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Hunter-Gatherers, Mobility, and Technological Organization: The Early Archaic of East Tennessee

Philip James Carr
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Philip James Carr entitled "Hunter-Gatherers, Mobility, and Technological Organization: The Early Archaic of East Tennessee." 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:

Charles Faulkner, Jeff Chapman, Jan Simek, Thomas L. 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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HUNTER-GATHERERS, MOBILITY, AND TECHNOLOGICAL ORGANIZATION: THE EARLY ARCHAIC OF EAST TENNESSEE

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Philip James Carr
May, 1995

DEDICATION

This dissertation is dedicated in the memeory of my grandfather

Louis Bertram Carr
"Gramps"

who inspired my interest in archaeology
and
helped me believe I could accomplish anything.

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I want to thank McClung Museum for providing access to the Tellico collections and space to carry out my analyses. The University of Tennessee Anthropology Department provided computer time for statistical analyses. The artifacts analyzed in this study were excavated and originally analyzed under a series of contracts with the Tennessee Valley Authority, the National Park Service, and the Heritage Conservation and Recreation Service. Without that original support, the research presented here would not have been possible.

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From weekly phone calls, to visits to sites during the summers, I always knew someone was thinking of me. My grandparents, brother, sister, aunts, and cousins are all very special people who have helped me in numerous ways. My boys, Chris and Nick, provided help of a different source. They were always ready to distract me with trips to the comic-book store, movies, videos, and card games. For this, I may retain some sanity. I cannot put into words the tremendous help I received from my wife and the innumerable things she did so that I could finish this thing. I know without her help, I would have given up long ago.

ABSTRACT

Behavioral variability exists in past hunter-gatherer lifeways but there is no simple means to study this variability and gain an understanding of past hunter-gatherer lifeways and culture change. Previously, archaeologists have depended, in large part, on ethnographic accounts to make inferences concerning past hunter-gatherer behavior. However, the revisionist debate and evaluations of the role of hunter-gatherer ethnography for archaeological interpretation point to the problems caused by an overemphasis on ethnographic data.

One solution is that archaeologists begin to examine prehistoric hunter-gatherer settlement-mobility patterns. Mobility is a behavior that is related to both social and economic strategies so it provides an initial means of investigating these two areas of behavior. The documentation of prehistoric settlement-mobility patterns is a useful research strategy for the investigation of hunter-gatherer lifeways and changes in hunter-gatherer behavior.

In this study, an organization-of-technology approach guided the analysis of the chipped-stone assemblages recovered in the excavations of the Early Archaic components excavated during the Tellico Archaeological Project. The study of these assemblages provides something of a unique opportunity to examine the potential for change in hunter-gatherer lifeways.

The emphasis of the analyses was the flake debris but published stone tool and feature data were important to the conclusions reached in this study. Based on this study, it is suggested that patterns of technological organization appear generally similar over the Early Archaic, but there are apparent changes in settlement-mobility strategies. For example, the Lower Kirk occupation at Icehouse Bottom is suggestive of a forager settlement mobility system while a number of the Upper Kirk assemblages appear quite similar and fit expectations for collector base camps. Also, patterning is revealed in a comparison of the Tellico assemblages with other Early Archaic sites in the southeast. One such is the low occurrence of unhafted bifaces in the Tellico assemblages. Another pattern is the similarity between the Haw-River Palmer and Hardaway assemblages. Finally, it is suggested that the reanalysis of existing archaeological collections can play a significant role in the advancement of archaeological knowledge.

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CHAPTER I

Introduction

The examination of hunter-gatherer settlement-mobility patterns has received increasing attention in anthropology (e.g., Binford 1980; Keeley 1988; Kelly 1983, 1992, 1995; Price and Brown 1985). Archaeologists are working to document the temporal and spatial variability in settlement-mobility patterns of prehistoric hunter-gatherer groups (e.g., Andrefsky 1991; Bamforth 1990; Kelly 1988; Parry and Kelly 1987; Savelle 1987; Soffer 1991). For example, the examination of Paleoindian settlement-mobility patterns is the subject of a considerable number of studies, and several models of these patterns have been suggested (e.g., Anderson 1992; Hofman 1991; Kelly and Todd 1988; Meltzer 1989; Shott 1989). Some of the findings concerning prehistoric hunter-gatherer settlement-mobility patterns are based on the analysis of lithic assemblages using an organization-of-technology approach (e.g., Carr 1994; Ingbar 1994; Larson 1994; Odell 1994; Sassaman 1994). This new approach has enabled the use of a variety of lithic data to address questions concerning past social and economic strategies and has proven successful in a number of case studies (Carr 1994; Nelson 1991).

An organization-of-technology approach is used here to examine Early Archaic settlement-mobility patterns in East Tennessee. This study complements the research on Paleoindian settlement-mobility patterns and the work with materials from other Early Archaic sites in the Southeast. This study is a reanalysis of existing Early Archaic collections recovered during the Tellico Archaeological Project and it builds upon the previous research. Specifically, this study is a reanalysis of a sample of the Early Archaic chipped stone assemblages recovered in the Tellico Archaeological Project (TAP). Chipped stone tools and flake debris comprise the majority of the recovered assemblage. The focus of this reanalysis is the flake debris. Raw material and reduction analyses of the flake debris can provide important new information concerning site activities and prehistoric human behavior.

The high quality of the excavation, reporting, and curation makes reanalysis of these Early Archaic assemblages important for several reasons. The original report provided a description of the chipped stone tools but only a general analysis of the flake debris. More detailed analyses of the flake debris can provide a better understanding of prehistoric human behavior. Also, the recent development of an organization-of-technology approach allows for the assemblage to be examined from a new perspective, while the development of a variety of methods of flake debris analysis allows for new data to be obtained. Further, the interpretations of these assemblages are aimed at understanding the role these sites played in the prehistoric settlement system. The investigation of prehistoric hunter-gatherer mobility and settlement patterns continues today and the development of new models and perspectives in these areas provides a means of assessing the original interpretations. Finally, these specific assemblages have importance for investigating human behavioral change during the Early Archaic time period in the Southeast. Human behavioral change over this time period has not often been investigated. This is in part due to the lack of excavated assemblages with the necessary temporal parameters. Distinct components of the Early Archaic (Lower Kirk, Upper Kirk, and Bifurcate) are definable at a number of sites in the TAP study area. This reanalysis of the Early Archaic assemblages from Tellico provides a case study for applying new approaches for investigating prehistoric technologies and settlement-mobility patterns as well as contributing to our understanding of this time period in the Southeast.

The Early Archaic in the Southeast

The Archaic period in the southeastern United States is generally divided into three temporal units: Early (10,000-8,000 B.P.), Middle (8,000-6,000 B.P.), and Late (6,000-2,700 B.P.). Regional cultural historical sequences based on diagnostic projectile points/knives allows for the recognition of these time periods and often finer divisions within these periods. The Early Archaic roughly corresponds to the early Holocene, accepting a date of 10,000 B.P. for the Pleistocene/Holocene boundary, ending with the onset of the Hypsithermal interval during the middle Holocene. Generally, the Early Archaic time period is characterized as the beginning of the shift from a focal Paleoindian adaptation to a diffuse or generalized Archaic hunting and gathering lifeway (e.g., Cleland 1976:69). Steponaitis (1986:370-372) discusses the Early and Middle Archaic as a single unit because they were "marked by similar lifeways." However, Smith (1986) stresses continuity with Paleoindian adaptations. He cites the use of formal "curated" unifacial tools such as endscrapers and lateral scrapers as examples of this continuity as well as evidence for bipolar knapping (Smith 1986:14). Also, recognizing the limited evidence of the range of plants and animals utilized during the Early Archaic, Smith (1986:10) suggests that it is unproductive to represent the Early Archaic as "a transitional adaptation between earlier Paleoindian and subsequent Archaic groups" and he predicts "general southeastern adaptive continuity that encompassed the entire early Holocene."

The Early Archaic toolkit is quite diverse. Chipped stone tools include a variety of forms of projectile points/knives, end scrapers, retouched flakes, and the bifacial adze. Bifacial, blade and bipolar reduction techniques are all suggested to have been used during the Early Archaic (e.g., Chapman 1975; Smith 1986). A number of researchers have identified unmodified flake and blade tools that were used expediently (Anderson and Schuldenrein 1983;

Broyles 1971; Chapman 1975, 1977; Goodyear 1974). The ground-stone assemblage includes hammerstones, pitted cobbles, manos, and metates. Net and basketry impressions preserved on fired clay hearths at the Icehouse Bottom site (40MR23) provide a rare glimpse of material culture not often recoverable in the archaeological record (Chapman 1977:107-111). Large globular bags, large rectangular mats, and a net or net bag are just a few of the examples from what was undoubtedly a well-developed textile industry (Chapman and Adovasio 1977).

A small range of features is identified at Early Archaic sites which include hearths, rock clusters, and small shallow pits (e.g., Anderson and Hanson 1988; Broyles 1971; Chapman 1975, 1977, 1978; Clagget and Cable 1982). The lack of post molds suggests that "people may have lived in lightly constructed shelters or tents" (Steponaitis 1986:371). The Sloan site is proposed to represent an Early Archaic cemetery, although no human skeletal remains were identified, based on the recovery of 448 Dalton artifacts in about 20 clusters or caches within a limited (130 square meter) area (Morse 1975). Well-documented examples of Early Archaic burials are the cremated green bone redepositions at the Icehouse Bottom site (Chapman 1977:112-115).

The Early Archaic toolkit, combined with the absence of evidence for substantial structures and formal cemeteries, has been taken to indicate that the settlement-mobility patterns consisted of "small and impermanent camps that were frequently moved" (Steponaitis 1986:371). However, a variety of more detailed settlement-mobility patterns have been proposed for specific regions (e.g., Anderson and Hanson 1988; Chapman 1975; Clagget and Cable 1982). These proposed settlement-mobility systems are reviewed in detail in Chapter IV.

Early Archaic Investigations: The Tellico Archaeological Project

The Tellico Archaeological Project (TAP) was initiated in 1967 to conduct research in the area to be flooded by the construction of the Tellico Dam. The Tellico Reservoir encompasses the lower Little Tennessee River Valley beginning at the confluence of the Little Tennessee River and the Tennessee River and ending at the Chilhowee Dam near river mile 33 (Figure 1). The federally-funded archaeological project continued until 1982. The amount of information generated by this project for the Archaic time period is "virtually unparalleled in the eastern United States" (Chapman 1985:142). The importance of the Tellico data is evident in reviews of Southeastern prehistory by both Smith (1986) and Steponaitis (1986). In particular, the Early Archaic data base from Tellico remains one of the best available for study.

Based on the Tellico excavations, Chapman (1985) has subdivided the Early Archaic for the southern and middle Ridge and

Valley physiographic region into five temporal units: Lower Kirk (10,000-9300 BP), Upper Kirk (9400-8800 BP), St. Albans (8900-8500 BP), LeCroy (8500-7800 BP), and Kanawha (8100-7800 BP). This temporal sequence is based on the recovery of distinct projectile point/knife types and associated radiocarbon dates in stratified context at the Icehouse Bottom (40MR23) and Rose Island (40MR44) sites. Stratified Early Archaic deposits excavated at the Bacon Farm (40LD35) and Patrick (40MR40) sites confirmed this temporal sequence. Early Archaic data were also generated through buried site backhoe testing (Chapman 1978), probabilistic (Davis 1990) and non-probabilistic (Kimball 1985) surveys in the reservoir area.

The presence of deeply buried, stratified Early Archaic deposits in the Tellico Reservoir was first noted at the Rose Island site located on an alluvial terrace at the downstream end of the island between river miles 16.8 and 18.4 (Chapman 1975:1). Over 40,000 artifacts that date from the Upper Kirk through Kanawha temporal units were recovered (Chapman 1985). These include over 27,000 pieces of flake debris and 3000 blocky core fragments (Chapman 1975:96). Chapman (1975:100-170) provides a typology and description of the remaining 1943 recovered artifacts that include chipped stone and ground stone tools.

At the time of the analysis of materials from the Rose Island site, a detailed study of lithic raw material sources had not been completed, but it was thought that "the manufacture of artifacts was derived almost entirely from readily available local sources" (Chapman 1975:96). Thermal alteration of cherts locally available to the Rose Island site (Knox varieties) was investigated by Purdy (1975). Her data suggest that heat treatment did not improve the workability of these cherts, in fact it lessened the quality, and was apparently little used.

A total of 655 bipolar pieces was identified (Chapman 1975). Examination of the use of the bipolar reduction technique and *pieces esquillees* at Rose Island suggests that *pieces esquillees* were deliberately produced to be used as tools as opposed to being byproducts of the reduction technique (Chapman 1975:143). A total of 63 flakes was categorized as blade-like but there was no discussion of a blade industry at the site. It was recognized that bipolar reduction could produce flakes that resembled blades and ten flakes were placed in a pseudo-blade category (Chapman 1975:150).

The Bifurcate component at Rose Island is the focus of the discussion (Chapman 1975:235-273). A classification of bifurcate points is proposed and a discussion of functional considerations of bifurcate points is included. In terms of function, Chapman (1975:268) suggested that the bifurcate base would have acted to increase lateral stability of the hafted point, which is advantageous for cutting and scraping activities. However, this design argument is not pursued and it is concluded that the bifurcate point base represents nothing more than the "hafting style in popular use at the time" (Chapman 1975:269).

Based on the data from Rose Island, a speculative settlement pattern was developed. Rose Island was suggested to represent a base camp for one or more bands which "served as a focus and an axis for seasonally controlled hunting and gathering camps elsewhere" (Chapman 1975:272). This settlement pattern was referred to as a central-based transhumance system and has been a powerful influence on subsequent interpretations of Early Archaic settlement-mobility patterns for the Little Tennessee River Valley (e.g., Davis 1990; Kimball 1992).

Building upon the success of excavations at Rose Island, Chapman (1977) devised a research design to identify and test buried Archaic horizons as part of the TAP. After initial work at Icehouse Bottom (40MR23) as part of this research design, it was apparent that it was a site of major importance. The Icehouse Bottom site is located on the first terrace of the south bank of the Little Tennessee River (River Mile 21). Icehouse Bottom is the only Early Archaic site excavated as part of the TAP that contained a Lower Kirk component; Upper Kirk through Lecroy components were also excavated.

In the excavations of the Early Archaic components of the Icehouse Bottom site, over 79,000 lithic artifacts were recovered of which 77,000 were flakes or core fragments (Chapman 1977:24). A gross description of raw materials was used in classifying the lithic artifact assemblage based on color, banding, and inclusions. General observations led to the suggestion that the Lower Kirk assemblage had the highest frequency of "black included chert" and the remainder of the Early Archaic assemblage was dominated by local grey and black cherts (Chapman 1977:24-25). The classification of projectile point/knives for cultural historical purposes was a major focus of the research. Chipped-stone tools were also classified into traditional morphofunctional categories such as bifaces, scrapers, drills, and then further divided based on extent of retouch utilized in tool manufacture. Low magnification use-wear analysis was also conducted. A total of 3300 blade-like flakes was noted, some of which were utilized, as was the presence of *pieces esquillees* (n=391) and bipolar flakes and cores (n=778). Surprisingly, with such evidence for bipolar reduction, no pseudo-blades like those from the Rose Island assemblage were identified. *Pieces esquillees* "were distinguished from bipolar cores by the presence of one or more edges that could have served as scraping or slotting tools, or that exhibited columnar fractures that could have functioned as burins" (Chapman 1977:82). Based on the data from the Icehouse Bottom site, a change from a blade-making industry in the Lower and Upper Kirk assemblages to a bipolar-oriented industry in the Bifurcate assemblages is suggested (Chapman 1977:89).

Fulgham (1980) conducted a raw material analysis of a sample of flake debris and all chipped stone tools recovered from the Icehouse Bottom site. The major objective of the study was to determine if differential selection of raw materials occurred over time. A total of 52 raw material types based on macroscopic observations was defined in the study. These raw material types were based on the flake debris and tools found at the Icehouse Bottom site and a grab sample of cherts from quarry sites 40MR22 and 40MR45. Both of the quarry sites are within 0.5 km of Icehouse Bottom. In defining raw materials, artifacts were first sorted according to types such as chert, quartz, quartzite and chalcedony. These categories were then further subdivided based on "color, texture, luster, translucency, fracture pattern, and availability" (Fulgham 1980:42).

Fulgham (1980:105) determined that there was conscious selection for easily worked, local materials at the Icehouse Bottom site. However, patterning in the selection of specific raw materials for specific tool types was not evident. "Black and gray cherts were selected for most artifacts" (Fulgham 1980:109).

The Patrick site (40MR40) is located at the lower end of Thirty Acre Island very near the Icehouse Bottom site. Only a small area was excavated at the site (two 10x10 ft units), but Upper Kirk through Kanawha components were sampled. A total of 3526 stone artifacts was recovered in the excavation of the Early Archaic horizons of which 3292 are flake debris and core fragments. A discussion of the artifacts and the tool types found at the site are presented in Chapman (1977). Bipolar cores (n=46) and *pieces esquillees* (n=41) are identified in the assemblage but no bipolar flakes. A total of 109 blade-like flakes is identified.

The Bacon Farm site (40LD35) is located on the south bank on the first terrace and second terraces of the Little Tennessee River from river mile 11.7 to 11.9. Upper Kirk and Bifurcate components were excavated at the site and a total of 17,635 lithic artifacts was recovered of which 15,275 are cores and flake debris (Chapman 1978). Flake debris was divided into seven categories: unmodified nodules, modified nodules, bipolar cores, bipolar flakes, decortication flakes, bifacial thinning flakes, and flat/shatter flakes. The projectile point/knife sequence followed that found at other Early Archaic sites in the TAP study area and other lithic artifacts were assigned to previously used type descriptions. The Bacon Farm site is suggested to have functioned as a base camp during the Upper Kirk component based on the diverse activities suggested by the variety of tool types present (Chapman 1978).

The Early Archaic data set generated by the TAP was used most recently in devising a generalized model of internal site structure (Kimball 1993) and a more detailed settlement pattern for the area (Kimball 1992).

Kimball (1993) used grid count data from the LeCroy component of the Rose Island site to suggest internal site structure for Early Archaic sites. The occurrence of different tool types, flake debris, carbonized botanical remains, and features was analyzed using multivariate techniques to detect spatial patterning. This patterning is interpreted through comparison with a general model of hunter-gatherer site structure based on ethnographic and ethnoarchaeological descriptions. The resulting model of Early Archaic residential site structure includes a shelter, external hearth/general work area, flintworking area, rock oven, and smudge pit/hideworking area (Kimball 1993:Figure 13).

Kimball (1992) has presented a retrospective on the Early Archaic assemblages excavated during the TAP with the goal of putting existing data into current technological organization and settlement strategy terms. He provides an excellent discussion and interpretation of a number of data sets available from Tellico. Specifically, Kimball makes use of Chapman's (1978) buried site excavations, his own nonprobabilistic survey (Kimball 1985), and the probabilistic survey (Davis 1990).

Kimball (1992:149) found that expected densities of materials are high for the deeply stratified Tellico sites (Icehouse Bottom, Bacon Farm, Rose Island, Calloway Island) when compared with two other well-known Early Archaic sites in the Southeast (Ruckers Bottom, 9EB91 and G.S. Lewis, 38AK228). This suggests that the Tellico sites were intensively utilized. He divides the four Tellico sites in two groups: 1) high flake:tool and low tool:feature ratios (Icehouse Bottom and Calloway Island) and 2) low flake:tool and high tool:feature ratios (Rose Island and Bacon Farm). He suggests that this patterning is due to the use of these sites as different kinds of residential bases.

In discussing projectile point/knives, Kimball focuses on chronology. Despite the "tremendous variation in projectile point haft morphology in the early phases of the Early Archaic," Kimball (1992:150-151) suggests that a tentative regional projectile point sequence would be Lower Kirk to small Upper Kirk to large Upper Kirk. The Bifurcate sequence of St. Albans to Lecroy to Kanawha similar to that proposed by Broyles (1971) is substantiated by the Tellico data.

Kimball (1992:153) provides a relatively detailed discussion of lithic tool categories due to the "continued disagreement over what kind of tool classification or which existing tool typology should Paleoindian and Early Archaic analysts employ." Descriptions of bifacial and unifacial tool categories are provided, as are discussions of blade and bipolar reduction methods. The examination of blank selection is an important start in describing the technological strategies employed during the Early Archaic at Tellico. One pattern in blank selection, as previously noted by Chapman (1977:89) at the Icehouse Bottom site, is a decrease in the use of blades over time and an increase in bipolar flakes for blanks (Kimball 1992:159-163).

Finally, Kimball describes settlement pattern variation from diachronic and synchronic perspectives. These are described in detail in Chapter V. One of the major conclusions reached by Kimball is that there are differences between Kirk and Bifurcate settlement patterns. For future research, one important area noted by Kimball (1992:181) is the reanalysis of existing collections.

During the TAP, nearly 250,000 lithic artifacts were recovered from undisturbed Archaic contexts of which over 139,000 are from Early Archaic components of which 95% is flake debris (Chapman 1985). The analysis of the chipped stone tools was thorough. All stone tools were typed according to morphofunctional class such as projectile point/knife, biface, drill, scraper. In some cases, such as with the Icehouse Bottom assemblage, tools were examined by low-magnification techniques to examine use-wear and determine function (Chapman 1977). Samples of flake debris were classed by reduction method (bipolar, blade) or divided into different categories such as primary, biface thinning, or shatter categories depending on the site. A variety of raw material analyses were conducted over the course of the TAP. Early investigations of raw materials (Chapman 1975, 1977) relied on general descriptions. Fulgham (1980) defined 52 raw material types based on macroscopic attributes in her study of the Icehouse Bottom assemblages. Fulgham (1980:) admits to the speculative nature of the raw material types defined in this study and calls for further work to be conducted in the area. At this point in time, it does not appear possible (Chapman 1994, personal communication) or beneficial to try and reconstruct these raw material types. Kimball (1985) conducted a thorough geologic survey and has provided the best description available of locally available cherts. The work by Kimball provides the basis for the raw material analysis conducted as part of this study.

The research presented here builds on the previous work, specifically as conducted by Chapman (1975, 1977, 1978, 1979) and Kimball (1985, 1992, 1993) by reanalyzing the Early Archaic assemblages from the Rose Island, Icehouse Bottom, Patrick, and Bacon Farm sites. Each of these sites contain deeply buried Early Archaic components and have been characterized as base camps (Chapman 1975, 1977, 1978). These sites are the focus of the analysis because distinct Early Archaic components are defined so that the potential for change over the period can be investigated. The analysis presented here contrasts with Kimball's (1992) diachronic analysis because he focused on examining broad settlement patterns across landforms. A more detailed analysis of the assemblages from proposed base camps complements the broad settlement pattern approach employed by Kimball (1992).

The Reanalysis

The core of the research reported here is a thorough and detailed reanalysis of samples of the flake debris from each Early Archaic component. This includes raw material and reduction analyses. The previous documentation of bifacial, bipolar, and blade reduction techniques makes these assemblages particularly interesting from an organization-of-technology perspective. A raw material analysis of a sample of the chipped-stone tools from each assemblage provides comparative data. The use of an organization-of-technology perspective allows for an investigation of prehistoric social and economic strategies, particularly in terms of the settlement-mobility patterns employed. The goals of the reanalyses are: 1) to provide a description of the technologies employed during the Early Archaic and how those technologies were organized; and 2) to reconstruct settlement-mobility patterns during this time period in East Tennessee.

In addition to the specific questions addressed in this study, the reanalysis of existing collections of excavated materials has a more-general and important role to play in the advancement of archaeological knowledge. Often in the original reporting and interpretation of an archaeological assemblage, only general analyses are undertaken due to time and budget constraints. Certain artifact classes are simply counted with little or no specific analysis of these artifacts. The examination of these artifact classes during the reanalysis of an archaeological assemblage can provide important new information. Archaeologists must explore every potential data source that is retrievable from the archaeological record because of the difficulty of addressing questions of prehistoric human behavior and behavior change. Also, much of current archaeological knowledge is based on the original reporting and interpretations of key sites and assemblages. Reporting errors or biases in artifact classifications (i.e., Beck and Jones 1989) can have a significant effect on interpretations. Reanalysis of these sites allows for confirmation of the original reported data. Finally, archaeology is still a young discipline so that new methods and approaches rapidly develop. The application of these new methods or approaches can help solve unanswered questions or clarify ambiguities present in the original report and interpretations.

Study Organization

In Chapter II, a brief review of the current state of hunter-gatherer research is presented with a focus on the investigation of hunter-gatherer settlement-mobility patterns. In Chapter III, an organization-of-technology approach is defined and reviewed. This approach is used in the analysis of the Tellico Early Archaic chipped stone assemblages. In order to place the Tellico Early Archaic assemblages in a wider context, a detailed description and assessment of settlement-mobility patterns proposed for this time period in various regions of the Southeast is presented in Chapter IV. Chapter V describes the Early Archaic environment in the Southeast in general and more specifically in the Tellico area. In Chapter VI, the specific materials and methods are presented. The results of the analyses are presented in Chapter VII, as well as inferences based on these results. A summary with conclusions is presented in Chapter VIII.

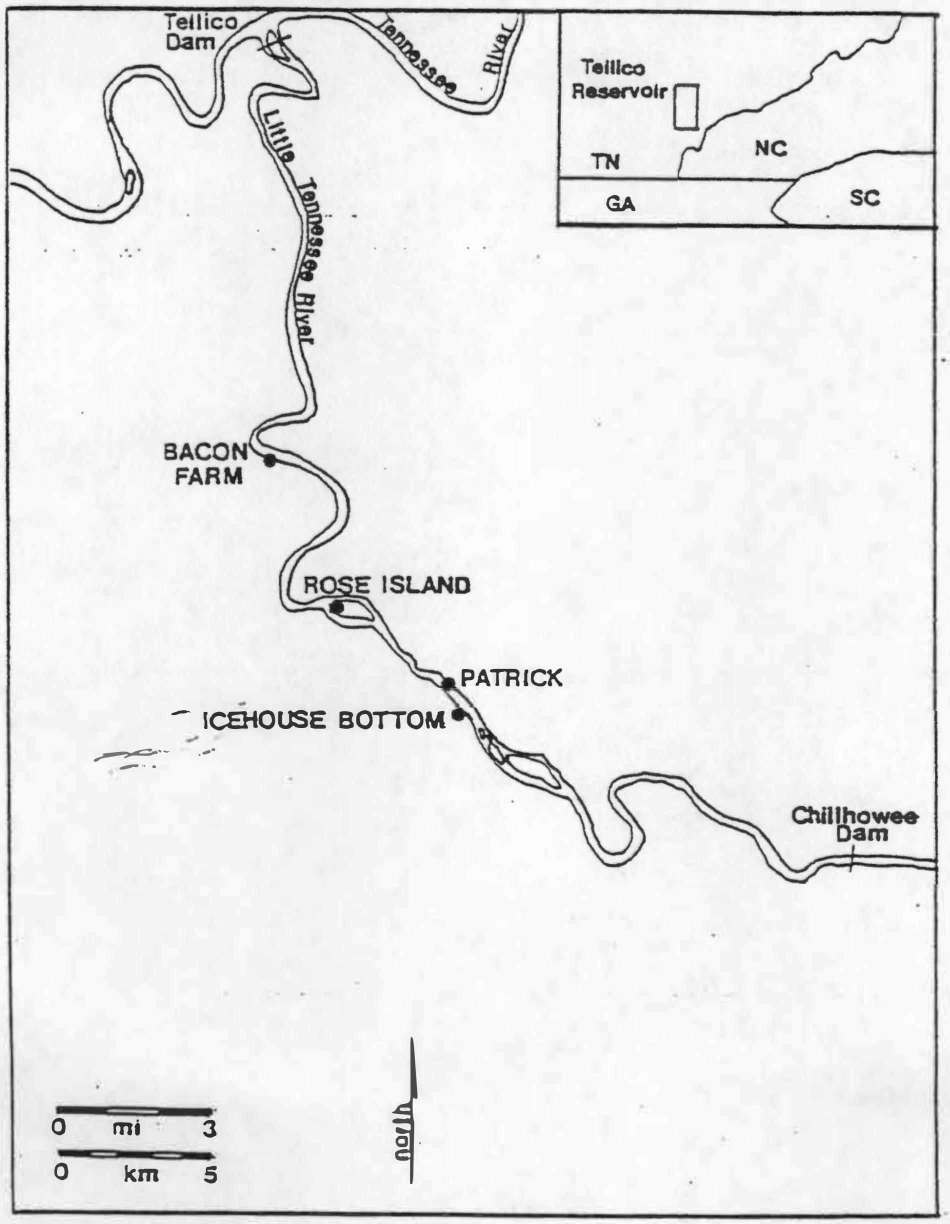

Figure 1: The Tellico Archaeological Project Study Area and Sites Included in this Study.

CHAPTER II

Hunter-Gatherers and Mobility

In this chapter, a brief review of the current state of hunter-gatherer research is presented. The revisionist debate is examined and the implications of this debate for the archaeology of hunter-gatherers are explored. The study of prehistoric hunter-gatherer settlement-mobility patterns is an important area of study. Criticisms of investigating settlement-mobility patterns are addressed and the forager-collector model serves as a useful heuristic device for this purpose. However, this model is best used with a consideration of both the dynamics that underlie the model and the particulars of the environmental setting. Finally, investigations of hunter-gatherer settlement-mobility patterns are best accomplished using both regional and site-specific levels of analysis.

There are strong links between hunter-gatherer research, the development of anthropology as a discipline, and the popularity and subsequent decline of a number of anthropological theories. Bettinger (1991) views hunter-gatherer research as the core of the discipline and refers to hunter-gatherers as the "quintessential" anthropological topic. Kelly (1995) points to the key role hunter-gatherer research has played in the development of certain anthropological theories from nineteenth century evolutionism to Steward's cultural ecology. Finally, Bettinger (1991:v) effectively argues that hunter-gatherers provide the acid test for any reasonably comprehensive anthropological theory. The use of hunter-gatherer data continues to play a significant role in anthropology but recent debates have had a major impact on some fundamental aspects of hunter-gatherer research.

Hunter-gatherer research is currently going through something of a transformation which is linked to changes in the discipline and the modern world. Changes in the modern world have meant a drastic decline in the number of peoples that subsist mainly on wild foods. Ethnographers have fewer opportunities to study the behavior of modern hunter-gatherers. The future of fieldwork among hunter-gatherers is in the nature of applied research and aiding the remaining hunter-gatherers in dealing with shifting situations (Burch 1994:446). This has meant that there are more archaeologists than cultural anthropologists conducting hunter-gatherer research (Lee 1992). In the study of prehistoric hunter-gatherers, archaeologists have always relied to a greater or lesser degree on the ethnographic record. The revisionist debate, with ethnographers and archaeologists on both sides, has major implications for hunter-gatherer research. This debate has caused an examination of the utility of ethnographic accounts for understanding prehistoric hunter-gatherers and a questioning of the idea of a core of hunter-gatherer behaviors.

Hunter-Gatherer Research

The "Man the Hunter" conference held in 1967 is widely recognized for its significant impact on the study of hunter-gatherers (Burch and Ellanna 1994; Kelly 1995; Speth 1991). A great amount of ethnographic data was published in the subsequent edited volume of the same name. These data revealed that hunter-gatherer lifeways exhibit a large degree of variability. Although this variability was reported, there was still an attempt to provide a general picture of hunter-gatherer lifeways. In addition to the basic assumptions that hunter-gatherers live in small groups and move around a lot, characteristics such as egalitarianism, a lack of territoriality, and fission to reduce conflict were considered part of that general picture (Lee and DeVore 1968:11-12). Ethnographic accounts concerning the Kalahari San were important influences on this picture, and they became the "typical" hunter-gatherer group. Stereotypic views became very influential on studies of past and present hunter-gatherers. Isaac (1987:2, 1990:324) has referred to this as the "San-itation" of the field.

The revisionist stance (Denbow 1986; Schrire 1984; Wilmsen 1989; Wilmsen and Denbow 1990) calls into question any general picture of hunter-gatherers based on ethnographic accounts. The revisionist debate is complex and detailed, but Speth (1991:vii) has aptly summarized the revisionist stance:

> hunter-gatherers of the "ethnographic present," no matter how isolated and "pristine" they may at first appear, have all been seriously affected, perhaps in fact totally altered, by generations of interaction with, and subordination to, politically and economically dominant agricultural or pastoral societies.

This stance is based on evidence from archaeology, history, and ethnography. The revisionists have particularly focused on the Kalahari San as an example because of their status as the typical hunter-gatherer group. Revisionists argue that the Kalahari San have been subordinant to agricultural/pastoral peoples for over a thousand years (Denbow 1986; Schrire 1984; Wilmsen 1989).

Both sides of the debate appear to recognize that pristine hunter-gatherers were not available for study by ethnographers (Lee 1991; Yellen 1989), although the degree of contact and its affects are still very much in question (e.g., Solway and Lee 1990; Wilmsen and Denbow 1990). However, some revisionists suggest that the general picture of hunter-gatherers based on the San that includes small populations, mobility, and sharing are byproducts of this contact (Schrire 1984; Wilmsen 1989). If this is correct, the characteristics thought generally attributable to most hunter-gatherers are not valid. Obviously this debate has wide ranging repercussions, not the least of which is the questioning of the use of ethnographic data for interpreting the past.

The utility and difficulty in using the ethnographic record for archaeological interpretation was recognized prior to the revisionist debate. Wobst (1978) has written of the tyranny of the ethnographic record in structuring archaeological inferences and has pointed out some of the limitations of ethnographic data particularly with regard to the restricted view of the ethnographer and informant. Others have pointed out that the ethnographic record of hunter-gatherers is biased toward certain latitudes and marginal environments (Lange 1980; Price and Brown 1985). More recently, Isaac (1990:323-324) has focused specifically on the generalized foraging model derived from the ethnographic study of the !Kung San. He suggests the generalized foraging model is the cause of premature inferences and that it potentially misdirects investigations toward unprofitable areas. Extreme revisionists would suggest that the study of modern peoples that subsist on wild food sources provides no relevant information for understanding prehistoric hunter-gatherers (e.g., Schrire 1984).

While it is clear that archaeologists cannot simply situate the behaviors of the Kalahari San or any other hunter-gatherer people into the past, archaeological interpretation can still benefit from ethnographic data. As effectively argued by Speth (1991:viii), modern hunter-gatherers who still engage in some foraging must address dietary, demographic, and social problems similar to those faced by any group of people that subsist on wild food sources. Archaeologists have in the past, and can continue in the future, to gain significant insights from ethnographic data. However, as advocated by Shott (1991:34-35), archaeologists must become more critical consumers of ethnographic data. Archaeologists cannot simply assume that specific characteristics recorded for modern hunter-gatherers are attributable to those of the past (Shott 1991:35-36). For example, egalitarian social relations must be demonstrated based on archaeological evidence and not assumed. The ethnographic record can provide general insight into hunter-gatherer lifeways but the burden is on archaeologists to use the archaeological record to explore and explain behavioral variability among prehistoric hunter-gatherers.

