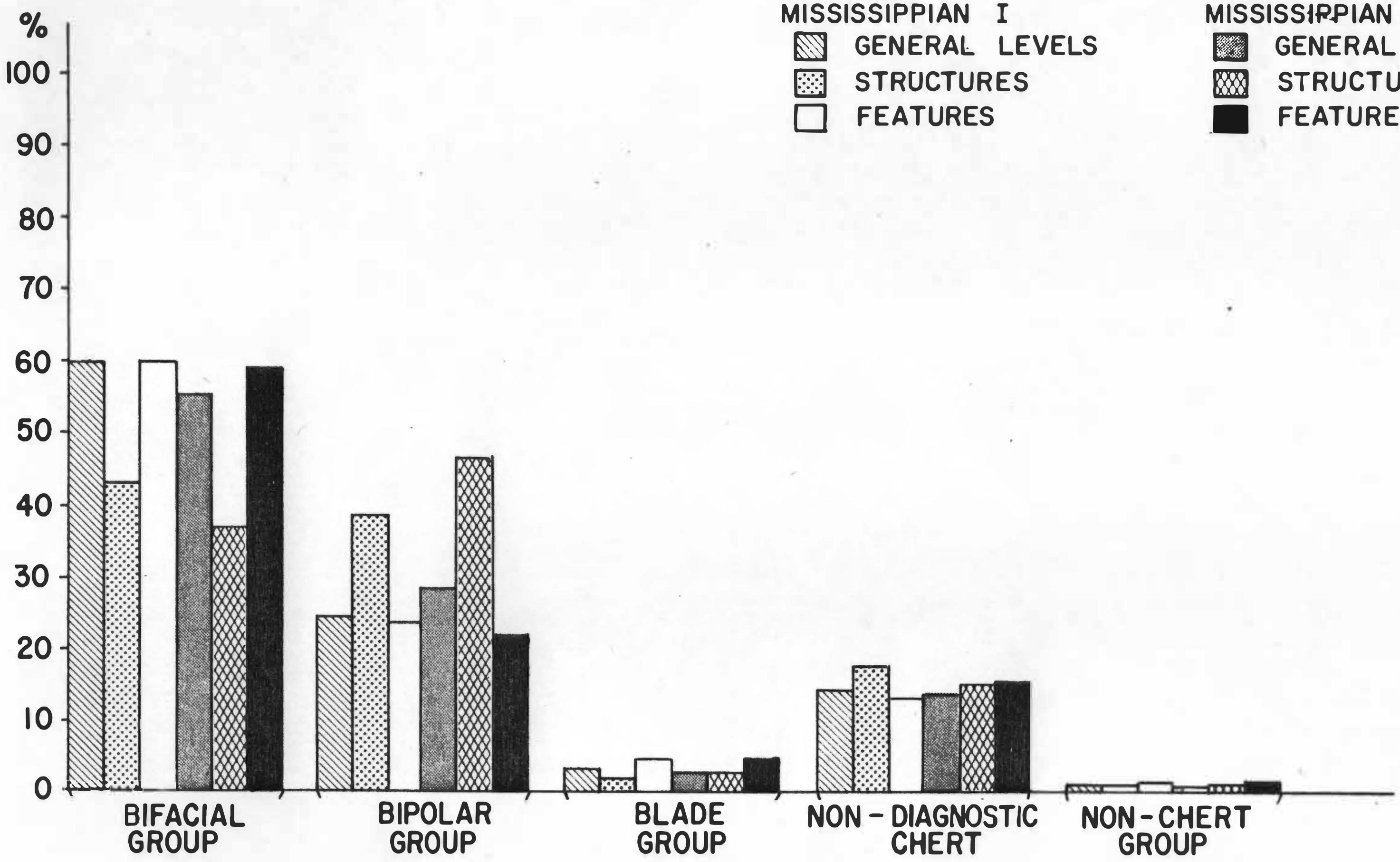

Figure 11. Percentages of Technological Groups by Context--40MR20.

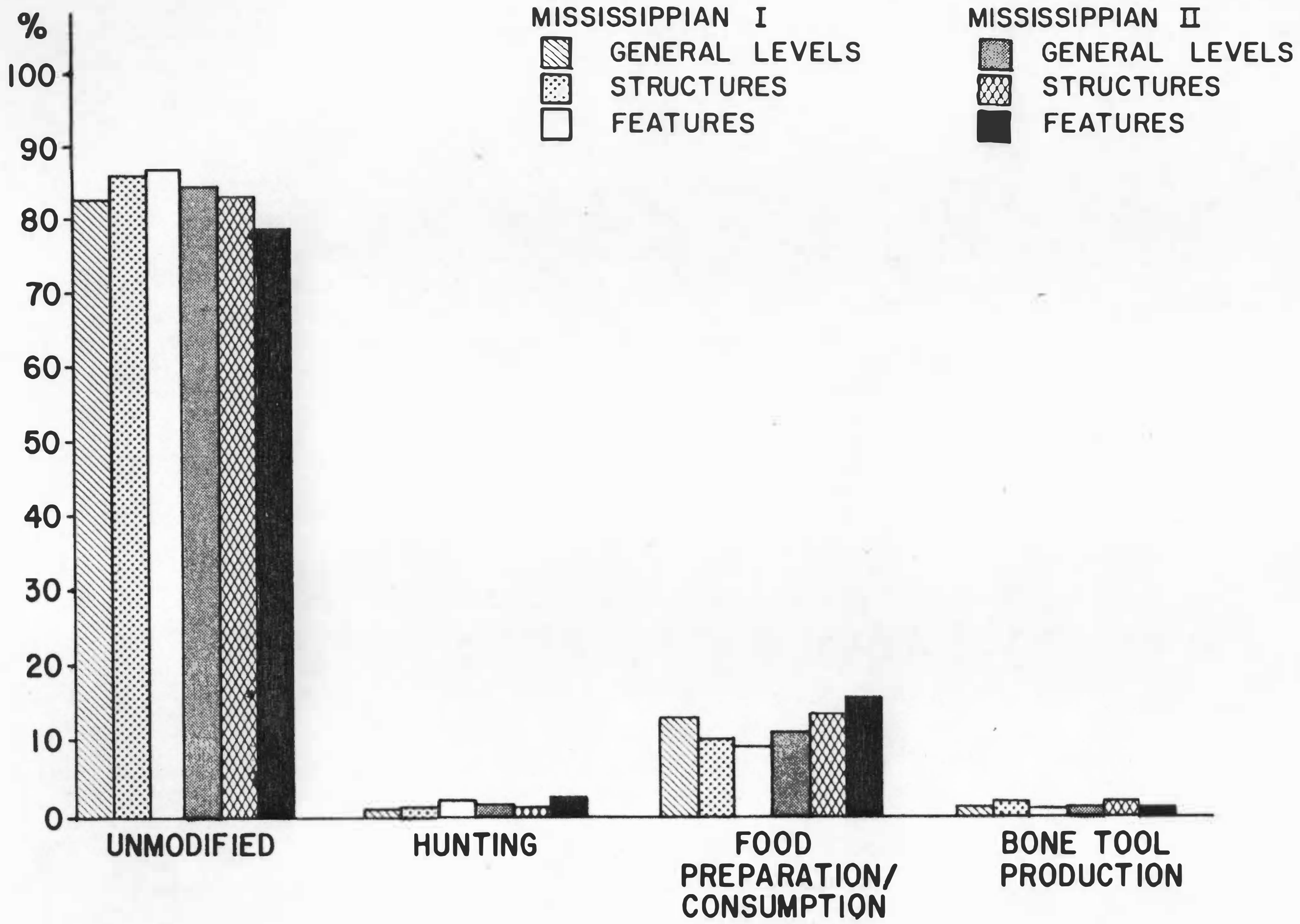

Figure 12. Percentages of Functional Groups by Context--40MR20.

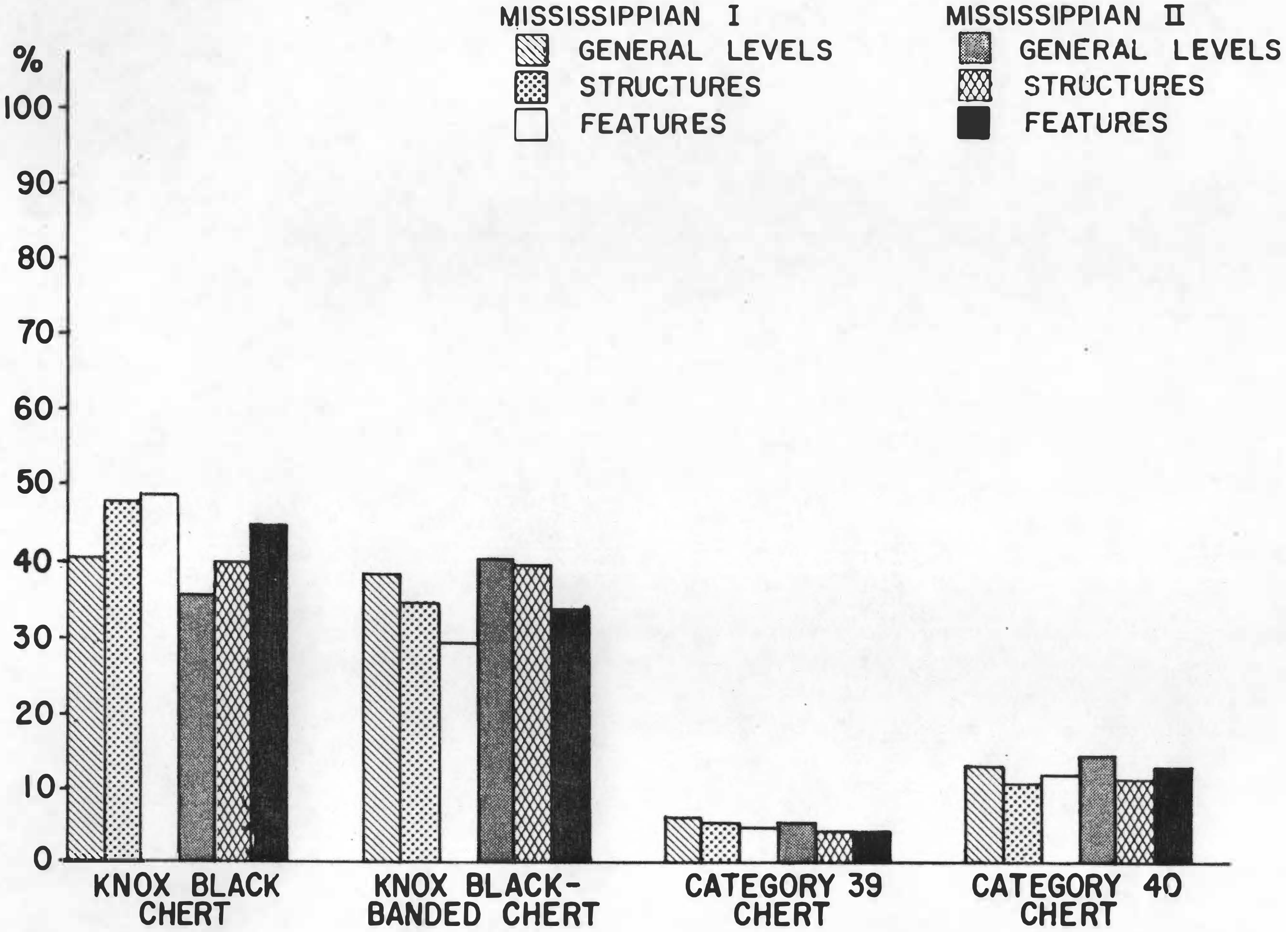

Figure 13. Percentages of Major Raw Material Groups by Context--40MR20.

assemblages from Martin Farm. The highest percentages of unheated chert are also noted for the features of both assemblages (Figure 14), while heated cherts are most prevalent in the general levels of the assemblages.

Comparison of the Martin Farm, Tomotley, and Jones Ferry Feature Assemblages

Finally, the features from the Mississippian I and II assemblages from Martin Farm are compared to Features 20 and 80 from Jones Ferry and Feature 325 from Tomotley. In terms of the major technological groups (Figure 15), the features from the two assemblages from Martin Farm show no significant differences between each other. The features from Jones Ferry also do not show any intrasite differences. However, when the two sites are statistically compared by a chi-square test (Table 13), a $X^2 = 40.37$ is computed ($\alpha = .05$, df = 3), showing a significant difference between the two sites. Considering the sample size, the degree of difference between the observed and expected values is not great, and the X^2 is probably artificially inflated by the sample size. This means that, in terms of the frequencies of the major technological groups, the Martin Farm and Jones Ferry lithics are not significantly different.

An examination of Figure 15 indicates that Feature 325 is anomalous, because it contains a very high percentage of bifacial artifacts. Thus, it can generally be stated that the Martin Farm features have higher percentages of bipolar artifacts than the features from the other two sites. Even so, it is obvious from the bar graphs

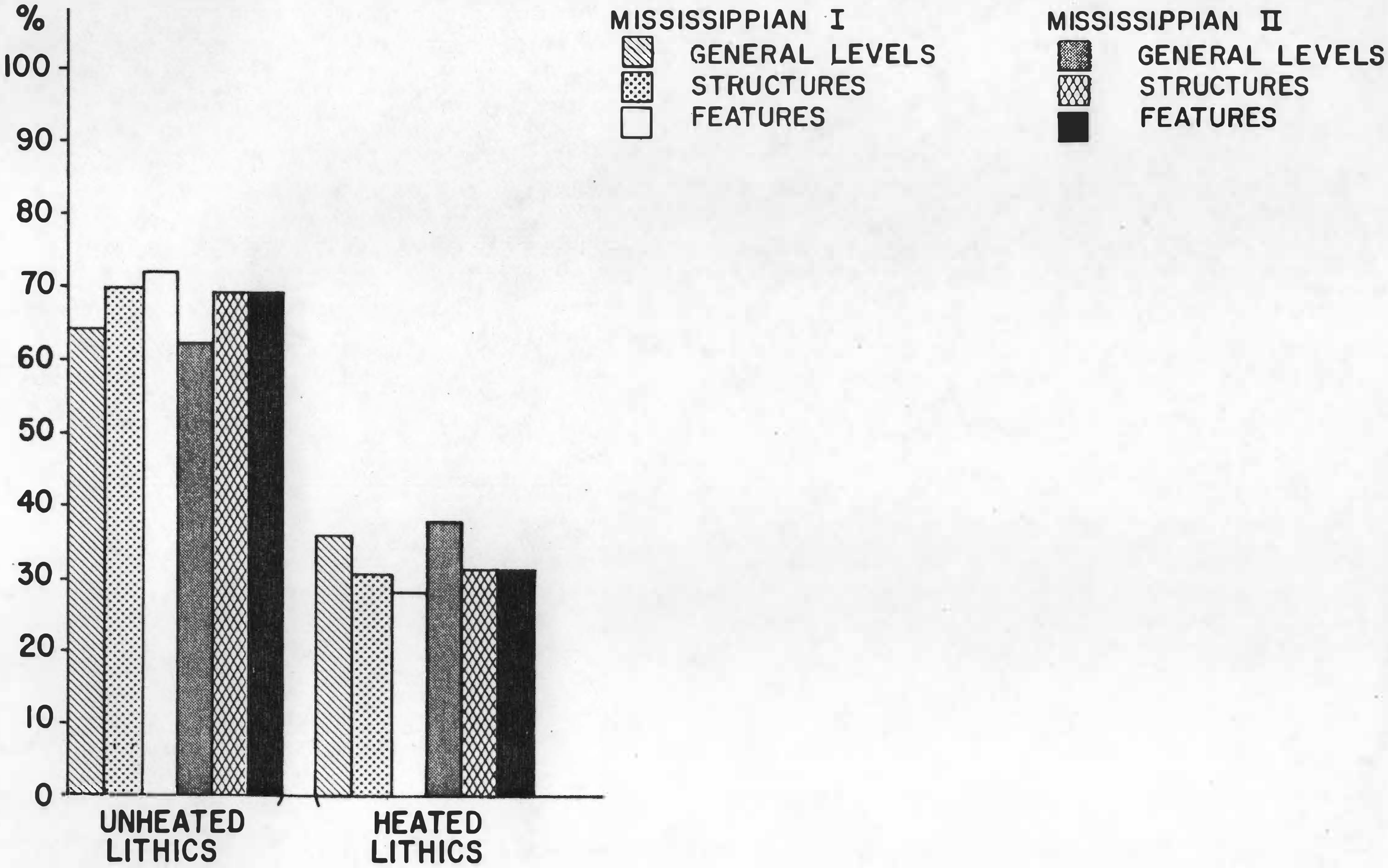

Figure 14. Percentages of Heat Alteration by Context--40MR20.

