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Lithic Analysis and the Discovery of Prehistoric Man-Land Relationships in the Uplands of the Big South Fork of the Tennessee Cumberland Plateau

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To the Graduate Council:

I am submitting herewith a dissertation written by Terry Andrew Ferguson entitled "Lithic Analysis and the Discovery of Prehistoric Man-Land Relationships in the Uplands of the Big South Fork of the Tennessee Cumberland Plateau." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Anthropology.

Walter E. Klippel, Major Professor

We have read this dissertation and recommend its acceptance:

Jefferson Chapman, Michael Logan, Charles Faulkner, Tom Bell

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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

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and recommend its acceptance:

Michael H. Logan

Accepted for the Council:

Vice Provost
and Dean of The Graduate
School

LITHIC ANALYSIS AND THE DISCOVERY OF PREHISTORIC MAN-LAND RELATIONSHIPS IN THE UPLANDS OF THE BIG SOUTH FORK OF THE TENNESSEE CUMBERLAND PLATEAU

A Dissertation

Presented for the Degree

of Doctor of Philosophy

University of Tennessee, Knoxville

Terry Andrew Ferguson

August 1988

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ABSTRACT

Prehistoric man-land relationships within the uplands of the Big South Fork River valley in east-central Tennessee were studied by lithic based settlement analysis. Lithic artifact assemblages from 45 sites located within three study areas in contrasting biophysical environments were investigated. Investigations were designed to identify culturally meaningful patterning in the information content of the archaeological record and to draw inferences concerning adaptive behavior. Patterns were evaluated for the study areas, viewed holistically and synchronically, and for individual sites viewed diachronically. The analytical investigations focused on the assemblage variability present within and between the study areas and concerned variation in patterns of raw material utilization, reduction sequence technology, and technological organization.

Viewed synchronically and holistically the upland surface and upland gorge study areas exhibit similar patterning for all three sources of variability. The lack of lithic resource availability appears to be the principal factor contributing to the overall similarity. Observed differences in patterns of raw material utilization can generally be explained as a function of

distance from source areas and suggest seasonal movement into the area from the west throughout prehistory. Staged biface production is the predominate pattern of lithic reduction, with a bias toward middle and late production stages. Both curated and expedient patterns of technological organization are present, with curation being indicated in the upland surface areas and expedience in the gorges. This suggests that differential patterns of utilization are likely. Selection of raw material or curation of bifacial implements are also suggested.

The earliest and most intensive utilization occurs during the Early Archaic period. The absence of evidence for Middle Archaic utilization suggests dessication during the mid-Holocene. Light usage is indicated during the Late Archaic/Early Woodland periods followed by intensive utilization during the Middle Woodland period. Moderate utilization is indicated for the Late Woodland/Mississippian periods.

There appears to have been a preference for open upland surfaces as opposed to gorge rockshelters during the Early Archaic. The reverse is suggested for the Middle Woodland. A curated pattern of technological organization is suggested for the Early Archaic with a more expedient pattern being suggested for the Middle Woodland and Late Woodland/Mississippian.

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CHAPTER I

INTRODUCTION

One of the principal goals of contemporary archaeology is understanding the process of cultural adaptation and how culturally adaptive behavior has changed over time. Accordingly, a vital concern of contemporary archaeology is the development of problem oriented pattern recognition strategies for the discovery of regularities in prehistoric man-land relationships. This dissertation develops and employs such pattern recognition strategies to conduct a lithic based settlement analysis concerned with a search for adaptive behavioral patterning, as exhibited by lithic artifacts and their contexts in the uplands of the Big South Fork River Drainage on the Cumberland Plateau of Tennessee.

The Study Areas and Background of Previous Research

The analyses in this study focus on the patterning exhibited by the lithic artifacts from three areas within the uplands of the Big South Fork drainage basin (Figure A.1)[1]. One study area is located in the headwaters of the Big South Fork drainage on three

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[1] All Figures and Tables are in Appendices A and B.

tracts of land owned by the Hiwassee Land Company. The other two areas are located adjacent to one another in the central part of the drainage basin within the Bandy Creek portion of the Big South Fork National River and Recreation Area (hereafter referred to as BSFNRRA).

The artifactual and contextual data for the current study were recovered during the course of grant and contract investigations conducted by the University of Tennessee Department of Anthropology between 1980 and 1984. The following sub-sections briefly summarize the pertinent aspects of these investigations and their relationship to the present study.

The CARP Upland Study Area

One area selected for study is located in a relatively undissected portion of the headwaters of the Big South Fork drainage. The University of Tennessee Department of Anthropology's initial archaeological investigations in the Big South Fork drainage were conducted in this area during 1980 and 1981 under funding from the Tennessee Historical Commission (Ferguson and Pace 1981b). This project was designated the Cumberland Archaeological Research Project (hereafter referred to as CARP).

The purpose of this initial study was to produce an overview of the settlement patterning on the Cumberland

Plateau. The principal management objective of this study was to provide a general model of settlement patterning to aid cultural resource managers in assessments of adverse impact caused by federally permitted coal mining. The primary research objective of this project was the development of a general research design for archaeological investigations in the Cumberland Plateau region. Meeting this objective required an assessment of methodological problems and potential substantive contributions of operationalizing such a design. With these objectives in mind a research program was initiated with the following goals:

1. The development of appropriate methodologies for locating archaeological resources in the rugged plateau area, for maximizing the informational potential of these resources, and for effectively integrating that information for research and management purposes.
2. The development of a reliable data base which can be used to generate models of archaeological site location and test ideas concerning patterns of cultural adaptation (Ferguson and Pace 1981b: 1).

Field investigations were undertaken within large tracts of land in the headwaters area of the Big South Fork drainage which had been cleared, plowed, and disced for commercial tree planting by the Hiwassee Land Company, a Division of the Bowater Paper Company. These tracts were initially chosen for study because they supplied a unique opportunity to inspect large contiguous areas with an average of 90% ground visibility.

Systematic controlled surface collection was the principal artifact recovery procedure employed during CARP investigations. This procedure was supplemented by systematic shovel testing at selected sites. Seven tracts of land containing approximately 360 ha (800 ac) were inspected (Figure A.2) during the course of project investigations. Sixty-three distinct artifact concentrations definable as sites, containing approximately 2300 artifacts were located within this 360 ha.

Three tracts (Hiwassee Land Company tract numbers 426, 428, and 442), were studied more intensively than the others (Figures A.3 and A.4). These three tracts received more intensive study because they contained the largest contiguous areas surveyed, the widest range of topographic variation, and a large percentage of artifactual data recovered. Tracts 426 and 428 are directly adjacent to one another and enclose a surveyed area of approximately 180 ha (396 ac). Fourteen distinct prehistoric artifact concentrations containing 1699 artifacts were defined within tracts 426 and 428. Tract 442 enclosed a surveyed area of approximately 40 ha (88 ac) and contained 143 artifacts within 11 distinct prehistoric artifact concentrations. The data from these three tracts (426, 428, and 442) will be used below, as samples of the archaeological variability present in the upland areas of the headwaters of the Big South Fork drainage.

The analysis of the data recovered during the CARP investigations, particularly from tracts 426, 428, and 442, indicated that topographic and hydrographic environmental factors within the situational context of these tracts had a significant effect on the distribution, size, and content of artifact concentrations. Based on this analysis, it was felt that the potential existed for constructing settlement models with reliable predictive capability. For example, one model based on site slope, horizontal and vertical distant to water appeared to account for much of the variability in the distribution of artifacts across the study area. This model was both general and synchronic in nature in that specific cultural behavior and change over time were not considered.

In spite of the limitations of the predictive models produced, the key finding of the CARP investigations was the indication that the structure of the environment played a strong and persistent role in the prehistoric site selection strategies and influenced patterns of adaptation to upland area contexts on the Cumberland Plateau. This key finding gave rise to positive recommendations for further and more detailed investigation into prehistoric man-land relationships on the Cumberland Plateau.

The Bandy Creek Upland Study Area

The two other areas selected for study are located directly adjacent to one another, in the central part of the Big South Fork river basin, in the portion drained by Bandy Creek. One area consists of a relatively undissected upland surface and is similar to the CARP study area. This upland area was investigated, from 1981 through 1985 under funding from the U.S. Army Corps of Engineers (Ferguson et al. 1982, 1983, 1986; Hoffman 1987; Whyte 1984, 1985), as a part of a series of investigations designated the Big South Fork Archaeological Project (hereafter referred to as BSFAP). The purpose of this project was to evaluate the cultural resources located within specific development areas of the BSFNRRA. General research objectives concerned the application of the research design developed during the CARP investigations, with particular emphasis placed on settlement modeling leading to an understanding of cultural adaptation (Ferguson and Pace 1981a).

During the BSFAP, investigations were carried out in a total of eight development areas containing approximately 1642 ha (4036 ac) (Figure A.5). Of this total area approximately 59 ha (146 ac) were intensively investigated; the remaining area received only a reconnaissance level inspection. Within the entire project area, a total of 340 archaeological sites were defined, with 281 containing prehistoric components and 95 containing historic components.

The Bandy Creek development area, located in the central portion of the Big South Fork drainage, is one of the most intensively investigated areas in the proposed BSFNRRA. It contained approximately 409 ha (1000 ac), 39 ha (85 ac) of which were areas of direct impact, and 370 ha (915 ac) contained areas receiving only indirect impact. The direct impact areas were investigated intensively by means of systematic shovel testing, controlled surface collection, and test excavations. The indirect impact areas were investigated utilizing only high visibility pedestrian reconnaissance. Fifty-six prehistoric sites were defined within the boundaries of the Bandy Creek development area, 37 open sites and 19 rockshelter sites (Figures A.6 and A.7).

The 20 sites receiving the greatest attention during the course of Bandy Creek investigations are within or directly adjacent to the direct impact areas. These sites are located within a topographically well defined upland in the eastern part of the Bandy Creek development area (Figure A.8). During the course of three field seasons 16,501 artifacts were collected from these 20 sites. A variety of methods consisting of systematic controlled surface collection, systematic shovel testing, 1 x 1 m testing, and small block excavation were employed in the recovery of these artifacts.

The initial analytical investigations of the archaeological remains from the Bandy Creek Upland study area focused on general artifact characterization and characterization of the environmental context. The initial artifact characterization indicated that the material present in the uplands consisted almost entirely of lithic artifacts. The range of artifact types present was limited and was consistent with the findings of previous studies in the Cumberland Plateau uplands (ie. Pace and Kline 1976; Ferguson and Pace 1981b). In spite of a general similarity, there appeared to be some distinct differences in artifact assemblage composition between sites, within situations, and between different situations.

The initial characterization of the environmental context and its relationship to site location within the Bandy Creek Upland area involved the generation of a settlement pattern model based on a multivariable stratification of topographic and hydrographic factors.

This analysis produced a reasonably reliable predictive model of site and artifact distribution and density. The model generated was comparable with the CARP model discussed above and generally supported the previous conclusions of the CARP study (Ferguson et al. 1986).

In summary, the importance of the investigations in Bandy Creek from 1981-1983 were the indications that non-random patterning exists in the spatial distribution of archaeological remains with respect to environmental factors and that interpretable assemblage variability is also present. It was concluded that further detailed analysis of assemblage variability could lead to the discovery of culturally meaningful interpretations of settlement activity if adequate artifact samples could be recovered.

The non-random patterning in the spatial distribution of archaeological remains is apparent both within and between contrasting situational contexts. Since the environmental boundaries of the situational contexts are easily defined, it was decided that further, more detailed investigation of settlement and assemblage structure within and between situational contexts would be profitable. The primary worth of more detailed investigation was seen as the ability to make statements about culturally adaptive behavior. Many archaeological settlement studies deal with sites as collections of artifacts at points in space and seldom evaluate the sites behavioral information. Accordingly, investigations conducted from 1983-1984 were directed toward the recovery of larger samples of artifacts from selected sites within the Bandy Creek Upland area and the discovery and interpretation of lithic assemblage variability.

Data from the BSFAP investigations, specifically that recovered during the intensive investigation of the 20 sites located in the well defined eastern portion of the Bandy Creek development area, will be used as samples of the archaeological variability from open sites in the central portion of the Big South Fork Drainage. As with the CARP areas selected for further study in the headwaters of the Big South Fork drainage, the Bandy Creek area was selected due to the intensity of previous investigations and the contiguous nature of the investigated area. Most important, the Bandy Creek Upland study area was selected because it provided another upland situation in the central portion of the drainage which could be compared and contrasted with the situation in the headwaters area investigated during the CARP investigations.

The Bandy Creek Gorges Study Area

The other central drainage study area consists of portions of the entrenched gorges located directly adjacent to the Bandy Creek Upland area discussed above. The Bandy Creek Gorges were initially investigated in 1981 and 1982 as a part of the BSFAP survey of indirect impact areas within the Bandy Creek Development area. The portions of gorges investigated contain 113 definable shelters, 19, or approximately 17%, of which exhibit evidence of prehistoric occupation (Figure A.7). This sample of 113 rockshelters is only a small portion of 2080 recorded in all the study areas investigated during the course of the BSFAP (Ferguson et al. 1986). Out of these 2080 rockshelters, 154, or approximately 7%, contained prehistoric archaeological sites.

Five of the prehistorically occupied shelters located in the Bandy Creek Gorges were investigated utilizing 1 x 1 m test excavations in 1982. These five sites were part of a sample of 30 rockshelter sites tested by the University of Tennessee in 1982 in an assessment of the archaeological variability exhibited by the prehistoric rockshelter sites in the Big South Fork project area. The results of these investigations are discussed by Ferguson et al. (1986).

The data recovered from the five tested sites in the Bandy Creek Gorges will be used in this study as samples of archaeological variability from rockshelter sites in the central portion of the drainage basin. The results of the analyses of these sites conducted in the current study should be generalized only to rockshelter sites in similar environmental contexts in the central portion of the drainage and even then with caution.

The findings of the 1982 rockshelter investigations supported the general conclusions of the Bandy Creek Upland investigations. Variation in artifact assemblages exists within the gorges and between them and the adjacent uplands and that this variability was most probably due to differences in patterns of adaptation to the different environmental contexts (Ferguson et al. 1986).

The Artifact Content and Environmental Context of Sites Located within the Study Areas

Table B.1 presents a summary of the artifactual information for the three study areas. A detailed discussion of the various recovery methods is presented in the fourth chapter. Since a variety of different, and not necessarily comparable, recovery methods were used, an attempt was made to control for potential biasing effects by size sorting all artifact samples. Therefore only those artifacts which would not pass through 0.64 cm (1/4 in) screen mesh were analyzed in this study (Table B.2).

Specific locational and environmental information for the sites within the study areas can be found in Table B.3. Locational information includes UTM coordinates and elevations. Environmental information includes site and landform slope and aspect, local relief, horizontal and vertical distance to the closest water, and the stream rank of the closest water.

The artifacts recovered from 45 sites (16 from the Bandy Creek Upland study area, 5 from the Bandy Creek Gorges study area, and 24 from the CARP Upland study area) are the primary samples under study. Tables B.4 and B.5 present summary information on the artifacts from these sites.

Definition of Research Problem Orientation

Understanding the behavior patterns of prehistoric populations in relationship to specific environmental habitats is an integral part of the study of the process of cultural adaptation. The fundamental assumption of this study is that archaeologists can understand the interrelationships between past cultural and environmental subsystems through the systematic investigation of variability exhibited by aggregates of archaeological remains at various contextual levels. Such contextual levels are the site, the area or the situation, as used by geographers, and the region. These levels are basically synonymous with what Butzer (1982:38) defines as the site microenvironment, site mesoenvironment, and site macroenvironment of the landscape context.

The basis for the underlying assumption can be understood if the archaeological and past environmental records are viewed systemically and if the conduct of archaeological inquiry is seen as an analogue of information processing. Past cultural and environmental records can be conceived of as the observable and tangible aspects of a complex dynamic system (Klippel 1976). The subsystems of this complex dynamic system are intricately related and interact in many diverse ways. With this systems view in mind Butzer (1982:6-7) indicates that the objectives of what he terms environmental archaeology should be:

> ...to define the characteristics and processes of the biophysical environment that provide a matrix for and interact with socioeconomic systems as reflected, for example in subsistence activities and settlement patterns...and...to understand the human ecosystem defined by that systemic intersection...

The underlying assumption of this study is consistent with the proposition of Foley (1981:1),

> ...that archaeological data relate primarily to long term, gross behavioral characteristics and that ecological theory may be used to predict their structure.

This assumption is also consistent with the ideas concerning long-term land use put forth by Binford (1983).

Investigation of this complex system of interrelated subsystems can be facilitated through the perception of both the archaeological and environmental records as information systems. Each record exhibits characteristic and distinctive patterning in its information content which can be identified if investigated using suitable pattern recognition techniques.

Often information about past environmental records is quite sketchy and difficult to obtain. In these instances, the patterning of the adaptive information contained in artifact assemblages within specific environmental contexts, becomes the principal basis for inferences concerning the functioning of both past cultural and environmental subsystems. This assumption is consistent with the proposition of Binford (1978a:3) that:

> ...the archaeological record derives from an adaptation... also... *adaptations have all the properties of a system* in which various components are responsive to one another in their ongoing operation. The basic elements or components of the system are units of organization rather than discrete elements as viewed by us in the contemporary world. One cannot

> understand the workings of... [a system] through a strategy that enumerates all the... parts. One must first develop some way of recognizing basic functioning components,... then seek to understand how these units articulate with one another and interact under differing conditions external to the system to which they are responsive. Ways of developing a realistic appreciation for the characteristics of a system of adaptation must be sought...

Recent attempts to implement behaviorally sensitive research orientations directed toward discovering patterns of adaptive behavior in the archaeological record have been developed under what Binford (1977) has termed Middle Range Theory. Relevant examples of such attempts are studies of prehistoric hunter-gatherer ecology by Thomas (1983a and 1983b).

The development and implementation of the pattern recognition strategies for the study of prehistoric cultural adaptation can also be seen as aspects of Middle Range Theory. Furthermore, it is vital to the refinement and future usefulness of Middle Range Theory that more pattern recognition strategies of this type be developed. Implementation of systematic pattern recognition strategies within a precisely defined, problem oriented framework are essential if useful information is to be recovered from past archaeological and environmental records.

Operationalization of Research Problem and Expectations

If a meaningful search for patterning is to take place, the manner in which the specific research problem is to be addressed and associated research expectations need to be clearly defined. In the following sections, an attempt will be made to outline the basis for this study's specific analytical approach to the research problem. Patterns, which might be expected to be discovered in the analytical phases of investigation, are also discussed.

Local Versus Regional Settlement Modeling

Both settlement pattern and settlement system analyses are generally thought of as being conducted on a broad regional scale. In practice it is difficult if not impossible to understand the intricacies of man-land interactions and adaptive strategies unless study is also undertaken at the local scale within various contrasting situational contexts. This present research concentrates on the delineation and comparison of patterning in archaeological record from three such local situational contexts: the Bandy Creek Upland area, the adjacent Bandy Creek Gorges area, and the CARP Uplands area.

This focusing on pattern recognition within contrasting situational contexts is consistent with the suggestion that:

> ...if archaeologists are to be successful in understanding the organization of past cultural systems they must understand the organizational relationships among *places* which were differentially used during the operation of past systems...of adaptation and their evolutionary modification...
>
> The processes which caused site patterning are the long-term repetitive patterns in "positioning" of adaptive systems in geographic space. Site patterning derives from repetition, or lack there of, in the spatial positioning of systems (Binford 1982:5-6).

The three study areas which are dealt with in the present study contain a range of archaeological places located in contexts of differing environmental diversity. This analysis is concerned with the patterns of differential utilization between these different environments, and with the organizational structure of the adaptive cultural systems that exploited these environments in the past.

At the outset of this research it was hoped that additional study areas documenting a broader and more diverse range of contrasting environmental situations within the drainage of the Big South Fork River could be included in the settlement analysis. These anticipated study areas included: another upland area in the greatly dissected northern portion of the drainage basin, at least two areas of terrace development, and at least two areas containing rockshelters in the deeply entrenched main gorge of the Big South Fork River.

The inclusion of these areas in the present analysis would have greatly improved interpretive power and enabled the generation of a more complete picture of settlement activity on this portion of the Cumberland Plateau. Unfortunately, several factors precluded the inclusion of these study areas in this study. These factors included contractual constraints and access restrictions, the associated inability to recover adequate and comparable artifact samples, and the absence of artifacts from stored collections recovered by previous investigations. For example, investigations directed toward the further sampling of sites in the uplands and terraces in the Blue Heron portion of the BSFNRRA (Ferguson et al. 1984) were canceled by the Corps of Engineers in the late stages of planning in 1984.

Another example of the problems encountered concerns the attempted use of the artifactual information recovered by Wheaton (n.d.) from 40ST6 located within the terrace at Leatherwood Ford. This site is the only extensively excavated terrace site within the drainage basin of the Big South Fork. When the artifacts from this site were finally obtained, after no small degree of difficulty, it was discovered that all lithic implements had been separated from the debitage and lost, thus greatly reducing the analytical value of this site.

Finally, investigations conducted under the Corps of Engineers only allowed for the limited testing of a sample of rockshelters (Ferguson et al. 1986). As with the limited testing of selected terrace sites during the BSFAP investigations, the data from the test excavations of rockshelters in other areas of the Big South Fork failed to produce adequate samples and often lacked sufficient temporal controls. At the outset of the field investigations it was hoped that a full range of artifactual information, including abundant and well preserved floral and faunal remains, from temporally sound contexts would be recovered. Such rockshelters are known to exist on the Plateau and have been observed by amateur archaeologists. Unfortunately, no contextually sound sites with exceptional preservation were encountered within the sample of 30 rockshelters tested by Ferguson et al. (1986).

Admittedly, the three study areas upon which the present analysis focuses do not document the full range of contextual variability , or presumably the assemblage variability present within the drainage of the Big South Fork. In spite of this limitation, these three areas do illuminate the variability present within a range of poorly understood upland contexts.

Lithic Artifact Variability as an Indicator of Adaptive Behavior

Binford states:

> ...behavior is the dynamics of adaptation. People draw upon a repertoire of cultural background and experience to meet changing or variable conditions in their environment, both social and physical. Our expectations, then are for variability in the archaeological record to reflect a variety of coping situations (Binford 1977b:132).

And that:

> ...human systems of adaptation are assumed to be internally differentiated and organized arrangements of formally differentiated elements. Such internal differentiation is expected to characterize the actions performed and the location of different behaviors (Binford 1980:4).

The analyses of the lithic artifact samples from the study areas are designed to identify patterns in cultural adaptation for these areas. These adaptive patterns are indicated by variability in behavioral patterning that can be inferred from artifactual remains and their contexts.

One of the major problems in undertaking such a behaviorally oriented analysis is determining which elements of the archaeological record will yield the most important information about what people of the past really did. In reference to this problem it has been noted that:

> One of contemporary archaeology's greatest difficulties is the linkage problem -- the necessity to determine the archaeologically visible correlates of behaviorally significant events (Thomas 1983b:425).

In this study, three aspects of lithic assemblage variability were selected as indicators of a range of adaptive behavioral patterning. Theses are: (1) the variability associated with lithic raw material utilization, (2) reduction sequence technology, and (3) technological organization. The justification for choosing these particular aspects of cultural behavior, as manifest in the archaeological record is outlined below.

Patterning in lithic raw material utilization can provide the archaeologist with a wide range of settlement related information. For example, Amick (1984:12-13), in a through review of previous studies, indicates that:

> Spatial incongruence of resources is perceived as a major factor leading to activity differentiation and assemblage variability...Lithic assemblage variability can monitor settlement differences effected by resource distribution differences... Previous studies of raw material variability have indicated that organizational properties of technologies, settlement-subsistence systems, and social organization can be inferred for prehistoric populations.

Raw material variability has long been considered a vital source of behavioral information (cf. Collins

1975). Current archaeological understanding of behavioral patterning associated with raw material procurement and utilization has increased greatly in recent years, with the increased ethnoarchaeological study (eg. O'Connell 1977; Binford 1979). These studies have shown that, through the investigation of lithic raw material variability, inferences can be made about procurement strategies, territoriality, mobility, and intensity of site utilization.

Specific expectations for the Big South Fork Drainage of the Cumberland Plateau relating to raw material utilization are as follows:

1. Due to the lack of locally available lithic raw materials in the Big South Fork drainage (ie. sources for the areas studied ranging from 14 to 26 km away), it might be expected that lithic raw material procurement within the prehistoric settlement systems which operated on the Cumberland Plateau would tend to be more embedded than direct or indirect.
2. The relative abundance of exotic raw materials, particularly in discarded bifacial implements, should indicate the location of settlement activities in adjacent regions prior to utilization of the Cumberland Plateau.

Patterning in reduction sequence technology is another important indicator of settlement related information. Raw material availability and suitability directly effect lithic production, maintenance, and utilization. Therefore, many of the same cultural aspects which can be addressed through the analysis of variability in raw material utilization can also be investigated through the study of variability in reduction sequence technology. Much of the cultural behavior involved in the manufacture and maintenance of chipped stone implements has been well established through ethnographic and experimental study (Hester and Heizer 1973; Johnson 1978).

Lithic debitage is an important source of technological information, due to the fact that debitage is usually unaffected by many of the past behavioral processes such as breakage, retooling, rehafting, removal, discard, and loss which can bias technological interpretations based solely on lithic implements (ie. Jelinek 1976; Jefferies 1982; Keeley 1982). Therefore, the study of debitage can supply a more accurate reflection of artifact manufacturing and maintenance trajectories. Studies by Raab et al. (1979), Davis et al. (1982), Jefferies (1982), and Johnson and Raspet (1982) are particularly relevant examples of where debitage has served as a major source of information concerning technological patterning and as a source of information about settlement activities.

Patterning, similar to that suggested by Jefferies (1982) for the upland plateau areas surrounding the Lookout Valley of northern Georgia might be generally expected for the study areas of the Big South Fork:

> A limited amount of primary reduction activities would be expected....Secondary reduction and tool use, modification, and discard would be more common activities...
>
> Primary reduction should be an infrequently occurring activity at upland plateau sites because of the distance to the chert resource area. Lithic activities... would include some secondary reduction, but the majority of activities would, however, concentrate on tool use, modification/resharpening, and discard (Jefferies 1982:105).

Some previous research suggests that throughout prehistory the utilization of the Cumberland Plateau has mainly involved special purpose activities, the following might also be generally expected:

> Manufacturing debris occurring on special purpose sites which are intermediate between residential sites and procurement sites (such as hunting stands or camps) may well exhibit considerable lithic debris from work on partially finished or "staged" items. . . many "incomplete" items would be further modified on such locations, resulting in "disjunctive" debris to tool relationships (Binford 1979:70).

Specific expectations for the Big South Fork study areas for reduction sequence related technology, which can be drawn from these propositions, are as follows:

1. Based on the suggestions of Binford (1979) and Jefferies (1982) the relative abundance of predominantly small debitage, as opposed to large or a normally distributed range of debitage size might well be expected if the majority of sites contain the residues of special purpose activities.
2. The suggestions of Binford (1979) and Jefferies (1982) also indicate that the relative diversity of debitage classes, characterized by technologically sensitive indicators, would not be expected to conform to distributions expected for primary lithic implement production.

The variability exhibited by certain formalized implements, such as projectile point/ knives, has long been recognized as a diagnostic indicator of association with a particular cultural pattern and period. In recent years, the variability exhibited by a much broader range of formalized implements, characterized by a variety of manufacture and use related indicators, has been the focus of behaviorally sensitive research. Three good examples of settlement related research of this type are the studies by Johnson (1977), Davis (1986) and Thomas (1983b:419-425).

Based on extensive ethnoarchaeological investigations Binford (1977, 1979), has developed a body of theory relating to the organizational properties of technology and related site formation processes. The fundamental assumptions underlying Binford's work are that:

> ...we might anticipate certain regular contrasts between archaeological assemblages deriving from highly organized, curated technologies, versus those that are poorly organized and tend toward the expedient manufacture, use and abandonment of instrumental items in the immediate context of use.
>
> ...[there are definable] archaeological consequences of cultural systems differing in their degrees of technological organization on a scale from completely expedient manufacture, use and abandonment of tools, versus a curated and maintained technology (1977:34).

In order to understand Binford's assumptions, one must also understand his definitions of archaeological assemblage, site patterning, and the distinctions he makes between curated as opposed to expedient technological organization.

> Assemblages are sets of artifacts (both items and features) which are found in clustered association (normally defined stratigraphically) at or in archaeological sites. The degree to which such clustered associations may be treated as the results of occupations, or the material derivatives surviving from an uninterrupted use of a single place by participants in a cultural system, is yet to be clarified (see Dunnell 1971:150-153 for a discussion of assemblage definition) (Binford 1982: 5-6).

When analyzing assemblages from specific places Binford indicates that archaeologists should be:

> ...concerned with *site patterning* both in the frequency with which occupations occur at different places, and in the processes which generate associations among archaeological materials at a site. *Site patterning* in both within-place and between-place contexts is a property of the archaeological record. The accuracy with which we are able to give meaning to the record is dependent on our understanding of the processes which operated in the past to bring into being the observed patterning. Put another way, our accuracy depends upon our ability to correctly infer causes from observed effects (1982:6).

Based on these definitions of assemblage and site patterning it is possible to focus on the variability in technological organization exhibited at various archaeological places and perceive it as a fundamental indicator of past systems of adaptation.

Binford (1977) makes two basic distinctions between expedient (or non-curated) technologies, and curated technologies. The first and most important distinction:

> ...is the recognition that in non-curated technologies replacement rates are directly proportional to the frequency of participation in activities in which tools were used. In curated assemblages replacement rates are directly proportional to the life span or utility of the tool under maintenance care, and may bear no direct relationship to the frequency of activity performance involving tool use (Binford 1977:34).

A portion of Binford's second distinction relates to the locational or associational relationships for curated as opposed to expedient organization.

> ...in curated assemblages where tools are transported and returned to a residential location for repair...we can expect that the tool manufacturing debris will only regularly be associated with broken or discarded parts of tools and not vary with the number of tools manufactured `from scratch' which would have been removed from the location (1977:34).

Binford proposed a series of propositions concerning expectations under conditions of curated, maintained, and portable technological organization. Those with relevance to this research are as follows:

> ...High variability approaching randomness between the total number of tools and the quantity of tool manufacturing debris among random site samples. Inverse relationships will dominate comparisons between special purpose locations such as hunting camps, quarries, kill sites, etc., and a tendency toward direct relationships will pervade comparisons between base camps or residential locations where repairs are more apt to be made.
>
> ...Intersite variability in relative tool frequencies to be relatively low and to vary independently of the seasonal and situational differentiation in the locus of task performance.
>
> ...Decreasing relative frequencies through time to vary inversely with the importance of the item in the technology. In short, as curation increases, the relative frequency of technologically important items will increase (1977:35-36)

Alternatively, Binford contrasts the above propositions with expectations for expedient manufacture and use of tools:

> ...A regular proportional set of direct relationships between the number of tools present, regardless of condition, and the quantity of debris remaining from tool manufacture.
>
> ...Intersite variability in relative tool frequencies to be high and to vary directly with seasonal and situational differentiation in the locus of task performance.
>
> ...Changing frequencies to vary directly with the importance of the activity in which the tool was used (1977:35-36).

In stating these propositions Binford (1977:35-36) repeatedly emphasizes the condition, "other things being equal." This caveat is particularly relevant where other things cannot necessarily be considered equal. Consider for example, how would these propositions would be affected by a lack of locally available raw material and increasing distance to lithic raw material source areas. Since such conditions exist in the drainage of the Big South Fork, their effect must be considered in some way. Both Amick (1984) and Simek and Leslie (1983) attempt to deal with curation and the relationships between implements and lithic raw material. Of particular interest is the work of Simek and Leslie (1983) in which it is assumed that differential utilization of exotic raw material (as opposed to more abundant locally available material) within and between groups of implement types is a valid indicator of the degree of curation exhibited by a particular lithic assemblage. The same assumption will be made in this study. This assumption is related to other assumptions about usage which should be noted. Assumptions of particular note are those concerning rates of discard due to maintenance and replacement.

An assumption of this study, related to implement use, is that the amount of energy expended in the manufacture and maintenance of specific lithic implements can be an indicator of the degree of expedience or curation. In other words, the more energy required to manufacture and maintain an implement, the more likely that implement is to be curated. Conversely, the less energy required to manufacture, and maintain an implement the less likely that implement is to be curated.

The assumptions relating to curation and maintenance discussed above give rise to specific expectations for technological organization as exhibited in formal implement variability within the drainage of the Big South Fork:

1. Due to the lack of locally available lithic raw material the assemblages of the Big South Fork drainage should tend to be more curated

than expedient. Thus, assemblages should be dominated by implements requiring a relatively great expenditure of energy to manufacture and maintain. If assemblages are more expedient, the converse is expected.

2. If assemblages are curated, there should also be evidence of differential utilization of raw material in implements requiring more energy to manufacture and maintenance.
3. Finally, curated and maintained assemblages should not exhibit any systematic patterning in implement to debitage ratios.

CHAPTER II

THEORETICAL JUSTIFICATION FOR RESEARCH ORIENTATION

This chapter more fully develops the theoretical justification of the research orientation selected for this dissertation. The discussion will focus on the underlying assumptions of archaeological inquiry as communication or information processing and lithic based settlement models as archaeological patterning. A more complete understanding of archaeology as information processing is necessary to clarify the heuristic basis of the pattern recognition approach of this research. A greater understanding of settlement models based on lithic data is required to see how this particular study differs from more traditional settlement analyses.

Archaeological Inquiry As Communication

Shannon (1948:379) describes the fundamental problem of communication or information processing as the reproducing at one point, either exactly or approximately, a message or signal selected at another point. The analogue for archaeological inquiry, based on this description, can be restated in the following terms. The fundamental problem of archaeological inquiry is the approximate reproduction of a message containing past cultural information in the archaeological present. Archaeological inquiry as information processing is probably best described with the assistance of an illustration. Figure A.9 presents a general communication system model developed by Shannon (1948) with specific constructs defined in archaeological terms. The discussion that follows will explain this model's relevance to archaeological inquiry and its value as a heuristic device.

Shannon (1948:379) indicates that messages have meaning, refer to, or are correlated according to some system with certain physical or conceptual entities. In our interpretation of Shannon's model of information processing, messages have meaning, refer to, or are correlated with past cultural systems, more specifically with adaptive behavioral systems. Theoretically, these cultural messages should be generated from a finite set of possible messages, or what Shannon (1948) refers to as a message ensemble, with a definable probability distribution. In other words, there are a range of culturally adaptive behavior patterns from which cultures choose appropriate behaviors relative to particular social circumstances and environmental settings. Unfortunately, the probability distribution for the range of possible behavior patterns cannot be definitely defined, but only approximated, primarily through inferences drawn from ethnographic analogies.

Thus the information "source" (see Figure A.9) for our model of archaeological inquiry can be defined as adaptive cultural behavior.

From ethnographic and experimental studies (eg. Binford 1978; Johnson 1978; O'Connell 1977) it is known that particular cultural behaviors utilize and produce specific material culture elements. Thus a particular range of messages produced by the "source" and input into the "transmitter" or " encoder" will have associated material cultural referents. The encoding of cultural information into archaeologically meaningful signals therefore, consists of the reduction of the cultural behavior into material cultural elements through what has been termed depositional site formation processes (cf. Schiffer 1987). These material cultural elements possess specific attributes (cf. Clarke 1968) which are the actual information indicators, whether we view them as artifacts exhibiting specific attributes or as assemblages of specific artifacts. The "encoder" can thus be seen as transforming "messages" to "signals" and then inputing these "signals" into the transmission "channel," or archaeological record.

The "channel" or archaeological record actually refers to archaeological contexts. These contexts are either the site, area or situation, or region depending on the level of inquiry. With respect to a particular "channel " or context, cultural elements or artifacts possess what Clarke (1968) refers to as contextual attributes. The importance of these attributes along with the specific attributes mentioned above will become apparent in the decoding or pattern recognition step in the process of archaeological inquiry. But before we discuss that step in the information processing model, the input of "noise" into channel must be considered.

Noise can be simply defined as extraneous information. This extraneous information causes disruption of a signal's integrity, or more plainly, information loss. The archaeological interpretation of the input of "noise" into a particular context can be seen as the actions of post depositional site formation processes (cf. Schiffer 1987). Due to the high levels of noise usually associated with archaeological "channels," output "signals" consist of only a select sample of the original input "signals." In spite of the selection process, generally related to differential preservation and site formation processes (cf. Schiffer 1987), some patterning or redundancy exhibited by the original input "signals" is retained in the modified "signals" which are output to the decoder. It is this patterning or redundancy which is the principal concern of the "decoder" within our interpretation of archaeological inquiry.

The "receiver" or "decoder" aspect of the model is analogous to the pattern recognition stage of archaeological analysis. The material cultural remains that are "output," or recovered from the "channel," are systematically searched for patterning relative to particular research questions. During the initial stages of "decoding" artifactual and contextual information is transformed into archaeological data suitable for specific problem oriented analyses. This archaeological or material cultural data consists of observed or perceived information relating to the specific and contextual attributes identified as relevant to the research problem during previous stages of the transmission process. This pattern recognition or "decoding" generally takes place during the initial stages of exploratory analysis, but can also occur as an integral part of confirmatory analysis as well. Regardless of whether analyses are exploratory or confirmatory, inferential information relating to patterning in cultural adaptations is produced. It is these cultural inferences which are the "messages" that are output from the "decoder" into the "target."

In reference to the information processing of the "target," Shannon (1948:379) indicates that the significant aspect of the communication process is that the actual message received is one selected from a larger set of possible messages. Thus interpretations of patterning in prehistoric cultural behavior, which are based on the inferences drawn from the material cultural remains in specific contexts, are probability statements. In other words, the interpretations about past adaptive behavior which are drawn from the analytical inferences are the most probable of a set of possible adaptive patterns based on recovered cultural remains. This view of the process of archaeological interpretation thus allows for evaluation and refinement of the indefinite probability distribution of possible messages or the message ensemble discussed in reference to the "source." The process of archaeological inquiry can also be seen as cyclical with the output of the "target" contributing to the investigator's knowledge about the "source," or in the case of this model, new knowledge about adaptive cultural behavior.

Settlement Models as Archaeological Patterning

Settlement Patterns

The investigation of cultural adaptation, through the delineation of patterning in man-land relationships, is generally undertaken within the analytical framework known as settlement pattern analysis. The fundamental assumptions of settlement pattern analysis is that distributions of cultural remains exhibit distinct and interpretable spatial patterning which can be detected through systematic study. This patterning, referred to as a settlement pattern, has been defined as "the sociographic and physiographic relationships of a contemporaneous group of sites within a single culture " (Winters 1969:110).

Winters' definition of settlement pattern can serve as a working definition of settlement pattern if the following points are taken into consideration. Culture as used here should more precisely be cultural system, or the cultural system of a particular cultural group. For the archaeologist these cultural groups or populations are not the same as those studied by the ethnographer. The archaeologist studies archaeological populations or groups which exhibit similar cultural patterning. However, archaeological populations or cultural groups are not contemporaneous in the ethnographic sense but are aggregates of several groups viewed over a specific period of time. The cultural systems are therefore also aggregates which must be considered relative to their functioning within given spatial dimensions over time.

Observations made by the archaeologist about the spatial distribution of archaeological remains and the structure and features of the biophysical environmental context are used to produce analytical constructs or models. It is these analytical constructs or models that are the settlement pattern. Settlement pattern models can thus be considered as descriptions of how specific archaeological cultures differentially utilize the biophysical environment. Accordingly, settlement pattern models are synchronic in nature. A series of these models is generally required for a given area to investigate diachronic change by means of comparative study.

The discussion above describes one type of settlement pattern model which we can define as the culture specific type. Another type of settlement pattern model is the modal settlement pattern model. Unlike the culture specific models, modal models are defined at a more general level of abstraction and cover much broader time periods. They are useful in holistically describing the patterning of cultural remains and their spatial relationships within specific biophysical environments for several archaeological cultures simultaneously. When the archaeologist uses a modal model he is more concerned with the definition of patterned regularities or consistent relationships as opposed to the definition of how relationships have changed over time. Both types of settlement pattern model are valid and useful analytical tools.

Settlement Systems

Settlement systems, which are assumed to underlie settlement patterns, are behavioral in nature. Winters (1969:110) defines a settlement system as "functional relationships among sites contained within the settlement pattern." Roper (1979:16) elaborates on the settlement system concept by stating,

> A community's settlement system is a solution to locating sites so as to minimize the amount of energy that must be expended to procure necessary resources, be this by judicious choice of location of a single site, the location of several sites at different times in different situations, development of storage and/or preservation techniques, or a combination strategy.

As with Winters' definition of settlement pattern, it is important to realize that these definitions of settlement system, as defined by Winters and Roper, refer to the behavior of ethnographically definable groups or communities, not archaeological groups. Accordingly, archaeological models of both settlement patterns and settlement systems must be viewed differently than those used by the ethnographer or geographer. For example, the archaeologist cannot identify all the specific sites which were used by a particular archaeological population and the seasonal order in which they were used in the same way an ethnographer can. Neither can the archaeologist directly observe the behavior of site inhabitants to determine individual site function. Therefore, when an archaeologist refers to functional relationships between sites for archaeological groups, the settlement system model which is formulated is a generalized one dealing with hypothesized relationships. The hypothesized relationships are usually between ideal site types or zones of utilization which have been derived in the mind of the archaeologist from primarily ethnographic sources.

In general, settlement system models reflect not only behavioral adaptation to the physical environment, but to the sociocultural environment as well. As with settlement pattern models, two types of settlement system models can be developed: culture specific synchronic and modal synchronic. The culture specific synchronic settlement system model describes the adaptive behavior of a specific archaeological culture or group of archaeological cultures possessing the same adaptive strategy. The modal synchronic settlement system model describes a more general behavioral adaptation to certain selective or limiting environmental factors which are assumed to be always present and relatively constant in effect on all archaeological cultures in a given environment, over time.

The formulation of settlement pattern models can either precede, follow, or be concurrent with the generation of settlement system models. To a degree settlement pattern and systems analysis are not totally inseparable operationally. Due to the interrelated nature of settlement pattern and settlement system analysis, certain basic assumptions relating to both can be outlined.

The Assumptions Underlying Settlement Analysis

Settlement analyses, by their very nature, are concerned with past cultural behavior. Accordingly, they must in some way be concerned with the two fundamental aspects of the archaeological record: artifacts and context, for these two aspects are the principal sources of information about past behavior. The investigation of these aspects as they relate to settlement should be viewed relative to the five basic underlying assumptions discussed by Roper (1979:10-12):

1. The biophysical environment is not uniform, either spatially or seasonally.
2. Man is a refuging animal.
3. Communities will tend to act in a rational manner in exploiting their natural environment.
4. The archaeological record is reflective, at least in part, of the behavior operative in its deposition.

5. Settlement -- the process of establishing settlements over the landscape is an adaptation to two sets of conditions, "site," and "situation."

The concept of refuging behavior, as employed by Roper (1979:10), refers to a pattern of rhythmic dispersal from and around a fixed point in space, which can be used in conjunction with the concept of a non-uniform biophysical environment to provide justification for defining various types of exploitation zones around a site (e.g. Roper 1979). Associated with the assumption of refuging behavior is the assumption of rational exploitation of the physical environment. This assumption is related to the adaptive behavior as modeled by the Principle of Least Effort (Zipf 1949). These concepts are discussed at length by Cancian (1966), Plog and Hill (1971), and Roper (1979). Simply stated, the basic premise of the Principle of Least Effort, as applied to the study of settlement patterning, is that individuals and groups act to maximize the return on any investment of labor in procurement and utilization activities.

The assumption that the archaeological record is, at least in part, reflective of prehistoric behavior is a basic premise of contemporary archaeology. Placed in a systems framework, the redundancy or patterning in material cultural residues and their contexts contains information which reflects the systematic and rational behavior of participants in a broader archaeological cultural context. As indicated by Limp et al. (1981: 60), it is recognized that archaeologically derived settlement patterns are incomplete relative to the full pattern which once existed, due to the effects of natural disturbance processes and methodological limitations. It is assumed that if properly constructed, systemic redundancy within the model will makeup for these limiting factors.

Roper's last assumption is of primary importance to understanding the approach to settlement analysis conducted during this study. The concepts of site and situation were originally developed in geography by Ullman (1954). Based on Ullman, Berry (1964) defines site as a unit of analysis, characterized by local man-land relations and by form and morphology. Berry (1964:4) goes on to define situation as a horizontal as well as a functional unit of analysis which refers to regional interdependences and connections between places, or to what Ullman calls spatial interaction. Eschman and Marcus (1972:28) define site as "...the features of the local environment on which settlement are established and over which they grow." Situation is further defined by Eschman and Marcus (1972:28) as,

> both ... the physical conditions relative to the site that extend over a wider area than the actual settlement occupies and to man's cultural characteristics within and around the (settlement).

Archaeologists have generally approached settlement studies by concentrating almost exclusively on site characteristics (e.g., Ray et al. 1976). Exceptions to this trend are the studies employing some form of site catchment analysis. Roper (1979:12-17) has indicated that it is at least of equal importance to consider situation since man-land interaction is not only a site specific adaptation but also an adaptation to an ecologically-defined environmental context.