The revisionist stance also questions the existence of core hunter-gatherer behaviors and whether "hunter-gatherers" is even a meaningful category (cf. Barnard 1983; Burch 1994; Feit 1994; Myers 1988). After "Man the Hunter", hunter-gatherers were defined as possessing certain characteristics such as small populations, high mobility, and egalitarian social relations. However, these characteristics may represent a strategy of resistance by the lowest class to their situation as opposed to the essentials of a hunting and gathering way of life. The meaning and usefulness of a hunter-gatherer category is, therefore, debatable. Barnard (1983:208) suggests that the category hunter-gatherers is meaningful if hunter-gatherers are distinguishable from other categories and this distinction allows cross-cultural comparisons of aspects other than subsistence.

In the study of modern peoples, distinguishing between hunter-gatherers and non-hunter-gatherers has not always proven an easy task even when relying on subsistence as the only criterion. Harris (1979) points out that there is a gray area between foraging and cultivating and that the trade of wild foods for domesticated ones is a confounding element. The question arises as to what percent must a group depend on wild foods to qualify as hunter-gatherers? Or, to what degree must they forage to qualify? Thus, in making comparisons, the enormous amount of variability in behavior demonstrated by different hunting and gathering groups is a problem. The behavioral variability contained within the category "hunter-gatherer" has led some to conclude that there is greater similarity between different categories of subsistence practices than within those categories (Ellen 1982).

The relevance of labelling a group as hunter-gatherers in the ethnographic present is questionable. Of greater relevance is aiding these people in their current situations and accurately recording contextual and ethnographic data. People that subsist mainly on wild resources are disappearing, but ethnographers can still view foraging behaviors. However, except in a very few cases, the hunting and gathering way of life as a coherent system is gone, and those foraging are likely peripheral to the larger group (Burch 1994). The usefulness of these data for understanding hunter-gatherers past or present is best judged based on the questions that are asked.

For archaeologists, the category "hunter-gatherer" may retain greater meaning and usefulness. Based on archaeological evidence, peoples that subsisted only on wild foods are recognizable from those that subsisted on domestic food sources. This is not to say that there is an absence of gray areas. This is especially true at the time of initial domestication of plant and animal resources. However, archaeologists are particularly interested in transitions so that comparisons are made between groups before, during, and after the adoption of agriculture. The recognition of hunter-gatherers in the archaeological record and the usefulness of comparisons between these groups and others argues for the retention of a hunter-gatherer category in archaeology.

While the category "hunter-gatherer" retains some usefulness, the search for pristine, isolated hunter-gatherers or a set of core hunter-gatherer behaviors does not. As pointed out by Yellen (1989), the fact that ethnographically known hunter-gatherers are not pristine or isolated should not inhibit the use of these data because hunter-gatherers of the past were certainly not isolated themselves. However, there is great variability in hunter-gatherer behaviors and searching for core behaviors in this variability may be counterproductive. Instead, models and explanations of the past must incorporate and seek to explain this variability.

No longer depending on the general foraging model or a typical hunter-gatherer group aids in exploring variability in prehistoric hunter-gatherer behavior but it also means the loss of a foundation for interpretation of the archaeological record. This coupled with the coarse-grained nature of the archaeological record leaves archaeologists with the difficult task of trying to say something accurate concerning prehistoric hunter-gatherer lifeways. These are reasons that archaeologists should focus on variability in certain features of hunter-gatherer behavior before proceeding to other aspects. These behaviors should be capable of being reconstructed from archaeological evidence and relevant for an understanding of other aspects of hunter-gatherer behavior. One such behavior, mobility, is relevant for understanding both social and economic strategies and has the potential to be accurately reconstructed from archaeological evidence.

Mobility

The association of mobility with hunter-gatherers has a long history. Prior to ethnographic study, hunter-gatherers were considered aimless wanderers who were lacking in every aspect of culture (Hobbes 1651). For example, Lee and Devore (1968), at the Man the Hunter Symposium, stated that "we make two assumptions about hunter-gatherers: 1) they live in small groups and 2) they move around a lot". After the "Man the Hunter Symposium," aimless wandering was replaced by the seasonal round in which hunter-gatherers had an intimate knowledge of their environment which they used to its fullest. Today, in addition to a focus on general patterns, there is ethnographic documentation of variability from individual to individual and from year to year (Jochim 1991). From aimless wandering to patterned movements to variability, mobility continues to play an important role in the study of hunter-gatherers both past and present.

Kelly (1992:60) has effectively argued that the examination of mobility is essential for developing an understanding of human evolutionary change. One reason for this is that mobility is a universal human characteristic used to solve problems. Hunter-gatherers, pastoralists, horticulturalists, and agriculturalists are all mobile as are members of bands, tribes, chiefdoms, and states. Mobility can solve a number of problems including access to subsistence resources (e.g., Binford 1980; Kelly 1983), reduction of social tension (e.g., Lee 1979), and population viability (e.g., Wobst 1974). All people are mobile but they are not all mobile in the same way. This leads to another reason for the importance of the anthropological investigation of mobility. Changes in the various dimensions of mobility have strong effects on a number of other cultural behaviors including sociopolitical organization and territoriality (Kelly 1992:38).

Hunter-gatherers are generally viewed as egalitarian, lacking both political hierarchies and territorial boundaries. However, many hunter-gatherers are nonegalitarian, with political hierarchies, strong social and gender inequalities, and territorial boundaries (Price and Brown 1985). The examination of these characteristics has often fallen under the study of cultural complexity. The importance of the study of mobility/sedentism for understanding the development of cultural complexity is widely recognized (Kelly 1992). Price and Brown (1985:9) have constructed a detailed model illustrating the conditions, causes, and consequences of cultural complexity. A key element in their model is decreased mobility. This model is supported by Keeley's (1988) research involving an ethnographic sample of hunter-gatherers in which he found a high correlation between population pressure and socioeconomic complexity. Keeley (1988:397) suggests that population pressure leads to increased dependence on storage which leads to sedentism. While population pressure is given primacy in Keeley's argument, the role of sedentism in the developmental process of cultural complexity is also important. With sedentism, hunter-gatherers often experience population growth (Binford and Chasko 1976; Hitchcock 1982; Roth 1981). Decreases in child mortality and increases in female fertility are two reasons proposed for populations growing with a decrease in mobility (Kelly 1992:59). A decrease in mobility feeds into the cycle because it can lead to increased population and pressure on subsistence resources.

Mobility warrants study as an important aspect of human behavior and through this examination other aspects of human behavior are better understood. For archaeologists the examination of mobility has another important quality. Although the archaeological record is coarse-grained making the examination of certain aspects of human behavior difficult to examine, the study of settlement-mobility patterns is a major focus of archaeological investigations.

Approaches employed in the conduct of ethnography and the areas investigated among modern hunter-gatherers has had an important affect on the archaeological study of hunter-gatherers. Archaeological investigations of prehistoric hunter-gatherers have also affected the study of modern hunter-gatherers making it a two-way relationship. For example, archaeologists were involved in the Man the Hunter symposium, and they raised questions concerning the use of ethnographic data for interpretation of the archaeological record (Lee and DeVore 1968). More recently, archaeologists have engaged in ethnoarchaeology to collect the data they feel are necessary for the interpretation of archaeological remains. Archaeologists, also cognizant of the potential variability in the behavior of past hunter-gatherers, are attempting to examine that variability through general models and evidence from the archaeological record.

Ethnographic Approaches to Hunter-Gatherers and Mobility

Despite the significance of mobility for understanding human evolutionary change, ethnographers have rarely developed models and theories of hunter-gatherer movements. This is not to say mobility is ignored. A number of descriptions of hunter-gatherer movements of differing detail exist for a variety of groups. However, general examinations are more rare, especially in comparison to general models and characterizations of subsistence practices.

Ethnographers characterizing hunter-gatherers have focused on subsistence practices and drawn distinctions between immediate return and delayed return economies (Woodburn 1980) or between storers and non-storers (Testart 1982, 1988). Immediate return societies (non-storers), are those "with economies in which people usually obtain an immediate yield for their labor, use this yield with minimal delay, and place minimal emphasis on property rights." All other societies are delayed return or storers. The San and Hadza are good examples of immediate return societies. Hunter-gatherers of the Northwest Coast (U.S.) would fit the definition of a delayed return economy. Although the focus is on the use of subsistence resources, mobility enters into this characterization because subsistence practices and mobility are related (Kelly 1983). This is shown in general models such as those derived from evolutionary ecology and cross-cultural ethnographic data.

Models derived from evolutionary ecology have played an important role in the ethnographic study of hunter-gatherers, especially with regard to subsistence. These models are often derived from optimal foraging theory which is "an attempt to explain hunter-gatherer subsistence as part of general strategies for optimal resource procurement" (Durham 1981:219). For example, the optimal diet of foragers is addressed with the diet breadth model (Winterhalder 1981). This model is used to determine which subsistence resources would be selected by an optimal hunter-gatherer who is maximizing the amount of energy gain. Search and handling costs as well as caloric content of a subsistence resource are keys to this model and are used to determine the return rate usually expressed in kilocalories per hour. Resources are ranked by return rate which is used to model the decision making of the optimal forager.

The diet breadth model has stood up quite well against ethnographic and historical data. Winterhalder (1981) examined historical trends in Cree hunting behavior and found these behaviors consistent with the diet breadth model. O'Connell and Hawkes (1981) found that the diet breadth model provided an explanation as to why the Alywara had effectively dropped seeds from their diet. This application is of particular interest because it illustrates one of the strengths of models derived from evolutionary ecology that they can provide counterintuitive results (Kelly 1995; Smith and Winterhalder 1981). In general, one would expect that an abundant resource would always be taken by hunter-gatherers. However, this is not necessarily the case as with the seeds not taken by the Alywara. Consideration of the costs of procuring and handling seeds reveals a relatively low return rate. As long as resources are available with greater return rates, seeds or any other resource with a lower return rate will not be added to the diet, regardless of the abundance of that resource.

More recently, Winterhalder (1986) has put a twist on the diet choice model with interesting results for understanding hunter-gatherer subsistence, sharing, and mobility. The twist is that instead of assuming a rate maximizing hunter-gatherer, a risk-minimizing hunter-gatherer is used in the model. The goal in this model is to avoid the risk of starvation and any serious shortfall of food. It is somewhat surprising, given a major change in a basic assumption of the model, that the rate-maximizing and risk-minimizing diet strategies are quite similar. Not so surprising is that when sharing of subsistence resources is included in the model, the result is a significant reduction in risk. Winterhalder (1986:Figure 5) demonstrates that with a relatively small group (minimum of six foragers) that sharing significantly reduces the risk of food shortfall for members of that group. Kelly (1995) suggests that Winterhalder's results provide support for the "magic number 25" which is the assumed number of people in a local hunter-gatherer group. A group of 25 will have a large number of dependents and about six to ten active foragers. Having at least six foragers reduces the risk of food shortfalls while restricting group size to about 25 minimizes local resource depletion rates. Depleting local resources at high rates forces nearly continuous residential mobility which is not efficient in most situations. A group of 25 hunter-gatherers is a compromise between reducing the risk of food shortfall and reducing the rate of local resource depletion.

Kelly (1995) developed simple foraging models to more directly investigate hunter-gatherer mobility based on principles derived from evolutionary ecology. These models examine the distance a hunter-gatherer will travel from a residential base in a daily foraging trip and the amount of time until the residential base is moved. The first model is used to determine the distance a hunter-gatherer can effectively travel in the exploitation of a subsistence resource which is termed the effective foraging radius. Kelly (1995:IV-7) shows that the factors determining the effective foraging radius are the return rate for the resource and the energetic needs of the hunter-gatherer. In the model, if a family obtains half of its calories from a resource that provides 1200 kcal/hr, then the effective foraging distance for that resource is 6.25 km from camp. Changes in the return rate or the amount of dependence alters the effective foraging distance. In the second model the length of time until the residential base is moved is investigated. Factors important in this model are return rate and dependence with the addition of the density of the resource within the effective foraging radius. Kelly (1995) shows that for a 1200 kcal/hr resource with a post collection density of 0.25, a 1000 m foraging radius would support a group for 37 days. However, the decision to remain at a camp is related not only to what is available within the effective foraging radius there but also to what is available elsewhere. Kelly (1995) effectively illustrates the point that moving to a new area can provide greater returns than in the previously occupied area even if the first area was not completely exploited and if there is a cost to moving the camp. The models developed by Kelly (1995) illustrate the connection of hunter-gatherer individual and group movements with the environment and subsistence activities, while demonstrating the utility of models derived from evolutionary ecology for understanding hunter-gatherer behavior.

While they have not often engaged in general model building of hunter-gatherer mobility, ethnographers have recorded in varying detail the settlement patterns of specific hunter-gatherer groups. Through these descriptions, the seasonal round and the process of aggregation-dispersion are derived. These are two foundations for the current approach to hunter-gatherer mobility. The recognition by ethnographers of a seasonal round was an important breakthrough that illustrated that hunter-gatherer subsistence and mobility were tied to the environment and both varied over the year. The process of aggregation/dispersion tied to the seasonal round points to the amount of variability in hunter-gatherer mobility and brings out the importance of factors other than subsistence in hunter-gatherer lifeways.

A seasonal round is the manner in which hunter-gatherers move across the landscape during the course of a year. Movements are generally tied to the season and the resources that are available at different times of the year. With seasonal changes, hunter-gatherers will move to different niches in their environment. For example, the Washo moved from the lowlands to Lake Tahoe at a higher elevation during the spring to take advantage of fish runs and they moved back to the lowlands in the fall to harvest pinon nuts (Downs 1966). Not only might hunter-gatherers move with seasonal changes, they might also employ different mobility patterns from one season to the next. For example, the G/Wi of the Kalahari Desert have a high degree of residential mobility during the wet season of the year, but make few, if any, residential moves during the dry season (Silberbauer 1981). The recognition of hunter-gatherer seasonal rounds is important for understanding mobility because it demonstrates that hunter-gatherer moves are not random and can vary over the course of a year.

The second major contribution from ethnography concerning a general understanding of hunter-gatherer mobility is the aggregation-dispersion model. Ethnographers in a variety of environmental settings have reported the flexibility of hunter-gatherer group size and composition over a yearly cycle, where small dispersed subsistence groups come together as large aggregate reproductive groups (e.g., Damas 1969; Martin 1974; Steward 1955). This cycle of aggregation and dispersion is an effective means of adjusting to changing seasonal conditions, as well as having important social and ritual dimensions (Conkey 1980; Lee 1979).

Aggregation often occurs at a time of the year when there is restricted access to a particular resource or when there is an abundance of subsistence resources. An example of a restricted resource is water, the Kalahari San aggregate at water holes during the winter when little other water is available (Lee 1979:355). The Washo are a group that aggregate during times of plenty: in the summer at Lake Tahoe for the fish runs and again in the fall for the pinyon harvest (Downs 1966). Although ecological factors have an affect on hunter-gatherer aggregation, social factors are equally important (Conkey 1980; Hofman 1986). For the Australian aborigines, Spencer and Gillen (1899) note that aggregation populations form during ceremonial gatherings (cited in Lee 1979:360). Subsistence activities are at a halt during the autumn aggregations of Eskimo when people are taking advantage of opportunities to extend social networks (Damas 1969:52). Lee (1979:365) notes a number of activities that occur during !Kung San aggregations that include "trance dancing and curing, initiations, trading, storytelling, and marriage brokering." For the Washo, aggregating at Lake Tahoe with plenty of food after a winter of isolation meant time for dancing and courtship as well as games such as a form of field hockey, archery and races (Downs 1966:13). At Washo aggregations, spiritual and ritual activities were important as well as social interaction including storytelling, courtship, and gossip (Downs 1966:23). The social interaction during times of aggregation played an important role in maintaining viable populations (Wobst 1974), exchanging information concerning environmental conditions and group movements (Conkey 1980), and establishing social ties as a means of risk reduction (Cashdan 1985; Wiessner 1982).

Archaeology and Hunter-Gatherer Mobility

In attempts to understand prehistoric hunter-gatherer lifeways, archaeologists have often focused on reconstructing settlement-mobility patterns (e.g., Bar-Yosef 1991; Conkey 1980; Isaac 1978; Montet-White 1991; Soffer 1991). Archaeological investigations of settlement-mobility patterns have particularly dominated much of the interest of North American archaeologists in the past (e.g., MacDonald 1968; Wilmsen 1973; Winters 1969) and interest in these investigations continues today (e.g., Henry 1989;

Ingbar 1994; Johnson 1989; Kuhn 1994). In the late 1960s during the debate over the New Archaeology, Trigger (1967:151) broadly defined settlement archaeology as "the study of societal relationships using archaeological data" and suggested three levels of analysis "the individual structure, the settlement, and settlement distributions." Today, archaeologists interested in prehistoric hunter-gatherers still employ a similar approach and work is conducted at all three of these levels of analysis as illustrated in the work of Kimball (1993), Kent (1991), and Anderson (1992), respectively.

Torrence (1994) has recently criticized North American archaeologists for an overemphasis on mobility and she suggests that other aspects of prehistoric behavior be given greater consideration. Torrence (1994:124) suggests three possible reasons for this overemphasis: 1) the importance of mobility in Binford's work; 2) the apparent ease with which archaeologists have identified foragers and collectors in the archaeological record; and, 3) the assumption by archaeologists that changes in mobility are connected to other things of interest, such as the origin of agriculture.

The connection between Binford's work and archaeologists' focus on hunter-gatherer mobility is valid. With regard to organizational studies and particularly to studies of lithic technological organization, it is recognized that Binford's work was a strong impetus and in a sense, set the course of this research (Carr 1994a). Lithic analysts in particular have been heavily criticized for failing to relate their research to larger anthropological questions within an explicit theoretical framework (Amick 1987; Collins 1975; Cross 1983; Dunnell 1980, 1984; Thomas 1986). An organizational approach to technology has enabled questions to be addressed with lithic data that are more congruent with mainstream archaeology. The debt to Binford is great, but there is a wealth of research pertaining to hunter-gatherer settlement-mobility patterns that both pre-dates Binford's ethnoarchaeology and forager-collector model (e.g., Beardsley et al. 1956; Damas 1969; Downs 1966; Lee and DeVore 1968; Steward 1955) or does not build directly upon this research (e.g., Testart 1982, 1988; Woodburn 1980). This clearly indicates that, while Binford has influenced the course of archaeological studies of hunter-gatherers, the importance of mobility is recognizable without this influence.

The claim by Torrence that archaeologists have met with little difficulty in the application of the forager-collector model is not completely true. Certainly, the forager-collector model is greatly used (e.g., Andrefsky 1991; Kuhn 1989; Odell 1994). In some cases, this use of the forager-collector model is problematic. This is often due to oversimplifications in structuring relationships between the environment, technology, and mobility. More specifically, ambiguous results are noted in some applications of the forager-collector model which have led to a reconsideration of both the expectations based on the model and methods of analysis (e.g., Carr 1994b; Odell 1994). Torrence also feels that the use of the forager-collector model puts a halt to theory building because the emphasis is on reconstruction and theory use. Certainly the blind application of any theory or theoretical model is not likely to lead to reliable results or to theory building. However, the critical use of either in the consideration of data can lead to new interpretations as well as new theory. For example, Kelly and Todd (1988) in using the forager-collector model in their interpretation of Paleoindian settlement of North America found that aspects of both foragers and collectors are applicable, and the mobility pattern employed during colonization has no modern analog. This illustrates that the forager-collector model can aid in framing our thinking while the use of data allows interpretations to go beyond the framework. This cycle of creating models, using these models to interpret data, and using the findings to add to the model is similar to the process used by evolutionary ecologists in their research strategy. Application of the forager-collector model to examine prehistoric hunter-gatherer settlement-mobility patterns illustrates the importance of using theory to interpret data as well as the need for data in building new theory.

Torrence (1994) is certainly correct in suggesting that archaeologists' interest in mobility stems from their assumption that it can inform them about other aspects of prehistoric behavior. The rise of cultural complexity is one such area in which archaeologists have an interest. Links between population pressure, a decrease in mobility, and the rise of cultural complexity have been successfully modelled by Price and Brown (1985). Torrence (1994:126) suggests this is a "very Southwest Asian-centric view of cultural evolution and one which certainly cannot be generalized to many other parts of the world." However, Keeley (1988) has demonstrated a connection between cultural complexity, storage, and mobility using a range of ethnographic data. Torrence further suggests that the focus by archaeologists on reconstructing mobility is a limited approach because it fails to explain why patterns of mobility are variable over time. Admittedly, in many of the case studies settlement-mobility patterns are simply documented and archaeologists have often failed to take the extra step to explain variability. This does not undermine the value of those studies. There must be well-documented variability in hunter-gatherer mobility over time before there is something to explain. The use of models, the interpretation of archaeological data, the establishment and explanation of variability are all components of attaining an understanding of the evolution of prehistoric hunter-gatherer lifeways.

Mobility can inform us about other things we would like to know, but Torrence (1994:126) is correct in reminding us that mobility is not the only form of hunter-gatherer behavior worth investigating. Technological, economic, and social strategies must all be given due consideration. At this point, the models, frameworks, and methods to link technological organization to social strategies are more weakly developed. Following Isaac (1990), a greater focus on economy must be added to the established ecological analysis of prehistoric hunter-gatherers. Torrence's (1994:124) call for continued theory building is an important challenge for archaeologists. In Torrence's view, the process of theory building is completely separate from archaeological data while the view presented here is that theory building can also be pursued using data in an interactive manner.

Seasonal Round, Aggregation-Dispersion, and the Archaeological Record

Archaeologists readily adopted the idea of a hunter-gatherer seasonal round and developed specific seasonal rounds for certain areas for specific time periods. A classic example of this type of approach is Winter's (1969) description of the Late Archaic Riverton culture of the central Wabash Valley. Winters (1969:110) used a range of data including faunal remains, lithics, and features to develop the Riverton seasonal round or settlement system that included specific settlement types for certain seasons. Dye (1980) uses archaeological data and ethnohistorical accounts to suggest a seasonal round for the Late Archaic of western Tennessee in which the focus is on warm weather and cool weather work. Hofman (1984) outlines a seasonal round for the Middle Archaic of Middle Tennessee based on likely major subsistence pulls. The formulation of a seasonal round is a difficult task due to the likely variability in prehistoric hunter-gatherer behavior and the archaeological data needed. However, it remains a goal of many archaeological investigations of prehistoric hunter-gatherers.

The investigation of patterns of aggregation and dispersion have also been investigated by archaeologists. Probably the most widely known discussion of prehistoric aggregation is Conkey's (1980) case for Altamira. Conkey (1980) innovatively uses the diversity of engraved bone and antler from the Lower Magdalenian Cantabrian site of Altamira to provide evidence for its use as an aggregation site. She argues that an aggregation site should have the highest diversity in stylistic elements because diverse groups of people are brought together there. The diversity of the Altamira assemblage was found to be the greatest of those examined in Conkey's (1980:618-619) original analysis and in a re-analysis of the diversity measures and the significance of those measures by Kintigh (1989).

In another consideration of hunter-gatherer organization, Hofman (1986) uses mortuary data to evaluate the argument that Archaic shell midden sites in the Southeast are locations of hunter-gatherer aggregation. Hofman argues that organizational differences in mobility and group composition are reflected in the proportion, age, and sex of secondary burials at hunter-gatherer sites. This argument is based on the assumption that secondary burials represent individuals who died during periods of group dispersion and were brought to the aggregation site for final burial. Only individuals considered important to the larger aggregate group would receive such treatment. Secondary burials would be most frequent when residentially mobile groups occupy large economic territories but have fixed seasonal aggregation sites. In the application of his model of hunter-gatherer mortuary organization, Hofman focused on Middle Archaic shell middens located in the Middle South which generally fit expectations for seasonal aggregation sites.

Investigations of a seasonal round and the timing/placement of aggregation and dispersion episodes has opened up the investigation of variability between sites, but has limited the investigation of year-to-year variability or variability over the time period being investigated. Jochim (1991) points out that ethnographers have often presented a normative description of the seasonal round of a hunter-gatherer group which has shaped the way archaeologists approach prehistoric hunter-gatherer activities. That is, archaeologists attempt to reconstruct the one or dominant seasonal round for a specific area for a particular time period. Ethnographic accounts show that variability in a seasonal round can result from individual or family activities that differ from the group. For example, Spencer (1976:133) suggests that a Nunamiut nuclear family could choose between a number of options after the caribou drive. Variability in the seasonal round is also evident for a particular group from year to year. Sillberbauer (1981) describes four different seasonal rounds for the G/Wi which are tied to variability in rainfall. Jochim (1991:Figure 1) has developed a model of environmental contexts that shows the types of associations expected between season, location, and activities. For example, when environmental spatial and temporal variation are both low a strong association is expected but when spatial variability is high with low temporal variability there is a strong association between season and activities but little relation of either with location. This model is an important aid to archaeologists interested in investigating prehistoric hunter-gatherer activities and it helps determine at what level to investigate the seasonal round.

As with the seasonal round, the identification of prehistoric aggregation sites remains problematic even with the innovative approaches developed by Conkey (1980) and Hofman (1986). There is great variability in the preservation of faunal or human remains precluding the application of either of these approaches in many situations. Continued work in this area with other artifact classes is necessary. Although it is premature at this time to attempt to identify aggregation sites by using projectile points or other lithic remains to recognize different band segments, some work in this area is encouraging (Wiessner 1983; Greaves 1982; c.f. Sinopoli 1991) and continued effort has the potential to yield satisfactory results.

Ethnoarchaeology, Archaeology, and the Forager-Collector Model

In the 1970s, archaeologists interested in settlement-mobility patterns and other aspects of hunter-gatherer behavior turned to ethnoarchaeology (e.g., Binford 1977, 1978; O'Connell 1979; Yellen 1977). This is because it was recognized that the study of living peoples has the potential to aid in the interpretation of the past through middle range theory building and that ethnographers were not often recording the information archaeologists needed. As Yellen (1976:48) comments "it is easier to find out what an individual calls his cross-cousin [in the ethnographic literature] than it is to obtain an accurate description of the house or the settlement in which he (the hunter-gatherer) lives." Ethnoarchaeological studies are now common (e.g., Fisher 1993; Gamble and Boismer 1991; O'Connell et al. 1991). The investigation of hunting, butchering, and faunal remains is a major area of interest of ethnoarchaeologists (e.g., Bartram 1993; Bunn 1993; Hudson 1993) as are studies of spatial patterning (e.g., Fisher and Strickland 1991; Gargett and Hayden 1991; Nicholson and Cane 1991; Parkington and Mills 1991). Kent (1991) combined an interest in site structure and hunter-gatherer mobility with some enlightening results. She demonstrates that anticipated mobility is highly correlated with a number of elements of site structure among the Basarwa and Bakgalagadi including site size and hut diameter (Kent 1991:39-41). Ethnoarchaeology has provided a wealth of information for understanding the archaeological record concerning faunal remains and site structure. Ethnoarchaeology has resulted in fewer models and less data concerning settlement-mobility patterns, but major exceptions are Binford's (1977, 1978, 1979, 1980) work with the Nunamiut and his forager-collector model.

The forager-collector model has had a tremendous impact on how archaeologists approach prehistoric hunter-gatherer settlement-mobility patterns. Early investigations of settlement patterns described groups as mobile or sedentary (e.g., Beardsley 1956). From this, categories such as fully nomadic, semi-nomadic, semi-sedentary, and fully sedentary were developed (Murdock 1967). These categories forced a great deal of variability in group and individual movement into a limited typological framework. The number of group moves was treated as the single important variable for determining the degree of nomadism or sedentism, ignoring other dimensions such as distance of move or amount of individual movement. Kelly (1992:43) notes that this "blinded us to the fact that mobility is universal, variable, and multi-dimensional." Binford's (1980) forager-collector model is one attempt to overcome the shortcomings of previous approaches to hunter-gatherer mobility. It is an economic model that focuses on hunter-gatherer organization and is based on a dynamic conception of mobility.

In the model, foragers have a high degree of residential mobility, which means consumers are moved to resources. Foragers range out in search of food on an encounter basis and return each day to their residential base. Collectors, on the other hand, exhibit less residential mobility and move resources to consumers through logistically-organized task groups. Collectors store food for at least part of the year and create a wider range of site types. Binford's model is presented as a continuum from foraging to collecting, with a mixed foraging-collecting strategy occupying much of the continuum.

The tremendous impact of Binford's model is evident by the interest in reconstructing hunter-gatherer settlement mobility patterns and the numerous applications of the model (e.g., Amick 1994; Andrefsky 1991; Bamforth 1991; Ingbar 1994; Kuhn 1989; Lothrop and Koldehoff 1992; Odell 1994; Sassaman et al. 1988). Various methods to measure residential and logistical mobility (e.g., Kelly 1988; Shott 1986) and to identify collecting versus foraging sites (e.g., Savelle 1987) have been proposed by a number of archaeologists. Certain areas within a region have been labelled as logistical or foraging (e.g., Hanson 1988). For other regions, detailed settlement systems with foraging and collecting components have been proposed (e.g., Anderson and Hanson 1988).

Magne (1989) has focused on lithic assemblage formation as related to hunter-gatherer technological organization and mobility. Concepts of curation and maintenance (Binford 1977, 1979) as well as logistical and residential mobility are keys to his approach. Magne (1989:Figure 1) proposes an assemblage formation model in which flake-to-tool ratio is plotted against the percent of late stage flake debris to determine the degree of tool manufacture/maintenance and discard rates. Building on this, Magne (1989:Figure 7) proposes another model that relates assemblage diversity slope to the percent of late stage flake debris. The diversity slope is determined by plotting the number of artifact classes by the assemblage size. This model is an aid in determining site type and use. For example, a relatively low percentage of late stage flake debris with a high diversity slope is indicative of a residence while high values for both indicates a repeatedly used logistical camp. Magne (1989) recognizes that raw material distributions are an important consideration when examining technological organization, but suggests that this model should be effective in most situations.

More closely tied to the forager-collector model, Carr (1994b) utilizes an organization-of-technology framework to infer the mobility patterns of the prehistoric occupants of an Archaic site in Middle Tennessee. Given the particular raw material distribution of the region, different technological strategies and tool designs are suggested for foragers and collectors along with assemblage compositions for each. Test implications involving frequencies of flake debris in specific raw material types and reduction stages are developed for several potential site types. Although some aspects of the interpretive framework were ambiguous, Carr was able to infer that the Hayes site was employed as a forager residence during the Middle Archaic and a collector residence during the Late Archaic.

In another example involving lithic analysis and the forager-collector model, Odell (1994) employs use-wear data to test a model of hunter-gatherer residential mobility for the American Midwest. The data are derived from a detailed lithic analysis of sites in the Lower Illinois Valley. Decreasing residential mobility over time with an increase in logistical mobility is supported by temporal trends in the lithic data which included increases in tool hafting and heat treatment and decreases in core standardization, functional units per tool, and worked materials per tool. In this paper, Odell explores what he initially found to be ambiguous results regarding two other variables (mean retouched and utilized polar coordinates per tool). This was accomplished through a consideration of multiple and conflicting influences on technological organization so that these results are interpretable using the model he developed.

These studies represent significant advances in the investigation of hunter-gatherer organization and have begun the process of developing theory and models for interpretation of the archaeological record. However, the application of the forager-collector model in the examination of archaeological assemblages is often problematic. Archaeologists have generally failed to consider both the dynamics that underlie the model and the particulars of the environmental setting.

For example, in one study it is suggested that the relative abundance of animal taxa in an archaeological assemblage can be used to distinguish among collector, forager, or forager-collector mixed strategies (Lyman 1991). It is assumed that collectors concentrate on a few densely occurring food resources, while foragers take a broader range of food resources in more equal abundances. There are two major problems with this approach: 1) it assumes a specific relationship between mobility type and hunting practices; and 2) the forager-collector mix enters into the interpretation only when the data do not clearly support either a collector or forager strategy.

It is unlikely that such a simple relationship between mobility type and hunting practices would hold in all environmental settings. It is certainly possible for a forager site to contain a few animal species that were available in the immediate area, while a collector site would contain those and other animal species brought in by logistical task groups some distance from the site.

Using the simple assumptions postulated above concerning relative abundance of animal taxa, these sites would obviously be misidentified. Further, it has been shown through models based on optimal foraging theory that different species will be added to a diet only if there is the possibility of net caloric gain (Winterhalder 1981). In certain environmental situations, it may be more likely that collectors will add additional species to their diet than foragers. That is, as the area around a campsite is exploited and primary resources are consumed, collectors may be more likely to turn to second line resources and rely on logistical task groups, while foragers might simply move to another foraging patch.

Failure to consider the environmental context while broadly connecting foraging, collecting, and animal abundance ignores the dynamics captured in the forager-collector model as well as site formation processes. For example, foragers and collectors are likely to have dissimilar butchery practices because they are organized differently. These disparate butchery practices can have a profound effect on the composition of the faunal assemblage of a site. Logistical task groups may bring back only meat from a long distance foray, skewing any simple relationship between species abundance in an archaeological assemblage and settlement-mobility strategy.

From these few examples, it is clear that simple relationships between mobility and hunting practices or mobility and faunal assemblages may not hold in many situations. Knowledge of the specific environmental context (i.e., species availability) and of the dynamics of the model (i.e., differing butchery methods) must be obtained in order to determine if general relations will hold in specific cases.

The second problem is that the forager-collector mix enters into the interpretation only when the data do not clearly support either a collector or forager strategy. The continuum is generally lumped into a forager-collector mixed strategy that remains undefined or simply ignored. When it is not ignored, it becomes a "catch-all category." Cases that do not fit either extreme are often considered to represent the forager-collector mixed strategy with little further evaluation.

Three points are evident from this discussion. First, in using the forager-collector model to interpret archaeological materials, attention must be paid to the particular environmental context of sites. Otherwise general concepts may be misapplied in specific situations. Second, archaeologists must be aware of the dynamics that underlie the model. This awareness will aid in the recognition of cultural transforms, such as differing butchery practices, that may have considerable effects on archaeological assemblage formation. Finally, archaeologists have generally used foragers and collectors as two discrete types. The evidence of a continuum is the forager-collector mixed strategy. The mixed strategy type is used when archaeological data do not fit expectations for either foragers or collectors. This masks the variability in prehistoric hunter-gatherer mobility patterns that archaeologists must investigate.

Conclusion

The investigation of prehistoric hunter-gatherers has both gained insight and been restricted by the ethnographic study of modern hunter-gatherers. It has been argued here that archaeologists must not project patterns of behavior derived from ethnographies into the past but rather must explore the variability of prehistoric hunter-gatherer behavior. One area of behavior where this seems especially fruitful is the investigation of mobility patterns.

The construction of models is very useful for the investigation of prehistoric mobility. Models make assumptions explicit and when considered with regard to data new interpretations or a reworking of the model can result. Theoretical model and data interact in a cyclical or dialectic manner to drive investigations forward.

Models that consider prehistoric hunter-gatherer mobility must minimally take into account the possibilities of differential seasonal use of sites, aggregation versus dispersion, logistical versus residential mobility, and year-to-year variation in mobility patterns.