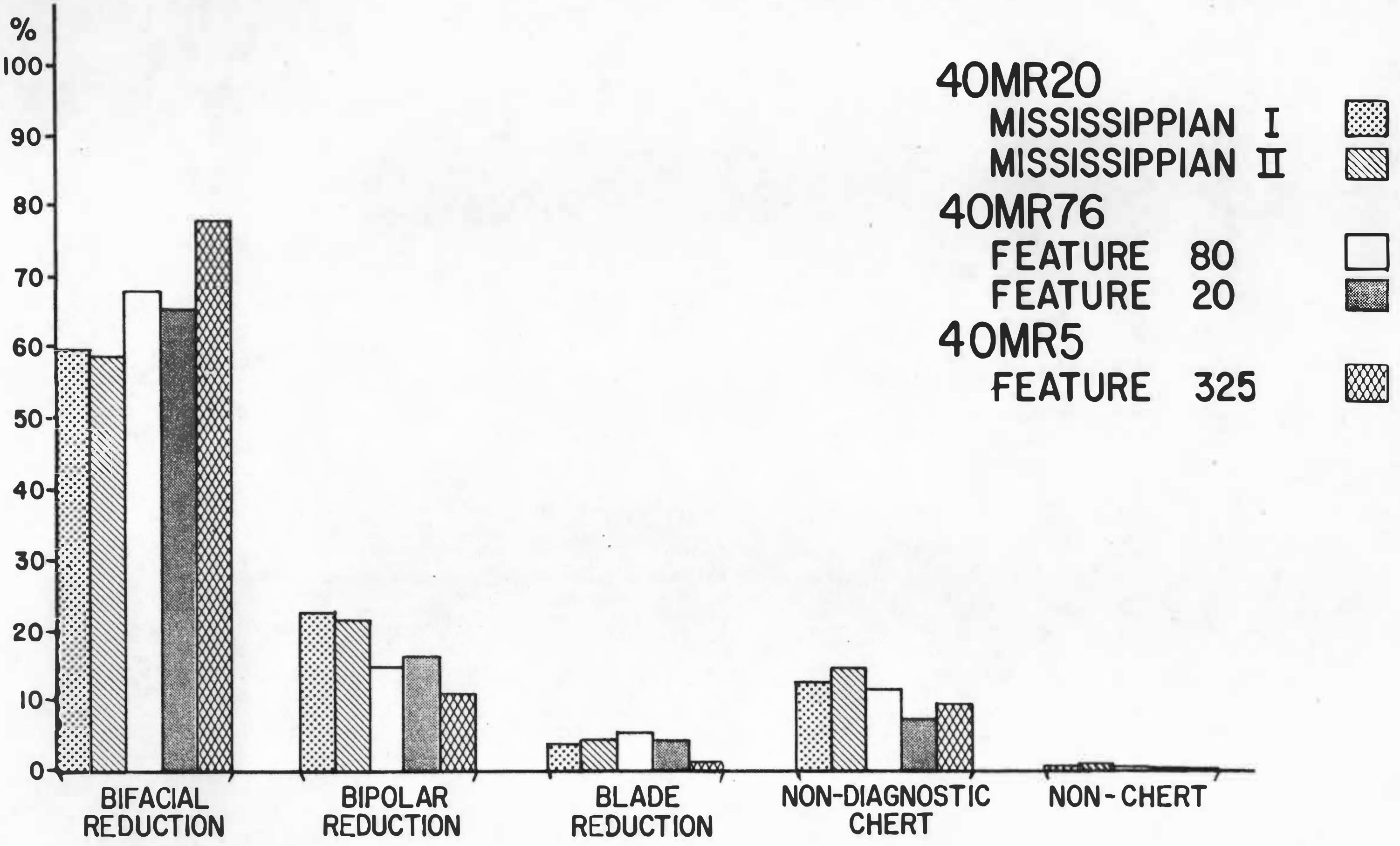

Figure 15. Percentages of Technological Categories for Features.

Table 13. Comparison of Martin Farm and Jones Ferry features in terms of technological groups.

Sites		Technological Groups			
		Bifacial	Blade	Bipolar	Other
Martin Farm					
	O_i	2134	149	807	496
	E_i	(2211.7)	(159.7)	(727.9)	(486.7)
Jones Ferry					
	O_i	1038	80	237	202
	E_i	(960.3)	(69.3)	(316.1)	(211.3)
					X^2=40.37

that the proportions of technological groups are the same for all the sites--all sites have more bifacial artifacts than bipolar artifacts, and they have more bipolar than blade artifacts.

As a final point in the discussion of the similarities in blanks, the frequencies of the major projectile point types in the features from Martin Farm and Jones Ferry (Table 14) are compared. The Tomotley material is not used because of insufficient sample sizes of projectile points. The following hypotheses are tested:

H_0: There is no significant difference between the features of the sites in terms of the frequencies of the Hamilton, incurvate base/straight blade, and Madison projectile points.

H_1: There is a significant difference between the frequencies of the projectile point types.

The chi-square value obtained from the test is 4.073 (α = .05, df = 6), far below the critical value of 12.59. Thus, there is no

Table 14. Comparison of Mississippian projectile point types from Martin Farm and Jones Ferry.

Assemblages	Projectile Point Types: Hamilton	Incurvate/ Straight	Madison
Mississippian I	9 (9.80)[a]	12 (12.20)	10 (8.97)
Mississippian II	5 (4.40)	5 (5.50)	4 (4.10)
Feature 20	5 (2.80)	2 (3.60)	2 (2.60)
Feature 80	5 (6.95)	11 (8.70)	6 (6.40)
		$X^2 = 4.073$	

[a]Expected values are in parentheses.

significant difference between the sites or the features in terms of the major Mississippian projectile point types.

As can be noted from the bar graphs (Figure 16), the percentages of functional groups for the features from the sites examined are generally comparable in that the unmodified and food preparation/consumption groups show the highest percentages in all the assemblages from all the sites. Feature 325 appears anomalous, since it has the highest percentage of unmodified artifacts and the lowest percentage of artifacts in the food preparation/consumption group.

The major raw material chert categories show a similar distribution for most of the analyzed features (Figure 17). However, the percentage of Knox black-banded is highest in Feature 20 at Jones Ferry, whereas Knox black chert is most frequent in the other contexts examined. Chert category 40 is highest in Feature 325, which also has the highest percentage of heat altered artifacts (Figure 18).

The results of the nominal data analysis of the lithic artifacts show that Feature 325 from Tomotley is anomalous. This is because its lithic assemblage exhibits a high percentage of bifacially produced artifacts, unmodified artifacts and heated artifacts. The probable reason for this is sampling bias resulting from the examination of a single feature. This conclusion is reinforced by the examination of another bell-shaped pit--Feature 64 from the Mississippian II assemblage at Martin Farm. Fifty percent of the lithic artifacts from this feature are bifacial, while 30 percent are bipolar, 4.8 percent are blades, and 15.2 percent are none of the above. Thus, the pattern for

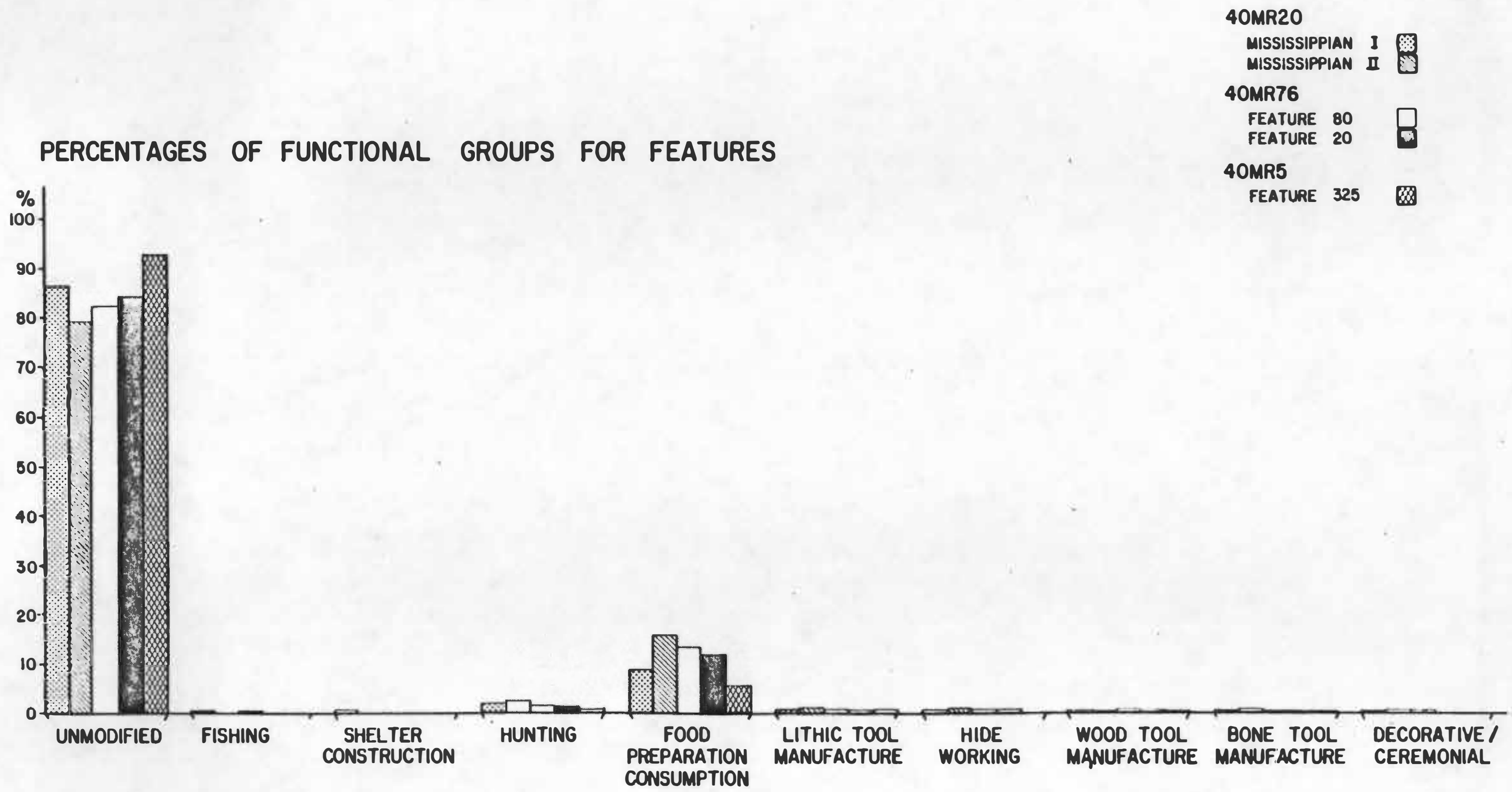

Figure 16. Percentages of Functional Groups for Features.

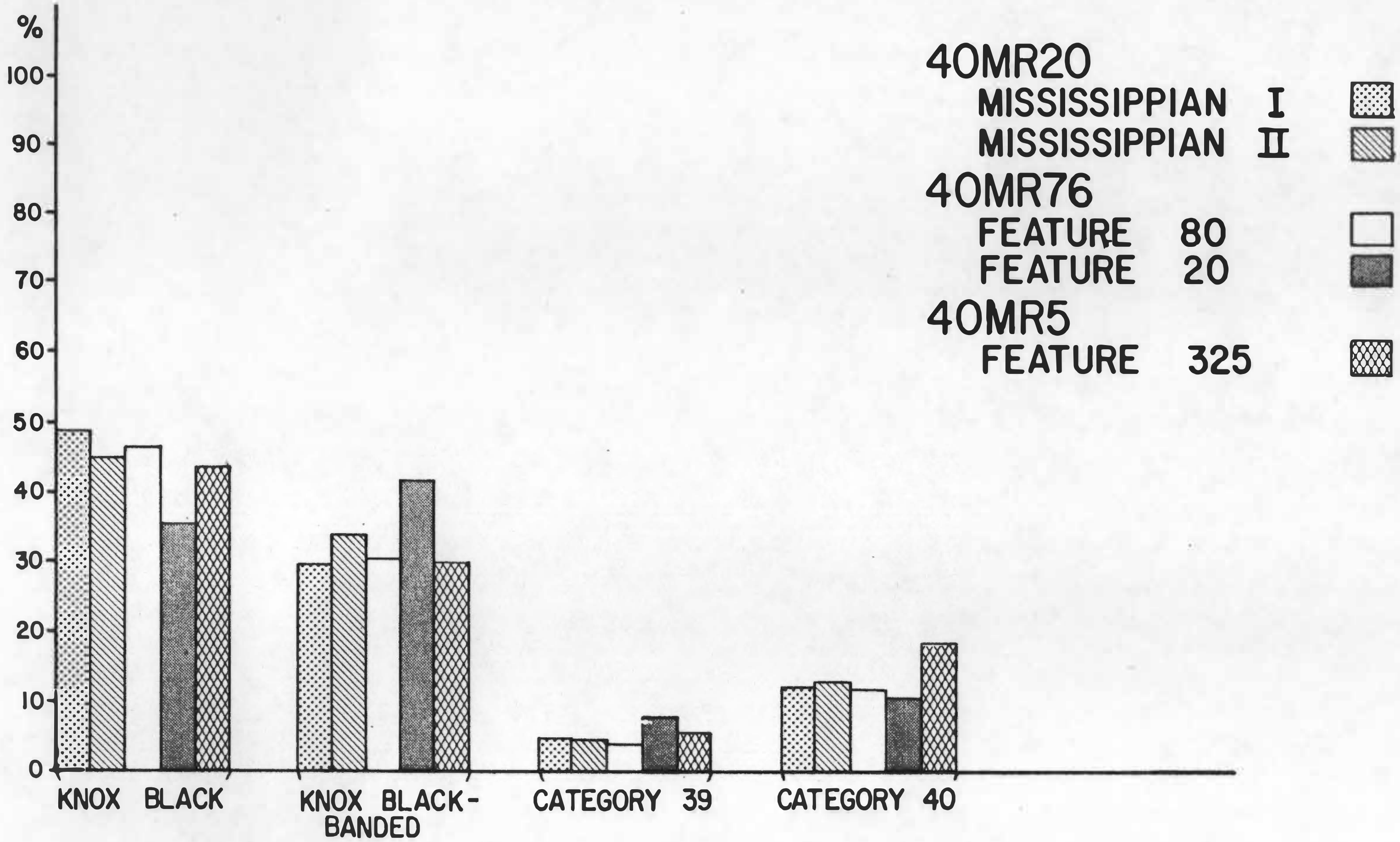

Figure 17. Percentages of Knox Black and Black-Banded Cherts and Heated Variants for Features.