The overall ecological implications for settlement pattern analysis in particular but also for settlement systems analysis is that both types of analysis are systemic in nature. In other words, the cultural and environmental records are the material remains of a single dynamic system composed of many interrelated subsystems that a ? effect one another in many diverse ways. The systemic relationships of archaeological cultures and the environments to which they adapted are typically investigated either by describing the interrelationships of cultural behavior within the larger systemic context that includes the natural environment, or by isolating the natural phenomena or factors which are related to the origin or development of cultural behavior (Vayda

1969:xi). Both approaches are involved in the creation of settlement pattern and system models.

Two basic types of synchronic settlement models can be generated, culture specific and modal. The remainder of this discussion and subsequent analysis will concentrate primarily on the assumptions underlying the more general modal models. It should be noted, however, that certain assumptions relative to the generation of modal synchronic models have implications for generation of the more detailed and refined culture specific synchronic and diachronic settlement models.

The basic assumption underlying the generation of modal synchronic settlement models is that the structure of the environment tends to produce a "modal" pattern or distribution of cultural residues. For instance, in non-uniform environmental situations certain locations will inherently be more suitable for different types of human activity than others. This assumption is directly related to the assumption that certain selective or limiting factors are always present in a given environment. Underlying this assumption is the suggestion that, given the relatively constant effects of these factors, in the same environment humans will tend to act in similar ways. This does not mean humans will always act in exactly the same manner, but that "there will tend to be a modal pattern of behavior that is selected for and repeated because of its appropriateness or fitness in acquiring required resources in the environment in question" (Plog and Hill 1971:13).

The assumption that certain limiting environmental factors are always present and constant in effect may, however, not be entirely valid. The physical environment, like the cultural subsystem within it, is constantly evolving and changing. Certain subsystems of the physical environment are less dynamic than others. As a result of these differential rates of change, certain factors can be assumed to be relatively constant in effect. These factors are the only ones that can be studied with any validity when developing modal synchronic settlement models. Other more dynamic factors are best studied only when developing culture specific synchronic and diachronic settlement models.

A broad range of factors have been suggested as effecting man-land relationships in general and playing significant roles in influencing past behaviors relative to specific sites and situations, site location selection in particular. Several authors have pointed out (cf. Salmon 1975; Grady 1980) that the delineation of all factors relevant to site location is practically impossible. There is, however, considerable agreement among anthropologists as to those factors considered most relevant. These factors, with examples of specific variables that can be studied, are listed in Table B.6.

The first three groups of factors may be considered less dynamic types, therefore appropriate for the construction of modal synchronic settlement models. The fourth and fifth groups are extremely dynamic and should be studied only when generating culture specific synchronic settlement models. It should be noted that these factors are not totally unrelated and in some cases highly interrelated. Therefore, as noted by Plog and Hill (1971:49) it is difficult to assess the relative importance of these factors on site and situation choice.

Due to the difficulty in assessing the relative importance of the environmental factors and the general lack specific information about past biophysical conditions within the Big South Fork drainage, no attempt will be made in this current study to address and integrate these factors except in a general fashion. As indicated previously, this study will concentrate on the information contained in the artifact assemblages as contained in only very generally defined contexts. The following chapter will outline what is currently known about past environmental factors and suggested cultural relationships.

The settlement analysis in this current study is by necessity quite general with regard to cultural and environmental relationships. In spite of this lack of specificity this study can be viewed as a necessary first step toward understanding complex sets of relationships. It is hoped that future investigations will be able to more precisely and fully model and investigate the interactions between the cultural and environmental factors.

CHAPTER III

ENVIRONMENT AND CULTURAL CONTEXT AND CONTENT

This chapter contains brief summaries of past environmental and cultural systems which operated on the Cumberland Plateau. These summaries will place this dissertation in prospective with what is currently known about past environments and cultures for the Southeast in general, and the Cumberland Plateau and drainage of the Big South Fork River in particular.

General Environmental Setting of the Big South Fork River Drainage and the Cumberland Plateau

The following section discusses the environmental setting of the prehistoric habitation of the Cumberland Plateau region. The majority of this information has been drawn from more lengthy and detailed compilations by Ferguson and Pace (1981b) and Ferguson et al. (1986).

Topography, Hydrography, Geology

The Cumberland Plateau has been characterized by geographers (Fenneman 1938; Thornbury 1965) as a distinct physiographic region. Fenneman (1938) defines the Cumberland Plateau as a part of the Appalachian Plateaus Physiographic Province, a belt of elevated tableland that extends from western Pennsylvania to northeastern Alabama. The plateau is considered a true peneplain, exhibiting a broad, undulating surface submaturely dissected by valleys whose steepness and depth increase toward its edges (Fenneman 1938:337). In the area south of the Cumberland River and north of the Tennessee River, the portion of the Cumberland Plateau in Tennessee ranges from 48 to 88 km (30 to 55 mi) wide, with the eastern and western boundaries of the plateau marked by high escarpments. On the east the escarpment is a high, almost unbroken linear scarp which in places rises up to 300 m (1000 ft) above the adjacent Ridge and Valley Physiographic Province. The western escarpment, which divides the Cumberland Plateau from the Interior Low Plateau Province, is less pronounced and very irregular due to the number of deeply entrenched drainage basins which have eroded in a headward direction into the more resistant rocks. This has resulted in the formation of deep valleys which have in some cases cut into underlying limestone and shale formations. The elevated tableland of the Cumberland Plateau results from the erosionally resistant sandstones and conglomerates of the Pennsylvanian System. These rocks occur in predominantly undisturbed horizontal strata and overlay older, less erosionally resistant rocks consisting predominantly of limestones and shales. These older rocks have been exposed by erosion in adjacent regions, the Ordovician System to the east and the Mississippian System to the west.

The drainage of the Big South Fork of the Cumberland River contains about 3200 km^2 (1240 mi^2), or roughly 24% of the total area defined as the Cumberland Plateau region, and extends from its headwaters section in north-central Tennessee to its juncture with the Cumberland River, north of Burnside, Kentucky. The drainage of the Big South Fork is almost entirely contained within the western portion of the Cumberland Plateau, with the exception of a single tributary system, the Little South Fork. The Big South Fork is the largest single drainage system of the plateau and as a result encompasses an area exhibiting relatively high environmental diversity.

The eastern portion of the drainage, the headwaters of the New River, contains the Cumberland Mountains which are characterized by pronounced relief and elevations of over 900 m (3000 ft) AMSL. The central and western portions of the drainage are more typical of the remainder of the plateau. These portions are characterized predominantly by broadly undulating upland terrain lying between 50-550 m (150-1800 ft) AMSL, with more dissected terrain and progressively deeper entrenchment along the major tributaries. Mississippian formations are exposed in the most deeply entrenched portions of the major tributaries in the extreme northern portion of the basin. The downcutting of streams has created a complex network of gorges with sandstone bluffs ranging from several meters to several tens of meters in height.

The transition between these gorge areas and adjacent uplands is abrupt, and its effect on edaphic and biotic variability has produced prominent and generally clear-cut environmental boundaries. Because of the topographic and hydrographic variability, a number of edaphic situations are present which are important in determining micro-climatic and micro-environmental variation. Continued erosion has littered the lower slopes and valley bottoms with boulders from the bluffs. Because of the high runoff and narrow water channels, opportunities for the development of alluvial deposits are limited. Only a few alluvial floodplains and terraces exist along the major streams. These are mainly confined to the lower sections of tributaries with a Strahler rank of three or higher, as indicated on 7.5 minute quadrangles. Middle and lower slopes along the streams are chiefly comprised of colluvial material, as are many of the terraces.

Within the gorges, the relative stratigraphic position of resistant sandstones and conglomerates has contributed to the formation of a variety of distinctive landforms. The area abounds with chimneys, promontories, arches, ledges, precipices, overhangs, and waterfalls. The numerous rockshelters are the most prominent features in the gorge areas of the Big South Fork drainage. McFarlan (1943:120) attributes the formation of rockshelters to the effective weathering of locally weaker zones within the Pennsylvanian strata.

The Pennsylvanian System of the Cumberland Plateau is generally 200 to 300 m (650-975 ft) thick. In the Cumberland Mountains, Pennsylvanian rocks are even thicker. The Pennsylvanian System is composed of predominantly horizontally lying sandstones, conglomerates, and shales between which occur coal deposits and occasionally localized deposits of fine clay (Wilson et al. 1956). Most of the lithology of the Pennsylvanian system of the Cumberland Plateau is non-marine and formed primarily as delta and floodplain deposits of a low, swampy coastal plain (McFarlan 1943).

Little intensive geologic mapping has been conducted within the drainage of the Big South Fork. Only a few areas have been subjected to detailed geologic mapping. Two such areas are the Burrville 7.5 min. Quadrangle, in Tennessee (Jewell 1972), and the Barthell 7.5 min. Quadrangle, in Kentucky (Pomerance 1964). The Burrville Quadrangle is located west of the CARP study area and south of the Bandy Creek study area.

The Barthell Quadrangle is located north of the Bandy Creek study area. The geologic cross sections for these two mapped areas are presented in Figure A.10.

There are few cryptocrystalline silicates suitable for the manufacture of chipped stone implements to be found in any of the rocks of the Pennsylvanian System. Two possible exceptions are silicate nodules which occur in certain formations and quartz pebbles from certain of the sandstone conglomerates. There are few indications that any of the lithic raw material utilized prehistorically on the Cumberland Plateau came from the rocks of the Pennsylvanian System.

While rocks of the Pennsylvanian System dominate the exposed plateau surface, older rocks of the Mississippian System, predominantly limestones and shales, can be found in the most deeply incised areas, particularly along the western escarpment of the Cumberland Plateau. Several of the limestone formations of the Mississippian System contain abundant fine grained chert and other cryptocrystalline quartz suitable for stone implement manufacture. But since these formations are only narrowly exposed in the most deeply incised gorge areas there is an almost total lack of outcroppings throughout the Cumberland Plateau. Thus, locally available cherts and other cryptocrystalline rocks are almost entirely lacking throughout the region. Therefore, lithic raw materials exploited by the prehistoric inhabitants of the Cumberland Plateau could be considered exotic as opposed to local in nature.

The nearest extensive outcroppings of chert bearing formations are of the Mississippian System of the Eastern Highland Rim Physiographic Province and the Mississippian and Ordovician Systems within the Ridge Physiographic Province and Valley. The outcroppings of the Eastern Highland Rim are located 12 to 28 km (7 to 17 mi) west of the Bandy Creek and CARP study areas. The outcroppings of the Mississippian and Ordovician Systems of the Ridge and Valley are located 27 to 33 km (17 to 20 mi) east of the CARP and Bandy Creek study areas. Much of the chert from the Mississippian and Ordovician Systems is distinct in character, particularly with regard to color and texture. Occurrences of chert within the formations of these systems are of varying quality and quantity, and appear to be differentially distributed. Wilson and Finch (1980) and Ferguson et al. (1986) have reported areas of intensive prehistoric quarrying activity in the Upper Mississippian formations on the Eastern Highland Rim immediately adjacent to the western escarpment at the Cumberland Plateau. Unfortunately, no systematic studies have been conducted to document resource distribution and extent of prehistoric utilization. For more detailed discussions of the geologic aspects of the Mississippian and Pennsylvanian (Carboniferous) Systems of the Cumberland Plateau and the Eastern Highland Rim see Rice et al. (1979) for Kentucky, and Milici et al. (1979) and Wilson and Stearns (1958) for Tennessee.

Paleoenvironmental Climate, Flora, and Fauna

The environmental factors discussed in the preceding section can generally be assumed to have changed relatively little over the past 12,000 years. However, since interpretation of prehistoric man-land relationships requires an understanding of past environmental dynamics, a brief discussion of relevant research into the more dynamic environmental factors of the past is in order.

Periodic fluctuations in climate influenced regional prehistoric environments, and consequently, patterning in prehistoric cultural adaptation, particularly subsistence and settlement. In spite of a general agreement in the validity of the preceding statement, there has been considerable disagreement over the kind of climatic changes, the degree of variation, and the human effect on early environments in Eastern North America during the Pleistocene and Holocene (eg. Antevs 1955, Braun 1950, Martin 1958).

Recent research on the Eastern Highland Rim, in particular Delcourt and Delcourt (1979) and Delcourt (1979), has established a fairly clear picture of climatic and vegetational changes over time on the Eastern Highland Rim and the Cumberland Plateau. The interpretations of Delcourt and Delcourt (1979) and Delcourt (1979) are based on the analysis of radiocarbon-dated pollen and plant macrofossils from sediment cores taken at two pond sites on the Eastern Highland Rim. Analysis of samples from Anderson Pond in White County, Tennessee, indicated that during the Farmdalian Interstadial (25,000 +/- 3,000 yr BP.), the climate was cooler and moister than at present. Forest taxa apparently consisted of a mixture of northern *Diploxylon* pines, spruce and deciduous species (Delcourt 1979).

During the Late Wisconsin glacial maximum (19,000-16,300 BP.) temperatures were apparently much cooler than at present with longer winters and shorter summers. The forest vegetation was comparable with present day conditions in southern Manitoba and consisted of a boreal coniferous forest of predominantly jack pine, spruce, and fir. This boreal forest appears to have changed during the period of warming temperatures from 16,300-12,500 yr BP. into a predominantly deciduous forest similar to present day northeastern Wisconsin and

Minnesota. The jack pine-spruce-fir were replaced by deciduous taxa initially consisting of ash, ironwood, hickory, birch, butternut, willow, and elm, with the later addition of beech and sugar maple (Delcourt and Delcourt 1979, Delcourt 1979).

By 12,500 yr BP. a cool, mesic climate existed, and mixed mesophytic taxa were well established on the Eastern Highland Rim and most probably the adjacent Cumberland Plateau. Mixed mesophytic taxa remained abundant until around 8000 yr BP. From 12,000 to 10,000 yr BP. forest conditions were probably roughly the same as present day forest communities in the Allegheny Plateau region of Ohio and West Virginia (Delcourt 1979).

Apparently the arboreal flora of the Eastern Highland Rim and the Cumberland Plateau have changed very little from 9,500 yr BP. to the present, with pollen indicating the presence of such warm temperate taxa such as oak, sweetgum, blackgum, and chestnut, with southern pines never becoming prominent. At around 8000 yr BP., conditions were apparently similar to present day eastern Kentucky (Delcourt 1979).

A period of climatic warming and drying is inferred to have occurred between 9,000 and 5,000 yr BP. This period is known as the Hypsithermal Interval (Wright 1976) and is roughly equivalent to Antevs' (1955)

Altithermal. This warming and drying of the climate was accompanied by a diminishing of mixed mesophytic taxa and a substantial increase of more xeric taxa such as oak, ash, hickory, swamp alder, and buttonbush. During the mid-Holocene mixed mesophytic taxa appear to have been generally restricted to northeast facing gorges and the Cumberland Mountains on the Cumberland Plateau (Delcourt and Delcourt 1979, Delcourt 1979). Further support that a mid-Holocene warming occurred on the Cumberland Plateau can be found in the macrofloral record of Newt Kash Shelter, Menifee County, Kentucky. Jones (1936) found indications of large amounts of prairie type vegetation that suggested an ancient environment that was closely akin to a tall grass prairie.

After 5,000 yr BP., mesic forest taxa are represented on the Eastern Highland Rim and Cumberland Plateau. During the late Holocene, there appears to have been an increase in precipitation which is reflected in the pollen spectra from Anderson Pond for both 2,000 yr BP. and 200 yr BP. (Delcourt 1979).

As indicated by Delcourt (1979:257), present day distributions of species populations and forest types on the Cumberland Plateau are related to such factors as substrata, degree and exposure of slope, aspect, soil moisture, and soil mantle stability. The most xeric habitats on the Cumberland Plateau occur on the bluffs with sandy soil underlain by thick permeable sandstone. These habitats generally contain hickory forest and scrub pine (Braun 1950). Oak-hickory forest communities occur on southeast to southwest facing slopes particularly in the broad coves of the Cumberland Plateau (Caplenor 1965, Delcourt 1979). The north to northeast-facing sides of steep, narrow gorges contain restricted communities of mixed hardwoods and hemlock (Caplenor 1965, Delcourt 1979). Eastern white pine also grows on the Cumberland Plateau (Delcourt 1979). Table B.7, taken from Ferguson et al. (1986), presents a breakdown of the major forest associations of the Cumberland Plateau, as defined by Safley (1970). Further information on the habitats of particular taxa can be found in recent studies by Cabrera (1969), Hinkle (1978), and Safley (1970). In general, these studies found that the variation in edaphic conditions have a great effect on present day forest composition on the Cumberland Plateau. A detailed inventory of plant taxa within the Big South Fork drainage was compiled during preparation of the environmental impact statement for the Big South Fork National River and Recreation Area (USCOE 1976: Appendix C). This inventory documents over 40 canopy sites, and lists over 400 vascular plant species which constitute the forest understory. Major biotic communities have been identified for the Cumberland Plateau and mapped within the Big South Fork National River and Recreation Area (USCOE 1976:109-126). Comprised of a number of different forest associations, these communities, as characterized, can be used to define typical terrestrial biotic communities of plant and animal taxa. These biotic communities are summarized in Table B.8. For a more detailed discussion of these communities, and more complete listings of potential plant foods, available within them prehistorically, see Ferguson and Pace (1981b: Appendix B) and Ferguson et al. (1986).

The prehistoric faunal record from regions near or adjacent to the Cumberland Plateau generally support the major environmental changes indicated by the floral record. For example, Pleistocene faunal remains from Boone County, Kentucky, suggest that horse, ground sloth, elk, moose, caribou, musk ox, bison, mastodon, mammoth, and bear (Funkhouser 1925:31) might have been present on portions of the Cumberland Plateau. An assemblage of late Pleistocene fauna from Cheek Bend Cave in the Nashville Basin of Tennessee supports the indication that boreal conditions existed (Klippel and Parmalee 1982). Boreal or northern microtines, including: yellow-cheeked, meadow, redback, and heather voles; along with boreal or northern soricides such as:

pygmy, masked, smokey, water, and arctic shrews, were abundant in the Pleistocene strata. Furthermore, the presence of red squirrel, pine martin, and least weasel, beyond their present day ranges, clearly supports a cool climatic regime during the late Pleistocene. The marked reduction in boreal species for the fauna of Cheek Bend Cave also lends support to the establishment of modern species at the Pleistocene-Holocene transition (Klippel and Parmalee 1982), a period when mass extinctions of Pleistocene megafauna and avifauna occurred.

Support for the mid-Holocene warming can also be found at Cheek Bend Cave by a decrease in the abundance of short-tailed shrews relative to least shrews, suggesting drier conditions more typical of the oak-hickory associations of the central Midwest United States (Klippel and Parmalee 1982).

The diversity of present day fauna generally reflects the habitat diversity of the Cumberland Plateau. For example, a recent sampling of fauna conducted within the Big South Fork National River and Recreation Area (USCOE 1976:Appendix C) identified fifty-seven species of mammals, seventy-four species of amphibians and reptiles, eighty-one species of fish and over two hundred and fifty species of avifauna as current inhabitants of the drainage. For more detailed discussions of Cumberland Plateau fauna potentially suitable for meeting prehistoric subsistence needs see Ferguson and Pace (1981) and Ferguson et al. (1986).

General Cultural Setting of the Big South Fork Drainage and the Cumberland Plateau Region

The Cumberland Plateau is often considered an archaeological void. As noted by Faulkner (1967), this is generally due to the fact that the Cumberland Plateau has remained relatively isolated and therefore protected from human activities that expose archaeological remains or require the mandating of archaeological investigation. Such activities include extensive agricultural utilization, urban or industrial expansion and or the development of major water control projects. Little is known about the prehistory of the Cumberland Plateau, because until recently very little systematic, large scale investigation had been conducted. The lack of emphasis given to previous archaeological investigations can be seen in the fact that in 1979 there were fewer than 175 sites recorded in the official Tennessee State site files for the 16 counties covering the Cumberland Plateau in Tennessee (Ferguson and Pace 1981b:16-17).

Previous Archaeological Investigations

Most early and several recent archaeological investigations on the Cumberland Plateau focused on the conspicuous rockshelter sites, particularly those in eastern Kentucky (eg. Thurston 1890, Hogue 1920, Myer 1928, Jones 1936, Parris 1946, Hassler 1947, Funkhouser and Webb 1929, 1930, 1932, Webb and Funkhouser 1936, Hartney 1963, Ahler 1967, Marquardt 1970, Dunnell 1972, Dunnell, Hanson and Hardesty 1971, Cowan 1975, 1976, Vento et al. 1980, Cowan et al. 1981, and Hoffman 1987). This focus was due in large part to discovery of well preserved botanical and other perishable remains. In general, the concern with rockshelters, to the exclusion of other types of sites, has led to a fairly biased view of prehistory on the Cumberland Plateau.

Recently, with the mandated investigations related to cultural resource management (cf. Clay 1981), a less biased view has started to emerge of the nature of the archaeological record of the Cumberland Plateau. Around 1980, over 80% of sites recorded on the Cumberland Plateau had been recorded by CRM projects. Unfortunately, most of the CRM-related projects have covered only limited areas, and discussions of findings have been limited to cursory descriptions, with little attempt to integrate the information or address substantive theoretical or methodological issues. There are a few exceptions where CRM-related research has been conducted on a relatively broad scale (ie. Pace and Kline 1976; Wyss and Wyss 1977; Greenhouse 1979, 1980; Jobe et al. 1980; and Millican Associates Inc. 1981). But like many CRM-projects these projects have been biased in site sampling due to inadequate survey techniques and the reporting which has tended to be primarily descriptive. Turnbow and Allen (1979), and Ball and Chapman (1977) have noted that for most CRM-related projects on the Cumberland Plateau, disparities have existed between project goals and research designs, with the paucity of previous archaeological research being considered as a major cause for this disparity (Ferguson and Pace 1981b:16). The almost total lack of information relating to culture chronology, settlement patterning, and assemblage variability, has certainly made the conduct of substantive archaeological research difficult. Interpretations of culture history, subsistence strategies, and patterns of prehistoric culture in general have been based on information from surrounding regions or on biased and largely inadequate information (Ferguson and Pace 1981b).

One CRM-related study of particular note is that of Pace and Kline (1976), who conducted an archaeological survey of the Huber Coal Field, located in the southern portion of the Cumberland Plateau. The study area included parts of Tennessee counties of Bledsoe, Sequatchie, and Van Buren. This investigation, like some of those using alternate sources of funding (eg.

Cowan and Wilson 1977, Cowan 1978 and Cowan et al. 1981), at least attempted to integrate their findings with the general body of anthropological knowledge.

Finally, three CRM-related projects, conducted in the Big South Fork drainage, other than those conducted by the University of Tennessee, have relevance to this current study. All three projects were conducted in association with the Corps of Engineers' development of the Big South Fork National River and Recreation Area (hereafter referred to as BSFNRRA). The first of these studies by Wilson and Finch (1980) consisted of a reconnaissance level survey of selected areas within the BSFNRRA. The second study, by Fiegel (1979), concerned the archaeological investigations along the Leatherwood Ford Road right-of-way within the BSFNRRA. The third study by Wheaton (n.d.) concerned excavations conducted at 40ST6 a terrace along the Big South Fork River prior to BSFNRRA road construction. These studies are of relevance in that they provided additional collections from some of the sites studied by the University of Tennessee, as well as material for comparative study.

For more detailed discussions of previous archaeological investigations see Ferguson and Pace (1981b) and Ferguson et al. (1986) These reports present more lengthy discussions, but identify numerous other projects relating to archaeology of the Cumberland Plateau.

Culture History and Past Lifeways

Based on the archaeological investigations conducted to date on the Cumberland Plateau and in surrounding regions, only a very general picture of the culture history can be outlined. As indicated above, very little of what is known about the culture history of the region is based on investigations which have been conducted on the Cumberland Plateau. Accordingly, most inferences about the culture history, as well as past lifeways, and cultural processes of the Cumberland Plateau are drawn from investigations in adjacent regions.

In this section, only a brief outline will be given of the culture history of the Cumberland Plateau with emphasis being placed on the findings of those studies actually carried out on the Cumberland Plateau. For a more detailed and broader discussions of the culture history, see Ferguson and Pace (1981b) and Ferguson et al. (1986). For the purposes of this discussion of the regional culture history the following chronologic periods, which roughly define spans of time in which cultures exhibited similar behavioral patterning, will be used: Paleo-Indian (13,000?-10,000 yr BP.), Archaic

(10,000-2,700 yr BP.), Woodland (2,700-1,000 yr BP.), and Late Prehistoric/ Mississippian (1,000-200 yr BP.) (cf. Steponaitis 1986).

Information about the Paleo-Indian Period on the Cumberland Plateau is limited almost exclusively to temporal-stylistic projectile point/ knives similar to ones that have been dated to this period in other regions. These projectile point/ knives have been recovered as isolated surface finds, from mixed contexts, or recovered by amateur collectors who are unable or unwilling to identify the context. Thus, there are indications that the Plateau was utilized during the Paleo-Indian Period. But, the lack of information hinders any meaningful interpretation of assemblage content and context, and therefore, no substantive conclusions can be drawn concerning prehistoric cultural behavior during this period (Ferguson et al. 1986).

The Archaic Period (10,000-2,700 yr BP.) in eastern North America is generally divided by archaeologists into three sequential periods, Early (10,000-8,000 yr BP.), Middle (8,000-6,000 yr BP.) and Late (6,000-2,700 yr BP.). For the Archaic Period in the Southeast as a whole, there appears to have been general increases in population and cultural complexity through time, particularly in cultural elements related to subsistence

(Steponaitus 1986). Purrington (1967:16-17) suggests that these general trends may not have been as pronounced on the Cumberland Plateau. Purrington (1967) and later Dunnell (1972) suggest that a more "generalized" pattern, exhibiting less cultural, specifically technological complexity may have existed on the Cumberland Plateau throughout the Archaic Period. Though this view is still held by some archaeologists, others (ie. Marquart 1970, Turnbow and Allen 1977, and Brooks et al. 1979) suggest that the pattern of general development seen elsewhere throughout the Southeast may have held for the Plateau region as well. The general picture that is emerging, as more systematic investigations are carried out, suggests that the latter is probably the case, but that for certain periods within the Archaic and for certain restricted areas on the Cumberland Plateau, that the former might also be possible.

> On the Cumberland Plateau there is... evidence to indicate that an essentially diffuse exploitative strategy persisted through time; however, diagnostic... [implement]...types indicate that parallels in cultural development through time exist with respect to developments in neighboring regions and seems more likely to indicate intensive seasonal exploitation of the plateau by groups from adjacent areas rather than the presence of stable long-term resident populations. This seems to be indicated by a limited range of variability with respect to site structure and content throughout the Archaic (Ferguson et al. 1986:32)

Most of the broad scale archaeological surveys within the Big South Fork Drainage (eg. Wilson and Finch 1980; Ferguson and Pace 1981b; Ferguson et al. 1986), and elsewhere on the Cumberland Plateau (eg. Pace and Kline 1976), have produced evidence to indicate extensive utilization during the Early Archaic Period (10,000-8,000 yr BP.). For example, 39% of the sites defined by Ferguson and Pace (1981) contained Early Archaic components. The studies by Pace and Kline (1976), and Wilson and Finch (1980), both documented the occurrence of Early Archaic sites in a wide variety of environmental settings and inferred that the patterning was most likely produced by seasonal exploitation by small groups of hunters and gatherers (Ferguson et al. 1986). Based on distributional data concerning site aspect, Pace and Kline (1976) went on to infer a late summer to early winter utilization for the Early Archaic sites they observed on the southern portion of the Plateau. But as indicated by Steponaitis (1986:372) for the Southeast in general, until more information is recovered concerning assemblage variability and seasonality on the Cumberland Plateau, the nature of settlement will remain obscure.

Archaeological evidence from the Middle Archaic Period (8,000-6,000 yr BP.) is extremely scarce on the

Cumberland Plateau. Surveys by Pace and Kline (1976), Wilson and Finch (1980), Ferguson and Pace (1981), and Ferguson et al. (1986), all show a distinct lack of archaeological materials attributable to the Middle Archaic Period. This pattern is somewhat of an anomaly, when viewed relative to adjacent regions, where Middle Archaic sites are more abundant and the general trend of increasing technological complexity and population increase appears to be consistent.

Pace and Kline (1976) have suggested that the warmer and drier conditions of the Altithermal Period, or mid-Holocene warming, might have caused poor hydrographic conditions and extremely dry and late summers and falls. Pace and Kline (1976) show support for this by indicating that when the infrequent Middle Archaic sites occur they are predominantly at sheltered localities with adequate and stable water supplies. The overall suggestion is that a long period of desiccation may have occurred which had marked effects on the biotic conditions and general suitability of the Cumberland Plateau for utilization during the Middle Archaic Period.

The Late Archaic Period (6,000-2,700 yr BP.), unlike the preceding Middle Archaic, is well represented in survey collections on the Cumberland Plateau (cf. Pace and Kline 1976; Wilson and Finch 1980; Ferguson and

Pace 1981b; Ferguson et al. 1986). Even though Late Archaic cultural remains are well represented they are not as frequent as Early Archaic remains.

Suggestions vary concerning Late Archaic utilization of the Cumberland Plateau vary greatly. For example, Pace and Kline (1976:100) suggest that areas in the southern Plateau were utilized in the summer and fall, based upon distributions of site aspect. Wilson and Finch (1980) suggest a year round utilization during the Late Archaic Period. Both Pace and Kline (1976) and Wilson and Finch (1980) interpret large Late Archaic sites near permanent water sources as an indicator of increasing sedentism. Ison and Sorenson (1979:32), based on their analysis of data from a rockshelter excavation, suggest repeated seasonal utilization of the site, most probably during the winter. As with the Early Archaic, Steponaitis' (1986) observations concerning a lack of representative samples from assemblages and evidence of seasonality apply equally to the Late Archaic. Accordingly, most definitive statements concerning settlement related behavior during the Late Arcahic will have to wait on this information.

For the Southeast as a whole distinct changes that deviate from previous lifeways appear to have begun developing around 4,000 yr BP.

> These changes were marked in the archaeological record by four salient trends: (a) the adoption of cultivated plants as an adjunct to the diet; (b) the appearance of large, dense middens with evidence of dwellings and storage pits; (c) the first use of heavy containers made of pottery and stone; (d) the intensification of long distance exchange. These trends were functionally linked to higher population densities and bespeak a greater degree of sedentism that was made possible (or perhaps necessary) by a new set of economic strategies (Steponaitis 1986:373).

Evidence for changes in subsistence patterning on the Cumberland Plateau in Kentucky has been reported by Cowan et al. (1981), who noted the presence of *Cucurbita pepo* in the Late Archaic rockshelter deposits. This occurrence of squash indicates that developmental trends in subsistence patterning which began in adjacent regions around 4,500 yr BP. (cf. Chapman and Shea 1981), may hold for the Cumberland Plateau as well.

Evidence to support the other three trends indicated by Steponaitis is lacking in the limited information that has been recovered from the Cumberland Plateau for the Late Archaic Period. Sites with Late Archaic components, such as the one tested by Wheaton (n.d.), suggest that more intensive utilization of the limited terrace areas may have taken place during the Late Archaic. Such a suggestion would be in keeping with the increase in sedentism which has been inferred in other regions of the Southeast. But, as indicated previously, more study is required before any clear picture can be obtained of settlement and subsistence related trends on the Plateau.

The Woodland Period (2,700-1,000 yr BP.) is generally conceived of as having three divisions: Early (2,700-2,000 yr BP.), Middle (2,000-1,400 yr BP.), and Late (1,400-1,000 yr BP.). As a whole, the Woodland Period in the Southeast is characterized by a change from a hunting and gathering lifeway to a horticultural lifeway that had its beginnings in the Late Archaic Period. During the Woodland Period this horticultural lifeway eventually evolved into a lifeway based primarily on agriculture.

> Important trends that characterized this period [in the Southeast] were (a) an increasing emphasis on the gathering and gardening of seed-bearing plants, (b) a general increase in the degree of sedentism, and (c) the appearance of new, elaborate forms of mortuary ritual which, at least in some localities, seem to have symbolically expressed (and thereby validated) the enhanced prestige of community leaders (Steponaitis 1986:379).

Evidence from regions adjacent to the Cumberland Plateau, and the Southeast in general, indicates that accompanying this shift are increases in population and sedentism throughout the Woodland Period. The manner and extent to which these general trends are manifest on the Cumberland Plateau is unclear at present. As with the Archaic Period, evidence for Woodland Period utilization of the Cumberland Plateau is based almost entirely on a few large scale surveys (eg. Pace and Kline 1976; Wilson and Finch 1980; Ferguson and Pace 1981b; Ferguson et al. 1986) and a few important rockshelter excavations (eg. Ahler 1967; Cowan 1976; Cowan et al. 1981).

Evidence from adjacent regions suggests that the development of incipient horticulture began in the Late Archaic and continued into the Early Woodland Period (2900-2000 years BP). Major characteristics of this development consisted of increased utilization of native herbaceous and arboreal seed crops and the introduction of non-native cultigens (cf. Chapman and Shea 1981). Indications that this developmental trend in subsistence patterning holds for the Plateau can be found in the studies by Jones (1936) and Cowan et al. (1981). For example, Cowan et al. (1981) indicate that after (3,000 yr BP.) botanical elements of the Eastern Agricultural Complex increase dramatically.

Based on faunal evidence from the Early Woodland, Cowan et al. (1981) suggests that there existed a stable pattern of broad based exploitation, with an emphasis on large game. Unlike plant exploitation, the patterning in formal exploitation appears to have changed little from that developed during the Archaic Period.

Based entirely on distinctive projectile point/knife styles, there is an indication that the sphere of influence of the Adena cultural pattern of the Ohio Valley may have extended into the Cumberland Plateau. Unfortunately, no other evidence indicative of the regional exchange and mortuary ceremonialism associated with this cultural pattern has been observed on the Plateau.

Surveys by Pace and Kline (1976), Wilson and Finch (1980), Ferguson and Pace (1981b) and Ferguson et al. (1986) note a relative abundance of Early Woodland Period sites. Pace and Kline (1976) see little evidence of a change in settlement patterning between the Late Archaic and the Early Woodland in the areas they surveyed in the southern portion of the Plateau. Ahler (1967) recovered evidence suggesting an intensive winter occupation of a rockshelter in the Emory River drainage of the Plateau. Attempting to place his findings in a larger context, Ahler (1967) suggests that along the Emory River and other major rivers of the Plateau, stable Early Woodland groups were exploiting the major terraces during the summer. Ahler (1967) also suggests a fragmentation into smaller groups during the late fall and winter, with the focus of exploitation shifting to more remote upland areas.

The Middle Woodland Period (2,000-1,400 yr BP.) in the Southeast is generally viewed as an elaboration of the trends of the Early Woodland. The elaboration of these trends includes increasing sedentism, intensification of horticultural practices, elaboration of mortuary ceremonialism and long-distance exchange of valued commodities (Steponaitis 1986: 379-383).

Whether or not the trend toward increasing sedentism is supported on the Cumberland Plateau is unclear at the present time. What is clear is that there is a marked increase in the number of Middle Woodland sites on the Plateau relative to the preceding Early Woodland Period. In fact, sites with Middle Woodland components are almost as abundant as sites with Early Archaic components. Studies by Pace and Kline (1976), Wilson and Finch (1980), Ferguson and Pace (1981b), and Ferguson et al. (1986) all indicate this relative abundance. Pace and Kline (1976), see this increase in site frequency, particularly in the upland areas, as a dramatic shift in settlement between the Early Woodland and Middle Woodland to more lengthy and intensive, multi-seasonal or even year round occupation by stable and possibly resident populations. Pace and Kline (1976) further suggest that the such changes might be caused by increasing population pressure in adjacent regions. Support for these interpretations is supplied by Wilson and Finch (1980) who perceive increased numbers of Middle Woodland rockshelter sites in a wide variety of settings as indicative of possible year-round occupation.

An alternative interpretation of the increasing site frequency by Ferguson and Pace (1976) suggests that there was a marked increase in seasonal hunting and gathering by large semi-sedentary populations in adjacent regions. Again, demographic stress on the groups in adjacent regions such as the Highland Rim may have been forcing these groups to supplement their food production with selected resources, particularly protein, available on the Plateau uplands. Such exploitation would be most likely during the fall and early spring (Ferguson and Pace 1981b). Potential support for this suggestion can be found in Ahler's interpretations of rockshelter deposits in the central Plateau as indicating sporadic utilization by small hunting groups. Yet, a nearby survey conducted by Ahler (1967), which noted the presence of mound sites, led Ahler to suggest that local intensification of horticulture and storage of accumulated foodstuffs allowed for stable year round occupation of developed terraces, with utilization of upland areas being restricted to short forays during the winter.

At present, little evidence exists from the Cumberland Plateau to indicate whether or not the other general trends, concerning horticultural practices, mortuary ceremonialism, or exchange, hold for the Plateau during the Middle Woodland. As with settlement, more information is required before substantive statements can be made.

The Late Woodland Period (1,400-1,000 yr BP.) for the Southeast is characterized by a relatively unchanged continuation of hunting, gathering, and horticultural economies. Settlements were usually small and dispersed, with the broad general pattern being one of residential bases with substantial housing and storage, which were supported by seasonally occupied special purpose camps (Steponaitis 1986:383-384). In general, sedentism appears to have both increased and decreased in particular regions due to a variety of factors relating to local resource variability (Steponaitis 1986:384).

Population increase continued as a general trend in the Southeast during the Late Woodland. Related to this trend there appears to have been a general diversification of the subsistence base (Steponaitis 1986:384). Another important trend indicated for the Late Woodland for the Southeast is a general reduction in the elaborateness of the mortuary ceremonialism (Steponaitis 1986:384).

Most of the survey data from studies such as those by Pace and Kline (1976), Wilson and Finch (1980), Ferguson and Pace (1981b), and Ferguson et al. (1986) indicate a definite decline in the frequency of Late Woodland sites. Ferguson et al. (1986) suggest that this decline may be indicative of a decrease in the intensity with which groups utilized the Plateau. Ferguson et al. (1986) also suggest that this trend might also be related to a general decline in population and food production in adjacent regions. Such a suggestion is supported by evidence from the Eastern Highland Rim as interpreted by Crites (1978). Indications of population problems and nutritional stress on the Plateau can be found in the analysis of Late Woodland coprolites from a rockshelter on the Plateau in Eastern Kentucky by Cowan (1978).

The Late Prehistoric/Mississippian Period (1,000-300 yr BP.) was a period of marked contrast between various regions of the Southeast. Populations in many regions appear to have maintained essentially the same lifeway that developed during the Late Woodland Period. In other regions, a distinctive cultural pattern developed which gives the Mississippian Period its name.

> Over the years, the term "Mississippian" has taken on a variety of meanings. It was originally applied to a distinctive complex of material traits, including shell-tempered pottery, wall-trench houses, and flat-topped pyramidal mounds. Later its meaning was broadened to include all Southeastern populations whose subsistence was derived principally from agriculture. Most recently the term has also been used to refer to a particular kind of sociopolitical organization that entailed hereditary ranking and centralized leadership. Although the many traits implied by these definitions were not invariably correlated they became widespread during the last major episode of Southern prehistory, after about A.D. 1000.
>
> The most revolutionary change that marked this period was the wholesale adoption of maize agriculture... Given the available evidence, it seems most likely that the shift to maize agriculture was precipitated by demographic stress. ...there is little doubt that intensive agriculture was the foundation on which the complex societies of this period were built.
>
> ...these societies...were intensively hierarchical in structure...[with] social differentiation clearly expressed in mortuary ritual...
>
> Most Mississippian-period communities were linked by political, economic and social ties into larger polities. These polities varied greatly in size and complexity, both across space and through time...
>
> There is good evidence...that chiefly officials were entitled to payments of tribute from the populations they controlled...Relations between communities were also maintained by means of exchange (Steponaitis 1986:387-389).

As indicated by Ferguson et al. (1986), very little is currently known about the Late Prehistoric/ Mississippian Period utilization of the Cumberland

Plateau. On portions of the Cumberland Plateau in Kentucky, Dunnell et al. (1971) have identified the Woodside Phase, which they describe as having a similar adaptive pattern to the Fort Ancient Aspect of the Ohio Valley. In the Big South Fork drainage, Funkhouser and Webb (1932:395-397) reported a stone box grave cemetery. But in general, very little evidence of the complex cultural patterning associated with the Mississippian Period elsewhere in the Southeast can be found on the Cumberland Plateau.

Survey data by Pace and Kline (1976) and Wilson and Finch (1980) indicate a general decrease in the number of Late Woodland and Mississippian sites. In regard to this trend, it should be noted that most survey data consists almost entirely of lithic cultural material and that the diagnostic projectile point/knife styles of the Late Woodland and Mississipian are difficult to differentiate. Thus, definite trends for Mississipian as distinct from Late Woodland, are difficult to distinguish. The presence of shell tempered ceramics in contexts with good preservation, such as rockshelters, is the only other indication of cultural affinity.

The reduction in the frequency of Late Woodland and Mississippian sites may be directly related to the lack of arable land on the Cumberland Plateau, particularly in the drainage basins of such rivers the Big South Fork

(Ferguson et al. 1986). Generally, components that can be assigned to the Late Prehistoric/Mississippian Period appear for the most part to be small seasonal campsites, consisting predominantly of rockshelter sites and upland lithic scatters which might as likely be Late Woodland Period sites, for the reason noted above.

In general the Late Prehistoric/Mississippian utilization of the Cumberland Plateau is unknown. The data at present, with possibly a few exceptions, appear to suggest that the seasonal utilization strategy for the Plateau was possibly gathering and hunting forays from settlements in other regions. This is consistent with the findings of Crites (1978) and Kline and Crites (1979) which indicate a continued emphasis on wild plants as well as cultigens during this period on the Eastern Highland Rim. As noted above, permanent have been established along some of the major rivers of the Cumberland Plateau. Another possibility is that late prehistoric populations utilizing the Plateau maintained an adaptive strategy and way of life similar to that in evidence during the Archaic Period throughout the Late Prehistoric Period and into the Historic Period (Ison and Sorenson 1979:9).

CHAPTER IV

METHODOLOGY

General Research Strategy

The field investigations, analysis, and interpretative aspects of this study were conducted within a settlement analysis framework focusing on both past cultural and environmental records. The principal sources of cultural information were lithic artifacts and their archaeological contexts.

Isaac (1977) has outlined a general research strategy for the systematic problem oriented analysis of prehistoric lithic artifacts and their contexts, directed toward the discovery of recurrent patterning at the assemblage level. Isaac (1977:6) indicates such a research strategy should contain the following steps:

> 1. Acquisition of a set of valid samples of assemblages relevant to the problem at hand;
>
> 2. Characterization of the assemblages [samples] in terms relevant to the questions that the inquiry seeks to answer;
>
> 3. Analysis--the assessment of patterns of resemblance and difference, plus search for regularities and order among the variables;
>
> 4. Projecting patterns discerned in the artifactual evidence against external

dimensions such as time, space, habitat, site character, etc.; and

5. Interpretation.

The following sections discuss the specific procedures employed in implementing these various steps. The first step involving the acquisition of adequate samples is discussed in the section entitled Field Recovery and Processing Methodology. The other four steps are discussed in the section entitled Analytical Methodology. For clarity, each step is discussed under its own sub-section heading. The methods involved in the second step in the above scheme are addressed in this chapter under the heading of Artifact Characterization. The methods involved in the third step are addressed in this chapter under the heading of Artifact Pattern Analysis. The fourth step is addressed in the chapter entitled RESULTS. Finally, step five is addressed in the final chapter entitled SUMMARY AND CONCLUSIONS.

Field Recovery and Processing Methodology

In accordance with the first step of the general research strategy discussed above, data recovery methods were designed and implemented, within the study areas, so as to yield as valid, adequate, and comparable samples as possible for the assessment of assemblage variability. These methods included controlled surface collection procedures, systematic shovel testing procedures, test excavation procedures, and small block excavation procedures. This variety of methods was utilized during data recovery because of variation in site setting, particularly surface vegetation.

Controlled Surface Collection

Recent studies have demonstrated that controlled surface collection procedures can be an efficient and expedient means of recovering samples suitable for assemblage comparisons within a regional settlement pattern analysis framework. A review by Lewarch and O'Brien (1981a) summarizes several studies where systematic, controlled surface collections have been successfully used to recover analytically useful data of this type. The controlled surface collections conducted by Ferguson and Pace (1981b) and Ferguson et al. (1982) are also examples of the value of utilizing such procedures.