Jochim (1991) has recently suggested that archaeologists interested in hunter-gatherer mobility should look at the general texture of land-use in a broad framework as opposed to site specific analyses. Examining the broad patterns of land-use is a meaningful suggestion but this approach is best used in conjunction with site specific analyses. Analyses that focus only on broad patterns cause the concern that big sites will be labelled large aggregations or repeatedly-used collector residences and small sites will be called dispersed foraging residences or special-purpose logistical camps. Site specific analyses allow for the exploration of variability which may not be evident at a more general level. Methods that examine the broad regional settlement system and those that are employed at the site-specific level are complementary and should be employed together when possible.

CHAPTER III

Technological Organization

Archaeologists are successfully employing an organizational approach in technological studies to address general questions of prehistoric human behavior (e.g., Bamforth 1991; Jeske 1992; Kuhn 1991; Lothrop 1989; McDonald 1991; Nelson 1992; Nelson and Lippmeier 1993; Shott 1989). This is something which has not always been accomplished in the past, especially in studies of lithic assemblages. Also, an advantage of this approach is that different classes of data can be integrated allowing for the use of multiple lines of evidence. Although an organization-of-technology approach has had a significant impact on the analysis of lithic assemblages, there is some debate as to the proper conduct of research within this approach. Much of this debate is related to the relatively recent development and adoption of the approach. Other aspects of this debate stem from differing perspectives on theory building and the confusion concerning the role of case studies. The current debate, which has resulted in a closer examination of assumptions and stimulated new methods of analysis, is a healthy sign of renewed interest in the potential of lithic studies.

Technological Organization

Nelson, in a major review, effectively defines the organization-of-technology as:

> the study of the selection and integration of strategies for making, using, transporting, and discarding tools and the materials needed for their manufacture and maintenance. Studies of the organization of technology consider economic and social variables that influence those strategies (1991:57).

Although other definitions and descriptions of an organization-of-technology approach have been proposed (Binford 1979; Kelly 1988; Koldehoff 1987), each emphasizes the dynamic role played by technology and (stone) tools within prehistoric cultural systems. In all definitions, technology is viewed as a means to solve problems posed by both the physical and social environments (Binford 1977, 1978; Nelson 1991; Torrence 1989a), since particular environmental conditions will favor choosing and organizing one technological strategy or combination of strategies over others (Bleed and Bleed 1987). The ultimate goal of studies of technological organization is to determine "how technological changes reflect large scale behavioral changes in prehistoric societies" (Kelly 1988:717).

Adopting an organizational approach to study prehistoric technologies provides a framework for assessing variability within and between archaeological chipped stone tool assemblages. This variability can be related to the functional requirements of tool use as well as to economic and social strategies. Examining prehistoric hunter-gatherer mobility, which is responsive to both economic and social concerns, has often been accomplished using an organization-of-technology approach (e.g., Amick 1987; Anderson and Hanson 1988; Andrefsky 1991; Bamforth 1991; Binford 1979; Bleed 1986; Hofman 1991; Kuhn 1989; Lothrop and Koldehoff 1992; Magne 1985; Parry and Kelly 1987; Sassaman et al. 1988; Torrence 1983). Economic strategies have also been investigated through considerations of tool function (Odell 1994a; 1994b) and design (Nelson 1994). Social issues that have been addressed include craft specialization (Parry 1994) and gender (Gero 1991; Sassaman 1992). Finally, data from diverse analyses can be integrated within this approach. For example, Nelson and Lippmeier (1993) employ chipped stone data to make inferences concerning land use patterns so that attributes related to technological organization of ground stone tools could be assessed, effectively building analytic theory (sensu Schiffer 1988).

Relation to Theory

Lithic analysts must move beyond simply viewing technologies as organized. Studies of technological organization must be guided by general theory. For many analysts utilizing an organization-of-technology framework, this would be some variety of evolutionary theory. Although not often explicit, evolutionary ecology is the theoretical approach that often guides studies of technological organization (e.g., Carr 1994; Kelly 1988; Larson 1994; Nelson 1992).

Evolutionary ecology is grounded in Darwinian evolutionary theory and is widely applied in the study of anthropological and archaeological data sets (e.g., papers in Smith and Winterhalder, editors 1992; Torrence, editor 1989; Winterhalder and Smith, editors 1981). Winterhalder and Smith (1992:5) define evolutionary ecology as "the application of natural selection theory to the study of adaptation and biological design in an ecological setting." The ecological setting or environment is broadly conceived to include physical, biological, and social aspects. Natural selection theory and the use of the hypothetico-deductive method based in models are characteristics of evolutionary ecology (Winterhalder and Smith 1992:23). Concepts such as optimality and risk play important roles in formulating models within this approach.

Evolutionary ecology is still being developed as a theoretical perspective. However, the application of this approach in case studies (papers in Smith and Winterhalder, editors 1992) and the continuing development of models (e.g., Metcalfe and Barlow 1992) make it attractive as a guiding theoretical perspective. Shared concerns such as a broad perception of the environment are readily apparent between evolutionary ecology and the study of technological organization. It is not surprising that studies of technological organization often implicitly or explicitly employ concepts of risk or optimality (e.g., papers in: Carr, editor 1994; Johnson and Morrow, editors 1987; Torrence, editor 1989). It is likely that future studies of technological organization will be more explicitly guided by evolutionary ecology as a theoretical orientation.

This is not to propose that evolutionary ecology is the only theoretical orientation that can inform studies of technological organization or that further theory building within an organization-of-technology framework is unnecessary. For example, Sassaman (1994) employs historical materialism as a guiding theory to infer aspects of prehistoric economic and social strategies. Other theoretical orientations or paradigms are certainly viable and these could provide for new avenues of research.

Technological Organization and Lithic Analysis: Addressing Criticisms

Over the past two decades, lithic analysis in North America has been at odds with mainstream archaeology concerning the proper questions to be asked and how to go about answering those questions. As a result, the analysis of chipped stone tool assemblages has proceeded in many different directions, most divergent from the remainder of the discipline. A key factor related to this divergence has been the concentration by North American archaeologists on subsistence-settlement system studies. Traditional methods and approaches to lithic analysis rarely succeeded in these studies (Collins 1975). As a consequence, many lithic analysts became increasingly specialized by developing methods in areas such as fracture mechanics, use-wear, experimental replication, and conjoining (Cross 1983; Torrence 1989). "How" questions dominated the field. How does stone break? How was this tool made? How was this tool used? Critics quickly appeared and challenged the minute detail lithic analysts were pursuing with little thought to a theoretical orientation or to answering larger anthropological questions (Amick 1987; Cross 1983; Dunnell 1980, 1984; Thomas 1986).

To consider these new methods and specializations as inherently "bad" is to miss the point. On the contrary, they represent great strides in establishing the "facts" of stone tool manufacture and use. These facts can be used in building accurate reconstructions of the past and in building theory, given the proper approach. The problem is that these facts were rarely integrated in making inferences or addressing larger questions (e.g., Thomas 1986). Lithic analysts were operating in a theoretical vacuum in which inferences concerning economic and social strategies were not easily formulated. The result is a focus on specific functional considerations of stone tool use at the expense of embedding the functional aspects within the wider cultural system (Jochim 1989; Shott 1986).

Recently, some North American lithic analysts have refocused their efforts using an organization-of-technology framework to meet the challenges of their critics in both relevance to the discipline and theoretical orientation. Different and innovative questions are posed, stimulating renewed interest in lithic studies. "Why" questions are now addressed. Why is there variability in stone tool manufacture, form, use, and discard? Rather than a static indicator of types of activities and the frequency with which they were carried out, chipped stone assemblages are currently examined as a potential source of information concerning mobility, social strategies, subsistence, risk, and other aspects of behavior (e.g., Anderson and Hanson 1988; Arnold 1987; Bamforth 1991; Bleed 1986; Camilli 1989; Clark 1987; Gero 1989; Jeske 1992; Julig et al. 1989; Kuhn 1991; Lothrop 1989; McDonald 1991; Morrow 1987; Nelson 1992; Sassaman et al. 1988; Shott 1989; Teltser 1991). These avenues of research are not meant to replace the how questions, far from it. "How" and "why" questions are complementary and must be addressed in conjunctive fashion.

Torrence (1994) suggests that what I have identified as a change in questions from how to why is actually a change in subject matter. She is critical of this change which she views as from lithic assemblages and building archaeological theory to the prehistory of a particular region. I would argue that the change is more in focus. The answers to the "how" questions that concern the specifics of stone tool manufacture, use, modification, and re-use are still important, but are not the only focus of the study. Following Nelson's (1991) diagram (Figure 2), these answers or data are used in a number of ways including to provide information concerning economic and social strategies. In addressing why questions involving economic and social strategies, a particular theory or paradigm will likely be followed, models generated, analytical methods developed, and links formed between artifact patterns and behavior. These are all important aspects of building theory.

Schiffer (1988) has examined the structure of archaeological theory in which he defined three realms and a number of domains. The three realms are social theory, reconstruction theory, and methodological theory. Social theory functions to "explain variability and change in human behavior" (Schiffer 1988:464). Examples include evolutionary theory, Marxism, and symbolic structuralism. Reconstruction theory "is the process of inferring aspects of the cultural and natural past by rigorously applying explicit principles to archaeological evidence" (Schiffer

1988:469). Three domains of reconstruction theory are identified which are correlates, cultural transforms, and noncultural transforms. The final realm of theory is methodological which "provides guidance in selecting methods and techniques... and in applying the principles of reconstruction to given bodies of material" (Schiffer 1988:474). Methodological theory is composed of recovery, analytic, and inferential domains.

In a particular organization-of-technology case study, all of the theoretical realms and domains identified by Schiffer (1988:465) should come into play. Torrence (1994) takes a much narrower view of theory so that the only theory worth building is Schiffer's social theory. She views organization-of-technology studies to have entered the mainstream of archaeology so that work is carried out within a particular paradigm thus ending attempts at building theory. However, in the context of conducting case studies one may find that the general "social" theory in use is inadequate or inappropriate. In both cases, this would lead to theory building. In this way, as suggested by Torrence (1994:124), "you can push and pull at existing theory by trying it out within the context of case studies." It is recognized that it is rare, when conducting case studies, to question one's paradigm or social theory but not nonexistent. More often in the context of a case study, reconstruction and methodological theory are built especially in the correlates and analytic domains. An example of building correlate theory is the simulations of raw material patterning and application to an archaeological assemblage in a case study by Ingbar (1994). An example of building analytic theory is the work of Larson (1994) who shows in a case study how flake debris and stone tool analyses can be conducted in a complementary fashion. The case study is a way to try out new methods and ideas and to build theory while working on the prehistory of a particular region. Sometimes archaeological data do not fit expectations. This causes an examination of the theory, at all levels, in use in that study. This testing of theory can in turn lead to the development of new theory.

Torrence (1994:125) is correct in suggesting that the examination of variability is an important aspect of building theory. Examining the results of applying a particular method or theory in a number of different situations can reveal inadequacies and provide new insights. With respect to the discussion on theory building presented here (Chapter 1), this strategy is employing the same approach at different sites. However, as implied by Torrence, the value of that strategy does not detract from the value of applying a new method or approach in one particular case study. The use of particular case studies and data from a number of areas is best viewed as complementary. In a particular case study, the general usefulness of a particular method or approach can be outlined and operationalized. Further use of this method or approach in the examination of variability at different sites will reveal ambiguities and allow for fine tuning or show that it is inadequate and be discarded.

Technological Organization and Methods of Lithic Analysis

Nelson (1991) has developed a very useful diagram illustrating the levels of analysis in technological organization research. This diagram illustrates both the potential of technological organization studies to inform us of the past and how one might proceed in attaining that potential. In her discussion, Nelson works down the diagram examining each level of analysis and how it might be studied using an organization-of-technology approach. Nelson's diagram is used as the framework for the discussion provided here. This discussion will proceed up the diagram with a focus on identifying examples of approaches and methods that are appropriate for each level of analysis.

Artifact Form and Artifact Distribution

Artifact form and artifact distribution are at the base of Nelson's diagram. The analysis of stone tools has traditionally been descriptive with a focus on general artifact form through defining morphological types. A morphological type is a "descriptive and abstract grouping of individual artifacts whose focus is on overall similarity rather than specific form or function" (Thomas 1989:660). For example, a general tool type is defined such as scraper. Then, a number of variants are described that fit the basic definition of scraper but are perceived as distinct in certain respects of artifact form such as shape or location of retouch (i.e., end scraper, side scraper, etc.). Patterning in the distribution of morphological types at a site and between sites is then examined and interpretations presented.

The lithic analysis in the Pickwick report (Webb and DeJarnette 1942) is an excellent example of the use of morphological types in Southeastern archaeology. Johnson (1993:38) suggests that the Pickwick lithic analysis was "completely abstract... there were no goals other than description, and classes were established solely on the basis of form." Johnson (1993) suggests that the abstract nature of the Pickwick typology foiled the original attempts to search for chronological trends and masked the abundant evidence for biface production activities. Most lithic analyses in the Southeast subsequent to the publication of the Pickwick report were driven by cultural historical concerns in which temporal types of projectile points were defined. However, the analysis of most other classes of stone tools was generally based on morphological types and these types are often employed today.

The patterning in the distribution of morphological types presents problems for interpretation. Variation in the morphological types present and their frequencies between activity areas or sites may be due to a number of different factors. These factors include time, function, technology, and style. Often, archaeologists have erroneously assumed artifact form can be equated with function and have attempted to interpret the patterning of morphological types as reflecting different activities. That is, morphological types have been given functional labels and invested with functional meaning when no explicit arguments have been presented that demonstrate the association of the type with a specific use.

Use-wear analysts have demonstrated that form does not necessarily equal function (e.g., Ahler 1971; Keeley 1980; Odell 1981). The low-power magnification study by Odell (1981) of the lithic assemblage from a Dutch Mesolithic settlement is one interesting case. Those artifacts that are distinguished by particular technological features such as microlithic points were found to have functional and morphological correspondence. Most microlithic points were used as armatures. Functional integrity was lacking among morphological types that did not exhibit distinctive technological features. For example, artifacts belonging to the morphological type "borer" were found to be used as armatures, cutting implements, and scrapers, as well as for boring. The functional analysis of the Bergumeer assemblage illustrates that form and morphological type labels do not necessarily correspond to function.

Defining morphological types aids in providing an inventory of the recovered assemblage and may provide insights into the potential for more detailed analyses. However, the utility of examining the patterning in the distribution of morphological types is questionable. In the study of artifact form, analytical alternatives to defining simple morphological types allow patterning in artifact distribution to be discerned. One alternative is devising a goal-oriented typology (Brown 1982; Thomas 1989) and another is to focus on the occurrence of specific attributes without defining types (Dunnell 1971). Both of these alternatives allow for the selection of attributes that best fit the purpose of the analysis. Examining patterning in the occurrence of a goal-oriented type or a specific attribute should be more readily interpretable than a morphological type.

Temporal markers are a good example of a goal-oriented typology. Types are defined with the specific goal of constructing culture histories. These types are based on a combination of time sensitive attributes. With chipped-stone tools, attributes of the haft element are often important in this endeavor (Justice 1987; Thomas 1981). The effectiveness of temporal types can be tested through the use of absolute dating techniques such as radiocarbon.

For purposes of studying stone tool technologies, a completely different set of attributes from those used in defining temporal types may be selected. These attributes, in turn, would be unlikely to be used in functional or stylistic analyses. Each type of analysis will focus on a specific set of attributes that correspond to the purpose for which the typology is devised with the potential for little overlap in attribute selection.

The other alternative is to simply examine the occurrence of attributes as opposed to defining types. The use of archaeological typologies has been criticized in general (Dunnell 1989:45). It has been suggested that typologies simply represent modal descriptions of the data in which much of the variation is lost (Dunnell 1989). Some have argued that behavioral variation is the key to understanding human adaptation and cultural evolution (e.g., Jochim 1991; Leonard and Jones 1987; Winterhalder 1980) so that this variation is not lost, the appropriate scale of analysis must be chosen. Finally, types are not themselves directly observable. One does not observe a Clovis projectile point but rather the attributes that define the type Clovis projectile point. This alternative of focusing on attributes as opposed to types is considered by some to allow for the investigation of more fine scale variation. It should be kept in mind that the scale of the investigation should correspond to the goal or question that is addressed.

Whether focusing on attributes or defining types, an important consideration is to have a purpose in mind when selecting which aspects to consider. Following Nelson's diagram, studies of technological organization can be guided by higher levels of analyses. In Nelson's diagram, artifact form and artifact distribution are subsumed by design and activity distribution, respectively. However, an intermediate level of analysis that is above both artifact form and artifact distribution is manufacture/use. In her review, Nelson (1991:78-84) discusses manufacture/use with the activity distribution level of analysis. Certainly activity distribution is an important aspect of stone tool manufacture/use and can be related to site function inferences. However, not all analyses that consider manufacture/use also consider activity distribution or site function. A separate consideration of manufacture/use avoids confusion by placing archaeological studies at their appropriate level of analysis.

Artifact Manufacture and Use

Raw material acquisition, stone tool manufacture, use, reuse, and discard are all key elements in the definition of technological organization (Kelly 1988:717; Nelson 1991:57). This focus has its roots in the flow diagram developed by Collins (1975).

The study of artifact manufacture and use made great strides with the development of experimental archaeology. The re-inventing of flintknapping by Francois Bordes and Donald Crabtree among others was extremely important for the investigation of artifact manufacture. The study of stone tool use was made more scientific through the experimental use of tools that were then examined microscopically for distinctive wear traces (e.g., Keeley 1980; Keeley and Newcomer 1977; Odell 1979; Odell and Odell Vereecken 1980). Data from both of these areas of analysis have been used in studies of technological organization.

Organizational studies of the manufacture and use of stone tools attempt to consider the full range of activities and the context under which these activities occur. The first step in the process of stone tool manufacture is the acquisition of raw materials.

With regard to the acquisition of raw materials for stone tool manufacture, at least two areas have been investigated. Binford (1979) introduced the distinction between direct and embedded procurement. He suggests that much of raw material acquisition for hunter-gatherers was embedded in other activities such as subsistence so that the cost of raw material acquisition was quite low. A second area of interest is distinguishing between direct/embedded acquisition and indirect acquisition such as through trade. This has important implications when considering exotic raw materials at a site. Meltzer (1989) ran into a number of difficulties in making this distinction in considering raw material acquisition by Eastern Paleoindian groups. He suggests that equifinality is a substantial problem because "the two processes, direct and indirect acquisition, can yield essentially the same product" (Meltzer 1989:26). However, he does identify two conditions in which they may be distinguished and concludes, for the majority of sites, that there is evidence for the direct acquisition of exotic stone by Eastern Paleoindian groups.

The study of the selection of raw materials has also received attention and again the Paleoindian has served as the major time period of interest. Goodyear (1979, 1989) has made an effective argument concerning the selection and focus on high quality cryptocrystalline raw materials by Paleoindian groups. He suggests that "among mobile hunter-gatherers, the use of high quality cryptocrystalline raw materials is a strategy for creating portable and flexible technologies to offset geographic incongruences between resources and consumers" (Goodyear 1989:8). The flaking qualities of cryptocrystalline materials make them ideal raw materials for implementing this strategy. The focus by Goodyear on the relationship between assemblage patterning and behavioral strategies is an important precursor to studies of technological organization.

After selecting and acquiring raw materials, stone tool manufacture is the next step. The study of stone tool manufacture has received considerable attention with the re-invention of flintknapping. Although the determination of the method of manufacture of different types of stone tools has been a major area of study, especially of fluted projectile points (e.g., Callahan 1979; Crabtree 1972; Gryba 1988), studies of stone tool manufacture are not restricted to an interest in how a particular tool was made. A number of experiments are being conducted with the major interest being the flake debris produced during different stages of stone tool manufacture (e.g., Ahler 1989a, 1989b; Bradbury and Carr n.d.; Magne 1985). Flake debris analysis has received considerable attention with an organization-of-technology approach.

Several characteristics of flake debris make it useful for an organization-of-technology analysis. First, flakes are generally not curated as are tools, so they are deposited where produced. Second, stone tool manufacture is a reductive process, so flake debris shows evidence of how it was removed and of the events that occurred prior to that removal. Third, flake debris occurs in large numbers making it suitable for statistical manipulation. Therefore, analysis of flake debris can provide insights into the reduction methods used at a particular site (bipolar, blade) and indicate the point in the reduction sequence where a flake was removed.

The traditional approach of dividing flake debris into primary, secondary, and tertiary categories based, in most cases, exclusively on the amount of cortex cover has been found unreliable (Bradbury and Carr n.d.). In their experiments, Bradbury and Carr (n.d.:7) found that the amount of cortex cover may be providing more information concerning the initial size of the nodule reduced than the kind of reduction that took place. Other problems with this approach include the varying amounts of cortex cover employed by different analysts in using a primary/secondary/tertiary typology (Sullivan and Rozen 1985:Figure 1) and recording the amount of cortex cover is prone to error (Fish 1978; Jeter 1977; Shott 1994). Over the past decade a number of alternative approaches have developed for the analysis of flake debris. Individual flake (Magne 1985) and mass analysis (Ahler 1989a, 1989b) methods are particularly useful because of being based on experimental assemblages. Sullivan and Rozen's (1985) focus on flake portions is a useful means of describing an assemblage using mutually exclusive categories. However, interpreting these categories is not straightforward and experimental assessments of this approach have had varied results (Bradbury and Carr n.d.; Ingbar et al. 1989; Prentiss and Romanski 1989; Tomka 1989). Recently, Bradbury and Carr (n.d.) have suggested the complementary use of individual flake and mass analysis methods due to the difficulty in accurately characterizing a flake debris assemblage.

Another method that deserves greater attention in the analysis of flake debris is refitting. Simek (1994:119) has argued that the empirical strength of refitting is an important means of evading the problem of equifinality associated with experimental replications and he has pointed to the success of this approach in European studies. Hofman (1992) has pointed to some of the applications of refitting which include evaluating post depositional processes, examining horizontal artifact distributions and site activities, and enhancing technological studies. The mechanics of refitting are relatively simple, but the time involved can make such an endeavor costly to undertake. Also, certain excavation procedures such as opening trenches as opposed to block areas or maintaining bulk provenience instead of piece-plotting of all recovered items can inhibit the usefulness of refitting. Refitting of chipped stone assemblages is not practical in every analysis, but its' use should increase because of the important information it can yield.

Once a stone tool is manufactured, it is ready to be used. Torrence (1994:127) provides an important reminder that stone tools are made to be used, and how that stone tool is intended to function has an impact on "how that technology was created." While suggesting that the technology must be responsive to other factors, Torrence places the greatest emphasis on stone tool use. Certainly tools must function, but there are a number of design alternatives available for making a stone knife. A simple flake will serve to cut many materials. Why would someone invest the time and raw material to produce a bifacial knife? It is because other factors come into play such as economic and social strategies as well as a consideration of environmental conditions, especially raw material distributions. In considering different design alternatives such as maintainable versus reliable, one must not lose sight of the fact that the tool must be able to be used. However, Nelson (1991:76) suggests that "the specific function of a tool, in the task sense, may influence the form of the tool less than do the exigencies of transporting it." Function must be considered in the broadest sense such that stone tool use and other factors are given their proper emphasis which will likely vary from case study to case study. Information concerning the uses of specific stone tools in an assemblage can be an important component of organization-of-technology studies.

The study of stone tool use has made great strides over the past two decades. Although there is still some debate over the level of specificity and accuracy that can be achieved in use-wear studies (e.g., Bamforth et al. 1990; Grace 1990; Newcomer et al. 1986), there is a general acceptance of both low magnification and high magnification techniques. With this acceptance, the results of this work are being integrated with other data sets, and use-wear data are being used to answer general questions of human behavioral change. An excellent example of this integration is the work at Meer where all recovered lithic remains were mapped and labelled, a detailed use-wear study was accomplished, and a refitting analysis was conducted (Cahen et al. 1979) The mapping of materials in the field at Meer allowed concentrations to be identified. The refitting defined the reduction procedure and association of different tools and flake debris, while the use-wear analysis identified specific functions for tools in the concentrations. This allowed for statements concerning the amount of tool curation and expediency at the site (Cahen et al. 1979: 671-672; cf. Dunnell 1979; Newcomer 1979; Odell 1979). With regard to employing use-wear data in making general behavioral inferences, Odell (1994a, 1994b) has examined prehistoric mobility and sedentism in the North American Midcontinent. He argues that with greater sedentism there should be a greater use of hafting of stone tools as opposed to using hand held tools. This argument is made in a framework of risk considerations and with reference to aspects of tool design, specifically tool reliability. Employing chipped stone assemblages from the Lower Illinois Valley of Illinois that range from the Early Archaic to the Mississippian period, Odell (1994b:63-68) shows an increase in haft wear throughout the Holocene which he contends is in direct response to increased sedentism. These two examples show the great potential for use-wear data in organization-of-technology studies.

Design and Activity Distribution

Nelson identifies design and activity distribution as levels of analysis in research on technological organization that subsume artifact form and artifact distribution, respectively. In the brief summary of the work by Odell (1994a, 1994b), the importance of the consideration of design and activity distribution for addressing general questions of prehistoric behavior was shown.

According to Nelson (1991:66), "Design refers to conceptual variables of utility that condition the forms of tools and the composition of tool kits." Bleed (1986) introduced concepts of reliability and maintainability as two design variables that can be used to optimize the availability of any technical system. Availability is defined as "the amount of time that a system is available to do a job" (Bleed 1986:739). A system designed to be reliable is dependable so that it will work when needed. Characteristics of a reliable system include overdesigned parts, careful fitting of parts, and overall good craftsmanship (Bleed 1986). Maintainable systems can be "quickly and easily brought to a functional state" even if broken or not designed for the specific task at hand (Bleed 1986:739). Maintainable systems are characterized as light and portable, extra components ready for use, design for partial function, and repair/maintenance occur at use. Bleed (1986), after examining the costs and benefits, relates these design alternatives to the forager-collector model. Maintainable systems are best used for generalized tasks where there is a continuous need but unpredictable schedules and failure costs are low. Reliable designs will be used when failure costs are high or when tasks have predictable schedules with available downtime. According to Bleed (1986), foragers would optimally be equipped with maintainable weapons and collectors with reliable weapons.

Nelson (1991) subdivides maintainability into versatile and flexible designs which parallels the use of these terms by Shott (1986). Flexible tools are reshaped in order to accomplish a number of different tasks. Versatile tools are maintained in a generalized form that can be used to accomplish a number of different tasks. A large bifacial core is used as an example of a tool form with design flexibility and versatility. As a flexibly designed tool, "a variety of flake forms (for use as tools) can be produced" and the biface itself can be used for pounding/chopping and as a sharp cutting tool (Nelson 1991:72). Additionally, since design flexibility requires a change in tool form, Nelson (1991) suggests that simple repair kits will be a component of the flexibly designed toolkits. The large biface with a generalized edge is an example of a versatile tool design and can be used for a wide variety of activities (Johnson 1987; Nelson 1986, 1991). Tools designed to be versatile should have multiple functional edges and/or exhibit differential use-wear patterns (Nelson 1991:73; Shott 1986).

Nelson also adds transportability as a design strategy. A toolkit designed to be transportable will "accommodate the constraints of mobility and anticipate future needs" (Nelson 1991:76). Transportable systems are characterized as being small, lightweight, and resistant to breakage. It has been suggested that if transportability is achieved by restricting the toolkit to a small number of items that these tools must be either flexible or versatile (Nelson 1991:74; Shott 1986). Further, conservation of these items is expected in order to maximize the use-life of tools.

Hayden and Franco (1992) have questioned the usefulness of design concepts, specifically with regard to operationalization. They argue that it is difficult to determine the design concepts employed in the manufacture of a stone tool and question the ability of archaeologists to identify tools designed to be reliable versus those designed to be maintainable. Nelson (1994:57) points out that the term "design option" is not synonymous with "tool type" so that "tools and weapons are combinations of greater and lesser emphasis on design options." Nelson (1994) employs a strategy of applying design options in developing expectations about suitable tool forms in different contexts. Specifically, she focuses on technological strategies that would facilitate two economic responses to subsistence risk: resource specialization and resource diversity. For resource specialization, Nelson (1994:56) argues that the design of tools and weapons should emphasize reliability and use-efficiency. For resource diversification, tools would be designed to be maintainable (for multiple use and portability). Nelson uses projectile point data from five regions in the Southwest to examine the role, if any, that resource specialization or resource diversity played in alleviating subsistence risk. The uneven recording of attributes among the samples was a confounding problem; however, some general conclusions were reached. First, based on a lack of versatile point designs, it is concluded that generalized hunting was not a risk-reduction strategy employed in the Southwest (Nelson 1994:52). Second, the use of side-notched points in one area is suggested to represent specializing in group hunting of large animals as a means of reducing risk in conjunction with intense agriculture activities (Nelson 1994:53). This work illustrates one potential avenue of research in using design concepts in the study of technological organization.

In contrast with the study of tool design, the examination of activity distribution has received considerable attention. Inferences concerning settlement-mobility patterns and site function are commonly made based on raw material, stone tool, and/or flake debris patterning (Carr 1994; Ingbar 1994; Larson 1994). These inferences are based on expectations of the location of tool manufacture, use, reuse, and discard events. For example, all stages of manufacturing debris are generally assumed to occur at most types of residential bases (e.g., Binford 1977, 1979; Ebert 1986; Thomas 1983). Flaking debris present at special-activity or extractive camps, on the other hand, will not be from all stages of manufacture but will generally be restricted to late stage reduction activities such as the resharpening of transported tools (e.g., Goodyear et al. 1979; Nelson 1991). These expectations may not be applicable in all situations and must minimally be associated with a consideration of raw material distributions.

An example of this type of approach is the work by Carr (1994b). He utilizes an organization-of-technology framework to infer the mobility patterns of the prehistoric occupants of an Archaic site in Middle Tennessee. Given the particular raw material distribution of the region, different technological strategies and tool designs are suggested for foragers and collectors along with assemblage compositions for each. Test implications involving frequencies of flake debris of specific raw material types and reduction stages are developed for several potential site types. Carr's analysis resulted in ambiguous results for the Late Archaic component but he was able to infer that the site was used as a forager residence during the Middle Archaic.

Larson (1994) also considers activity distribution, but uses a holistic approach to chipped stone assemblages incorporating both flake debris and stone tool data to provide an understanding of technological organization. Minimum analytic nodule analysis is the method used in achieving this holistic approach. Minimum analytic nodule analysis is considered complementary to refitting and is a method in which "analytic nodules are defined according to similarities in raw material type, color, texture, inclusion, and cortex characteristics and contain flakes, tools, cores, and other items" (Larson 1994:58). This creative approach is employed in the study of an Early Plains Archaic assemblage from the Central Rocky Mountains. Minimum analytic nodule analysis is combined with data on raw material frequencies and tool fragmentation to discuss on-site production activities, labor investment, and tool design. One conclusion based on this work is that few complete production trajectories were found at the site suggesting the site occupants were residentially mobile (Larson 1994:62).

In contrast with the above approaches, Nelson (1991:86) points out that "some research on technological organization addresses patterning in the distribution of technological strategies on a regional scale that does not proceed from the identification of site types." In some of these regional analyses, data are recorded in terms of site clusters (e.g., Nelson 1990; Nelson and Camilli 1984) while in others the site concept is not employed (e.g., Dunnell and Dancey 1983; Ebert 1986; Foley 1981). The site cluster approach has parallels with the site type approaches. For example, Kelly (1988) suggests that the isolated occurrence of bifacial flakes in one area as opposed to at site clusters in another area indicates differences in mobility patterns, logistical versus residential, respectively.

Technological Strategies

In Nelson's diagram, design and activity distribution are both subsumed by technological strategies. The two technological strategies most commonly examined are curation and expediency to which Nelson (1991:62) adds opportunistic behavior. Although curation and expediency have generally been contrasted, there is some confusion concerning the meaning of curation (McAnany 1988; Nelson 1991; Odell 1992). Nelson (1991:62) suggests that curation is "a strategy of caring for tools and toolkits that can include advanced manufacture, transport, reshaping and caching or storage... it need not include all of these dimensions." Bamforth (1986:39) citing Binford (1977, 1979) identifies five different aspects of curation which are: "production of implements in advance of use, design of implements for multiple uses, transport of implements from location to location, maintenance, and recycling." Nelson (1991) drawing on her diagram of technological organization points out that Bamforth's characterization of curation confuses technological strategy with design. Specifically, tools that are effective for a variety of tasks are examples of a versatile design while tools that are recycled are an example of a flexible design (Nelson 1991:63). Odell (1992) also points out problems with Bamforth's characterization of curation. He uses the incidence of hafting as a measure of the advanced preparation of tools and the relative quantity of bifaces to measure tools manufactured for multiple uses. In his data set, he finds that these two aspects of curation behave in an opposite manner. Odell (1992:14) suggests that to refer to both of these behaviors as curation is misleading and in using the term curation one must be explicit in its definition. Following Nelson (1991), the bifaces would represent a versatile design and, therefore, would be given different consideration following her diagram.

Expediency as a technological strategy has been the subject of less debate. "Expediency refers to minimized technological effort under conditions where time and place of use are highly predictable... expediency anticipates the presence of sufficient materials and time" (Nelson 1991:64). This definition of expediency is at odds with Binford's (1977) suggestion that an expedient technology is less organized than a curated one. It is clear from Nelson's (1991) discussion that expediency is a planned strategy so that characterizing it as less organized than a curation strategy simply adds confusion.

Nelson (1991) contrasts the technological strategy of expediency with opportunistic behavior. Opportunistic behavior "is not planned" and is "responsive to immediate, unanticipated conditions" (Nelson 1991:65). Although for both expediency and opportunism, tools are produced at the time and place of use, these two strategies should not be merged. That expedient behavior is planned while opportunism is not has different implications for the manufacture and distribution of stone tools.

Social and Economic Strategies, and Environmental Conditions

In Nelson's diagram, technological strategies are subsumed by both social and economic strategies which are in turn subsumed under environmental conditions. These levels build on Nelson's (1991:58) notion of strategies as "problem-solving processes that are responsive to conditions created by the interplay between humans and their environment." In this view, a focus on strategies is not meant to account for all behavior, technological or otherwise, or explain all the variation in the archaeological record. Behaviors that contribute to human adaptation are the key and this approach focuses on technology as such a set of adaptive behaviors as opposed to a set of objects (Nelson 1991:59).

As discussed previously, studies of technological organization have often focused on prehistoric settlement patterns and examining prehistoric mobility patterns. This is not to say that other studies of economic or social strategies are unimportant. Greater consideration of these areas are needed to provide a balanced understanding of the past. However, mobility and settlement patterns have both economic and social implications and deserve continued study along with developing new avenues of research.

The investigation of craft specialization and the role of indirect procurement with regard to the social relations of production in complex societies have been examined in studies of technological organization. McAnany (1989:341), through analysis of flake debris and stone tools, is able to establish one site as a consumer locality "in an entrenched system in which there is an institutionalized separation between the place of production and the subsequent place(s) of consumption." Parry (1994) takes an alternate approach by exploring the different times and places that blade technologies were used in North America and concludes with a discussion of craft specialization and its role in certain of these blade technologies.