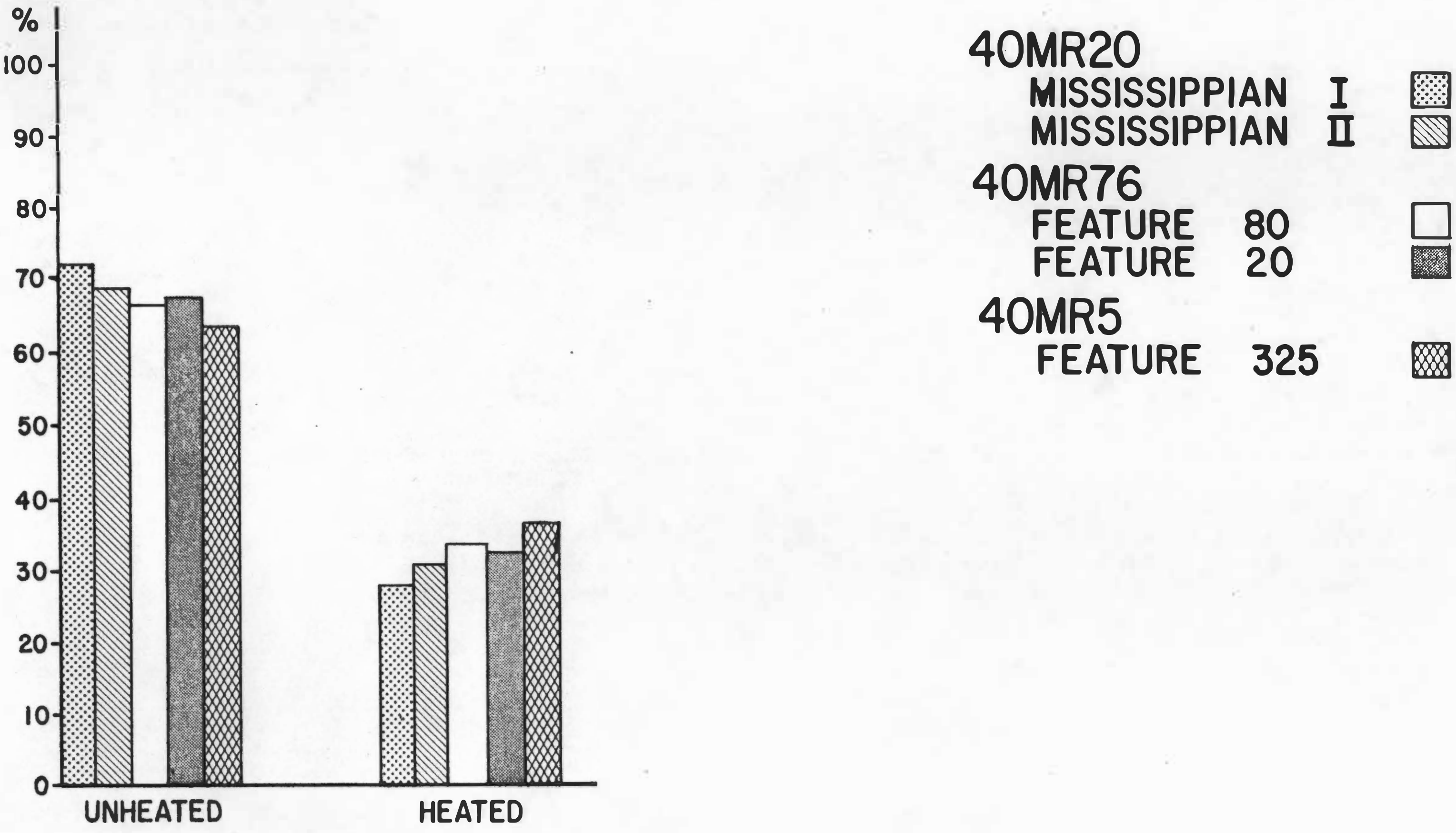

Figure 18. Percentages of Heat Alteration for Features.

this feature is similar to the Mississippian I pattern, and quite different from Tomotley Feature 325.

Behavioral Implications of the Martin Farm and Jones Ferry Data

The primary differences between the Martin Farm and Jones Ferry components occur in the frequencies of the technological groups: a higher percentage of bipolar artifacts occur at Martin Farm. One possible explanation for this is the location of the site near a major chert resource where small nodules of good quality Knox black or black-banded chert were easily obtained. The most expedient means of reducing these nodules would be the bipolar method, since many nodules could be obtained with little effort.

In contrast, the Jones Ferry site is located over five miles from Rock-Crusher Bluff, the closest known source of Knox black and black-banded chert. Although these are the most frequently used lithic raw materials at Jones Ferry, it obviously required a greater expenditure of energy to carry this chert to the site. Thus, the prehistoric inhabitants of Jones Ferry may have been more selective in their chert resource procurement, taking more time to collect larger nodules which would be more efficiently reduced by the bifacial method. Despite this possibility, a likely explanation for the technological differences between the Martin Farm and Jones Ferry lithics is the artificial bias introduced by a large sample size.

Most of the projectile points are in the probable Mississippian projectile point fragments category. An examination of these fragments and other broken projectile points indicates that few show any definite

damage from use. Instead, almost all of the breaks occurred in manufacture, recycling (through bipolarization) or other means (possibly through trampling or post-depositional disturbance).

This pattern is consistent with the view of the Martin Farm site as a permanent or semi-permanent settlement. Obviously, any hunting expeditions would involve "gearing up" (Binford 1979) beforehand at the settlement. Thus, a high frequency of artifacts resulting from manufacture or maintenance would be expected. In addition, artifacts broken by trampling would be more frequent in a semi-permanent or permanent settlement, due to the greater density of people and activities. This would certainly affect the Mississippian projectile points, since most are made from flakes which were further thinned by retouching.

The higher frequency of bipolar artifacts in the structure areas of the Mississippian I and II assemblages may reflect the effects of trampling and increased activity in these locations. This would result in a greater frequency of breakage of the thinner and less durable bifacial flakes, making them less likely to be recovered and correctly identified.

The higher frequency of heated lithic artifacts in the general levels fits with a pattern of heat treatment of chert outside of structures. However, intentional heat treatment by the inhabitants of the site cannot be proven, especially since many of the heated artifacts show potlids and crazing from overheating or uneven heating or cooling.

Finally, the higher frequency of modified artifacts in the Mississippian I assemblage general levels, as opposed to the higher frequency in the Mississippian II features, may reflect differing disposal patterns between these assemblages. Specifically, the Mississippian II general levels and structures, which would be expected to represent the highest frequency of activity and, therefore, contain the greatest number of utilized artifacts, might be swept, and the artifacts might be secondarily deposited in the features. Sweeping of such areas may not be a behavior pattern common during the Mississippian I occupation. However, it must be cautioned that the general levels from the Mississippian I component are closely associated with Structure 3; for this reason, the high percentage of utilized artifacts could reflect sampling bias. Also, the unique shape and size of Feature 7 makes the comparison of its contents to those of other features more difficult, and the conclusions derived from such a comparison less secure.

CHAPTER IV

RESULTS OF THE METRIC ANALYSIS

Analysis of the Projectile Points

The attributes and attribute states measured for the metric projectile point study are defined in Tables 15 and 16, while the continuous and discrete data for the attributes are given in Tables 17 and 18. The measurement landmarks for the projectile points are visually presented in Figure 19. A total of 65 projectile points was measured using the metric coding format (Davis et al. 1980).

T-tests. As a first step in the metric analysis, the means of the continuous attributes for each assemblage are compared using t-tests. The means reflect the combined measurements of all projectile point types within an assemblage with the exception of the corner-notched Mississippian points which, because of their unique geometry and their location only in the Mississippian I assemblage, were excluded from further analysis (Tables 19 and 20). Hamiltons, Madisons and other projectile point types are not individually compared between assemblages because the sample sizes are too small for each type. The t-tests were calculated using the information presented in Table 21. Because nearly 60 t-tests were calculated for both the projectile points and debitage, only the results of the t-tests indicating significant differences between the assemblages are presented and discussed in detail.

The results of the t-tests show no significant differences in any of the attributes examined between the Mississippian I and II

Table 15. Attribute definitions for continuous projectile point measurements.

Attribute[a]	Definition
Length	Maximum length to nearest 0.1 mm
Width	Width of blade to nearest 0.1 mm
Thickness	Maximum thickness to nearest 0.1 mm
Stem Length	Stem length to nearest 0.1 mm (stemmed points only)
Neck	Neck width to nearest 0.1 mm (same as width for triangular points)
Stem Width	Stem width to nearest 0.1 mm (stemmed points only)
Weight	Weight to nearest 0.1 gm
Base Curvature	Base curvature to nearest 0.5 mm
Stem Angle	Stem angle averaged to nearest 5 degrees for both sides of stem (stemmed points only)
Lateral Edge 1 Curvature	Right blade edge curvature to nearest 0.5 mm (with catalogue number and distal end of point facing up, lateral edge 1 is on the right)
Lateral Edge 2 Curvature	Left blade edge curvature to nearest 0.5 mm

[a]Attributes and definitions are derived from Davis et al. 1980.

Table 16. Attribute and attribute state definitions for discrete projectile point measurements.

Attributes[a]	Attribute State Codes and Definitions
Stem Preparation	1 Ground
	2 Unground
Stem Shape	1 Straight
	2 Incurvate
	3 Corner removed
	4 Corner notched
	5 Side notched
	6 Round stem
	7 Tapered stem
	8 No stem--triangular point
Base Preparation	1 Ground
	2 Unground
	3 Burinated
	4 Cortex (unfinished base)
	5 Flat (unfinished base)
Base Shape	0 Not observable
	1 Straight
	2 Excurvate
	3 Incurvate
	4 Bifurcate
Condition	1 Complete
	2 Broken (not in manufacture)
	3 Bipolarized (recycled)
	4 Broken in manufacture
	5 Distal impact fracture

[a]Definitions and codes derived from Davis et al. 1980.

Table 17. Metric attributes and attribute states for projectile points.

Projectile Points/ Assemblages[a]	Attributes[b] Length	Width	Thickness	Weight	Base Curvature	Lateral 1 Curvature	Lateral 2 Curvature
Dallas Excurvate							
MISS I (n=1)							
x	23.90	12.60	4.20	1.10	0.0	1.50	2.00
s	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MISS II (n=1)							
x	19.60	13.30	3.80	0.90	0.0	2.50	2.50
s	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hamilton Incurvate							
MISS I (n=6)							
x	20.73	13.58	3.56	0.63	-1.00	-0.75	-0.83
s	0.65	1.26	0.62	0.08	0.32	0.52	0.41
MISS II (n=8)							
x	19.53	15.31	3.20	0.69	-1.44	-0.81	-0.81
s	3.76	2.08	0.40	0.29	0.56	0.26	0.46
FEAT 20 (n=3)							
x	22.33	15.20	4.17	0.87	-1.00	-0.67	-1.00
s	6.86	0.79	0.31	0.35	0.50	0.58	0.0
FEAT 80 (n=3)							
x	20.87	15.80	3.97	0.73	-0.83	-0.83	-0.17
s	0.61	1.25	0.74	0.06	0.29	0.29	0.29
Incurvate Base/ Straight Blade							
MISS I (n=10)							
x	21.14	13.69	3.17	0.68	-1.05	0.0	0.05
s	3.57	2.20	0.42	0.19	0.16	0.0	0.16

Table 17 (Continued)

Projectile Points/ Assemblages[a]	Attributes[b]						
	Length	Width	Thickness	Weight	Base Curvature	Lateral 1 Curvature	Lateral 2 Curvature
MISS II (n=b)							
$\bar{x}$	20.97	14.20	3.60	0.73	-1.17	0.0	0.0
s	1.59	1.13	0.28	0.14	0.68	0.0	0.0
FEAT 20 (n=2)							
$\bar{x}$	16.75	15.95	3.05	0.70	-0.75	0.0	0.50
s	2.05	2.19	0.35	0.28	0.35	0.0	0.71
FEAT 80 (n=8)							
$\bar{x}$	19.45	15.50	3.34	0.75	-1.00	0.31	0.13
s	2.45	1.29	0.33	0.12	0.0	0.46	0.35
Madison							
MISS I (n=6)							
$\bar{x}$	21.85	15.72	4.00	1.03	0.0	0.17	0.25
s	3.41	1.71	0.70	0.29	0.0	0.41	0.61
MISS II (n=4)							
$\bar{x}$	21.35	13.05	3.80	0.70	-0.13	0.0	0.0
s	1.20	1.71	0.47	0.12	0.25	0.0	0.0
FEAT 20 (n=1)							
$\bar{x}$	19.80	12.20	4.00	0.70	0.0	0.0	0.0
s	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FEAT 80 (n=6)							
$\bar{x}$	20.47	15.07	3.45	0.77	0.0	0.0	0.0
s	2.60	2.31	0.39	0.23	0.0	0.0	0.0

[a]MISS I and MISS II are the Mississippian I and II assemblages from Martin Farm. FEAT 20 and FEAT 80 are Features 20 and 80 from Jones Ferry.

[b]Weight is measured in grams. All other measurements are in millimeters.

Table 18. Discrete attribute states for projectile points.

Projectile Points/ Assemblages[a]	Base Preparation A.S.[b]	Base Preparation %[c]	Base Shape A.S.	Base Shape %	Condition A.S.	Condition %	Raw Material A.S.	Raw Material %	Heat Alteration A.S.	Heat Alteration %
Dallas Excurvate										
MISS I (n=1)	2	100.00	1	100.00	5	100.00	1	100.00	4	100.00
MISS II (n=1)	1	100.00	1	100.00	1	100.00	1	100.00	0	100.00
Hamilton Incurvate										
MISS I (n=6)	2	100.00	3	100.00	1	33.33	1	66.67	0	66.67
					2	33.33	2	33.33	1	33.33
					4	33.33				
MISS II (n=8)	2	100.00	3	100.00	1	87.50	1	37.50	0	62.50
					2	12.50	2	25.00	1	12.50
							39	25.00	3	12.50
							40	12.50	7	12.50
FEAT 20 (n=3)	2	100.00	3	100.00	1	100.00	1	100.00	0	100.00
FEAT 80 (n=3)	2	100.00	3	100.00	1	100.00	1	66.67	0	100.00
							2	33.33		
Incurvate Base/ Straight Blade										
MISS I (n=10)	2	100.00	3	100.00	1	60.00	1	80.00	0	80.00
					4	10.00	2	10.00	4	10.00
					5	30.00	40	10.00	7	10.00
MISS II (n=6)	1	16.67	3	100.00	1	50.00	1	66.66	0	83.33
	2	83.33			2	33.33	9	16.67	9	16.67
					5	16.67	39	16.67		
FEAT 20 (n=2)	2	100.00	3	100.00	1	100.00	1	100.00	0	100.00

Table 18 (Continued)

Projectile Points/ Assemblages[a]	Base Preparation		Base Shape		Condition		Raw Material		Heat Alteration	
	A.S.[b]	%[c]	A.S.	%	A.S.	%	A.S.	%	A.S.	%
FEAT 80 (n=8)	2	100.00	3	100.00	1	62.50	1	50.00	0	62.50
					5	37.50	2	25.00	1	12.50
							6	12.50	3	12.50
							40	12.50	4	12.50
Madison										
MISS I (n=6)	2	100.00	1	100.00	1	33.33	1	66.67	0	100.00
					2	16.67	2	33.33		
					4	33.33				
					5	16.67				
MISS II (n=4)	2	100.00	0	25.00	1	75.00	1	25.00	0	75.00
			1	75.00	2	25.00	2	75.00	6	25.00
FEAT 20 (n=1)	1	100.00	1	100.00	1	100.00	9	100.00	0	100.00
FEAT 80 (n=6)	2	100.00	1	100.00	1	50.00	1	50.00	0	66.67
					4	16.67	2	33.33	1	16.67
					5	33.33	39	16.67	4	16.67

[a]MISS I and MISS II are the Mississippian I and II assemblages from Martin Farm. FEAT 20 and FEAT 80 are Features 20 and 80 from Jones Ferry.

[b]A.S. = attribute state.

[c]% = percent of each attribute state in each assemblage.