Proper implementation of systematic controlled surface collection procedures require that certain activities be performed to insure optimal recovery and to minimize bias. Such activities include conducting repeated collections of the same area at different times and collection only after sufficient rainfall has occurred to minimize the effects of soil deflation and artifact sorting. Turner (1986) gives a thorough discussion of biasing effects such factors as soil deflation and artifact sorting as well as other factors and their affects on the implementation of controlled surface collections. The need for both repeated collection and control for rainfall can be seen in Table B.9, which summarizes controlled surface collections conducted by Ferguson et al. (1982) at site 40ST70 within the Bandy Creek area. Marked differences can be seen between each of the individual collections and the combined sample. From this summary it is obvious that problems in interpretation could result if percentage compositions between adequately and inadequately sampled sites were compared. Fish et al. (1978) present a similar comparison of repeated collections and briefly discuss analytical problems relating to frequency comparisons. Studies by Ammerman and Feldman (1978) and Ammerman (1985) also address the importance of repeated collections. Ammerman (1985:34) observes the critical point that the surface of a site will exhibit a subset or sample of artifacts present in the plow-zone and that the composition of this sample can be highly variable from collection to collection. In support of these observations Ammerman (1985), in a controlled experiment, derived ratios ranging from 1:14 to 1:23 for surface to subsurface artifacts frequencies. In a reworking of results by Lewarch and O'Brien (1981b), Ammerman (1985:40) showed how these ratios were also highly variable relative to artifact size.

In accordance with the preceding discussion, systematic controlled surface collections were utilized to investigate six sites (40ST70, 40ST71, 40ST72, 40ST73, 40ST74, and 40ST75) within the Bandy Creek Development Area, during the 1981, 1982 and 1983 investigations. All of these sites were located totally or primarily in fields that have been under recent cultivation.

The 1981 and 1982 investigations in the plowable portions of the Bandy Creek study area were undertaken on land that had been plowed, disced, and planted in corn during the previous growing season, with harvesting having occurred only a couple of months prior to the commencement of field investigations. Again, because of the span of time between plowing and collection adequate rainfall and soil deflation had occurred to minimize bias. Unfortunately, because of harvesting practices, ground visibility during the course of the 1981/1982 investigations averaged only about 70%. In all, approximately 12 ha (30 ac) were inspected in the Bandy Creek Upland study area during these field seasons.

During the 1983 investigations of the Bandy Creek study area initial field preparation involved the bushhogging, plowing, and discing of approximately 6 ha (15 ac) of land encompassing the six sites indicated above to insure adequate surface visibility and to be certain that all sites experienced comparable exposure to rainfall. Initial preparation also involved the sure establishment of the reference grid used in previous investigations to aid in artifact plotting and to insure compatibility and proper integration.

Following field preparation in mid-July 1983, rainfall gauges were placed on or near each site area and were monitored to determine when rainfall had occurred to minimize bias. It was initially hoped that amounts of rainfall in excess of 6.25 cm, a figure suggested by Turner (1980), could be recorded prior to collection. Unfortunately, the summer of 1983 was an unusually dry one and this figure was not reached during the scheduled field season. Thus, the 1983 controlled surface collections were not conducted under optimal recovery conditions and were probably biased.

The same basic procedures used for the controlled surface collections during the Bandy Creek investigations were similar to those developed and employed during the CARP investigations (see Ferguson and Pace 1981b). In both projects, plowed areas were initially walked employing parallel transects. During the CARP investigations an interval spacing of 10 m was used. Where cultural materials were encountered along the initial transects, subsequent transects were walked perpendicular to the first set employing a 1 m to 3 m interval. During the BSFAP investigations these subsequent transects were walked at an interval spacing of approximately 1 m. For all controlled surface collections the locations of cultural materials observed during the walkovers were marked with color coded survey flags. Upon completion of the systematic transects all artifacts were individually labeled with consecutive field numbers, then piece-plotted. Piece-plotting was accomplished by means of a polar coordinate grid method employing a metric tape, Brunton pocket transit and tripod. As each artifact was removed, its azimuth and distance from the grid referenced transit station were recorded. If any additional artifacts were observed during the piece-plotting procedure they were also recorded, removed, and given a different type of field number. This number consisted of the numerical designation of the nearest initially observed artifact along with the letter A and continuing on through the alphabet. This different numbering scheme was used to insure that subsequent non-systematically recovered artifact finds could be distinguished from systematic finds.

Following completion of controlled surface collection activities during the 1981, 1982 and 1983 field investigations at Bandy Creek, all artifactual and contextual information were returned to the laboratory for processing. In an attempt to maximize the information recovery, all artifacts were washed, counted, and individually cataloged. Provenience information was recorded on artifact distribution maps. From these distribution maps, isopleth maps modeling artifact density were derived for all major artifact concentrations. The derivation of these maps involved calculation of running means or weighted moving averages for density estimates at systematic control points located at the intersection of adjacent cells of a control grid. Isopleth lines of equal density were then interpolated from these control points. For this density estimation procedure, a control grid with a 10 m interval spacing was selected and overlain on the polar coordinate plots. After initial experimentation with a four cell estimation, an estimation based on nine cells was eventually chosen for use in the moving average calculations. For a general description of the calculation of running means see Cole and King (1968).

Systematic Shovel Testing

In vegetated areas with low surface visibility systematic shovel testing was employed as an investigation procedure. The usefulness of locating and defining sites under densely vegetated conditions has been discussed by Alexander (1983), Lovis (1976), Chartkoff (1978), McMamanon and Ives (1980), Ferguson and Turner (1981), Krakker et al. (1983), and Shott (1985).

In order to maximize the return of information return from shovel testing procedures, such procedures must be systematically implemented. One of the initial considerations in the systematic implementation of shovel testing involves the choice of appropriate sampling strategies. Effective sampling of an area is most efficiently and expediently accomplished utilizing a rectangular sampling grid. The first critical consideration consists of choosing an appropriate sampling interval. The choice of an appropriate sampling interval involves an evaluation of desired site discovery probabilities in relation to desired intensity of discovery and project time constraints. This choice and other related considerations are discussed at length by Ferguson and Turner (1981) and Krakker et al. (1983). In general, the evaluation of appropriate sampling interval can be greatly facilitated through the use of procedures utilized in geological prospecting for the determination of discovery probability (e.g. Koch and Link 1971; Drew 1967, 1979). Using graphical methods (Figures A.11-A.13) described by Koch and Link (1971) or formulas described by Drew (1979), the archaeologist can determine the probability with which a site, or cluster of artifacts in a non-site survey, will be discovered utilizing a particular interval spacing. A simple example using Figures A.11 and A.12, will demonstrate how an evaluation of site discovery probability can be made for sites or clusters of a given size and shape. If a sampling interval of 20 m was employed, then roughly circular sites with a diameter of 20 m would have approximately a 65% chance of being encountered during the course of investigations. Roughly elliptical sites with a length of 20 meters and width of 10 meters would have approximately a 45% probability of being encountered. It should be noted that such encounter probabilities assume 100% detection. In other words, it is assumed that a shovel test falling within a site or cluster boundary will detect the site. Unfortunately, due to such factors as low artifact density, lack of obtrusiveness, and other factors discussed by Schiffer et al. (1978), an assumption of 100% detectability cannot be made. Thus, discovery probability estimates of this type should be viewed only as biased best guess estimates. There are ways to improve the chances of detection which relate to other critical considerations, such as the related choices of unit volume and screen size.

Shovel testing procedures produce volumetric measures of artifact density (e.g. artifact/cubic centimeter). When dealing with low density artifact distributions, it is important that adequate volumes of soil be sampled to insure relatively reliable information recovery. Such an estimate of adequate volume can be determined though field evaluation using units of various volumes at selected locations within the study area. As in the case of sampling interval selection, choice of shovel test unit volume is also greatly affected by considerations of expediency relative to constraints of time and available manpower. Regardless of the unit size selected it is important that units of equal volume be excavated.

It is equally important that the fill from the shovel tests be filtered through screen mesh. The analytical usefulness and comparability of unscreened units is highly questionable. As in the case of selecting an adequate sample volume, choice of screen mesh size is important especially with regard to biasing factors such as artifact obtrusiveness discussed above. Generally, it can be assumed the smaller the mesh size the better, especially since the most common artifacts on many sites are very small pieces of debitage. But again, this decision must be made relative to practical considerations such as the ability of a given soil type to pass through a particular mesh size and general soil condition such as whether the ground is wet or frozen.

Finally, the systematic implementation of a shovel testing procedure should consider the comparability of samples of artifacts recovered with samples recovered by other procedures such as controlled surface collection and excavation. As with surface collections, shovel tests yield very small samples of the population of subsurface artifacts present at the time investigations are conducted. If an archaeologist is interested in comparing and synthesizing the information recovered from these various procedures then an empirically based evaluation of shovel test recovery with surface and subsurface recovery is required.

During the 1980 CARP investigations systematic shovel testing was conducted as a pilot study at two sites, 40MO52 and 40MO55. These two sites were investigated by both controlled surface collection and shovel testing procedures. The investigations indicated that systematic shovel testing was not only a reliable and replicable site discovery procedure, but also comparable to controlled surface collection strategies for the determination of site density and site limits. These indications can be seen graphically in Figure A.14 which shows superimposed artifact density isopleths for both shovel tests and controlled surface collections from site 40MO55. For these investigations, a grid interval of 10 m was selected. A standardized volume of approximately 20 liters was removed from each of the approximately 50x50 cm units to a depth of generally 6 to 10 cm. All fill was screened thru 0.64 cm (1/4 in) mesh.

During the 1981 and 1982 field investigations within the Bandy Creek uplands systematic shovel testing was conducted over seven areas containing a total of approximately 50 ha (125 ac). Within these areas a total of almost 2000 shovel test units, containing almost 40,000 liters fill, were excavated. Based on the probability tables of Koch and Link (1971) discussed above, an initial interval spacing along the reference grid was selected for placement of the shovel tests. It was determined that this interval would theoretically provide for approximately a 65% probability of locating a relatively circular site target 20 m in diameter which contained sufficiently dense concentrations of obtrusive artifacts. Expediting an already highly labor intensive endeavor was also a consideration in selecting an initial interval of 20 m. In general, the Bandy Creek investigations retained the 50x50 cm unit size, the 20 liter volume and the screening of fill through 0.64 cm mesh, used during the CARP investigations. Initially, each shovel test consisted of clearing a 1x1 m area of ground cover to allow for visual inspection of the ground surface prior to excavation of the 20 liter, 50x50 cm unit. But since only 5% of the artifacts recovered from this type of unit came from the cleared 1x1 m area this technique was eliminated from the shovel testing procedure.

Following completion of the systematic shovel testing at the 20 m interval, subsequent 50x50 cm, 20 liter units were placed in a prescribed radial pattern around each of the original units which had produced cultural material. These subsequent shovel test units were placed successively at 10 m intervals in the cardinal directions and 14.14 m intervals along the diagonals extending outward from the initial positive test. These units were continued outward until two sterile units for each of the cardinal directions and one for each of the diagonals had been encountered. When subsequent units producing cultural material were encountered they were treated in a similar fashion to the initial positive units.

Following completion of both the initial 20 m and subsequent 10 m shovel testing, artifact distribution and artifact density maps were produced, as was done with the information recovered during the controlled surface collection phase. These maps thus facilitated comparisons between surface collected and shovel tested areas.

During the 1983 investigations the areas within the Bandy Creek Development Area, containing sites 40ST69, 40ST76, 40ST79, and 40ST80, were re-investigated utilizing systematic shovel testing procedures similar to those described above. The principal differences were in the use of a 10 m testing interval throughout and in the use of a 5 m interval, and 0.32 cm (1/8 in) screen mesh in one special case at site 40ST80. All shovel tests were placed systematically within the 10 m grid diagonally adjacent to the original shovel test units excavated during the 1981 and 1982 investigations.

The purpose for replicating the original shovel testing of these four sites was twofold. First, it allowed for an evaluation of the reliability of the original shovel testing. Secondly, it allowed for verification of the isodensity maps of the sites based on the initial shovel testing and permitted the compilation of more accurate isodensity maps utilizing the results of both episodes of shovel testing. These revised isodensity maps were also designed to be the primary basis on which the locations of test units were selected.

Test Excavation

During the 1981 and 1982 investigations, testing was conducted at a selected sample of sites within both the uplands and gorges areas of the Bandy Creek Development Area. The specific sites selected for testing were chosen in a non-random fashion with the principal consideration being the potential to yield information on site variability. Testing of the upland and rockshelter sites generally involved the strategic placement of at least one 1x1 m test unit from which soil was excavated in arbitrary 10 cm levels until bedrock or successive levels of sterile soil had been encountered. The fill from the 1 x 1 m units from the upland open sites, excavated during 1981 and 1982, was screened through 0.64 cm (1/4 in) mesh. This mesh size was used due to poor seasonal soil conditions. The gorges rockshelter units, because of better soil conditions, were screened through 0.32 cm (1/8 in) mesh, to maximize data recovery.

Small Block Excavation

Due to the impracticality of implementing controlled surface collection activities in heavily forested areas, small block excavations were employed during the 1983 investigations within the boundaries of the 4 sites (40ST69, 40ST76, 40ST79, and 40ST80) of the Bandy Creek study area. Small block excavation offers an equally viable, but less cost efficient data collection strategy than controlled surface collection.

Based on isodensity maps generated during the surface collection and shovel testing phases of the investigations, 1x1 m units with horizontal control at 50x50 cm and vertical control at 10 cm were excavated in those areas of sites 40ST69, 40ST76, 40ST79, and 40ST80 exhibiting the highest densities. These units were generally excavated to 30 cm below the surface. The 30 cm depth was chosen as a cut off in order to optimize recovery, even though artifacts occur below this depth, Previous investigations by Ferguson et al. (1982) indicated that the majority of artifacts present within the Bandy Creek upland sites are located within the top 30 cm. All fill removed from the small block excavations was dry screened through 0.32 cm (1/8 in) mesh. Originally, 5 m areas were to be excavated at sites 40ST69 and 40ST72. But eventually, only one 1x1 m unit was excavated at 40ST69 and no units at 40ST72. The decision to recover smaller samples from these sites was made for several reasons. First of all, no previous 1x1 m units were placed during previous investigations at these sites due to their relatively low densities. The single unit placed at the location with the highest predicted artifact density at 40ST69 produced virtually no artifacts. Secondly, approximately 2/3 of site 40ST72 was sampled during controlled surface collection activities. These investigations provided comparable coverage to those investigations implemented at 40ST70, 40ST71, 40ST73, 40ST74, and 40ST75. Finally, since greater amounts of information relative to subsequent interpretation could be recovered from investigations at 40ST70, 40ST73, 40ST76, 40ST79, and 40ST80, efforts were concentrated on these sites.

Analytical Methodology

Artifact Characterization

In keeping with step two of Isaac's strategy, the initial stages of the artifact analysis involved the characterization of the variability in the artifact samples recovered. Three distinct aspects were characterized: lithic raw material content, technological content relative to placement in reduction sequence trajectories, and formalized implement content as an indicator of adaptive technological organization and cultural association.

Lithic Raw Material Characterization. Lithic raw material characterization involved the classification of recovered artifacts relative to a raw material type collection assembled during the initial stages of analysis and modified during the course of investigations. This type collection consisted of artifacts and hand samples which document much of the range of variation in the cherts and other silicates from the Pennsylvanian, Mississippian and Ordovician lithologic systems of middle and eastern Tennessee and Kentucky. These systems represent the principal sources of the lithic raw materials for those peoples utilizing the Cumberland Plateau (Figure A.15). Thirteen raw material types were defined during the course of investigations (Table B.10). Comparison of individual artifacts with the specimens contained within the type collection employed macroscopic techniques such as those described by Blakeman (1977) and Amick (1981).

Technological Characterization. Characterizations relative to lithic reduction sequence staging involved the study of technologically related attributes. The specific artifact attributes were selected to indicate the presence and absence of specific stages in reduction sequence trajectories, particularly the biface production trajectory.

The most sensitive and abundant artifactual evidence for the study of reduction technology is debitage. Accordingly, reduction sequence characterization in this study concentrated on the analysis of debitage. Ten debitage types were defined based on detectable differences in production techniques and completeness (Table B.11). For these debitage types specific, technologically sensitive attributes and attribute states were chosen for study. These particular debitage attributes and related attribute states are listed in Table B.12.

Formal Implement Characterization. Formalized implement content was characterized relative to implement morphology with particular attention being paid to the kinds of working edges or tool edges present on the implement. Principal morphological distinctions were based on the division of implements into flake implements and bifacial implements. Flake implements were initially divided into 21 types based on specific attributes relating to the presence and location of intentional edge modification, use wear and edge damage visible under low (10X) magnification. These type distinctions are seen in Table B.13. Formalized bifacial implements were analyzed relative to reduction related, use related, and temporal-stylistic attributes.

Specific attributes were chosen primarily to facilitate eventual evaluation of technological organization. These specific attributes and attribute states are listed in Table B.14.

Hafted bifacial implements identifiable functionally as projectile points or hafted knives were compared stylistically with other hafted biface types from dated contexts in other areas of Tennessee and Kentucky, and elsewhere in eastern North America. These comparisons are of a tentative nature and should be viewed with some caution until good temporal control for these styles have been established for the Cumberland Plateau region. In this study, such comparisons were used only as indicators of probable association with general cultural periods such as Early Archaic and Middle Woodland. Forty provisional types of projectile points or knives were defined for the Big South Fork drainage during the course of investigations.

Artifact Pattern Analysis

The stage of lithic analysis following characterization involved the search for patterning within and between aggregates of artifacts or assemblages. Assemblages can be comparatively investigated within a series of hierarchically defined contextual levels which correspond roughly to the macro, meso, and micro-levels of context defined by Butzer (1982). These levels in descending order of aggregation are the regional level, area or situational level, and the within and between site level. The artifact pattern analysis conducted during this study stage concentrated on the meso-level with characterizations and comparisons being made within and between contrastive localized areas and between sites within localized areas. Analytical techniques employed during this stage of artifact analysis primarily involved the application of descriptive and exploratory statistical procedures within analytical frameworks suggested by previous, inductively oriented research.

Raw Material Pattern Analysis. The first stage in the raw material analysis involved the reduction of the original 13 raw material types into four type groups. This involved excluding the two poorly represented categories of raw material not used in chipped stone implement manufacture, quartzite and sandstone. The remaining 11 lithic raw material types were grouped by known geological association into, Upper Mississippian Cherts, Fort Payne Cherts, Other Cherts, and Quartz and Chalcedony. This regrouping changed the original nominal scale types into ordinal scale type groups. The ordinal nature relates to proximity of the sources or exoticness and the related factor of relative abundance.

The second stage involved the generation of cumulative percentage ogives of the four revised raw material type groups, for the three study areas viewed individually and combined. The use of cumulative percentage ogives for comparison of archaeological patterning was suggested by Thomas (1983b:419-425). Thomas (1983b:423-424) also suggested the comparative evaluation of cumulative percentage ogives with the aid of the Kolmogorov-Smirnov two-sample test. The Kolmogorov-Smirnov two-sample test is a non-parametric statistical procedure designed to test the probability that two samples could have been drawn from the same population (Siegel 1956:127-136; Thomas 1976:322-327). Accordingly, the third stage of the raw material pattern analysis involved the statistical comparison of the cumulative percentage ogives utilizing Kolmogorov-Smirnov two-sample tests.

The fourth stage of the analysis of raw material, involved application of the an exploratory data analysis procedure known as median polish to a contingency table breaking down study areas by raw material type group data expressed as percentages. Median polish is an exploratory statistical procedure, similar to ANOVA but without the parametric constraints, which can be used to search for further information and structure in two-way tables (Velleman and Hoaglin 1981:219-256; Emerson and Hoaglin 1983:166-210). For a discussion of the application of median polish to contingency tables analysis in archaeology see Lewis (1986).

Technological Pattern Analysis. One of the informative and sensitive indicators of technology or reduction sequence patterning is debitage from artifact manufacture and maintenance. Stahle and Dunn (1982, 1984), in a recent experimental study, demonstrated that the size range of waste flakes from the manufacture of bifacial implements decreases from initial to final reduction stages. Accordingly, the initial stages of technological or reduction sequence patterning involved the analysis of artifact size, specifically debitage size. The initial stage involved the recreation of a cumulative percentage ogives for the four stages from the experimental data of Stahle and Dunn (1982:86). In an attempt to facilitate comparisons with the artifact samples from the study areas, all artifacts less than 0.64 cm experimental (1/4 in) were excluded from the original experimental data prior to plotting.

The second stage of the analysis involved the generation of cumulative percentage ogives of debitage size data for the study areas. The third stage involved the comparative analysis of cumulative percentage ogives. As with the comparisons of the raw material ogives Kolmogorov-Smirnov two-sample tests were used to facilitate the comparisons.

Technological patterning was further investigated utilizing a methodology similar to that suggested by Johnson (1982) and Johnson and Raspet (1980). This fourth stage of analysis utilized what Johnson and Raspet describe as a debitage paradigm (Table B.15), which consists of contingency table comparisons of platform surface characteristics with percentage of cortex present on the dorsal surfaces of debitage samples. In Johnson's interpretation of the paradigm or biface reduction model, the cells along the primary diagonal of the contingency table should have greater observed frequencies than expected frequencies, given a normal distribution. The off-diagonal cells should all have observed frequencies less than those expected by a normal distribution. If these conditions are met then a biface production trajectory can be inferred for the site or area.

The fourth stage of the technological pattern analysis involved the generation of modified debitage paradigms for the three study areas. The modified debitage paradigm used in this study (Table B.16), differed from that used by Johnson and Raspet (1980).

Unlike Johnson and Raspet, only whole flakes were used in the generation of the model. It was felt that broken flakes could not be reliably broken down relative to percentage of dorsal cortex since 100% of the dorsal surface was not present on broken flakes. Other differences in the modified debitage paradigm were slight differences in the breakdown of the variables. Percent dorsal cortex was broken down into, >66% dorsal cortex instead of >75%, <66% dorsal cortex instead of <75%. and none or no dorsal cortex. Platform surface configuration was broken down into, missing, cortex covered, but instead of <2 facets, plain was used, and for >2 facets, a state combining peaked, multi-facteted, and point plain was used. It was felt that these changes were in keeping with the underlying assumptions of the original model. Accordingly, the expectations of the original model were expected to hold for the modified model.

In an attempt to further evaluate the patterning of debitage paradigms generated for the study areas the fifth stage of analysis involved application of the median polish procedure discussed above. The modified debitage paradigm models for the study area were all analyzed in an attempt to determine to the location and magnitude of variation with the models.

Formal Implement Pattern Analysis. The initial stage in the analysis of patterning in formal implement variability began with the reduction of the original chipped stone implement categories into analytically meaningful type groupings. The 21 flake implement type groupings and bifacial implements were reduced to a tripartite set of type groupings based on general patterns of use wear and a consideration of the relative energy expended in their manufacture and use. The three type groupings are: utilized flake implements, retouched flake implements, and bifacial flake implements. These three division were selected in order to facilitate the evaluation of technological organization, specifically the distinction between expedient and curated technologies. The three part division of implements can be viewed as an ordinal set of curational class categories with utilized flake implements reflecting expedience and formalized bifacial reflecting curation.

The second stage of the formal implement pattern analysis involved the generation of cumulative percentage ogives for the curational class categories for the study areas. As with the analyses discussed previously, the third stage involved the comparative analysis of cumulative percentage ogives using Kolmogorov-Smirnov two-sample tests.

The fourth stage of the formal implement analysis involved the recategorization of the culturally diagnostic projectile point/knife types present into general type groupings. The new type groupings recategorized the diagnostic projectile point/knife types relative to general cultural periods with which they were most probably associated. The fifth and sixth stages involved the generation of cumulative percentage ogives for the culturally diagnostic type groupings and the subsequent comparison of these ogives by means of Kolmogorov-Smirnov two-sample tests.

Simultaneous Factor Pattern Analysis. The first stage in the analysis of patterning to be found in more than one factor simultaneously involved the search for patterning exhibited by cross-tabulations of raw material, reduction sequence, and formal implement variability. This was investigated through the use of an analytical methodology outlined by Simek and Leslie (1983). In their study, Simek and Leslie (1983) utilized the partitioning chi-square procedure to evaluate the strength of relationships exhibited by frequency distributions for various lithic implement categories relative to raw material categories within relative frequency tables. Simek and Leslie (1983:83) describe the assumptions of their method relative to selective utilization or curation as follows:

> In order to determine if particular chert materials were being selected for the production of tools, the frequencies of unmodified waste were chosen as a model for chert reduction ... If specific cherts were favored in tool production, and if these were from "exotic" or distant sources, or if certain tools (produced during the occupation from local materials) were transported out of the site, then tool frequencies should deviate from model frequencies. Conversely, if model frequencies adequately predict tool frequencies, then material use reflected on-site availability rather than selective utilization or curation of particular types.

In this dissertation similar assumptions can be made, therefore, the partitioning chi-square procedure was applied to contingency tables breaking down the implement type groups by raw material type groups for the study areas.

The exploratory data analysis procedure, median polish, discussed above, has been shown by Lewis (1986) to be a comparable procedure for analyzing data in contingency table form to the partitioning chi-square procedure used by Simek and Leslie (1983). Accordingly, in the second stage of analysis, median polish was used to verify the results of the partitioning chi-square analyses. As with the partitioning chi-square analyses, median polish was applied to contingency tables breaking down the implement type groups by raw material type groups for the study areas.

The third stage of the simultaneous factor pattern analysis involved the generation and comparison of implement to debitage ratios for the study area sites. Comparisons of implement to debitage ratios have been used previously by Ferguson et al. (1986) to compare sites relative to variability in behavioral activities and duration of occupation. This stage was the first of three to focus on individual sites rather than areas or situations.

The fourth stage of the simultaneous factor pattern analysis involved the generation and comparison of unifacial implement to bifacial implement ratios for the study area sites. Comparisons of unifacial implement to bifacial implement ratios provide another means of assessing the relative composition of assemblages based on a binary distinction of use and the relative energy expended in implement manufacture and use.

The fifth and final stage of the analysis involved a multivariable search for patterning within a selected sample of sites from the study areas. Johnston and Semple (1983) discuss a classification algorithm drawn from information theory, which is appropriate for the simultaneous, multivariate analysis of the information relating to site variability. Specifically, the technique is based on the statistical decomposition of clusters or groupings characterized by information statistics. Interpretation is initially based on assessments of the percentage variability which can be accounted for by various groupings of cases, or in this study, sites. Subsequent interpretation is based on a set of z scores which indicate the direction (positive or negative) and the degree of variation given clusters or groupings have relative to the overall means and standard deviations for the variables used to characterize the cases.

In this study, Johnston's and Semple's (1983) classification technique was used to analyze a sample of 15 sites selected from the three study areas. The sites selected were: 40ST70, 40ST71, 40ST73, 40ST74, 40ST76, 40ST79, AND 40ST80, from the Bandy Creek Upland Study Area, 40ST152, 40ST161, 40ST164, AND 40ST165, from the Bandy Creek Gorges Study Area, and 40MO52, 40MO55, 40MO56, and 40MO59 from the CARP Upland Study Area. The sites were selected based primarily on the intensity of investigation (greater than 100 artifacts recovered), and known cultural affiliation.

It should be noted that the number of artifacts recovered is an important consideration because of the biasing effects of sample size which have been discussed by Kintigh (1983), Jones et al. (1983) and Thomas (1983b). No correction was made for the potential biasing effects of sample size in this particular analysis since the samples from the sites selected were of comparable size and due to the fact that information statistics are resistant to the effects of sample size variation. In spite of this assumption and condition, the possible biasing effects of sample size in this particular analysis and the other analyses conducted as a part of this study should be considered. At present, though, an effective means of evaluating sample size effects has yet to be devised, and the development of a method for doing so, or even evaluating previously suggested methods, is beyond the scope of this study.

CHAPTER V

RESULTS

This chapter presents the results of the characterization and analytical steps of the investigations. The presentation of the results will deal initially with the analyses of raw material variability, technological variability, and formal implement variability, for the three study areas. The discussion will continue with a presentation of the results of the simultaneous analysis of assemblage variability exhibited by the study areas and selected sites within the areas. The discussion of the results of the simultaneous analysis will initially address raw material and formal implement content. This will be followed by the discussion of the simultaneous analysis of reduction sequence and formal implement content. The chapter will conclude with a discussion of the simultaneous analysis of all three sources of variability.

Analysis of Raw Material Variability

The descriptive results of the characterization of raw material content of the three study areas and sites can be found in Tables B.17-B.20. The cumulative percentage ogives for the four revised raw material type groups are presented in Figure A.16. The results of Kolmogorov-Smirnov two-sample tests on cumulative percentage data from the three study areas are presented in Table B.21.

Based on these results we can infer that the three study areas exhibit similar, generalized patterning relative to raw material utilization. In spite of this general similarity, some differences do exist, with the greatest difference existing between the Bandy Creek Upland and the CARP Upland areas.

Median polish was applied to the raw material data in an attempt to further investigate the patterning in raw material variability. Results of the median polish on the raw material data expressed as percentages by study area are presented in Table B.22. The results of the median polish analysis indicate that:

1. Lithic raw material from Upper Mississippian sources is greatly overrepresented in the Bandy Creek Upland study area and somewhat underrepresented in the CARP Upland study area.
2. Material from Fort Payne sources exhibits the inverse of the pattern exhibited by the Upper Mississippian chert, with moderate over representation in the CARP Upland study and moderate underrepresentation in the Bandy Creek Upland study area.

3. Other cherts are moderately overrepresented in the CARP Upland study area and moderately underrepresented in the Bandy Creek Gorge study area.
4. Quartz and chalcedony are greatly overrepresented in the Bandy Creek Gorge area and somewhat underrepresented in the CARP Upland study area.

There are several interpretations which can be made based on these results. First of all, the most abundant lithic raw material for this portion of the Cumberland Plateau is clearly the chert from the Upper Mississippian formations. The relative abundance of the Upper Mississippian chert in both the Bandy Creek study areas and the reduced representation in the CARP study area can be expected since the Upper Mississippian formations are the closest and apparently the most abundant sources. Since the CARP study area is the farthest area from known and intensively exploited lithic resource extraction zones containing Upper Mississippian cherts, this pattern can also be viewed as a function of distance and consistent with diminishing returns to scale, and distance decay functions so pervasive for other forms of human interaction (eg. Zipf 1948).

The Fort Payne chert is the only exotic lithic raw material, obtained in any marked quantity, which originates from the farthest known distance to the west of the study areas. The relative abundance of Fort Payne chert in the CARP study area and the reduced representation in the Bandy Creek Upland study areas might be explained if one considers that some of the groups utilizing the CARP area may have come from the west and, therefore, not exploited areas containing the Upper Mississippian cherts. Another possibility is that the Fort Payne chert was a more highly curated raw material. Its relatively greater abundance in the CARP study area might be a function of the discard of exhausted implements made of Fort Payne or the replacement of exhausted implements with implements fashioned on the Plateau from staged bifaces of Fort Payne chert.

The category "other cherts" includes all other exotic lithic raw material. Thus, it includes cherts (eg. Blue-Black modular chert) originating from the Ridge and Valley east of the study areas. The relative abundance of other chert in the CARP study area and the reduced representation in the Bandy Creek Gorges study area might be explained if one considers that the CARP study area is closer to the sources to the east and, therefore, more likely to contain raw materials brought into the area by groups coming from the east. Another possibility is that some of the groups utilizing the CARP area may have come onto the Plateau from the west, but exploited with greater intensity areas where the relative abundance of other cherts was greater. The converse would hold for the Bandy Creek Gorges study area. Another possibility is that certain other cherts might have experienced greater curation and their relatively greater abundance in the CARP study area was a function of the discard of exhausted implements made of certain other cherts or the replacement of exhausted implements with staged bifaces made of other chert.

The underrepresentation of quartz and chalcedony in the CARP study area is possibly related to the fact that the quartz and chalcedony available at the western border of the Cumberland Plateau were not as suitable for lithic implement production as was chert. Therefore, it is more likely that a raw material with greater workablity, rather than a less desirable material, would be transported to those sites farthest from the source areas. The great overrepresentation of quartz and chalcedony in the Bandy Creek Gorge's study area might be due to the materials relative abundance in close proximity to the study area. It might also be an indication of selection for less workable, but more readily available, raw material by those groups utilizing the gorge area. This second possibility indicates that those groups utilizing the gorge areas might have been more expediently organized than those utilizing the other study areas.

Analysis of Technological Variability

The descriptive results of the characterization of flake or debitage size as an indicator of technological variability for the study areas and sites can be found in Tables B.23-B.24. The cumulative percentage ogives for the four stages from the experimental data of Stahle and Dunn (1982), controlling for artifact size greater than one quarter inch are presented in Figure A.17. The cumulative percentage ogives of flake size for the three study areas are presented in Figure A.18. The cumulative percentage ogives of the surface and subsurface data from the Bandy Creek Upland study area, viewed separately, have also been included in Figure A.18.

Marked differences can be seen in the frequencies of smaller debitage when the ogives from the study areas are compared with the ogive based on the experimental evidence of Stahle and Dunn (1982). In the study area data, small size classes such as 1/4 and 3/8 in. exhibit relatively low percentages. Three factors could account for these differences.

First of all, post depositional site formation processes may have selectively removed or displaced the smaller debitage while leaving the larger sizes. For example, breakage by such activities as trampling or burning may have also caused the reduction of the smaller debitage classes into even smaller classes which were not recoverable. Secondly, the differences in the raw material used in the experimental study and that used in the study areas may differ relative to workability and size of originally procured pieces. Finally, the lack of small debitage in the study areas may be a reflection of the reduction sequence behavior that was conducted and the underrepresentation indicates a lack of behaviors that more readily produce small debitage. Of these factors the first seems the most likely. The second factor is probably involved in the observed differences but the magnitude of the differences are much greater than one could expect by this factor alone. The final factor is the most unlikely one of the three to account for the differences since all stages of lithic reduction produce some small debitage.

Whichever factors are involved in the observed differences in debitage size, it is clear that the almost total lack of small debitage from the study areas presents problems for interpretation which should be considered more fully. Yet such a study is beyond the scope of this dissertation. Therefore, with this caveat in mind, the present study will proceed with the assumption that some non-cultural effects have been the primary cause of the observed differences in debitage patterning.

The results of comparisons of flake size data from the three areas utilizing Kolmogorov-Smirnov two-samples tests are presented in Table B.25. These results indicate that when all collection methods are considered, the Bandy Creek Upland and Bandy Creek Gorge study areas exhibit similar patterning in debitage size distributions. These results also indicate that differences exist between the patterning exhibited by both Bandy Creek study areas and the CARP study area.

Due to potential biasing effects of what has been termed the size effect (cf. Baker 1978), it was felt that the Bandy Creek Upland sample, recovered from both surface and sub-surface contexts, should be divided relative to method of recovery and then re-evaluated. The results of the subsequent analysis indicate that the surface samples alone from the Bandy Creek upland area appear to be similar to the CARP samples which were recovered almost entirely from the surface, thus indicating that the size effect might very well have a biasing influence. When the surface samples from the

Bandy Creek Upland area are considered in relation to the sub-surface samples from the Bandy Creek Gorges, the Bandy Creek Upland area, and the combined samples from the Bandy Creek Upland area there appear to be differences. It also appears that the sub-surface sample from the Bandy Creek Upland area is different than the samples from the other two areas and the combined samples from the Bandy Creek upland area. Thus it appears that no clearly definable similarities exist between the study areas.

The modified debitage paradigms for the study areas are presented in Tables B.26-B.30. The debitage paradigms for the surface and sub-surface data from the Bandy Creek Upland study area, viewed separately, have also been included in Tables B.26-B.30. The breakdowns of the whole debitage for the study areas by the debitage classes defined by the modified debitage paradigm are presented in Table B.31. Based on the assumptions for use of the debitage paradigm, outlined by Johnson and Raspet (1980), the following results are indicated:

1. All three areas appear to exhibit, with one minor exception, the same general pattern with respect to the overall occurrence of positive loadings or frequencies greater than those which should be expected from a normal

distribution. The debitage paradigms for Bandy Creek Upland study area, viewed for the whole sample and as surface and subsurface samples, along with the CARP study area paradigm, exhibit positive loadings along the principal diagonal in cells DB4 (>66% dorsal cortex with a cortex covered platform), DB8 (66% dorsal cortex with a plain platform), DB12 (no dorsal cortex with either a point-plain, peaked, or multi-faceted platform), and in off-diagonal cells DB5 (<66% dorsal cortex with a cortex covered platform), and DB7 (>66% dorsal cortex with a plain platform).

2. The Bandy Creek Gorge area debitage paradigm does not exhibit a positive loading on the DB8 cell (<66% dorsal cortex with a plain platform), but otherwise exhibits the same patterning as the other areas.

Johnson and Raspet (1980) suggest that for the expectation of a primary biface production strategy to be met, positive loadings must occur along the principal diagonal (cells DB4, DB8, and DB12), with all negative loadings elsewhere. All paradigms, except the Bandy Creek Gorge area paradigm, exhibit positive loadings along the principal diagonal, but also exhibit positive loadings in two off-diagonal cells (DB5 and DB7).

Therefore, biface production appears to be taking place in all three areas, but in a staged, rather than primary production, trajectory. Johnson and Raspet (1980), interpret a positive loading in DB5 as possibly representing the production of flake implements. It is possible, however, to expect positive loadings in these off-diagonal cells if bifaces roughed out elsewhere are being transported to the sites in these areas, for further reduction as needed. This latter staged production strategy is further supported by another fact not apparent in the data as presented; the total lack in any of the samples of whole flakes exhibiting 100% dorsal cortex.

The application of median polish to the debitage paradigms allows for further delineation and interpretation of the variability in reduction sequence technology. The results of the median polish analysis of these debitage paradigms are presented in Tables B.32-B.36. Inspection of the information contained in the modified debitage paradigms and the models after median polishing indicate the following:

1. For the Bandy Creek Upland study area, as represented by both surface and sub-surface samples, whole debitage with point plain, peaked, or multi-faceted platform surfaces, along with no dorsal cortex appear to be the

most abundantly represented bivariate debitage type. The whole debitage exhibiting cortex covered platform surfaces and no dorsal cortex appear to be the most underrepresented. Debitage with cortex covered platforms and greater than 66% dorsal cortex appear to be somewhat overrepresented. The debitage with point plain, peaked, or multifaceted platform surfaces and greater than 66% dorsal cortex appear to be only somewhat underrepresented. This same pattern appears to hold for both the surface and sub-surface samples from the Bandy Creek Upland study area.

2. For the Bandy Creek Gorge study area, the whole debitage exhibiting point plain, peaked, or multi-faceted platform surfaces and no dorsal cortex, appears to be greatly overrepresented. The debitage exhibiting point plain, peaked, and multi-faceted platform surfaces with greater than 66% dorsal cortex appears to be somewhat underrepresented. Debitage exhibiting cortex covered platform surfaces with no dorsal cortex is also underrepresented.
3. The CARP Upland study area appears to exhibit the same general patterning as that described for the Bandy Creek Upland study area.

The results for the median polishing of the modified debitage paradigms indicate that the samples from the Bandy Creek Upland study area and the CARP study area generally exhibit the same patterning thus indicating that a similar pattern of reduction sequence related behavior, possibly staged production, occurred generally in both areas. The lack of a relatively strong overrepresentation of debitage exhibiting cortex covered platforms and greater than 66% dorsal cortex, combined with the lack of a positive loading in the cell for debitage exhibiting plain platforms with less than 66% cortex in the initial paradigm assessment, indicate a different pattern exists for the Bandy Creek Gorge area. One suggestion is that the Bandy Creek Gorge area samples were primarily produced by reduction sequence activities more directed toward resharpening and maintenance than in other areas. Another possibility is that the groups utilizing the shelters were engaged in staged reduction as well, but were generally utilizing material in a later stage of reduction, thus accounting for the lack of cortical debitage.

Analysis of Formal Implement Variability

The descriptive results of the characterization of projectile points/knives, expressed as originally defined types by study area and site can be found in

Tables B.37-B.38. The reduced and redefined type groupings for culturally diagnostic projectile point/ knife types, as indicators of formal implement variability for the study areas and sites can be found in Tables B.39-B.40. Figure A.19 presents a graphical representation of the relative frequency of culturally diagnostic projectile point type groups by study area.

The cumulative percentage ogives for the culturally diagnostic projectile point/knife type groupings are presented in Figure A.20. The results of the comparisons of these distributions for the three study areas utilizing Kolmogorov-Smirnov two-samples tests are presented in Table B.41. Based on these results we can infer that the distributions of diagnostic projectile point/knife types are quite similar. The distributions for the two upland areas are the most similar. The gorge sample differs the greatest from the upland samples, exhibiting higher percentages of Middle Woodland and Early Woodland/Late Archaic and lower percentages of Middle Archaic/Early Archaic projectile points/knives. But the differences between the gorge samples and the two upland areas are not statistically significant for these samples.

The median polish results for culturally diagnostic projectile point/knife types, expressed as percentages by study area, are presented in Table B.42. The results of the median polish analysis indicate that:

1. Late Woodland/Mississippian projectile points appear to be slightly overrepresented in the Bandy Creek Gorge study area.
2. Middle Woodland projectile points appear to be somewhat underrepresented in the Bandy Creek Upland study area and somewhat overrepresented in the Bandy Creek Gorge study area.
3. Early Woodland, Terminal Archaic, and Late Archaic projectile points considered together appear to be slightly overrepresented in the Bandy Creek Gorge study area and slightly underrepresented in the CARP study area.
4. Middle and Early Archaic projectile points considered together appear to be slightly overrepresented in the Bandy Creek Upland study area and greatly underrepresented in the Bandy Creek Gorge study area.

The results of the median polish analysis of the two-way table of culturally diagnostic projectile points by study area suggest that the study areas were utilized differently particularly during the Middle Woodland and Early Archaic Periods. Open sites were apparently preferred over the gorge shelters in the central portion of the drainage during the Early Archaic. The opposite pattern was the case during the Middle Woodland.

The descriptive results of the characterization of flake implements expressed as originally defined tool types by study area and site can be found in Tables B.43-B.44. The reduced and redefined type groupings of chipped stone implement types for the study areas and sites can be found in Tables B.45-B.46.

The cumulative percentage ogives for the chipped stone implement type groupings are presented in Figure A.21. The results of the comparisons of these distributions for the three study areas utilizing Kolmogorov-Smirnov two-samples tests are presented in Table B.47. These results indicate that the distributions of the chipped stone implement type groupings for the three study areas are relatively similar. In spite of this general similarity, some differences do exist, with the greatest difference existing between the Bandy Creek Gorges and the CARP Upland areas.

The results of the median polish of the breakdown of the chipped stone implement type group data expressed as percentages by study area, can be found in Table B.48. The results of the median polish analysis indicate that:

1. Utilized flake implements appear to be greatly overrepresented in the Bandy Creek Gorge study area and slightly underrepresented in the CARP Upland study area.
2. Retouched flake implements appear to be slightly underrepresented in the Bandy Creek Gorge study area.
3. Bifacial implements appear to be greatly overrepresented in the CARP Upland study area.

The results suggest that the prehistoric cultures that utilized the Bandy Creek Gorge study area tended to be more expediently organized and those cultures utilizing the CARP Upland study area tended to be more curated.

Simultaneous Analysis of Formal Implement and Raw Material Variability

The two-way tables of the three general implement type groupings by the four general raw material type groupings for the study areas are presented in Tables B.49-B.51. The results of the partitioning chi-square analyses of these contingency tables are also presented in Tables B.49-B.51. Based on Simek and Leslie's (1983:82) guidelines for use of partitioned chi-square statistics, the following interpretations of the results are indicated:

1. The chi-square statistics for both the combined and difference partitions are significant at an alpha level of .01 for both the Bandy Creek Upland and CARP Upland study areas. This indicates that "the data are probably not consistent with the model" provided by the raw material distribution of the debitage, "and the populations are not homogeneous with respect to any model" (Simek and Leslie 1983:82).
2. The chi-square statistics for the combined and difference partitions are not significant for the Bandy Creek Gorge area. This indicates that the model provided by the debitage is probably "consistent with the observed data, and that the populations are homogeneous with respect to the model" (Simek and Leslie 1983:82).

Based on the assumptions of Simek and Leslie (1983), past cultural behavior in the Bandy Creek Upland and CARP Upland study areas can modally be considered to favor selection of specific raw materials and possibly the curation of certain types of implements. Past cultural behavior in the Bandy Creek Gorge area appears to modally indicate utilization of most readily available and abundant raw material and possibly more expedient as opposed to curational strategies.

In a manner similar to Simek and Leslie (1983), the fit of the model, or lack therefore, and the variation caused by the specific implement types, was evaluated further by applying the partitioning chi-square procedure to paired implement categories. The results of these analyses are presented in Tables B.52-B.54. The results of the partitioned chi-square analyses for paired implement categories indicate the following:

1. For the Bandy Creek Upland study area the chi-square statistics for the combined and difference partitions for the pairing of utilized flakes and retouched flakes (categories A and B), are not significant at an alpha level of .01. The implement category pairing for retouched flakes and formalized bifaces (categories B and C), yield a chi-square statistic that is not significant for the combined partition but significant for the difference partition at an alpha level of .01. The pairing of utilized flakes and formalized bifaces (categories A and C) yields chi-square statistics that are significant for the combined partition and not significant for the difference partition at an alpha level of .01. According to Simek and Leslie (1983:82), this

indicates that for the pairing of categories A and B, the model defined by the debitage is probably "consistent with the observed data and that the populations are probably homogeneous with respect to the model." For the pairing of categories B and C, the model is probably "consistent with the data if the data are aggregated but there is considerable variability among the populations" (Simek and Leslie 1983:82). In other words, the model appears to be good on the average but some populations differ from it. For the pairing of categories A an C, it appears, relative to the model defined by the debitage, that the "populations are homogeneous, but the model is inappropriate. Some other model will fit the data" (Simek and Leslie 1983:82).