In addition to craft specialization, other aspects of social strategies have been investigated. For example, Sassaman (1994) examines the organization of technology in the South Carolina Coastal Plain over a 7,000-year period as it relates to social strategies. Using risk avoidance as a unifying theme, he discusses the role of biface manufacture in meeting economic and social needs. In this discussion, economic decisions of production and design are viewed as embedded in social strategies for risk avoidance. Gender issues have also been investigated (Gero 1991; Sassaman 1992).

The investigation of prehistoric settlement-mobility patterns has received the greatest attention in studies of technological organization. Specific technological studies have been directly linked to specific mobility patterns. Binford (1977) has suggested a link between logistical mobility and curation which has been taken by Bamforth (1986) to imply a connection between foragers and expediency. However, Carr (1994b:36) has pointed out that a one-to-one correlation between technological strategy and mobility strategy is unwarranted. For example, work by Bleed (1986) illustrates that collectors would employ reliably-designed weapons while foragers would employ maintainable weapons. Reliable and maintainable designs are alternatives for a curated technological strategy and cannot be related to expediency. These designs are alternatives for optimizing the time a system is available to do work, whereas an expedient technology is used when sufficient time is available. Hunter-gatherers employing either type of mobility would use at least some curated tools. This is not terribly surprising, but the assumed association of residential mobility with an expedient technological strategy (Bamforth 1986) is called into question. Further, collectors can be expected to practice some expedient production of tools at base camps depending on the availability of raw materials. The realization that foragers and collectors are both likely to use curated and expedient tools underscores the point that mobility and technological strategy are not directly correlated. Depending on conditions of raw material availability and tool needs, the same technological strategy may be employed by both foragers and collectors (Kelly 1988:717).

Investigating prehistoric hunter-gatherer settlement-mobility patterns using an organization-of-technology approach can only proceed with an understanding of raw material distributions in the region. Further, simple relationships between technological strategy and mobility strategy are unwarranted. However, the investigation of tool design has the potential to aid the study of prehistoric settlement-mobility patterns. This area must be further developed, especially with regard to the operationalization of design concepts.

Relation to the *Chaine Operatoire*

An innovative approach, the *chaine operatoire*, has recently been developed in French archaeology for the study of prehistoric lithic assemblages. It has been suggested that this approach has been largely ignored by the bulk of English-speaking archaeologists (Sellet 1993). A comparison of organization-of-technology and *chaine operatoire* approaches can reveal similarities and differences that can further illuminate each and show benefits that each can derive from the other.

Simek (1994:119) points out that the concept of *chaine operatoire* is not easy to translate and cannot be equated with reduction sequence or lithic tool production. This is because, in using a *chaine operatoire* approach, technology is embedded in other aspects of behavior. Inizian et al. (1992:12) suggest that *chaine operatoire* "includes all processes, from the procurement of raw material until it is discarded, passing through all the stages of manufacture and use." Geneste (1985) suggests that "the chaine is a sequence of gestures--behaviors--determined by material constraints, situational contingencies, and cultural parameters." Certain similarities are obvious between this definition and description of *chaine operatoire* and that offered by Nelson (1991) for technological organization, but there is an even closer parallel with Kelly's (1988) definition of technological organization. Kelly (1988:717) defines technological organization as:

> the spatial and temporal juxtaposition of the manufacture of different tools within a cultural system, their use, reuse, and discard, and their relation not only to tool function and raw-material type, but also to behavioral variables which mediate the spatial and temporal relations among activity, manufacturing, and raw-material loci.

The definition of *chaine operatoire* offered by Sellet (1993:106) as "a technological approach that seeks to reconstruct the organization of a technological system at a given archaeological site" further illustrates the similarity in the two approaches. These similarities include a focus on the entire life history of stone used by prehistoric peoples and a focus on technology. The oft cited *chaine operatoire* study by Geneste (1985) in which there is an attempt to "link the major variables of technological reduction (in a proposed *chaine operatoire*), raw material economy, and traditional industrial typology in the interpretation of lithic evidence from several Mousterian sites in the Perigord" (Jelinek 1991:9), illustrates further similarities, especially in an interest of raw material availability and variability. For example, in his re-analysis of Geneste's data, Jelinek (1991:26) suggests that "a major potential implication of the ordering discovered in the association of distinct categories of lithic materials with distinctive chaine reduction types is that some form of deliberate material selection or preference was part of the behavior of the Neandertals who brought both raw material and previous reduction products to the sites from which they have been recovered." The parallel between these observations and those by Larson (1994) and Carr (1994b) is obvious.

Other similarities between *chaine operatoire* and other approaches that have been used by North American archaeologists in the past have been noted. For example, Jelinek (1991:7) suggests that the *chaine operatoire* is similar to the schemes and flow diagrams developed in lithic studies in North America in the 1970s. Sellet (1993:107) points to the similarity of the *chaine operatoire* with Schiffer's (1976) behavioral chain. Also, an organization-of-technology approach developed from the flow diagrams that were used in the 1970s and reference is often made by those employing such an approach to the diagram developed by Collins (1975).

Several differences also exist between *chaine operatoire* and an organization-of-technology approaches. As noted by Simek (1994), there is a greater use of both experimental replication and refitting in the *chaine operatoire* approach. Greater use of these two methods will certainly benefit those interested in technological organization. Another difference is the interest in the cognitive realm (e.g., Pelegrin 1993), especially concepts and knowledge. In some *chaine operatoire* studies, objects, the sequence of gestures, and the shared group technical knowledge are all integrated (Sellet 1993). As noted by Simek (1994:120) this integrative systemic approach "should clearly be of interest to American lithic analysts."

The organization-of-technology and *chaine operatoire* approaches are most similar in their focus on strategies of raw material analysis, tool manufacture, and use. Those employing a *chaine operatoire* approach might benefit from the design and strategy concepts that are used in an organization-of-technology approach as well as the levels of analysis as diagrammed by Nelson (1991). Also, Sellet (1993:109) suggests that those interested in the *chaine operatoire* would benefit from adopting a minimal nodule analysis. Larson's (1994) use of this approach has already been discussed here.

The French *chaine operatoire* and the American organization-of-technology approaches have several commonalities and each could benefit from a consideration of the differences. Greater communication between these two different schools of thought should produce a fertile arena for new avenues of research.

Conclusion

An organization-of-technology approach holds great promise for the study of lithic assemblages. The details generated from diverse analyses can be integrated and brought to bear on questions of general interest in archaeology. The framework of the levels of analysis developed by Nelson (1991) provides a means of structuring the study of lithic assemblages and of making inferences of past behavior. The adoption of this new approach with its focus on technological strategies is one of the strengths of the reanalysis of the Tellico Early Archaic lithic assemblages presented here.

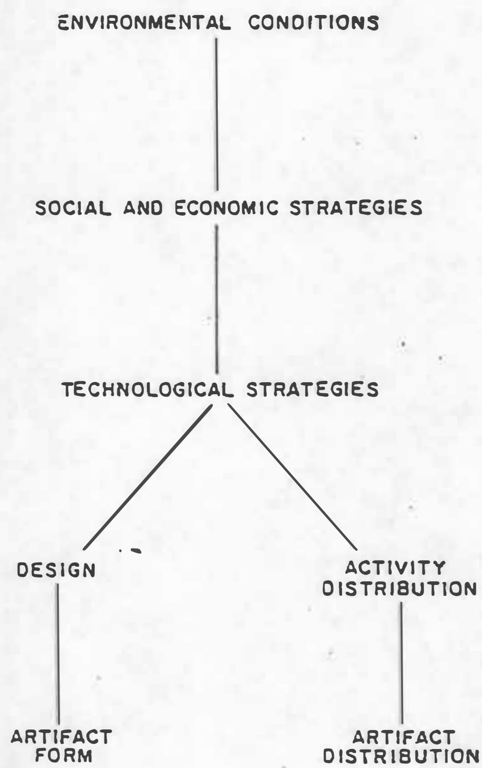

Figure 2: Levels of Analysis in Organization-of-Technology Studies (after Nelson 1991).

CHAPTER IV

Models of Early Archaic Settlement in the Southeast

In this chapter, four Early Archaic settlement-mobility models that have been proposed for different areas of the Southeast are reviewed and evaluated. Each of these models possesses strengths and weaknesses and all represent significant contributions to our understanding of Early Archaic lifeways. However, too often, the focus is on the entire Early Archaic time period without considering the potential for change over this period. A review of these models establishes the current state of investigations of the Early Archaic which provides the foundation and context for the research conducted in this study.

Three of the most influential models of Early Archaic settlement-mobility in the Southeast have recently been reviewed, re-examined, or tested. The first is the Central Based Transhumance model employed by Chapman (1975) to interpret the Early Archaic occupation of the Little Tennessee River Valley. This model has recently been revised with the addition of new data and interpretations by Davis (1990) and Kimball (1992). The second model, termed the Effective Temperature/Technological Organization (ET/TO) model (Anderson 1992), was developed by Cable (1982) to interpret the Haw River sites located in the North Carolina Piedmont. Cable (1992) has since re-evaluated and re-analyzed the data and presented a revised ET/TO model. The third is the Band-Macroband model, also termed the Biocultural model (Anderson and Hanson 1988), which has come under the greatest scrutiny of late. Sassaman (1992) has tested some aspects of this model using new data. In addition, the findings of O'Steen (1992) concerning the Early Archaic of the Georgia Piedmont are relevant to the evaluation of this model. Recently, Daniel (1992, 1994) has criticized several of the assumptions of the Band-Macroband model and offered the Uwharrie-Allendale model as an alternative.

Central Based Transhumance Model

The Early Archaic settlement pattern in the Little Tennessee River Valley has been described as a central-based transhumance system (Chapman 1975:272). This model was based on findings at the Rose Island site. In the Central-Based Transhumance model, Rose Island is a base camp for one or more bands which served as the hub for other hunter-gatherer activities. Logistical camps and locations (sensu Binford 1980), evidence for which are the occurrence of isolated or a very limited number of projectile point/knives at numerous surface sites in the Little Tennessee River Valley, are the sites of these other activities.

Archaeological investigations at other sites in the Tellico area are suggested to provide support for the Central Based Transhumance model. The discovery of large, dense Early Archaic sites such as Icehouse Bottom, Patrick, and Calloway Island led to the recognition that these base camps were situated in areas of maximum microenvironmental and resource diversity. The access from these base camps to a variety of both microenvironmental zones and resources is suggested to have eliminated the need for large scale (residential) mobility (Chapman 1978:142). Smaller, less dense floodplain sites discovered through deep backhoe testing may represent transient extractive camps similar to the surface sites with only a few projectile point/knives (Chapman 1978). The Central Based Transhumance model is clearly related to what Binford (1980) has described as a collector strategy based on logistical mobility.

Anderson (1992:25) has noted that the implications for site location in the Central Based Transhumance model have been widely employed by a number of other researchers in the southeastern United States (e.g., Anderson and Schuldenrein 1985; Clagget and Cable 1989; Goodyear et al. 1979). The influence of the Central Based Transhumance model is clearly seen in the Riverine/Interriverine model developed for the Archaic period of the Piedmont and South Atlantic Slope (Goodyear et al. 1979). The Riverine/Interriverine model is based on a consideration of environmental factors and archaeological site data from those areas. In the model, base camps were located in the riverine zone and extractive camps in the interriverine zone to take advantage of resource distributions. For the Early Archaic period, it has been stated that the evidence is "somewhat ambiguous, but tends to argue against the model" (Anderson 1992:25). Only minimal differences between Early Archaic sites in the riverine and interriverine zones have been documented indicating a much greater use of the interriverine zone than predicted by the model (Anderson and Schuldenrein 1983:201-205). Further, Ward (1983:67-68) has proposed that there are greater environmental similarities than differences between the two zones so that variability in hunter-gatherer activities and hence archaeological assemblages should be minimal. Although the Interriverine-Riverine model is generally no longer considered applicable for the Early Archaic period of the South Atlantic Slope, the influence of the Central Based Transhumance model with its emphasis on environmental factors and logistical mobility is still evident in other models of Early Archaic settlement in the southeastern United States (e.g., Anderson and Hanson 1988; Cable 1982).

Davis (1990), using data from the Tellico Archaeological Project (TAP), has examined general land use patterns and developed a series of settlement models for the aboriginal occupation of the lower Little Tennessee River Valley. An Early Archaic settlement pattern is presented that is based on a collector settlement system (Davis 1990:17-19) which effectively builds upon the Central Based

Transhumance model of Chapman (1975). In examining general land use patterns, probabilistic survey data were analyzed with a focus on differences between valley and upland site use. All available site data from the study area were employed in the development of settlement models including data from probabilistic surface reconnaissance, nonprobabilistic surface reconnaissance, deep testing for buried sites, and archaeological excavation.

In the examination of general land use patterns, only early (Early Archaic through Early Woodland) and late (Middle Woodland through Historic) temporal units were used. The major reason for this division is that it permitted the use of most artifact samples from the probabilistic survey. An obvious difference in general land use between valley and upland areas was found for early sites (Davis 1990:189) similar to that proposed in the Riverine/Interriverine model. High artifact density and generalized assemblage content suggested residential base camps were located in the valley. Lower artifact densities and less diverse contents were identified in the uplands suggesting extractive activities. These findings are somewhat in contrast to a test of the Riverine-Interriverine model for the South Atlantic Slope where only during the Late Archaic does the Riverine-Interriverine model hold (White 1982:226-227).

Davis (1990) also analyzed site patterns for the lower Little Tennessee River Valley for more precise time periods. A total of 269 Early Archaic components was classified as base camps, logistical camps, or activity loci in this study. A general classification scheme for site assemblages recovered from surface survey and limited backhoe excavations was employed based on numbers of projectile point/knives (Davis 1990:197). Settlement models for five Early Archaic phases (Lower Kirk, Upper Kirk, St. Albans, LeCroy, Kanawha) were developed. Residential base camps during all Early Archaic phases were mainly located on the first terrace of the Little Tennessee River. Occupation intensity increased from Lower Kirk to Upper Kirk but decreased thereafter. Logistical camps for all periods were generally located on the floodplain. Several Upper Kirk phase logistical camps and numerous activity loci were identified in the uplands. Activity loci for the St. Albans, LeCroy, and Kanawha phases are mainly restricted to the Little Tennessee River Valley and is indicative of greater areal focus.

The general settlement pattern developed by Davis (1990) for the Early Archaic period based on a variety of data sets generally fits with the Central Based Transhumance model proposed by Chapman (1975). Base camps are located in the valley and logistical camps are located in valley and upland areas. Davis (1990:202) admits the possibility that some of the base camps with dense artifact assemblages may have served as aggregation sites (use by multiple bands as originally postulated by Chapman 1975:272) but without more substantive evidence he prefers to interpret these sites as repeatedly occupied as opposed to aggregation sites.

Kimball (1992) has presented a retrospective on the Early Archaic data from the TAP with a focus on technological organization and settlement strategies. As did Davis (1990), Kimball makes use of buried site excavations, nonprobabilistic and probabilistic survey results. However, the data employed by Kimball are slightly different in several ways due to re-defining environmental boundaries and combining surface survey and deep testing survey results (Kimball 1992:164).

Kimball (1992) uses diachronic and synchronic analyses to interpret Early Archaic settlement patterns in the lower Little Tennessee River Valley. The diachronic perspective makes use of all available excavation and survey data. Kimball (1992:168) found distinct differences between the distribution of Kirk and Bifurcate sites across different landforms. Bifurcate sites were found to be focused on the front edge of the floodplain (T-1 and islands) while Kirk sites were spread over a variety of landforms. The synchronic perspective focused on identifying site functional variability using 41 Upper Kirk assemblages from Tellico and the adjacent Great Smoky Mountains National Park. Tools from each assemblage were grouped into ten activity categories and a debitage:tool ratio was also used in the cluster analysis of sites (Kimball 1992:Table 10.11). The eight site clusters that resulted were interpreted in terms of a collector settlement-mobility pattern which included locations, field camps, and residential bases as site types (Kimball 1992:171). Logistical field camps were located either in the mountains or uplands while locations are found throughout the study area but mainly in the uplands along tributaries. Two types of residential bases were recognized for the Upper Kirk; Icehouse Bottom is suggested to represent a gearing-up residence and Bacon Farm a main fall residence (Kimball 1992:179). Contrary to Davis (1990), Kimball (1992:181) suggests that Icehouse Bottom and Bacon Farm would have been likely aggregation sites where several bands came together.

Combining the results from the synchronic and diachronic analyses, the Kirk settlement strategy is interpreted as a collector system with a shift to greater residential mobility or forager system during the Bifurcate occupation. The interpretation of the Kirk occupation as a collector system is consistent with Davis (1990) and Chapman's (1975) Central Based Transhumance model. The interpretation of the Bifurcate occupation as representing a forager settlement system is based mainly on the synchronic analysis where fewer Bifurcate sites were noted and those found were concentrated on the front edge of the floodplain. The lower number of Bifurcate sites is suggested as a consequence of foragers not employing logistical field camps. A shift in blank selection from blade to bipolar flakes from the Kirk to Bifurcate occupation and suggested environmental changes are used as supporting evidence for the interpretation of a forager system operating during Bifurcate times (Kimball 1992:169).

In some respects, the Central Based Transhumance model has remained intact with the addition of new data, analyses, and interpretations. In the most recent study, a collector system is proposed for the Lower and Upper Kirk time periods with a shift to greater residential mobility occurring with the Bifurcate time periods (Kimball 1992). This is somewhat in contrast to the findings by Davis (1990) who has identified logistical base camps, albeit few in numbers, during the Bifurcate time period. However, the accuracy of his conclusions are suspect because of the somewhat simplistic method he used to classify sites identified by surface survey and limited backhoe testing. His conclusions were based on numbers of projectile point/knives and the evidence of features. A base camp was defined where greater than five projectile point/knives or archaeological features were observed. Logistical camps contained between two and five projectile point/knives and locations only one such artifact. However, it could be argued that logistical camps would contain features for certain types of processing or for other activities and possibly large numbers of projectile point/knives because of high discard rates due to intensive activities. Also, forager residences that were not repeatedly occupied may have no discernible features or a small number of projectile point/knives. Kimball (1992), on the other hand, has not provided sufficient evidence to document a shift to residential mobility during the Bifurcate period. There is no evidence that the Bifurcate occupations represent forager base camps as opposed to collector base camps or even logistical camps. Variable site usage, shifts in the entire settlement system, or repeated occupation of sites must be considered as alternative explanations for the purported differences between Kirk and Bifurcate settlement strategies.

In both analyses (Davis 1990; Kimball 1992), an overemphasis is placed on finding evidence of logistical camps and a collector settlement system. This stems from the original formulation of the Central Based Transhumance model. It is unclear what expectations were used to demonstrate a collector system was operating during the entire Early Archaic as opposed to a forager system. Certainly, the abundance of artifactual remains and features has been taken to indicate base camps. It is possible, however, that sites identified as base camps represent repeatedly occupied forager residential bases as opposed to collector residential bases. Also, sites interpreted as logistical camps might be moderately reoccupied residential bases. A more in-depth examination of the chipped stone tools and flake debris may provide a means to address these problems.

Currently, it would be difficult to reliably characterize the Early Archaic settlement pattern in the Little Tennessee River Valley as a collector system, forager system, or as changing from one to the other over time. Previous research has been too general to address this issue or has simply assumed a collector logistical system was operating. The Early Archaic data base from the TAP remains one of the best available for study and holds great promise for addressing a number of questions related to prehistoric settlement-mobility patterns.

Haw River Model

The Effective Temperature/Technological Organization or Haw River model was developed by Cable (1982) to illustrate patterns of prehistoric hunter-gatherer mobility at the Haw River sites (31CH8, 31CH29). This model is one of the earliest examples applying Binford's (1980) ideas concerning foragers, collectors, effective temperature, and technological organization in the interpretation of the archaeological record. This example has been followed by other attempts, especially those that relate technological organization to mobility (e.g., Andrefsky 1991; Bamforth 1991; Kuhn 1991; Larson 1994; Parry and Kelly 1987; Sassaman 1994). The Haw River model and the conclusions reached through its application have had an important impact on studies of the Early Archaic in the Southeast.

The Haw River sites, located on the North Carolina Piedmont, are an important sample of stratified Late Paleoindian and Archaic occupations (Clagget 1982). Block A at 31CH29 is the most extensive stratigraphic excavation at Haw River and is the basis for the discussion of changes in lithic technology and the Haw River settlement-mobility model (Cable 1982). The cultural sequence in Block A of the site as defined by Cable (1982, 1992) is as follows: Hardaway-Dalton, Palmer I, II, and III, Kirk I/St. Albans, Kirk I/II/Stanly/Lecroy. The association in the latter part of the sequence of Kirk and Bifurcate projectile point/knives has yet to be explained. Cable (1992:104) has stated that this association may represent either the overlapping ranges of two distinct cultural groups or functional variability within a single cultural group.

In the analysis of the Haw River sites, Binford's (1980) forager-collector model was employed to infer mobility strategies. An important component of Binford's (1980:13-18) work was relating mobility patterns to environmental structure, namely effective temperature (ET) as a relative measure of the growing season. Following Binford, Cable (1982:Figure 11.7) developed a time-transgressive Holocene effective-temperature gradient for the Haw River Project area based primarily on pollen stratigraphic information and paleoclimatic analogies. An ET of 14 degrees C (180-day growing season) was identified as the least value at which hunter-gatherers could securely depend on a foraging adaptation. Based on the reconstructed ET values, the Hardaway-Dalton and Palmer settlement-mobility pattern was suggested to contain a logistical component and a shift to a foraging adaptation was suggested to have occurred with the Kirk I/St. Albans occupation.

Support for the proposed pattern of an early reliance on logistical mobility that was later replaced with a foraging adaptation was obtained from analysis of the lithic assemblages. Again, Cable employs Binford's forager-collector model, but this time with a focus on his discussion of curated (personal gear) and expedient (situational gear) technologies (Binford 1980). Binford (1977:35) suggested that logistical mobility would be dependent on a curated technology which has been taken to imply an association between expedient technology and foragers. The Hardaway-Dalton and Palmer assemblages are dominated by curated tools and later assemblages contained a greater number of expedient tools. This was taken as support for the hypothesized shift in the settlement-mobility pattern from a collector to a forager system.

One of the most significant conclusions reached through the application of the Haw River model is that a forager adaptation involving high degrees of residential mobility was adopted during the Early Archaic. This conclusion was in opposition to other Early Archaic models prevalent at that time (e.g., Central Based Transhumance, Riverine/Interriverine) in which permanent to semi-permanent base camps were suggested to be occupied for much of the year. The Haw River model was further supported by a general test using published Early Archaic site data from Georgia and the Carolinas where it was found that these assemblages contained a highly expedient technology with a low incidence of curated tools (Anderson and Schuldenrein 1983:201). However, the general association of expedient tools with foragers and curated tools with collectors has been called into question (Carr 1994b). Carr (1994b:36-37) has argued that depending on environmental context and tool needs, both foragers and collectors can be expected to employ both expedient and curated tools. Importantly he points out that foragers and collectors are likely to design curated tools in different manners. The questioning of the general association of mobility strategy and technological strategy undermines the interpretations of the Haw River data as well as the general test conducted by Anderson and Schuldenrein (1983).

Cable (1992) has undertaken a wide-ranging, in depth re-examination of the original Haw River data set and settlement-mobility model. This re-examination mainly focuses on paleo-environmental reconstruction and assemblage comparisons using sample size:diversity statistics. Interestingly, Cable (1992:124) notes that "I totally contradicted my original set of arguments concerning changing patterns of hunter-gatherer mobility...but somehow wound up with a very similar conclusion."

An important aspect of the original Haw River study was the use of effective temperature reconstructions for developing hypotheses concerning settlement-mobility patterns. Dincauze

(1992) has raised some criticisms of the reliable reconstruction of effective temperature and the use of effective temperature or any single variable model for mapping resources. Cable (1992) provides a discussion of paleoclimatic and orbital geometry models as a means of examining the effective temperature reconstructions in the original Haw River model. In the original model, the major question was whether temperatures were cold enough to promote logistical mobility. Cable (1992:127) suggests that at Haw River there was greater climatic contrast between the seasons than today and that the daily high temperatures never exceeded freezing for half of the winter season. Based on this, it is hypothesized that in the North Carolina Piedmont hunter-gatherer mobility at the Pleistocene-Holocene boundary was divided into a cold season collector strategy and a warm season forager strategy. Changes in hunter-gatherer mobility during the Early and Middle Holocene are viewed as adapting to increasingly milder winters and decreased contrasts between seasons.

In re-examining the Haw River lithic data, Cable (1992) focuses on sample size and diversity relationships. A primary assumption of the original Haw River analysis was that all of the assemblages represented residential base camps. If this assumption is correct, then all assemblages should exhibit a relatively high diversity of tool types and a strong, positive correlation between sample size and diversity. The first assumption is upheld by the data but the second is not (Cable 1992:119). Cable then examines expedient and curated tools separately. Expedient tool diversity and sample size follows the pattern of a strong, positive correlation but there is no relationship between curated tools and sample size. This is taken to indicate that expedient tools were being discarded in a similar manner for each assemblage but the curated tools were not. In the early assemblages, there is both greater diversity and numbers of curated tools (Cable 1992:120). To explain these patterns of assemblage diversity, the early assemblages are suggested to represent logistical field camps at which bulk processing took place, resulting in the accelerated discard of curated tools. The patterns of expedient and curated tools from the Kirk I/St. Albans and later assemblages are suggested to represent seasonal or subseasonal base camps. Support for this interpretation is that the density and diversity of features increases with the later assemblages.

Cable (1992:128-141) provides a discussion of endscrapers as a means to provide supporting evidence for the inference of the early Haw River assemblages representing bulk processing logistical field camps. Cable employs data provided by Shott (1989) from three Northeastern Paleoindian sites to examine the relationship between endscrapers, curated tools, assemblage size, and bulk processing of deer. A strong, negative correlation exists between end scraper proportions and curated tool diversity at the Northeastern sites. This is taken as evidence that the high proportion of end scrapers is biasing the diversity values. If endscrapers are eliminated from consideration, a strong positive relationship exists between curated tools and assemblage size. This suggests that these assemblages are similar and that differences are a consequence of use intensity or occupation duration. There is also a correlation between endscraper frequency and the diversity and frequency of other curated tools. This suggests that these assemblages are not the result of a variety of activities as would be conducted at a base camp but are indicative of a highly-integrated activity. These patterns suggest that the Northeastern Paleoindian sites represent bulk processing locations. Although limited by small sample sizes, similar patterns were found in the Hardaway-Dalton and Palmer assemblages at Haw River which supports the suggestion that the early assemblages represent logistical field camps where bulk processing took place.

The original and revised Haw River models make good use of the theory concerning hunter-gatherer mobility available at the time of their formulation. The paleoenvironmental and lithic evidence, upon which the conclusions concerning Early Archaic mobility are based, appears quite solid. A similar finding by Kimball (1992), that a switch to a forager mobility strategy took place during the Early Archaic, is intriguing. However, the Haw River model essentially incorporates data from a single site (Block A excavations at 31CH29) limiting the generality of the conclusions. The revised Haw River model must be further applied and tested.

Band-Macroband Model

The final model to have a major impact on how the Early Archaic is viewed in the Southeast is the Band-Macroband or Biocultural model developed by Anderson and Hanson (1988). The current influence of this model is clearly evident by the fact that it is cited in almost every paper in a recent volume on Paleoindian and Early Archaic populations of the Southeast (Anderson et al. 1992). The Band-Macroband model has been revised by some (e.g., Sassaman 1992) and heavily criticized by others (e.g., Daniel 1992, 1994). The strength of the model derives from its building on existing theoretical constructs and composing a more complete picture of Early Archaic lifeways.

Anderson and Hanson (1988:264-266) employ Binford's (1980) arguments that hunter-gatherer mobility strategies (foragers, collectors) are roughly correlated with basic ecosystem characteristics (environmental grain, effective temperature). Based on the paleoenvironmental setting, they suggest a winter strategy of logistical mobility and a summer strategy of increased residential mobility. Anderson and Hanson (1988:266-267) significantly build upon Binford's original formulation through a consideration of prehistoric population structure. Using arguments presented by Wobst (1974, 1976) concerning the minimum number of people needed to maintain a viable reproductive population and evidence of the importance of information sharing (Hayden 1982; Moore 1981; Wiessner 1982), Anderson and Hanson incorporate aggregation sites as an important aspect of the biocultural model.

Anderson and Hanson (1988) postulate two levels of settlement organization (local band-level, regional macroband level) for the Early Archaic settlement on the South Atlantic Slope. Eight bands corresponding to major drainages are suggested to compose the South Atlantic macroband. Given the postulated low regional population density, three to five bands had to have been in regular contact to maintain viable populations. The fluid movement of individuals and coming together of members of two or more bands at aggregation sites located at the Fall Line are the mechanisms suggested to maintain social contact. The Savannah River basin is the focus of the analysis for patterns at the level of the band. Winter base camps are suggested to have been located in the Upper Coastal Plain from which a collector strategy was employed. The remainder of the year was characterized by high residential mobility or a forager mobility strategy. Movement away from the winter base camp in early spring is proposed to have been toward the coast and back into the Upper Coastal Plain and Piedmont from late spring to early fall. While returning to winter base camps during the late fall, side trips to aggregation sites are proposed.

To test this model, Anderson and Hanson (1988:272-280) use data from the Savannah River basin with the Rucker's Bottom site (9EB91) and the George S. Lewis site (38AK228) playing significant roles. The Rucker's Bottom site, located in the central Piedmont, is interpreted as a short duration, residential location. This interpretation is mainly based on a curated-to-expedient tool index where, relative to other sites, Rucker's Bottom has a low index. Further, this site is suggested to have been occupied during the summer and to have been a part of a forager mobility system. The George S. Lewis site, situated in the Upper Coastal Plain, has a higher curated-to-expedient tool index and is interpreted as a collector winter base camp. Data from five other excavated sites in the Savannah River basin are employed in an interassemblage comparison focused on curated-to-expedient indices. The analyses of the seven excavated assemblages are interpretable in terms of a mixed forager-collector mobility strategy.

The support for the interpretation of a riverine-based mobility system is derived from analysis of Early Archaic hafted bifaces collected from the length of the Savannah River basin. First, the occurrence of a "gradual, rather than a dramatic or step-like fall off" of lithic raw material types is taken as support of minimal social boundaries (Anderson and Hanson 1988:280). Second, the use of nonlocal raw materials appears greatest along rather than across drainages which is taken to indicate that most band activities occurred within a drainage. It should be kept in mind that seasonal aggregations of bands from different drainages are postulated in the model so that some between drainage activities are not ruled out.

While the band-macroband model is supported by the data used to test it, it is recognized that further archaeological work is needed. Along with the hope of recovering preserved floral and faunal remains, more intensive archaeological fieldwork and the continued development and refinement of analytical strategies and models are recognized as future goals.

Although not presented in relation to the band-macroband model, data gathered by O'Steen (1992) has some bearing on the model. O'Steen (1992) has examined Early Archaic settlement in the Georgia Piedmont using a large data base developed primarily from surveys of approximately 70 square kilometers along a 60 km stretch of the Oconee River. Early Archaic components were identified at 272 sites. Three site types were identified: short-term camp, quarry-related, and residential base camp. Assemblages that exhibited high tool diversity were interpreted as short term camps or residential-base camps. Artifact density was used to differentiate these two site types. Short-term camps have low artifact density while that of residential bases is high. The tool kit present at short term camps is described as highly curated and portable. Short-term camps are found mainly in the floodplain with a few in upland areas while residential-base camps are found only adjacent to shoal areas. O'Steen (1992:94) suggests that Early Archaic groups may have identified with shoal areas and that these favored locations were perhaps aggregation sites. Quarry-related sites are located in the uplands and the assemblages are characterized by flake debris, expedient tools, and some formal curated tools. Interestingly, aborted and discarded preforms are rare but tool manufacture is evidenced by bifaces broken during manufacture being reworked and utilized for a variety of tasks. This evidence is taken to suggest that other activities took place at these sites in addition to the procurement of raw materials.

An Oconee band is postulated to have been a part of the South Atlantic macroband in the Anderson and Hanson (1988:Figure 3) Band-Macroband model. In accordance with the Band-Macroband model, O'Steen (1992) has suggested that a band would have been oriented along the entire Oconee River. However, at least one specific of the Band-Macroband model based on data from the Savannah River basin does not hold for the Oconee River basin. In the Band-Macroband model, the Piedmont is expected to be exploited through use of a residentially-mobile foraging strategy. For example, the Rucker's Bottom site is suggested to represent a forager base camp and is characterized by a low curated-to-expedient tool index. However, O'Steen has suggested that short-term base camps are found in the Piedmont along the Oconee River which contain a highly curated tool kit. Following the reasoning of Anderson and Hanson (1988), a highly curated tool kit is indicative of a collector system so that these short-term camps may be interpreted as collector-logistical camps. The presence of logistical camps is unexpected based on the settlement pattern outlined in the Band-Macroband model. Similar to the Band-Macroband model, possible aggregation sites are identified in the Oconee drainage. The identification of these as aggregation sites is based on the high artifact density and tool diversity. All of these sites are clustered below the constriction of shoals suggesting this area as a favored location.

Although data from the Oconee drainage cannot be used as a strict test of the Band-Macroband model, some insight is gained through its examination. The major congruences between the band-macroband model and the Oconee data interpretations are the suggestions of both a riverine-based settlement pattern and aggregation sites. Little data are offered by O'Steen (1992) to support either of these suggestions. Inferring the presence of collector-based logistical camps in the Piedmont based on arguments similar to those presented by Anderson and Hanson (1988) seriously challenges the applicability of the specific settlement pattern presented as part of the Band-Macroband model outside the Savannah River basin.

Implications of the Band-Macroband model have been more directly tested by Sassaman (1992) using survey and site data from South Carolina and Georgia. Sassaman suggests that the presence of Coastal Plain chert side-notched points and Edgefield scrapers in the Georgia Piedmont supports the contention that the settlement patterns of Early Archaic bands were drainage-wide. Further, new raw material data of Palmer-Kirk points for several major drainages in South Carolina support the assertion that Early Archaic mobility was oriented along major rivers and encompassed entire drainages. Sassaman (1992:53) suggests that the strongest evidence for Early Archaic bands moving along, rather than across, drainages is from Horry County which is equidistant from the Uwharrie rhyolite quarries and the Allendale Coastal Plain chert quarries. In Horry County, 82% of Palmer-Kirk bifaces are manufactured using rhyolite located along the drainage while only 9% are made from Coastal Plain chert located across drainages. However, Sassaman (1992:56) did find some across-drainage movement of Coastal Plain chert and suggests that the band-macroband model should be expanded to incorporate these findings.

Sassaman uses site and survey data from the Savannah River Valley in the Upper Coastal Plain to examine the specific yearly settlement-mobility pattern proposed in the Band-Macroband model. In the model, it is suggested that this area was occupied from winter to late spring using a mixed forager-collector strategy so that base camps and logistical camps are expected. The archaeological record from the Upper Coastal Plain does exhibit a dichotomy between dense, diverse assemblages located on the terraces of major rivers (suggested to represent base camps) and small, low diversity assemblages distributed widely over the area, including the uplands that would represent specialized, logistical camps.