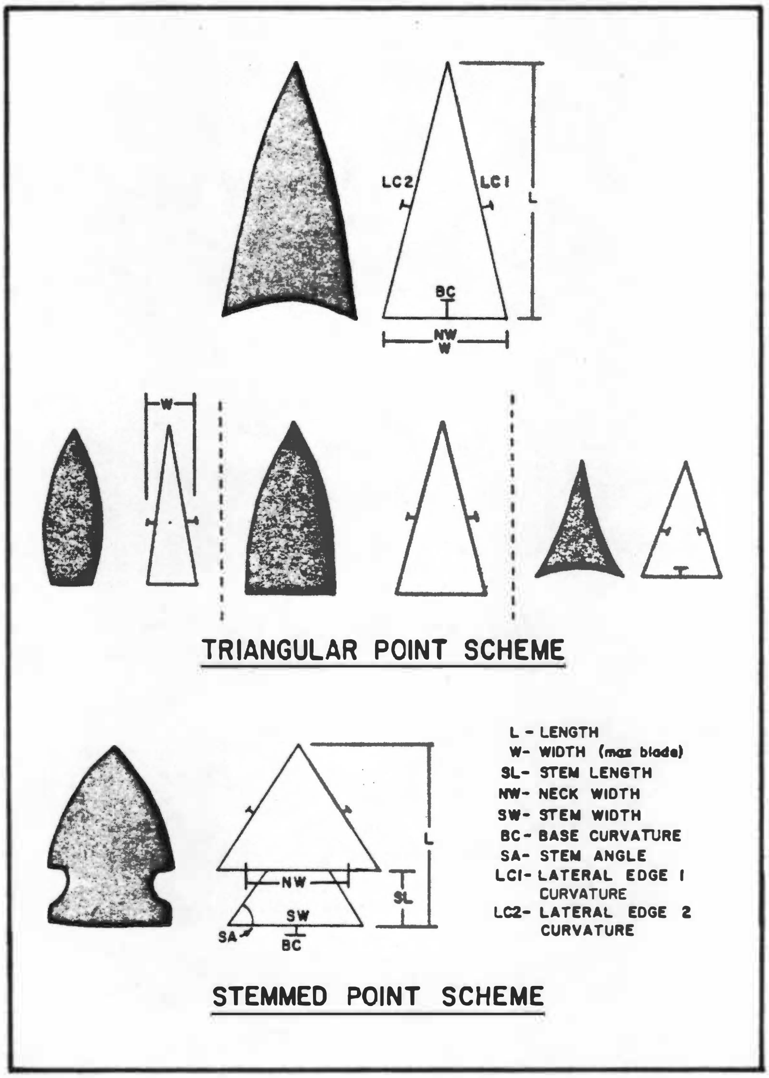

Figure 19. Continuous Measurement Landmarks for Projectile Points.

Table 19. Metric attributes and attribute states for corner-notched triangular Mississippian projectile points from Martin Farm.

Attributes	Attribute States[a] Mississippian I (n=2) $\bar{x}$	s
Length	27.90	0.71
Width	18.20	1.41
Thickness 1	4.10	0.14
Stem Length	8.65	0.07
Neck	11.55	1.91
Stem Width	15.80	5.23
Weight	1.90	0.57
Base Curvature	1.00	1.41
Stem Angle	67.50	3.54
Lateral Edge 1 Curvature	1.75	2.48
Lateral Edge 2 Curvature	2.00	2.83

[a]The stem angle measurement is in degrees and the weight measurement is in grams. All other measurements are in millimeters.

Table 20. Discrete attributes and attribute states for corner-notched triangular Mississippian projectile points from Martin Farm.

	Mississippian I (n=2)	
Attributes	Attribute State	%
Stem Preparation	1	50.00
	2	50.00
Stem Shape	4	100.00
Base Preparation	1	50.00
	2	50.00
Base Shape	1	50.00
	2	50.00
Condition	1	100.00
Raw Material	40	100.00
Heat Alteration	1	100.00

Table 21. Continuous attribute states of projectile point assemblages.

	Assemblages[a]							
	MISS I (n=23)		MISS II (n=19)		FEAT 80 (n=17)		FEAT 20 (n=6)	
Attributes	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Length	21.34	2.91	20.37	2.67	20.06	2.27	20.05	2.27
Width	14.14	1.99	14.38	1.84	15.40	1.64	14.95	1.78
Thickness 1	3.53	0.64	3.48	0.43	3.49	0.47	3.77	0.61
Weight	0.78	0.26	0.72	0.20	0.75	0.15	0.78	0.27
Base Curvature	-0.72	0.52	-1.00	0.76	-0.62	0.49	-0.75	0.52
Lateral Edge 1 Curvature	-0.09	0.60	-0.21	0.79	0.00	0.53	-0.33	0.52
Lateral Edge 2 Curvature	-0.04	0.72	-0.21	0.82	0.03	0.28	-0.33	0.82

[a]MISS I and II are the Mississippian I and II assemblages from Martin Farm. FEAT 80 and 20 are Features 80 and 20 from Jones Ferry.

projectile point assemblages from Martin Farm. Nor is there any significant difference between the projectile points from Features 80 and 20 at Jones Ferry, although the Feature 20 projectile point sample is extremely small (n=6).

As can be seen in Table 19, the mean width of the Mississippian I (Martin Farm) projectile points is 14.14mm, while the mean width of the points from Feature 80 (Jones Ferry) is 15.40mm. A comparison of these means resulted in a t-score of -2.123 with 38 degrees of freedom and $\alpha = .05$. This indicates a significant difference between the widths of the projectile points from the two assemblages.

Comparison of the Mississippian II and Feature 80 projectile point assemblages by t-tests shows that these assemblages do not significantly vary in terms of any of the attributes. The Feature 20 points from Jones Ferry were not compared to the Martin Farm contexts, since the sample size (n=6) is too small for a valid statistical comparison.

Inspection of the non-metric attributes of the projectile points shows little difference in terms of raw material selection, base preparation, or heat alteration. Formal variability between projectile point types is responsible for the observed difference in base shape.

<u>Factor analysis.</u> The next step in the metric analysis is the factor analysis of the projectile points (Kim 1975:468-514). A principal-component analysis, with varimax rotation, results in the simplification of seven continuous attributes into a three factor

solution which explains 79.1 percent of the total variance in the population, using an eigenvalue cut-off of 0.9. The factor loadings are presented in Table 22.

Factor 1 is interpreted as expressing shape because of the high loadings on basal and lateral edge curvature. Factor 2 expresses length based on the high loadings on length, thickness and weight. Factor 3 expresses width based on the high loadings on width and weight. Factor scores derived from these factors are obtained for each projectile point, and these scores are used as the input data for grouping the points in a hierarchical cluster analysis.

Cluster analysis. The projectile points used in the cluster analysis are defined in Table 23 and the cluster dendrogram is presented in Figure 20. The results of a Scree test on the maximum distance within the clusters indicate that significant differences in within group distances occur at the seven-, four- and three-cluster solutions.

These three solutions are presented in Figures 21, 22 and 23. The projectile point geometry for each cluster represents the mean length, width and curvature measurements for that cluster. Tables 24, 25 and 26 present the means and standard deviations of the continuous attributes for each cluster. The clusters in the seven-cluster solution (Figure 21) clearly represent the major projectile point types noted in these assemblages. Clusters 1, 2 and 3 represent shorter, smaller versions of the Madison, Hamilton and incurvate base/straight blade projectile points, respectively. Cluster 4 represents the grouping of the two Dallas projectile points and a Madison point with one excurvate side

Table 22. Factor loading matrix for projectile points (varimax rotation).

Variables	Factors[a]			Communalities
	Factor 1	Factor 2	Factor 3	
Length	-0.11785	0.79728	0.17665	0.68075
Width	-0.07519	0.12786	0.95617	0.93627
Thickness 1	0.10720	0.84867	-0.06240	0.73562
Weight	0.23917	0.77069	0.52091	0.92251
Base Curvature	0.67841	0.33917	-0.11428	0.58833
Lateral Edge 1 Curvature	0.91021	-C.07367	0.03975	0.83550
Lateral Edge 2 Curvature	0.91363	-0.03196	-0.00216	0.83574
Eigenvalue	2.57475	2.02915	0.93082	
Percent Variance	36.8	29.0	13.3	

[a]Underlined factor loadings indicate significant loadings for a factor.

Table 23. Projectile point identification numbers and contexts used in cluster analysis.

Projectile Point Types	Projectile Point Numbers and Assemblages[a]			
	Mississippian I	Mississippian II	Feature 20	Feature 80
Hamilton	6,7,11,13,17, 22	28,29,30,35,37 38,43,44	62,64,66	48,51,53
Madison	2,3,5,9,14,25	27,36,40,42	67	45,49,50, 52,54,59
Incurvate Base/ Straight Blade	1,4,8,12,15, 16,19,21,23,24	31,32,33,34,39, 41	63,65	46,47,55, 56,57,58, 60,61
Dallas	10	26	None	None

[a]The Mississippian I and II assemblages are from Martin Farm. Features 20 and 80 are from Jones Ferry.

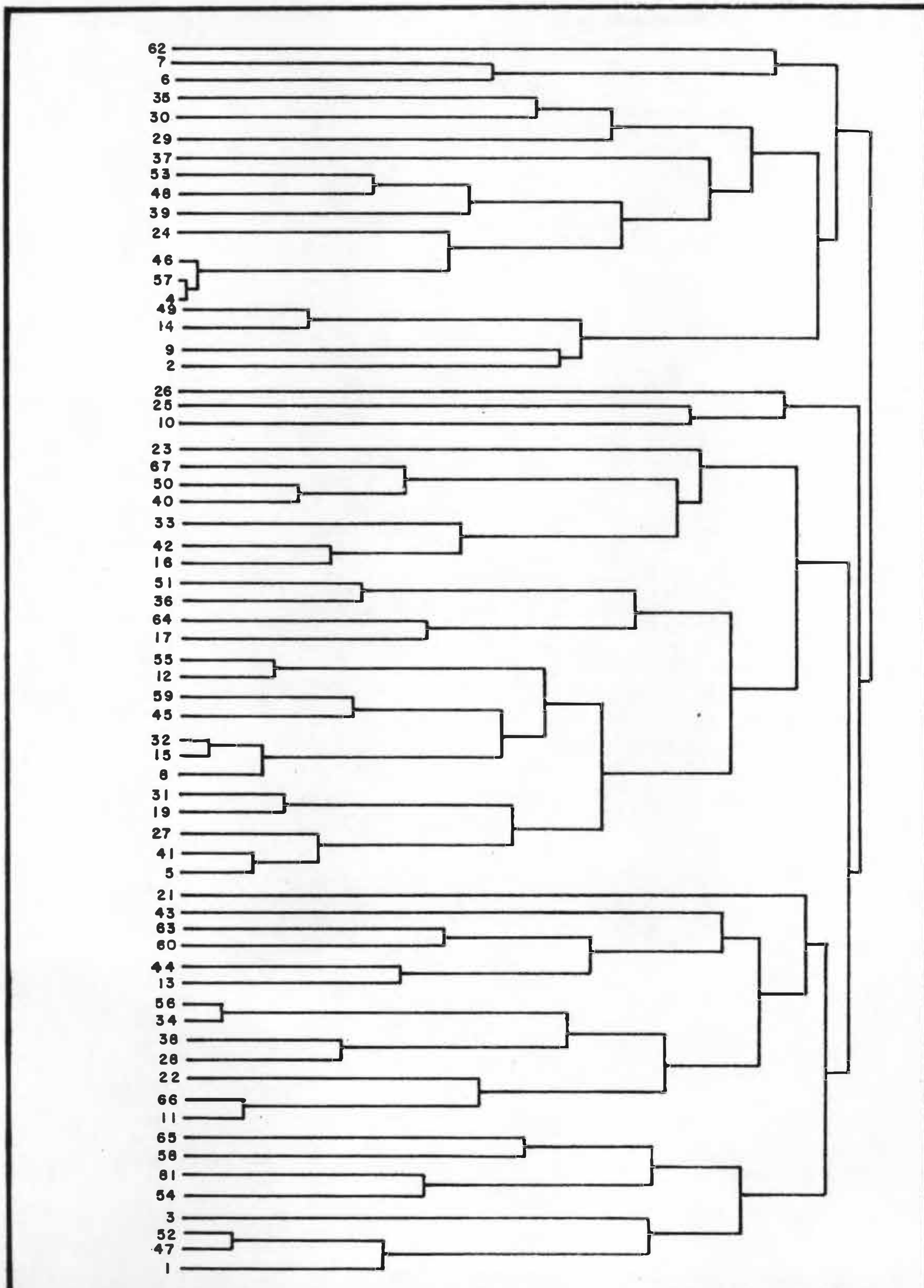

Figure 20. Cluster Analysis Dendrogram Showing the Projectile Point Numbers.

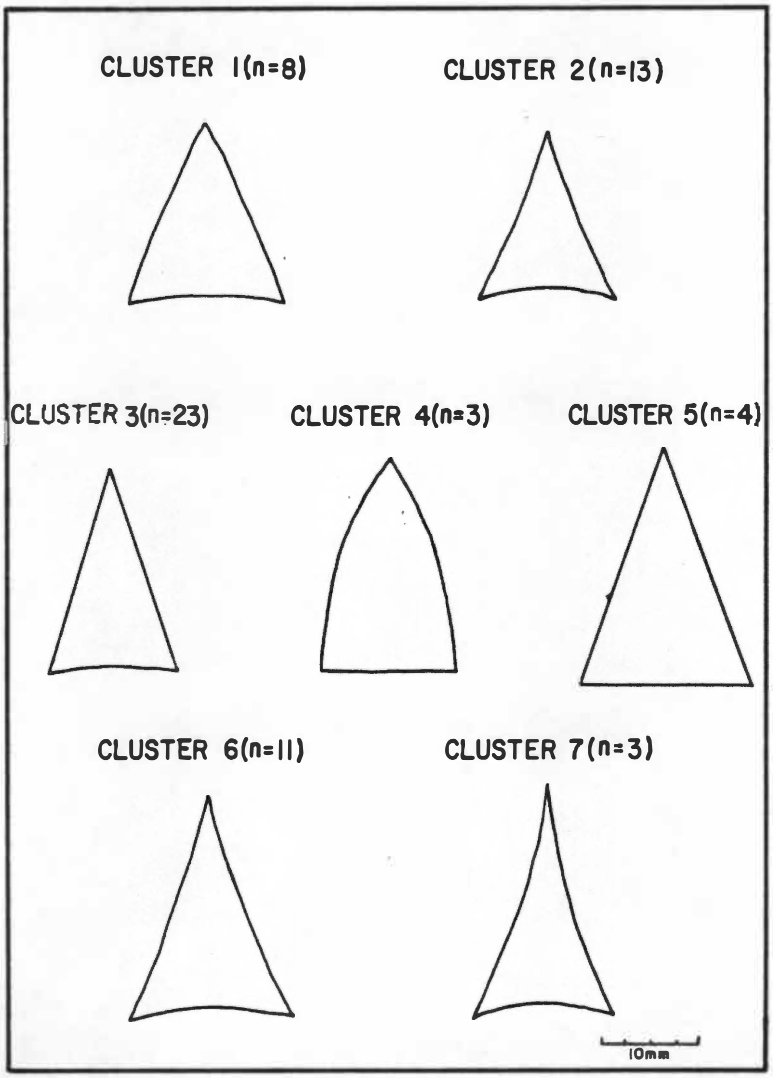

Figure 21. Seven-Cluster Solution--Projectile Points.