2. The Bandy Gorge study area exhibits patterning similar to the Bandy Creek study area. For parings of categories A and B, as well as categories B and C the results and interpretations for both areas are the same. For the pairing of categories A and C both the combined and difference partitions are statistically insignificant at an alpha level of .01.

3. The CARP Upland area exhibits a different pattern than the other two areas. For the paring of categories A and B both the combined and difference proportions exhibit non-significant chi-squares at an alpha level of .01, as did the other two areas. The other two sets of parings B and C, and A and C, exhibit significant chi-square statistics at an alpha level of .01, for both partitions. According to Simek and Leslie (1983:82) this indicates that for both sets of parings the data are probably "not consistent with the model provided by the debitage and that the populations are probably not homogeneous with respect to any model" (Simek and Leslie 1983:82).

These results for all three study areas indicate that when considered together the frequencies of utilized and retouched flake implements are similar and consistent with the expectations based on the frequency distribution model provided by the lithic debitage from each separate study area. This pattern is not surprising given that the choice of raw material is usually not a major concern in the manufacture of utilized flake implements and they are generally not expected to be curated. On the other hand, the similarity of the distribution of retouched flake implements to the distributions for the utilized flakes and debitage indicates a potential need to reconsider the expectation that retouched flakes are more likely to be curated than utilized flakes. Retouched flakes may not require substantially more energy to manufacture and maintain than utilized flakes.

The results for the two Bandy Creek study areas also indicate that when retouched flakes and formalized bifaces are considered together the model provided by the debitage for each area is consistent when the categories are aggregated but that one of the categories differs. The results of the other pairing of categories for the Bandy Creek Upland study area indicate that when utilized flakes and formalized bifaces are considered together that the frequency distributions for the two categories appear similar but different from the model provided by the debitage. Based on these findings, it is unclear whether retouched flake implements or formalized bifaces are contributing to the overall pattern for the Bandy Creek Upland Area. Regardless of this, these problematic results support the findings of the analysis in which all categories are considered and suggest that for bifaces and possibly retouched flake implements differential selection of raw material or curation of implements were modal behavior patterns.

The parings of utilized flakes and formalized bifaces for the Bandy Creek Gorge study area suggest that these two categories are similar and consistent with the expectations based on the frequency distribution model provided by the lithic debitage. The findings from the Bandy Creek Gorge study area generally support the findings of the analysis where all categories were considered. The similarity of the distributions of utilized flakes and bifaces to the expected debitage distribution suggests that selection of raw material was not a major consideration in the modal behavior patterning for the study area and that technological organization was more expedient than curated. The difference in the distribution of retouched flakes can be viewed as somewhat problematic. But, the fact that utilized flakes in the samples were manufactured only from Upper Mississippian chert, can also be viewed as lending support to the interpretation above.

The results from the comparisons of retouched flakes and formalized bifaces, along with the comparisons of utilized flakes and formalized bifaces for the CARP study area indicate that neither the distribution for the retouched flakes or for the formalized bifaces is consistent with the model provided by the debitage. This lends support to the findings of the analysis where all categories were considered together. To reiterate, when considered in a modal fashion, it appears that there was differential raw material selection, curation or both involved in the past cultural behavior relating to utilization of flake implements and formalized bifaces in the CARP study area.

The results of the median polish analyses of the two-way comparisons of implement type groups by raw material type groups expressed as frequencies for the implements are presented in Tables B.55-B.57. The results of these analyses can be summarized as follows:

1. For the Bandy Creek Upland study area utilized flake implements made of Upper Mississippian chert appear to be the most abundantly represented. Retouched flake implements made of Upper Mississippian chert appear to be the most underrepresented. Formalized bifaces made of Fort Payne chert appear to be somewhat overrepresented, while formalized bifaces made of either quartz or chalcedony appear to be somewhat underrepresented.
2. For the Bandy Creek Gorge study area, as with the Bandy Creek Upland Area, utilized

flake implements made of Upper Mississippian chert appear to be greatly overrepresented. Retouched flakes implements made of Upper Mississippian chert appear to be somewhat underrepresented.

3. For the CARP Upland study area utilized flakes made of Upper Mississippian chert appear to be only slightly overrepresented. Formalized bifaces made of Upper Mississippian chert appear to be slightly underrepresented.

In an attempt to further evaluate the two-way comparison of implement type groups and raw material type groups in a manner more in keeping with the partitioned chi-square analyses discussed above, data were converted to percentages across the implement type groupings. The results of the median polish analyses of these two-way comparisons expressed as percentages of implement type group by raw material type group are presented in Tables B.58-B.60.

The results of these analyses can be summarized as follows:

1. For the Bandy Creek Upland study area, utilized flake implements made of Upper Mississippian chert appear to be overrepresented. Utilized flake implements made of Fort Payne chert appear to be somewhat underrepresented.

Formalized bifaces made of Upper Mississippian chert appear to be underrepresented, while formalized bifaces made of Fort Payne appear to be somewhat overrepresented.

2. For the Bandy Creek Gorges study area formalized bifaces of Upper Mississippian chert appear to be underrepresented, while formalized bifaces made of Fort Payne or other chert appear to be somewhat overrepresented. Finally, the formalized bifaces of either quartz or chalcedony appear to be somewhat underrepresented.
3. For the CARP Upland Study area retouched flake implements made of Upper Mississippian chert appear to be the overrepresented. Retouched flake implements made of Fort Payne chert appear to be somewhat underrepresented. Formalized bifaces made of Upper Mississippian chert appear to be markedly underrepresented, while formalized bifaces of Fort Payne chert and other chert appear to be somewhat overrepresented. Finally, formalized bifaces of either quartz or chalcedony appear to be somewhat underrepresented.

The results from the two median polish analyses of the two-way comparisons of implement type groups and raw material type groups indicate the presence of a few consistent patterns among the three study areas. Utilized flake implements of Upper Mississippian chert are by far the most frequently occurring lithic implements in all three study areas. Formalized bifaces made of Upper Mississippian chert exhibit the lowest relative percentage for any of the implement types while those made of Fort Payne chert exhibit the highest relative percentage for all three study areas. Unlike the two Bandy Creek study areas, the formalized bifaces made of Upper Mississippian chert show a relatively low frequency of occurrence for the CARP study area. For both Bandy Creek study areas the frequency of retouched flake implements is low compared to the other implements produced on Upper Mississippian chert. In the CARP Upland study area the frequency of retouched flakes on Upper Mississippian chert is not low and relative percentage of these implements is high.

As with the partitioned chi-square analysis the results of the median polish analyses indicate that differential selection of raw material or curation was taking place prehistorically within the study areas. The patterning exhibited by the utilized flakes as well as the retouched flakes appear to exhibit patterning indicative of a more local procurement pattern with discard immediately or shortly after manufacture and use. The formalized bifaces, on the other hand, exhibit patterning more indicative of non-local procurement and curation with discard occurring sometime after manufacture, use and repeated recycling. The differences in the patterning exhibited by the CARP study area in contrast with the Bandy Creek Study areas might well be a function of distance from raw material sources, a factor which would be expected to affect both selection and curation activities.

Simultaneous Analysis of Reduction Sequence and Formal Implement Variability for Study Area Sites.

The implement to debitage and flake implement to bifacial implement ratios for the sites within the study areas are presented in Tables B.61-B.62. Before discussing the interpretation of these ratios it should be noted that there appear to be a couple of biasing factors involved. First, samples from sites where subsurface samples were obtained through excavation generally appear to have markedly lower implement to debitage ratios than do sites with only surface samples. As can be seen in Table B.61, surface samples from sites where both subsurface and surface samples were recovered tend to exhibit higher implement to debitage ratios than the combined samples. It is possible that both a surface to subsurface size effect (cf. Baker 1978) and a sample size effect (cf. Jones et al. 1983, Kintigh 1984) are involved. These or other factors may also have an effect on the flake implement to biface ratios where there are generally higher flake implement to biface ratios for excavated as opposed to surface collected sites. But the potential biasing effects in this second case do not appear as likely since surface samples from excavated sites when viewed separately generally appear to be fairly consistent with the combined sample figures. Given these caveats, an attempt will be made to develop interpretations which can be considered likely to reflect cultural behavior as opposed to site formation processes or data recovery.

The only clear patterns emerging from the inspection of implement to debitage ratios relates to low implement to debitage ratios. Sites (40ST73, 40ST152, 40ST164, 40MO59), at which only Middle Woodland components were identified, tend to have relatively lower implement to debitage ratios than other sites.

Two sites (40ST79 and 40ST80), from which only Early Archaic diagnostics were recovered, also have fairly low implement to debitage ratios. The other sites with Early Archaic components generally tend to exhibit higher ratios, but most are also multi-component sites. The differences in sites 40ST79 and 40ST80 from the other sites with Early Archaic components may be related to their location on the crest of a narrow ridge in the north central portion of the Bandy Creek Upland study area. Activities at such a location may have been more specialized and focused. The visibility such a ridge would afford of the movements of game between the adjacent gorge and upland surface suggests hunting activities as a probable focus.

One excavated site (40ST76), from which no diagnostic artifacts were recovered has an anomalously low implement to debitage ratio. Why this particular site should have such a low ratio is unclear.

There are several sites (40MO68, 40ST72, 40ST74, 40ST77, 40ST78, 40MO53, 40MO54, 40MO57, 40MO58, 40MO62, 40MO71, 40MO73, 40MO74, 40MO75), most of which contained no or few diagnostic artifacts were recovered which have relatively high implement to debitage ratios. As indicated above, small sample size may be affecting these ratios. It should be noted, however, that these sites generally tended to have much lower artifact densities relative to site area, whereas the sites with the low implement to debitage ratios tend to have much higher densities. It is possible that the low artifact densities may be a reflection of site function, and these sites are possibly special purpose sites at which little manufacture or maintenance activities took place. Site 40ST74, from which both Early and Late Archaic diagnostics were recovered is of particular note relative to this possibility. The site consists of a relatively light density surface scatter located around the head of a large gully.

Movement between gorge and upland areas is generally difficult if not impossible due to vertical to overhanging bluffs. This gully and a few similar gullies offer the only easy access between the gorges and uplands. Such a site location would thus be a logical place for monitoring game movements as well as staging forays into the gorge. Specialized activities, such as butchering, might possibility be expected at such a locality.

In general, the sites from all three study areas have relatively high implement to debitage ratios, particularly when compared to what one would expect at a quarry or workshop site. The lack of any systematic relationships between implement and debitage ratios for the study areas or cultural periods generally tends to support the expectation that modally the assemblages from the study areas should be considered curated and maintained. This does not, however, preclude the existence of specific assemblages reflecting expedient organization.

No clear patterns can be easily distinguished in the flake implement to biface ratios but certain patterns are suggested. Sites from the CARP study area tend to not have either particularly high or low flake implement to biface ratios. The other two study areas both contain sites which have relatively high and low ratios. The reason for this is unclear, but might possibly be related to the increased number of bifacial implements noted in the CARP study area.

Some sites (40ST165, 40ST71, 40ST67, and 40ST73) have what might be considered anomalously high flake implement to biface ratios. This might possibly be an indication of more expedient technological organization, but might also indicate curation in that bifaces were not being discarded. A couple of sites (40ST74 and 40ST161) have fairly low flake implement to biface ratios. These sites might be locations where discard related to retooling was a dominant activity. In general, there is no clear patterning in flake implement to biface ratios relative to specific cultural periods.

Simultaneous Analysis of Raw Material, Technological, and Formal Implement Variability for a Sample of Selected Sites

Tables B.63-B.64 present the data used in the two information statistic-based cluster analyses. These tables present the sets of 10 and 14 variables from the sample of 15 sites used in the analyses. Cumulative percentage ogives of the variables for the 15 sites are presented in Figures A.22-A.29. The results of the most interpretable solutions for the two cluster analyses are presented in Tables B.65-B.66.

In the analysis of the 15 site sample employing 10 variables, (Table B.65) a four cluster solution accounts for 59% of the variation present in the data. The four site types produced by this solution indicate the following:

1. The first cluster contains sites (40ST70, 40ST71, and 40ST80), dominated by a high percentage of retouched flake implements and a relatively low percentage of bifacial implements. A relatively high percentage of Fort Payne chert as a raw material along with a low percentage of cortex covered platforms are also indicated for these sites.
2. The second cluster contains a single site (40ST152) with a relatively high percentage of bifacial implements, a relatively high percentage of quartz and chalcedony, with relatively low percentages of Upper Mississippian and other cherts, low percentages of cortex covered and plain platforms, and a high percentage of peaked, point plain, and faceted platforms.
3. Cluster three contains five sites (40ST74,

40ST161, 40MO52, 40MO55, 40MO56) with low percentages of utilized flake implements but high percentages of bifacial implements. Relatively low percentages of Upper Mississippian chert with relatively high percentages of Fort Payne and other chert are also indicated for these sites. Finally, these sites exhibit slightly lower percentages of peaked, point plain, and faceted platforms than the other sites.

4. Cluster four contains six sites (40ST73, 40ST76, 40ST79, 40ST164, 40ST165, and 40MO59) with high percentages of utilized flake implements and low percentages of bifacial implements. The sites also contain high percentages of Upper Mississippian chert and low percentages of Fort Payne chert and slightly lower percentages of quartz and chalcedony. Slightly higher percentages of cortex covered platforms are also indicated for these sites.

In the analysis of the 15 sites employing 14 variables, Table B.66 indicates that a five cluster solution accounts for 78% of the variation contained in the data. The five clusters of site types produced by this solution indicate the following:

1. Cluster one contains five sites (40ST73, 40ST76, 40ST152, 40ST164, and 40MO59) which can be assigned to the Middle Woodland Period. These sites contain relatively low percentages of retouched flake implements, relatively high percentages of Upper Mississippian chert with relatively low percentages of Fort Payne and other chert.
2. Cluster two contains five sites (40ST70, 40ST71, 40ST79, 40ST80, and 40MO52) which have strongest associations with the Early Archaic Period. These sites contain relatively high percentages of retouched flake implements, and other chert along with relatively low percentages of cortex covered platforms.
3. The third cluster contains a single site (40ST74), with an apparently strong association with the Early Woodland-Late Archaic cultural periods. This site contains no utilized flake implements but a relatively high percentage of bifacial implements, along with a relatively high percentage of other chert.
4. The fourth cluster also contains only a single site (40ST165) which is associated with the Mississippian-Late Woodland cultural periods.

This site has a high percentage of flake implements along with a low percentage of bifacial implements. The site also exhibits a relatively high percentage of Upper Mississippian chert and a relatively low percentage of plain platforms.

5. The fifth cluster contains three sites (40ST161, 40MO55, 40MO56) with mixed components indicating no clear patterns of association with specific cultural periods. These sites exhibit relatively low percentages of utilized flake implements along with relatively high percentages of bifaces. The sites also exhibit high percentages of Fort Payne chert, relatively high percentages of plain platforms, and relatively low percentages of peaked, point plain, and faceted platforms.

The results of these cluster analyses suggests several patterns. First of all, the first cluster of the four cluster solution for the 10 variable analysis, can be interpreted as sites with assemblages that exhibit a moderate position in the continuum between expedience and curation. Such an interpretation is suggested by the high percentage of retouched flakes, but the low percentage of bifaces. An interpretation of curation is slightly favored over expedience by the relatively high percentage of Fort Payne chert which is present. This percentage of Fort Payne also indicates that the groups utilizing these sites previously occupied localities to the west of the Cumberland Plateau and that a strategy of embedded procurement was followed. The lack of cortex covered platforms suggests that early stages of lithic reduction were not generally carried out at these sites. Finally, this patterning is apparently indicative of an Early Archaic behavioral system, since all the sites in this cluster are associated with the Early Archaic Period.

The second of the four cluster solution for the 10 variable analysis, contains a Middle Woodland site with an anomalous pattern from most of the other Middle Woodland sites in the study areas. The high percentage of bifacial implements suggests curatorial behavior. The raw material utilization on the other hand suggests that the groups utilizing this site had previously occupied an area with abundant quartz and chalcedony. The relative percentages of various platform preparation suggest that late stage production and maintenance were predominant activities at this site.

The third of the four cluster solution for 10 variables, can be interpreted as sites exhibiting a relatively great amount of curation, as evidenced by the high percentage of bifacial implements. The high percentages of Fort Payne and other cherts indicate the utilization of areas to the west and probably the east of the Cumberland Plateau prior to utilization of these sites. The relatively low percentage of late stage debitage indicates that late stages of lithic production and maintenance activities were not the dominant activities at these sites. Finally, the cultural associations of the sites in this cluster indicate that this pattern occurred throughout prehistory in this portion of the Cumberland Plateau.

The fourth of the four cluster solution for 10 variables suggests that the assemblages at certain sites associated with all major cultural periods were more expediently organized. Support for this interpretation can be found in the high percentage of utilized flake implements and the low percentage of bifaces. The high percentages of Upper Mississippian chert and low percentages of Fort Payne chert along with quartz and chalcedony support this interpretation. The relatively high percentage of early stage debitage suggests that early production was an important activity at these sites.

In the second analysis, cultural affiliation was added to the other three sources of variability in an attempt to force the generation of culturally relevant patterning. The first of the five cluster solution for

14 variables produced such patterning for the Middle Woodland Period. In general, Middle Woodland sites appear to contain relatively low percentages of retouched flake implements, thus suggesting a slight tendency toward expedient as opposed to curatorial organization. The relatively high percentages of Upper Mississippian and relatively low percentages of Fort Payne and other cherts suggest a more limited range of seasonal movement prior to utilization of these areas. These suggestions favor a pattern of Middle Woodland utilization consisting of seasonal hunting forays from permanent settlements elsewhere on the plateau or immediately adjacent to the plateau.

The second cluster of the five cluster solution for 14 variables characterizes a general pattern for the Early Archaic Period. The relatively high percentage of retouched flake implements in these sites suggests curation as opposed to expedient technological organization for the assemblages from these sites. The relatively low percentage of early stage debitage suggests that early stages of lithic production were not important activities at this site. These results support an interpretation of staged production as a general pattern of activity for the Early Archaic.

The third cluster of the five cluster solution for 14 variables indicates that at least one site associated with the Early Woodland or Late Archaic Period exhibits a fairly unique pattern. Curation is strongly suggested for this site's assemblage based on high percentages of both bifacial implements and raw material from other chert sources.

The fourth cluster of the five cluster solution for 14 variables identifies a unique pattern associated with the Late Woodland or Mississippian Period. Expedient technological organization is strongly suggested for this site, by its high percentage of flake implements and its low percentage of bifacial implements. This interpretation is supported by the relatively high percentage of Mississippian chert utilization. The low percentage of plain platforms suggests that late stage production and maintenance were dominant activities at this site during the Late Woodland or Mississippian occupations.

Finally, the fifth cluster of the five cluster solution for 14 variables suggests a pattern that might be associated with several different cultural periods. The low percentage of utilized flakes, the high percentage of bifaces, and the high percentage of Fort Payne chert all suggest curated assemblages. The relatively high percentage of debitage with plain platforms and the relatively low percentage of peaked, point plain, and faceted platforms, suggest that the middle or secondary stages of lithic reduction dominated the activities at these sites with late stage reduction and maintenance being of minor concern.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study has attempted to discover settlement related patterning in the prehistoric lithic remains from three study areas in the uplands of the Big South Fork River drainage. Based on the patterns discovered, several conclusions can be drawn concerning the nature of prehistoric adaptive behavior within and across the study areas. Specific behaviors for which conclusions can be drawn concern lithic raw material utilization, lithic implement manufacture and use, and technological organization. This chapter begins with a section that briefly summarizes the modal synchronic patterning exhibited by the three study areas and the behavioral inferences that can be drawn from these patterns. The next section summarizes the diachronic patterning for specific cultural periods and related behavioral inferences. The final section briefly reviews the methodological and theoretical considerations of this study and makes recommendations for future research.

Synchronic Patterning of Man-Land Relationships Within and Between the Study Areas

All three study areas exhibit a similar pattern of lithic raw material utilization when viewed holistically. Upper Mississippian chert is by far the most abundant raw material present in all three areas. Fort Payne chert is the second most common raw material. For the Bandy Creek Upland and CARP Upland study areas all other cherts comprise the third most common raw material with quartz and chalcedony being the least common. The relative abundance of quartz and chalcedony, as compared to all other cherts, is reversed for the Bandy Creek Gorges area.

Even though there is a general similarity in the patterning of raw material utilization across the areas there does appear to be a statistically significant difference in the distributions between the CARP Upland area and the Bandy Creek Upland study area. Reasons for such a difference can be seen in comparisons of the relative percentage of raw material types across the study areas.

The relative frequency of Upper Mississippian chert is highest in the Bandy Creek Study area and lowest in the CARP Upland study area. The reverse is true for Fort Payne chert. All other cherts exhibit the highest relative frequency in the CARP study area and lowest in the Bandy Creek Gorges study area. The relative frequency of quartz and chalcedony is somewhat higher in the Bandy Creek Gorges than in the other study areas, with the lowest exhibited by the CARP Upland study area.

If seasonal utilization and movement onto the Cumberland Plateau from adjacent regions is assumed to have occurred throughout prehistory, the general patterning in raw material utilization is not inconsistent with the expectation that embedded procurement was a dominant strategy. However, the possibility of direct procurement, particularly for the Bandy Creek Gorges area, cannot be totally ruled out.

The patterning in lithic raw material utilization generally indicates that all three study areas were utilized predominantly by peoples moving on to the Cumberland Plateau from the West. The CARP Upland area is the only study area with evidence suggesting limited movement from the East.

Finally, there are indications that certain raw materials may have been differentially selected for in the manufacture of specific kinds of implements, most notably those requiring high amounts of energy to manufacture and maintain. The patterning exhibited by comparisons of implements by raw material types for both the Bandy Creek and CARP Upland areas suggests that certain raw materials, particularly Fort Payne chert, were preferentially selected for the manufacture of bifacial implements and possibly retouched implements. Another possible explanation for the observed differences, to be discussed later, is the curation of certain implements.

As with the patterning in lithic raw material utilization, the patterning in lithic reduction appears similar when the three areas are viewed in a holistic fashion. General patterns of similarity are exhibited by the distributions of debitage size and expectations based on a normal distribution for the bivariate comparison of technologically sensitive indicators of reduction sequence technology.

In all three study areas over 75% of the debitage sorted through 0.64 cm (1/4 in.) mesh has a maximum dimension of less than or equal to 5/8 in. This pattern lends support to the expectation that the majority of debitage at the sites on the Cumberland Plateau should be small and have been produced by late reduction stage activities such as maintenance and resharpening. In spite of this apparent support, a full evaluation of the expectation is problematical since the small debitage categories (ie., 0.64 cm or 1/4 in.) for all three study areas is greatly underrepresented. This lack of small debitage is most likely due to biasing factors, such as biased collection methods and post depositional processes such as size sorting, but might also be a concrete archaeological pattern.

The bivariate characterization of the whole debitage from the study areas for platform configuration and percent dorsal cortex suggests that late stage lithic reduction was a primary behavioral activity for all three study areas. Even though this finding supports the expectation concerning late stage reduction there is sufficient early stage debitage in proportions greater than can be expected for a normal distribution. This suggests that staged biface production may have been the predominant modal strategy for the prehistoric groups occupying the Cumberland Plateau, particularly in the Bandy Creek and CARP Upland study areas. The pattern exhibited by the Bandy Gorges area is somewhat different than that of the other two study areas. The Bandy Gorges study area exhibits a pattern more in keeping with the expectation for an almost complete absence of any early or middle stage debitage. But like the other two study areas, the debitage patterning as a whole indicates that staged biface production was a probable modal strategy.

When the chipped stone implements from the three study areas are compared on the basis of the energy required for manufacture and maintenance, the two upland study areas exhibit similar patterning in the relative abundance of utilized flakes, retouched flake implements, and formalized bifacial implements.

The patterns exhibited by the two Bandy Creek study areas appear to be similar but not as similar as the two upland areas. Only the patterning exhibited by the CARP Upland area and the Bandy Greek Gorges area indicate the presence of statistically significant differences in patterning. In the Bandy Creek Gorges study area, over 60% of the chipped stone implements are utilized flakes, where as in the CARP Upland study area over 60% are formalized bifacial implements. The Bandy Creek Gorges area also contains the lowest frequency of retouched flake implements for the three study areas. Thus, when viewed modally, the technological organization of the Bandy Creek Gorges area appears to have required much less energy, which suggests expedience and the CARP Upland area appears to have required relatively more energy, suggesting curation. The Bandy Creek Upland area exhibits a modal pattern which suggests an intermediate position on a continuum between expedience and curation.

When the chipped stone implements are broken down by raw material and evaluated relative to the probability distribution for raw material supplied by the debitage, selection, curation or both appear to be the modal patterns present within the Bandy Creek Upland area and the CARP Upland area, but only for certain implements. In the Bandy Creek Upland area, formalized bifaces and possibly retouched flakes appear to have experienced differential raw material selection or curation. In the CARP Upland area this pattern is suggested primarily for formalized bifacial implements. The utilized flakes and generally the retouched flakes from all three areas tend to conform to the model set by the debitage and therefore suggest that selection and possibly curation were not major factors considered in the modal behavioral patterns related to these implements. This latter pattern appears to hold for the bifaces from the Bandy Creek Gorges area as well. The retouched flake implements from the Bandy Creek Gorge and CARP study areas appear to have experienced differential selection but probably not curation since the retouched flake implements from both areas are manufactured solely on Upper Mississippian chert.

Additional support for the suggested patterning in curation and selection, is exhibited by the percentage representation of raw material utilized for bifaces across the study areas. For example, the relative percentage of bifaces made of Upper Mississippian chert is underrepresented for all three study areas. Accordingly, for the Bandy Creek Upland study area and the CARP Upland study area the relative percentage of Fort Payne chert is overrepresented. These findings indicate that bifacial implements are almost solely responsible for the nature of the modal patterning in technological organization observed in the study areas.

Masked within the general modal patterning of raw material utilization, manufacture and maintenance behavior, and technological organization for the study areas when viewed as aggregates, is the variability exhibited by individual sites. In the following section this individual site will be discussed within the cultural and environmental contexts in which variability occurs.

Diachronic Patterning of Man-land Relationships for the Study Areas

The interpretations of cultural chronology for the sites located within the study areas are based almost entirely on the morphological similarity of projectile points/knives with well defined temporal stylistic types from other areas of the Southeast. Some additional chronological interpretations are based on the presence of temporal-stylistic ceramic types. All interpretations of culture history for the study areas should, therefore, be viewed as general probability statements and not definitive interpretations.

The two cultural periods exhibiting the greatest abundance of diagnostic cultural material from the study areas are the Early Archaic and Middle Woodland Periods.

These two cultural periods also exhibit the highest percentages of what appear to be single component sites or sites probably containing cultural material from a single cultural period. All other cultural periods are represented by only a few single components sites or in mixed component sites. Accordingly, the majority of the interpretations of culture history in this section will deal with sites from the Early Archaic and Middle Woodland Periods.

The most general diachronic patterns for the study areas relate to what appears to be differential utilization of the study areas through time. These general patterns discussed through time from earliest to latest are as follows. There is no evidence of any occupation of the study areas during the Paleoindian Period. The Early Archaic appears to be the earliest and one of the most intensive periods of occupation and utilization. The Early Archaic groups occupied both the upland areas and the gorges, but based on the frequency of sites within the study areas there appears to have been a preference for the uplands as opposed to the gorges during this period.

The greater relative frequency of relatively exotic cherts indicates that the groups utilizing the study areas during the Early Archaic exploited fairly extensive and relatively distant areas before occupying the study areas. This pattern suggests that the seasonal movements of Early Archaic groups were broad ranging.

There does not appear to be any systematic patterning in implement to debitage ratios for sites attributable to the Early Archaic Period. These findings are consistent with expectations for curated and maintained assemblages and suggest that for the Early Archaic as a whole technological organization tends to have been more maintained and curated than expedient.

Only one site, 40MO53, located in the CARP Upland study area, produced any diagnostic artifacts which might possibly be associated with the Middle Archaic Period. Even the single projectile point/knife from this site is similar in form to projectile points dating from the transition from Early Archaic to Middle Archaic. The almost total lack of Middle Archaic artifacts is consistent with previous studies on the Cumberland Plateau (ie. Pace and Kline 1976, Ferguson and Pace 1981b, and Ferguson et al. 1986). As indicated by Ferguson et al. (1986) this lack of Middle Archaic occupation on the Cumberland Plateau probably relates in someway to a period of climatic warming during the mid-Holocene. Desiccation of the upland areas and accompanying stress on the biotic communities are probable, but certainly not the only factors involved in this hiatus in the cultural record.

The portion of the Cumberland Plateau represented by the study areas appears to have been utilized in at least a limited fashion during the Late Archaic and Early Woodland Periods. Based on the frequency of diagnostic artifacts, the intensity of utilization appears to have been less than for the Early Archaic and subsequent Middle Woodland Periods.

Site 40ST74, located in the Bandy Creek Upland study area, is the only site that produced any diagnostic cultural material that could be strongly associated with the Late Archaic/Early Woodland. The high percentage of bifacial implements, and low percentage of utilized flakes, along with a high percentage of chert from relatively exotic sources, indicates that this site was utilized by groups whose technological organization was highly curated. The abundance of relatively exotic raw material at site 40ST74 also suggests that Late Archaic/ Early Woodland groups possessed a similar pattern of broad regional exploitation and seasonal movement to that exhibited by Early Archaic groups. The high implement to debitage ratio and low flake implement to biface ratio also strongly suggest that this site was a location of specialized activities.

The frequency of diagnostic artifacts attributable to the Middle Woodland Period indicates that the study areas were intensively utilized during this period. The only period with a greater frequency of diagnostic artifacts is the Early Archaic. The frequency of diagnostic artifacts also indicates that Middle Woodland groups occupied both the upland areas and the gorges, but based on the frequency of sites within the study areas there appears to have been a slight preference for the gorges as opposed to the uplands during this period.

Sites clearly associated with the Middle Woodland Period consistently exhibit low implement to debitage ratios. This pattern suggests a high incidence of manufacture and maintenance activities and the technological organization of the groups exploiting these sites may not have been as highly curated and maintained as Archaic groups.

Another consistent pattern for Middle Woodland sites is the presence of a high percentage of the most readily available and abundant raw material, Upper Mississippian chert. With the exception of site 40ST152, Middle Woodland sites exhibit the highest percentages of Upper Mississippian chert of any of the major sites in the study areas. This pattern suggests that the Middle Woodland groups utilizing the study areas did not come from as far away as the Archaic groups and that the area they exploited was much more restricted. This patterning is also consistent with the interpretation that the during the Middle Woodland the Cumberland Plateau was utilized for short seasonal forays by groups permanently or semi-permanently settled in the riverine zones of adjacent regions, such as the Eastern Highland Rim.

In spite of the consistent patterning indicated above, Middle Woodland sites exhibit a fair amount of variability in the patterning of reduction sequence technology, and chipped stone implement usage. For example, some sites (40MO59, 40ST73 and 40ST76) exhibit debitage patterns indicating early and middle reduction sequence stages. Other Middle Woodland sites (40ST164 and 40ST152) exhibit debitage patterning suggesting late stage reduction.

Even though all Middle Woodland sites have a generally low percentage of retouched flake implements there is a great deal of variation in the relative percentage of utilized flakes and formalized bifaces. If the relative percentage of chipped stone implement types present can be assumed to be an indicator of technological organization, this patterning suggests that Middle Woodland groups may have been technologically organized in both expedient and curated manner, with differences possibly relating to the season of utilization, or activities undertaken within a particular situation.

Based on the frequency of diagnostic artifacts, the intensity of utilization in the Late Woodland/ Mississippian Period appears to have been greater than the Late Archaic/Early Woodland Period but less than the Early Archaic and subsequent Middle Woodland Periods. Based on the sample of sites from the study areas there does not appear to have been a preference for uplands over gorges.

Only one site (40ST165) is clearly associated with the Late Woodland/Mississippian Period. This site's anomalously high flake implement to biface ratio and high percentage of utilized flakes suggest utilization by groups which were technologically organized in a expedient fashion. This site also has some of the strongest evidence for late stage lithic reduction of any of the sites in the study areas. The predominance of Upper Mississippian chert suggests a pattern of raw material exploitation similar to that indicated for the Middle Woodland.

Recommendations for Future Research

In conclusion, this study has demonstrated how understanding of past cultural behavior can be achieved through a systematic search for patterning in the archaeological record. This study has shown how such a systematic search for patterns in cultural information can be particularly useful in areas where very little is known concerning past cultural behavior.

It is hoped that future research will seek to refine both the methodologies and theoretical basis of the pattern recognition strategies used in this study. Accordingly, the remainder of this chapter will discuss specific areas where methodological and theoretical problems were encountered and make suggestions for future investigations.

A few problems were observed in association with the use of debitage as indicators of reduction sequence technology and manufacturing trajectories. The first of these problems concerns the use of debitage size distributions as an indicator of lithic reduction stages. Experimentally derived models, such as those derived by Stahle et al. (1982), are apparently most useful as heuristics. Such factors as recovery technique, post depositional size sorting, along with variation in workability from one raw material type to another, all tend to create problems with the use of the models with archaeologically derived data. Artifact breakage due to post depositional processes, such as unintentional thermal alteration (cf. Whyte 1984, 1985) all tend to complicate the usefulness of debitage as an indicator of lithic reduction activities. It is recommended that future investigations should attempt to utilize only whole flakes in analyses which are sensitive to the biasing effects of breakage, as was done in this study. In future research particular attention should be given developing pattern recognition strategies which avoid these and other related problems.

In this study assumptions were made concerning the amount of energy expended in the manufacture, maintenance, and use of particular implements. It was also assumed that such energy expenditure would serve as a reliable indicator of technological organization on a continuum from expedience to curation. This study suggests that retouched flakes might not differ markedly enough from utilized flakes relative to energy requirements to assume that they occupy an intermediate position along the assumed continuum. Future research should continue to pursue the relationship of energy expenditure to technological organization but seek to find better ways to characterize the energy indicators.

One possibility for further study of technological organization would involve more detailed functional characterization of the lithic implements directed toward the delineation of organizational and systemic variability. Such characterization has been used effectively by Davis (1986) to elucidate settlement related, land use patterning. Davis (1986) utilized the more detailed functional characterization as the basis for defining types of gear (see Binford 1980) and types of activity loci. Such an approach might provide a more effective means of delineating settlement related technological organization than those attempted in this study.

As indicated in the first chapter, it was hoped that it would be possible to investigate other study areas, in addition to the three that were investigated, in an attempt to more fully delineate the settlement activity which took place prehistorically on this portion of the Cumberland Plateau. Even though this was not feasible for the present investigations, it is still hoped that future investigations will be able to compare the findings of this study with those from other contrasting areas.

The cluster type sampling strategy, focusing on the through investigation of contrasting areas, suggested by this study appears to be more suited to the environmental variability, particularly the topographic variability present on the Cumberland Plateau than a probabilistic strategy. As Wilson and Finch (1980) discovered, a probabilistic sampling strategy on the Cumberland Plateau can be extremely difficult to effectively implement and interpret.

In conclusion, a logical next step in extending the interpretive power of the culturally directed pattern recognition strategies outlined in the present study would be an attempt to more fully integrate the cultural and biophysical information relating to settlement behavior and cultural adaptation. Such research would logically be directed toward the investigation of the relationships between the cultural information gained in this and similar studies and the information gained in the analysis of the biophysical environment at appropriate temporal and spatial scales. It is only when such relationships are fully understood for local and situational contexts that meaningful inferences about settlement behavior will be possible within and across regions such as the Cumberland Plateau.

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APPENDICES

APPENDIX A

Figures

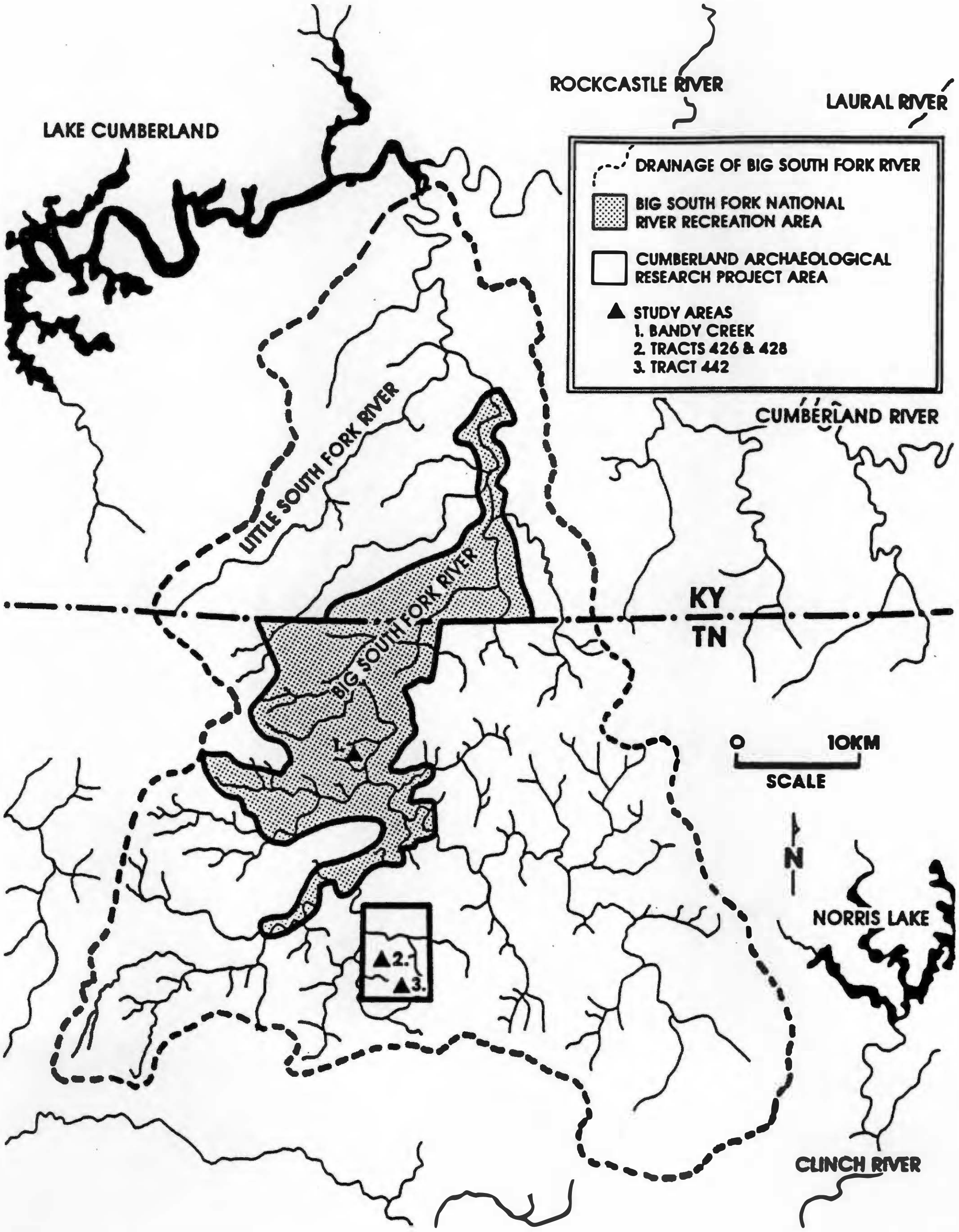


Figure A.1. Location of Study Areas within the Big South Fork Drainage of the Cumberland Plateau.

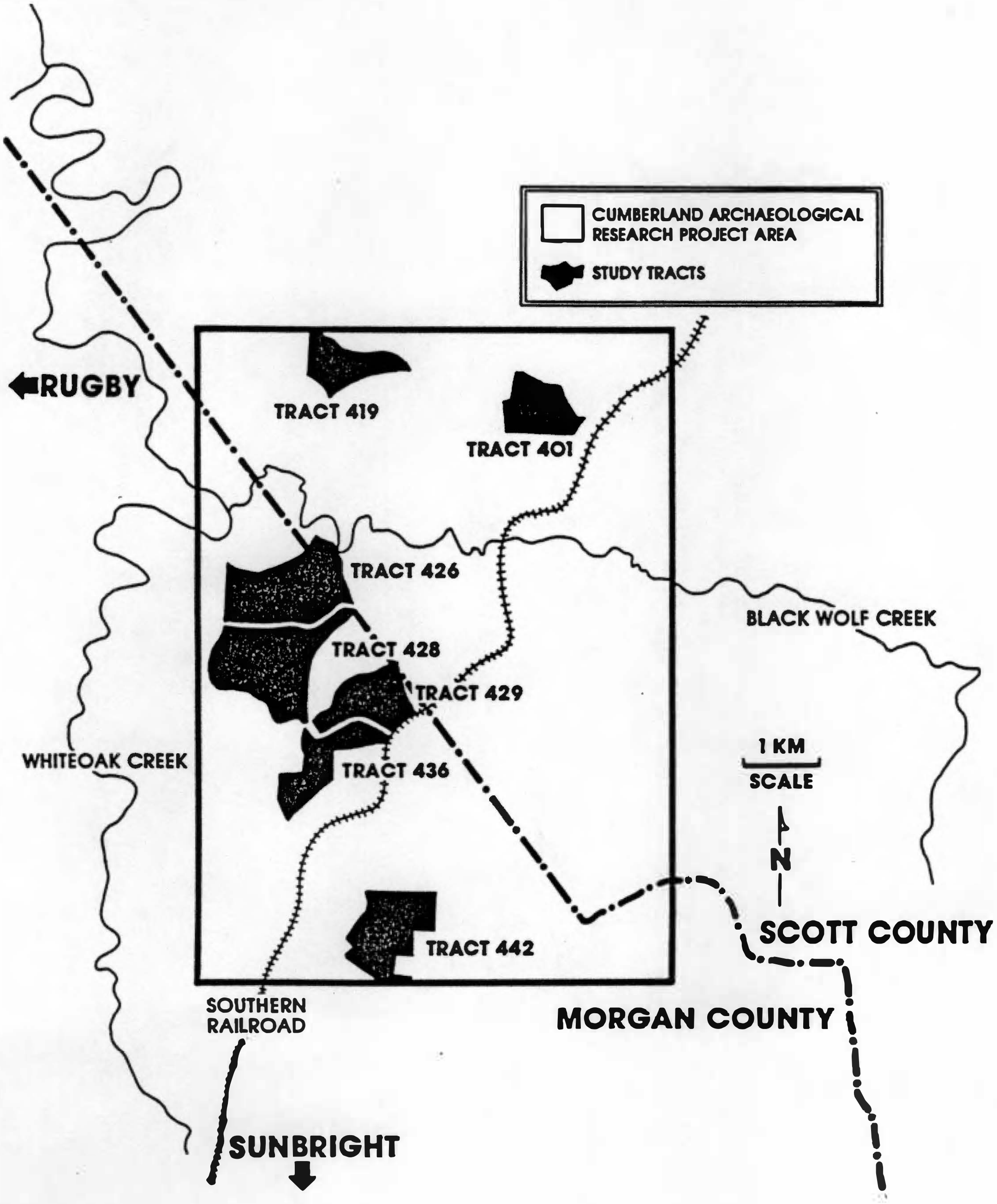


Figure A.2. Map of Cumberland Archaeological Research Project Study Areas.