The major problem with the model according to Sassaman is the role of aggregation sites. He notes that "there are currently no satisfactory means of discriminating such (aggregation) sites from locations of repeated, long-term or seasonal habitation by smaller co-resident groups" (Sassaman 1992:65). Sassaman (1992:64) believes that interaction and group affiliation were more flexible than in the Band-Macroband model in which regularly planned large-scale group aggregations are suggested. Key locations in the uplands, such as the confluence of major streams, contain assemblages with a substantial degree of raw material diversity. Sassaman suggests that trade among individuals from different parts of the region took place at these sites. Bands from separate drainages were integrated by flexibility in group affiliation dependent on relations between trading partners rather than at aggregation sites.

Sassaman generally finds support for the Band-Macroband model. He interprets the raw material data as generally indicating settlement patterns oriented along rather than across drainages. Also, Sassaman interprets the archaeological record of the Upper Coastal Plain as conforming to a collector-based logistical mobility system. Sassaman attempts to modify the model by down playing the role of aggregation sites and replacing this social interaction with an emphasis on individual mobility and exchange. Sassaman notes the problems of identifying aggregation sites, but major difficulties also exist in distinguishing individual movement and exchange from direct acquisition (cf. Meltzer 1989). At this time, data with strong bridging arguments are nonexistent for supporting a case for aggregation sites or trading partners.

In contrast to the general support provided by Sassaman (1992), Daniel (1994) critically examines the Band-Macroband model and proposes an alternative for Early Archaic settlement. In particular, Daniel questions the proposed mixed forager-collector settlement strategy and the drainage-based settlement range that are major components of the Band-Macroband model.

The distinctive nature and limited occurrence of Uwharrie rhyolite enables Daniel (1994) to examine settlement range in the Carolina Piedmont. He documented Early Archaic projectile points made of this material found along the Yadkin-Pee Dee River basin and through the eastern Piedmont. Daniel's (1994) study is undertaken to examine whether Early Archaic settlement was restricted to single river drainages as suggested in the Band-Macroband model (Anderson and Hanson 1988) or extended across drainages contrary to that model. Daniel found that the distribution of Uwharrie rhyolite along the Yadkin-Pee Dee was not significantly different from its occurrence across the eastern Piedmont. This is taken to indicate that mobility patterns were oriented across drainages as much as along drainages. In support of this contention, Daniel reinterprets Sassaman's (1992) data concerning the distribution of projectile points made from Allendale chert across the Coastal Plain. Daniel suggests that Allendale chert is moving across drainages on the Coastal Plain the same distances and at the same frequencies as along the Savannah River. This is in direct opposition to the data used to support the Band-Macroband model where Early Archaic hunter-gatherers are suggested to largely remain within single drainages. It should be pointed out, that in general, Sassaman (1992:65) found that his data supported the drainage-based settlement pattern.

Daniel (1992) also questions the forager-collector mixed mobility system used in the Band-Macroband model. As pointed out by Daniel, Anderson and Hanson (1988:278) use a curated-to-expedient tool index to infer site use and group mobility strategy. High proportions of curated tools are taken to indicate a logistical mobility strategy while high proportions of expedient tools indicate a forager strategy. Although the availability of raw materials has been suggested to have a significant impact on this relationship (Andrefsky 1994; Bamforth 1986, 1990; Carr 1991, 1994b), Anderson and Hanson fail to take raw material distributions into consideration. Daniel suggests, contrary to Anderson and Hanson, that the high frequency of expedient tools at the Rucker's Bottom site is less informative of overall settlement strategies and more indicative of how the technology was organized with respect to raw material availability.

Failure to consider raw material distributions when interpreting technological strategies is a serious flaw with the evidence used to support the Band-Macroband model. However, Daniel appears to believe that because raw material availability may be playing a significant role in determining how the chipped stone tool technology was organized, this assemblage cannot provide information concerning mobility patterns. If he is wrong, it should be possible to infer the mobility strategy employed at the Rucker's Bottom site or any other site, given an understanding of raw material availability. This type of strategy was successfully used by Amick (1987) and Carr (1991, 1994b) to examine prehistoric hunter-gatherer mobility in the Central Basin of Tennessee.

Daniel (1994) offers the Uwharrie-Allendale settlement model as an alternative to the Band-Macroband model. Daniel suggests that sources of lithic raw material were the geographical focus of Early Archaic settlement systems as opposed to the watershed focus of the Band-Macroband model. In the Uwharrie-Allendale settlement model, two regions are proposed that correspond to the distribution of these raw material types. Band mobility is considered restricted by the need to visit these raw material sources, but is also variable across the Piedmont and Coastal Plain. Daniel (1992:267) suggests that scheduled trips were made to the Uwharrie and Allendale quarries specifically to acquire stone and that other models of Early Archaic settlement in the Southeast have overly emphasized the embedded nature of raw material acquisition in subsistence practices.

Support for the boundaries of these two regions is provided by the fact that the distribution of Taylor points and Hardaway side-notched points fits the Allendale and Uwharrie regional boundaries, respectively. The presence of long-term base camps near each raw material source is taken as further support for the Uwharrie-Allendale model. These base camps are not considered specialized lithic procurement stations, but habitation sites occupied by an Early Archaic band that is within foraging distance of quarries. Interestingly, this is similar to the finding by O'Steen (1992) that at quarry-related sites in the Georgia Piedmont activities unrelated to raw material procurement were undertaken. Also, the Tellico base camps are within what has been termed foraging distance of lithic raw material sources.

In the Uwharrie-Allendale model, a forager adaptation is suggested to best characterize Early Archaic settlement in these two regions. Daniel (1992:260), contrary to Anderson and Hanson (1988), suggests that the seven Early Archaic components used in the Band-Macroband model can all be interpreted as either residential bases or locations which could both result from a forager adaptation. Daniel suggests that the Taylor site represents an aggregation site based on the diversity of raw materials present. Further, the same sites are identified as aggregation sites in the Band-Macroband and Uwharrie-Allendale models, but for different reasons. In the Band-Macroband model, these are considered aggregation sites because they are located at the fall-line between the Coastal Plain and Piedmont. In the Uwharrie-Allendale model these sites are aggregation sites because they are equidistant to the two raw material sources.

With the current information available, we are unable to determine whether the Band-Macroband or Uwharrie-Allendale model is a better representation of Early Archaic settlement-mobility patterns on the South Atlantic Slope. With regard to the evidence for drainage based settlement systems, the same data set is interpreted to support (Sassaman 1992) and refute (Daniel 1994) the Band-Macroband model. The same distribution of sites is interpreted as either a mixed forager-collector mobility pattern (Anderson and Hanson 1988) or a strict forager mobility pattern (Daniel 1994).

However, with regard to the drainage-based settlement system, the use of lithic raw material data for such an interpretation is problematic without a more careful consideration of alternatives. For example, Ingbar (1994) illustrates through a number of simple simulations that raw material proportions are best understood within a consideration of technological organization. More specifically, it is shown that simply changing the number of tool-depleting activities or requiring the tool kit to be maintained at a certain number of tools drastically changes the proportion of raw materials found at a site (Ingbar 1994:47-49). This suggests the possibility that patterning in raw material frequencies on the South Atlantic Slope is the result of different strategies of technological organization and not the result of a drainage-based settlement system. Both possibilities deserve further consideration.

The Band-Macroband model added significantly to our understanding of the Early Archaic by considering the biocultural aspects of hunter-gatherer lifeways. However, the archaeological evidence to support this model is somewhat lacking. Daniel (1994) suggests that the Band-Macroband model is too heavily influenced by ethnographic and ethnoarchaeological data concerning hunter-gatherers. The danger of "San-itizing" the past is real and caution must be exercised in inferring beyond available archaeological data.

The Uwharrie-Allendale model intended to replace the Band-Macroband model is not without problems. The Uwharrie-Allendale model is clearly more closely linked to available archaeological data but as such it is potentially more greatly affected by data lacking in the archaeological record. Namely, data concerning population sizes and subsistence. Wright (1989) suggested that our understanding of Paleoindian lifeways is hampered by not having information concerning population densities which is also true for the Early Archaic. In the Uwharrie-Allendale model, the focus is on lithic resource distributions with subsistence resources assuming somewhat of a secondary role in determining large-scale population movements. Daniel (1994) runs the risk, one which he recognizes, of being labelled a lithic determinist. That is, Daniel may be too focused on the data available in the archaeological record which consist predominately of lithic remains.

Both the Band-Macroband and Uwharrie-Allendale models have important aspects that aid in our better understanding Early Archaic lifeways. From one perspective, these models represent attacking the problem of archaeological interpretation from opposite directions, one being more influenced by ethnographic and ethnoarchaeological data concerning hunter-gatherers and the other more closely tied to the archaeological record. Both of these approaches to archaeological interpretation and model building are important. Interestingly, this same type of debate was previously conducted concerning Dalton settlement patterns between Morse and Schiffer. That debate has still not been settled. Archaeologists continue to struggle with attempting to say meaningful things about the past through balancing ethnographic analogy with archaeological data.

Conclusions

A number of Early Archaic settlement-mobility models are currently proposed for different areas of the Southeast. Models from one area to another are not competing but do exert influences on how other areas are interpreted. The examination of these various models provides a number of insights and illustrates the possibility of new means of inference and ways of interpreting existing data. It is important to realize that these models are not set in stone but represent a step in the process of developing a sound understanding of the past. Critique and re-analysis resulting in the reformulation of models is one manner in which this is accomplished.

CHAPTER V

The Early Archaic Environment of East Tennessee

The environment, especially biotic resource structure, has a demonstrable influence on technological organization and settlement-mobility patterns (e.g., Binford 1980; Kelly 1983, 1995; Nelson 1991; Price and Brown 1985; Shott 1986). In previous chapters, the environment was discussed or referred to in a general manner when reviewing hunter-gatherer and technological studies, as well as specific models of Early Archaic settlement in the Southeast. In this chapter, the physiographic and environmental characteristics of the early Holocene in the Tellico Archaeological Project (TAP) study area are presented. This provides the context needed for investigating Early Archaic settlement-mobility patterns in the area.

Environment and Hunter-Gatherer Settlement-Mobility Patterns

Hunter-gatherer settlement-mobility patterns can be related to the environment and biotic resources through a surrogate measure of seasonality and length of the growing season called effective temperature (ET) (Binford 1980; Kelly 1983). ET was developed by Bailey (1960) and is defined as "a measure of both the amount and annual distribution of solar radiation available over a given region" (Kelly 1983:282). Values of ET range from 26 C at the equator to 8 C at the poles (Binford 1980:14). Binford (1980) used ethnographic data to demonstrate that there is a relationship between hunter-gatherer mobility patterns and ET. Using ethnographic data, he found that there is a reduction in residential mobility and an increase in storage dependence as ET decreases; in fact, storage is found only among hunter-gatherers in environments where ET is less than 15. However, Binford (1980:14) notes that mobility strategies are responsive to factors other than ET and the general amount of food available in a region. Kelly (1983) further examines the relationship between ET and hunter-gatherer mobility with a larger and more detailed ethnographic data set. He found an increase in average distance per residential move, greater logistical mobility, and more dependence on fauna for subsistence with decreasing ET (Kelly 1983).

Cable (1992) identified an ET of 14 degrees C, which corresponds to a 180 day growing season, as a threshold at which a forager mobility system is expected to be employed. In the ET/TO model developed for interpreting the Haw River site in North Carolina, Cable (1992:111) suggests that a shift from a collector to a forager mobility system occurred around the time when the ET of the area reached 14 degrees C. This shift in mobility was expected to occur during the Early Archaic between the Palmer and Kirk I/St Albans occupations of the site.

Early Holocene Environmental Conditions in the Southeast

Changes in environmental conditions in the southeastern United States over the past 20,000 years has been a major topic of research. Investigations in the Southeast of the late Pleistocene to Holocene transition and the hypsithermal are subjects of particular interest (e.g., Anderson and O'Steen 1992; Cridlebaugh 1984; Delcourt and Delcourt 1980, 1983; McMillan and Klippel 1981). The specifics of the early Holocene environment have received less attention.

Smith (1986) suggests that post-Pleistocene warming was in part driven by the decrease in volume of the Laurentide ice sheet after 17,000 B.P. This drastically changed the coast line of the Southeast through sea level rise and established the modern westerly-dominated air circulation patterns by 12,500 to 11,000 B.P. (Smith 1986:3). For the area of present day Arkansas, North Carolina, and Tennessee, Holocene warming caused the transition from a Pleistocene boreal forest dominated by spruce and pine to an early Holocene temperate deciduous forest (Delcourt and Delcourt 1981; Steponaitis 1986). Smith (1986) suggests that the early Holocene forests were both temporally and spatially variable. At the "mid-latitudes" between 34 and 43 degrees North, a "homogenous, largely deciduous, closed-canopy forest" existed during the early Holocene (Smith 1986:5). In the northern region of South Carolina above 33 degrees North latitude, it has been suggested that a mesic oak-hickory forest replaced the glacial spruce-pine by no later than 9,000 B.P (Anderson and O'Steen 1992:3).

There is some disagreement as to the effect of the post-Pleistocene environmental changes on human behavior. Smith (1986:10) suggests that there was "a general southeastern adaptive continuity" from the Paleoindian through Early Archaic time periods. However, Anderson and O'Steen (1992) suggest that Pleistocene to Holocene environmental changes would have likely resulted in a transition from a Paleoindian collector settlement system to an Early Archaic forager-based system. They suggest "as the hardwood canopy expanded from its refugia below latitude 33 in the lower Southeast, and resource structure changed throughout the region, foraging adaptations appear to have been literally forced upon the resident human populations" (Anderson and O'Steen 1992:6). Although arguments concerning the adaptive advantages of a particular mobility system within a specific environmental setting can be made, mobility systems are not forced. Binford (1983) has pointed out that high rates of residential mobility are favored by some hunter-gatherers so that increased residential mobility may have been welcomed.

The Early Holocene environment of the mid-latitudes of the Southeast is generally characterized as a deciduous mixed hardwood forest (Cridlebaugh 1984; Delcourt and Delcourt 1981; Smith 1986; Steponaitis 1986). Further, it has been suggested that Early

Holocene hunter-gatherers in such an environment would likely have employed a forager-mobility system (Anderson and O'Steen 1992). However, it is recognized that there is both temporal and spatial variability in the Early Holocene environment of the Southeast. Greater investigations of this potential variability with support from the archaeological record is needed before general statements concerning hunter-gatherer mobility can be accepted.

Early Archaic Environment in the Tellico Area

The Tellico Archaeological Project (TAP) study area includes the final 33.1 river miles of the Little Tennessee River and the final 20.5 miles of its major tributary, the Tellico River (Chapman 1975). The area consists of approximately 34,440 acres of both bottomlands and uplands of which 14,400 acres are now inundated by Tellico Lake (Chapman 1985).

Delcourt and Delcourt (1981) have mapped a jack pine-spruce forest over East Tennessee at 14,000 B.P. which was replaced by a mixed hardwood forest with the Holocene warming trend at approximately 10,000 B.P. However, as early as 9,500 B.P., oak-chestnut forests expanded at the expense of the mixed hardwoods (Cridlebaugh 1984).

Dincauze (1992) has questioned the utility of paleovegetation maps for understanding prehistoric human adaptations. She suggests that humans do not adapt at the regional sale but rather at the neighborhood scale which must be given much greater attention (Dincauze 1992:359). The important work by Cridlebaugh (1984) provides an examination of the paleovegetation at such a scale for the TAP study area. Data from Icehouse Bottom, Black Pond, and Tuskegee Pond suggest that the TAP study area was dominated by oak and chestnut with a mosaic of mixed mesic trees from 9,500 B.P. to the present (Cridlebaugh 1984:89). More specifically, during the Early Archaic the Icehouse Bottom pollen assemblage indicates that:

> the local vegetation was late-successional closed forest predominantly comprised of deciduous species such as chestnut, oak, basswood, hickory, beech, ash, birch, maple, cottonwood, and hophornbeam. Hemlock may have existed in local stands on mesic sites. The low values of Pinus and herbs such as grass and composites indicate a low frequency of disturbance with only limited openings in the forested landscape (Cridlebaugh 1984:92).

This palynological reconstruction is supported by the paleoethnobotanical evidence (Chapman and Shea 1981). Although pine was not abundant in the study area during the Early Archaic, there is an increase in pine wood charcoal during the Bifurcate occupation (Chapman et al. 1982). Finally, Cridlebaugh (1984) suggests that different source areas (bottomland, upland, disturbed) were deliberately exploited by Early Archaic populations in the study area. The Early Archaic culture history and environmental data for the TAP are summarized in Table 1.

Along with the suggestion that there has been little change in vegetation from 9500 B.P. to the present, Davis (1990:23) suggests that modern climatic conditions are generally applicable for the entire human occupation of the TAP study area. Further, it has been suggested that most recent paleoclimatic reconstructions of the southeastern United States suggest that there is very little difference between the climate of 10,000 years ago and today (Dincauze 1991). The modern regional climate of East Tennessee is temperate continental and is classified as humic mesothermal with 200 days as the average length of the growing season (Thornwaite 1948). The average annual precipitation in the TAP study area is approximately 60 inches with flooding of the lower terraces most common during the winter and early spring (Tennessee Valley Authority 1979).

Applying expectations developed by Cable (1992) concerning the relationship between ET/length of the growing season and hunter-gatherer mobility to the TAP study area, a forager system would be expected for the Early Archaic. This is in contrast to the previous interpretations of the mobility systems in which a collector system is inferred for the entire Early Archaic (Chapman 1985; Davis 1990). However, it must be kept in mind that factors other than length of the growing season or ET can effect hunter-gatherer mobility systems. While the environment provides one indication of hunter-gatherer mobility patterns, other lines of evidence must be explored before hunter-gatherer settlement-mobility systems can be inferred with confidence.

The Tellico Area Physiography

The majority of the study area lies within the Ridge and Valley physiographic province with the remainder in the Blue Ridge Province. The transition between the two provinces is marked by Chilhowee Mountain. The Blue Ridge Province is characterized by rugged, mountainous terrain and steep, narrow stream valleys. The Ridge and Valley province has greater diversity and is divided by Davis (1990:24) into four sections consisting of northeast-southwest trending ridges and relatively broad valleys. The first of these sections west of the Blue Ridge province is the Dissected Knobs. The Dissected Knobs section is somewhat similar to the Blue Ridge province and is characterized by a belt of deeply eroded knobs and rolling hills. Stream valleys are usually steep-walled with narrow alluvial terraces. The next section to the west is referred to as the Upper Valley. This section also contains rolling hills but generally the relief is lower. The Upper Valley section is also characterized by the broadest floodplains, largest islands, and greatest meanders of the Little Tennessee Valley. The third section is the Bat Creek-Red Knobs which is a steeply dissected ridge that is about one mile wide. This steep-sloped ridge could have been something of a barrier to travel in the uplands (Davis 1990:25). The final section of the Ridge and Valley province in the study area is the Lower Valley. It is narrower and steeper- sided than the Upper Valley but does contain low rolling hills.

The Little Tennessee River flows in a northwesterly direction from the Blue Ridge Province and cross cuts all four regions of the Ridge and Valley Province in the study area. Delcourt (1980) identified ten alluvial surfaces along the Little Tennessee River. The older terraces (T3-T9) were generally identified as isolated remnants while the younger terraces (T0-T2) were more continuous. Davis (1990:25) suggests that these alluvial terraces would have been attractive to prehistoric populations because they are "well-drained, close to permanent water sources, and situated in close proximity to several potentially rich microenvironments." The T1, which contains the deeply buried Early Archaic deposits, averages about 500 feet in width but ranges up to 4000 feet wide in the Upper Valley. Davis (1990:197-210) suggests differences in Early Archaic land use patterns over time based on the inferred location of base camps, logistical camps, and activity loci on different landforms (i.e., terrace, slope, valley, etc.).

Kimball (1992), in his diachronic analysis of settlement pattern variation for the Early Archaic in the TAP study area, chose to divide the study area differently than Davis (1990). Kimball (1992:164) focuses on the Ridge and Valley Province and divides it into three sections: Lower Valley, Upper Valley, and Dissected Knobs. The small portion of the Blue Ridge Province is not included in his study and the boundary between the Upper and Lower valleys is at the Bat Creek-Red Knobs. The focus on these three different sections of the study area allows certain key environmental differences to be highlighted. The highest quality cherts (Knox Black and Knox Black Banded) are found only in the Upper Valley (Kimball 1985:98-108). No chert is available in the Dissected Knobs and only poor quality Knox Dolomite cherts are available in the Lower Valley which were rarely used during the Early Archaic (Kimball 1992:146). An important feature of both the Upper and Lower valleys is the karst topography which is not present in the Dissected Knobs. Due to the karst features of these sections, there is a general lack of surface water beyond the primary tributaries (Davis 1990:24-25). Further, streams are more localized in the Lower Valley so that there is only one primary tributary of the Little Tennessee River there which drains 20 square miles (Davis 1990:25). An obvious difference between the three sections is the size of the alluvial terraces, which are typically widest in the Upper Valley and narrowest in the Dissected Knobs (Davis 1990). Also, Kimball (1992:146-147) has suggested that there are differences between the sections in terms of nut-bearing trees important to humans or animals, and he suggests that the Dissected Knobs would have the highest density of such trees, followed by the Upper Valley, and the Lower Valley.

Conclusions

Any investigation of hunter-gatherer settlement-mobility patterns must provide information concerning environmental conditions. Dincauze (1992:359) points out that most considerations of the environment in Southeastern archaeology are at a broad regional level and that more specific "neighborhood" reconstructions are needed to understand human adaptation. Such information is available for the TAP study area for both paleovegetation (Cridlebaugh 1984) and raw material availability (Kimball 1985). This information provides the context needed to investigate Early Archaic settlement patterns in the TAP study area.

Smith (1986:10) suggests that there was "a general southeastern adaptive continuity" from the Paleoindian through Early Archaic time periods. Others suggest that environmental changes over that time would have caused a shift in mobility from a Paleoindian collector system to an Early Archaic forager system (Anderson and O'Steen 1992; Cable 1992). Differences in Early Archaic environments across the Southeast and over time suggest the possibility for temporal and spatial variability in Early Archaic adaptations. Kimball (1992:168), based on differences in the distribution of Kirk and Bifurcate sites across different landforms, suggests that there was a change from a Kirk collector to a Bifurcate forager settlement system during the Early Archaic. However, in general, change over the Early Archaic time period has not been investigated. The various models of Early Archaic settlement-mobility patterns for different regions and possibly different segments of time might all be accommodated with a consideration of temporal and spatial variability (e.g., Anderson and Hanson 1988; Chapman 1985; Daniel 1994). The TAP study area provides the opportunity to examine variability over the Early Archaic period and make comparisons with sites and settlement-mobility systems in other areas of the Southeast.

Based simply on the length of the growing season, a forager adaptation is expected for the Early Archaic time period. However, factors other than length of the growing season or ET can effect the adoption of a settlement-mobility strategy. An examination of the organization of technology during the Early Archaic time period provides an additional means of assessing hunter-gatherer settlement-mobility patterns.

Table 1: Early Archaic Culture History and Environmental Data for the Tellico Archaeological Project.

Culture Period	Date (B.P.)	Environment
Paleoindian	?	Pleistocene Boreal Forest
Early Archaic, Lower Kirk	10,000 9,500-9300	Holocene Mixed Hardwood Oak-Chestnut
Early Archaic, Upper Kirk	9400-8800	Oak-Chestnut (increase in disturbed taxa)
Early Archaic, Bifurcate	8900-7800	Oak-Chestnut (increase in disturbed taxa)

CHAPTER VI

Materials and Methods

In this chapter, the specific materials and methods employed in the analysis are presented. The focus of the reanalysis of artifactual materials was the chipped stone flake debris. Raw material and reduction analyses were performed using samples of flake debris from four of the major buried Early Archaic sites excavated as part of the Tellico Archaeological Project (TAP). These data along with published stone tool data and limited reanalysis are used to examine change in the organization of lithic technology over the Early Archaic time period and make general inferences concerning prehistoric hunter-gatherer settlement mobility patterns for this time period in the TAP study area. These data are also used to make comparisons with other Early Archaic sites in the southeastern United States.

Materials

The focus of this study is a reanalysis of the Early Archaic chipped-stone assemblages from the Rose Island, Icehouse Bottom, Bacon Farm, and Patrick sites excavated during the TAP. These sites were chosen because specific Early Archaic components (i.e., Lower Kirk, Upper Kirk, and Bifurcate) could be identified at each. The study of these components allows for the examination of potential change over the Early Archaic time period. The focus of this analysis is the flake debris and to a lesser degree the chipped stone tools. The site specific analyses presented here complement the broader areal approach employed by Kimball (1992) and reviewed in Chapter IV.

A random sample of flake debris was examined from each of the four sites. Although similar excavation methods were employed at each of the sites, sometimes differences in excavation methods prevented the use of certain recovered materials. For example, at the Bacon Farm site, several units were not screened. These units were not included in the sample because there is a bias against the recovery of small tools and flake debris. In one case, sample size was reduced because the materials could not be relocated. Some of the Upper Kirk flake debris from the Rose Island site was not located which reduced the sample size for this component of the site. These problems aside, an attempt was made to analyze a 10 to 15% random sample of the flake debris from each of the Early Archaic components from the four sites. In some cases, the analyzed sample was larger.

Three temporal segments of the Early Archaic period are the focus of this study which are Lower Kirk, Upper Kirk and Bifurcate. These temporal divisions are employed despite the fact that finer divisions have been proposed. St. Albans, LeCroy, and Kanawha divisions of the Bifurcate time segment have been proposed for the TAP study area. However, the distinction of each of these components at any particular site is sometimes unclear. The grouping of these finer divisions under a Bifurcate heading seems appropriate as it follows previous investigations (i.e., Kimball 1992). In terms of other divisions of the Early Archaic, Kimball (1992) has suggested that the Upper Kirk component be subdivided into small Upper Kirk and large Upper Kirk. Although this proposal has promise, greater investigation of this temporal sequence is needed before it is used to structure analyses. Using Lower Kirk, Upper Kirk, and Bifurcate components provides an initial means of investigating potential changes in technological organization and settlement-mobility patterns over time.

It is assumed in this study that the excavated sample of the early Archaic sites for each component is comparable. It should be noted, however, that because areas of different size were exposed at a single site and between the sites that this assumption may not hold true. Further, the differential overlap of components is also a potentially confounding problem.

Excavations at the Icehouse Bottom site revealed distinct Lower Kirk, Upper Kirk, and Bifurcate components (Chapman 1977:Table 2). This is the only site excavated during the TAP with a Lower Kirk component. The focus of excavations at the Icehouse Bottom site was the Kirk component because a large sample of Bifurcate material had previously been recovered at the Rose Island site.

In the analysis of the flake debris from Icehouse Bottom, a pilot study was first undertaken in which the flake debris from a single randomly-selected excavation unit that contained materials from all three components was analyzed. This provided the opportunity to examine the variability in raw materials and reduction methods in the assemblages. The remainder of the sample of flake debris used in this study consisted of randomly-selected provenience units which were chosen separately for each component. A raw material analysis of a random sample of tools was also undertaken and all recovered stone tools that were associated with distinct Early Archaic components are used in the comparative analyses.

At the Rose Island site, six major units, were excavated to sample the Early Archaic occupations (Chapman 1975:Figure 2). These major units generally consist of a number of ten by ten foot excavation units. The focus of the excavations was to sample the rich Bifurcate components present at the site.

The random sample of flake debris analyzed in this study from the Rose Island site was derived from the two major areas: Block A and Block C. These blocks were used because they contained distinct Upper Kirk and Bifurcate materials. The random sample of stone tools for the raw material analysis was similarly restricted to Blocks A and C, as was the use of the published data for comparative purposes.

A number of trenches and test pits, generally ten by ten foot in size, were excavated at the Bacon Farm site. These excavations revealed Upper Kirk and Bifurcate components. The focus of the excavations was the Upper Kirk component in order to obtain a comparative assemblage for the Icehouse Bottom materials (Chapman 1978:9).

The excavation procedures at the Bacon Farm site were dictated by the need to be opportunistic and to recover as large a sample as possible in a short period of time. Not all excavated test pits were screened which presents a bias against the recovery of small flake debris and tools. The Test Pit 2 block consisting of excavation units 2A through 2G were the focus of this study. The excavated soil matrix from all of these units were screened and the stratigraphy in this area was relatively distinct (Chapman 1978:9-14). The random samples of flake debris and stone tools that were analyzed in this study were derived from the Test Pit 2 block. Stratum VIII was not used in this study because of the possibility of mixing of Upper Kirk and Bifurcate materials in this stratum (Chapman 1978:25). Similarly, the use of the published stone tool data is restricted to this block, excluding Stratum VIII.

Of the four sites included in this study, the smallest number of units was excavated at the Patrick site. Two, ten by ten foot, units were excavated at this site which revealed distinct Bifurcate and Upper Kirk components (Chapman 1977:Figure 44). The random sample of flake debris and stone tools used in this study were drawn from these two units. Stratum 15 was not included in the study because of the mixing of Upper Kirk and Bifurcate materials in this stratum. The published stone tool data from both units were used in the comparative analyses.

General Comparisons

In an attempt to provide a general means of comparison for the four Early Archaic sites (Icehouse Bottom, Bacon Farm, Rose Island, and Calloway Island) from the TAP, Kimball (1992:149) determined the expected site density per square meter of tools, features, and flake debris, as if the sites were deflated and the entire assemblage recovered. Icehouse Bottom has the highest density (480 per square meter), followed by Rose Island (387 per square meter), Bacon Farm (191 per square meter) and Calloway Island (107 per square meter) (Kimball 1992:Table 10.2). It should be kept in mind that Bacon Farm site covers the greatest area (3.45 hectares), then Icehouse Bottom (1.86 hectares), Calloway Island (0.68 hectares), and Rose Island (0.32 hectares). There are apparent differences between the Early Archaic occupation of these sites in terms of artifact density and site area. These differences potentially relate to differential site use and the amount of reoccupation.

Kimball (1992:Table 10) further compares these sites using a flake-to-tool ratio and a tool-to-feature ratio. He found that Icehouse Bottom had the highest flake to tool ratio (52.4) and the lowest tool-to-feature ratio (3.2). These are comparable to Calloway Island which has a much lower flake-to-tool ratio (22.5) but only a slightly higher tool-to-feature ratio (4.7) so that these two sites are grouped together. Bacon Farm and Rose Island are grouped together for having lower flake-to-tool ratios (16.3 and 15.8 respectively) and higher tool-to-feature ratios (13.0 and 23.7 respectively). Kimball (1992:149) suggests that these two groups likely represent different kinds of residential bases and that "these places had different meanings within the context of the settlement strategy for the drainage."

While these comparisons are useful and point to the potential of variability in the use of the major sites excavated during the TAP, an examination of the patterning over time has the potential to reveal new interpretations. In the analysis conducted here, similar comparisons and ratios are developed for the specific site components. Calloway Island is not included in this study because specific Early Archaic components are unrecognized. In this study, specific excavated samples are employed as opposed to expected tool frequencies since there is the potential for variable site density, especially over large areas. Also, ratios such as projectile point/knife-to-hearth and flake-to-hearth are found particularly useful. These general comparisons are presented as a means to explore the variability present in the assemblages and as a means to establish patterns for further investigation through more detailed analyses.

Analytical Methods

The same analytical methods were employed in the analysis of the flake debris from the Rose Island, Icehouse Bottom, Bacon Farm, and Patrick sites. Two different kinds of analyses were performed. The first was the assignment of each piece to a raw material category through the use of a geologic comparative collection. The second was the determination of reduction technique and the quantities of early, middle, and late stage flakes from each site component for each raw material category.

Raw Material Analysis

The determination of raw material type was accomplished with the aid of written descriptions and using a geologic type collection (Kimball 1985). Written descriptions provided information on key distinguishing attributes, while the type collection was continuously used for comparative purposes.

All flake debris, excluding burnt flakes, were assigned to a raw material category. Raw materials common to the area that were present in the geologic type collection include the varieties of Knox chert, chalcedony, quartz, and Fort Payne chert. Following other raw material analyses conducted in the study area (e.g., Kimball 1985; Davis 1990), both an "unknown, probable local" and an "unknown, probable nonlocal" categories were used. Burnt flakes, which exhibit heat damage consisting of potlidding, crazing, and a dull luster, were not sorted into raw material categories. Burnt flakes were simply counted and weighed as a group for each provenance level.

Although a number of different varieties of Knox chert have been identified, only one Knox chert category was used in this study. The separation of the different varieties of Knox chert is not an easy task due to the similarities between the different types. Also, variability in a single Knox chert nodule can cause problems because small flakes from the outer portion of the nodule may appear quite different from those from the inner portion of the nodule. Further, the heating of Knox chert, whether intentional or accidental, changes properties of the material making raw material category assignments tenuous. These difficulties aside, the major reason that the varieties of Knox chert was not separated is that what is of interest is the use of local versus non-local raw material categories. The vast majority of Knox chert used by Early Archaic populations in the TAP study area was Knox Black and Knox Black-Banded chert which has a restricted availability in the study area to the Upper Valley physiographic province (Kimball 1992). Knox chert is considered a local resource for all sites within 10 km of the Upper Valley. Ten kilometers is used because in hunter-gatherer ethnographic studies this is considered the average distance that will be traveled away from the base camp by a forager (Kelly n.d.).

The assignment of flake debris to raw material categories is often a difficult task due to the variability in a single raw material type and the similarities between different types. Three different means were employed to avoid possible biases that might result over the course of the raw material analysis (Beck and Jones 1990). The first of these is at the halfway point (about 5000 pieces) of the examination of the largest sample of flake debris, the entire analyzed assemblage was re-examined. A number of clarifications in assigning flake debris to different raw material categories were made at this time. For example, after having analyzed such a large amount of flake debris, many flakes that were previously placed in unidentifiable categories could be placed in specific raw material categories. Second, during this major reanalysis diagnostic pieces of specific raw material categories were pulled for comparative purposes. Large pieces that illustrated the range of variability in the raw material category were commonly pulled for comparisons. Third, a spot checking system of random bags over the entire analysis was used to insure that perceptions of different raw material categories did not change appreciatively over time. After the major reanalysis, there were only minor differences in the initial classification and the random spot checking.

A raw material analysis was also undertaken of a sample of the Early Archaic chipped stone tools from each of the components of the four sites. These data in combination with the flake debris raw material data can provide important information concerning manufacture, curation, and discard behaviors.