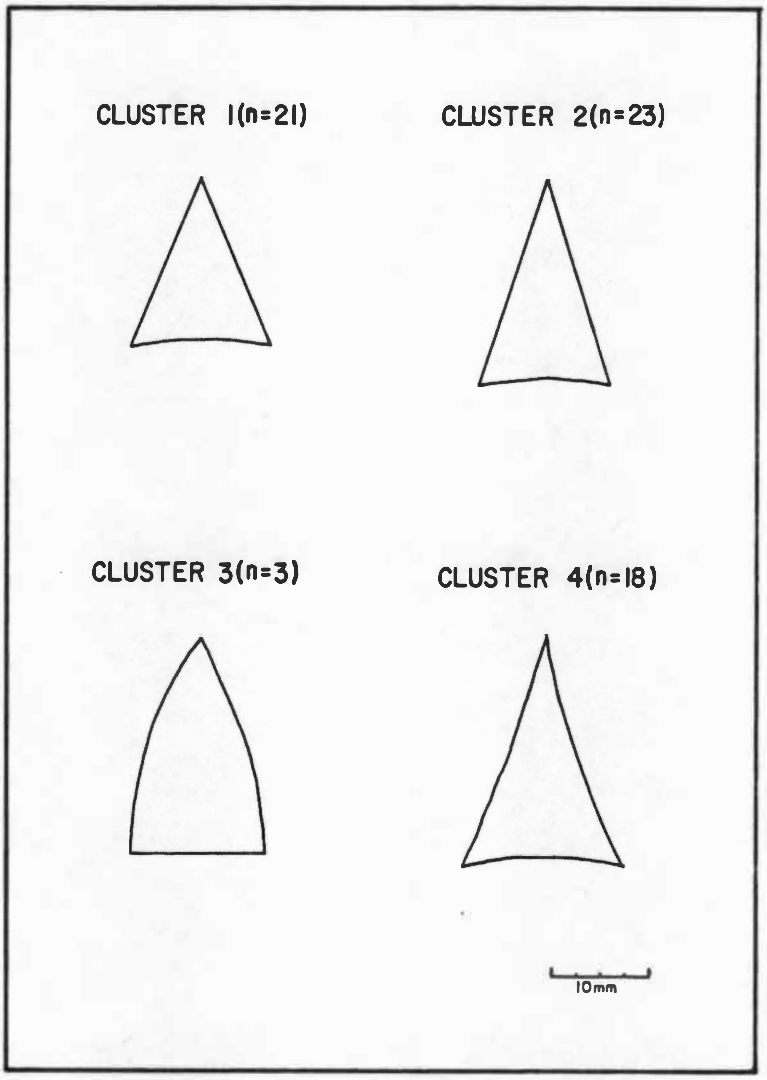

Figure 22. Four-Cluster Solution--Projectile Points.

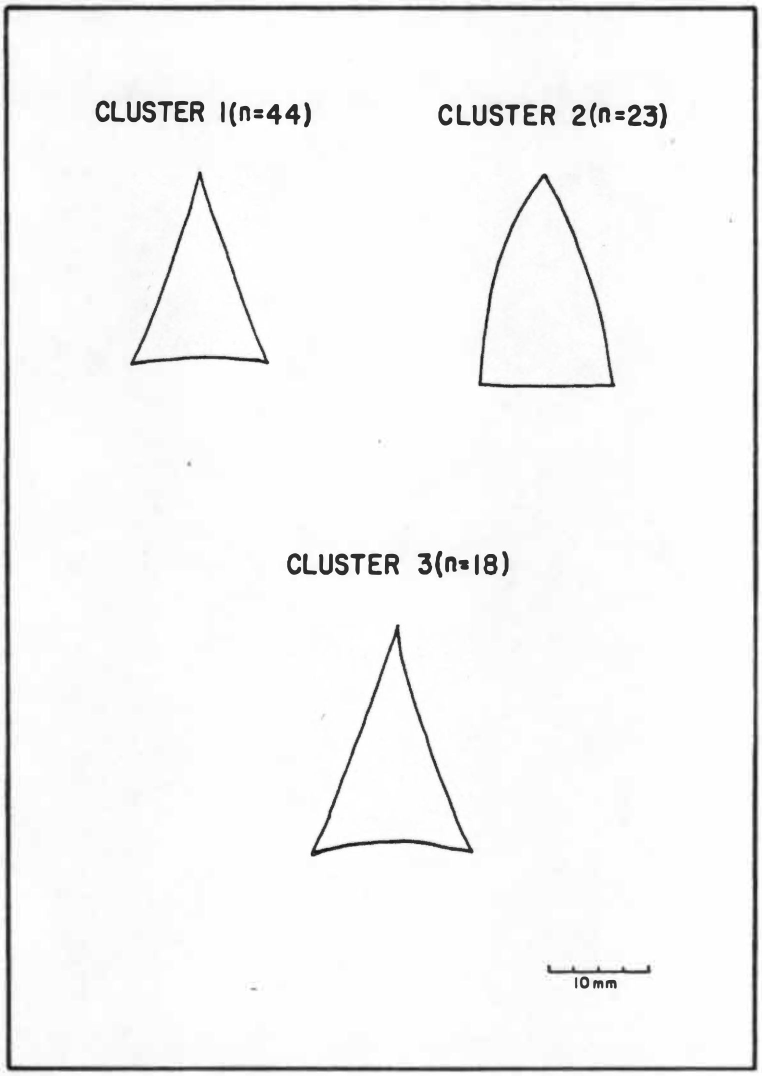

Figure 23. Three-Cluster Solution--Projectile Points.

Table 24. Metric data for seven-cluster solution for projectile points.

	Clusters													
	I		II		III		IV		V		VI		VII	
Attributes[a]	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Length	18.44	1.55	17.03	2.27	21.31	1.43	21.90	2.17	23.65	1.72	22.51	1.66	24.07	5.00
Width	16.01	1.33	13.74	1.23	13.58	1.60	13.67	1.29	16.98	1.24	16.41	1.06	13.83	1.70
Thickness 1	3.21	0.34	3.03	0.39	3.69	0.46	4.10	0.26	4.28	0.52	3.43	0.27	4.10	0.30
Weight	0.75	0.12	0.51	0.10	0.72	0.10	1.03	0.12	1.23	0.13	0.85	0.16	0.87	0.29
Base Curvature	-0.56	0.50	-1.15	0.32	-0.57	0.48	0.00	0.00	0.00	0.00	-1.27	0.61	-1.33	0.29
Lateral Edge 1 Curvature	0.44	0.50	-0.42	0.45	-0.04	0.14	1.33	1.26	0.00	0.00	-0.50	0.50	-1.17	0.29
Lateral Edge 2 Curvature	0.25	0.46	-0.35	0.47	-0.07	0.23	2.00	0.50	0.00	0.00	-0.45	0.57	-1.17	0.29

[a]The weight measurement is in grams. All other measurements are in millimeters.

Table 25. Metric data for four-cluster solution for projectile points.

Attributes[a]	Clusters I $\bar{X}$	I s	II $\bar{X}$	II s	III $\bar{X}$	III s	IV $\bar{X}$	IV s
Length	17.57	2.10	21.31	1.43	21.90	2.17	23.02	2.35
Width	14.60	1.67	13.58	1.60	13.67	1.29	16.11	1.56
Thickness 1	3.10	0.37	3.69	0.46	4.10	0.26	3.73	0.50
Weight	0.60	0.16	0.72	0.10	1.03	0.12	0.93	0.23
Base Curvature	-0.93	0.48	-0.57	0.48	0.00	0.00	-1.00	0.73
Lateral Edge 1 Curvature	-0.10	0.62	-0.04	0.14	1.33	1.26	-0.50	0.54
Lateral Edge 2 Curvature	-0.12	0.55	-0.07	0.23	2.00	0.50	-0.47	0.58

[a]The weight measurement is in grams. All other measurements are in millimeters.

Table 26. Metric data for three-cluster solution for projectile points.

Attributes[a]	Clusters I $\bar{x}$	I s	II $\bar{x}$	II s	III $\bar{x}$	III s
Length	19.52	2.58	21.90	2.17	23.02	2.35
Width	14.07	1.70	13.67	1.29	16.11	1.56
Thickness 1	3.41	0.51	4.10	0.26	3.73	0.50
Weight	0.66	0.14	1.03	0.12	0.93	0.23
Base Curvature	-0.74	0.51	0.00	0.00	-1.00	0.73
Lateral Edge 1 Curvature	-0.07	0.44	1.33	1.26	-0.50	0.54
Lateral Edge 2 Curvature	-0.09	0.41	2.00	0.50	-0.47	0.58

[a]The weight measurement is in grams. All other measurements are in millimeters.

and, thus, can be considered a "Dallas" cluster. Clusters 5, 6 and 7 represent larger versions of the Madison, incurvate base/straight blade and Hamilton projectile points, respectively.

Although many of these clusters contain a mixture of nominal projectile point types (Cluster 6, for example, contains five incurvate base/straight blade points and six Hamiltons), these clusters more accurately define the predominant projectile point types in these assemblages than any nominal classification could, since they are based on replicable measurements and not intuition or a priori notions of "types." More importantly, points from different assemblages and from both sites have combined to form clusters, indicating that there are no significant temporal or spatial differences between any of the Woodland or Early Mississippian component assemblages. This conclusion is also supported by the other cluster solutions.

In the four-cluster solution (Figure 22), Clusters 1 and 2 have combined to form a short, wide, slightly incurvate point, while Cluster 2 is the same as Cluster 3 in the seven-cluster solution--a longer, narrower point than in Cluster 1. Cluster 3 is the Dallas cluster, and Cluster 4 is formed by the combination of Clusters 5, 6 and 7 in the seven-cluster solution. In this solution, clusters reflect projectile point size.

Projectile point size is also reflected in the three-cluster solution (Figure 23), wherein Clusters 1 and 2 of the four-cluster solution have combined to form a single cluster. Cluster 1 represents the smaller, narrower Hamilton, Madison and incurvate base/straight blade points, Cluster 2 represents the "Dallas" cluster and Cluster 3

represents the larger, wider Hamilton, Madison and incurvate base/ straight blade points. Thus, while the nominal typological distinctions between these points appear to be useful at a basic analytical level, this analysis clearly shows that types should be defined only after a detailed analysis of their continuous metric attribute states. The inadequacy of intuitive type definitions is reflected in the clustering of several different "types."

Analysis of the Debitage

The attributes and attribute states measured for the metric debitage analysis are defined in Tables 27 and 28, and the continuous and discrete data for these attributes are presented in Tables 29 and 30. Measurement landmarks for the debitage are visually presented in Figure 24. A total of 626 flakes was analyzed from the Mississippian I and II assemblages and Feature 80 from Jones Ferry; as with the projectile points, the tables present the measurements by assemblage and, in this case, flake blank.

T-tests between assemblages. The first step in the analysis of the debitage was the comparison of the means of the metric attribute states for the complete assemblages by t-tests (Table 31). For the Mississippian I and II assemblages at Martin Farm, there are no statistically significant differences between the means of any of the metric attributes measured, and the two assemblages are quite similar. Both assemblages, however, are different from the Jones Ferry Feature 80 assemblage in terms of debitage platform and angle size. The mean platform length for the Mississippian I assemblage is 4.87mm, while the

Table 27. Continuous attribute definitions for debitage.

Attribute	Definitions[a]
Length	Maximum length of axis parallel with the direction of force
Width	Maximum length of axis perpendicular to the direction of force
Thickness 1	Maximum thickness of flake
Thickness 2	Midpoint thickness
Thickness 3	Thickness at long axis
Weight	Weight of flake to nearest 0.1 gm
Striking Platform Length	Striking platform length measured between the lateral edges of flake
Striking Platform Width	Striking platform width measured between dorsal and ventral surfaces of flake
Angle 1	Angle of striking platform plane to bulb of force plane
Angle 2	Angle of striking platform plane to ventral surface plane

[a]All attributes, except weight, are measured to the nearest 0.1 mm.

Table 28. Discrete attribute definitions for debitage.

Attribute	Code and Definition[a]
Platform Preparation	0 Not observable
	1 Cortex and unabraded
	2 Cortex and dorsally abraded
	3 Cortex and completely abraded
	4 Flat and unabraded
	5 Flat and dorsally abraded
	6 Flat and completely abraded
	7 Faceted and unabraded
	8 Faceted and dorsally abraded
	9 Faceted and completely abraded
Lip	0 Not observable
	1 Absent
	2 Present
Erailllure	0 Not observable
	1 Absent
	2 Present
Distal Termination	0 Not observable
	1 Feather
	2 Hinge
	3 Step
	4 Outrepassé
	5 Perverse
	6 Broken from use/snapped/use-retouch/ heat damage
	7 Flat or cortex
	8 Crushed bipolarly
Dorsal Scars	Frequency of dorsal scars
Dorsal Cortex	0 Not observable
	1 0%
	2 25%
	3 50%
	4 75%
	5 100%
	6 25% (water-tumbled)
	7 50% (water-tumbled)
	8 75% (water-tumbled)
	9 100% (water-tumbled)

Table 28 (Continued)

Attribute	Code and Definition[a]
Heat Alteration	0 Not observable
	1 Incipient potlids/crazing
	2 Potlids
	3 Sugary surface
	4 Extremely lusterous
	5 Crenated fracture
	6 Color change
	7 Incipient potlids and sugary surface
	8 Incipient potlids and potlids
	9 Potlids and sugary surface

[a]Attributes and definitions derived from Crabtree 1972 and Purdy 1975.

Table 29. Continuous attributes and attribute states for debitage.

Technological Categories/ Assemblages[a]	Attributes[b]									
	Length	Width	Thick 1	Thick 2	Thick 3	Weight	SPL	SPW	Angle 1	Angle 2
Blades with Prominent Bulbs										
Mississippian I (n=1)										
$\bar{x}$	16.10	8.80	2.40	2.40	2.80	0.30	4.50	2.00	120.00	110.00
s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mississippian II (n=3)										
$\bar{x}$	26.23	16.00	4.73	3.70	4.90	2.27	6.67	2.53	118.33	101.00
s	10.74	2.26	1.17	1.31	1.77	1.75	1.45	0.58	5.13	5.57
Feature 80 (n=8)										
$\bar{x}$	18.99	11.74	3.89	3.46	4.26	0.79	5.86	3.08	120.38	104.63
s	2.99	2.13	0.86	0.91	0.96	0.32	1.20	0.55	3.78	5.40
Blades with Diffuse Bulbs										
Mississippian I (n=27)										
$\bar{x}$	19.34	10.97	3.30	3.00	3.63	0.70	5.02	2.21	119.48	117.70
s	2.83	2.57	0.79	0.79	0.95	0.35	1.81	0.86	7.84	8.42
Mississippian II (n=26)										
$\bar{x}$	20.58	11.34	3.42	2.98	3.94	0.80	5.17	2.10	118.08[c]	115.80[c]
s	5.74	3.20	0.84	0.76	1.26	0.55	2.43	1.13	7.80	9.47
Feature 80 (n=25)										
$\bar{x}$	18.22	10.47	3.42	3.22	3.97	0.70	4.50	1.96	114.16	111.12
s	6.86	3.03	0.89	0.89	1.19	0.57	1.77	0.91	7.33	7.92

Table 29 (Continued)

Technological Categories/ Assemblages[a]	Attributes[b]									
	Length	Width	Thick 1	Thick 2	Thick 3	Weight	SPL	SPW	Angle 1	Angle 2
Primary Decortication Flakes										
Mississippian I (n=11)										
$\bar{x}$	15.87	13.89	3.96	3.73	4.41	1.02	4.70	1.77	117.18	113.18
s	5.96	4.99	2.04	2.11	2.40	1.66	1.40	0.74	7.74	8.55
Mississippian II (n=8)										
$\bar{x}$	18.96	17.71	4.73	4.45	4.91	1.94	7.05	2.84	121.88	110.88
s	8.12	5.07	1.27	1.17	1.45	1.78	3.40	0.82	5.79	8.58
Feature 80 (n=25)										
$\bar{x}$	13.66	12.89	3.53	3.26	3.68	0.58	4.84	1.88	115.72	110.40
s	4.99	3.92	1.26	1.05	1.42	0.55	1.96	0.61	5.37	8.22
Secondary Decortication Flakes										
Mississippian I (n=40)										
$\bar{x}$	15.27	13.67	3.44	3.18[d]	3.70[d]	0.83	5.23[d]	1.86[d]	118.90[d]	113.95[d]
s	5.03	4.81	1.57	1.57	1.64	1.09	3.83	1.40	7.41	10.43
Mississippian II (n=80)										
$\bar{x}$	14.88	13.72	3.75	3.51	3.86	0.77	4.69	1.80	116.51[e]	112.55[e]
s	5.28	4.18	1.85	1.78	1.87	1.05	2.65	1.02	8.83	8.75
Feature 80 (n=55)										
$\bar{x}$	14.78	13.86	3.60	3.38	3.79	0.69	4.51	1.75	117.71	113.07
s	4.40	4.23	1.36	1.37	1.49	0.63	2.09	0.85	6.87	7.69

Table 29 (Continued)

Technological Categories/ Assemblages[a]	Attributes[b]									
	Length	Width	Thick 1	Thick 2	Thick 3	Weight	SPL	SPW	Angle 1	Angle 2
Bifacial Thinning Flakes										
Mississippian I (n=82)										
$\bar{x}$	13.62	12.12	2.88	2.70	3.06	0.46	4.68	1.66	121.84[f]	119.78[f]
s	4.67	3.76	1.18	1.10	1.25	0.49	2.35	0.83	11.50	12.30
Mississippian II (n=149)										
$\bar{x}$	13.62	11.83	2.58	2.30	2.85	0.48	4.70	1.64	120.59[g]	119.54[g]
s	4.83	3.40	1.07	0.91	1.15	0.56	2.44	0.95	10.06	11.16
Feature 80 (n=86)										
$\bar{x}$	13.15	11.73	2.48	2.29	2.73	0.38	3.94	1.31	119.27	116.01
s	3.78	3.39	1.02	0.92	1.09	0.35	1.86	0.70	8.21	9.00

[a]The Mississippian I and II assemblages are from Martin Farm. Feature 80 is from Jones Ferry.