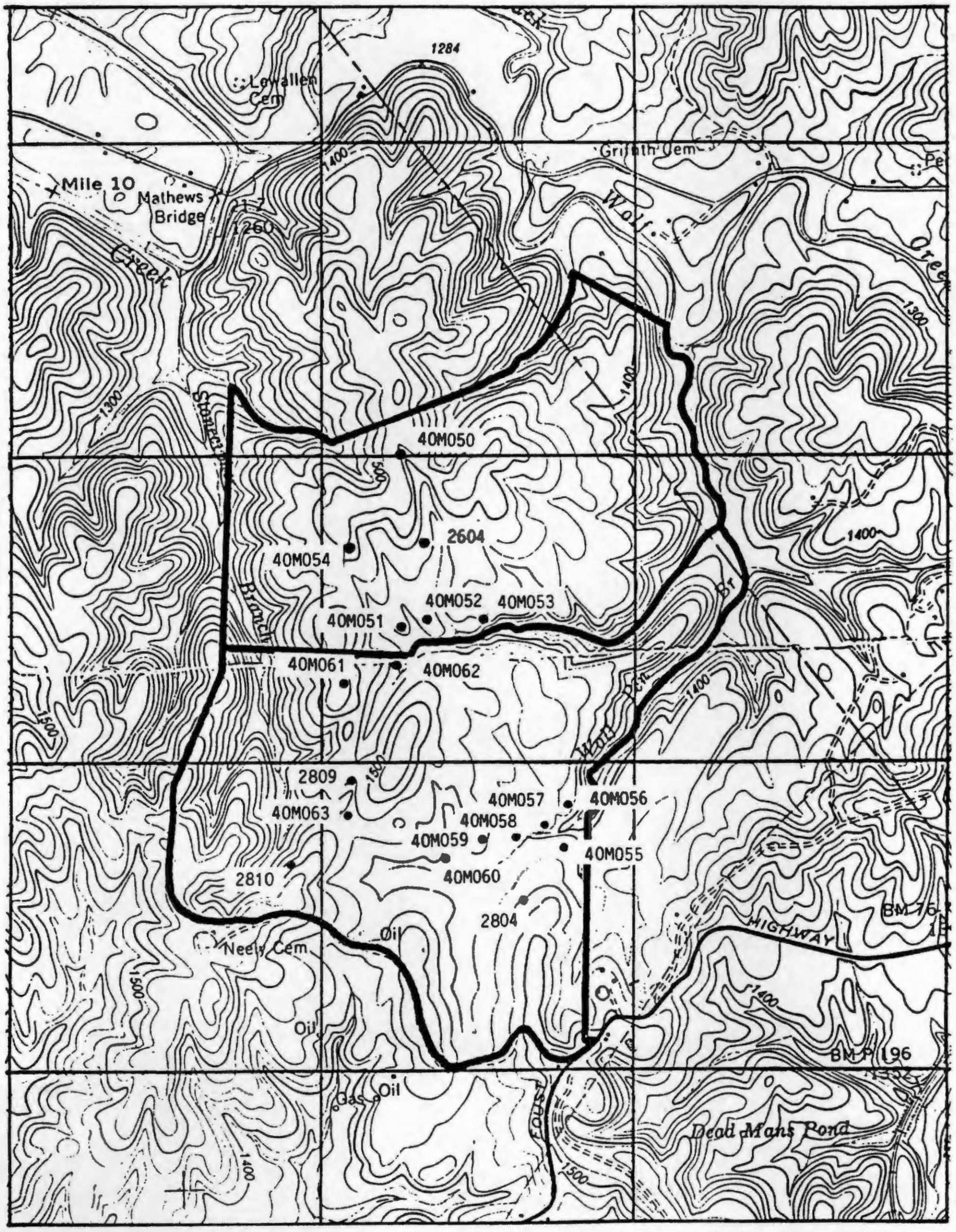


Figure A.3. Map of Hiwassee Land Company Tracts 426 and 428 Showing Prehistoric Site Locations.

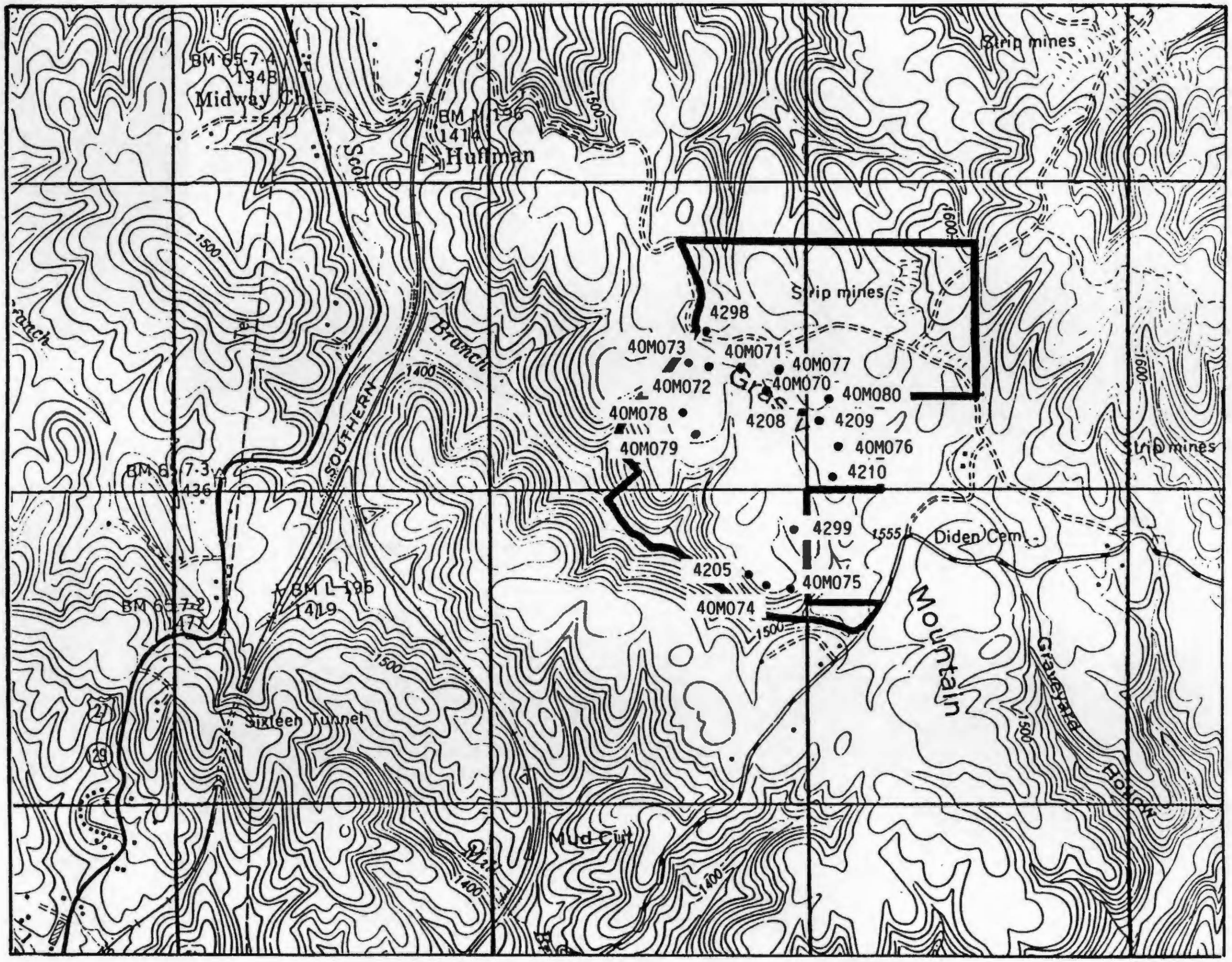


Figure A.4. Map of Hiwassee Land Company Tract 442 Showing Prehistoric Site Locations.

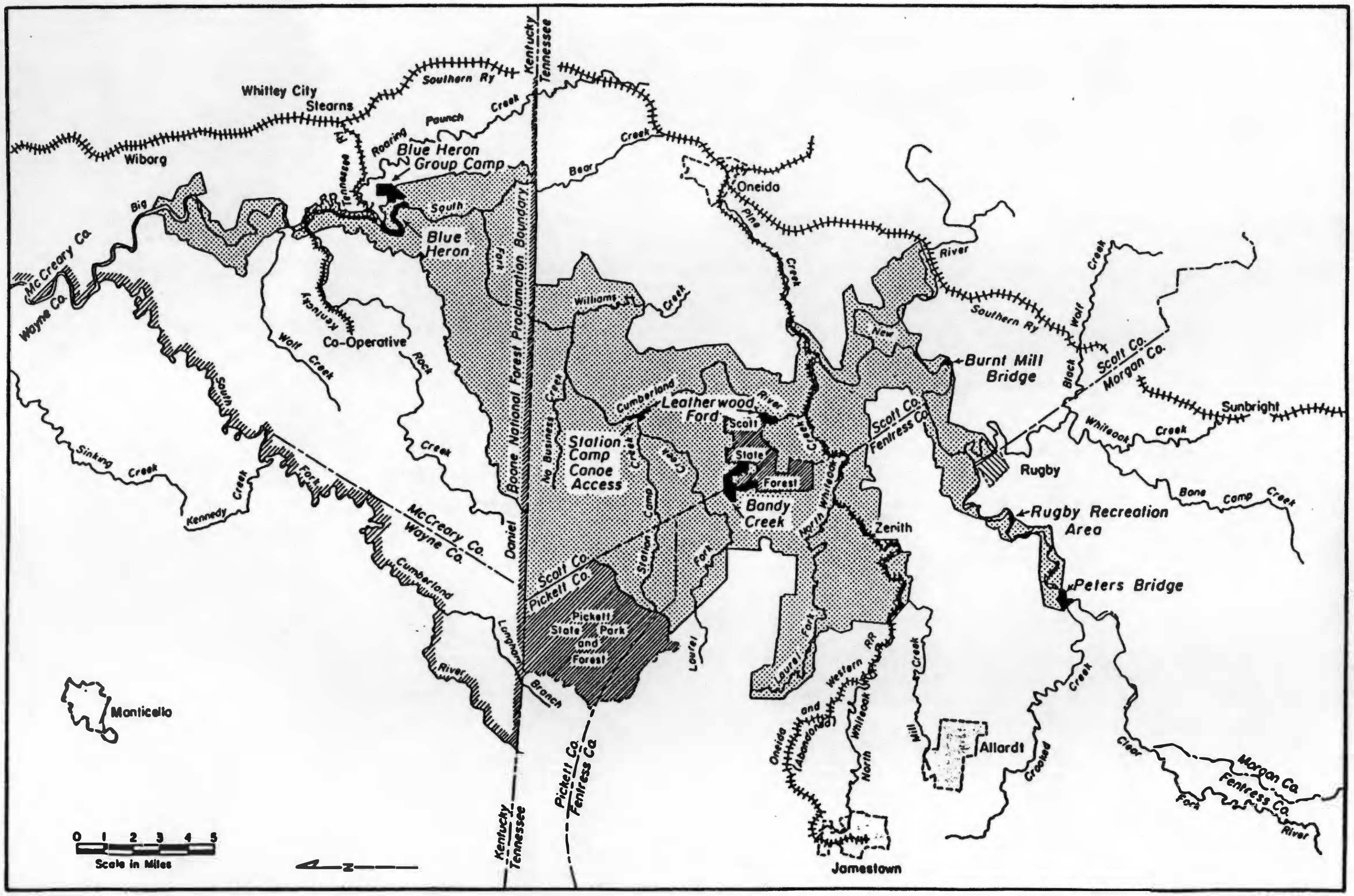


Figure A.5. Big South Fork Project Area.

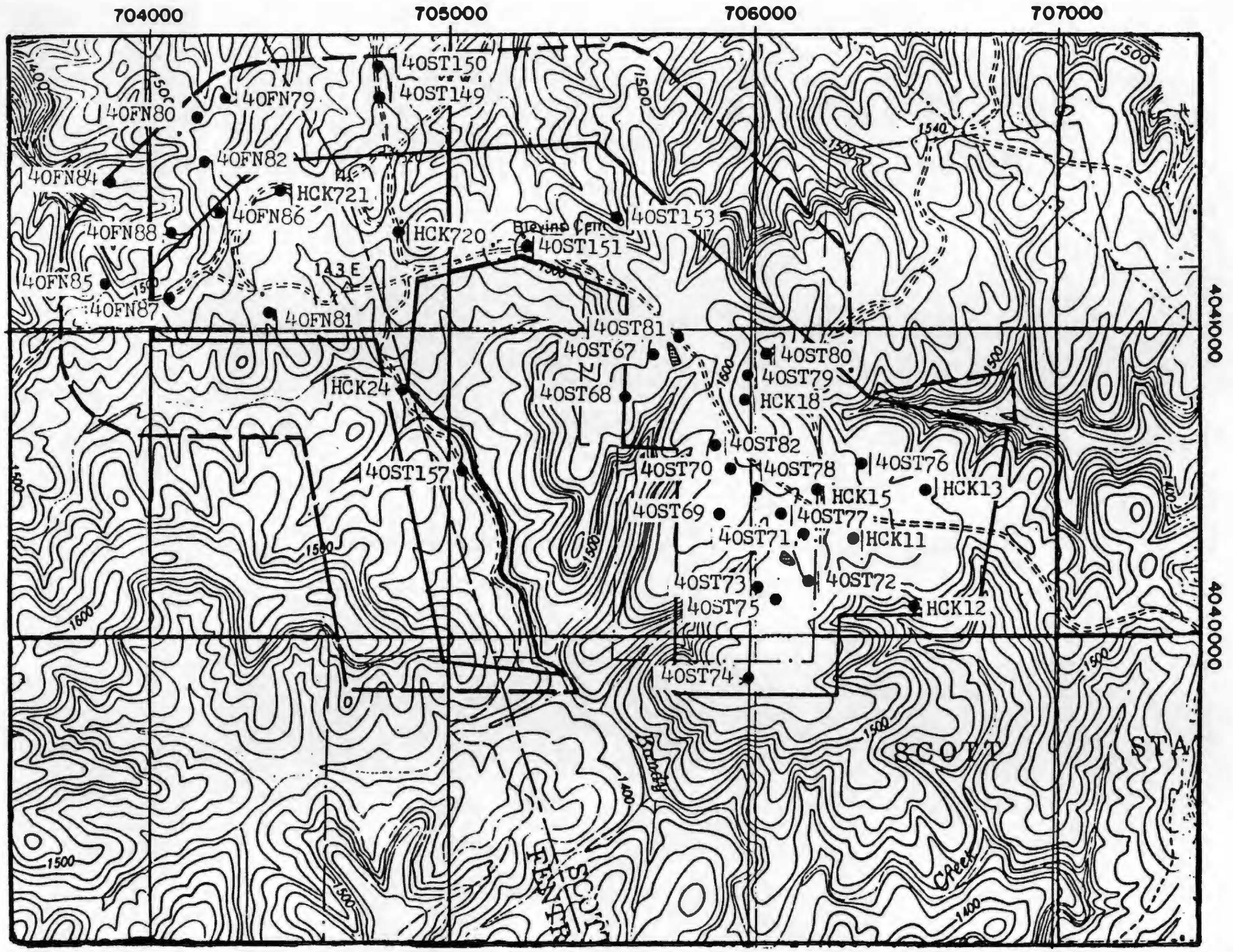


Figure A.6. Map of Bandy Creek Development Area Showing Locations of Prehistoric Open Sites.

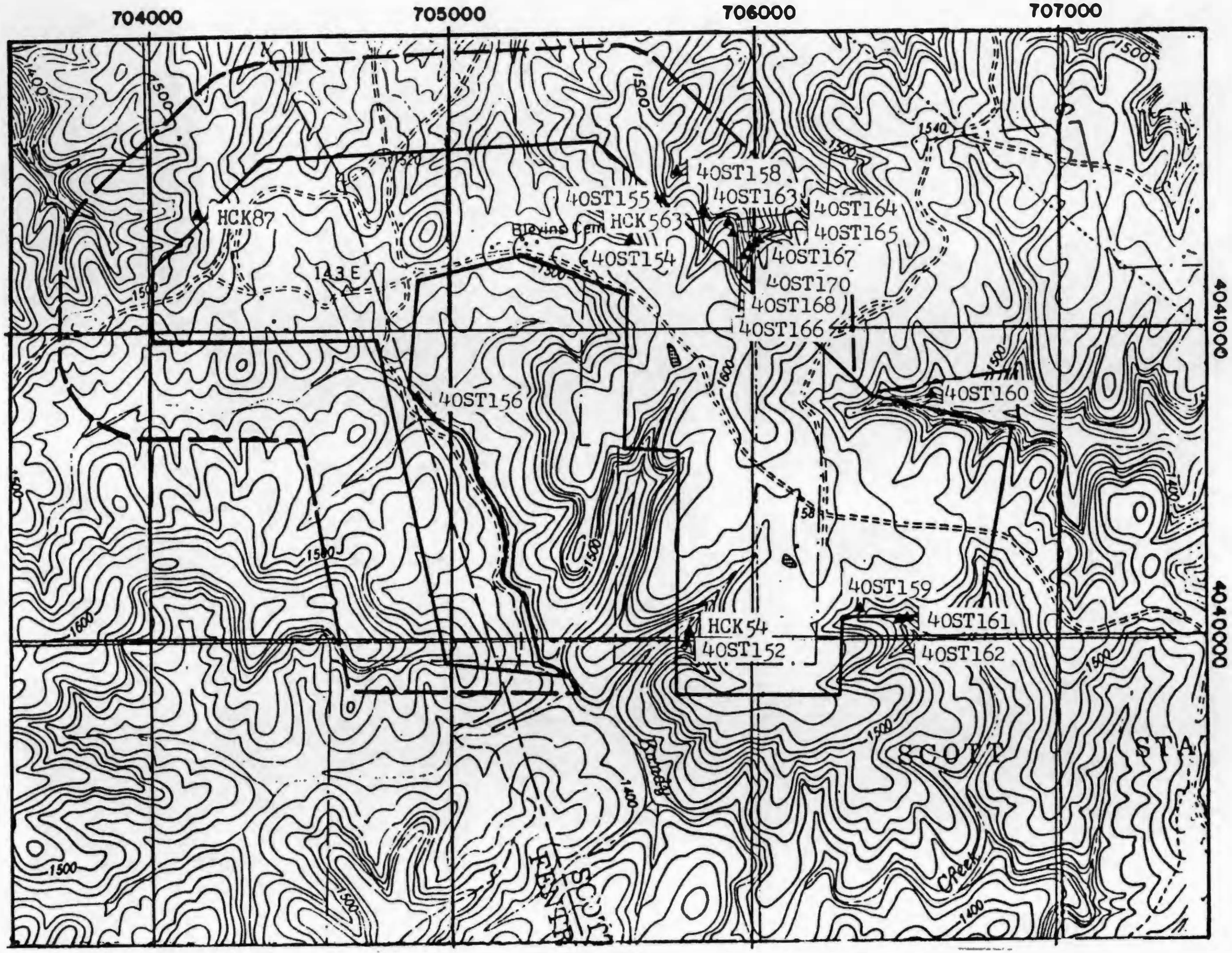


Figure A.7. Map of Bandy Creek Development Area Showing Locations of Prehistoric Rockshelter Sites.

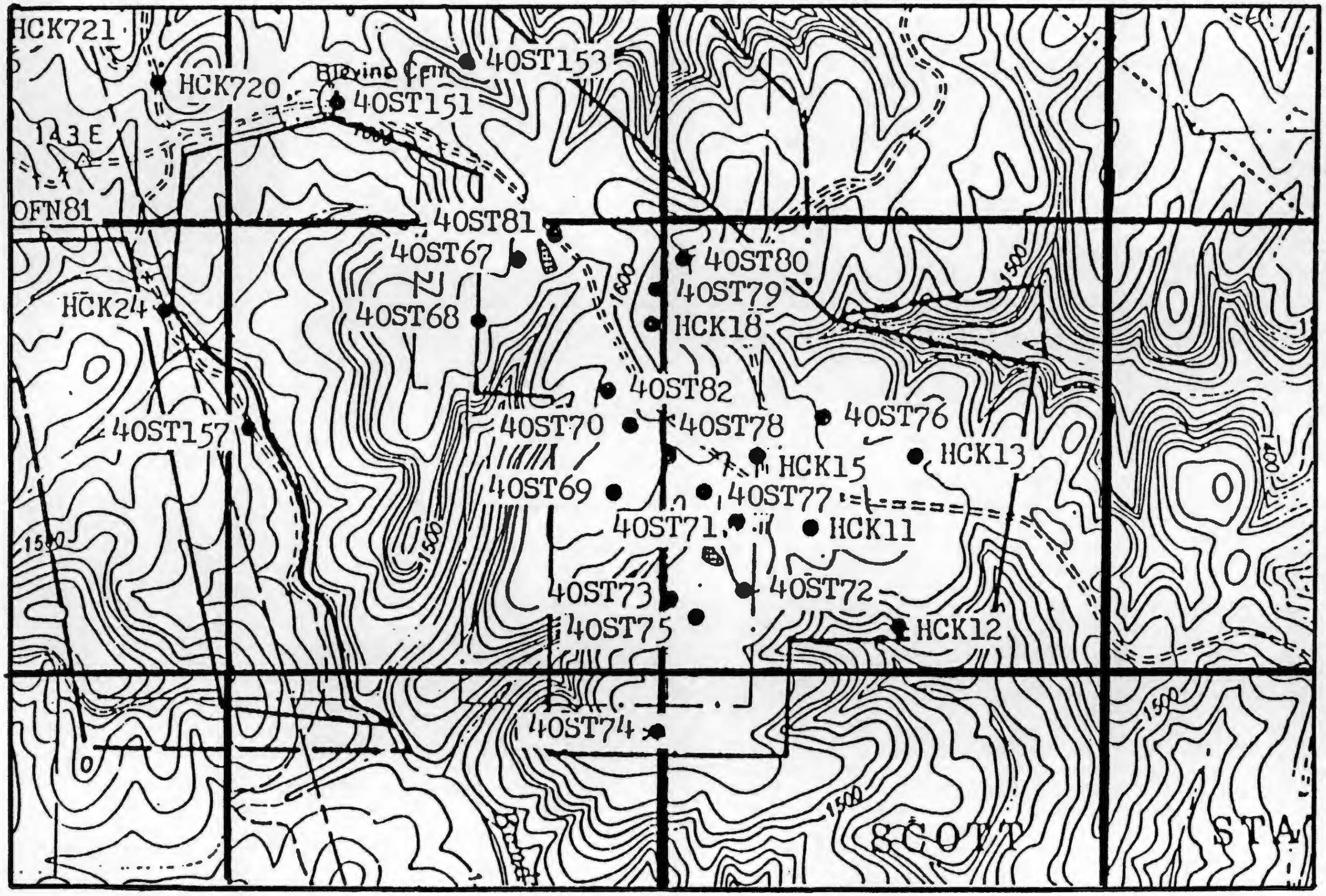
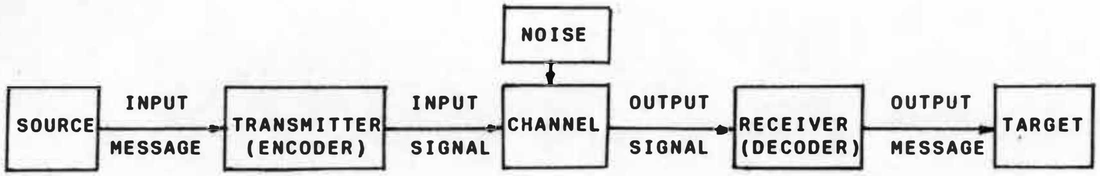


Figure A.8. Bandy Creek Upland Study Area.



(Adapted from figures by Shannon (1948) and Sampson (1976)).

COMPONENTS OF MODEL DEFINED IN CULTURAL TERMS

SOURCE:	Adaptive cultural behavior. The generation of cultural messages from a finite set of possible cultural messages or message ensemble with a hypothetically definable probability distribution.
TRANSMITTER:	Material cultural remains. The reduction of adaptive cultural behavior to material cultural remains through depositional site formation processes. (eg. artifacts with specific attributes; assemblages with specific artifacts)
CHANNEL:	Archaeological contexts. The preservation of artifacts within site, area, and regional contexts.
NOISE:	Extraneous information. The disruption of the signal by post depositional processes and differential preservation.
RECEIVER:	Material cultural data. The observed or perceived information based on artifactual evidence and its contexts acquired through the application of pattern recognition strategies.
TARGET:	Cultural behavioral patterning. The interpretation of the patterning in past adaptive cultural behavior based on the archaeological data.
MESSAGES:	Cultural information.
SIGNALS:	Information properties of the material cultural remains. (i.e. specific and contextual attributes; see Clarke 1968)

Figure A.9. Model of Archaeological Inquiry as Communication.

<table>
<tr><td colspan="3"></td><td colspan="3">Burrville, TN 7.5' Quadrangle</td><td colspan="2">Barthell, KY 7.5' Quadrangle</td></tr>
<tr><td colspan="3">System and Series</td><td colspan="3">Formation</td><td colspan="2">Formation and Member</td></tr>
<tr><td colspan="3">Quaternary</td><td colspan="3" rowspan="3"></td><td colspan="2">Alluvium</td></tr>
<tr><td colspan="3">Tertiary and Quaternary</td><td colspan="2">Colluvial Blocks</td></tr>
<tr><td rowspan="13">Carboniferous</td><td rowspan="13">Pennsylvanian</td><td>Middle Pennsylvania</td><td colspan="2">Breathitt Formation</td></tr>
<tr><td rowspan="12">Lower Pennsylvanian</td><td rowspan="4">Crooked Fork Group</td><td colspan="2">Coalfield Sandstone</td><td rowspan="12">Lee Formation</td><td>Corbin (?) Sandstone Member</td></tr>
<tr><td colspan="2">Burnt Mill Shale</td><td>Undifferentiated Shale and Siltstone</td></tr>
<tr><td colspan="2">Crossville Sandstone</td><td>Undifferentiated Sandstone</td></tr>
<tr><td colspan="2">Dorton Shale</td><td>Undifferentiated Shale and Siltstone</td></tr>
<tr><td rowspan="5">Crab Orchard Mtn. Group</td><td colspan="2" rowspan="3">Rockcastle Conglomerate *</td><td>Undifferentiated Sandstone</td></tr>
<tr><td>Undifferentiated Shale *</td></tr>
<tr><td>Rockcastle Conglomerate Member</td></tr>
<tr><td>Vander, Newton and Whitwell Formations *</td><td rowspan="6">Fentress Formation</td><td rowspan="5">Beatyville Shale Member *</td></tr>
<tr><td>Sawanee Conglomerate</td></tr>
<tr><td rowspan="3">Gizzard Group</td><td>Signal Point Sandstone *</td></tr>
<tr><td>Warren Point Sandstone</td></tr>
<tr><td>Racoon Mtn. Formation *</td></tr>
<tr><td></td><td>Mississippian</td><td>Upper Mississippian</td><td colspan="2">Pennington Formation</td><td colspan="2">Pennington Formation</td></tr>
<tr><td colspan="8">* Indicates the Presence of Coal Bed.</td></tr>
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Figure A.10. Geologic Cross Sections of the Barthell and Burrville 7 1/2 Min. Quadrangles.

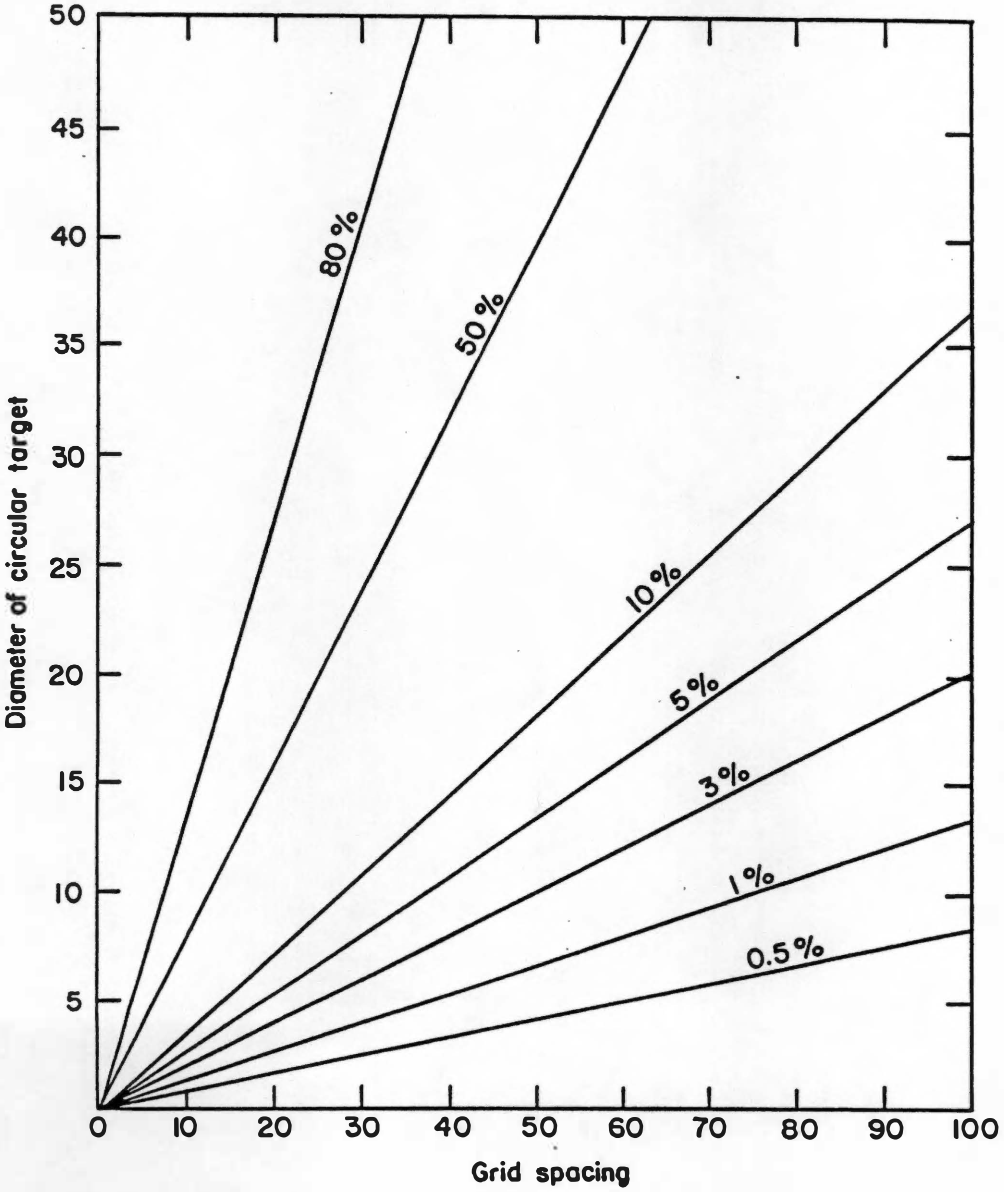

Figure A.11. Probabilities for Detection of Circular Targets with Grid Spacing of Various Sizes (After Koch and Link 1971).

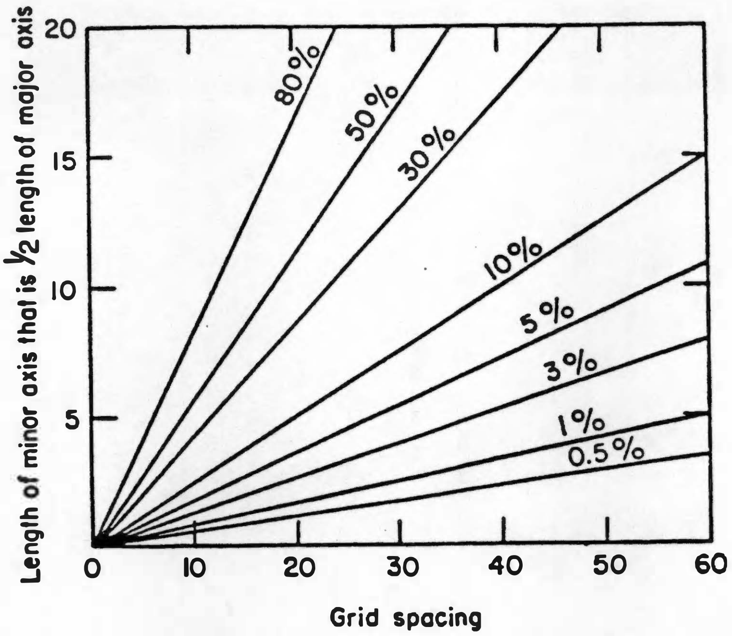

Figure A.12. Probabilities for Detection of Elliptical Targets with Minor Axis 1/2 the Length of the Major Axis with Grid Spacings of Various Sizes (After Koch and Link 1971).

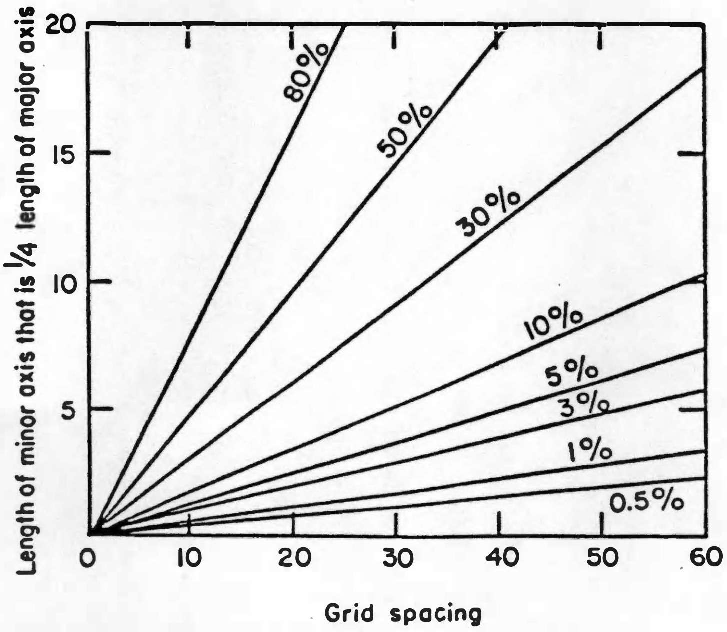

Figure A.13. Probabilities for Detection of Elliptical Targets with Minor Axis 1/4 the Length of the Major Axis with Grid Spacings of Various Sizes (After Koch and Link 1971).

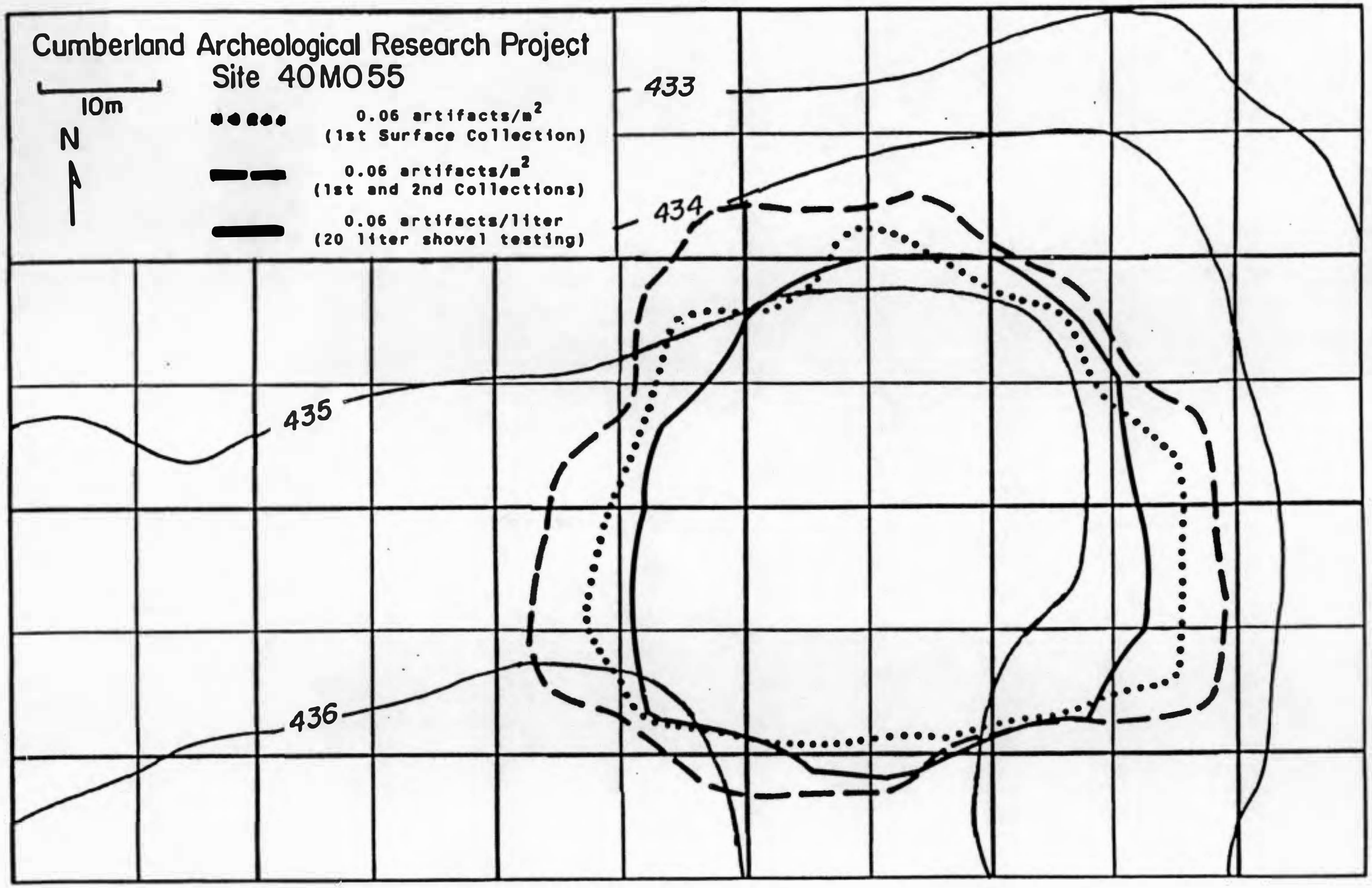

Figure A.14. Isodensity Map of Artifact Density Distributions at Site 40MO55 for Shovel Testing and Controlled Surface Collection.

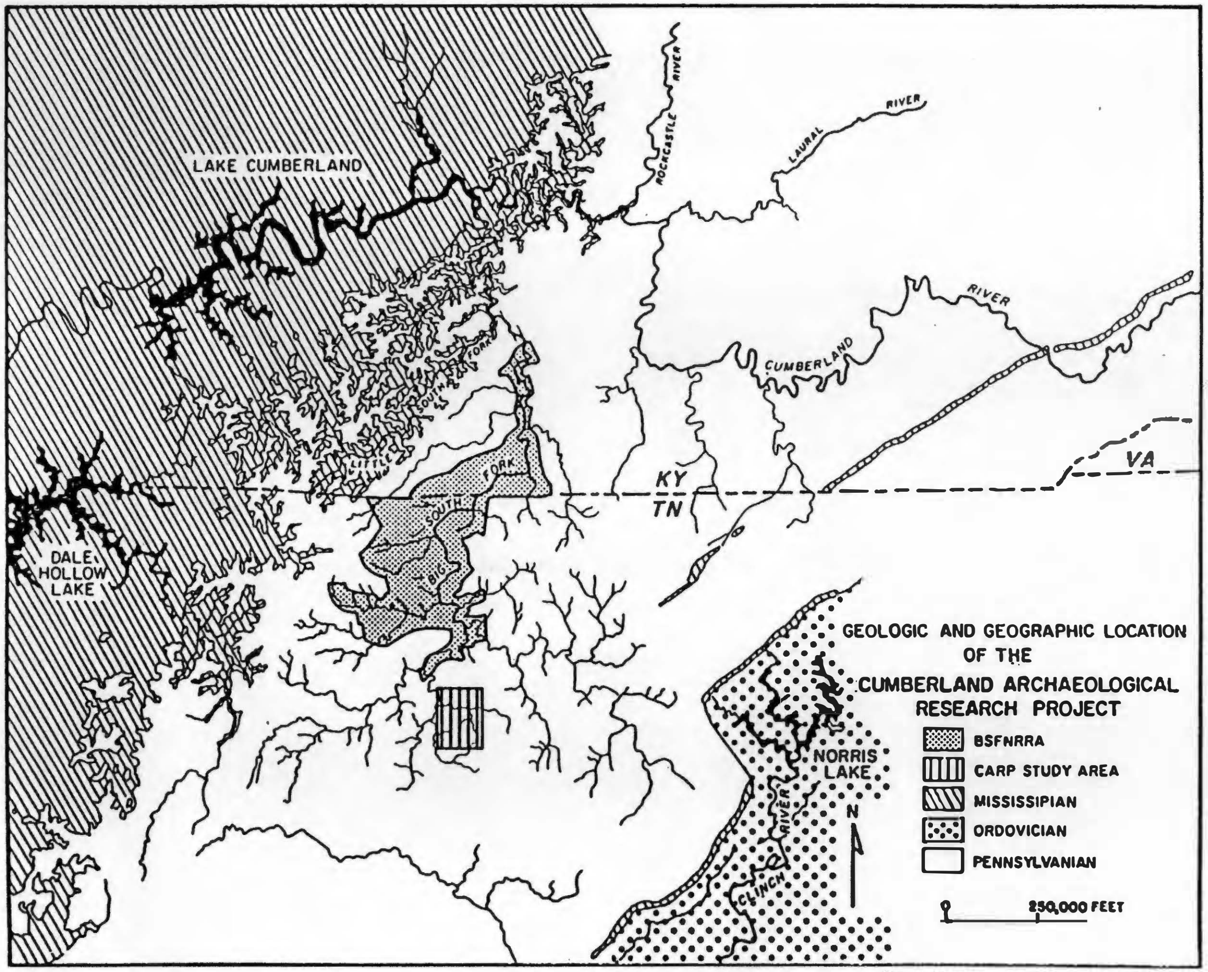

Figure A.15. Geologic And Geographic Location of the Big South Fork of the Cumberland River.

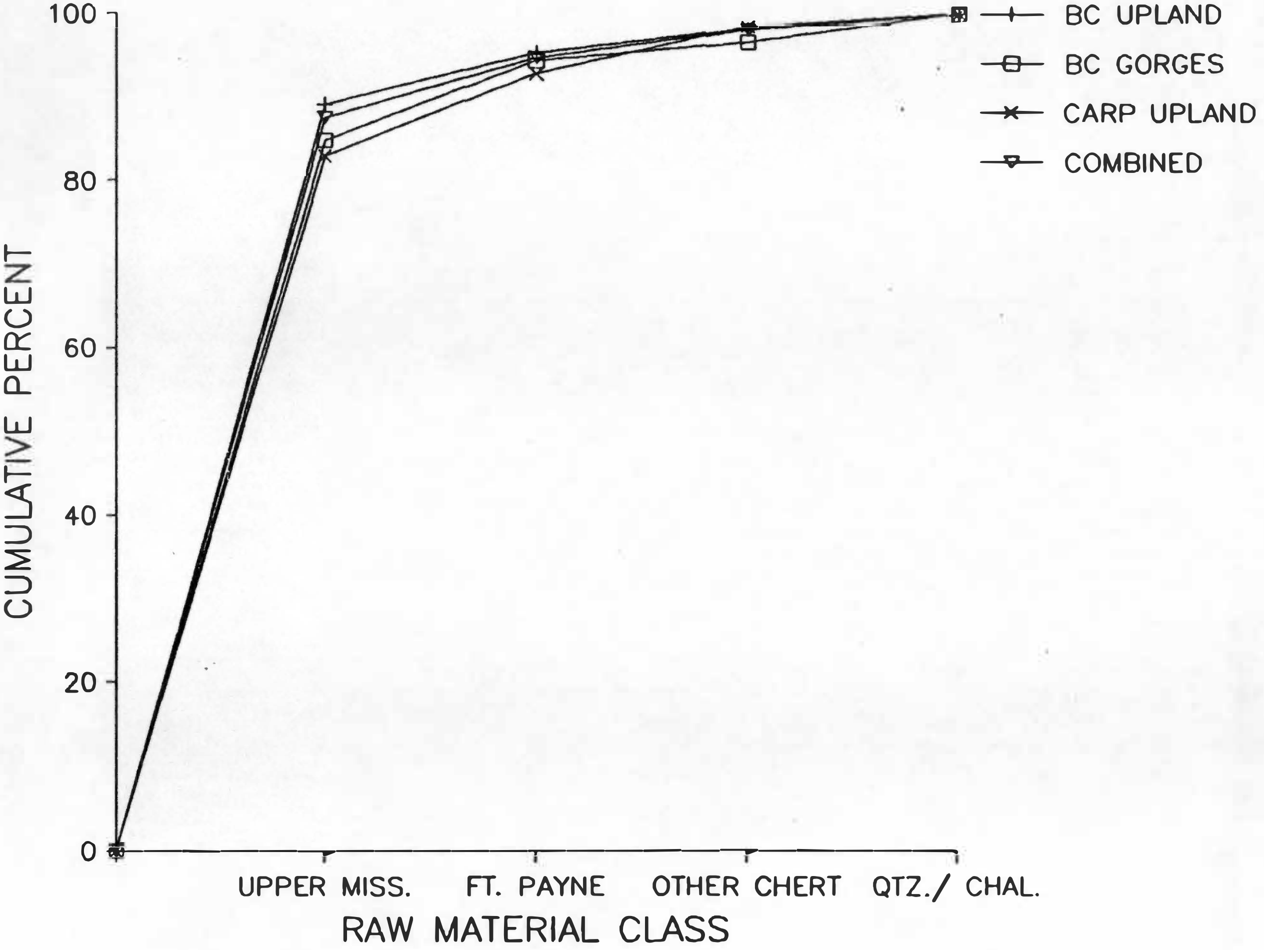

Figure A.16. Cumulative Percentage Ogives for Raw Material by Study Area.