Reduction Analysis

Various attributes and combinations of attributes are used to classify flake debris according to a reduction stage or method of production (e.g., Ahler 1989a, 1989b; Magne 1985; Sullivan and Rozen 1985). As pointed out by Mauldin and Amick (1989), some of these attributes are based on experimentation, others on logical arguments, and still others on intuition. The difficulty is assigning accurate meaning related to stone tool manufacture to these flake attributes. Although archaeologists have defined attributes and given them meaning, until recently very little work has been undertaken to determine the relevancy of these attributes and to test the accuracy of the assigned meaning. For example, because the manufacture of chipped stone tools is a reductive process it has been assumed that the amount of cortex on a flake would progressively decrease from the early stages of core reduction to the late stages of tool manufacture. However, it has been shown through experimentation that cortical flakes are produced during all stages of manufacture (e.g., Ahler 1989a, 1989b; Magne 1985; Odell 1989). Therefore, cortex alone is not an accurate indicator of reduction stage. This is not to say that the amount of cortex on a flake should not be recorded. The amount of flake cortex can provide important information concerning reduction in combination with other attributes.

More recently, a large number of flintknapping experiments have been conducted that are directed specifically at the analysis of flake debris with a major focus of determining reduction methods/stages (e.g., Ahler 1989a; Baumler and Downum 1989; Ingbar et al. 1989; Magne 1985; Mauldin and Amick 1989; Odell 1989). Although more experimentation is needed to assure accurate and unambiguous meaning is assigned to relevant variables, researchers have produced a sizable body of useful experimental data. The use of flake debris attributes, tested through flintknapping experimentation, to examine archaeological assemblages has been limited but not without some success (e.g., Ahler 1989a, 1989b; Carr 1994; Magne 1985, 1989). Experiments by Ahler (1988) and Magne (1985), which were designed to accurately determine reduction method/stages represented in a chipped-stone assemblage, measure up well against criteria of a good experiment.

Carr (1992) reviewed the qualities of a good experiment and examined how different flintknapping experiments measured up against these qualities. These qualities were: relation to theory, accuracy, validity, and coverage. He found that the experiments by Ahler (1989a, 1989b) and Magne (1985) measure up well against these criteria and that the experiments by Magne provide greater coverage (Carr 1991:66).

Attributes from both Ahler's (mass analysis) and Magne's (individual flake analysis) experiments are used to determine the reduction stages present in the Early Archaic chipped-stone assemblages from the Rose Island, Icehouse Bottom, Bacon Farm, and Patrick sites. As previously noted, Magne's experiments have greater coverage and for this reason serve as the primary determinant of reduction stages in the assemblages. General trends in the mass analysis data are used as additional lines of evidence for comparison with the reduction stage determinations. The advantage of using more than a single method or line of evidence is that inferences will be strengthened or ambiguities revealed.

Mass Analysis

The entire sample of flake debris was sorted into burnt and unburnt categories. The burnt flake debris was simply counted and weighed. All other flake debris was assigned to one of the raw material categories and any flakes that exhibited retouch or scarring along an edge that could potentially represent use were pulled at this time for individual flake analysis. Next, the flake debris in each raw material category was passed through a series of nested screens to determine the size grade. The process of determining size grades followed the methods outlined by Ahler (1989a). However, four nested screens (grade 1 = one inch, grade 2 = 1/2 inch, grade 3 = approximately 1/4 inch, grade 4 = approximately 1/8 inch) were employed instead of five. This is because flake debris in the smallest size grade do not figure into the general trends that are used in this study. Also, the field recovery method was to screen all excavated matrix through a one quarter inch mesh screen so there is a bias in the recovery of smaller debris. Flake debris in each screen was weighed as a group to the nearest tenth gram using a digital scale and then counted. The cortical flakes were also counted. Cortical flakes, in this case, are defined as any piece of flake debris that exhibits cortex on the platform or dorsal surface. Together, this provides the information needed to examine general trends using data from the mass analysis technique.

Carr (1992) employed three general trends based on Ahler's (1989) experimental mass analysis data to compare to inferences based on individual flake analysis. In general, the trends supported the findings of the individual flake analysis suggesting that using the two methods in a complementary fashion is effective (Carr 1992). One trend observable in the mass analysis data is that the average weight of flake debris in size grades 2 and 3 is less with later stages of reduction. A second general trend is that the number of cortical flakes decreases in all size grades with later stages of reduction. The final general trend involves the ratio of flakes in size grade 4 to all those in size grades 1 through 3. Although a number of size grade 4 flakes are present in the assemblage, there was not systematic recovery of such small flake debris so the third trend is not used in this study. This was also the case for a study of the flake debris recovered in excavations at Wickliffe Mounds and the use of the first two trends still provided useful information (Carr and Koldehoff 1994).

Individual Flake Analysis

Flake debris in size grades 1 through 3, in addition to being examined using the mass analysis technique outlined above, were also analyzed individually. Flakes in size grade 4 were not included in this analysis because flake debris that would pass through a quarter inch screen were not included in the experiments conducted by Magne (1985).

Individual flake analysis included recording eight attributes for each flake: raw material, size grade, weight, portion, platform type, facet count, dorsal cortex, and dorsal scar count. Variable states for these attributes are defined in the Appendix. Facet count and dorsal scar count are the two variables Magne (1985) found through his experiments to be most effective in assigning individual flakes to a manufacturing stage and his analytical methods are followed here. Flakes with an intact platform were assigned to a reduction stage based on the number of platform facets (0-1 facets = early stage, 2 facets = middle stage, 3 or more facets = late stage). Flake debris without an intact platform but with a distinguishable dorsal surface were assigned a reduction stage based on the number of dorsal scars (0-1 scars = early stage, 2 scars = middle stage, 3 or more scars = late stage). Flakes lacking both an intact platform and a distinguishable dorsal surface could not be assigned to a reduction stage by this method.

A supplemental method of flake debris analysis is also employed in this study which is referred to here as the "portion method." The portion method is based on a classification scheme developed by Sullivan and Rozen (1985). In this scheme, flakes are classified as complete, broken, fragment, and debris based on the presence of flake features such as an intact platform and distal termination. Sullivan and Rozen (1985:769) use the percentages of flake debris in each of these categories as indicators of the dominant type of reduction present in an assemblage. For example, biface reduction is expected to produce relatively high percentages of broken flakes and flake fragments while core reduction is expected to produce relatively high percentages of complete flakes and debris. The use of this scheme for making interpretive statements has been heavily criticized because the links between pattern and inference are weakly developed (Amick and Mauldin 1989;

Ensor and Roemer 1989; Prentiss and Romanski 1989). Data from controlled flintknapping experiments or fracture mechanic data are needed to support the interpretive statements. Flintknapping experiments undertaken to examine the link between pattern and inference have produced ambiguous results in which some inferences are supported and others not (Prentiss and Romanski 1989:92; Ingbar et al. 1989:120-121; Tomka 1989). Experiments by Bradbury and Carr (n.d.) suggest that biface manufacture produces a comparatively higher percentage of broken flakes and core reduction a higher percentage of debris but approximately equal proportions of complete flakes and flake fragments. The portion method at the least assigns flake debris to general categories which can help provide a general description of the assemblage. The use of this method here as an additional line of evidence at the same level as the mass analysis trends is unwarranted. However, while recognizing that greater work is needed to link pattern with inference, the portion method provides a supplemental means of examining patterning in the chipped stone assemblages.

Bipolar and Blade Reduction

Flake debris produced during bipolar and blade reduction techniques were identified in the individual flake analysis based on the presence of distinctive characteristics. The attributes listed above were recorded for these flakes but for this study the bipolar and blade flakes were simply counted and this total is used to represent the relative amount each technique was used at each site.

Distinctive characteristics of the bipolar reduction method include: "shattered or pointed platforms with little or no surface area; evidence of force having been applied at opposite ends of the flake; an angular, polyhedral transverse cross section with steep lateral edge angles; the lack of a definite positive bulb of force; very pronounced ripple marks; and the lack of distinction between dorsal and ventral flake faces" (Ahler 1989b:210). A flake need not exhibit all of these characteristics to be considered bipolar but a combination of these relatively distinct characteristics are used to define bipolar flakes. However, it is important to keep in mind that a flake can be produced by the bipolar method that lacks these characteristics so the number of bipolar flakes will represent a minimum amount. The experimental bipolar reduction of a number of Knox chert nodules prior to the analysis produced a comparative collection that aided in the identification of bipolar flake debris.

Flakes produced by a blade technique can be difficult to distinguish from long, thin flakes produced by other reduction methods such as biface thinning or bipolar reduction. Johnson (1983:50) defines blades as long thin flakes with a "prepared broad angle platform, parallel lateral edges, and dorsal flake scars that parallel the longitudinal axis of the blade and originate from the same platform." Parry (1994) adds the following "at least half of the specimens that meet these criteria will also have two dorsal ridges and a trapezoidal cross-section." These rather strict criteria will prevent the misidentification of fortuitously long, thin flakes produced by other reduction methods from flakes produced by a true blade technology.

The identification of bipolar and blade flake debris is an important aspect of this study. The removal of these flakes from the individual flake and mass analyses is important for obtaining meaningful patterns in those analyses. Also, a pattern in which a decrease in the number of blades with an increase in the number of bipolar flakes selected for tool blanks over the Early Archaic time period has been noted (Kimball 1992). Greater investigation of this pattern is needed to fully understand the role of bipolar and blade reduction techniques in the organization of Early Archaic technologies.

Stone Tool Analysis

As previously noted, a raw material analysis was conducted using a sample of the stone tools from each site. A comparison of the representation of flake debris and stone tools in different raw material categories can provide information concerning manufacturing and discard behaviors. For example, a pattern of a high proportion of stone tools of nonlocal material compared to a high percentage of local flake debris would indicate that retooling was an important activity at that site. Curated tools of nonlocal materials were discarded and replacements of these tools were manufactured which were, in turn, curated and discarded at another site.

The patterning of tool classes can also be informative. For this study, the published tool class data are used. Consistent morphological classes were employed in the analysis of the sites included in this study and these data provide a general means of comparison between the Tellico assemblages. For comparisons with other sites in the region, the detailed classes are combined into more general ones so that differences between analysts does not add significant biases. This allows for making some broad comparisons between Early Archaic sites in the region. Published stone tool data from the Hardaway (Daniel 1994), Haw River (Cable 1992), Rucker's Bottom (Anderson and Hanson 1988), G.S. Lewis (Anderson and Hanson 1988), and Taylor (Michie 1992) sites are used in the regional comparisons.

Summary

The focus of this study is a detailed analysis of the flake debris from the Rose Island, Icehouse Bottom, Bacon Farm and Patrick sites. These sites were chosen because distinct Early Archaic components were defined in the original investigations which allows for the examination of change over the time period. The study of the flake debris includes raw material and reduction analyses. The focus of the raw material analysis is the identification of local and nonlocal flake debris. Individual flake, portion, and mass analysis methods are all part of the flake debris reduction analysis. The identification and separate analysis of flakes produced by bipolar and blade reduction is also an important part of the flake debris analysis.

Published stone tool data and limited reanalysis of a sample of the stone tools from the Early Archaic components supplement the flake debris analyses. A raw material analysis of a sample of the stone tools provides data for comparison with the patterns found through the flake debris analyses. This type of comparison can provide information concerning the transport and discard of raw materials as well as hunter-gatherer manufacturing and mobility patterns. The use of published stone tool data provides a means to make detailed comparisons between the four Tellico sites and general comparisons with other Early Archaic sites in the Southeast.

CHAPTER VII

Results

In this chapter, the results of the analyses of the Early Archaic chipped-stone assemblages from the Rose Island, Icehouse Bottom, Bacon Farm, and Patrick sites are presented. First, the sample size for each analyzed Early Archaic component is reported. Then, general comparisons using published chipped stone tool, flake debris, and feature frequencies are used to explore variability in the assemblages. Also, patterns are established for further investigation using the results of the detailed analyses conducted as part of the study presented here. This is followed by the results of the raw material analysis of samples of both the flake debris and stone tools. Next, the results of the reduction technique and stage analysis of the flake debris are presented. Finally, comparisons of general chipped stone tool frequencies between the components analyzed here and other important Early Archaic sites in the Southeast region are presented. These different analyses allow for the examination of temporal and spatial variability during the Early Archaic. The results of the analyses presented in this chapter are specifically used to make statements concerning the organization of technology and settlement-mobility patterns employed during this time period in the TAP study area.

Sample Sizes

Over 125,000 pieces of flake debris were recovered in the excavations of the Early Archaic components of the Rose Island, Icehouse Bottom, Bacon Farm, and Patrick sites. This large amount of material and the relatively detailed analyses outlined in Chapter VI preclude the examination of the entire recovered assemblage. An attempt was made to sample between 10% and 15% of the flake debris from each site and to maintain these levels as minimums for each individual component.

The sample sizes for each site and component are presented in Table 2. The percentages of the total recovered flake debris for the analyzed samples range from 13.1% to 24.2%. The percentages for the individual components range from 8.7% to 67.8%. In general, the high sample size percentages correspond to assemblages in which small amounts of flake debris were recovered and the low percentages correspond to larger flake assemblages.

The tool analysis focused only on those chipped-stone tools that were retouched or bifacially worked such as projectile points/knives, bifaces, drills, end scrapers, and side scrapers. The ambiguity in identifying utilized flakes by macroscopic means is too great to include these potential tools in this analysis.

Over 1650 retouched or bifacially-worked chipped-stone tools were recovered in the excavation of the Early Archaic components of the sites included in the study sample. The sample sizes range from 30% to 65% for the randomly-chosen stone tools used in the raw material analysis.

General Comparisons

The comparisons between site components of artifact and feature densities as well as artifact and feature ratios provide some interesting results. The density of various artifact and feature classes are presented in Table 3. There are obvious differences over time for each site. This calls into question any comparisons where the Early Archaic is treated as a single unit. At the Icehouse Bottom site, the Upper Kirk (IBUK) and Bifurcate (IBBI) components are relatively comparable and are two of the most dense assemblages in the sample. However, the Lower Kirk (IBLK) component is not very dense and stands in contrast with the other two. In the Bacon Farm assemblages, the Upper Kirk (BFUK) is quite dense but the Bifurcate (BFBI) assemblage is markedly less so, while the opposite is true for the Rose Island and Patrick sites. In general, sites with low flake densities have low densities of other artifacts and features. One exception is the Bifurcate assemblage at Patrick (PBI) in which the flake density is low but the densities of tools and features are markedly high.

These measures of site density are some of the best indicators archaeologists have to ascertain the intensity of occupation at a site. It might be tempting to interpret this patterning directly in terms of a forager-collector settlement model; dense sites being collector residences and less dense sites collector camps or forager residences. However, it is difficult to determine whether these patterns of site densities are due to long site occupations, occupation by a large group, frequent site reoccupation, or some combination of these possibilities. More detailed examination is needed before one can draw any conclusions.

To further explore the patterning between sites, ratios of chipped stone tool, flake debris, and feature frequencies are used. These ratios can bring out differences that may not be clear in the simple density measures. Flake-to-tool (F:T) and tool-to-feature (T:F) ratios were used by Kimball (1992) to group Early Archaic sites in the TAP study area but this was not accomplished using individual Early Archaic components. He separated sites with high flake-to-tool ratios and low tool-to-feature ratios from those sites with the opposite pattern. In the ratios calculated here (Table 4), some different patterns emerge. At Icehouse Bottom, the Upper Kirk (IBUK) and Bifurcate (IBBI) components have high flake-to-tool ratios but the Upper Kirk component also has a relatively high tool-to-feature ratio. The IBUK pattern is also seen in the PBI component and the IBBI is similar but the tool-to-feature ratio is not quite so high. The fact that the Upper Kirk and Bifurcate components have high flake-to-tool ratios is not surprising considering that the site is located near a major outcrop of Knox black chert. However, it is surprising that the IBLK component does not also have such a high ratio and that the tool-to-feature ratio is also low. The BFBI component similarly has low flake to tool and tool-to-feature ratios. Following the distinctions identified by Kimball (1992), the RIUK, BFUK, and the RIBI components all have a low flake to tool ratio with a high tool-to-feature ratio while the PUK assemblage exhibits the opposite pattern. The remaining site components do not fit either of these patterns illustrating the complexity of assemblage patterning and the temporal variability.

Three general groups of site components emerge from the examination of flake-to-tool and tool-to-feature ratios. The RIUK, BFUK and RIBI all exhibit a high-low pattern for these two ratios. That is, high flake-to-tool and low tool-to-feature ratios. It should be noted that the BFUK assemblage has a tool-to-feature ratio which is extremely high compared to the remainder of the components. The IBLK and BFBI components exhibit a low-low pattern and the IBUK and PBI exhibit a high-high pattern. The PUK component is the only one to show a high-low pattern. The patterning in these ratios is interesting, in spite of the difficulty of interpretation. One general conclusion is that there is obvious spatial and temporal variability in site usage over the early Archaic time period. This variability is likely related to the intensity of manufacturing and subsistence activities. A major problem for deriving interpretations from these ratios is that the tool category contains a variety of implements, some of which were curated and others which were used expediently. Also, the feature category likely contains significant functional variability.

One solution to these problems is to focus on specific tool and feature categories of which the meaning is more clear. For example, while it is arguable that retouched flakes were curated, most researchers would accept pp/k as curated tools (Odell 1993). Also, the feature category "hearth" is probably a good measure of the intensity of occupation and re-occupation of a site. Ratios of flake-to-hearth (F:H), pp/k-to-hearth (PP/K:H), and other feature-to-hearth (OF:H) are presented in Table 5.

The flake-to-hearth ratio provides a general means of assessing the intensity of manufacturing carried out at a site. The value for the IBBI is about average for these assemblages while the IBLK, PUK, RIBI, and BFBI are low and the IBUK, RIUK, BFUK and PBI are all high. The pp/k-to-hearth ratio is a good measure of the rate of discard of curated tools. The IBUK, RIBI, and BFBI assemblages all exhibit a similar pp/k-to-hearth ratio which is about average for the components considered here. The RIUK and BFUK have a comparatively high ratio and the IBLK, IBBI, and PBI assemblages all have a low ratio. Examining these two ratios in combination, the RIUK and BFUK assemblages likely represent sites where the replacement of curated tools was an important activity. Although not as clear, the IBUK assemblage may fit this pattern but the manufacturing of tools other than pp/k must also have been an important activity. These sites may represent residential bases from which logistically organized task groups were sent to obtain subsistence and other resources. Manufacturing activities are interpreted as less intense in the IBLK and PUK components and the discard of curated tools is also less intense. This is similar to what is observed for the RIBI and BFBI assemblages but with greater discard for these components and more intense manufacturing at RIBI. The IBBI and PBI components are similar in that there appears to be relatively intense manufacturing activities but a low discard rate of curated tools. This may signify "gearing-up" activities in which tool manufacture is intense but these tools are used and discarded at other sites.

The feature-to-hearth ratio (Table 5) provides a general measure of the intensity of other activities at a site. Relatively high feature-to-hearth ratios are observed for the IBUK, BFUK, RIBI, and PBI components as well as a very high ratio for the RIUK component. The IBLK, PUK, IBBI, and BFBI components all exhibit relatively low ratios.

Looking at the ratios overall reveals some interesting patterns. First, there is a general similarity between the Upper Kirk ratios, excluding the PUK component. These Upper Kirk components all exhibit intense manufacturing activities and high occurrences of pp/ks and features other than hearths. The very low flake-to-tool ratios in the RIUK and BFUK components in combination with the high flake-to-hearth and feature-to-hearth ratios suggest that a range of activities, including manufacturing, was important at these sites. Based on this evidence, it is suggested that the IBUK, RIUK, and BFUK components all represent base camps. These base camps were likely supported to some degree by logistically organized task groups but a variety of activities were also undertaken at each of these sites. The PUK component does not fit this pattern, but the Upper Kirk component at Patrick is the least excavated and dense of the assemblages considered here (see Table 2).

The Upper Kirk patterns observed at Icehouse Bottom (IBUK), Rose Island, (RIUK), and Bacon Farm (BFUK) are very different from those observed for the Icehouse Bottom Lower Kirk (IBLK) component. Manufacturing, discard of curated tools, and the number of features other than hearths are all low but are similar to the pattern observed for the Patrick Upper Kirk (PUK) and Bacon Farm Bifurcate (BFBI) components. The IBBI assemblage is probably most similar to this unintensive group but with a greater emphasis on manufacturing. The RIBI component is interpreted as one in which manufacturing activities were not as important as activities related to the use of features other than hearths. The Bifurcate component of the Patrick site appears to represent gearing up activities in which manufacturing of tools is important and they are curated for use elsewhere.

The general similarity of activities inferred for the Upper Kirk components stands in contrast to the varied patterns observed for the Bifurcate. Base camps in the TAP that date to the Upper Kirk appear to have been used in similar ways. This is different from the Lower Kirk and Bifurcate pattern. If any of these sites represent collector base camps, one would expect gearing up activities for logistical forays. Collectors are expected to emphasize the reliability of their tool kits, so that in situations of raw material availability, there should be an emphasis on manufacturing activities, and a relatively high rate of replacement and discard of curated tools. This appears to be the pattern displayed for the Upper Kirk assemblages. The lack of emphasis on manufacturing activities and the apparent low rate of replacement and discard of curated tools observed for the Lower Kirk assemblage would seem to indicate that the maintainability of the tool kit is emphasized. This is what would be expected for a forager settlement-mobility system. The variability apparent among the Bifurcate components suggests the possibility of change in the settlement system occurring during this period, differential use of the area from each of these sites, or variation in site usage over the seasonal round. The ratios for the Bifurcate components at Icehouse Bottom (IBBI) and Patrick (PBI) indicate relatively intense manufacturing activities while activities other than manufacture are emphasized at the Rose Island site (RIBI) at this time. The density of the Bacon Farm Bifurcate (BFBI) component is relatively low and interpretations of the ratios are not evident.

More detailed analyses are needed to further examine the inferences derived from the general comparisons presented above. There appear to be major differences among the three Early Archaic components excavated in the TAP study area. The relatively high densities of chipped stone tools and features has been taken in the past to indicate the use of these sites as base camps (Chapman 1975, 1977, 1978; Kimball 1992). The patterns observed here suggest that, if each of these sites are base camps over the entire Early Archaic period, they may have been part of very different settlement-mobility systems. Also, there is the possibility, especially during the Bifurcate occupations, of variable site usage over a seasonal round. In this situation, a site which served as a base camp during one season might be used as a field camp during another season.

Raw Material Analysis Results

In contrast to the marked variability in the densities and frequencies of tools, flakes, and features, there is a lack of obvious differences in the use of raw materials except for the

Lower Kirk component at Icehouse Bottom. The vast majority of the flake debris from each site for each component was local Knox chert. The Lower Kirk component at Icehouse Bottom contained the lowest percentage of local (Knox) chert (84.9%). The Upper Kirk and Bifurcate assemblages from the sites contained between 96.1% and 99.0% Knox chert. The percentages of local and nonlocal flake debris for each assemblage is presented in Table 6. A chi square test shows that component and raw material type are dependent ($p<0.0001$). That is, in spite of the obvious focus on local raw materials, there are significant differences between the components and the amount of local and nonlocal flake debris. More specifically, there is a greater amount of nonlocal flake debris than expected in the IBLK assemblage and a lesser amount of nonlocal flake debris than expected is present in the BFBI, BFUK, IBUK, and RIBI assemblages. Performing separate chi square tests for the Upper Kirk and Bifurcate components shows that site and raw material are independent for the Upper Kirk ($p=0.312$) and dependent for the Bifurcate ($p<0.001$). It is legitimate to combine the Upper Kirk assemblages but not the Bifurcate. Comparing the Lower Kirk to the combined Upper Kirk assemblages shows that temporal unit and raw material type are dependent ($p<0.001$) further supporting that differences exist between Lower Kirk and Upper Kirk components.

The results of the raw material analysis of the flake debris is quite interesting, especially considering the patterns observed through the general ratio comparisons. As in the general comparisons, similarities are observed for the Upper Kirk assemblages and the pattern exhibited by the Upper Kirk assemblages differs from that of the Lower Kirk and Bifurcate. Further, no clear patterns or similarities are apparent for the Bifurcate components supporting the idea of variable site usage or changes in settlement-mobility strategy at this time.

A variety of flake debris of nonlocal raw material types was present in the assemblages. These types include: chalcedony, Chickamuaga chert, Fort Payne chert, and quartz. Interestingly, a small amount of Knox chert is reported for the Early Archaic assemblage from the Hardaway site (Daniel 1992:62) and a black chert which is potentially Knox is reported from the Taylor site (Michie 1992:238) but no Uwharrie rhyolite or Allendale chert was found in the Early Archaic assemblages from the TAP.

In general, the low amount of nonlocal flake debris present in any one assemblage presents problems for interpretation. One evident pattern is that the majority of nonlocal flake debris in the Lower Kirk assemblage from Icehouse Bottom is Fort Payne chert (72.2%). In general, this would not be taken as indicative of a hunter-gatherer aggregation site at which a number of different groups from different places of the landscape come together which would result in a variety of nonlocal raw materials. Rather, this dominance of the nonlocal material category by a single raw material type is indicative of a group coming to Icehouse Bottom

(IBUK) with curated tools manufactured of Fort Payne chert. One explanation of this pattern is a settlement-mobility system in which long distances are traveled during residential moves which is generally associated with a collector settlement-mobility system. The role of Fort Payne chert is further examined in the reduction analysis.

The majority of the tools in the analyzed sample from each site for each component was local Knox chert, although there is greater variability in these percentages than present in the flake debris assemblages. The lowest percentages of local chert are from the Upper Kirk components of the Icehouse Bottom (82.5%) and Rose Island (60.0%) sites while over 90% of the tools from the remainder of the components are of local chert. Very few retouched flake tools of nonlocal chert were identified. When considering all the assemblages, only four of 135 flake tools are of nonlocal raw materials. These could represent either curated flake tools brought from another site or flake tools produced at the site from bifacial cores of nonlocal raw material. The bifaces and projectile points/knives of nonlocal materials, on the other hand, were likely brought as curated tools from other sites. The relatively high percentage of nonlocal pp/ks and bifaces in the Upper Kirk assemblages from the Icehouse Bottom (22.9%) and Rose Island (40%) sites combined with the relatively low percentages of nonlocal flake debris from these components are indicative of a high rate of discard with replacement of these tools using local materials. Although the percentage for Rose Island appears significantly high compared to the others, the sample size is small (n=5) making conclusions somewhat suspect. Interestingly, the Lower Kirk component of the Icehouse Bottom site which had the highest percentage of nonlocal flake debris has the second lowest percentage (1.2%) of tools manufactured of nonlocal material. This pattern is indicative of curated tools of nonlocal raw materials being brought to the site and maintained, but rarely discarded there. If not for the presence of discarded tools made from local raw materials, this pattern might indicate the site was not occupied for an amount of time long enough for stone tools to be used so extensively that they must be discarded. The fact that tools of local materials are present in the assemblage indicates the possibility that nonlocal materials were valued and were mainly conserved for future use. Another possibility is that during this time the site was used for aggregations. The local group occupied the site and focused on the local materials. The visiting group brought curated tools of nonlocal chert but were not heavily engaged in economic activities, therefore tools were rarely worn out or broken and little discard of nonlocal tools occurred. However, this does not completely explain such a high percentage of nonlocal flake debris.

Raw material analysis provides the base-line for making inferences concerning the organization of prehistoric chipped-stone tool technologies. In general, the presence of non-local materials on prehistoric hunter-gatherer sites is taken to indicate patterns of movements. The high percentages of non-local flake debris from relatively distant sources in Paleoindian assemblages is inferred to reflect the high rate of mobility employed during that time period (e.g., Goodyear 1989; Kelly and Todd 1988; Meltzer 1989). However, the lack of nonlocal materials or a dominance of local materials versus nonlocal materials does not necessarily reflect a sedentary culture. The work with assemblage simulations of raw material frequencies by Ingbar (1994) indicates that variation in the rate of tool discard can have a significant effect on the patterning of different raw materials present in an assemblage. A high rate of discard of curated tools of nonlocal materials at sites near Knox chert sources outside the TAP study area which are occupied prior to those examined here is one possible explanation for the dominance of Knox (local) chert in most of the assemblages for both flakes and tools. Also, it is possible that the focus on local raw materials is indicative that the Early Archaic site components considered here represent fairly stable, long-term residences.

The presence of a variety of raw materials in an assemblage has been used as evidence for aggregation sites. For example, the Taylor site is interpreted as an Early Archaic aggregation site based mainly on the raw material diversity present in the assemblage (Daniel 1994). In the ethnographic record, there are accounts of aggregation sites being important for economic reasons such as those used by the Washo (Downs 1966) but there are also aggregations of hunter-gatherers at which few economic activities where undertaken such as with some Eskimo groups (Damas 1969). The bulk processing of subsistence resources could result in a high rate of discard of curated tools. Aggregations of different bands, during which economic concerns are of great importance, would likely result in a variety of raw materials being present in the archaeological record. However, the periodic reuse of a site after directional shifts in the entire mobility system could also result in a variety of raw materials present in an assemblage. At aggregation sites where economic activities are secondary to social concerns, little variety of raw materials may be present. From this discussion, it should be evident that raw material variety, or a lack thereof, is not sufficient evidence for making a determination of whether an assemblage is the result of hunter-gatherer aggregation or not. Other lines of evidence are necessary to draw such conclusions.

In summary, there is a dominance of local material use during the entire Early Archaic time period in the TAP study area. However, there are significant differences between the components in the use of local and nonlocal materials. Interestingly, the flake raw material analysis supports the general comparisons in which similarities in the Upper Kirk assemblages were noted. Another pattern worth pointing out is that there is a relatively high percentage of nonlocal curated tools in the Icehouse Bottom and Rose Island Upper Kirk assemblages, although the sample size for Rose Island is small. In general, this pattern indicates the importance of retooling at these sites and that the importance of Icehouse Bottom as a quarry-related site. More specific possibilities could be raised such as the use of these sites for hunter-gatherer aggregations, but without other lines of evidence such an interpretation is extremely tenuous.

Reduction Analysis: Blades, Bipolar, and Stages

An examination of the reduction patterns of local and nonlocal materials can provide insight into the organization of prehistoric technologies and other aspects of past behavior. Flake debris was classified by individual flake analysis to a specific reduction method (bipolar, blade), to a reduction stage (early, middle or late), or as shatter. The assignment of flakes to a stage of reduction by individual flake analysis is considered in light of data derived from mass analysis and flake portion methods.

One pattern previously noted for the Early Archaic in the TAP study area is that over time, there is a trend toward greater use of bipolar flakes for tools and less use of blades for tools (Chapman 1977; Kimball 1992). The amount of flake debris assigned to bipolar, blade, and core/bifacial categories provides an indication of the importance of these reduction techniques for each component.

Surprisingly, very few blades were identified in the reanalysis of the chipped stone assemblages. A rather strict definition of a blade was employed in this study to insure that long flakes produced by other reduction techniques were not misidentified as representing a true blade technology. In the original reports (Chapman 1975, 1977, 1978), it was recognized that other reduction techniques can produce elongated "blade-like" flakes. In the Rose Island report, for example, a bipolar "pseudo-blade" category was recognized (Chapman 1975:150). Although it was recognized that other reduction techniques can produce blades and a blade-like flake category was used, it appears that any flake that was twice as long as its width was considered a blade. This resulted in the identification of a relatively large number of blades, especially in the Icehouse Bottom assemblages where 3,252 blade-like flakes were identified in the Early Archaic components (4.2% of the total recovered assemblage). Following Johnson's (1983) more strict definition, only 14 blades (0.1% of the reanalyzed sample) were identified in the Icehouse Bottom assemblages and only three had two dorsal ridges and a trapezoidal cross-section. All 14 of the identified blades were of local Knox chert. In the Patrick assemblages, only two possible blades were identified, both of Knox chert (0.3% of the reanalyzed assemblages). Many of the flakes that had previously been considered blades in the Icehouse Bottom and Patrick assemblages would fit in the bipolar pseudo-blade category employed in the Rose Island classification. No potential blades were identified in the reanalysis of the components from the other two sites, although the blades identified in the original report were stored separately and were not re-examined. Only 23 blade-like flakes were originally identified in the Early Archaic components from Units A and C at the Rose Island site which is 0.1% of the total flake debris from those units. A total of 52 blades were originally identified in the Unit 2 Block at Bacon Farm which is 0.4% of the total flake debris. In addition to identifying very few blades in the Tellico Early Archaic assemblages, other diagnostics of a blade technology such as blade cores, crested blades, core preparation and rejuvenation flakes were not found. Although Chapman (1977:) suggests that the small nodule size of local Knox materials might limit the occurrence of such diagnostics, the blade cores at the least should be recognizable in the assemblage. The lack of blade cores and other diagnostics of a blade technology combined with the low percentages of blades identified in the reanalysis and in the original reports suggests that a blade reduction technique played a very minor role in the organization of Early Archaic chipped stone technology in the TAP study area. This does not indicate that the trend in tool blank selection noted by Chapman (1977) and Kimball (1992) is absent. The selection of tool blanks in the Icehouse Bottom Lower Kirk (IBLK) and Upper Kirk (IBUK) assemblages was likely oriented toward flakes twice as long as they are wide but produced by means other than a true blade technology.

True blade technologies are relatively uncommon and highly localized in the New World. Parry (1994), in a recent review, identified only nine well-documented blade technologies in North America and Mexico. It is not surprising that a true blade technology appears to have been non-existent or played an extremely minor role during the Early Archaic in the TAP study area.

Bipolar knapping, in contrast to blade reduction, did play a role in the organization of technology during the Early Archaic in the TAP study area. The percent of bipolar flakes varies from component to component ranging from 3.2% in the Icehouse Bottom Lower Kirk (IBLK) assemblage to a high of 12.0% during the Bifurcate occupation of the Rose Island site. The greatest amount of bipolar flake debris is in the Bifurcate components (7.9%), followed by the Upper Kirk (6.7%), and Lower Kirk (3.2%). Although not quantified in this study, there are a notable number of tools from all sites and components with evidence of having been subjected to bipolar forces.

Goodyear (1993) has argued that bipolar reduction is a strategy for knapping small pieces of raw material to produce flakes for expedient tools. Using Paleoindian assemblages in the Northeast as case studies, he effectively argues that what have been identified as *pieces esquillees* are actually bipolar cores. *Pieces esquillees*, which have been taken as evidence for the manufacture of bone and wood implements, are the result of bipolar knapping used to acquire flakes for use as tools in situations where there are scarce raw materials. Goodyear suggests that

> The bipolar reduction of biface fragments, core remnants, fluted points and scrapers (e.g., at Debert) would literally signal the last possible effort to squeeze usable flakes from a nearly exhausted tool kit. Where no other comparable raw material is nearby, such a practice of intensive recycling is an effective means of dealing with a tool replacement problem (1993:12-13).

This view has important implications for interpretations of Paleoindian and other occurrences of bipolar knapping. Goodyear (1993:13) suggests that the incidence of bipolar knapping is an indication of tool kit entropy in a lithic assemblage because it is a simple method for producing flakes to be used as expedient tools.