[b]Thick 1 = Thickness 1; Thick 2 = Thickness 2; Thick 3 = Thickness 3; SPL = Striking platform length; SPW = Striking platform width.

[c]For these attribute states, n=25.

[d]For these attribute states, n=39.

[e]For these attribute states, n=77.

[f]For these attribute states, n=80.

[g]For these attribute states, n=147.

Table 30. Discrete attributes and attribute states for debitage.

Technological Group/ Assemblage[a]	Attributes and Attribute States: Platform Preparation A.S.[b]	%[c]	Lip A.S.	%	Eraillure A.S.	%	Distal Termination A.S.	%	Dorsal Scars A.S.	%	Dorsal Cortex A.S.	%	Heat Alteration A.S.	%
Blades with Prominent Bulbs														
Mississippian I (n=1)	2	100.00	2	100.00	2	100.u0	2	100.00	1	100.00	2	100.00	0	100.00
Mississippian II (n=3)	4	33.33	2	100.00	2	100.00	1	66.67	2	66.67	2	33.33	0	100.00
	5	66.67					7	33.33	3	33.33	3	33.33		
											4	33.33		
Feature 80 (n=8)	4	12.50	2	100.00	1	12.50	1	12.50	2	12.50	1	50.00	0	62.50
	5	75.00			2	87.50	2	25.00	3	50.00	2	25.00	4	25.00
	7	12.50					3	12.50	4	12.50	3	25.00	7	12.50
							6	50.00	5	25.00				
Blades with Diffuse Bulbs														
Mississippian I (n=27)	1	14.82	2	100.00	1	18.50	1	25.93	1	7.41	1	55.55	0	92.59
	2	22.22			2	81.50	2	51.85	2	11.12	2	29.63	1	7.41
	4	29.63					6	11.11	3	33.33	3	7.41		
	5	29.63					7	11.11	4	33.33	4	7.41		
	8	3.70							5	7.41				
									6	3.70				
									10	3.70				

Table 30 (Continued)

Technological Group/ Assemblage[a]	Platform Preparation A.S.[b]	%[c]	Lip A.S.	%	Eraillure A.S.	%	Distal Termination A.S.	%	Dorsal Scars A.S.	%	Dorsal Cortex A.S.	%	Heat Alteration A.S.	%
Blades with Diffuse Bulbs														
Mississippian II														
(n=26)	1	3.84	2	100.00	1	3.85	1	7.69	1	3.84	1	50.00	0	88.46
	2	19.23			2	96.15	2	42.31	2	15.39	2	15.39	1	7.69
	4	15.39					3	7.69	3	50.00	3	26.92	7	3.85
	5	53.85					6	19.23	4	7.69	4	7.69		
	8	7.69					7	23.08	5	15.39				
									7	7.69				
Feature 80 (n=25)	1	16.00	2	100.00	1	28.00	1	20.00	1	16.00	1	16.00	0	68.00
	4	36.00			2	72.00	2	12.00	2	24.00	2	20.00	1	20.00
	5	32.00					3	8.00	3	36.00	3	52.00	4	4.00
	7	12.00					4	4.00	4	16.00	4	12.00	7	4.00
	8	4.00					5	16.00	5	4.00			8	4.00
							6	4.00	6	4.00				
							7	36.00						
Primary Decortication Flakes														
Mississippian I														
(n=11)	1	9.09	2	100.00	2	100.00	1	45.46	0	27.28	3	27.27	0	100.00
	2	18.18					2	27.27	1	27.27	4	9.09		
	4	36.36					7	27.27	2	18.18	5	63.64		
	5	9.09							3	27.27				
	7	18.18												
	8	9.09												

Table 30 (Continued)

Technological Group/ Assemblage[a]	Attributes and Attribute States													
	Platform Preparation		Lip		Eraillure		Distal Termination		Dorsal Scars		Dorsal Cortex		Heat Alteration	
	A.S.[b]	%[c]	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%
Primary Decortication Flakes														
Mississippian II (n=8)	1	25.00	1	12.50	1	12.50	2	25.00	0	87.50	3	12.50	0	87.50
	2	25.00	2	87.50	2	87.50	3	12.50	2	12.50	5	87.50	7	12.50
	4	12.50					6	37.50						
	5	25.00					7	25.00						
	8	12.50												
Feature 80 (n=25)	1	28.00	2	100.00	1	28.00	2	16.00	0	84.00	5	100.00	0	84.00
	2	4.00			2	72.00	3	4.00	1	16.00			1	12.00
	4	32.00					7	80.00					3	4.00
	5	28.00												
	7	4.00												
	8	4.00												
Secondary Decortication Flakes														
Mississippian I (n=40)	0	2.50	0	2.50	0	2.50	1	37.50	1	7.50	1	2.50	0	77.50
	1	17.50	2	97.50	1	25.00	2	17.50	2	30.00	2	35.00	1	12.50
	2	10.00			2	72.50	5	17.50	3	25.00	3	35.00	4	5.00
	3	5.00					6	7.50	4	27.50	4	20.00	7	5.00
	4	32.50					7	20.00	5	5.00	5	5.00		
	5	12.50							7	5.00	8	2.50		
	7	10.00												
	8	7.50												
	9	2.50												

Table 30 (Continued)

Technological Group/ Assemblage[a]	Attributes and Attribute States: Platform Preparation		Lip		Eraillure		Distal Termination		Dorsal Scars		Dorsal Cortex		Heat Alteration	
	A.S.[b]	%[c]	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%
Secondary Decortication Flakes														
Mississippian II (n=80)	0	1.25	0	1.25	0	1.25	1	21.25	1	33.75	1	1.25	0	82.50
	1	5.00	1	6.25	1	13.75	2	26.25	2	21.20	2	26.25	1	3.75
	2	5.00	2	92.50	2	85.00	3	1.25	3	17.50	3	53.75	3	1.25
	3	2.50					4	1.25	4	18.75	4	16.25	4	1.25
	4	53.75					5	16.25	5	3.75	7	1.25	6	3.75
	5	11.25					6	12.50	6	2.50	8	1.25	7	7.50
	7	10.00					7	21.25	7	2.50				
	8	10.00												
	9	1.25												
Feature 80 (n=55)	1	3.64	1	1.82	1	9.09	1	23.64	1	23.64	2	16.36	0	78.18
	2	1.82	2	98.18	2	90.91	2	23.64	2	38.18	3	38.18	1	12.72
	4	61.82					6	18.18	3	20.00	4	43.64	3	3.64
	5	18.18					7	34.54	4	12.72	8	1.82	4	1.82
	7	9.09							5	3.64			7	3.64
	8	5.45							6	1.82				
Bifacial Thinning Flakes														
Mississippian I (n=82)	1	4.88	2	100.00	1	15.85	1	45.12	1	1.22	0	1.22	0	79.27
	2	3.65			2	84.15	2	36.59	2	13.42	1	71.95	1	8.53
	4	25.61					3	2.43	3	21.95	2	24.39	3	4.88
	5	29.26					5	3.66	4	17.07	3	1.22	6	3.66
	6	1.22					6	4.88	5	12.19	4	1.22	7	2.44

Table 30 (Continued)

Technological Group/ Assemblage[a]	Attributes and Attribute States: Platform Preparation A.S.[b]	Platform Preparation %[c]	Lip A.S.	Lip %	Eraillure A.S.	Eraillure %	Distal Termination A.S.	Distal Termination %	Dorsal Scars A.S.	Dorsal Scars %	Dorsal Cortex A.S.	Dorsal Cortex %	Heat Alteration A.S.	Heat Alteration %
Bifacial Thinning Flakes														
Mississippian I cont.														
	7	4.88					7	7.32	6	20.73			9	1.22
	8	26.83							7	6.10				
	9	3.66							8	2.44				
									9	2.44				
									10	1.22				
									12	1.22				
Mississippian II (n=149)	1	2.01	1	2.01	1	22.15	1	27.52	1	0.67	1	75.84	0	80.54
	2	4.03	2	97.99	2	77.85	2	48.32	2	3.36	2	22.82	1	6.04
	4	14.77					3	3.36	3	16.78	3	1.34	2	0.67
	5	45.64					5	9.39	4	30.20			3	4.70
	7	6.04					6	9.39	5	20.81			4	0.67
	8	25.50					7	2.02	6	11.41			6	3.35
	9	2.01							7	6.71			7	2.69
									8	8.05			8	0.67
									9	1.34			9	0.67
									10	0.67				

Table 30 (Continued)

Technological Group/ Assemblage[a]	Attributes and Attribute States: Platform Preparation		Lip		Eraillure		Distal Termination		Dorsal Scars		Dorsal Cortex		Heat Alteration	
	A.S.[b]	%[c]	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%	A.S.	%
Bifacial Thinning Flakes														
Feature 80 (n=86)	1	1.16	1	1.16	0	2.33	1	38.37	1	1.16	1	72.09	0	81.40
	4	22.10	2	98.84	1	25.58	2	15.12	2	4.65	2	20.93	1	10.46
	5	26.74			2	72.09	3	2.33	3	13.95	3	6.98	4	3.49
	7	8.14					5	13.95	4	22.09			7	3.49
	8	40.70					6	24.42	5	23.26			9	1.16
	9	1.16					7	5.81	6	13.95				
									7	11.63				
									8	6.98				
									9	2.33				

[a]The Mississippian I and II assemblages are from Martin Farm. The Feature 80 assemblage is from Jones Ferry.

[b]A.S. = attribute state.

[c]% = percent of each attribute state for each technological group in each assemblage.

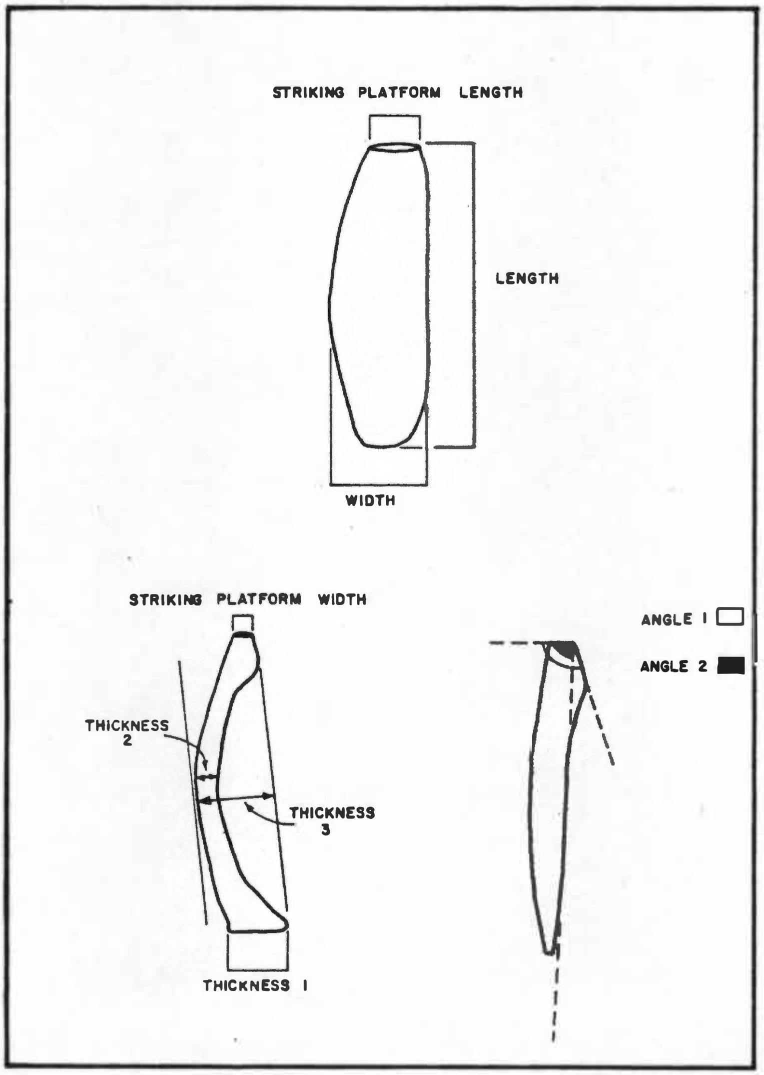

Figure 24. Continuous Measurement Landmarks for Debitage.

Table 31. Continuous attribute data for debitage by assemblage.

	Martin Farm						Jones Ferry		
	Mississippian I			Mississippian II			Feature 80		
Attributes	$\bar{x}$	s	n	$\bar{x}$	s	n	$\bar{x}$	s	n
Length	15.16	4.99	161	14.98	5.75	266	14.54	4.99	199
Width	12.42	4.06	161	12.58	3.89	266	12.31	3.78	199
Thickness 1	3.16	1.33	161	3.10	1.47	266	3.10	1.25	199
Thickness 2	2.94	1.30	160	2.81	1.38	266	2.88	1.18	199
Thickness 3	3.41	1.45	160	3.34	1.54	266	3.36	1.37	199
Weight	0.63	0.80	161	0.66	0.87	266	0.54	0.52	199
Platform Length	4.87	2.65	160	4.84	2.55	265	4.36	1.94	199
Platform Width	1.81	1.01	160	1.78	1.01	265	1.66	0.85	199
Angle 1	120.37	9.82	158	119.15	9.50	260	117.79	7.47	199
Angle 2	117.46	11.24	158	116.63	10.81	260	113.42	8.70	199

mean length for the Jones Ferry assemblage is 4.36mm. When the Mississippian I and Feature 80 assemblages are compared, the striking platform length t score is 2.11 with 357 degrees of freedom and an $\alpha = .05$. This is also the case when the Mississippian II assemblage is compared to Feature 80 at Jones Ferry; the t score here is 2.41 with 457 degrees of freedom and an $\alpha = .05$. The mean striking platform length of the Mississippian II debitage is 4.88mm.

Furthermore, there are significant differences between the three assemblages in terms of the angle 1 and angle 2 measurements. The mean angle 1 measurement for the Mississippian I assemblage is 120.37°, while the mean for Feature 80 is 117.79°. The t score for the Mississippian I and Feature 80 angle 1 measurement is 2.82 with 355 degrees of freedom ($\alpha = .05$); the t score for the Mississippian II and Feature 80 comparison is not significant.

For the angle 2 measurements, the mean for the Mississippian I assemblage is 117.46° and the mean for the Feature 80 assemblage is 113.42°. The t score for the Mississippian I and Feature 80 assemblages is 3.83 with 355 degrees of freedom ($\alpha = .05$). The mean for the Mississippian II assemblage is 116.63°; the t score for the Mississippian II and Feature 80 angle 2 means is 3.42 with 457 degrees of freedom ($\alpha = .05$).

As a result, the t-tests apparently indicate differences between the assemblages which are primarily related to locational variability.