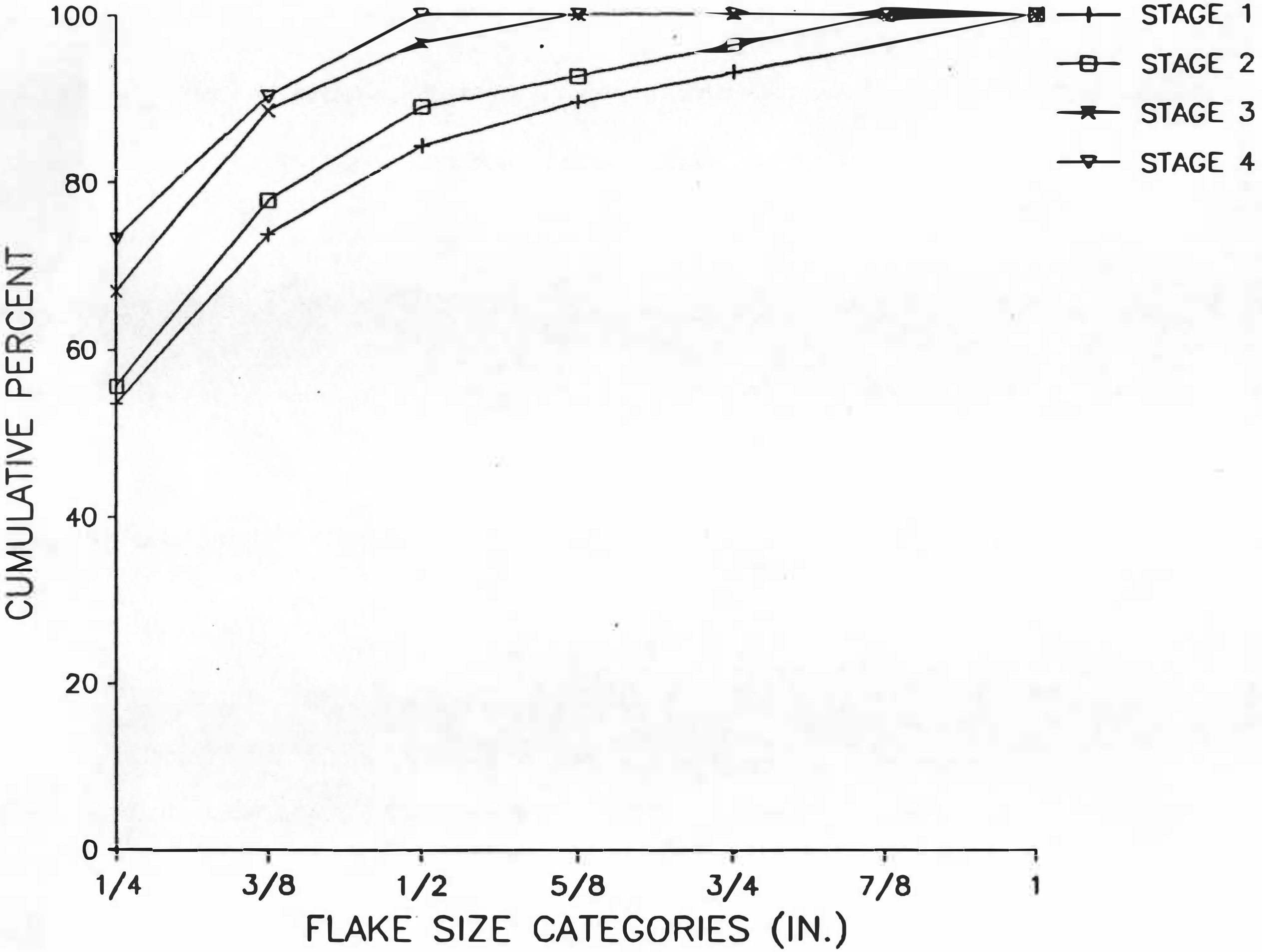

Figure A.17. Cumulative Percentage Ogives of Flake Size for Results of Stahle and Dunn (1982).

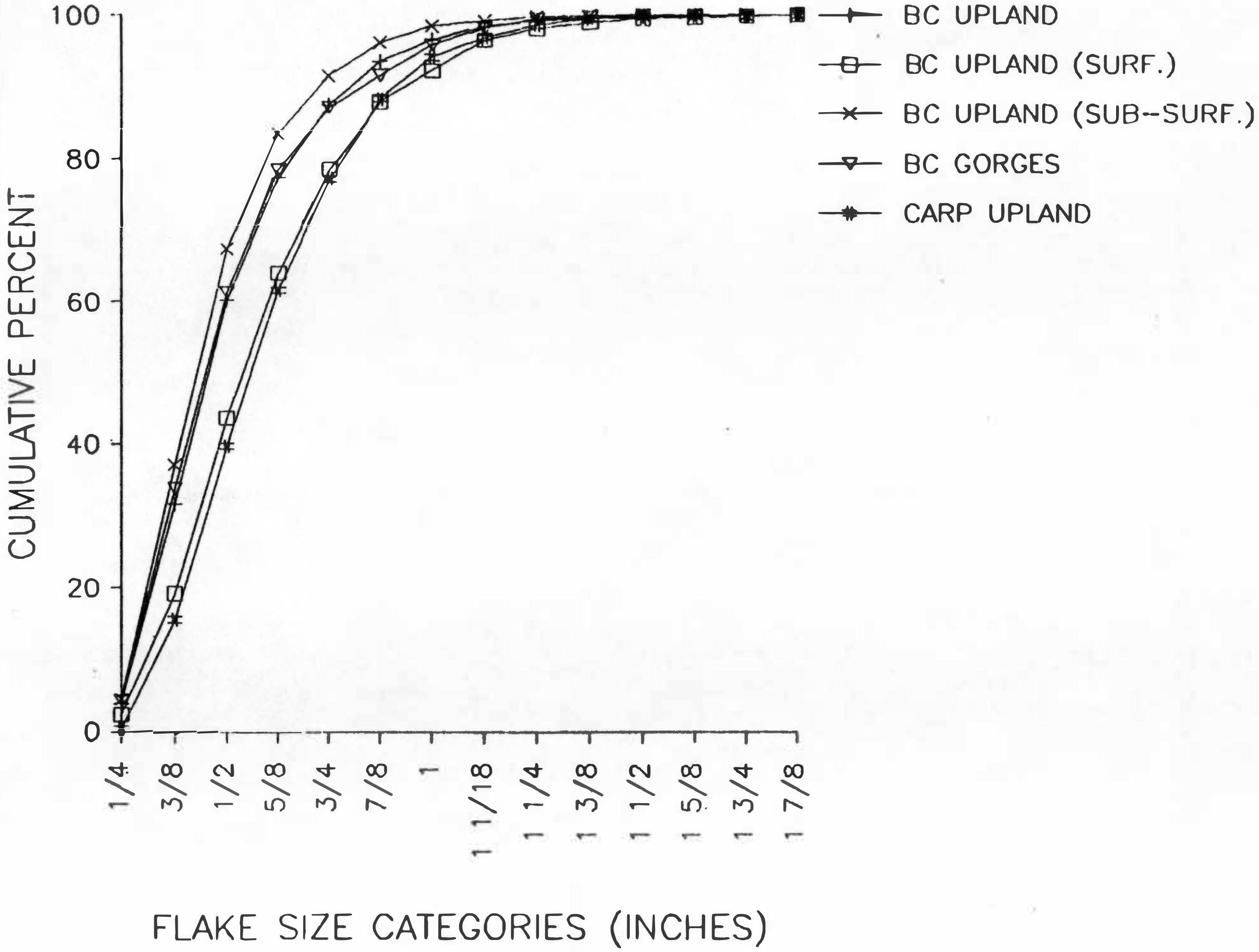

Figure A.18. Cumulative Percentage Ogives of Flake Size by Study Area.

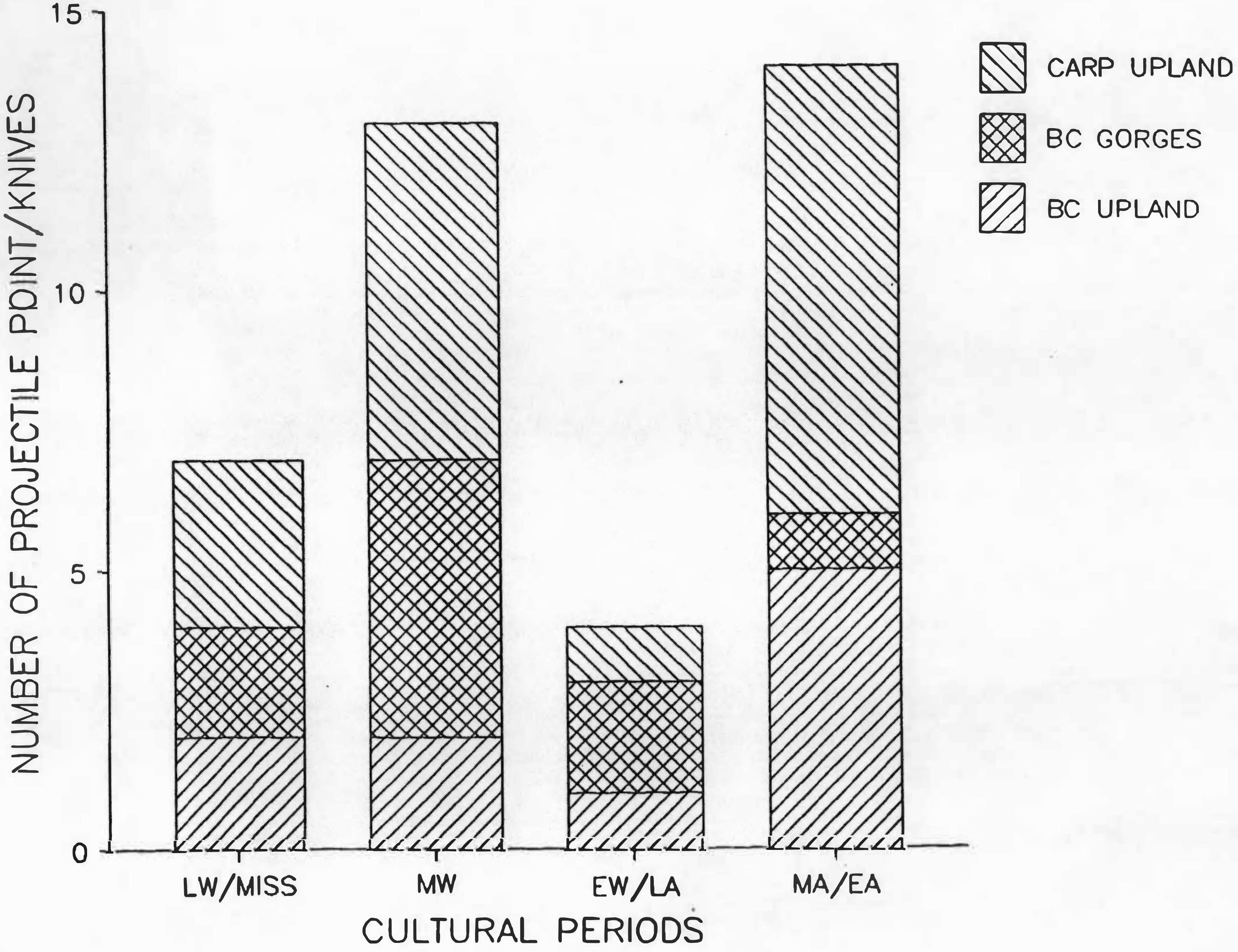

Figure A.19. Relative Frequency Histograms of Diagnostic Projectile Points/Knives for Cultural Periods by Study Area.

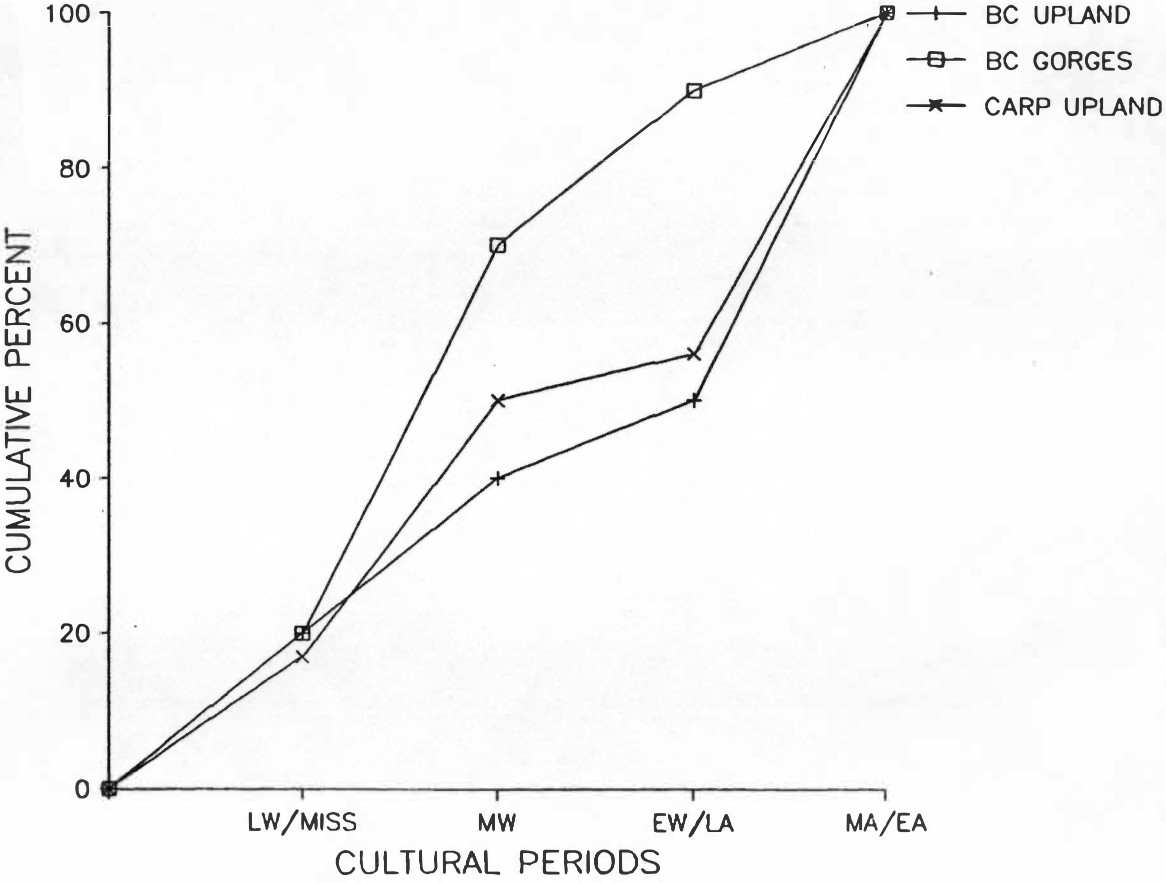

Figure A.20. Cumulative Percentage Ogives for Cultural Periods by Study Area.

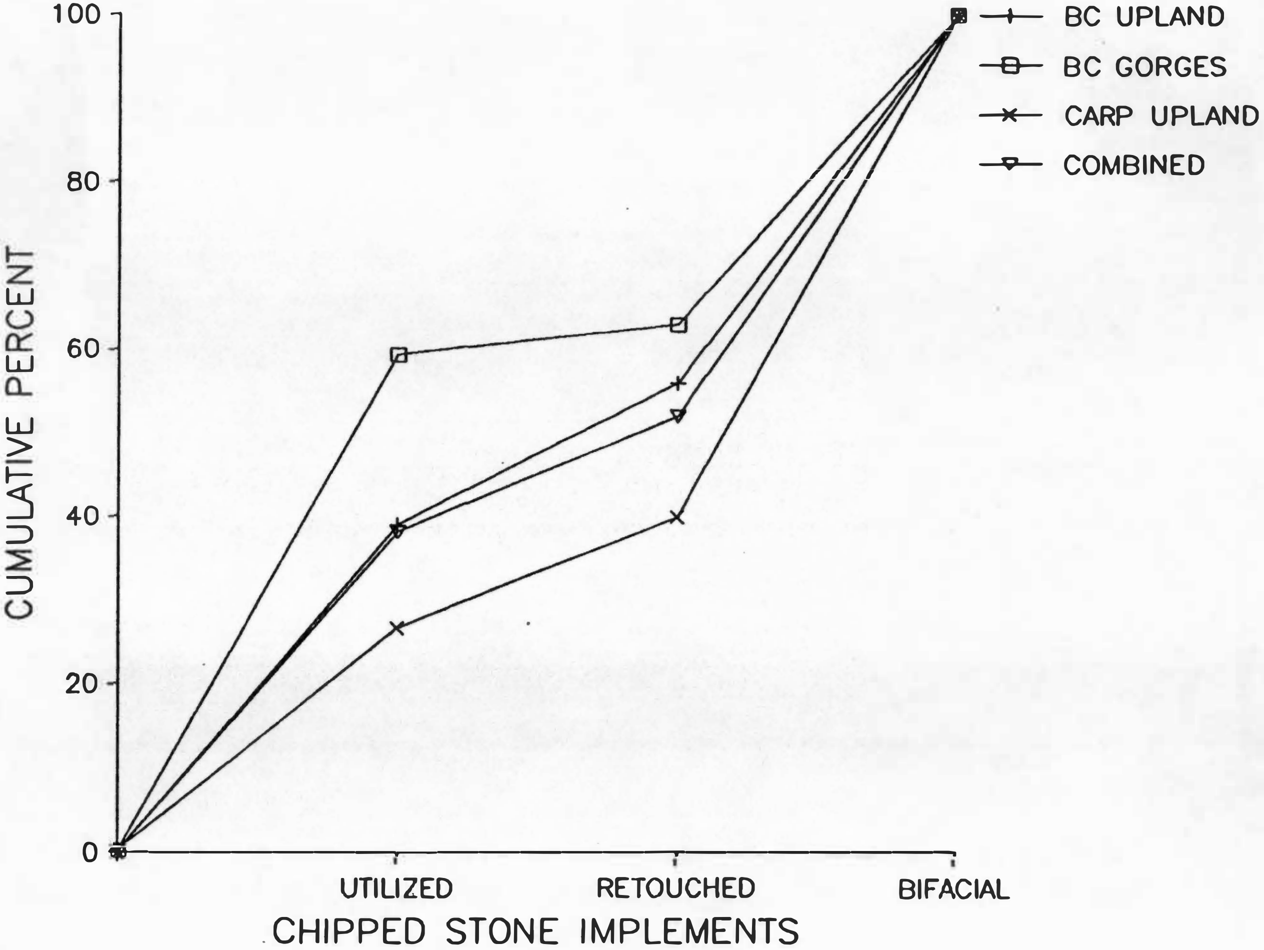

Figure A.21. Cumulative Percentage Ogives for Chipped Stone Implements by Area.

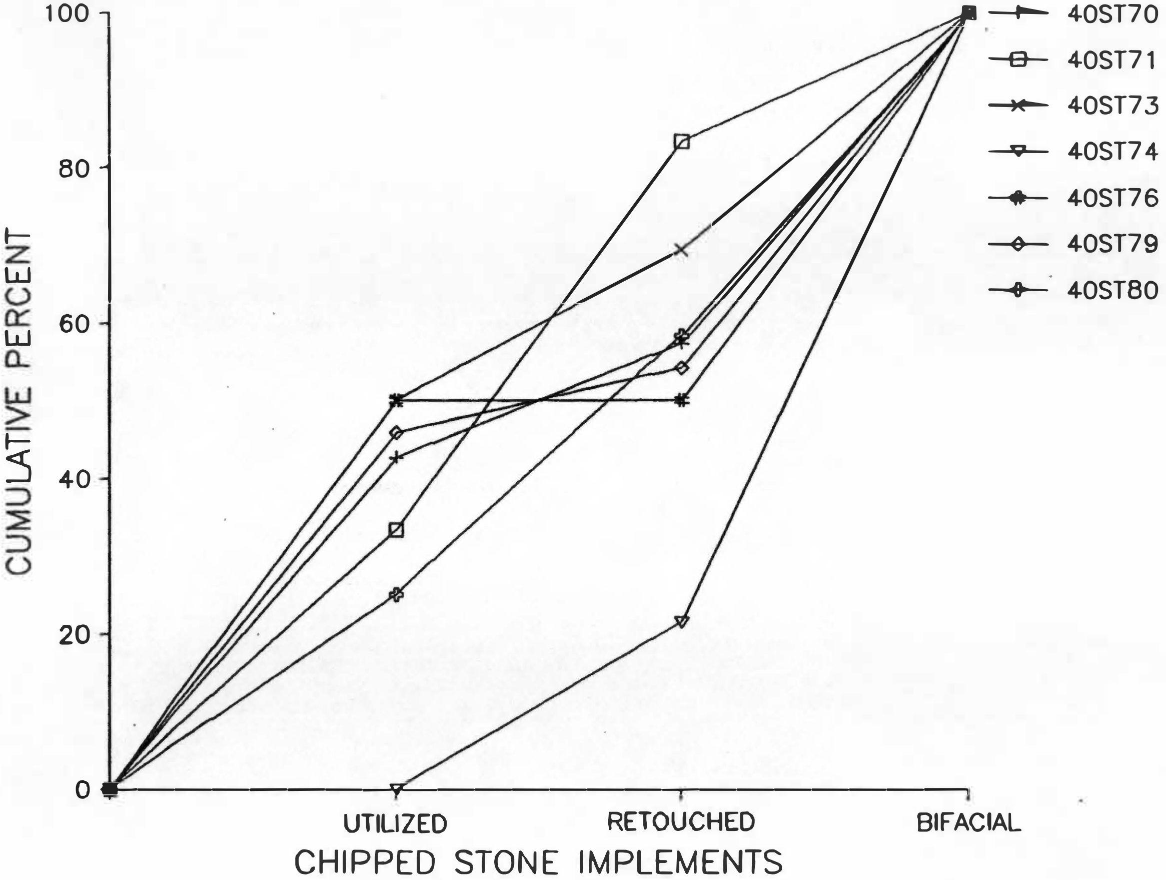

Figure A.22. Cumulative Percentage Ogives for Chipped Stone Implements for Selected Sites from Bandy Creek Upland Study Area.

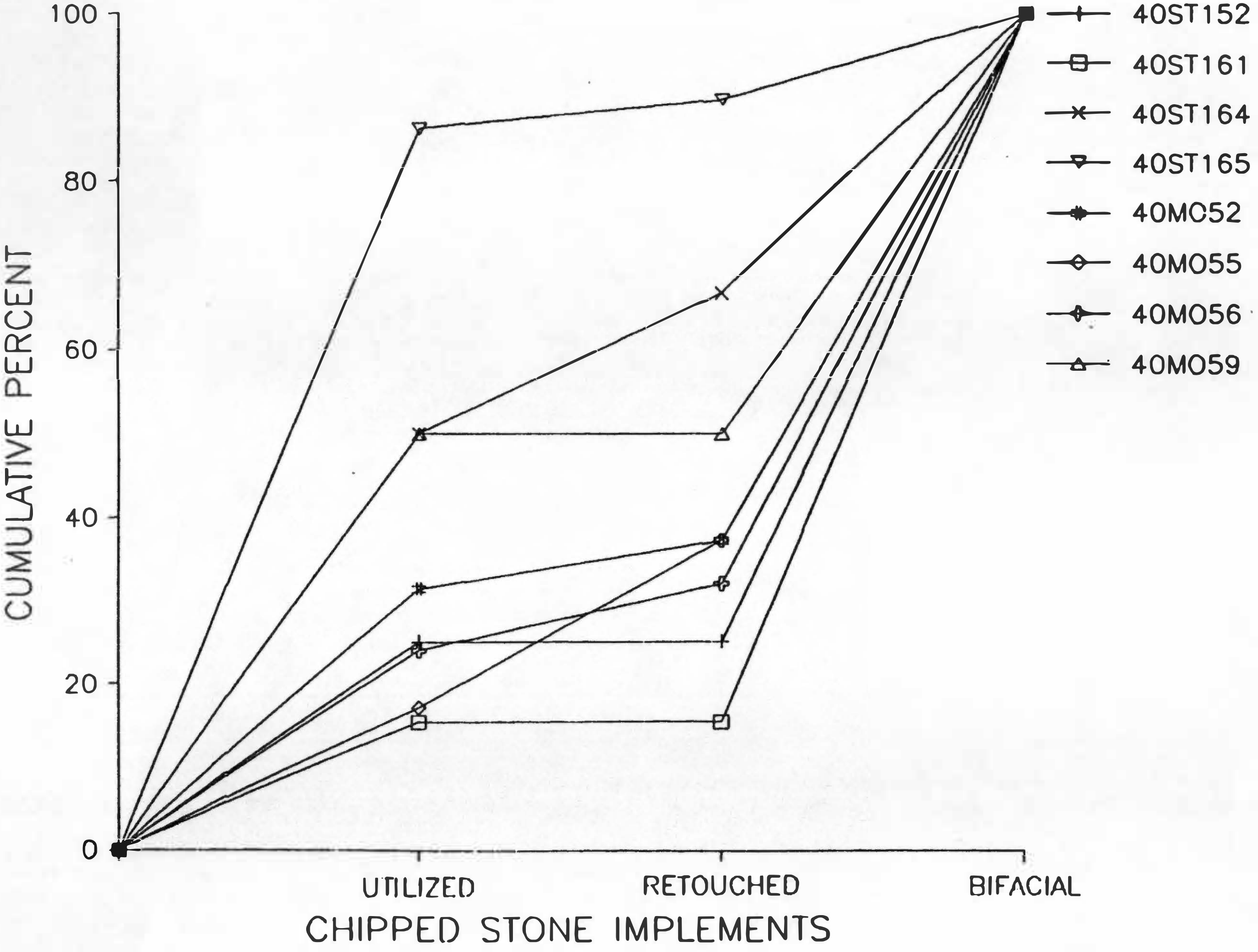

Figure A.23. Cumulative Percentage Ogives for Chipped Stone Implements for Selected Sites from Bandy Creek Gorges and CARP Uplands Study Areas.

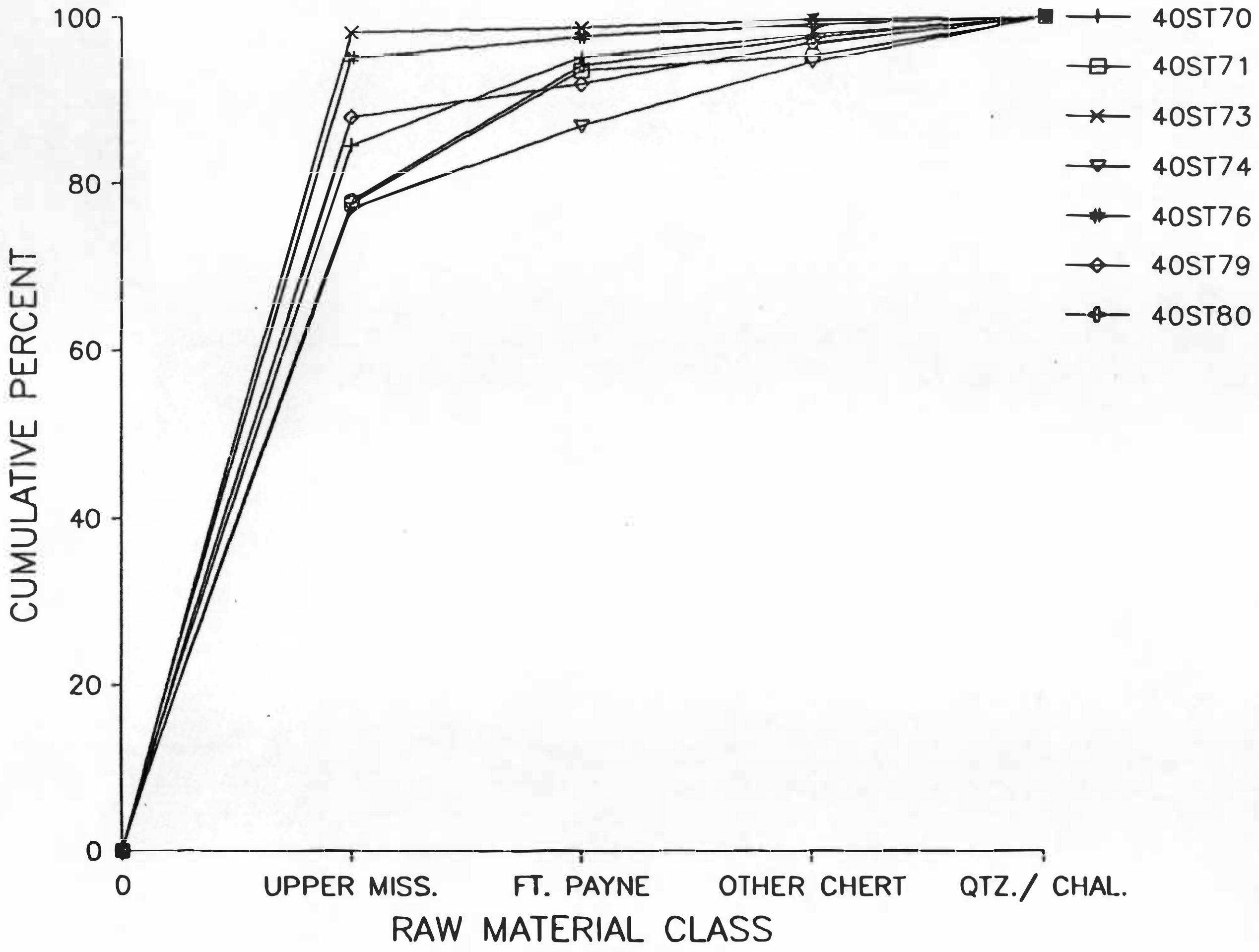

Figure A.24. Cumulative Percentage Ogives for Raw Material Classes from Bandy Creek Upland Study Area.

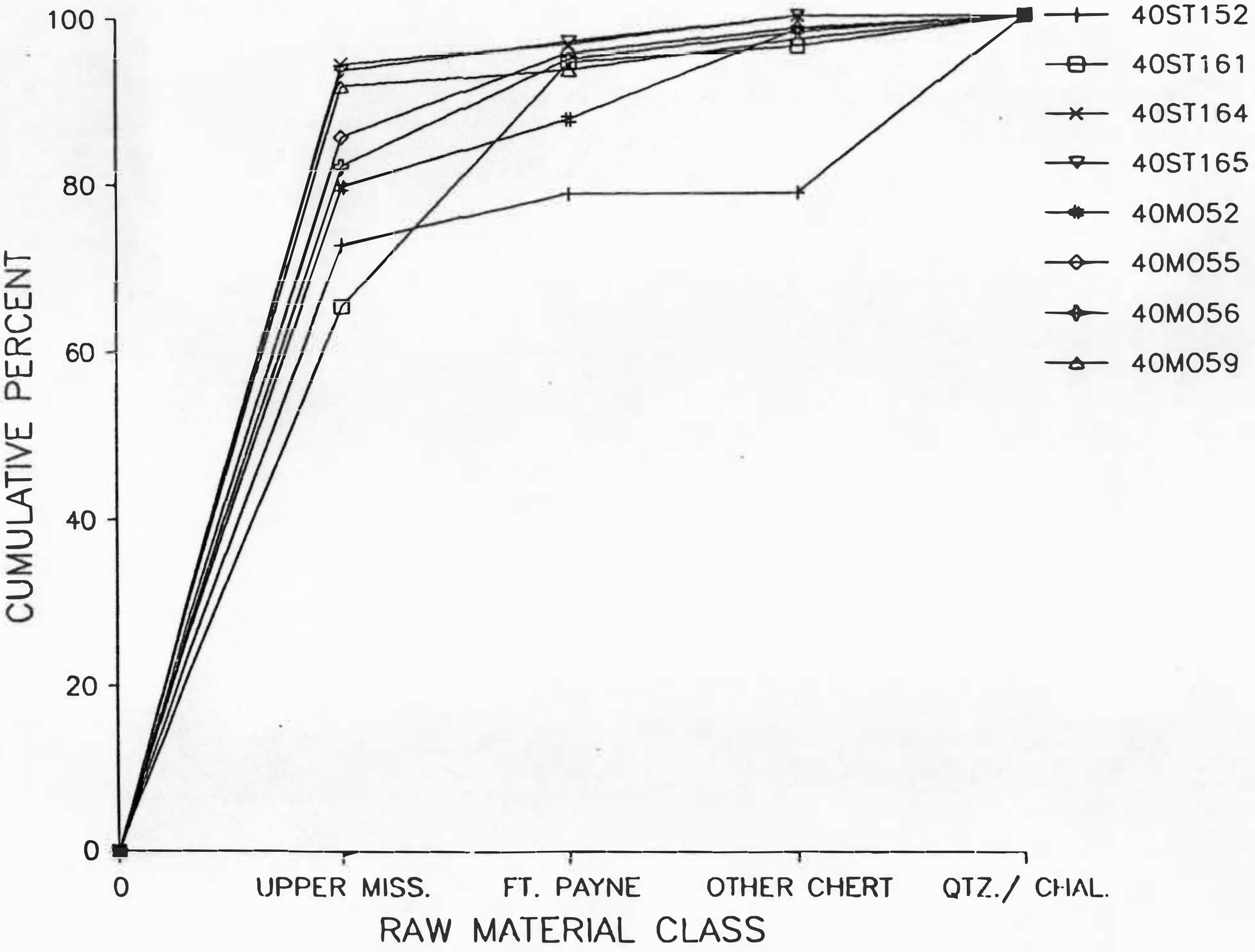

Figure A.25. Cumulative Percentage Ogives for Raw Material Classes for Selected Sites from Bandy Creek Gorges and CARP Uplands Study Areas.

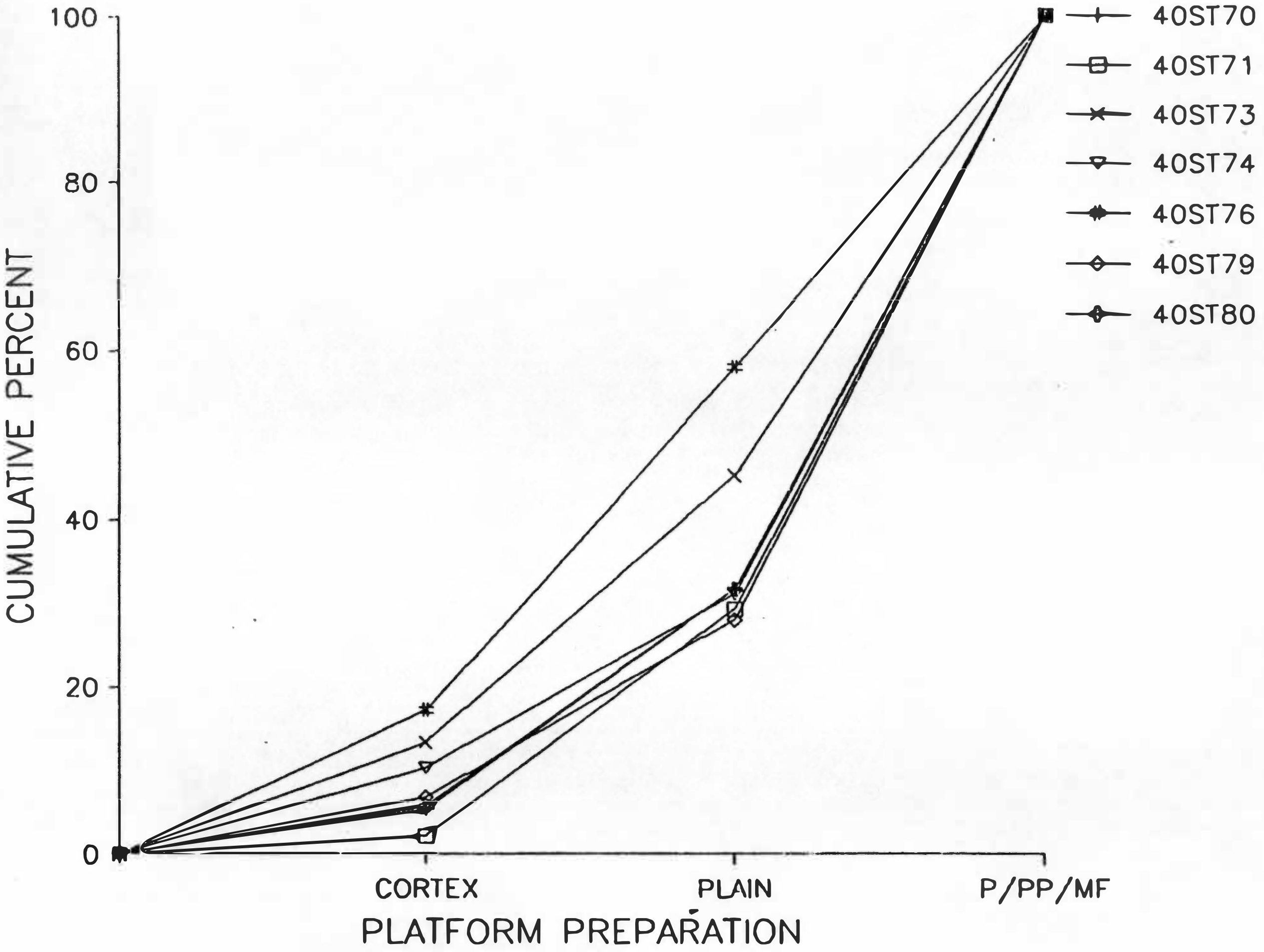

Figure A.26. Cumulative Percentage Ogives for Platform Preparation on Debitage for Selected Sites from Bandy Creek Upland Study Area.

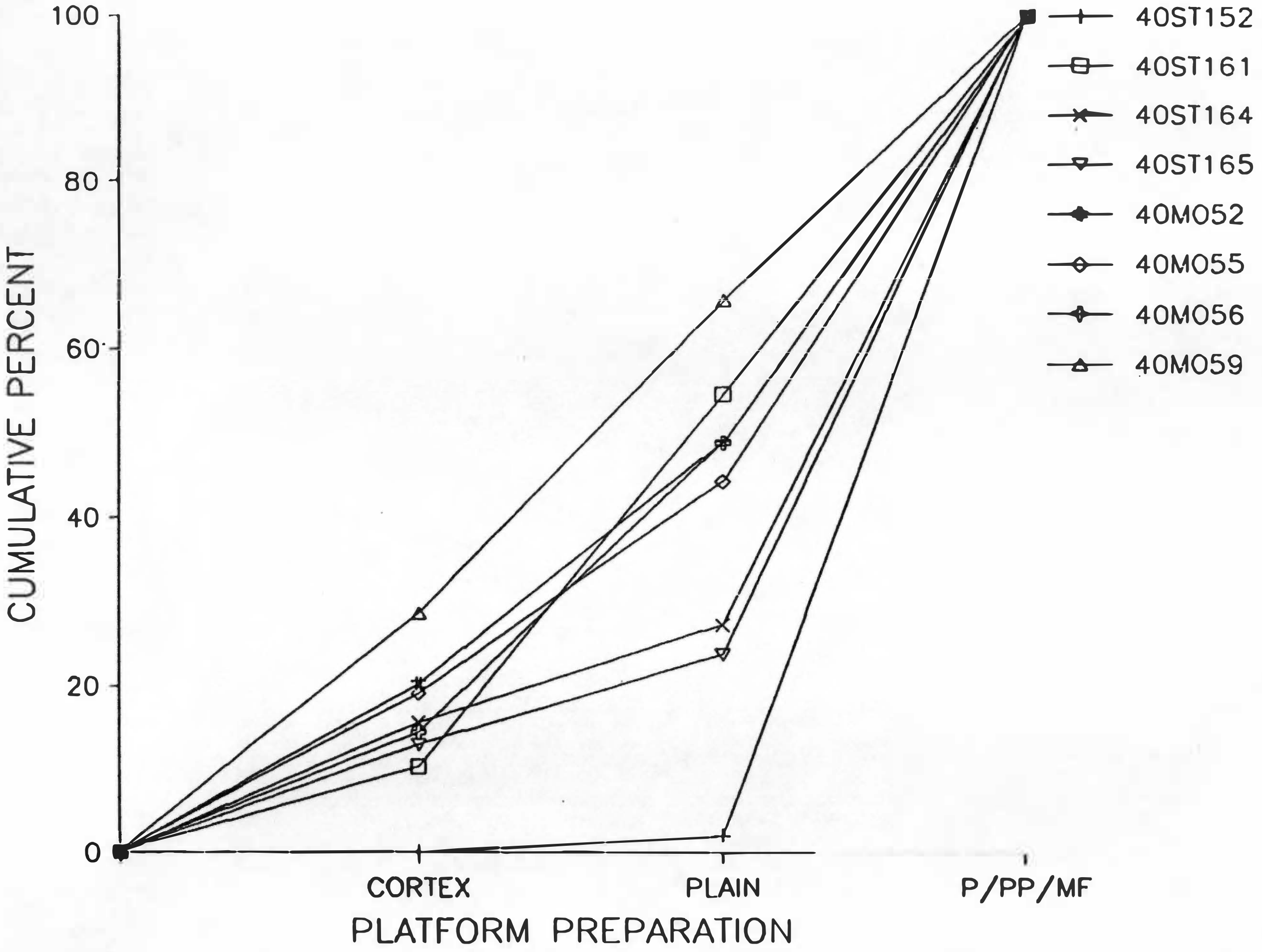

Figure A.27. **Cumulative Percentage Ogives for Raw Material Classes for Platform Preparation on Debitage for Selected Sites from Bandy Creek Gorges and CARP Uplands Study Areas.**

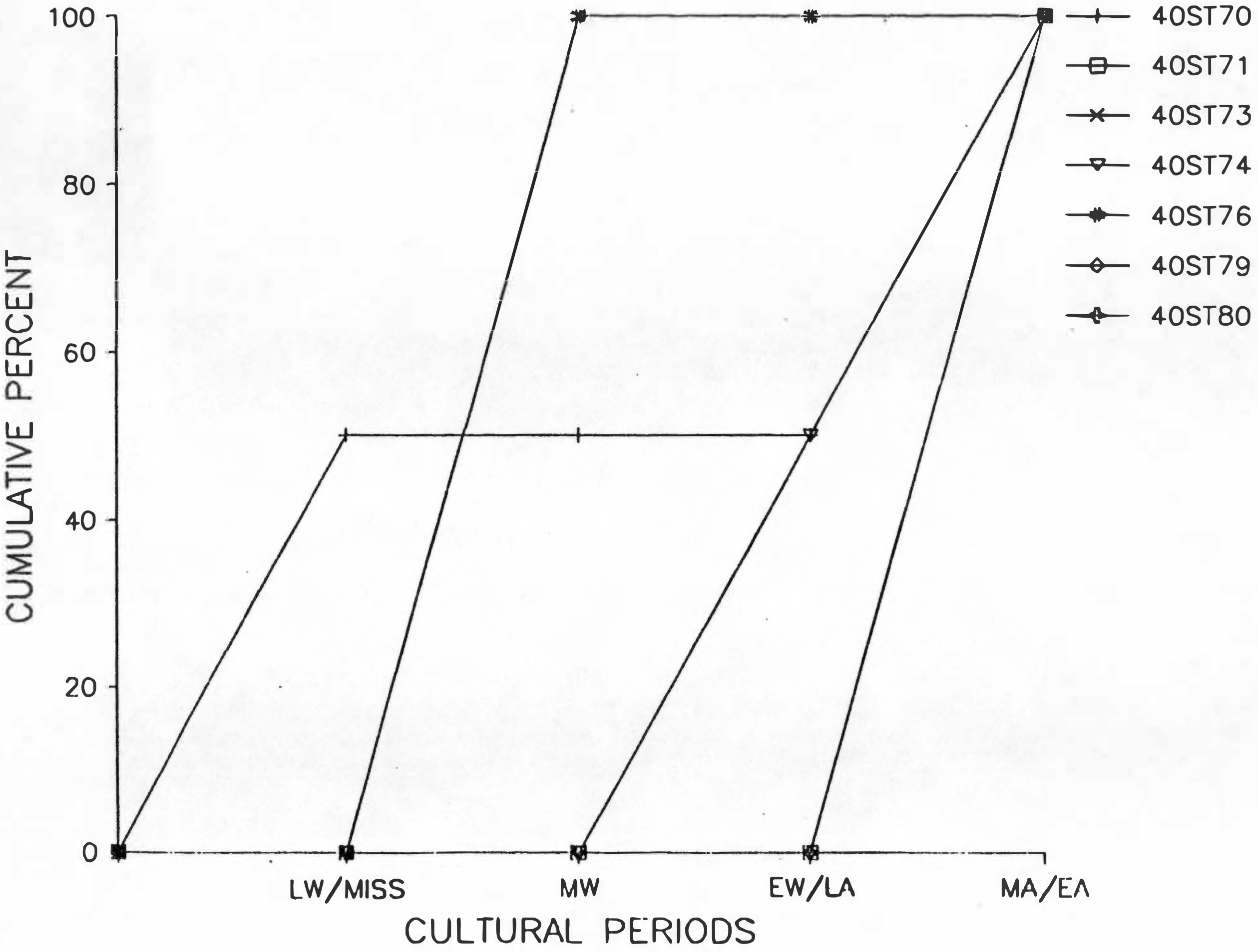

Figure A.28. Cumulative Percentage Ogives for Diagnostic Artifacts by Cultural Periods for Selected Sites from Bandy Creek Upland Study Area.