Pieces esquillees were identified in the original analysis of the excavated materials from the TAP study area (Chapman 1975, 1977, 1978). *Pieces esquillees* were distinguished from bipolar cores at all sites except Rose Island where a bipolar core category was not used. The presence of an edge that could possibly have served in slotting, scraping, or wedging tasks was used to differentiate *pieces esquillees* from bipolar cores but the difficulty of this was noted by Chapman (1977:82). As suggested by Goodyear (1993), the identification of these artifacts as wedging tools versus cores leads to very different interpretations. If identified as wedges, *pieces esquillees* are indicative of bone and wood implement manufacture which can be very important considering that these materials do not often preserve in the archaeological record. If identified as bipolar cores, *pieces esquillees* are indicative of the production of flakes for use as expedient tools. As pointed out by Shott (1989:1-2), the use of *pieces esquillees* as both wedges and cores is certainly possible, but it is likely that "one or the other interpretations accounts for the majority of events that produced bipolar objects."

Shott (1989) suggests a number of corollaries to distinguish between the use of bipolar objects as wedges or cores. Two of these corollaries are relevant to the materials analyzed here: "at least some of the flakes produced by bipolar reduction are used" and "given the expedient nature of bipolar reduction, it can be performed on chipped stone tools as well as unmodified raw material, whichever is available and best suits the immediate purpose" (Shott 1989:6). As evidence of the use of bipolar pieces, Kimball (1992:Figure 10.7) shows that there is an increase in the number of bipolar flakes, bipolar cores, and *pieces esquillees* selected for tools from Lower Kirk to Bifurcate times. Relevant to the second corollary, as previously noted, there are a substantial number of tools in the Early Archaic assemblages studied here that have been subjected to bipolar forces. This evidence appears to support the interpretation of the *pieces esquillees* from the Early Archaic components in the TAP study area as the result of bipolar knapping to produce flakes for expedient use. However, the presence of locally available, high quality raw materials argues against a strategy of obtaining the last bit of usable material from an exhausted tool kit.

Goodyear (1993:12) does recognize that bipolar knapping is most commonly reported at sites where raw material sources are represented by small pebbles or fragments. Certainly, the locally available Knox chert materials are of a small size (Kimball 1985) so it is not surprising that bipolar knapping was used in the reduction of the small nodules of locally available raw materials. However, while the reduction of chipped stone tools by bipolar knapping might be expected under conditions of raw material scarcity, it is somewhat surprising, considering the abundance of locally available raw materials, that chipped stone tools were bipolarly reduced in the Tellico Early Archaic assemblages. The bipolar reduction of tools may represent the use of these tools in wedging tasks or use as bipolar cores when access to local raw materials was limited due to environmental conditions such as winter freezes.

It is suggested that the majority of the bipolar flakes, bipolar cores, and *pieces esquillees* identified in the analysis and reanalysis of the Early Archaic assemblages included in this study are the result of bipolar knapping to produce flakes. In general, these flakes will not be suited for the manufacture of formal tools (Goodyear 1993). However, it was communicated to Chapman (1975:142) that LeCroy and St. Albans projectile/point/knife types were successfully replicated using "bipolar flakes derived from nodules similar in size to those found at Rose Island." It is certainly possible that some of the *pieces esquillees* and bipolarized chipped stone tools were used in bone and wood tool manufacture. The documentation of the presence of these tools and the quantification of their numbers depends on a systematic study using high-magnification techniques to identify use traces. The increase in the percent of bipolar blanks for tools over the Early Archaic may be indicative of scavenging of small pieces of raw material previously discarded on-site.

Based on the reanalysis presented here, blade reduction did not play a role in the organization of Early Archaic chipped stone technologies. The number of flakes potentially identified as blades is less than a half of a percent for each of the time units. The lack of blade cores and other diagnostic materials produced with blade reduction suggests that blade reduction was not practiced during this time.

It is suggested based on the reanalysis that bipolar reduction did play a role in the organization of lithic technology during the Early Archaic in the TAP study area. Bipolar cores, flakes, and *pieces esquillees* are all evidence of such an activity and the small nodule size of local materials makes bipolar reduction a practical way of producing flakes. Yet, there is only a small number of flakes identified as being produced during bipolar reduction. Also, the general availability of local materials argues against the use of this technique for obtaining the last bit of utility from an exhausted tool kit so the importance of the role of bipolar reduction does not appear great. The bipolarization of chipped stone tools is somewhat surprising and deserves further investigation.

Flake debris not diagnostic of either blade or bipolar reduction was considered to be the result of core and bifacial reduction and was assigned to a reduction stage when possible. The distribution of flakes for each stage of reduction for local material is shown in Table 7. The general pattern of the reduction of local materials is an emphasis on early stage (about 50%), followed by middle stage reduction (about 30%), and late stage reduction (about 20%).

This general pattern of an emphasis on early stage reduction is supported by the trends from the mass analysis data. The average weight of flakes in size grade three is expected to be relatively high with an emphasis on early stages of reduction (Ahler 1989). The average weight of flakes in this size grade for the local Knox chert ranges from 0.50 to 0.89 grams (Table 8). The percentage of cortical flakes for every size grade is expected to be relatively high with an emphasis on early reduction stages. The percentage of cortical flakes for each assemblage for each component ranges from 30.4% to 46.2%.

These results stand in marked contrast to those for the nonlocal raw materials. The pattern of reduction for nonlocal raw materials is generally an emphasis on middle stages of reduction (about 45%), followed by late (about 35%), and early (about 20%). The average weight for flakes in size grade three for nonlocal flake debris ranges from 0.33 to 0.52 grams (Table 8). The percentage of cortical flakes ranges from 1.5% to 8.9% for nonlocal flake debris.

Comparing the results of the local and nonlocal reduction analyses, the trends in the mass analysis data provide support for the conclusion of an emphasis on early reduction for local materials and an emphasis on middle and late stages of reduction for nonlocal materials. These patterns can be further examined using data from the portion method of analysis, although this method is not considered as reliable as the individual and mass analysis methods because of the ambiguity of experimental results. The use of the portion method here is exploratory in nature. Based on the experiments conducted by Bradbury and Carr (n.d.), there should be a relatively high percentage of debris (shatter) in assemblages with an emphasis on early stage reduction and a high percentage of broken flakes (platform remnant bearing flakes) with an emphasis on middle and late stages of reduction. The percentages of flake portions for local raw material and two assemblages containing nonlocal materials are presented in Table 9. Only two nonlocal samples (IBLK and IBUK) contained more than one hundred flakes and they are used here for comparative purposes. The percentages range from 7.9% to 33.7% for the flakes of local material classified as debris with an average of 19.7%. This is in marked contrast to the very low percentages for the nonlocal assemblages which are both less than 1%. This provides support for the conclusion that the focus of the knapping of local raw materials was early stage reduction. Conversely, the percentage of nonlocal broken flakes is quite high (44.7% and 41.5%) which compared to the local materials (range 13.6% to 35.4%; average 24.3%) provides support that the focus of the knapping of nonlocal materials was on middle and late reduction stages. Also, these results point to the potential of using the percentage of flake portions in an assemblage as an additional line of evidence to examine patterning in flake debris assemblages. However, greater experimentation using a variety of raw materials is needed, as well as more investigation of the potential effects of site formation processes on flake portions (i.e., Prentiss and Romanski 1989).

A general pattern appears in the reduction of local materials for all components. There is a focus on early stage, and less emphasis on middle and late stages. This is supported by the mass analysis data trends and the flake portion analysis. However, a chi square test for the local materials shows that component and reduction stage are not independent ($p<0.001$). Further, this is also true for the Upper Kirk components ($p=0.007$) and the Bifurcate components ($p<0.001$) calculated independently. The general pattern of reduction that is apparent in all assemblages is suggested to relate to the availability of local raw materials and to the small size of these available materials. The differences in the reduction of local materials when comparing all components is not surprising when considering the previously highlighted differences in the chipped stone assemblages. Further, the differences between the Bifurcate components is not surprising since distinct differences in these components have also been highlighted. It is somewhat surprising, considering the similarities observed for the Upper Kirk assemblages that differences are found among them in the reduction of local materials. These differences, however, are suggested to relate to minor variability in the importance of bipolar knapping in each assemblage, to the proximity of local raw material resources, and less to major differences in the use of these sites in the settlement system.

The low quantities of nonlocal materials in the assemblages makes interpretation difficult. The general pattern of a focus on middle and late stages observed for all components is supported by both the mass analysis data trends and the flake portion analysis. The nonlocal Fort Payne chert in the IBLK assemblage is the only particular chert type of an amount that deserves consideration. Although the individual flake analysis of this Fort Payne sample is clearly focused on middle and late stages of reduction, a surprising amount (14.1%) of early stage reduction is indicated. However, from the examination of the mass analysis data trends, there is some indication that there is an even greater concentration on later stages of reduction than suggested by individual flake analysis. The percent of cortical flakes of Fort Payne chert is less than 0.1% and the average weight of flakes in size grade three is quite low at 0.27 grams. Also, no Fort Payne flakes were classified as debris using the portion method.

In Magne's (1985) experiments and in experiments by Bradbury and Carr (n.d.), it was found that when using platform facets to classify flakes to reduction stage, middle and late reduction flakes are most likely to be misclassified as early stage. For the IBLK Fort Payne, 86% of the flakes were classified based on the number of platform facets. If dorsal scars had been used instead of platform facets, 94% of these flakes would have been classified as middle or late stage. Experiments by Bradbury and Carr (n.d.) indicate that flakes with one platform facet but a number of dorsal scars would most likely be produced during the reduction of a rough biface. This suggests that Fort Payne bifacial cores and finished bifacial tools were brought to the Icehouse Bottom site during the Lower Kirk occupation. The use of Fort Payne bifacial cores and tools was apparently not as intense during subsequent Early Archaic occupations of the TAP study area.

Comparisons to Early Archaic Sites in the Southeast

Intraregional comparisons of Early Archaic sites in the Southeast have not often been accomplished in the past. This is due in part to the variable levels of reporting for different sites. Often, the classification systems differ to such an extent that comparisons are difficult at a specific level. Also, differences in excavation techniques makes certain comparisons difficult to justify. For example, a comparison of the amount of flake debris from Icehouse Bottom to that from Hardaway would have little meaning because the excavated matrix at Hardaway was passed through a half inch mesh screen as opposed to the quarter inch screen used at Icehouse Bottom. Also, differences in formation processes can make the recognition of features in certain areas very difficult. Flakes and features, which figure prominently in the general comparisons and interpretations presented here, often cannot be used in comparisons to other sites.

In spite of these difficulties, comparisons between Early Archaic sites in the Southeast have the potential to highlight interesting differences. A discussion of a major Early Archaic site in the Southeast is followed by a comparison of general chipped stone tool categories for it, the Tellico sites, and other

Early Archaic sites (Figure 3).

The Hardaway site, located in the North Carolina Piedmont, is one of the most famous Early Archaic sites in the Southeast. Based on the materials recovered from this site, Coe (1964) was able to establish a culture chronology for the Carolina Piedmont which has been shown to have wide applicability for other areas of the Southeast (i.e, Anderson and Schuldenrein 1985; Cable 1992; Chapman 1975, 1977, 1978). The Early Archaic archaeological assemblage from Hardaway was recently reanalyzed by Daniel (1994). Daniel (1994:221) interprets the Hardaway site as a relatively long-term base camp repeatedly occupied as part of a forager settlement system (Daniel 1994:257-258). The importance of the nearby rhyolite raw material source within seven kilometers of the Hardaway site is emphasized in the proposed Uwharrie-Allendale settlement model which is reviewed in Chapter V.

The interpretation of the Hardaway site as a repeatedly occupied, relatively long-term base camp, near a raw material source is similar to the interpretations of the sites considered in this study. However, the frequency of tool classes is quite different (Table 10). As with most other Early Archaic sites considered here that are outside the TAP study area, there is a much lower percentage of pp/ks with a higher percentage of bifaces. These comparisons highlight well the lack of bifaces at the Tellico sites analyzed here. This might relate to the small nodule size of local raw materials in the TAP study area. The manufacture of bifacial cores or large bifaces much larger than pp/ks was not viable at the Tellico sites. Another obvious difference observed between the Hardaway assemblage and the Tellico sites is in the end scraper-to-pp/k ratio. The Hardaway ratio, similar to the Haw River-Palmer ratio, is five to six times greater than the Tellico sites. The significance of this is explored in the discussion of the Haw River site.

The Hardaway excavations were screened through one half inch mesh as compared to quarter inch mesh used during the TAP, so that comparisons of flake debris are somewhat compromised. One solution is to use only the flake debris retained in a half inch screen from the Tellico assemblages but this comparison is biased due to the small nodule size available in the TAP study area. The percentage of flakes classified as shatter, which is comparable to the debris category in the portion method used here, in the one half inch size grade for the Hardaway assemblage, are available for comparison (Daniel 1994:Table 4.14). Relatively high amounts of debris were reported here for the analyzed Tellico components which was taken as support for the pattern of a focus on early reduction. Only 1.0% of the flakes of local raw material at the Hardaway site were classified as debris. The percentages of flakes of a comparable size in this study range from 10.8% to 74.0%. This comparison not only highlights the difference between the Hardaway and Early Archaic Tellico components, but also the differences between the

Tellico components. The IBLK assemblage has the lowest value at 10.8%, followed by the RIUK, BFUK, and IBUK which have values of 23.8%, 26.9% and 29.3% respectively. The Bifurcate components are different still with values ranging from 33.3% to 74.0%.

The Haw River site, like Hardaway, is situated in the North Carolina Piedmont and has been called one of the more important sites in the Southeast because it contains stratified Late Paleoindian and Early Archaic living floors (Cable 1992:96). Distinct Palmer and Kirk/Bifurcate assemblages were recovered in the Haw River excavations. Cable (1982), based on the Effective Temperature/Technological Organization model (ET/TO) which is reviewed in Chapter V, argues that a switch from a collector to a forager settlement-mobility pattern likely occurred during the Kirk/Bifurcate occupation of the Haw River site. More recently, in a reanalysis of the Haw River data, Cable (1992) suggests that the Palmer occupation of the site represents a collector field camp where bulk processing took place. In contrast, the Kirk/Bifurcate component of the site would represent a forager base camp. The high proportion of end scrapers present in the assemblage is used as evidence for the conclusions concerning the Palmer occupation.

The end scraper-to-pp/k ratio for this component of the site is the highest of any in the comparisons made here and, besides the ratio for the Hardaway site, is substantially higher than any of the others. The similarity of the ratios for the Hardaway and Haw River Palmer occupation is striking and surprising, considering the first is considered a forager residence while the other is considered a collector field camp. Daniel (1994) suggests that the high number of end scrapers in the Hardaway assemblage is related to the retooling activities at the site. That is, the end scrapers were discarded at Hardaway and not necessarily used there. This might hold for some of the 230 end scrapers classified as curated by Daniel (1994) but not for the 191 end scrapers that were not considered curated. Simply using these non-curated end scrapers to calculate the ratio results in a figure of 0.7 which is still three times that of the other sites examined here. This certainly suggests the possibility for bulk processing having been carried out at the Hardaway site. Conversely, bulk processing does not appear to have been an important factor in the assemblage formation at the Tellico or other Early Archaic sites considered here.

The Rucker's Bottom site is located on the Savannah River in the central Piedmont (Anderson and Schuldenrein 1985). Early Archaic materials were found in stratified contexts and about 20% of the chipped stone assemblage was of nonlocal raw materials. This is taken as evidence of a fair amount of mobility (Anderson and Hanson 1988). The artifactual and feature evidence is used to infer a short-duration of site-use by people employing a mobile, wide ranging adaptation with an emphasis on an expedient technology (Anderson and Hanson 1988:274). The Rucker's Bottom site is suggested to represent a summer-fall forager residence in the Band-

Macroband Model (Anderson and Hanson 1988:Figure 2).

The Rucker's Bottom site has the highest percentage of bifaces of all the site assemblages examined. This contrasts sharply with the Tellico assemblages where few bifaces were recovered. The relatively high percentage of retouched flake tools in the Tellico assemblages may indicate that they were used at these sites for tasks that bifaces fulfilled at other Early Archaic sites. The percentage of nonlocal flake debris at Rucker's Bottom is comparable only to the level found in the IBLK assemblage for the Tellico sites. Interestingly, the percentage of pp/ks for Rucker's Bottom and IBLK are similar, especially considering the range for this artifact class shown in Table 10.

Rucker's Bottom is one of the few sites considered here for which the amount of flake debris is published. A total of 22,114 flakes was recovered from the Early Archaic block excavations at Rucker's Bottom (Anderson and Schuldenrein 1985:Table 10-1). A flake to pp/k ratio of 789.8 is calculated for Rucker's Bottom which is surprisingly higher than any value calculated for the Tellico sites, the closest being PBI (396.9), IBBI (370.6), and IBUK (364.3) assemblages. The IBLK value is substantially lower at 168.1, but it is one of the higher values for the Tellico sites. The extremely high value for Rucker's Bottom is made potentially more understandable when recovery techniques are examined. All excavated matrix in the Rucker's Bottom excavation of the early Archaic block was passed through an eighth-inch screen while a quarter inch screen was standard for the Tellico excavations. Although a large number of flakes that would pass through a quarter inch screen were recovered at the Tellico sites, the assemblages would probably have been substantially larger with the systematic screening through eighth-inch mesh.

The G.S. Lewis site is also implicated in the Band-Macroband model. It is located in the Upper Coastal Plain of South Carolina about 35 km below the Fall Line. The site contained dense archaeological materials from the Archaic period and a distinct Early Archaic, Kirk Corner Notched component was excavated there (Anderson and Hanson 1988). Similar to the Tellico sites, a high percentage of the G.S. Lewis (about 99%) chipped stone assemblage was local raw materials (Anderson and Hanson 1988:275). The G.S. Lewis site based on artifacts and distributions of those artifacts is interpreted as reflecting an intensive, recurring, extended occupation during which a wide range of activities were undertaken (Anderson and Hanson 1988:278).

The relatively high percentage of bifaces at G.S. Lewis makes comparisons with the Tellico sites difficult, as is the case with all the site assemblages considered for comparative purposes. The calculation of a retouched flake tool to pp/k ratio suggests some similarities between the G.S. Lewis site (0.9) and the Tellico sites (IBLK=1.3; IBUK=1.1; RIUK=0.6; BFUK=0.7; IBBI=0.6; RIBI=1.0;

BFBI=0.3; PBI=1.3), especially the Upper Kirk assemblages. The values of 3.1 for Hardaway and 3.8 for Haw River-Palmer are not unexpected based on previous discussions and the values of 1.6 for the Haw River-Kirk/Bifurcate component and 0.4 for Rucker's Bottom would represent the extreme ends of the range of the Tellico values.

The Taylor site (38LX1) is implicated in both the Band-Macroband model and the Uwharrie-Allendale model. Surprisingly, the site is considered to have functioned as the location of periodic hunter-gatherer aggregation in both models. This interpretation is based on its location at the Fall Line for the Band-Macroband model and the diversity of raw materials in the assemblage for the Uwharrie-Allendale model. Anderson and Hanson (1988:270) suggest that the "Fall Line river terraces are posited as aggregation loci, since the dramatic character of this macro-ecotone, where rocks and shoals first appear proceeding inland from the coast, would facilitate population rendezvous." Daniel (1994:261) suggests that "the diversity of raw materials from the Taylor site (Michie 1992), which exhibits frequencies of raw material types from both the Piedmont and Coastal Plain that are unique among known assemblages in the Carolinas, reflect aggregation events held between groups from the Uwharrie and Allendale regions. The inclusion of the Taylor site for comparisons here is important because the potential has been raised by Kimball (1992) for the Early Archaic residential bases examined in this study to have served as aggregation sites.

The Taylor site is located about two miles below the Fall Line on the western side of the Congaree River (Michie 1992). Two major concentrations of Early Archaic Palmer materials were excavated at the site which appeared to have little contamination from later occupations (Michie 1992:216). The percentage of tools from the Taylor site for the general categories used in the comparisons here is also presented in Table 9.

Of the sites examined for comparison to the Tellico assemblages, the Taylor site appears most similar in terms of the percentages of general tool categories. Surprisingly, the percentages of all the categories are within the ranges of the sites in the TAP study area and the end scraper-to-pp/k ratio is also similar. In particular, the similarities of the Taylor and IBUK percentages and ratio are striking. It is difficult to establish the connection of these percentages of general tool categories and the Taylor site functioning as an aggregation site. The similarity with the IBUK assemblage does not provide evidence of it being an aggregation site but the implication is intriguing.

Although only general comparisons between the Tellico components analyzed in this study and other Early Archaic sites in the Southeast were possible, some interesting observations were made. First, these comparisons highlighted the low incidence of bifaces and biface fragments in the Tellico assemblages. This low incidence of bifaces suggests that pp/ks and retouched flake tools were used to fill the role general bifaces played at other Early Archaic sites in the Southeast. This helps explain the high percentage of early reduction observed at all Early Archaic components analyzed from the TAP study area. Second, at Early Archaic sites that are near major raw material resources such as Hardaway, G.S. Lewis, and the Tellico sites, an almost exclusive focus on local raw materials (over 95%) is observed. This further highlights the distinctiveness of the IBLK assemblage which contains over 10% nonlocal flake debris. Finally, the suggestion of previously unrecognized bulk processing activities at Hardaway based on similarities to the Haw River-Palmer assemblage indicates that further consideration of the role of the Hardaway site in a regional settlement-mobility system is necessary. Also, bulk processing appears not to have been an important activity at the other Early Archaic sites and components considered here.

Organization of Technology

Bipolar, core, and bifacial reduction techniques were all part of the organization of Early Archaic technologies in the TAP study area. Blade reduction, although previously suggested to have been an important part of this Early Archaic technology, was found to be nonexistent or at the most to have played a very minor role in the organization of the technology. Bipolar knapping was an important technique for the production of flakes from small, locally available raw materials. As such, it is not necessarily an indication of tool kit entropy or the expedient nature of the technology as noted by Goodyear (1989) for some Paleoindian sites. Following arguments by Goodyear (1993) and Shott (1994), *pieces esquillees* identified in the Tellico Early Archaic components are interpreted as mainly being bipolar cores not wedges, although this does not preclude the use of some as wedges or other types of tools. The bipolarization of formal chipped stone tools in the Tellico Early Archaic components is intriguing. The local availability of high quality materials argues against this being a method for deriving the last benefits from an exhausted tool kit. It is possible that these tools were used as wedges or that they represent the scavenging of discarded on-site materials when access to locally available resources is restricted such as by winter snows and frozen ground. The majority of the flake debris from all components is the result of core and bifacial reduction of locally available raw materials. The focus was on early (core) reduction but substantial middle and late stage reduction, involving the manufacture of unifacial and bifacial tools, was also undertaken. Although little nonlocal material was observed in any of the assemblages, the focus of the reduction of nonlocal materials was on middle and late stages. This suggests that nonlocal materials entered the sites as bifacial cores or finished tools. The small number of retouched flake tools argues against a substantial transport of flake blanks. The reduction of Fort Payne chert from the IBLK component, the only nonlocal raw material of a large quantity, indicates that Fort Payne bifacial cores were an important part of the technology at this time. The general lack of bifaces, besides formal pp/ks, is an interesting feature of the Tellico assemblages which is quite different from other sites in the Southeast. This suggests that pp/ks and retouched flake tools had to fill the roles normally filled at other Early Archaic sites by bifaces. This in part explains the focus on early stage reduction found for the Tellico assemblages. Overall, there are few differences in the general pattern of technological organization over the Early Archaic time period in the TAP study area.

There are several particular aspects that do highlight the variability in the organization of technology over the Early Archaic. First, the IBLK component has a significantly higher amount of nonlocal raw material than the others. Second, the PUK assemblage differs from the other UK assemblages in terms of densities and frequencies of chipped stone tools, flake debris, and features. This may be more related to the small area excavated at this site, so that only the periphery of the UK occupation was tested. Third, while there are similarities that can be pointed out for the IBUK, RIUK, and BFUK assemblages, the Bifurcate assemblages appear quite different. The Bifurcate assemblages differ in both the frequency of local/nonlocal flake debris and the reduction of local raw materials. Finally, differences in the data from the mass analysis and flake portion analysis suggest the possibility for specific differences in the reduction of local materials so that further investigations can focus at this level of investigation if such specific information is needed.

Settlement-Mobility Patterns

The initial interpretation of the sites considered in this study was in terms of a central-based transhumance model (Chapman 1975, 1977, 1978). This model is equivalent to a collector settlement-mobility system, although greater residential stability is suggested in the central-based transhumance model. Kimball (1992) in focusing on the Upper Kirk assemblages suggests that a collector settlement-mobility system was used. He further suggests the possibility for change with the Bifurcate assemblages to a forager settlement system. This pattern goes along with expectations derived from environmental data, in which a switch from a collector to a forager settlement mobility pattern is expected to coincide with early Holocene warming. The study presented here supports some of these conclusions, is equivocal with regard to others, and provides some new interpretations for consideration.

The Lower Kirk occupation has not received as much specific attention as the Upper Kirk and Bifurcate time periods which are documented in greater detail in terms of excavated sites. Kimball (1992), in making general statements, combines the Lower and Upper Kirk for comparison with Bifurcate. The analysis here of the Icehouse Bottom Lower Kirk (IBLK) assemblage suggests that there are distinct differences between it and both the Upper Kirk and Bifurcate. The Icehouse Bottom Lower Kirk (IBLK) assemblage contains the greatest amount of nonlocal flake debris which some may take as evidence of a hunter-gatherer aggregation site. But surprisingly very few nonlocal tools and a substantial number of tools of local materials were recovered. The flake debris analysis of nonlocal Fort Payne chert points to the importance of bifacial cores during this time period. This, coupled with a lack of nonlocal tools, suggests that nonlocal tools were maintained at Icehouse Bottom but not discarded there. The lack of evidence for bulk processing argues against the use of the site as a logistically-organized field camp. Rather, the evidence suggests that the Icehouse Bottom Lower Kirk (IBLK) component was used as a forager residence. This does not imply that the entire settlement-mobility system during this time could be characterized as a forager system. As with the Band-Macroband model, seasonal variation in settlement-mobility patterns is certainly a possibility. But, whatever time of the year was spent at Icehouse Bottom during the Lower Kirk time period, the people appear to have been operating from this site as foragers.

On the other hand, the Upper Kirk occupation as represented by the Icehouse Bottom, Rose Island, and Bacon Farm assemblages appears to best be characterized as a collector settlement-mobility system. Bulk processing does not appear to have been an important activity at these sites, but rather they appear to be base camps which were, in part, supported by logistically-organized task groups. However, a variety of activities were also undertaken at each of these sites. The Patrick Upper Kirk (PUK) component does not fit this pattern, but the limited excavations at this site may not have sampled the core of the Upper Kirk occupation. The relatively high number of nonlocal bifacial tools in the Icehouse Bottom Upper Kirk (IBUK) and Rose Island Upper Kirk (RIUK) assemblages point to the possibility of these sites being used for hunter-gatherer aggregations. For the Icehouse Bottom site (IBUK), it is interesting to note that a secondary human burial was found which, following the arguments of Hofman (1986), is expected at aggregation sites. The lack of preservation of bone at the Tellico sites makes this only an interesting fact as opposed to true support for Icehouse Bottom being an aggregation site during the Upper Kirk occupation. It is difficult to interpret the variability observed for the Bifurcate assemblages. The Bifurcate assemblages from Icehouse Bottom (IBBI) and Patrick (PBI) are suggested to represent gearing-up activities. This type of activity is not necessarily associated specifically with either foragers or collectors and the flake and tool patterns at these sites are different from those observed for the Upper Kirk

Bifurcate components. This potentially suggests a fair amount of distance between residential moves and that these groups were preparing for a situation in which raw materials would be difficult to obtain. One the one hand, one could suggest that the lack of clear patterning represents a change over the time period from one system to the other so that the assemblages represent a palimpsest that is difficult to interpret at this level of analysis. On the other hand, these assemblages could represent palimpsests resulting from variable site usage over the seasonal round. Other interpretations are also undoubtedly possible. Although a clear interpretation for the Bifurcate sites in the TAP study area is lacking, what is clear is that these assemblages are different from both the Lower Kirk and Upper Kirk assemblages.

The change over time in the settlement-mobility systems employed during the Early Archaic in the TAP study area has some bearing on models suggested for other areas of the Southeast. The fact that change is evident in the assemblages analyzed here and that environmental data have been used to suggest change in settlement mobility patterns over the time period (Cable 1992), makes it possible that different settlement-mobility models retain validity. Specifically, the Band-Macroband and Uwharrie-Allendale models may not necessarily stand in direct opposition. At one time during the Early Archaic one model may provide a close approximation of hunter-gatherer lifeways while later in that period the other model is better. Greater investigation of the potential for change over the Early Archaic time period is needed in other areas of the Southeast so that models can be better assessed.

Table 2: Total Analyzed Flake Debris per Component with Total Percentage Analyzed for each Site. (IB = Icehouse Bottom, RI = Rose Island, BF = Bacon farm, P = Patrick)

	LK	UK	BI	Total	Site %
IB	3759	4718	2886	11363	14.6
RI	--	298	3352	3850	13.1
BF	--	2473	1023	3496	23.7
P	--	67	731	798	24.2

Table 3: Density Per Square Foot of Artifacts and Features for Each Component. (LK = Lower Kirk, UK = Upper Kirk, BI = Bifurcate)

	Flakes	Tools	PP/K	Hearths	Other Features
IBLK	3.5	0.05	0.02	0.04	0.02
IBUK	21.7	0.18	0.06	0.05	0.05
RIUK	1.5	0.04	0.02	0.01	0.01
BFUK	15.6	0.35	0.18	0.02	0.02
PUK	1.2	0.01	0.01	0.02	0.01
IBBI	18.0	0.12	0.05	0.07	0.04
RIBI	17.2	0.28	0.10	0.09	0.10
BFBI	2.2	0.03	0.02	0.02	0.01
PBI	3.2	0.25	0.08	0.10	0.12

Table 4: Ratios Calculated for Making General Comparisons Between the Components.

	Flake:Tool	Tool:Flake
IBLK	81.6	0.8
IBUK	126.1	1.9
RIUK	41.3	2.1
BFUK	44.7	7.8
PUK	116.0	0.3
IBBI	177.4	1.0
RIBI	60.9	1.5
BFBI	73.1	0.8
PBI	127.0	1.1
Average	94.2	1.9

Table 5: Other Ratios Calculated for Making General Comparisons Between the Components.

	Flake:Hearth	PP/K:Hearth	Other Feature: Hearth
IBLK	86.7	0.5	0.4
IBUK	481.2	1.3	1.0
RIUK	316.3	4.0	2.7
BFUK	743.3	8.4	1.1
PUK	58.0	0.5	0.5
IBBI	275.7	0.7	0.6
RIBI	190.4	1.1	1.1
BFBI	98.9	1.0	0.6
PBI	317.5	0.8	1.2
Average	285.3	2.0	1.0

Table 6: Sample Size and Percentage of Local and Nonlocal Flake Debris for Each Component.

	Local Flake Debris N	%	Nonlocal Flake Debris N	%	Total
IBLK	3102	84.9	551	15.1	3653
IBUK	4324	96.7	147	3.3	4471
RIUK	287	97.5	11	2.5	298
BFUK	2324	94.1	60	5.9	2384
PUK	63	98.7	2	1.3	65
IBBI	2553	96.3	161	3.7	2714
RIBI	3292	96.9	137	3.1	3429
BFBI	985	96.0	13	4.0	998
PBI	639	94.1	40	5.9	679
Average	---	95.0	--	5.0	

Table 7: Local Flake Debris Divided into Reduction Stages.

	Early Stage N	%	Middle Stage N	%	Late Stage N	%	Total
IBLK	935	48.3	642	33.1	361	18.6	1938
IBUK	1496	55.4	731	27.1	471	17.5	2698
RIUK	89	58.9	29	19.2	33	21.9	151
BFUK	766	50.9	469	31.1	271	18.0	1506
PUK	16	45.7	13	37.1	6	17.1	35
IBBI	688	55.1	384	30.7	178	14.2	1250
RIBI	1083	61.4	514	29.2	166	9.4	1763
BFBI	199	42.1	180	38.1	94	19.8	473
PBI	241	71.1	77	22.9	18	5.4	336

Table 8: Average Weight of Flakes in Size Grade Three for Local and Nonlocal Flake Debris for each Component.

	Local	Nonlocal
IBLK	0.50 g	0.33 g
IBUK	0.62 g	0.41 g
RIUK	0.59 g	0.37 g
BFUK	0.57 g	0.41 g
PUK	0.64 g	0.50 g
IBBI	0.89 g	0.46 g
RIBI	0.60 g	0.52 g
BFBI	0.66 g	0.48 g
PBI	0.72 g	0.43 g

Table 9: Percentage of Local Flake Debris Portions and Two Assemblages Containing Nonlocal Materials.