<u>T-test comparisons of identical flake categories between assemblages.</u> In order to more accurately define the assemblage

differences in the debitage platform and angle sizes, t-tests were used to determine the differences in the metric, or continuous, attribute states of identical flake categories from different assemblages. For this analysis, the blades with prominent bulbs of force and blades with diffuse bulbs of force have been combined into a "blade" blank category in order to increase the total sample size and make all assemblages roughly comparable in terms of the numbers of blades measured. The same has been done with the primary and secondary decortication flakes, which have been combined to form a "decortication flake" blank category (Table 32). The bifacial thinning flake category is unchanged. In Table 33, the significant t-test results are presented.

Significant differences occur between the Martin Farm and Jones Ferry assemblages, but not between the Mississippian I and II assemblages from Martin Farm. In addition, the most significant differences are in the striking platform size and the angle that the striking platform forms with the ventral surface of the flake for the blade and bifacial thinning flake categories.

These data indicate that the bifacial thinning flakes from Martin Farm are thicker than those from Jones Ferry. This is also supported by striking platform lengths and widths which are also significantly larger in the Martin Farm assemblages. As Crabtree (1972:12) notes, "thickness is primarily controlled by where the force is applied on the platform. Near the edge gives a thin flake or blade and away from the edge gives a thick flake or blade." The larger striking platform indicates that the blows struck to remove the bifacial thinning flakes in the Martin Farm

Table 32. Continuous attributes and attribute states for combined blade and decortication flake categories.

Technological Categories/ Assemblages[a]	Attributes[b] Length	Width	Thick 1	Thick 2	Thick 3	Weight	SPL	SPW	Angle 1	Angle 2
BLADES										
Mississippian I (n=28)										
x̄	19.22	10.90	3.26	2.98	3.60	0.68	5.00	2.21	119.50	117.43
s	2.84	2.56	0.79	0.78	0.95	0.35	1.77	0.84	7.70	8.39
Mississippian II (n=29)										
x̄	21.16	11.82	3.55	3.06	4.04	0.96	5.32	2.14	118.11[c]	114.21[c]
s	6.38	3.41	0.95	0.83	1.30	0.83	2.38	1.09	7.49	10.19
Feature 80 (n=33)										
x̄	18.41	10.78	3.54	3.28	4.04	0.72	4.83	2.23	115.67	109.55
s	6.11	2.86	0.89	0.89	1.13	0.52	1.74	0.96	7.12	7.84
DECORTICATION FLAKES										
Mississippian I (n=51)										
x̄	15.40	13.72	3.55	3.30[d]	3.86[d]	0.87	5.11[d]	1.84[d]	118.52[d]	113.78[d]
s	5.19	4.80	1.68	1.70	1.83	1.22	3.44	1.27	7.44	9.97
Mississippian II (n=88)										
x̄	15.25	14.08	3.84	3.60	3.96	0.88	4.90[e]	1.90[e]	117.01[f]	112.39[f]
s	5.66	4.39	1.82	1.76	1.85	1.17	2.79	1.04	8.71	8.70
Feature 80 (n=80)										
x̄	14.43	13.56	3.58	3.34	3.76	0.65	4.61	1.79	117.09	112.24
s	4.59	4.14	1.32	1.27	1.46	0.61	2.04	0.78	6.47	7.91

[a]The Mississippian I and II assemblages are from Martin Farm. Feature 80 is from Jones Ferry.

[b]Thick 1 = Thickness 1, Thick 2 = Thickness 2, Thick 3 = Thickness 3, SPL = Striking platform length, SPW = Striking platform width.

[c]For these attribute states, n=28.

[d]For these attribute states, n=50.

[e]For these attribute states, n=87.

[f]For these attribute states, n=85.

Table 33. Significant t values for assemblage comparisons by flake category.

Technological Group/ Attribute	Assemblage Comparisons[a]	$\bar{x}$	s	t Value[b]	df[c]
BLADES					
Angle 2	Mississippian I	117.43	8.39		
	Feature 80	109.55	7.84	3.75	59
	Mississippian II	114.21	10.19		
	Feature 80	109.55	7.84	2.02	59
BIFACIAL THINNING FLAKES					
Thickness 1	Mississippian I	2.88	1.18		
	Feature 80	2.48	1.02	2.35	166
Striking Platform Length	Mississippian I	4.68	2.35		
	Feature 80	3.94	1.86	2.27	166
	Mississippian II	4.70	2.44		
	Feature 80	3.94	1.86	2.51	233
Striking Platform Width	Mississippian I	1.66	0.83		
	Feature 80	1.31	0.70	2.91	166
	Mississippian II	1.64	0.95		
	Feature 80	1.31	0.70	2.80	233
Angle 2	Mississippian I	119.78	12.30		
	Feature 80	116.01	9.00	2.25	164
	Mississippian II	119.54	11.16		
	Feature 80	116.01	9.00	2.50	231

[a]Mississippian I and II are from Martin Farm. Feature 80 is from Jones Ferry.
[b]For all t values, $\alpha = .05$.
[c]df = Degrees of freedom.

assemblages were generally struck further away from the edge of the objective piece, thus producing thicker flakes.

In terms of the angle measurements, the important consideration is not the individual angle measurements, but the difference between the angle of the striking platform plane to the bulb of force plane and the angle of the striking platform plane to the ventral surface plane. Thus, the formula Angle 1 less Angle 2 measures the size of the bulb of force of a flake; the larger the angle produced by this calculation, the larger the bulb of force. For the bifacial thinning flakes, this difference is 2.06° for the Mississippian I assemblage, 1.05° for the Mississippian II assemblage, and 3.26° for the Jones Ferry Feature 80 assemblage. Thus, the average size of the bulb of force for the Jones Ferry bifacial thinning flake is greater than that for the flakes from the Martin Farm assemblages. This size difference is also the case for the blades from these assemblages. The Mississippian I blades have a bulb of force measuring 2.07°, the bulbs of the Mississippian II blades from Martin Farm measure 3.90° and the Feature 80 blades have bulbs measuring 6.12°.

According to Crabtree (1972:9, 13, 44), blades or flakes produced with a soft hammer percussor such as wood or antler will possess larger platform areas and more diffuse bulbs of force, since the percussor contacts a larger surface area of the objective piece. Flakes detached by a hard hammer percussor, such as another stone, will have smaller platforms and more pronounced bulbs of force.

Thus, the significant results of the t-tests outlined above possibly indicate that a soft hammer percussor was primarily used to

detach bifacial thinning flakes in both the Mississippian I and II assemblages at Martin Farm, while a hard hammer percussor was used to detach the flakes from Feature 80 at Jones Ferry. This should be further tested by experimentation. The smaller bulbs of force on blades from the Martin Farm assemblages indicate the probable use of a pressure technique to remove blades. The larger bulbs of the Jones Ferry blades indicate the possible use of a different production technique; however, this is not supported by significant differences in the platform sizes of the blades from the two sites.

Although the radiocarbon date for Feature 80 is approximately 300 years earlier than the dates for the Martin Farm assemblages, it is unlikely that intersite differences are related to temporal variability. The Jones Ferry inhabitants were undoubtedly aware of the greater efficiency of soft hammer percussion. No other technological differences are apparent between the two sites; both contain artifacts made from largely the same raw materials in proportionately the same technological groups (bifacial, bipolar, blade).

In addition to temporal variability, a second possibility is that the differences in platform size and angle measurements for blades and bifacial thinning flakes are due to spatial variability and its effects on lithic raw material procurement and utilization. Jones Ferry, unlike Martin Farm, is located five miles away from the nearest known source of Knox black chert. Since Knox black is the predominant chert type at Jones Ferry, it follows that the Jones Ferry inhabitants would use a more efficient soft hammer technique to remove flakes. However, since

this is not the case, the spatial variability explanation for observed differences is unsubstantiated.

The most likely explanation for the differences between the sites is sampling bias, since the debitage from only one feature from Jones Ferry is examined. The comparison of the two sites merely indicates the possibility of significant differences between them; whether these differences are real or not, and whether they are due to temporal or spatial variability must await further analysis.

More important, however, is that no significant variability occurs between the continuous attribute states for the debitage from the Mississippian I and II assemblages at Martin Farm. This is consistent with the projectile point analysis, and, when considered with the Jones Ferry data, further supports the model of an in situ development of Mississippian out of the earlier Woodland lifeway.

Inspection of the discrete attributes for the flake categories shows no significant difference between assemblages. Blades for all assemblages have predominantly flat and unabraded or dorsally abraded platforms, with lips along the ventral edges of the platforms, a predominance of eraillures, and between two and four dorsal scars. The predominance of lips and eraillures indicates the probable use of a soft hammer, and possibly a pressure technique, in blade production. Decortication flakes for all assemblages are characterized by predominantly flat and unabraded or dorsally abraded platforms, lips, eraillures, between one and four dorsal scars, and 50-100 percent dorsal cortex. Bifacial thinning flakes are characterized by flat and dorsally abraded platforms and faceted and dorsally abraded platforms, lips,

eraillures, between three and six dorsal scars and 0-25 percent dorsal cortex.

Factor analysis. The next step in the metric analysis of the debitage is a principal-component factor analysis of the metric attribute states of the debitage. The factor analysis reduced 10 original continuous variables to three factors, which explain 81.3 percent of the total population variance; an eigenvalue of 1.0 was used as a cut-off for the selection of the factors (Table 34).

Based on the factor loadings, Factor 1 is interpreted as a size factor, since the factor loadings are high for the length, width, thickness and weight variables. Factor 2 is interpreted as a technological factor expressing striking platform size, since the factor loadings are high for striking platform length and width. Factor 3 is interpreted as a technological factor expressing flake and bulb angle size, since the factor loadings are high for these variables. Factor scores were computed for each flake using these three factors.

Cluster analysis. Because the number of flakes is too large to inexpensively and efficiently perform a cluster analysis using the factor scores of individual artifacts, as was done for the projectile points, the flakes were grouped by assemblage and flake category, and the mean factor scores of these groups were used in the cluster analysis. Since the groups have sample sizes of 28 or more, the assumption that the group factor scores are based on normal distributions can be made with a high degree of confidence. The cluster analysis dendrogram is presented in Figure 25.

Table 34. Factor loadings for debitage factor analysis (varimax rotation).

Attributes	Factors[a] Factor 1	Factor 2	Factor 3	Communalities
Length	0.73259	0.10464	-0.02072	0.54807
Width	0.59425	0.38427	0.00780	0.50086
Thickness 1	0.91948	0.22778	-0.05319	0.90015
Thickness 2	0.91800	0.13590	-0.04871	0.86357
Thickness 3	0.94050	0.15512	-0.03321	0.90971
Weight	0.84624	0.29157	0.03059	0.80206
Striking Platform Length	0.17489	0.93393	0.01268	0.90297
Striking Platform Width	0.32758	0.84366	-0.07474	0.82465
Angle 1	0.05182	-0.02183	0.96904	0.94221
Angle 2	-0.10649	-0.02390	0.96262	0.93856
Eigenvalue	5.04346	1.86542	1.22393	
Percent Variance	50.4	18.7	12.2	

[a]Underlined factor loadings indicate significant loadings for a factor.

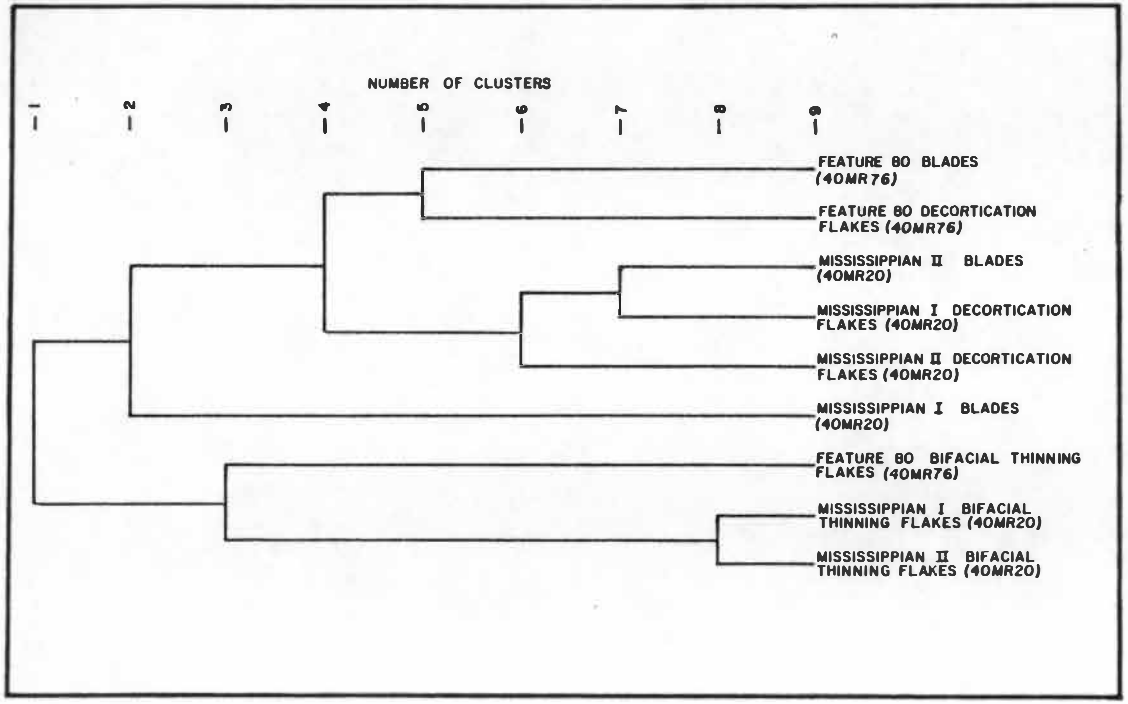

Figure 25. Cluster Analysis Dendrogram for Debitage Groups.

The results of a Scree test on the maximum distances within the clusters indicate that there is a significant break at the five- and two-cluster solution levels. In the five-cluster solution, Cluster 1 is formed by the blades and decortication flakes from Feature 80 at Jones Ferry, Cluster 2 is formed by the Mississippian II blades and Mississippian I and II decortication flakes from Martin Farm, Cluster 3 is formed by the Mississippian I blades, Cluster 4 is formed by the Jones Ferry bifacial thinning flakes and Cluster 5 is formed by the Mississippian I and II bifacial thinning flakes. Clusters 1, 2 and 5 clearly reflect differences between decortication flakes and blades on the one hand and bifacial thinning flakes on the other. In all three clusters, only artifacts from the same sites have clustered together. Cluster 3 is formed by the Mississippian I blades from Martin Farm, which probably cluster separately because they are thinner and lighter than either the Mississippian II or Jones Ferry blades. Cluster 4 represents the Jones Ferry bifacial thinning flakes, which have remained separate due to the differences between them and the Martin Farm bifacial thinning flakes in terms of thickness, angle and platform size.

The two-cluster solution results in a grouping of all the decortication flakes and blades into Cluster 1 and all the bifacial thinning flakes from all the assemblages into Cluster 2. Thus, the five-cluster solution emphasizes the distinction between the two sites, while the two-cluster solution emphasizes the technological differences between decortication flakes and blades, and bifacial thinning flakes. The major distinctions are that blades and decortication flakes from

these assemblages have larger platforms, more pronounced bulbs of force, and are straighter; whereas bifacial thinning flakes have narrower platforms, more diffuse bulbs of force and greater curvature due to a steeper angle of applied force.

Finally, the debitage cluster analysis shows that there is no significant difference between the Mississippian I and II assemblages at Martin Farm. In addition, the nominal distinctions between blades, decortication flakes and bifacial thinning flakes have been confirmed, with some overlap indicated for blades and decortication flakes.

Summary and Conclusions

There are no significant differences between the projectile points from the Mississippian I and II assemblages at Martin Farm and the Feature 80 and 20 assemblages from Jones Ferry, except that the Feature 80 points are slightly wider than the Mississippian I points. However, this single difference is very likely due to inadequate sample size, since the number of measurable projectile points from all the assemblages is small. This similarity is further indicated by the cluster analysis of the projectile points; the points clustered primarily on the basis of shape and size differences and not on the basis of temporal or spatial variability. The major projectile point types in all the assemblages are the Hamilton, Madison and the incurvate base/straight blade triangular projectile points, indicating the limited utility of these types as distinct temporal or cultural markers.