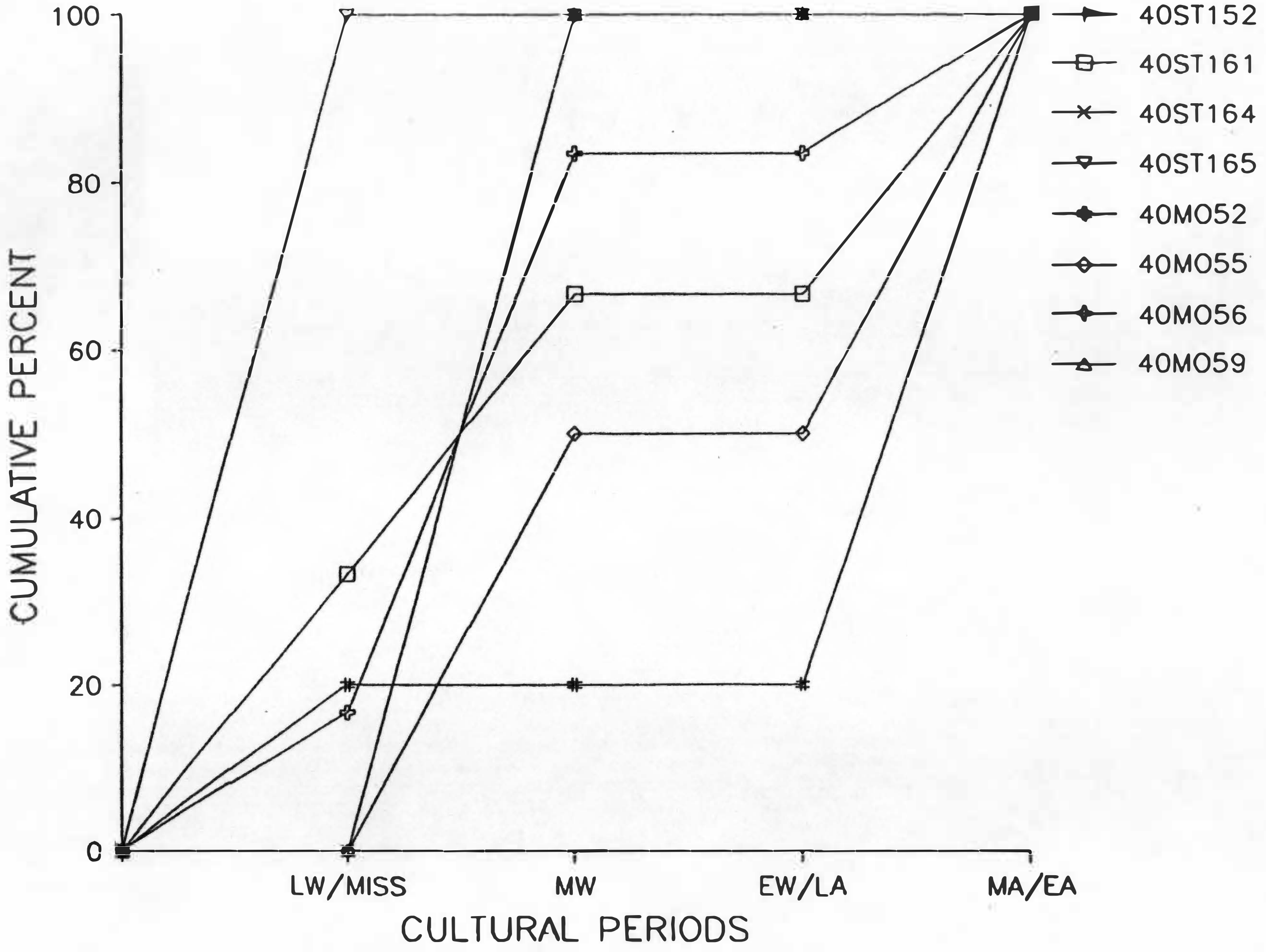

Figure A.29. Cumulative Percentage Ogives for Diagnostic Artifacts by Cultural Periods for Selected Sites From Bandy Creek Gorges and CARP Uplands Study Areas.

APPENDIX B.

Tables

Table 8.1. Summary of Field Investigation Information for Sites in the Study Area.

		Site Type		Recovery Procedures				Prehistoric Artifacts Recovered		
Study Area	Site	Open	Rockshelter	50x50 cm (20 liter) Systematic Shovel Testing	Controlled Systematic Surface Collection	Unsystematic Surface Collection and Sondage Testing	1X1 m and Small Block Test Excavation	Total Lithic Artifacts Recovered for All Seasons and Methods	Total Lithic Artifacts Recovered > 1/4 in. After Size Sorting	Total Ceramic Artifacts Recoverd for All Seasons and Methods
Sandy Creek Upland	40ST67	X		X			X	77	65	
	40ST68	X		X			X	12	10	
	40ST69	X		X			X	7	5	
	40ST70	X		X	X		X	2657	1459	
	40ST71	X		X	X		X	130	107	
	40ST72	X		X	X			42	34	
	40ST73	X		X	X		X	3219	1555	
	40ST74	X		X	X			110	81	
	40ST75	X		X	X			10	15	
	40ST76	X		X			X	2106	722	
	40ST77	X			X			82	63	
	40ST78	X		X	X			20	20	
	40ST79	X		X			X	4730	1672	
	40ST80	X		X			X	1641	525	
	40ST81	X		X				78	52	
	40ST82	X		X				7	5	
	MCK 11	X		X				1	1	
	MCK 12	X		X				1	1	
	MCK 13	X		X				1	1	
	MCK 15	X		X				1	1	
Subtotal	(20 Sites)							14949	6400	
Sandy Creek Gorges	40ST152		X			X	X	202	117	
	MCK 54		X			X		1	**	
	40ST154		X			X		2	**	
	40ST155		X			X	X	62	32	59
	40ST156		X			X		4	**	
	MCK 87		X			X		2	**	
	40ST158		X			X		26	**	
	40ST159		X			X		5	**	
	40ST160		X			X		201	**	
	40ST161		X			X	X	852	219	
	40ST162		X			X		1	**	
	40ST163		X			X		89	**	1
	MCK563		X			X		1	**	
	40ST164		X			X	X	611	212	
	40ST165		X			X	X	1532	371	10
	40ST166		X			X		201	**	
	40ST167		X					67	**	
	40ST168		X			X		373	**	
	40ST170		X			X		693	**	
Subtotal	(19 Sites)							4966 (3159)*	951	69
CARP Uplands	40MO50	X			X			8	8	
	40MO51	X			X			2	2	
	40MO52	X		X	X			503	503	
	40MO53	X			X			5	5	
	40MO54	X			X			14	14	
	40MO55	X		X	X			407	400	
	40MO56	X			X			457	407	
	40MO57	X			X			49	45	
	40MO58	X			X			22	17	
	40MO59	X			X			129	100	
	40MO60	X			X			21	21	
	40MO61	X			X			7	8	
	40MO62	X			X			8	7	
	40MO63	X			X			19	15	
	40MO70	X			X			8	4	
	40MO71	X			X			9	5	
	40MO72	X			X			13	13	
	40MO73	X			X			13	10	
	40MO74	X			X			11	11	
	40MO75	X			X			4	4	
	40MO76	X			X			5	5	
	40MO77	X			X			54	40	
	40MO78	X			X			10	8	
	40MO79	X			X			4	4	
	420 4	X			X			1	1	
	420 6	X			X			1	1	
	420 9	X			X			1	1	
	420 10	X			X			2	2	
	442 5	X			X			1	1	
	442 6	X			X			1	1	
	442 9	X			X			1	1	
	442 10	X			X			1	1	
	442 95	X			X			1	1	
	442 99	X			X			1	1	
Subtotal	(34 Sites)							1870	1766	
Totals	(73 Sites)									

* Note: Number in parentheses is total for only sites 40ST152,40ST155,40ST161,40ST164,and 40ST165.

** Note: Frequencies of artifacts greater than 1/4" not recorded for these sites.

Table B.2. Comparison of Total Lithic Artifacts Recovered with Percentage Greater than 1/4 Inch.

Study Area	Site	Total Lithic Artifacts Recovered for All Seasons and Methods	Total Lithic Artifacts Recovered > 1/4 in. After Size Sorting	Percentage of Total Made up of > 1/4 in. After Size Sorting
Bandy Creek Upland	40ST67	77	45	58.4%
	40ST68	12	10	83.3%
	40ST69	7	5	71.4%
	40ST70	2657	1499	56.4%
	40ST71	130	107	82.3%
	40ST72	42	34	81.0%
	40ST73	3219	1599	49.7%
	40ST74	110	91	82.7%
	40ST75	18	15	83.3%
	40ST76	2105	722	34.3%
	40ST77	92	83	90.2%
	40ST78	20	20	100.0%
	40ST79	4730	1672	35.4%
	40ST80	1641	525	32.0%
	40ST81	78	52	66.7%
	40ST82	7	5	71.4%
	HCK 11	1	1	100.0%
	HCK 12	1	1	100.0%
	HCK 13	1	1	100.0%
	HCK 15	1	1	100.0"
Subtotal	(20 Sites)	14949	6488	43.4%
Bandy Creek Gorges	40ST152	302	117	38.7%
	40ST155	62	32	51.6%
	40ST161	652	219	33.6%
	40ST164	611	212	34.7%
	40ST165	1532	371	24.2%
Subtotal	(5 Sites)	3159	951	30.1%
CARP Uplands	40M050	5	5	100.0%
	40M051	3	3	100.0%
	40M052	503	503	100.0%
	40M053	5	5	100.0%
	40M054	14	14	100.0%
	40M055	487	480	98.6%
	40M056	457	407	89.1%
	40M057	49	49	100.0%
	40M058	22	17	77.3%
	40M059	129	108	83.7%
	40M060	21	21	100.0%
	40M051	7	6	85.7%
	40M062	9	7	77.8%
	40M063	19	15	79.0%
	40M070	5	4	80.0%
	40M071	9	8	88.9%
	40M072	13	13	100.0%
	40M073	13	10	76.9%
	40M074	11	11	100.0%
	40M075	4	4	100.0%
	40M076	5	5	100.0%
	40M077	64	46	71.8%
	40M078	10	9	90.0%
	40M079	4	4	100.0%
	426 4	1	1	100.0%
	428 4	1	1	100.0%
	428 9	1	1	100.0%
	428 10	2	2	100.0%
	442 5	1	1	100.0%
	442 8	1	1	100.0%
	442 9	1	1	100.0%
	442 10	1	1	100.0%
	442 98	1	1	100.0%
	442 99	1	1	100.0%
Subtotal	(34 Sites)	1879	1765	93.9%
Totals	(59 Sites)	19987	9204	46.1%

Table B.3. Environmental Factors by Site.

Study Area	State Site Number	Field Site Number	UTM Coordinates (Zone 16) Easting	Northing	Site Elevation (meters)	Site Elevation (feet)	Site Slope (degrees)	Site Aspect (azimuth)	Landform Slope (degrees)	Landform Aspect (azimuth)	Relief (meters)	Relief (feet)	Horizontal Distance to Closest Water (meters)	Horizontal Distance to Closest Water (feet)	Vertical Distance to Closest Water (meters)	Vertical Distance to Closest Water (feet)	Stream Rank of Closest Water Source (Strahler rank)
Bandy Creek Upland Area	40ST67	HCK001	05670	040930	485	590	2	245	4	285	8	25	137	450	12	40	1
	40ST68	HCK002	05580	040790	483	585	1	236	4	320	11	35	175	575	23	75	1
	40ST69	HCK003	05890	040400	485	590	1	196	2	201	3	10	175	575	18	60	1
	40ST70	HCK004	05930	040550	480	580	4	248	4	237	8	25	282	925	24	80	1
	40ST71	HCK005	06170	040330	482	580	1	172	1	180	0	0	221	725	15	50	1
	40ST72	HCK007	06107	040180	482	580	1	172	1	200	3	10	229	750	15	50	1
	40ST73	HCK008	06020	040160	479	570	2	266	2	248	6	20	99	325	14	45	1
	40ST74	HCK009	05990	039870	472	550	4	279	4	279	9	30	229	750	40	130	1
	40ST75	HCK010	06090	040120	479	570	3	230	2	228	3	10	160	525	12	40	1
	40ST00	HCK011	06340	040320	479	570	3	69	2	107	5	15	305	1000	40	130	1
	40ST00	HCK012	06540	040100	459	505	15	200	14	198	30	100	76	250	23	75	1
	40ST00	HCK013	06580	040460	472	550	2	59	2	235	8	25	259	850	49	160	1
	40ST76	HCK014	06370	040570	474	555	3	104	3	73	5	15	206	675	20	65	1
	40ST00	HCK015	06220	040460	482	580	2	134	2	129	2	5	251	825	27	90	1
	40ST77	HCK016	06100	040400	479	570	4	252	2	249	5	15	213	700	12	40	1
	40ST78	HCK017	06020	040480	479	570	3	173	4	168	8	25	206	675	12	40	1
	40ST79	HCK018	05980	040700	494	620	1	201	1	167	9	30	229	750	23	75	1
	40ST79	HCK019	05990	040860	497	630	2	227	1	203	8	25	251	825	20	65	1
	40ST80	HCK020	06050	040930	500	640	22	158	14	136	14	45	320	1050	48	150	1
	40ST81	HCK021	05780	040990	485	590	2	270	2	270	3	10	191	625	14	45	1
	40ST82	HCK022	05880	040630	483	585	4	282	4	252	9	30	198	650	20	65	1
Bandy Creek Gorge Shelters	40ST152	HCK050	705775	4039985	443	1455	22	260	19	290	37	120	61	200	12	40	1
	40ST000	HCK054	705785	4040025	445	1460	12	312	19	295	37	120	30	100	14	45	1
	40ST154	HCK065B	705595	4041305	457	1500	8	325	9	312	27	90	137	450	14	45	1
	40ST155	HCK066	705700	4041435	460	1510	22	247	18	198	32	105	213	700	17	55	1
	40ST156	HCK081	704890	4040795	430	1410	1	145	1	157	9	30	8	25	0	0	1
	40ST000	HCK087	704150	4041390	454	1490	16	269	11	270	23	75	244	800	23	75	1
	40ST158	HCK099	705750	4041525	440	1445	11	262	5	212	21	70	236	775	11	35	1
	40ST159	HCK108A	706350	4040095	456	1495	16	312	13	293	26	85	145	475	17	55	1
	40ST160	HCK113	706585	4040795	443	1455	16	182	15	183	40	130	61	200	18	60	1
	40ST161	HCK116	706505	4040085	443	1455	22	214	13	168	27	90	30	100	5	15	1
	40ST162	HCK120	706480	4040080	443	1455	22	182	14	148	30	100	23	75	5	15	1
	40ST163	HCK562	705835	4041400	454	1490	39	84	24	94	43	140	152	500	23	75	1
	40ST000	HCK563	705845	4041385	442	1450	39	59	22	87	43	140	145	475	11	35	1
	40ST164	HCK565	705920	4041380	462	1515	22	33	19	28	40	130	76	250	30	100	1
	40ST165	HCK567	705935	4041325	460	1510	22	61	21	56	44	145	46	150	23	75	1
	40ST166	HCK570	705970	4041250	451	1480	22	233	10	13	37	120	8	25	0	0	1
	40ST167	HCK571	705990	4041275	454	1490	39	313	19	352	40	130	16	50	6	20	1
	40ST168	HCK572	706005	4041290	454	1490	39	325	24	325	43	140	30	100	14	45	1
	40ST170	HCK577	706020	4041300	454	1490	39	333	24	327	44	145	38	126	17	55	1
CARP Upland Study Area	40MO50	2001	710230	4021000	483	1490	17	135	12	135	•	•	270	886	20	66	1
	40MO51	2002	710240	4020420	439	1413	3	135	3	135	•	•	70	230	6	20	1
	40MO52	2003	710350	4020430	440	1416	2	180	5	180	•	•	45	148	6	20	1
	40MO00	2004	710320	4020700	447	1438	7	135	0	135	•	•	35	115	5	16	1
	40MO53	2005	710520	4020480	438	1403	17	135	8	135	•	•	30	98	15	49	2
	40MO54	2006	710080	4020680	460	1480	8	135	5	135	•	•	280	919	17	56	1
	40MO55	2001	710780	4019715	438	1403	4	45	4	45	•	•	50	164	3	10	1
	40MO56	2021	710710	4019780	433	1393	4	135	5	60	•	•	20	66	3	10	1
	40MO57	2022	710840	4019775	433	1393	3	90	3	90	•	•	10	33	1	3	1
	40MO58	2023	710520	4019725	439	1413	3	135	3	135	•	•	85	279	3	10	1
	40MO59	2003	710805	4019865	433	1393	5	135	10	135	•	•	45	148	6	20	1
	40MO00	2004	710855	4019505	448	1432	7	135	7	135	•	•	135	443	9	30	1
	40MO60	2005	710400	4019600	439	1413	2	135	2	135	•	•	50	164	1	3	1
	40MO61	2006	710080	4020250	483	1490	0	0	10	135	•	•	150	492	24	79	1
	40MO62	2007	710215	4020340	439	1413	5	45	8	45	•	•	20	66	1	3	1
	40MO63	2008	710080	4019630	448	1442	7	90	8	90	•	•	180	591	10	33	1
	40MO00	2009	710115	4019940	481	1451	3	45	3	45	•	•	220	722	13	43	1
	40MO00	2010	709905	4019875	454	1461	17	315	14	315	•	•	60	197	16	52	1
	40MO70	4201	711880	4018320	475	1529	2	180	0	0	•	•	370	1214	14	46	1
	40MO71	4202	711800	4018375	477	1535	0	0	2	180	•	•	450	1476	17	56	1
	40MO72	4203	711865	4018355	479	1541	0	0	0	0	•	•	370	1214	18	59	1
	40MO73	4204	711820	4018360	479	1541	0	0	0	0	•	•	295	968	18	59	1
	40MO00	4205	711850	4015725	471	1516	2	180	7	225	•	•	100	328	40	131	1
	40MO74	4206	711865	4015705	471	1516	2	180	5	180	•	•	100	328	24	79	1
	40MO75	4207	711970	4015700	468	1500	14	180	11	180	•	•	60	197	15	49	1
	40MO00	4208	711985	4016240	472	1519	4	180	3	225	•	•	230	755	6	20	1
	40MO00	4209	712040	4016220	474	1525	3	225	3	225	•	•	200	656	8	26	1
	40MO00	4210	712101	4016020	428	1377	1	180	1	180	•	•	10	33	2	7	1
	40MO76	4211	712120	4016130	471	1516	2	135	1	180	•	•	70	230	5	16	1
	40MO80	4212	712130	4016280	471	1516	4	90	3	90	•	•	150	492	5	16	1
	40MO77	4213	711905	4016405	477	1535	0	0	1	0	•	•	305	1001	15	49	1
	40MO78	4214	711820	4016240	477	1535	0	0	0	0	•	•	360	1181	60	197	1
	40MO79	4215	711870	4016180	479	1541	0	0	1	0	•	•	390	1280	62	203	1
	40MO00	4298	711860	4016495	474	1525	8	45	4	45	•	•	190	623	20	66	1
	40MO00	4299	712000	4015855	471	1516	1	180	0	0	•	•	80	262	6	20	1

Table B.4. Artifact Category Breakdown by Study Area.

Study Area	Debitage	Flake Implements	Bifaces	Cores	Hammerstones	Groundstone	Fire Cracked Rock	Manuports	Row Totals
Bandy Creek	6265	123	87	10	0	1	2	5	6493
Upland	96.5%	1.9%	1.3%	.2%		.0%	.0%	.1%	100.0%
Bandy Creek	886	39	20	6	0	0	0	0	951
Gorges	93.2%	4.1%	2.1%	.6%		.0%	.0%	.0%	100.0%
CARP	1594	66	78	15	1	3	2	6	1765
Uplands	90.3%	3.7%	4.4%	.8%		.2%	.1%	.3%	100.0%
Totals	8745	228	185	31	1	4	4	11	9209
	95.0%	2.5%	2.0%	.3%	.0%	.0%	.0%	.1%	100.0%

Table 8.5. Artifact Category Breakdown by Site.

Study Area	Site	Debitage	Flake Implements	Bifaces	Cores	Hammerstones	Groundstone	Fire Cracked Rock	Manuports	Row Totals
Bandy Creek Upland	40ST67	41	3	1						45
	40ST68	9		1						10
	40ST69	5								5
	40ST70	1424	43	29	4			2	1	1503
	40ST71	101	5	1						107
	40ST72	28	2	3	1				1	35
	40ST73	1560	25	11	3				1	1600
	40ST74	75	5	11			1		2	94
	40ST75	14	1							15
	40ST76	714	5	3						722
	40ST77	67	6	8	2					83
	40ST78	16	2	2						20
	40ST79	1646	15	11						1672
	40ST80	511	9	5						525
	40ST81	49	2	1						52
	40ST82	5								5
Bandy Creek Gorges	40ST152	111	2	3	1					117
	40ST155	30	1	1						32
	40ST161	199	6	11	3					219
	40ST164	204	4	2	2					212
	40ST165	342	26	3						371
CARP Uplands	40MO50	5								5
	40MO51	3								3
	40MO52	454	20	22	4		1	2		503
	40MO53	3		2						5
	40MO54	11	1	2						14
	40MO55	435	17	22	4	1	1		1	481
	40MO56	376	12	17	2				3	410
	40MO57	41	3	4	1					49
	40MO58	14	2		1					17
	40MO59	100	4	3	1					108
	40MO60	21								21
	40MO61	5					1			6
	40MO62	5	2						1	8
	40MO63	15		1	1					17
	40MO70	4								4
	40MO71	7	1							8
	40MO72	12		1						13
	40MO73	8		1						9
	40MO74	8	1	1	1					11
	40MO75	2		2						4
	40MO76	5								5
	40MO77	43	3							46
	40MO78	9							1	10
	40MO79	4								4
Totals		8741	228	185	31	1	4	4	11	9205

Table B.6. Enviromental Factors Relevant to Settlement Modeling.

Topographic Factors	Hydrographic Factors	Geologic and Pedologic Factors
landform distributions	drainage pattern distributions	distributions of various geologic formations and lithologies
slope distributions	distributions of ground and surface water	distributions of various soil and soil conditions
distributions of aspect		

Climatic Factors	Biotic Factors
distributions of rainfall availability	floral distributions
distributions of temperature gradients	faunal distributions

Table B.7. Forest Associations of the Cumberland Plateau Area of the Big South Fork of the Cumberland River (After Safley 1970).

Association	Other dominates	Location*	Aspect**	Character***
<u>Plateau</u> <u>Surface</u>				
1. North Aspect - White Oak	Northern Red Oak Sugar Maple	North facing Plateau slopes	NE	Sub-mesic to Xeric
2. Southern Aspect - White Oak	Sugar Maple Chestnut Oak Northern Red Oak Black Oak	South facing Plateau slopes	SW	Xeric
3. Virginia Pine - White Oak - Blackjack Oak		South facing Plateau slopes	SW	Xeric
4. Virginia Pine		Plateau Crests, exposed ridge lines		Xeric
<u>Gorge</u> <u>Slopes</u>				
Upper Slopes				
5. Shortleaf - pine - White Oak	Virginia Pine	North Facing upper slope	NE	Sub-mesic
6. Northern Red Oak - Chestnut Oak - White Oak		North facing ridges. Thin stony soil	NE	Sub-mesic
7. White Oak - Virginia Pine	Chestnut Oak Blackjack Oak	Northerly ridges	NE	Mesic
8. White Oak - hemlock Chestnut Oak		South facing draws, slopes	SW	Sub-xeric
9. Virginia Pine - White Pine		Exposed, south facing slopes	SW	Xeric
10. Virginia Pine - White Oak		Steep, rocky crest areas of gorges		Xeric
<u>Middle</u> <u>Slopes</u>				
11. White Oak - Virginia Pine	Northern Red Oak Hemlock	North facing middle - lower slopes	NW-SE	Mesic
12. White Oak - Hemlock - Chestnut Oak		South Facing draws and forges	SW	Sub-Mesic
13. White Oak - Chestnut Oak		Steep, south facing ridges, thin soil	SW	Xeric
<u>Lower</u> <u>Slopes</u>				
14. White Oak - Chinquapin Oak		Moist lower slopes	SW	Mesic
15. Tulip Poplar - Hemlock		North facing slopes, draws	N - E	Mesic
16. White Oak - Beech		South facing well-drained slopes	SW	Sub-xeric
17. Red Cedar		Limestone outcrops only	SW	
<u>Terraces</u>				
18. Tulip Poplar - Sweetgum	Black Walnut	First terraces		Mesic
19. River Birch	Sycamore Poplar	Lowest terraces flood plain		Mesic

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* Refers to typical location.
** Refers to favored orientation.
*** Refers to predominance of taxa considered mesic or sub-mesic/xeric or sub-xeric.

Table B.8. Biotic Communities of the Cumberland Plateau.

Biotic Community*	Forest Associations**	Situation	Associated or understory species	Associated animal or game species
Lotic		Aquatic - rapids and riffles	Riverweed, blue-green algae, green algae	Freshwater mollusks, gastropods, rainbow trout, darters, channel catfish, walleye, muskellunge, white bass, small mouth bass, rock bass, sunfish, turtles, raccoon
		Upland springs and seepages	Saxifrage, bittercress	
Lentic		Natural and man made ponds	Cattail, pondweed, rushes, peat moss	Leopard frogs, blue gill, largemouth bass, deer, raccoons, box turtles, snapping turtles
Sycamore/River Birch	River Birch	Flat alluvial plains, slopes next to river	Sparkleberry, arrowwood, sycamore, black willow green ash, alder, sweet gum, cucumber tree, ironwood, magnolia, basswood, cane, wild oats.	Grey squirrel, mink, river otter, beaver, muskrat, wood ducks, bullfrog, leopard frog, pickerel frog
Sugar Maple/Beech/ Yellow Birch	Tulip Poplar White Oak/beech	Moist, lower slopes	Tulip poplar, white oak, red oak, red maple, magnolia, redbud, dogwood, cucumber tree, basswood. Rich herbaceous layer.	Ruffed grouse, turkey, grey squirrel, chipmunk, spotted skunk, other small mammals, barred owl, red shouldered hawk.
Hemlock	Tulip poplar/Hemlock, White Oak/Hemlock/Chinquapin Oak	Cool moist coves and ravines on north facing slopes	Tulip poplar, white oak, white pine, serviceberry, magnolia, sourwood. Poor herbaceous development.	Cover for deer, small mammals, turkey and grouse, lizards and snakes
Mixed Oak	All oak associations except White Oak/Hemlock/Chinquapin Oak, White Oak/beech holly,	Upper slopes, upland plateau areas	Red oak, scarlet oak, hemlock, chestnut oak, chestnut, hickory, sourwood, sassafras, mountain laurel, huckleberry, oat grass, galax. Rich herbaceous layer.	Food for grouse, turkey, squirrels, opossum, black bear, deer, box turtle, small mammal species. Numerous reptiles.
Mixed Pine	Virginia Pine/White Pine. Virgina Pine	Thin xeric soils along gorge rim, plateau summits	Mountain laurel, teaberry, serviceberry, huckleberry, sourwood, chestnut oak, sassafras, black oak, scarlet oak, black cherry	Overall sparce cover. Seasonal food for turkey, grey squirrel, small mammals, box turtle. Young stands of pine provide good winter cover for game animals.

* Source: United States Corps of Engineers, Final Environmental Impact Statement, Big South Fork National River and Recreation Area, 1976.

** Source: Safley, M.W., 1970, Vegetation of the Big South Fork. Unpublished Master's thesis, University of Tennessee, Knoxville.

Table B.9. Summary of Controlled Collections: Site 40ST70.

Collection Information	Cortical Debitage	Non-cortical Debitage	Cores	Utilized Flakes	Unifaces	Bifaces	Projectile Points/Knives	Row Total
1st Collection	59	92		12	2	4	2	171
November 1981	34.5%	53.8%		7.0%	1.2%	2.3%	1.2%	100.0%
2nd Collection	34	108		1	1	1	3	148
December 1981	23.0%	73.0%		.7%	.7%	.7%	2.0%	100.0%
3rd Collection	81	207	1	4	4	6		301
March 1982	26.9%	68.8%	.3%	1.3%	1.3%	2.0%		100.0%
Total for First	174	407	1	15	7	11	5	620
Three Collections	28.1%	65.5%	.2%	2.4%	1.1%	1.8%	100.0%	

Table B.10. Raw Material Types.

Type	Description	Lithologic Association
1	Blue-gray nodular chert	Mississippian
2	Light gray nodular chert	Mississippian/Ordovician
3	Blue-gray and tan chert	Mississippian
4	Dark gray mottled chert	Mississippian
5	Porcelaineous cream white chert	
6	Gray-brown fossiliferous chert	
7	Chalcedony and Vein quartz	Mississippian
8	Various colored oolitic chert	Mississippian
9	Other unidentifiable cherts	
10	Quartzite	Pennsylvanian
11	Sandstone	Pennsylvanian
12	Light blue-gray speckled chert	
13	Black nodular chert	Ordovician

Table B.11. Debitage Types.

Type	Description
1	Blocky debris, angular shatter, and fire spawled pieces (i.e. pot lids).
2	Unbroken hard hammer percussion flakes.
3	Unbroken soft hammer percussion flakes.
4	Platform bearing remnants of hard hammer flakes.
5	Platform bearing remnants of soft hammer flakes.
6	Non-platform bearing remnants of flakes.
7	Unbroken blades.
8	Platform bearing remnant blades.
9	Bipolar flakes.
10	Indeterminate or unidentifiable debitage.

Table B.12. Debitage Analysis Attributes and Attribute States.

Attribute	Attribute State
Cortex Type:	
	1) no cortex
	2) matrix residual
	3) waterworn cobble cortex
	4) incipient fracture plane surface
Percentage of cortex present:	
	1) 0%
	2) 1-33%
	3) 34-66%
	4) 67-99%
	5) 100%
Presence and type of platform surface:	
	1) absent
	2) indeterminate or collapsed
	3) cortex covered
	4) plain
	5) peaked
	6) multi-faceted
	7) point-plain
Presence of platform preparation:	
	1) none
	2) prepared
	3) indeterminate
Condition:	
	1) complete
	2) broken
	3) waterworn
Presence of thermal alteration:	
	1) present
	2) absent

Table B.13. Flake Implements Types.

Type	Description
A	Utilized, distal, dorsal.
B	Utilized, distal, dorsal, notched.
C	Utilized, distal, dorsal, and lateral, bifacial.
D	Utilized, distal, bifacial.
E	Utilized, distal and lateral, dorsal.
F	Utilized, distal and lateral, bifacial.
G	Utilized, lateral, dorsal.
H	Utilized, lateral, ventral.
I	Utilized, lateral, bifacial.
J	Utilized, burinated.
K	Utilized, shatter.
L	Retouched, distal, dorsal.
M	Retouched, distal and lateral, dorsal.
N	Retouched, lateral, dorsal.
O	Retouched, lateral, dorsal, and utilized, distal, dorsal.
P	Retouched, lateral, dorsal, and utilized, lateral, ventral.
Q	Retouched, lateral, ventral.
R	Retouched, lateral, bifacial.
S	Retouched, proximal, dorsal.
T	Retouched, pointed, distal, unifacial.
U	Miscellaneous and unidentifiable, unifacial or bifacial.

Table B.14. Biface Analysis Attributes and Attribute States.

Attribute	Attribute State
Cortex cover:	
	1) none
	2) present on both faces
	3) present on one face
	4) present on edge, tip, or base
	5) present on one face and edge
Biface blank type:	
	1) core (nodular)
	2) flake
	3) indeterminate
Biface failure or breakage type:	
	1) material flaw
	2) edge collapse
	3) potlid/expansion/ crenate fracture
	4) bipolar
	5) lateral snap
	6) outre passe'
	7) impact fracture
	8) lateral burination (non-production)
	9) indeterminate
	10) radial fracture
Biface haft modification:	
	1) present
	2) absent
	3) not observable
Thermal alteration:	
	1) present
	2) absent

Table B.15. Original Debitage Paradigm as Defined by Johnson and Raspet (1980).

Platform Surface	Percent Cortex		
	>75 %	<75%	None
Missing	DB1	DB2	DB3
Cortex Covered	DB4	DB5	DB6
≤ 2 Facets	DB7	DB8	DB9
> 2 Facets	DB10	DB11	DB12

Table B.16. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch Indicating Debitage Types Defined by Johnson and Raspet (1980).

Platform Surface	Percent Cortex		
	>66 %	<66%	None
Missing	DB1	DB2	DB3
Cortex Covered	DB4	DB5	DB6
Plain	DB7	DB8	DB9
Point Plain/ Peaked/ Multi-Faceted	DB10	DB11	DB12

Table B.17. Raw Material Breakdown by Area.

Study Area	Blue-Gray Nodular Chert	Light-Gray Nodular Chert	Blue-Gray and Tan Chert	Dark Gray Mottled Chert	Procelaineous Cream Chert	Gray-Brown Chert	Chalceony/ Vein Quartz
Bandy Creek Upland	3325	2551	174	221	84	22	121
	51.2%	39.3%	2.7%	3.4%	1.3%	.3%	1.9%
Bandy Creek Gorges	559	247	55	35	1	4	33
	58.8%	26.0%	5.8%	3.7%	.1%	.4%	3.5%
CARP Uplands	1032	419	67	105	16	29	28
	58.6%	23.8%	3.8%	6.0%	.9%	1.6%	1.6%
Totals	4816	3217	296	361	101	55	182
	52.3%	34.9%	3.2%	3.9%	1.1%	.6%	2.0%

Study Area	Various Oolitic Chert	Other/ Unidentifiable	Quartzite	Sandstone	Lt. Blue-Gray Speckled Chert	Blue-Black Nodular Chert	Row Totals
Bandy Creek Upland	4	58	1	7	24		6492
							1
Bandy Creek Gorges	1	16					951
							1
CARP Uplands	2	24	3	8	15	14	1762
							1
Totals	7	98	4	15	39	14	9205
							1

Table B.18. Raw Material Breakdown by Site.

Study Area	Site	Blue-Gray Nodular Chert	Light-Gray Nodular Chert	Blue-Gray and Tan CHert	Dark Gray Mottled Chert	Prcelaineous Cream Chert	Gray-Brown Chert	Chalcedony Vein Quartz
Bandy Creek Upland	40ST67	23	15	2	3	1		
	40ST68	5	4			1		
	40ST69	3	1					
	40ST70	642	625	59	100	21	10	30
	40ST71	30	53	13	4	1	1	5
	40ST72	17	12	1	1			3
	40ST73	839	730	7	3	10		4
	40ST74	31	39	3	6	2		5
	40ST75	4	9			2		
	40ST76	522	164	3	16	7	2	6
	40ST77	52	16	4	7	2		2
	40ST78	7	8	1	3			1
	40ST79	786	682	42	25	27	5	52
	40ST80	221	188	34	51	10	2	13
	40ST81	39	4	5	2		2	
	40ST82	4	1					
Bandy Creek Gorges	40ST152	78	7	7				25
	40ST155	27	4		1			
	40ST161	121	22	36	28		1	8
	40ST164	135	65		5		3	
	40ST165	198	149	12	1	1		
CARP Uplands	40MO50	3		1	1			
	40MO51	2	1					
	40MO52	299	99	20	20	2	17	8
	40MO53	2	1					
	40MO54	6	4	2	1			1
	40MO55	276	133	14	34	4	6	7
	40MO56	236	98	17	35	5	4	8
	40MO57	26	10	1	6	3	1	
	40MO58	13	4					
	40MO59	75	24		2	2		3
	40MO60	14	3		4			
	40MO61	3	1				1	1
	40MO62	4		3				
	40MO63	11	6					
	40MO70	3	1					
	40MO71	5	3					
	40MO72	8	3	1				
	40MO73	3	3		1			
	40MO74	6	5					
	40MO75	3	1					
	40MO76	3	2					
	40MO77	24	15	1	1			
	40MO78	3	1	5				
	40MO79	1	1	2				
Totals		4813	3217	296	361	101	55	182

Table B.18. Continued

Study Area	Site	Various Oolitic Chert	Other/ Unidentifiable	Quartzite	Sandstone	Lt. Blue-Gray Speckeled Chert	Blue-Black Nodular Chert	Row Totals
Bandy Creek Upland	40ST67		1					45
	40ST68							10
	40ST69					1		5
	40ST70	3	3		3	7		1503
	40ST71							107
	40ST72				1			35
	40ST73		2	1		4		1600
	40ST74		2		3	3		94
	40ST75							15
	40ST76		2					722
	40ST77							83
	40ST78							20
	40ST79	1	46			5		1671
	40ST80		2			4		525
	40ST81							52
	40ST82							5
Bandy Creek Gorges	40ST152							117
	40ST155							32
	40ST161		3					219
	40ST164	1	3					212
	40ST165		10					371
CARP Uplands	40MO50							5
	40MO51							3
	40MO52		17		3	7	11	503
	40MO53					1	1	5
	40MO54							14
	40MO55		1	1	2	3		481
	40MO56	1	1	1	2	1	1	410
	40MO57		1			1		49
	40MO58							17
	40MO59					1	1	108
	40MO60							21
	40MO61							6
	40MO62				1			8
	40MO63							17
	40MO70							4
	40MO71							8
	40MO72							12
	40MO73		1					8
	40MO74							11
	40MO75							4
	40MO76							5
	40MO77	1	3			1		46
	40MO78			1				10
	40MO79							4
Totals		7	98	4	15	39	14	9202

Table B.19. Raw Material Breakdown of General Type Groups by Study Area.

Study Area	Upper Mississippian	Fort Payne	Other Chert	Quartz/ Chalcedony	Row Totals
Bandy Creek Upland	5776 89.1%	395 6.1%	192 3.0%	121 1.9%	6484 100.0%
Bandy Creek Gorges	806 84.8%	90 9.5%	22 2.3%	33 3.5%	951 100.0%
CARP Uplands	1451 82.9%	172 9.8%	100 5.7%	28 1.6%	1751 100.0%
Totals	8033 87.4%	657 7.2%	314 3.4%	182 2.0%	9186 100.0%

Table 8.20. Raw Material Breakdown of General Type Groups by Site.

Study Area	Site	Upper Mississippian	Fort Payne	Other Chert	Quartz/ Chalcedony	Totals
Bandy Creek Upland	40ST67	38	5	2		45
	40ST68	9		1		10
	40ST69	4		1		5
	40ST70	1267	159	44	30	1500
	40ST71	83	17	2	5	107
	40ST72	29	2		3	34
	40ST73	1569	10	16	4	1599
	40ST74	70	9	7	5	91
	40ST75	13		2		15
	40ST76	686	19	11	6	722
	40ST77	68	11	2	2	83
	40ST78	15	4		1	20
	40ST79	1468	67	84	52	1671
	40ST80	409	85	18	13	525
	40ST81	43	7	2		52
	40ST82	5				5
Bandy Creek Gorges	40ST152	85	7		25	117
	40ST155	31	1			32
	40ST161	143	64	4	8	219
	40ST164	200	5	7		212
	40ST165	347	13	11		371
CARP Uplands	40MO50	3	2			5
	40MO51	3				3
	40MO52	398	40	54	8	500
	40MO53	3		2		5
	40MO54	10	3		1	14
	40MO55	409	48	14	7	478
	40MO56	334	52	13	8	407
	40MO57	36	7	6		49
	40MO58	17				17
	40MO59	99	2	4	3	108
	40MO60	17	4			21
	40MO61	4		1	1	6
	40MO62	4	3			7
	40MO63	17				17
	40MO70	4				4
	40MO71	8				8
	40MO72	11	1			12
	40MO73	6	1	1		8
	40MO74	11				11
	40MO75	4				4
	40MO76	5				5
	40MO77	39	2	5		46
	40MO78	4	5			9
	40MO79	2	2			4
Totals		8030	657	314	182	9183

Table B.21. Results of Kolmogorov-Smirnov Two-sample Tests for Comparison of Lithic Raw Material for the Study Areas.

Study Areas Comparisons	Test Value of D	2-Tailed Critical Value of D (alpha = 0.01)	Significance
Bandy Creek Upland with Bandy Creek Gorge	0.043	0.057	Not Significant*
Bandy Creek Gorge with CARP Upland	0.019	0.057	Not Significant*
Bandy Creek Upland with CARP Upland	0.062	0.044	Significant**

* Note: Samples could have probably been drawn from the same population.
** Note: Samples probably couldn't have been drawn from the same population.

Table B.22. Median Polish Analysis of Study Areas by Raw Material Type Groups as Percentages.

	Chert Type Groups				
Study Area	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
Bandy Creek Upland	5.825	-1.875	0.000	0.000	-0.762
Bandy Creek Gorges	0.000	0.000	-2.225	4.000	0.762
CARP Upland	-1.138	1.063	1.937	-1.063	0.000
Column Effects	77.788	2.488	-2.488	-3.588	

Table B.23. Debitage Breakdown by Size.

Study Area	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"	1 5/8"	1 3/4"	1 7/8"	Totals
Bandy Creek	243	1725	1773	1067	625	383	182	114	54	21	14	8	7	2	6218
Upland	3.9%	27.7%	28.5%	17.2%	10.1%	6.2%	2.9%	1.8%	.9%	.3%	.2%	.1%	.1%	.0%	100.0%
Bandy Creek	38	259	240	151	76	40	37	20	12	2	2	0	1	0	878
Gorges	4.3%	29.5%	27.3%	17.2%	8.7%	4.6%	4.2%	2.3%	1.4%	.2%	.2%	.0%	.1%	.0%	100.0%
CARP	6	244	384	350	244	178	93	43	28	15	3	2	2	2	1594
Uplands	.4%	15.3%	24.1%	22.0%	15.3%	11.2%	5.8%	2.7%	1.8%	.9%	.2%	.1%	.1%	.1%	100.0%
Totals	287	2228	2397	1568	945	601	312	177	94	38	19	10	10	4	8690
	3.3%	25.6%	27.6%	18.0%	10.9%	6.9%	3.6%	2.0%	1.1%	.4%	.2%	.1%	.1%	.0%	100.0%

Note: There were no artifacts recorded in this table for sizes smaller than 1/4 inch.

Table B.24. Size Breakdown of Debitage by Site.

Study Area	Site	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"	1 5/8"	1 3/4"	1 7/8"	Row Totals
Bandy Creek Upland	40ST67	3	15	12	6	2	2				1					41
	40ST68		2	2	3	1		1								9
	40ST69			2	1	2										5
	40ST70	16	294	408	291	176	112	46	40	20	8	5	4	2	1	1423
	40ST71		16	24	23	13	10	6	7	2						101
	40ST72			6	4	4	7	4	1		2					28
	40ST73	52	349	441	273	198	117	62	39	13	3	5	2	2		1546
	40ST74		9	16	13	6	15	10	2	1	2				1	75
	40ST75		2	2	4	1	3		1		1					14
	40ST76	10	211	208	130	74	39	21	9	7	1	1	2	1		714
	40ST77		13	14	13	13	7	2	3	1	1					67
	40ST78		3	2		3	4	1		2				1		16
	40ST79	127	567	475	239	106	52	31	10	5		3		1		1616
	40ST80	34	233	143	57	22	10	4	1		2					506
	40ST81	1	8	17	9	4	5	4		1						49
	40ST82		2		1				1	1						5
Bandy Creek Gorges	40ST152	25	33	19	18	4	3	1								103
	40ST155		11	7	8		1	3								30
	40ST161		49	64	27	29	9	6	9	3	2	1				199
	40ST164	5	60	53	39	12	18	4	4				1			196
	40ST165	8	106	97	59	34	15	10	8	4		1				342
CARP Uplands	40MO50				1		1	1	1			1				5
	40MO51			1	1		1									3
	40MO52	3	73	94	104	87	46	30	8	6	2	1				454
	40MO53			1	1		1									3
	40MO54		2	2	3	1	1			1	1					11
	40MO55	3	63	115	102	65	42	18	13	11	2	1				435
	40MO56		67	115	72	52	36	18	7	2	5			1	1	376
	40MO57		4	7	13	6	2	4	2	1	2					41
	40MO58		1	1	4	1		2	2		1		1		1	14
	40MO59		15	24	22	10	22	4	2				1			100
	40MO60		4	1	2	3	7	3		1						21
	40MO61		1		1	1	2									5
	40MO62		1				1	3								5
	40MO63		5	3	3	3		1								15
	40MO70		1	1		1			1							4
	40MO71		1	1	1	1	3									7
	40MO72			1	2	2	2	2	1	2						12
	40MO73				2	1	1	2	1		1					8
	40MO74				3	1	2		2							8
	40MO75				2											2
	40MO76				1	3				1						5
	40MO77		5	13	6	9	5	2		3		1				44
	40MO78			1	2		2	1	2		1					9
	40MO79				1		1	1						1		4
Totals		287	2226	2393	1567	951	607	298	177	88	38	20	11	9	4	8676

Note: There were no artifacts recorded for sizes smaller than 1/8 inch.

Table B.25. Results of Kolmogorov-Smirnov Two-sample Tests for Comparison of Flake Size for the Study Areas.