The debitage from the Mississippian I and II assemblages at Martin Farm and from Feature 80 at Jones Ferry presented a more complex

picture. The primary differences in the debitage occur in the blade and bifacial thinning flake blank categories between the Martin Farm and Jones Ferry assemblages.

The major differences between the blades of the assemblages examined are that the Martin Farm Mississippian I blades are thinner and lighter than either the Martin Farm Mississippian II or Feature 80 Jones Ferry blades. More importantly, both Martin Farm assemblages exhibit smaller bulbs of force on blades than do the blades from Jones Ferry. However, these are the only significant differences; in all other respects, including platform size and preparation, the blades from these assemblages are similar. Although the larger bulb size of the Jones Ferry blades suggests a direct percussion blade production technique, or differences in the angle of applied force, the presence of lips, eraillures, and the absence of variability in platform size indicate that the blades from all the assemblages were probably produced by means of a soft hammer indirect percussion or pressure technique.

The differences between the Martin Farm and Jones Ferry bifacial thinning flakes, compared to the blades, are more substantial. The flakes from the Martin Farm assemblage are thicker and have larger striking platforms and more diffuse bulbs of force than the Jones Ferry bifacial thinning flakes. This suggests the use of a soft hammer as opposed to a hard hammer percussor in the Martin Farm occupations. The sample sizes of bifacial thinning flakes analyzed are sufficiently large to support this conclusion. Since, however, only a <u>single</u> feature was

analyzed from Jones Ferry, further analysis of this site may show differences undetected here.

CHAPTER V

CONCLUSION

This study of the lithic artifacts from Martin Farm, Jones Ferry and Tomotley analyzed nominal through ratio level data collected on the artifact assemblages by means of chi-square tests, visual representations, t-tests, principal-component analysis and cluster analysis. The results of this study are discussed in terms of the functional, formal and technological variability in the assemblages.

The analysis of the nominal level data on technological variability showed that the frequency of particular lithic reduction methods was comparable for the Mississippian I and II assemblages at Martin Farm and for the Martin Farm, Jones Ferry and Tomotley assemblages. In all cases, the predominant technological group was the Bifacial Reduction Group, followed by the Bipolar Reduction Group. In all cases, blades were the least common of the major technological groups represented.

The triangular projectile points from the Early Mississippian contexts were primarily produced by bifacial reduction and pressure retouch of flake blanks and, in some cases, small nodules. Based on the analysis of nominal level data on formal variability, the Hamilton Incurvate, Madison, and incurvate base/straight blade points were the most frequent projectile point types in all the assemblages. The metric univariate and multivariate analyses of the projectile points representing distinct types showed that they did not vary significantly

in terms of their formal attribute states between any of the contexts examined. The association of the Late Woodland Hamilton projectile point type with the Madison and Dallas Mississippian types supports the in situ development explanation for the origin of the Mississippian culture. This association also weakens previous ideas about the validity of these types as diagnostic temporal markers for Woodland and Mississippian manifestations.

The greatest formal variability in the metric attributes of the debitage occurred between the Martin Farm and Jones Ferry bifacial thinning flakes. This may be related to differences in the use of soft and hard hammer percussors and in the proximity of the sites to Knox chert sources. It is just as likely, however, that these differences were due to sampling bias. In any case, the Mississippian I and II assemblages at Martin Farm showed no significant differences in the formal, metric characteristics of their lithic debitage, supporting the idea that temporal variability in these assemblages is not reflected in the lithic artifacts.

Few (approximately 7-20 percent) lithic artifacts showed traces of use, based on an analysis of nominal level functional data. Most of these artifacts were in the food preparation/consumption activity group. This is a logical pattern for semi-permanent or permanent habitation sites. Since all the sites possessed well-built structures and storage pits, they were considered to be at least semi-permanent habitations.

The raw materials used in the production of lithic artifacts were primarily local cherts, and in all the assemblages examined, the

predominant types were Knox black and black-banded and heated varieties of these cherts. There was little difference between the Martin Farm and Jones Ferry sites in terms of raw material preference, even though their locations in relation to sources of Knox black and black-banded chert were different.

Based on the analysis of the nominal data reflecting heat alteration, only 30-37 percent of the lithic artifacts showed evidence of heat alteration. Most of the evidence consisted of incipient potlids on artifacts. Purdy (1975:135-136) indicates that incipient potlids and potlids occur when stone is heated very rapidly. This suggests that most alteration in the analyzed samples was unintentional because of the uncontrolled rise in temperature, and was probably the result of camp fires or noncultural events.

Finally, the lithic artifacts from the general levels, features, and structures from the Martin Farm assemblages were compared in terms of the frequency of their discrete functional, formal and technological characteristics. This analysis indicated that behavioral patterns reflected in the distribution of the artifacts were comparable for both the Mississippian I and II assemblages. For example, the higher frequency of bipolar artifacts in the structure areas of both assemblages reflected the resistance of these artifacts to trampling and increased activity within a structure. The one exception was the possible intentional disposal of utilized artifacts into features during the Mississippian II occupation.

The Mississippian I and II occupations at Martin Farm originally were defined on the basis of their different stratigraphic locations,

radiocarbon dates and ceramic assemblages. This study has now provided a detailed analysis of the lithic artifacts from these occupations as well. Based on the assumptions of adequate sample size and control of functional and spatial variability, the lithic analysis clearly indicates that there is no significant formal or technological variability between these temporally distinct populations. An overall similarity between these occupations and the earlier Jones Ferry features is also indicated by the lithic analysis.

This similarity shows that there was no abrupt break at the end of the Woodland period, during which a new group, the Mississippian people, entered eastern Tennessee and became the dominant culture. Instead, the analysis supports a model of gradual cultural change, wherein the Mississippian culture developed out of the Woodland culture. The analysis of the Martin Farm ceramics does indicate a break between the Mississippian I and II occupations at the site (Davis 1981:144-145). However, the gradual shift in predominance of limestone-tempered ceramics to shell-tempered plain and, finally, shell-tempered cordmarked ceramics, beginning with the Jones Ferry features and ending with the Mississippian II occupation at Martin Farm, also supports the in situ cultural development model.

The lithic analysis also clearly shows that culture change will occur at different rates in different aspects of culture. While the ceramic assemblages from Jones Ferry and Martin Farm did manifest change through time, the lithics did not. Thus, ceramic production, a more flexible, additive technology, is a more sensitive indicator of short-term temporal change. Lithic tool manufacture, a subtractive technology,

is, on the other hand, a less sensitive indicator of the relatively short-term temporal change examined in this study.

BIBLIOGRAPHY

BIBLIOGRAPHY

Anderson, D. G.
1979 Prehistoric selection for intentional thermal alteration: tests of a model employing Southeastern archaeological materials. Mid-Continental Journal of Archaeology 4:221-250.

Baden, W. W. (editor)
1981 Tomotley: An Eighteenth Century Overhill Cherokee village. Report submitted to the Tennessee Valley Authority and the Heritage Conservation and Recreation Service.

Barr, A. J., J. H. Goodnight, J. P. Sall, W. H. Blair, and D. M. Chilka
1979 SAS user's guide. SAS Institute, Inc., Raleigh.

Binford, L. R.
1979 Organizational and formation processes: looking at curated technologies. Journal of Anthropological Research 35:255-273.

1980 Willow smoke and dog's tails: hunter-gatherer settlement systems and archaeological site formation. American Antiquity 45:4-20.

Cahen, D., L. H. Keeley, and F. L. Van Noten
1979 Stone tools, tool kits and human behavior in prehistory. Current Anthropology 20:661-683.

Cambron, J. W. and D. C. Hulse
1964 Handbook of Alabama archaeology, part I: point types. Archaeological Research Association of Alabama, University of Alabama, Tuscaloosa.

Chapman, J.
1969 Testing at Martin Farm (40MR20). Unpublished field notes, McClung Museum, University of Tennessee, Knoxville.

1978 The Bacon Farm site and a buried site reconnaissance. University of Tennessee, Department of Anthropology, Report of Investigations 23.

1980a The Jones Ferry site, 40MR76. In The 1979 archaeological and geological investigations in the Tellico Reservoir, edited by J. Chapman, pp. 43-58. University of Tennessee, Department of Anthropology, Report of Investigations 29.

1980b Chert outcrop: 40MR22, Rock Crusher Bluff area. In The 1979 archaeological and geological investigations in the Tellico Reservoir, edited by J. Chapman, pp. 7-17. University of Tennessee, Department of Anthropology, Report of Investigations 29.

Crabtree, D. E.
1964 Notes on experiments in flintknapping 1: heat treatment of silica materials. _Tebiwa_ 7:1-3.

1972 An introduction of flintworking. _Occasional Papers of the Idaho State Museum_ 28. Pocatello.

Damon, P. E., C. W. Ferguson, A. Long, and E. I. Wallick
1974 Dendrochronologic calibration of the radiocarbon time scale. _American Antiquity_ 39:350-366.

Davis, R.P.S., Jr.
1980a A summary report of probabilistic "non-site" sampling in the Tellico Reservoir, 1979. In The 1979 archaeological and geological investigations in the Tellico Reservoir, edited by J. Chapman, pp. 59-90. University of Tennessee, Department of Anthropology, _Report of Investigations_ 29.

1980b A preliminary report of probabilistic and nonprobabilistic sampling in Industrial Area II, Tellico Reservoir, Tennessee. University of Tennessee, Department of Anthropology, _Tellico Archaeological Survey Report_ 2.

1981 An analysis of ceramic artifacts from the Martin Farm site. Ms. on file, McClung Museum, University of Tennessee, Knoxville.

Davis, R.P.S., Jr., L. R. Kimball, W. W. Baden and J. Chapman
1980 Research design for probabilistic sampling survey of the Tellico Reservoir, Tennessee. Research proposal submitted to the Tennessee Valley Authority, Norris, Tennessee.

Faulkner, C. H.
1972 The Mississippian--Woodland transition in the Middle South. _Proceedings of the Southeastern Archaeological Conference,_ Bulletin 15:38-45.

1975 The Mississippian--Woodland transition in the Eastern Tennessee Valley. _Proceedings of the Southeastern Archaeological Conference, Bulletin_ 18:19-30.

Gould, R. A.
1977 Ethnoarchaeology: or, where do the models come from? In Stone tools as cultural markers: change, evolution and complexity, edited by R.V.S. Wright, pp. 162-168. Australian Institute of Aboriginal Studies, _Prehistory and Material Culture Series_ 12.

1980 _Living archaeology._ Cambridge University Press, Cambridge.

Hair, J. F., Jr., R. E. Anderson, R. L. Tatham, and B. J. Grablowsky
1979 Multivariate data analysis with readings. Petroleum Publishing Company, Tulsa, Oklahoma.

Hayden, B.
1977 Stone tool functions in the Western Desert. In Stone tools as cultural markers: change, evolution and complexity, edited by R.V.S. Wright, pp. 178-188. Australian Institute of Aboriginal Studies, Prehistory and Material Culture Series 12.

1980 Confusion in the bipolar world: bashed pebbles and splintered pieces. Lithic Technology 9:2-7.

Johnson, S. C.
1967 Hierarchical clustering schemes. Psychometrika 32:241-254.

Keeley, L. H.
1980 Experimental determination of stone tool use: a microwear analysis. University of Chicago Press, Chicago.

Kim, J.
1975 Factor analysis. In SPSS: statistical package for the social sciences, by N. H. Nie, C. H. Hull, J. G. Jenkins, K. Steinbrenner, and D. H. Bent, pp. 468-514. McGraw-Hill, New York.

Kim, J. and C. W. Mueller
1978 Factor analysis: statistical methods and practical issues. Sage Publications, Beverly Hills.

Kimball, L. R.
1980a The 1977 archaeological reconnaissance: and an overall assessment of the archaeological resources of the Tellico Reservoir. Tellico Archaeological Survey Report 1, in press.

1980b A quantitative pattern recognition model of temporal variability in debitage for Early Archaic through historic Cherokee lithic assemblages in the lower Little Tennessee River Valley. Paper presented at the 37th annual meeting of the Southeastern Archaeological Conference, New Orleans.

1981 An analysis of residential campsite structure for two Early Archaic assemblages from Rose Island (40MR44), Tennessee. Unpublished M.A. thesis, Department of Anthropology, University of Tennessee.

Lewis, T.M.N., and M. Kneberg
1946 Hiwassee Island. University of Tennessee Press, Knoxville.

MacDonald, G. F.
1968 Debert: a Paleo-Indian site in central Nova Scotia. National Museum of Canada, Anthropological Papers 16.

McCollough, M.C.R., and C. H. Faulkner
1973 Excavations at the Higgs and Doughty sites: I-75 salvage archaeology. Tennessee Archaeological Society, Miscellaneous Paper 12.

Muto, G. R.
1971 A technological analysis of the early stages in the manufacture of lithic artifacts. Unpublished M.A. thesis, Department of Anthropology, Idaho State University.

Nie, N. H., C. H. Hull, J. G. Jenkins, K. Steinbrenner, and D. H. Bent
1975 SPSS: statistical package for the social sciences. McGraw-Hill, New York.

O'Connell, J. F.
1977 Aspects of variation in central Australian lithic assemblages. In Stone tools as cultural markers: change, evolution and complexity, edited by R.V.S. Wright, pp. 269-281. Australian Institute of Aboriginal Studies, Prehistory and Material Culture Series 12.

Polhemus, R.
1966 Testing at Martin Farm (40MR20). Unpublished field notes, McClung Museum, University of Tennessee.

Purdy, B. A.
1975 Fractures for the archaeologist. In Lithic technology: making and using stone tools, edited by E. Swanson, pp. 133-141. Mouton, The Hague.

Rummel, R. J.
1967 Understanding factor analysis. Conflict Resolution 11:444-480.

Salo, L. V.
1969 Martin Farm (40MR20). In Archaeological investigations in the Tellico Reservoir, Tennessee, 1967-1968: an interim report, edited by L. V. Salo, pp. 87-141. University of Tennessee, Department of Anthropology, Report of Investigations 7.

Schroedl, G. F.
1973 Radiocarbon dates from three burial mounds at the McDonald site in East Tennessee. Tennessee Archaeologist 29:3-11.

1975 Phase II--Archaeological excavations: excavations at Martin Farm. In A comprehensive research design for archaeological investigations in the Tellico Reservoir, by G. F. Schroedl, J. Chapman and R. Polhemus, pp. 15-18. Report submitted to A. K. Guthe, the Tennessee Valley Authority and the National Park Service.

Schroedl, G. F.
1978 Excavations of the Leuty and McDonald site mounds. University of Tennessee, Department of Anthropology, Report of Investigations 22.

Thomas, D. H.
1976 Figuring anthropology: first principles of probability and statistics. Holt, Rhinehart and Winston, New York.

Tryon, R. C.
1958 General dimensions of individual differences: cluster analysis vs. multiple factor analysis. Educational and Psychological Measurement 18:477-494.

Willey, G. R., and J. A. Sabloff
1980 A history of American archaeology (second edition). W. H. Freeman and Company, San Francisco.

VITA

Charles Clifford Boyd, Jr., was born in Johnson City, Tennessee on November 26, 1952. He graduated from University High School in Johnson City, Tennessee in June, 1970. In September, 1970, he entered East Tennessee State University, graduating summa cum laude with a Bachelor of Science degree in August, 1974, with majors in sociology and art.

After serving two years in the Peace Corps in Colombia, South America, and working on the family farm, he began graduate studies in anthropology at The University of Tennessee, Knoxville, in September, 1977. He received the Master of Arts degree in March, 1982. He is presently working as a lithic analyst for the Tellico Archaeological Project. He is a member of Phi Kappa Phi, the Society for American Archaeology and the Southeastern Archaeological Conference.

He is married to the former Donna Markland of Johnson City, Tennessee.