Study Areas Comparisons	Test Value of D	2-Tailed Critical Value of D (alpha = 0.01)	Significance
Bandy Creek Upland with Bandy Creek Gorges	0.015	0.036	Not Significant*
Bandy Creek Gorges with CARP Upland	0.215	0.068	Significant**
Bandy Creek Upland with CARP Upland	0.202	0.046	Significant**
Bandy Creek Upland (Surface Samples) with Bandy Creek Gorges	0.176	0.066	Significant**
Bandy Creek Upland (Surface Samples) with CARP Upland	0.039	0.055	Not Significant*
Bandy Creek Upland (Surface Samples) with Bandy Creek Upland (Sub-surface Samples)	0.243	0.044	Significant**
Bandy Creek Upland (Surface Samples) with Bandy Creek Upland (All Samples)	0.163	0.042	Significant**
Bandy Creek Upland (Sub-surface Samples) with Bandy Creek Gorges	0.176	0.066	Significant**
Bandy Creek Upland (Sub-surface Samples) with CARP Upland	0.282	0.048	Significant**
Bandy Creek Upland (Sub-surface Samples) with Bandy Creek Upland (All Samples)	0.080	0.046	Significant**

* Note: Samples could have probably been drawn from the same population.
** Note: Samples probably couldn't have been drawn from the same population.

Table B.26. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Surface and Sub-surface Samples Combined.

Platform Surface		Percent Cortex		
		>66 %	<66%	None
Cortex Covered	obs.	7 *	33 *	20
	exp.	3.60	16.93	39.47
Plain	obs.	17 *	59 *	118
	exp.	11.63	54.74	127.62
Point Plain/ Peaked/ Multi-Faceted	obs.	10	68	235 *
	exp.	18.77	88.32	205.91

* Indicates positive relationship.

Table B.27. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Surface Samples Only.

Platform Surface		Percent Cortex		
		>66 %	<66%	None
Cortex Covered	obs.	5 *	14 *	10
	exp.	2.09	10.46	16.45
Plain	obs.	6 *	26 *	37
	exp.	4.98	24.88	39.14
Point Plain/ Peaked/ Multi-Faceted	obs.	4	35	71 *
	exp.	7.93	33.66	62.40

* Indicates positive relationship.

Table B.28. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Sub-surface Samples Only.

Platform Surface		Percent Cortex		
		>66 %	<66%	None
Cortex Covered	obs.	2 *	19 *	10
	exp.	1.62	7.75	22.94
Plain	obs.	11 *	33 *	81
	exp.	6.28	30.16	89.12
Point Plain/ Peaked/ Multi-Faceted	obs.	6	33	164 *
	exp.	10.23	49.11	145.29

* Indicates positive relationship.

Table B.29. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Gorges Study Area.

Platform Surface		Percent Cortex		
		>66 %	<66%	None
Cortex Covered	obs.	4 *	23 *	17
	exp.	3.03	13.00	27.29
Plain	obs.	7 *	20	41
	exp.	4.80	20.58	43.21
Point Plain/ Peaked/ Multi-Faceted	obs.	14	67	168 *
	exp.	17.44	74.73	156.93

* Indicates positive relationship.

Table B.30. Modified Debitage Paradigm for Whole Debitage > 1/4 Inch from CARP Uplands Study Area.

Platform Surface		Percent Cortex		
		>66 %	<66%	None
Cortex Covered	obs.	12 *	32 *	22
	exp.	4.98	22.42	38.62
Plain	obs.	8 *	37 *	52
	exp.	7.32	32.94	56.74
Point Plain/ Peaked/ Multi-Faceted	obs.	4	39	112 *
	exp.	11.70	52.64	90.66

* Indicates positive relationship.

Table B.31. Whole Debitage > 1/4 Inch Crosstabulated by Type and Study Area.

	Study Area				
Debitage Type	Bandy Creek Upland Area (All Samples)	Bandy Creek Upland Area (Surface Only)	Bandy Creek Upland Area (Sub-surface Only)	CARP Upland Area	Bandy Creek Gorge Area
DB4	7	5	2	12	4
(>66 % dorsal cortex with cortex covered platform)	1 %	2 %	1 %	4 %	1 %
DB5	33	14	19	32	23
(≤66 % dorsal cortex with cortex covered platform)	6 %	7 %	5 %	10 %	6 %
DB6	20	10	10	22	17
(No dorsal cortex with cortex covered platform)	4 %	5 %	3 %	7 %	5 %
DB7	17	6	11	8	7
(>66 % dorsal cortex with plain platform)	3 %	3 %	3 %	3 %	2 %
DB8	59	26	33	37	20
(≤66 % dorsal cortex with plain platform)	10 %	13 %	9 %	12 %	6 %
DB9	118	37	81	52	41
(No dorsal cortex with plain platform)	21 %	18 %	23 %	16 %	11 %
DB10	10	4	6	4	14
(>66 % dorsal cortex with point plain/peaked/multi-faceted platform)	2 %	2 %	2 %	1 %	4 %
DB11	68	35	33	39	67
(≤66 % dorsal cortex with point plain/peaked/multi-faceted platform)	12 %	17 %	9 %	12 %	19 %
DB12	235	71	164	112	168
(No dorsal cortex with point plain/peaked/multi-faceted platform)	41 %	34 %	46 %	35 %	47 %

Table B.32. Median Polish of Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Surface and Sub-surface Samples Combined.

Platform Surface	Percent Cortex			
	>66 %	<66%	None	Row Effects
Cortex Covered	16.000	0.000	-72.000	-26.000
Plain	0.000	0.000	0.000	0.000
Point Plain/ Peaked/ Multi-Faceted	-16.000	0.000	108.000	9.000
Column Effects	-42.000	0.000	59.00	

Table B.33. Median Polish of Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Surface Samples Only.

Platform Surface	Percent Cortex			
	>66 %	<66%	None	Row Effects
Cortex Covered	11.000	0.000	-15.000	-12.000
Plain	0.000	0.000	0.000	0.000
Point Plain/ Peaked/ Multi-Faceted	-11.000	0.000	25.000	9.000
Column Effects	-20.000	0.000	11.00	

Table B.34. Median Polish of Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Upland Study Area for Sub-surface Samples Only.

Platform Surface	Percent Cortex			
	>66 %	<66%	None	Row Effects
Cortex Covered	5.000	0.000	-57.000	-14.000
Plain	0.000	0.000	0.000	0.000
Point Plain/ Peaked/ Multi-Faceted	-5.000	0.000	83.000	0.000
Column Effects	-22.000	0.000	48.00	

Table B.35. Median Polish of Debitage Paradigm for Whole Debitage > 1/4 Inch from Bandy Gorges Study Area.

Platform Surface	Percent Cortex			
	>66 %	<66%	None	Row Effects
Cortex Covered	0.000	0.000	-21.000	-3.000
Plain	0.000	0.000	0.000	0.000
Point Plain/ Peaked/ Multi-Faceted	-40.000	0.000	80.000	47.000
Column Effects	-13.000	0.000	21.00	

Table B.36. Median Polish of Debitage Paradigm for Whole Debitage > 1/4 Inch from CARP Uplands Study Area.

Platform Surface	Percent Cortex			
	>66 %	<66%	None	Row Effects
Cortex Covered	9.000	0.000	-25.000	-5.000
Plain	0.000	0.000	0.000	0.000
Point Plain/ Peaked/ Multi-Faceted	-6.000	0.000	58.000	2.000
	-------	-----	-----	
Column Effects	-29.000	0.000	15.00	

Table B.37. Projectile/Knife Types by Study Area.

Study Area	Types 1	2	3	4	7	8	9	10	11	13	14
Bandy Creek Upland	29 70.7%	1 2.4%	1 2.4%		1 2.4%			1 2.4%			
Bandy Creek Gorges	10 50.0%	1 5.0%		1 5.0%		1 5.0%	1 5.0%		1 5.0%	2 10.0%	
CARP Uplands	30 62.5%	3 6.3%						2 4.2%		4 8.3%	1 2.1%
Totals	69 63.3%	5 4.6%	1 .9%	1 .9%	1 .9%	1 .9%	1 .9%	3 2.8%	1 .9%	6 5.5%	1 .9%

Study Area	20	21	23	24	26	27	28	29	30	31	40	Row Total
Bandy Creek Upland		1 2.4%			1 2.4%		1 2.4%	3 7.3%			2 4.9%	41 100.0%
Bandy Creek Gorges	1 5.0%	1 5.0%							1 5.0%			20 100.0%
CARP Uplands			1 2.1%	3 6.3%		1 2.1%		1 2.1%	1 2.1%	1 2.1%		48 100.0%
Totals	1 .9%	2 1.8%	1 .9%	3 2.8%	1 .9%	1 .9%	1 .9%	4 3.7%	2 1.8%	1 .9%	2 1.8%	109 100.0%

Table B.38. Projectile Point/Knife Types by Site.

Study Area	Site	1	2	3	4	7	8	9	10	11	13	14	20	21	23	24	26	27	28	29	30	31	40	Row Total
Bandy Creek Upland	40ST67	1																						1
	40ST68	1																						1
	40ST69																							
	40ST70	4	1																1				2	8
	40ST71																							
	40ST72	1																		1				2
	40ST73	3				1			1															5
	40ST74	2												1			1							4
	40ST75																							
	40ST76	2																						2
	40ST77	3		1																1				5
	40ST78	1																						1
	40ST79	5																		1				6
	40ST80	5																						5
	40ST81	1																						1
	40ST82																							
Bandy Creek Gorges	40ST152							1			1													2
	40ST155	1								1														2
	40ST160	7	1										1	1										3
	40ST161	6			1						1										1			9
	40ST164						1																	1
	40ST165	3																						3
CARP Uplands	40MO50																							
	40MO51																							
	40MO52	5	1													3		1						10
	40MO53														1									1
	40MO54											1										1		2
	40MO55	9							1												1			11
	40MO56	7	1						1		3									1				13
	40MP57	2																						2
	40MO58																							
	40MO59	2									1													3
	40MO60																							
	40MO61																							
	40MO62																							
	40MO63		1																					1
	40MO70																							
	40MO71																							
	40MO72																							
	40MO73																							
	40MO74	1																						1
	40MO75	2																						2
	40MO76																							
	40MO77																							
	40MO78																							
	40MO79																							
	40MO80																							
	426 4	1																						1
	428 4	1																						1
Totals		69	5	1	1	1	1	1	3	1	6	1	1	2	1	3	1	1	1	4	2	1	2	109

Table B.39. Cultural Period Breakdown of Identifiable Diagnostic Projectile Point/Knife Types by Study Area.

Study Area	Late Woodland/ Mississipian (Types 2 - 4)	Middle Woodland (Types 7 - 13)	Early Woodland/ Terminal Archaic (Types 14)
Bandy Creek Upland	2 20.0%*	2 20.0%	
Bandy Creek Gorges	2 20.0%	5 50.0%	
CARP Uplands	3 16.7%	6 33.3%	1 5.6%
Totals	7 18.4%	13 32.4%	1 7.9%

* Note: Percent Indentifiable for Study Area by Cultural Period.

Study Area	Late Archaic (Types 20 - 21)	Middle Archaic/ Early Archaic (Type 23)	Early Archaic (Types 24 -31)	Unidentifiable (Types 1 and 40)
Bandy Creek Upland	1 10.0%		5 50.0%	31
Bandy Creek Gorges	2 20.0%		1 10.0%	10
CARP Uplands		1 5.6%	7 38.9%	30
Totals	3 2.6%	1 2.6%	13 32.4%	71

Table B.40. Cultural Period Breakdown of Identifiable Diagnostic Projectile Point/Knife Types by Site.

Study Area	Site	Late Woodland/ Mississipian (Types 2 - 4)	Middle Woodland (Types 7 - 13)	Early Woodland/ Terminal Archaic (Type 14)	Late Archaic (Types 20 - 21)	Middle Archaic/ Early Archaic (Type 23)	Early Archaic (Types 24 -31)	Unidentifiable (Types 1 and 40)
Bandy Creek Upland	40ST67							1
	40ST68							1
	40ST69							
	40ST70	1					1	6
	40ST71							
	40ST72						1	1
	40ST73		2					3
	40ST74				1		1	2
	40ST75							
	40ST76							2
	40ST77	1					1	3
	40ST78							1
	40ST79						1	5
	40ST80							5
	40ST81							
	40ST82							1
Bandy Creek Gorges	40ST152		2					
	40ST155		1					1
	40ST160	1			2			
	40ST161	1	1				1	6
	40ST164		1					
	40ST165							3
CARP Uplands	40MO50							
	40MO51							
	40MO52	1					4	5
	40MO53					1		
	40MO54			1			1	
	40MO55		1				1	9
	40MO56	1	4				1	7
	40MP57							2
	40MO58							
	40MO59		1					2
	40MO60							
	40MO61							
	40MO62							
	40MO63							
	40MO70							
	40MO71							
	40MO72							
	40MO73							
	40MO74							1
	40MO75							2
	40MO76							
	40MO77							
	40MO78							
	40MO79	1						
	426 4							1
	428 4							1
Totals		7	13	1	3	1	13	71

Table B.41. Results of Kolmogrov-Smirnov Two-sample Tests for Comparison of Diagnostic Projectile Points/Knives for the Study Areas.

Study Areas Comparisons	Test Value of D	2-Tailed Critical Value of D (alpha = 0.01)	Significance
Bandy Creek Upland with Bandy Creek Gorge	0.400	0.729	Not Significant*
Bandy Creek Gorge with CARP Upland	0.344	0.642	Not Significant*
Bandy Creek Upland with CARP Upland	0.033	0.642	Not Significant*

* Note: Samples could have probably been drawn from the same population.

Table B.42. Median Polish Analysis of Study Areas by Projectile Point/Knife Type Groups as Percentages.

	Projectile Point/ Knife Type Groups				
Study Area	Late Woodland/ Mississippian	Middle Woodland	Early Woodland- Late Archaic	Middle -Early Arcahic	Row Effects
Bandy Creek Upland	.500	-15.500	0.000	3.500	0.000
Bandy Creek Gorges	-4.500	9.500	5.000	-41.500	5.000
CARP Upland	0.000	0.000	-1.500	0.000	-2.500
Column Effects	-8.000	8.000	-17.500	19.000	

Table B.43. Flake Tool Types by Study Area.

Study Area	A	B	C	D	E	F	G	H	I	J
Bandy Creek Upland	35 10.5%	4 1.2%	3 .9%	1 .3%	4 1.2%		22 6.6%	4 1.2%	2 .6%	2 .6%
Bandy Creek Gorges	19 7.3%			1 .4%	1 .4%		9 3.4%	1 .4%	1 .4%	
CARP Uplands	12 4.6%					1 .4%	15 5.7%	3 1.1%	3 1.1%	
Totals	66 7.7%	4 .5%	3 .4%	2 .2%	5 .6%	1 .1%	46 5.4%	8 .9%	6 .7%	2 .2%

Study Area	L	M	N	O	P	Q	R	S	T	U	Row Total
Bandy Creek Upland	8 2.4%	3 .9%	15 4.5%	1 .3%			3 .9%	2 .6%	2 .6%	12 3.6%	333 100.0%
Bandy Creek Gorges	1 .4%								1 .4%	4 1.5%	262 100.0%
CARP Uplands	6 2.3%	2 .8%	4 1.5%		1 .4%	1 .4%	1 .4%			17 6.5%	261 100.0%
Totals	15 1.8%	5 .6%	19 2.2%	1 .1%	1 .1%	1 .1%	4 .5%	2 .2%	3 .4%	33 3.9%	856 100.0%

Table B.44. Flake Tool Types by Site.

Study Area	Site	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	Row Total
Bandy Creek Upland	40ST67	1						1							1								3
	40ST68																						
	40ST69																						
	40ST70	11	2	1		3		8	2	1	1		4		2	1			1	2		4	43
	40ST71							1	1				1	1							1	1	6
	40ST72					1															1		2
	40ST73	11						6			1		2	2	3							1	26
	40ST74												1		2								3
	40ST75	1																					1
	40ST76	1						2														2	5
	40ST77	2	1	1											2								6
	40ST78			1						1													2
	40ST79	5			1			4	1						1				1			2	15
	40ST80	3													3				1			2	9
	40ST81		1												1								2
	40ST82																						
Bandy Creek Gorges	40ST152							1															1
	40ST155	1																					1
	40ST161	1						1														4	6
	40ST164	1						2													1		4
	40ST165	16			1	1		5	1	1			1										26
CARP Uplands	40MO50																						
	40MO51																						
	40MO52	5						4		2			1						1			7	20
	40MO53																						
	40MO54												1										1
	40MO55	3						2	1				2	2	2			1				4	17
	40MO56	2						2	1	1			1				1					4	12
	40MP57	1						1														1	3
	40MO58	1						1															2
	40MO59							3														1	4
	40MO60																						
	40MO61																						
	40MO62							1					1										2
	40MO63																						
	40MO70																						
	40MO71														1								1
	40MO72																						
	40MO73																						
	40MO74														1								1
	40MO75																						
	40MO76																						
	40MO77						1	1	1														3
	40MO78																						
	40MO79																						
Totals		66	4	3	2	5	1	46	8	6	2		15	5	19	1	1	1	4	2	3	33	227

Table B.45. Breakdown of Chipped Stone Implements by Study Area.

Study Area	Utilized	Retouched	Bifacial	Totals
Bandy Creek	77	34	87	198
Upland	38.9%	17.2%	43.9%	100.0%
Bandy Creek	32	2	20	54
Gorges	59.3%	3.7%	37.0%	100.0%
CARP	34	16	78	128
Uplands	26.6%	12.5%	60.9%	100.0%
Totals	143	52	185	380
	37.6%	13.7%	48.7%	100.0%

* Note: Does not inculde Quartzite or Sandstone Artifacts.

Table B.46 Breakdown of Chipped Stone Implements by Site.

Study Area	Site	Utilized	Retouched	Bifacial	Row Totals
Bandy Creek Upland	40ST67	2	1	1	4
	40ST68			1	1
	40ST69				
	40ST70	29	10	29	68
	40ST71	2	3	1	6
	40ST72	1	1	3	5
	40ST73	18	7	11	36
	40ST74		3	11	14
	40ST75	1			1
	40ST76	3		3	6
	40ST77	4	2	8	14
	40ST78	2		2	4
	40ST79	11	2	11	24
	40ST80	3	4	5	12
	40ST81	1	1	1	3
	40ST82				
Bandy Creek Gorges	40ST152	1		3	4
	40ST155	1		1	2
	40ST161	2		11	13
	40ST164	3	1	2	6
	40ST165	25	1	3	29
CARP Uplands	40MO50				
	40MO51				
	40MO52	11	2	22	35
	40MO53			2	2
	40MO54		1	2	3
	40MO55	6	7	22	35
	40MO56	6	2	17	25
	40MP57	2		4	6
	40MO58	2			2
	40MO59	3		3	6
	40MO60				
	40MO61				
	40MO62	1	1		2
	40MO63			1	1
	40MO70				
	40MO71		1		1
	40MO72			1	1
	40MO73			1	1
	40MO74		1	1	2
	40MO75			2	2
	40MO76				
	40MO77	3			3
	40MO78				
	40MO79				
Totals		143	51	185	379

Table B.47. Results of Kolmogorov-Smirnov Two-sample Tests for Comparison of Chipped Stone Implements for the Study Areas.

Study Areas Comparisons	Test Value of D	2-Tailed Critical Value of D (alpha = 0.01)	Significance
Bandy Creek Upland with Bandy Creek Gorge	0.204	0.250	Not Significant*
Bandy Creek Gorge with CARP Upland	0.327	0.265	Significant**
Bandy Creek Upland with CARP Upland	0.170	0.185	Not Significant*

* Note: Samples could have probably been drawn from the same population.
** Note: Samples probably couldn't have been drawn from the same population.

Table B.48. Median Polish Analysis of Study Areas by Chipped Stone Implement Type Groups as Percentages.

	Chipped Stone Implement Type Groups			
Study Area	Utilized	Retouched	Bifaces	Row Effects
Bandy Creek Upland	0.000	0.000	0.000	5.000
Bandy Creek Gorges	27.000	-6.000	0.000	-2.000
CARP Upland	-7.000	0.000	22.000	0.000
Column Effects	0.000	-22.000	5.000	

Table B.49. Partitioned Chi-Square Analysis of Bandy Creek Upland Study Area.

			Chert Type Groups		
Implement Category		Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.
Debitage	obs.	5595	373	178	118
	model	.893	.060	.028	.019
A (Utilized Flakes)	obs.	75	1	1	1
	exp.	69.7	4.6	2.2	1.5
B (Retouched Flakes)	obs.	28	3	2	
	exp.	29.5	2.0	0.9	0.6
C (Formalized Bifaces)	obs.	62	15	9	1
	exp.	77.7	5.2	2.3	1.6
A,B and C combined	obs.	165	19	12	2
	exp.	176.9	11.8	5.6	3.7

Chi-Square Total = 45.802, df=9, $p < 0.001$
Chi-Sguare Comb. = 13.225, df=3, $p < 0.005$
Chi-Square Diff. = 32.577, df=6 $p < 0.001$

Table B.50. Partitioned Chi-Square Analysis of Bandy Creek Gorges Study Area.

		Chert Type Groups			
Implement Category		Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.
Debitage	obs.	752	82	20	32
	model	.849	.093	.023	.036
A (Utilized Flakes)	obs.	33	1		
	exp.	28.9	3.2	0.8	1.2
B (Retouched Flakes)	obs.	2			
	exp.	1.7	0.2	>0.1	0.1
C (Formalized Bifaces)	obs.	13	5	2	
	exp.	17.0	1.9	0.5	0.7
A,B and C combined	obs.	48	6	2	0
	exp.	47.5	5.2	1.3	2.0

Chi-Square Total = 16.733, df=9, $p < 0.500$
Chi-Sguare Comb. = 2.584, df=3, $p < 0.975$
Chi-Square Diff. = 14.148, df=6, $p < 0.050$

Table B.51. Partitioned Chi-Square Analysis of CARP Uplands Study Area.

Implement Category		Upper Miss.	Chert Type Groups Fort Payne	 Other Chert	 Quartz /Chal.
Debitage	obs.	1319	159	94	27
	model	.825	.099	.059	.017
A (Utilized Flakes)	obs.	27	5	3	
	exp.	28.8	3.5	2.1	0.6
B (Retouched Flakes)	obs.	15			
	exp.	12.4	1.5	0.9	0.3
C (Formalized Bifaces)	obs.	6	8	6	1
	exp.	17.3	2.1	1.2	0.4
A,B and C combined	obs.	48	13	9	1
	exp.	58.6	7.1	4.2	1.2

Chi-Square Total = 48.700, df=9, $p < 0.001$
Chi-Sguare Comb. = 12.518, df=3, $p < 0.010$
Chi-Square Diff. = 36.182, df=6, $p < 0.001$

Table 8.52. Partitioned Chi-Square Values for Pairs of Implement Categories From Bandy Creek Upland Area.

Implement Category	Chi-Square Total (df=6)	Chi-Square Combined (df=3)	Chi-square Difference (df=3)
A and B (Utilized Flakes and Retouched Flakes)	6.53 *	1.76 *	4.77 *
B and C (Retouched Flakes and Formalized Bifaces)	43.36 **	11.02 *	32.34 **
A and C (Utilized Flakes and Formalized Bifaces)	47.72 **	36.84 **	4.87 *

* Not Significant
** Significant

Table B.53. Partitioned Chi-Square Values for Pairs of Implement Categories From Bandy Creek Gorges Area.

Implement Category	Chi-Square Total (df=6)	Chi-Square Combined (df=3)	Chi-square Difference (df=3)
A and B (Utilized Flakes and Retouched Flakes)	4.41 *	4.39 *	.02 *
B and C (Retouched Flakes and Formalized Bifaces)	16.38 **	2.65 *	13.72 **
A and C (Utilized Flakes and Formalized Bifaces)	12.68 **	10.38 *	2.30 *

* Not Significant
** Significant

Table B.54. Partitioned Chi-Square Values for Pairs of Implement Categories From CARP Uplands Area.

Implement Category	Chi-Square Total (df=6)	Chi-Square Combined (df=3)	Chi-square Difference (df=3)
A and B (Utilized Flakes and Retouched Flakes)	4.99 *	.86 *	4.13 *
B and C (Retouched Flakes and Formalized Bifaces)	45.52 **	23.59 **	21.93 **
A and C (Utilized Flakes and Formalized Bifaces)	46.89 **	15.36 **	31.51 **

* Not Significant
** Significant

Table B.55. Median Polish Analysis of Implements as Frequencies by Raw Material for Bandy Creek Upland Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	20.625	-2.500	-0.375	0.500	0.000
B (Retouched Flakes)	-25.875	0.000	1.125	0.000	-0.500
C (Formalized Bifaces)	0.000	3.875	0.000	-7.125	7.625
Column Effects	51.875	1.000	-1.125	-2.000	

Table B.56. Median Polish Analysis of Implements as Frequencies by Raw Material for Bandy Creek Gorges Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	22.250	0.000	0.000	0.000	0.000
B (Retouched Flakes)	-8.250	-0.500	0.500	0.500	-0.500
C (Formalized Bifaces)	0.000	1.750	-0.250	-2.250	2.250
Column Effects	10.250	0.500	-0.500	-0.500	

Table B.57. Median Polish Analysis of Implements as Frequencies by Raw Material for CARP Uplands Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	8.000	0.000	-1.000	0.000	0.000
B (Retouched Flakes)	0.000	-1.000	0.000	4.000	-4.000
C (Formalized Bifaces)	-14.500	1.500	0.500	-0.550	1.500
Column Effects	14.500	0.500	-0.500	-4.500	

Table B.58. Median Polish Analysis of Implements as Percentages by Raw Material for Bandy Creek Upland Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	13.150	-6.050	-3.050	3.050	-1.750
B (Retouched Flakes)	0.000	0.000	0.000	0.000	0.000
C (Formalized Bifaces)	-16.150	5.450	1.550	-1.550	2.650
Column Effects	77.200	1.500	-1.500	-7.600	

Table B.59. Median Polish Analysis of Implements As Percentages by Raw Material for Bandy Creek Gorges Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	0.000	0.000	0.000	0.000	0.000
B (Retouched Flakes)	2.900	-2.900	0.000	0.000	0.000
C (Formalized Bifaces)	-37.100	17.100	5.000	-5.000	5.000
Column Effects	95.650	1.450	-1.450	-1.450	

Table B.60. Median Polish Analysis of Implements as Percentages by Raw Material for CARP Uplands Study Area.

	Chert Type Groups				
Implement Category	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Row Effects
A (Utilized Flakes)	0.000	0.000	0.000	0.000	-1.425
B (Retouched Flakes)	27.200	-10.000	-4.300	4.300	-5.725
C (Formalized Bifaces)	-60.900	11.400	7.600	-7.600	10.975
Column Effects	64.250	1.425	-4.275	-12.875	

Table B.61. Implement to Debitage Ratios for Artifacts > 1/4 Inch.

Study Area	Site	Implement to Debitage Ratios for > 1/4" Artifacts	Total Lithic Artifacts Recovered for All Seasons and Methods	Total Lithic Artifacts Recovered > 1/4 in. After Size Sorting	Percentage of Total Made up of > 1/4 in. After Size Sorting
Bandy Creek Upland	40ST67	1:10	77	45	58.4%
	40ST68	1:9	12	10	83.3%
	40ST69		7	5	71.4%
	40ST70	1:20 (1:15)*	2657	1499	56.4%
	40ST71	1:17 (1:14)	130	107	82.3%
	40ST72	1:6 (1:6)	42	34	81.0%
	40ST73	1:43 (1:24)	3219	1599	49.7%
	40ST74	1:6 (1:5)	110	91	82.7%
	40ST75	1:14 (1:11)	18	15	83.3%
	40ST76	1:89	2105	722	34.3%
	40ST77	1:5 (1:5)	92	83	90.2%
	40ST78	1:4 (1:4)	20	20	100.0%
	40ST79	1:53	4730	1672	35.4%
	40ST80	1:37	1641	526	32.0%
	40ST81	1:16	78	52	66.7%
	40ST82		7	5	71.4%
	HCK 11		1	1	
	HCK 12		1	1	
	HCK 13		1	1	
	HCK 15		1	1	
Subtotal	(20 Sites)	1:30	14949	6488	43.4%
Bandy Creek Gorges	40ST152	1:22	302	117	38.7%
	40ST155	1:15	62	32	51.6%
	40ST161	1:12	652	219	33.6%
	40ST164	1:34	611	212	34.7%
	40ST165	1:12	1532	371	24.2%
Subtotal	(5 Sites)	1:16	3159	951	30.1%
CARP Uplands	40MO50		5	5	100.0%
	40MO61		3	3	100.0%
	40MO52	1:11	603	603	100.0%
	40MO53	1:2	5	5	100.0%
	40MO54	1:4	14	14	100.0%
	40MO55	1:11	487	480	98.6%
	40MO56	1:13	457	407	89.1%
	40MO57	1:6	49	49	100.0%
	40MO58	1:7	22	17	77.3%
	40MO59	1:14	129	108	83.7%
	40MO60		21	21	100.0%
	40MO61		7	6	85.7%
	40MO62	1:3	9	7	77.8%
	40MO63	1:15	19	16	79.0%
	40MD70		5	4	80.0%
	40MO71	1:7	9	8	88.9%
	40MO72	1:12	13	13	100.0%
	40MO73	1:8	13	10	76.9%
	40MO74	1:4	11	11	100.0%
	40MO75	1:1	4	4	100.0%
	40MO76		5	5	100.0%
	40MO77	1:14	64	46	71.8%
	40MD78		10	9	90.0%
	40MO79		4	4	100.0%
	426 4		1	1	100.0%
	428 4		1	1	100.0%
	428 9		1	1	100.0%
	428 10		2	2	100.0%
	442 5		1	1	100.0%
	442 8		1	1	100.0%
	442 9		1	1	100.0%
	442 10		1	1	100.0%
	442 98		1	1	100.0%
	442 99		1	1	100.0%
Subtotal	(34 Sites)	1:11	1879	1766	93.9%
Totals	(59 Sites)		19987	9204	46.1%

Table B.62. Flake Implement to Biface Ratios for Artifacts > 1/4 Inch.

Study Area	Site	Flake Implement to Biface Ratios for > 1/4" Artifacts	Total Lithic Artifacts Recovered for All Seasons and Methods	Total Lithic Artifacts Recovered > 1/4 in. After Size Sorting	Percentage of Total Made up of > 1/4 in. After Size Sorting
Bandy Creek Upland	40ST67	3:1	77	45	58.4%
	40ST68		12	10	83.3%
	40ST69		7	5	71.4%
	40ST70	1.5:1 (1.4:1)	2657	1499	56.4%
	40ST71	5:1 (5:1)	130	107	82.3%
	40ST72	1:1.5 (1:1)	42	34	81.0%
	40ST73	2.3:1 (2.4:1)	3219	1599	49.7%
	40ST74	1:2.2 (1:2.2)	110	91	82.7%
	40ST75		18	15	83.3%
	40ST76	1.7:1	2105	722	34.3%
	40ST77	1:1.3 (1:1.3)	92	83	90.2%
	40ST78	1:1 (1:1)	20	20	100.0%
	40ST79	1.4:1	4730	1672	35.4%
	40ST80	1.8:1	1641	525	32.0%
	40ST81	2:1	78	52	66.7%
	40ST82		7	5	71.4%
	HCK 11		1	1	1
	HCK 12		1	1	1
	HCK 13		1	1	1
	HCK 15		1	1	1
Subtotal	(20 Sites)	1.4:1	14949	6488	43.4%
Bandy Creek Gorges	40ST152	1:1.5	302	117	38.7%
	40ST155	1:1	62	32	51.6%
	40ST161	1:1.8	652	219	33.6%
	40ST164	2:1	611	212	34.7%
	40ST165	8.7:1	1532	371	24.2%
Subtotal	(5 Sites)	1.95:1	3159	951	30.1%
CARP Uplands	40MO50		5	5	100.0%
	40MO51		3	3	100.0%
	40MO52	1:1.1	503	503	100.0%
	40MO53		5	5	100.0%
	40MO54	1:2	14	14	100.0%
	40MO55	1:1.3	487	480	98.6%
	40MO56	1:1.4	457	407	89.1%
	40MO57	1:1.3	49	49	100.0%
	40MO58		22	17	77.3%
	40MO59	1.3:1	129	108	83.7%
	40MO60		21	21	100.0%
	40MO61		7	6	85.7%
	40MO62		9	7	77.8%
	40MO63		19	15	79.0%
	40MO70		5	4	80.0%
	40MO71		9	8	88.9%
	40MO72		13	13	100.0%
	40MO73		13	10	76.9%
	40MO74	1:1	11	11	100.0%
	40MO75		4	4	100.0%
	40MO76		5	5	100.0%
	40MO77		64	46	71.8%
	40MO78		10	9	90.0%
	40MO79		4	4	100.0%
	426 4		1	1	100.0%
	428 4		1	1	100.0%
	428 9		1	1	100.0%
	428 10		2	2	100.0%
	442 5		1	1	100.0%
	442 8		1	1	100.0%
	442 9		1	1	100.0%
	442 10		1	1	100.0%
	442 98		1	1	100.0%
	442 99		1	1	100.0%
Subtotal	(34 Sites)	1:1.6	1879	1766	93.9%
Totals	(59 Sites)		19987	9204	46.1%

Table B.63. Data Expressed as Proportions for the 15 Site Sample Cluster Analysis for 10 Variables.

	Chipped Stone Implements			Lithic Raw Materials				Platform Preparation		
Site	Utilized Flakes	Retouched Flakes	Bifaces	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Cortex Covered	Plain	Peaked/ Pt.Plain /Faceted
40ST70	42.60	14.70	42.60	84.50	10.60	2.90	2.00	5.30	26.30	68.40
40ST71	33.30	50.00	16.70	77.60	15.90	1.90	4.70	2.10	27.10	70.80
40ST73	50.00	19.40	30.60	98.10	.60	1.00	.30	13.30	31.80	54.90
40ST74	.00	21.40	78.60	76.90	9.90	7.70	5.50	10.30	20.70	69.00
40ST76	50.00	.00	50.00	95.00	2.60	1.50	.80	17.10	40.80	42.10
40ST79	45.80	8.30	45.80	87.90	4.00	5.00	3.10	6.90	21.10	72.30
40ST80	25.00	33.30	41.70	77.90	16.20	3.40	2.50	5.70	25.90	68.40
40ST152	25.00	.00	75.00	72.70	6.00	.00	21.40	.00	2.00	98.00
40ST161	15.40	.00	84.60	65.30	29.20	1.80	3.70	10.30	44.30	45.40
40ST164	50.00	16.70	33.30	94.30	2.40	3.30	.00	15.70	11.60	72.80
40ST165	86.20	3.40	10.30	93.50	3.50	3.00	.00	12.90	10.80	76.30
40MO52	31.40	5.70	62.90	79.60	8.00	10.80	1.60	20.20	28.60	51.20
40MO55	17.10	20.00	62.90	85.60	10.00	2.90	1.50	19.10	25.10	55.80
40MO56	24.00	8.00	68.00	82.10	12.80	3.20	2.00	14.40	34.40	51.10
40MO59	50.00	.00	50.00	91.70	1.90	3.70	2.80	28.60	37.10	34.30

Table B.64. Data Expressed as Proportions for the 15 Site Sample Cluster Analysis for 14 Variables.

	Chipped Stone Implements			Lithic Raw Materials				Platform Preparation			Diagnostic Projectile Points			
Site	Utilized Flakes	Retouched Flakes	Bifaces	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Cortex Covered	Plain	Peaked/ Pt.Plain /Faceted	Late Woodland	Middle Woodland	Early Woodland -Late Archaic	Middle Archaic -Early Archaic
40ST70	42.60	14.70	42.60	84.50	10.60	2.90	2.00	5.30	26.30	68.40	50.00	.00	.00	50.00
40ST71	33.30	50.00	16.70	77.60	15.90	1.90	4.70	2.10	27.10	70.80	.00	.00	.00	100.00
40ST73	50.00	19.40	30.60	98.10	.60	1.00	.30	13.30	31.80	54.90	100.00	.00	.00	.00
40ST74	.00	21.40	78.60	76.90	9.90	7.70	5.50	10.30	20.70	69.00	.00	.00	50.00	50.00
40ST76	50.00	.00	50.00	95.00	2.60	1.50	.80	17.10	40.80	42.10	.00	100.00	.00	.00
40ST79	45.80	8.30	45.80	87.90	4.00	5.00	3.10	6.90	21.10	72.30	.00	.00	.00	100.00
40ST80	25.00	33.30	41.70	77.90	16.20	3.40	2.50	5.70	25.90	68.40	.00	.00	.00	100.00
40ST152	25.00	.00	75.00	72.70	6.00	.00	21.40	.00	2.00	98.00	.00	100.00	.00	.00
40ST161	15.40	.00	84.60	65.30	29.20	1.80	3.70	10.30	44.30	45.40	33.30	33.30	.00	33.30
40ST164	50.00	16.70	33.30	94.30	2.40	3.30	.00	15.70	11.60	72.80	.00	100.00	.00	.00
40ST165	86.20	3.40	10.30	93.50	3.50	3.00	.00	12.90	10.80	76.30	100.00	.00	.00	.00
40MO52	31.40	5.70	62.90	79.60	8.00	10.80	1.60	20.20	28.60	51.20	20.00	.00	.00	80.00
40MO55	17.10	20.00	62.90	85.60	10.00	2.90	1.50	19.10	25.10	55.80	.00	50.00	.00	50.00
40MO56	24.00	8.00	68.00	82.10	12.80	3.20	2.00	14.40	34.40	51.10	16.70	66.70	.00	16.70
40MO59	50.00	.00	50.00	91.70	1.90	3.70	2.80	28.60	37.10	34.30	.00	100.00	.00	.00

Table B.65. Results of the 15 Site Sample Cluster Analysis for 10 Variables.

	Chipped Stone Implements			Lithic Raw Materials				Platform Preparation		
Cluster	Utilized Flakes	Retouched Flakes	Bifaces	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Cortex Covered	Plain	Peaked/ Pt.Plain /Faceted
Cluster 1										
40ST70	.95	.33	.95	1.88	.24	.06	.04	.12	.58	1.52
40ST71	.74	1.11	.37	1.72	.35	.04	.10	.05	.60	1.57
40ST80	.56	.74	.93	1.73	.36	.08	.06	.13	.58	1.52
Cluster Means	.747	.726	.748	1.778	.316	.061	.068	.097	.587	1.538
Z Scores	-.24	2.43	-1.35	-.80	1.27	-.49	-.14	-1.84	.09	.79
Cluster 2										
40ST152	.56	.00	1.67	1.62	.13	.00	.48	.00	.04	2.18
Cluster Means	.556	.000	1.667	1.615	.133	.000	.476	.000	.044	2.178
Z Scores	-.57	-.98	1.17	-1.27	-.40	-1.33	3.56	-1.66	-2.14	2.29
Cluster 3										
40ST74	.00	.48	1.75	1.71	.22	.17	.12	.23	.46	1.53
40ST161	.34	.00	1.88	1.45	.65	.04	.08	.23	.98	1.01
40MO52	.70	.13	1.40	1.77	.18	.24	.04	.45	.64	1.14
40MO55	.38	.44	1.40	1.90	.22	.06	.03	.42	.56	1.24
40MO56	.53	.18	1.51	1.82	.28	.07	.04	.32	.76	1.14
Cluster Means	.391	.245	1.587	1.731	.311	.117	.064	.330	.680	1.211
Z Scores	-2.11	-.39	2.23	-1.56	1.56	1.55	-.27	.84	.96	-1.08
Cluster 4										
40ST73	1.11	.43	.68	2.18	.01	.02	.01	.30	.71	1.22
49ST76	1.11	.00	1.11	2.11	.06	.03	.02	.38	.91	.94
40ST79	1.02	.18	1.02	1.95	.09	.11	.07	.15	.47	1.61
40ST164	1.11	.37	.74	2.10	.05	.07	.00	.35	.26	1.62
40ST165	1.92	.08	.23	2.08	.08	.07	.00	.29	.24	1.70
40MO59	1.11	.00	1.11	2.04	.04	.08	.06	.64	.82	.76
Cluster Means	1.230	.177	.815	2.076	.056	.065	.026	.350	.567	1.306
Z Scores	2.33	-.97	-1.56	2.51	-2.15	-.52	-1.11	1.22	-.07	-.61
4 Clusters 58.65 Percent Explained										
Total Means	.808537	.297663	1.115459	1.870504	.197909	.077193	.076912	.269473	.574172	1.378844
Standard Deviations	.441906	.304850	.472335	.200550	.161960	.058000	.112063	.162179	.247191	.348733

Table 8.66. Results of the 15 Site Sample Culster Analysis for 14 Variables.

	Chipped Stone Implements			Lithic Raw Materials				Platform Preparation			Diagnostic Projectile Points			
Cluster	Utilized Flakes	Retouched Flakes	Bifaces	Upper Miss.	Fort Payne	Other Chert	Quartz /Chal.	Cortex Covered	Plain	Peaked/ Pt.Plain /Faceted	Late Woodland	Middle Woodland	Early Woodland -Late Archaic	Middle Archaic -Early Archaic
Cluster 1														
40ST73	.83	.32	.51	1.63	.01	.02	.00	.22	.53	.91	.00	1.67	.00	.00
40ST76	.63	.00	.83	1.58	.04	.02	.01	.28	.68	.70	.00	1.67	.00	.00
40ST152	.42	.00	1.25	1.21	.10	.00	.36	.00	.03	1.63	.00	1.67	.00	.00
40ST164	.83	.28	.55	1.57	.04	.05	.00	.26	.19	1.21	.00	1.67	.00	.00
40MO59	.83	.00	.83	1.63	.03	.06	.05	.48	.62	.57	.00	1.67	.00	.00
Cluster Means	.750	.120	.796	1.506	.045	.032	.084	.249	.411	1.007	.000	1.666	.000	.000
Z Scores	.97	-1.01	-.25	1.53	-1.90	-1.35	.71	.86	-.24	-.23	-1.21	2.84	-.60	-2.21
Cluster 2														
40ST70	.71	.24	.71	1.41	.18	.05	.03	.09	.44	1.14	.83	.00	.00	.83
40ST71	.55	.83	.28	1.29	.26	.03	.08	.03	.45	1.18	.00	.00	.00	1.67
40ST79	.76	.14	.76	1.46	.07	.08	.05	.11	.35	1.20	.00	.00	.00	1.67
40ST80	.42	.55	.69	1.30	.27	.06	.04	.09	.43	1.14	.00	.00	.00	1.67
40MO52	.52	.09	1.05	1.33	.13	.18	.03	.34	.48	.85	.33	.00	.00	1.33
Cluster Means	.594	.373	.699	1.358	.182	.080	.046	.134	.430	1.104	.233	.000	.000	1.433
Z Scores	-.09	1.47	-.87	-.66	.62	1.14	-.30	-1.25	-.01	.59	-.05	-2.17	-.60	2.71
Cluster 3														
40ST74	.00	.36	1.31	1.28	.16	.13	.09	.17	.34	1.15	.00	.00	.83	.83
Cluster Means	.000	.357	1.310	1.282	.165	.128	.092	.172	.345	1.150	.000	.000	.833	.833
Z Scores	-1.83	.58	1.34	-.81	.14	1.62	.40	-.25	-.46	.44	-.54	-.97	3.74	.29
Cluster 4														
40ST165	1.44	.06	.17	1.56	.06	.05	.00	.21	.18	1.27	1.67	.00	.00	.00
Cluster Means	1.436	.057	.172	1.558	.058	.050	.000	.215	.180	1.272	1.666	.000	.000	.000
Z Scores	2.50	-.73	-1.88	1.03	-.74	-.18	-.68	.11	-1.35	.91	3.14	-.97	-.27	-.99
Cluster 5														
40ST161	.26	.00	1.41	1.09	.49	.03	.06	.17	.74	.76	.55	.55	.00	.55
40MO55	.28	.33	1.05	1.43	.17	.05	.02	.32	.42	.93	.00	.83	.00	.83
40MO56	.40	.13	1.13	1.37	.21	.05	.03	.24	.57	.85	.28	1.11	.00	.28
Cluster Means	.314	.156	1.197	1.294	.289	.044	.040	.243	.577	.846	.278	.833	.000	.555
Z Scores	-1.53	-.51	1.76	-1.25	2.00	-.55	-.36	.59	1.36	-1.25	.13	.26	-.48	-.24
5 Clusters 77.67 Percent Explained														
Total Means	.6063	.2232	.8366	1.4028	.1484	.0579	.0577	.2021	.4308	1.0341	.2445	.7222	.0557	.6444
Standard Deviations	.3314	.2286	.3542	.1504	.1214	.0435	.0840	.1216	.1854	.2615	.4521	.7438	.2078	.6505

VITA

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In January of 1976 he entered the graduate program in Anthropology at the University of Tennessee, Knoxville. He received a Master of Arts Degree in June of 1980. In January of 1980 he began study toward a Doctor of Philosophy degree. This degree was awarded in August of 1988.

During his graduate studies from 1981 to 1984, Dr. Ferguson was also employed as a Research Associate in Anthropology by the University of Tennessee, Knoxville to conduct archaeological research on the Cumberland Plateau of Tennessee and Kentucky. Since September of 1984, he has been teaching at Wofford College in Spartanburg, South Carolina.