	Complete	Broken	Fragment	Debris
IBLK	22.4	35.4	34.2	8.0
IBUK	22.8	26.2	34.4	16.6
RIUK	32.9	26.2	32.9	7.9
BFUK	30.2	25.2	33.9	10.7
PUK	19.6	21.7	34.8	23.9
IBBI	17.4	25.9	26.6	30.1
RIBI	22.9	24.2	36.9	16.0
BFBI	20.4	20.3	28.8	30.4
PBI	20.7	13.6	31.9	33.7
IBLK-NL	12.8	44.7	42.0	0.5
IBUK-NL	21.1	41.5	36.6	0.8

Table 10: Percentages of General Tool Categories at Early Archaic Sites in the Southeast. (Ret. = retouched flakes; E:PP/K = end scrapers to projectile points/knives)

	PP/K	Biface	Ret.	Drill	E:PP/K
IBLK	34.7	17.9	46.3	1.1	0.2
IBUK	35.5	21.9	40.5	2.0	0.3
RIUK	60.0	0.0	35.0	5.0	0.2
BFUK	51.1	11.4	36.7	0.8	0.2
IBBI	48.4	19.9	31.2	0.5	0.2
RIBI	45.8	10.4	43.4	0.4	0.2
BFBI	70.8	8.4	20.8	0.0	0
PBI	32.0	28.0	40.0	0.0	0.1
Hardaway	13.5	44.3	42.1	0.1	1.5
HR-Palmer	15.6	20.8	63.6	0.0	1.7
HR-K/BI	22.7	41.5	35.8	0.0	0.1
Ruckers B.	26.9	63.5	9.6	0.0	-
G.S. Lewis	29.8	42.7	27.5	0.0	-
Taylor	42.4	21.2	36.3	0.0	0.3

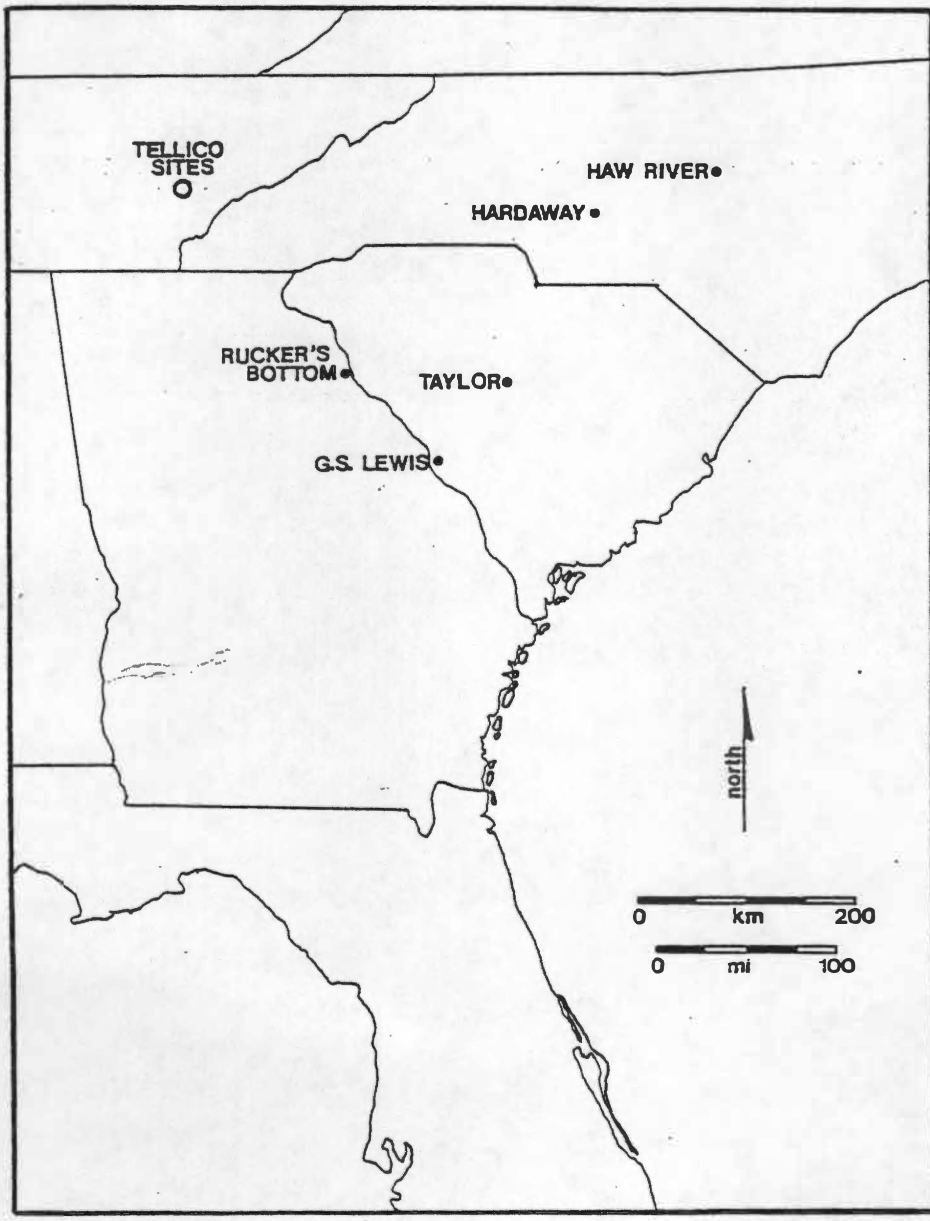

Figure 3: Location of Comparative Sites in the Southeast.

CHAPTER VIII

Summary and Conclusions

There is a great amount of behavioral diversity in ethnographic accounts of hunter-gatherers, so much so that the use of the category "hunter-gatherer" is called into question. This variability is doubtlessly surpassed by that of the past, especially considering the great time depth of the hunting and gathering lifeway and the transitions in cultural complexity that took place while people lived by hunting and gathering. Archaeologists have depended, in large part, on hunter-gatherer ethnographic accounts to make inferences concerning past behavior. However, the revisionist debate and evaluations of the role of hunter-gatherer ethnography for archaeological interpretation point to the problems caused by an overemphasis on ethnographic data such as the "San-itation" of the archaeological record. Archaeologists must attempt to examine hunter-gatherer behavioral variability without depending, completing, or even overemphasizing ethnographic accounts for interpretations. This presents a problem.

It is recognized that behavioral variability exists in past hunter-gatherer lifeways but there is no simple means to study this variability and gain an understanding of past hunter-gatherer lifeways and culture change. One solution is that archaeologists begin to examine prehistoric hunter-gatherer settlement-mobility patterns. Mobility is a behavior that is related to both social and economic strategies so it provides an initial means of investigating these two areas of behavior. Also, a decrease in mobility is linked to the development of cultural complexity. The documentation of prehistoric settlement-mobility patterns is a useful research strategy for the investigation of hunter-gatherer lifeways and changes in hunter-gatherer behavior. Another advantage of investigating settlement-mobility patterns is that archaeologists have had some success in such studies.

The archaeology of hunter-gatherers is largely the study of stones and bones but the analysis of these materials have not always been on an equal footing. The use of faunal remains for understanding prehistoric hunter-gatherer behavior, adaptations, and settlement-mobility patterns has been well recognized for over a decade. The recent publication of a number of important volumes concerning faunal studies illustrates the vibrancy of this area of research. The use of lithic remains in similar endeavors have not always been as successful. Thomas (1986), in a review of prehistoric hunter-gatherer studies berates lithic analysts while praising faunal analysts. He points out that the volume "*Bones*" has been published but its companion "*Stones*" was not even ready to be written. While not suggesting that the volume Stones is ready for publication, some recent advances in lithic analysis suggests that a rough draft may soon be forthcoming.

Advances in lithic analysis include a greater number of published flintknapping experiments, better methods for the analysis of flake debris, and, most importantly, the development of an organization-of-technology approach. It might be argued that the development of such an approach is linked to these other advances. One of the major questions that has been addressed with an organization-of-technology approach is prehistoric hunter-gatherer settlement-mobility patterns.

These advances in lithic analyses mean that stone and bone data can both be used for addressing similar questions. Multiple lines of evidence provide an important means of confirming interpretations or revealing ambiguities for further investigation. Also, since bones do not always preserve in the archaeological record, the study of stones is extremely important for understanding prehistoric hunter-gatherer lifeways.

An organization-of-technology approach guided the research presented in this study. The Early Archaic components reanalyzed here from the Tellico Archaeological Project did not contain preserved faunal remains. A large sample of chipped stone tools and flake debris was recovered in the excavation of a number of sites interpreted as base camps. The study of these sites provided something of a unique opportunity to examine the potential for change in the organization-of-technology and hunter-gatherer settlement mobility patterns over the Early Archaic period. In this study, several general and specific conclusions were reached. Conclusions specific to the Early Archaic in the Tellico area include the following:

1) although patterns of technological organization appear generally similar over the Early Archaic, there are apparent changes in settlement-mobility strategies;

2) the Lower Kirk occupation at Icehouse Bottom is suggestive of a forager settlement mobility system;

3) the Upper Kirk assemblages from Icehouse Bottom, Rose Island, and Bacon Farm generally appear quite similar and fit expectations for collector base camps, there is limited evidence to suggest that Icehouse Bottom was used as an aggregation site at this time; and,

4) the Bifurcate components are quite variable in assemblage composition, providing little evidence for clear interpretations, suggesting sites were used differently over the time period or used differently over a seasonal round;

5) based simply on the length of the growing season, a forager adaptation might be expected for the entire Early Archaic, however, other factors effect the adoption of a

mobility strategy which was apparently the case for at least the Upper Kirk occupation of East Tennessee;

6) the similarity between the Haw-River Palmer and Hardaway assemblages suggests that bulk processing took place at both sites and there is a lack of such evidence for other Early Archaic sites in the Southeast;

7) there is the possibility for change in the organization of technology and settlement-mobility patterns during the Early Archaic period in areas of the Southeast other than East Tennessee, so the various, apparently contradictory, settlement-mobility models could all retain some validity at different times.

Other, more general conclusions, were also reached including the following:

1) archaeologists should not project patterns of behavior derived from ethnographies into the past, but rather should explore the variability of prehistoric hunter-gatherer behavior;

2) site specific analyses allow for the exploration of variability which may not be evident at a more general level and these analyses complement studies at more general levels;

3) an organization-of-technology approach provides a means of structuring the study of lithic assemblages and of making inferences of past behavior, including social and economic strategies;

4) flake debris analysis serves as an important complementary data set to traditional chipped stone tool analyses and can play an important role in understanding the organization of prehistoric technologies and settlement-mobility patterns; and,

5) in attempting to understand patterning in prehistoric hunter-gatherer chipped stone assemblages, one should consider aspects of both the forager-collector and aggregation-dispersion models.

Finally, the research presented here illustrates well the value of reanalyzing existing collections and the role this can play in the advancement of archaeological knowledge. A number of programmatic statements have been made concerning the best course for the discipline of archaeology to take for the advancement of knowledge. Some theoreticians suggest greater middle range research. Others point to the lack of understanding of site formation processes, and variability in material culture. And, Darwinian evolutionary theory is emphasized by others. Still others suggest that archaeology should be more closely aligned with history or that interpretations are all relative and archaeology should be used to reveal current societal problems and archaeologists should be advocates for change. More recently, some archaeologists have observed that the best course of action is a reconciliation of current theoretical debates and a recognition that there are multiple ways of advancing archaeological knowledge.

It is suggested here that the reanalysis of existing collections can play an important role in advancing archaeological knowledge. In a manner of speaking reanalysis of existing collections as accomplished here can fit with all of the above. Archaeological interpretations depend on data. The only view that may question such a statement would be made by ultrarelativists whose programmatic statements lead to nihilism and nothing to say. If archaeological interpretations depend on data, then there must be solid, accurate descriptions and classifications of archaeological remains. In the "hard" sciences, experiments are conducted hundreds of times to verify results, yet in archaeology often one person will analyze an entire assemblage with little attention paid to possible biases in classifications or descriptions. Of course, what one considers relevant data depends on the questions asked and the approach or paradigm one is following. The reanalysis of existing collections not only allows for confirmation of original description but promotes looking at old materials in new ways or parts of an assemblage yet to be examined. Data and interpretations derived from several different analysts using different paradigms should result in some interesting debate. This type of debate has the potential to result in significant advances in archaeological knowledge in several areas: specific site and regional interpretations, methods of analyses, and paradigm development. Certainly, the reanalysis of existing collections is not a panacea that will remedy all archaeological debates. To the contrary, the result should be widespread debate. However, this simple task has promise for moving archaeology forward. A number of archaeologists working with several secure data sets from a single site or a number of sites is preferable to archaeologists in widely separate regions working sometimes with questionable data sets that are collected at different scales of analysis and then claiming that someone else's ideas do not work for their area.

The reanalysis here, while in some ways developing more questions than have been answered, was successful at revealing ambiguities in past analyses and pointing out new patterns. An artifact class that had previously received little attention has been examined in detail and a number of concluding remarks made concerning the specific cultures of a region. On the one hand, this study will not have a significant effect on the field of archaeology, even at a regional level, such as the Southeast. However, significant advances in archaeological knowledge can begin with one step.

References Cited

Ahler, S.A.

1971 Projectile Point Form and Function at Rodgers Shelter, Missouri. Missouri Archaeological Society Research Series, Number 8.

1989a Mass Analysis of Flaking Debris: Studying the Forest Rather Than the Trees. In Alternative Approaches to Lithic Analysis, edited by D.O. Henry and G.H. Odell, pp. 85-118. Archaeological Papers of the American Anthropological Association No. 1.

1989b Experimental Knapping With KRF and Midcontinent Cherts: Overview and Applications. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 199-234. BAR International Series 528.

Amick, D.S.

1987 Lithic Raw Material Variability in the Central Duck River Basin: Reflections of Middle and Late Archaic Organizational Strategies. TVA Publications in Anthropology 50, Norris, Tennessee.

1994 Technological Organization and the Structure of Inference in Lithic Analysis: An examination of Folsom Hunting Behavior in the American Southwest. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 9-34. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Amick, D.S., R.P. Mauldin, and L.R. Binford

1989 The Potential of Experiments in Lithic Technology. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 1-14. BAR International Series 528.

Anderson, D.G.

1992 Models of Paleoindian and Early Archaic Settlement in the Lower Southeast. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 28-47, Council of South Carolina Professional Archaeologists.

Anderson, D.G. and G.T. Hanson

1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Basin. American Antiquity 53:262-286.

Anderson, D.G. and L.D. O'Steen

1992 Late Pleistocene/Early Holocene Environmental Conditions in the South Carolina Area. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 3-6, Council of South Carolina Professional Archaeologists.

Anderson, D.G. and K.E. Sassaman

1992 Modeling Paleoindian and Early Archaic Settlement in the Lower Southeast: An Historical Perspective. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 19-27, Council of South Carolina Professional Archaeologists.

Anderson, D.G. and J. Schuldenrein

1983 Early Archaic Settlement on the Southeastern Atlantic Slope: A View from the Rucker's Bottom Site, Elbert County, Georgia. North American Archaeologist 4:177-210.

Anderson, D.G. and J. Schuldenrein (assemblers)

1985 Prehistoric Human Ecology Along the Upper Savannah River: Excavations at the Rcuker's Bottom, Abbeville, and Bullard Sites. Atlanta Interagency Archaeological Services Division, National Park Service, Russell papers 1985.

Anderson, D.G., K.E. Sassaman, and C. Judge (editors)

1992 Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective. Council of South Carolina Professional Archaeologists.

Andrefsky, W.

1991 Inferring Trends in Prehistoric Settlement Behavior From Lithic Production Technology in the Southern Plains. North American Archaeology 12:129-144.

1994 Raw-Material Availability and the Organization of Technology. American Antiquity 59:21-34.

Arnold, J.E.

1987 Technology and Economy: Microblade Core Production From the Channel Islands. In The Organization of Core Technology, edited by J.K. Johnson and C.A. Morrow, pp. 207-238, Westview Press, New York.

Bailey, H.P.
1960 A Method for Determining the Warmth and Temperateness of Climate. Geografiska Annaler 43(1):1-16.

Bamforth, D.B.
1986 Technological Efficiency and Tool Curation. American Antiquity 51(1):38-50.
1990 Settlement, Raw Material, and Lithic Procurement in the Central Mojave Desert. Journal of Anthropological Archaeology 9:70-104.
1991 Technological Organization and Hunter-Gatherer Land Use. American Antiquity 56:216-235.

Bamforth, D.B., G.R. Burns, and C. Woodman
1990 Ambiguous Use Traces and Blind Test Results: New Data. Journal of Archaeological Science 17:413-430.

Barnard, A.
1983 Contemporary Hunter-Gatherers: Current Theoretical Issues in Ecology and Social Organization. Annual Review of Anthropology 12:193-214.

Bartram, L.E., Jr.
1993 Perspectives on Skeletal Part Profiles and Utility Curves from Eastern Kalahari Ethnoarchaeology. In From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains, edited by J. Hudson, pp. 115-137. Center for Archaeological Investigations, Southern Illinois University at Carbondale, Occasional Paper No. 21, Carbondale.

Bar-Yosef, O.
1991 Raw Material Exploitation in the Levantine Epi-Paleolithic. In Raw Material Economies Among Prehistoric Hunter-Gatherers, edited by A. Montet-White and S. Holen, pp. 235-250, University of Kansas Publications in Anthropology, 19.

Baumler, M.F. and C.E. Downum
1989 Between Micro and Macro: A Study in the Interpretation of Small-Sized Lithic Debitage. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 101-116. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Beardsley, R.K., P. Holder, A. Krieger, M. Meggers, J. Rinaldo, and P. Kutsche
1956 Functional and Evolutionary Implications of Community Patterning. In Seminars in Archaeology 1955. Society for American Archaeology Memoir 11:129-157.

Beck, C. and G.T. Jones
1989 Bias and Archaeological Classification. American Antiquity 54:244-262.

Bettinger, R.L.
1991 Hunter-Gatherers: Archaeological and Evolutionary Theory. Plenum Press, New York.

Binford, L.R.
1962 Archaeology as Anthropology. American Antiquity 28:217-225.
1977 Forty-seven Trips: A Case Study in the Character of Archaeological Formation Process. In Stone Tools as Cultural Markers, edited by R.V.S. Wright, pp. 24-36. Australian Institute of Aboriginal Studies, Canberra.
1978 Nunamiut Ethnoarchaeology. Academic Press, New York.
1979 Organization and Formation Processes: Looking at Curated Technologies. Journal of Anthropological Research 35:255-273.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. American Antiquity 45:4-20.
1986 In Pursuit of the Future. In American Archaeology Past and Future, edited by D.J. Meltzer, D.D. Fowler, and J.A. Sabloff, pp. 459-479. Smithsonian Institution Press, Washington, D.C.
1987 Researching Ambiguity: Frames of Reference and Site Structure. In Method and Theory For Area Research, An Ethnoarchaeological Approach, edited by S. Kent, pp.449-512. Columbia University Press, New York.

Binford, L.R. and W.J. Chasko
1976 Nunamuit Demographic History: A Provocative Case. In Demographic Anthropology, edited by E. Zubrow, pp. 63-143. University of New Mexico Press, Albuquerque.

Bleed, P.
1986 The Optimal Design of Hunting Weapons: Maintainability or Reliability. American Antiquity 51:547-562.

Bleed, P., and A. Bleed
1987 Energetic Efficiency and Hand Tool Design: A Performance Comparison of Push and Pull Stroke Saws. Journal of Anthropological Archaeology 6:189-197.

Bousman, C. B.
1993 Hunter-Gather Adaptations, Economic Risk and Tool Design. Lithic Technology 18:59-86.

Bradbury, A.P. and P.J. Carr
n.d. Knapping Stone and Breaking Tradition: Experiments in Lithic Reduction. In press Lithic Technology.

Brown, J.A.
1982 On the Structure of Artifact Typologies. In Essays on Archaeological Typology, edited by R. Whallon and J.A. Brown, pp. 176-189. Center for American Archaeological Press.

Broyles, B.J.
1966 Preliminary Report: the St. Albans Site (46KA27), Kanawha County, West Virginia. The West Virginia Archaeologist 19:1-43.
1971 Second Preliminary Report: the St. Albans Site (46KA27), Kanawha County, West Virginia, 1964-1968. Report of Archaeological Investigations 3. West Virginia Geological and Economic Survey, Morgantown.

Bunn, H.T.
1993 Bone Assemblages at Base Camps: A Further Consideration of Carcass Transport and Bone Destruction by the Hadza. In From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains, edited by J. Hudson, pp. 138-155. Center for Archaeological Investigations, Southern Illinois University at Carbondale, Occasional Paper No. 21, Carbondale.

Burch, E.S.
1994 The Future of Hunter-Gatherer Research. In Key Issues in Hunter-Gatherer Research, edited by E.S. Burch and L.J. Ellana, pp. 441-455. Berg Press, Oxford.

Burch, E.S. and L.J. Ellanna
1994 Introduction. In Key Issues in Hunter-Gatherer Research, edited by E.S. Burch and L.J. Ellana, pp. 1-10. Berg Press, Oxford.

Byers, D.S.
1959 The Eastern Archaic: Some Problems and Hypotheses. American Antiquity 24:233-256.

Cable, J.S.
1982 Organizational Variability in Piedmont Hunter-Gatherer Lithic Assemblages. In The Haw River Sites: Archaeological Investigations at Two Stratified Sites in the North Carolina Piedmont, assembled by S.R. Clagget and J.S. Cable, pp. 637-688. Commonwealth Associates, Inc. Report R-2386, Jackson, MI. U.S. Army Engineer District, Wilmington. Wilmington, North Carolina.
1992 The Haw River Sites Revisited: Implications for Modeling Terminal Late Glacial and Early Holocene Hunter-Gatherer Settlement Systems in South Carolina. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 96-142, Council of South Carolina Professional Archaeologists.

Cahen, D., L.H. Keeley, and F.L. Van Noten
1979 Stone Tools, Toolkits, and Human Behavior in Prehistory. Current Anthropology 20:661-672.

Caldwell, J.
1958 Trend and Tradition in the Prehistory of the Eastern United States 9. American Anthropological Association Memoir 88.

Callahan, E.
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. Archaeology of Eastern North America 7:1-180.

Camilli, E.
1989 The Occupational History of Sites and the Interpretation of Prehistoric technological Systems: An Example from Cedar Mesa, Utah. In Time, Energy and Stone Tools, edited by R. Torrence, pp. 17-26, Cambridge University Press, Cambridge.

Carr, P.J.
1991 Organization of Technology and Lithic Analysis: Prehistoric Hunter-Gatherer Occupation of the Hayes Site (40ML139). Unpublished M.A. Thesis, Department of Anthropology, University of Tennessee, Knoxville.
1994a The Organization of Technology: Impact and Potential. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 1-8. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.
1994b Technological Organization and Prehistoric Hunter-Gatherer Mobility: Examination of the Hayes Site. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 35-44. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Carr, P.J. (editor)
1994 The Organization of North American Prehistoric Chipped Stone Tool Technologies. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Carr, P.J., J.L. Hofman, and W.E. Klippel
n.d. Exploring the Forager-Collector Continuum. Manuscript in possession of the author.

Carr, P.J. and B. Koldehoff
1994 A Preliminary Analysis of Mississippian Lithic Technology at Wickliffe Mounds (15BA4), Ballard County, Kentucky. Tennessee Anthropologist 19:46-65.

Cashdan, E.
1985 Coping with Risk: Reciprocity Among the Basawra of Northern Botswana. Man 20:454-474.

Chapman, J.
1975 The Rose Island site and the Bifurcate Point Tradition. University of Tennessee, Department of Anthropology, Report of Investigations No. 14.
1977 The Archaic Period Research in the Lower Little Tennessee River Valley--1975: Icehouse Bottom, Harrison Branch, Thirty Acre Island, Calloway Island. University of Tennessee, Department of Anthropology, Report of Investigations No. 18.
1978 The Bacon Farm Site and a Buried Site Reconnaissance. University of Tennessee, Department of Anthropology, Report of Investigations No. 23 and Tennessee Valley Authority Publications in Anthropology 9.
1979 The Howard and Calloway Island sites. University of Tennessee, Department of Anthropology, Report of Investigations 27 and Tennessee Valley Authority, Publications in Anthropology 23.
1985 Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In Structure and Process in Southeastern Archaeology, edited by R.S. Dickens and H.T. Ward, pp. 137-153. University of Alabama Press.

Chapman, J., P.A. Delcourt, P. Cridlebaugh, and H. Delcourt
1982 Man-Land Interaction: 10,000 Years of American Indian Impact on Native Ecosystems in the Lower Little Tennessee River Valley, East Tennessee. Southeastern Archaeology 1:115-121.

Chapman, J. and A.B. Shea
1981 The Archaeobotanical Record: Early Archaic period to Contact in the Lower Little Tennessee River Valley. Tennessee Anthropologist VI(1):61-84.

Clagget, S.R.
1982 Archaeological Background. In The Haw River Sites: Archaeological Investigations at Two Stratified Sites in the North Carolina Piedmont, assembled by S.R. Clagget and J.S. Cable, pp. 21-67. Commonwealth Associates, Inc. Report R-2386, Jackson, MI. U.S. Army Engineer District, Wilmington. Wilmington, North Carolina.

Clagget, S.R. and J.S. Cable (assemblers)
1982 The Haw River Sites: Archaeological Investigations at Two Stratified Sites in the North Carolina Piedmont, assembled by S.R. Clagget and J.S. Cable, pp. 21-67. Commonwealth Associates, Inc. Report R-2386, Jackson, MI. U.S. Army Engineer District, Wilmington. Wilmington, North Carolina.

Clark, J.E.
1987 Politics, Prismatic Blades, and Mesoamerican Civilization. In The Organization of Core Technology, edited by J.K. Johnson and C.A. Morrow, pp. 259-284, Westview Press, New York.

Coe, J.L.
1964 The Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society 54(5).

Collins, M.B.
1975 Lithic Technology as a Means of Processual Inference. In Lithic Technology: Making and Using Stone Tools, edited by E. Swanson, pp. 15-34, Hague, Mouton.

Conkey, M.W.
1980 The Identification of Prehistoric Hunter-gatherer Aggregation Sites: The Case of Altamira. Current Anthropology 21:609-630.

Crabtree, D.
1972 An Introduction to Flintworking. Occasional Papers of the Idaho State University Museum 28, Pocatello.

Cridlebaugh, P.A.
1984 American Indian and Euro-American Impact Upon Holocene Vegetation in the Lower Little Tennessee River Valley, East Tennessee. Unpublished Ph.D. dissertation, Department of Anthropology, University of Tennessee, Knoxville.

Cross, J.R.
1983 Twigs, Branches, Trees, and Forests: Problems of Scale in Lithic Analysis. In Archaeological Hammers and Theories, edited by J.A. Moore and A.S. Keene, pp. 87-106. Academic Press, New York.

Damas, D.
1969 Environment, History and Central Eskimo Society. In Contributions to Anthropology: Ecological Essays, edited by D. Damas, pp. 40-64, National Museums of Canada, Ottawa.

Daniel, I.R., Jr.
1992 Early Archaic Settlements in the Southeast: A North Carolina Perspective. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 68-77, Council of South Carolina Professional Archaeologists.
1994 Hardaway Revisited: Early Archaic Settlement in the Southeast. Unpublished Ph.D. dissertation, Department of Anthropology, University of Nort Carolina, Chapel Hill.

Davis, R.P.S.
1990 Aboriginal Settlement Patterns in the Little Tennessee River Valley. University of Tennessee, Department of Anthropology, Report of Investigations 50.

Delcourt, P.A.
1980 Quaternary Alluvial Terraces of the Little Tennessee River Valley, East Tennessee. In The 1979 Archaeological and Geological Investigations in the Tellico Reservoir, edited by J. Chapman, pp. 110-121. University of Tennessee, Department of Anthropology, Report of Investigations No. 29.

Delcourt, P.A. and H.R. Delcourt
1979 Late Pleistocene and Holocene Distributional History of the Deciduous Forest in the Southeastern United States. Veroff. Geobot. Inst. ETH, Stuftung Rubel, Zurich 68:79-107.
1980 Pollen Preservation and Quaternary Environmental History in the Southeastern United States. Palynology 4:215-231.
1981 Vegetation Maps for Eastern North America: 40,000 YR B.P. to the Present. In Geobotany II, edited by Robert Romans, pp. 123-165. Plenum Publishing, New York.

Denbow, J.R.
1986 A New Look at the Later Prehistory of the Kalahari. Journal of African History 27:3-28.

Dincauze, D.F.
1991 Discussant's Commentary on the Meeting. Paper presented at the Meeting of the Council of South Carolina Professional Archaeologists, Columbia.
1992 Symposium Comments, Reconsidered in Leisure. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 359-360, Council of South Carolina Professional Archaeologists.

Downs, J.F.
1966 The Two Worlds of the Washo: An Indian Tribe of California and Nevada. Holt, Rhinehart and Winston, Inc., Fort Worth.

Dunnell, R.C.
1971 Systematics in Prehistory. Free Press, New York.

1979 Comment on Stone Tools, Toolkits, and Human Behavior in Prehistory. Current Anthropology 20:673.

1980 Americanist Archaeology: The 1979 Contribution. American Journal of Archaeology 84:463-478.

1984 The Americanist Literature for 1983: A Year of Contrasts and Challenges. American Journal of Archaeology 88:489-513.

1989 Aspects of the Application of Evolutionary Theory in Archaeology. In Archaeological Thought in America, edited by C.C. Lamberg Karlovsky, pp. 35-49. Cambridge University Press, Cambridge, England

Dunnell, R.C. and W.S. Dancey
1983 The Siteless Survey: A Regional Scale Data Collection Strategy. In Advances in Archaeological Method and Theory, vol. 6, edited by M.B. Schiffer, pp. 267-287. Academic Press, New York.

Durham, W.H.
1981 Overview: Optimal Foraging Analysis in Human Ecology. In Hunter-Gatherer Foraging Strategies: Ethnographic and Archeological Analyses, edited by B. Winterhalder and E.A. Smith, pp. 218-231. University of Chicago Press, Chicago.

Dye, D.
1980 Primary Forest Efficiency in the Western Tennessee Valley. Unpublished Ph.D. dissertation, Department of Anthropology, Washington University, St. Louis, Missouri.

Ebert, J.I.
1986 Distributional Archaeology: Nonsite Discovery, Recording and Analytic Methods for Application to the Surface Archaeological Record. Ph.D. dissertation, University of New Mexico. University Microfilms, Ann Arbor.

Ellen, R.
1982 Environment, Subsistence and System. Cambridge University Press, Cambridge.

Ensor, K.C. and E. Roemer, Jr.
1989 Comments on Sullivan and Rozen's Debitage Analysis and Archaeological Interpretation. American Antiquity 54:175-178.

Feit, H.A.
1994 The Enduring Pursuit: Land, Time and Social Relationships in Anthropological Models of Hunter-Gatherers and in Subarctic Hunters' Images. In Key Issues in Hunter-Gatherer Research, edited by E.S. Burch and L.J. Ellana, pp. 421-440. Berg Press, Oxford.

Fish, P.R.
1978 Consistency in Archaeological Measurement and Classification: A Pilot Study. American Antiquity 43:86-89.

Fisher, J.W. and H.C. Strickland
1991 Dwellings and Fireplaces: Keys to Efe Pygmy Campsite Structure. In Ethnoarchaeological Approaches to Mobile Campsites, edited by C.S. Gamble and W.A. Boismer, pp. 215-236. International Monographs in Prehistory, Ann Arbor.

Foley, R.
1981 Off-site Archaeology: An Alternative Approach for the Short-sited. In Patterns of the Past: Studies in the Honor of David Clarke, edited by I. Hodder, G. Isaac, and N. Hammond, pp. 157-183. Cambridge University Press, Cambridge England.

Franklin, A.
1981 What Makes a Good Experiment?. British Journal of Philosophical Science 32:367-379.

Fulgham, S.
1980 Selection of Lithic Raw Materials at the Icehouse Bottom Site (40MR23) Monroe County, Tennessee. Unpublished M.A. thesis, Department of Geography and Anthropology, Louisiana State University.

Gamble, C.S. and W.A. Boismer (editors)
1991 Ethnoarchaeological Approaches to Mobile Campsites. International Monographs in Prehistory, Ann Arbor.

Gargett, R. and B. Hayden
1991 Site Structure, Kinship, and Sharing in Aboriginal Australia: Implications for Archaeology. In The Interpretation of Archaeological Spatial Patterning, edited by E.M. Kroll and T.D. Price, pp. 61-76. Plenum Press, New York.

Geneste, J.M.
1985 Amalysis Lithique d'Industries Moustriennes du Perigord: Une Approche Technoligique du Comportement des Groupes Humains au Paleolithique Moyen. Unpublished dissertation, l'Universite de Bordeaux I.

Gero, J.M.
1989 Assessing Social Information in Material Objects: How Well Do Lithics Measure Up?. In Time, Energy and Stone Tools, edited by R. Torrence, pp. 92-105, Cambridge University Press, Cambridge.
1991 Genderlithics: Women's Roles in Stone Tool Production. In Engendering Archaeology: Women and Prehistory, edited by J. M. Gero and M. W. Conkey, pp. 163-193. Basil Blackwell, Cambridge.

Gifford-Gonzalez, D.
1989 Modern Analogues: Developing an Interpretive Framework. In Bone Modification, edited by R. Bonnichsen and M. Sorg, pp. 43-52. Center for the Study of Early Man, University Maine, Orono.

Goodyear, A. C.
1974 The Brand Site: A Techno-Functional Study of a Dalton Site in Northeast Arkansas. Research Series No. 7. Arkansas Archeological Survey, Fayetteville.
1989 A Hypothesis of the Use of Cryptocrystalline Raw Materials Among Paleo-indian Groups of North America. In Eastern Paleoindian Lithic Resource Use, edited by C.J. Ellis and J.C. Lothrop, pp. 1-9. Westview Press, New York.
1993 Tool Kit Entropy and Bipolar Reduction: A Study of Interassemblage Lithic Variability Among Paleo-Indian Sites in the Northeastern United States. North American Archaeologist 14:1-23.

Goodyear, A.C., J.H. House, and M.J. Brooks
1979 Laurens-Anderson: An Archaeological Study of the Interriverine Piedmont. Institute of Archaeology and Anthropology, University of South Carolina, Anthropological Studies 4.

Grace, R.
1990 The Limitations and Applications of Use Wear Analysis. In The Interpretive Possibilities of Microwear Studies, edited by B. Graslund, H. Knutsson, K. Knutsson, and J. Taffinder, pp. 9-14. Societas Archaeologica Upsaliensis, AUN 14, Uppsala, Sweden.

Greaves, S.
1982 Upon the Point: A Preliminary Investigation of Ethnicity as a Source of Metric Variation in Lithic Projectile Points. Archaeological Survey of Canada 109, National Museum of Canada, Ottawa.

Griffin, J.B.
1952 Culture Periods in Eastern United States Archaeology. In Archaeology of Eastern United States, edited by J.B. Griffin, pp. 325-364, University of Chicago Press, Chicago.

Gryba, E.M.
1988 A Stone Age Pressure Method of Folsom Fluting. Plains Anthropologist 33:53-66.

Hanson, G.T.
1988 Early Archaic Technological and Spatial Organization at the G.S. Lewis Site. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix.

Harris, D.R.
1979 Foragers and Farmers in the Western Torres Strait Islands: An Historical Analysis of Economic, Demographic, and Spatial Differentiation. In Social and Ecological Systems, edited by P.C. Burnham and R.F. Ellen, pp. 75-109. Academic Press, London.

Hayden, B. and N. Franco
1993 Keatley Creek Lithic Strategies and Design. Paper presented at the Tulsa Conference on Theory in Lithic Analysis, Tulsa Oklahoma.

Henry, D.O.
1989 Correlations Between Reduction Strategies and Settlement Patterns. In Alternative Approaches to Lithic Analysis, edited by D.O. Henry and G.H. Odell, pp. 139-156. Archaeological Papers No. 1, American Anthropological Association, Washington, D.C.

Hitchcock, R.K.
1982 Patterns of Sedentism Among the Basarwa of Eastern Botswana. In Politics and History in Band Society, edited by E. Leacock and R.B. Lee, pp. 223-267. Cambridge University Press, New York.

Hofman, J.L.
1984 Hunter-Gatherers in the Nashville Basin of Tennessee, 8000-5000 B.P. Tennessee Anthropologist 9: 127-192.
1986 Hunter-Gatherer Mortuary Variability: Toward an Explanatory Model. Unpublished Ph.D. dissertation, Department of Anthropology, University of Tennessee, Knoxville.
1991 Folsom Land Use: Projectile Point Variability as a Key to Mobility. In Raw Material Economies Among Prehistoric Hunter-Gatherers, edited by A. Montet-White and S. Holen, pp. 335-356, University of Kansas Publications in Anthropology, 19.
1992 Putting the Pieces Together: An Introduction to Refitting. In Piecing Together the Past: Applications of Refitting Studies in Archaeology, pp. 1-20, edited by J.L. Hofman and J.G. Enloe, BAR International Series 578.

Hudson, J.
1993 The Impacts of Domestic Dogs on Bone in Forager Camps. In From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains, edited by J. Hudson, pp. 301-323. Center for Archaeological Investigations, Southern Illinois University at Carbondale, Occasional Paper No. 21, Carbondale.

Ingbar, E.E.
1994 Lithic Material Selection and Technological Organization. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 35-44. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Ingbar, E.E., M.L. Larson, and B.A. Bradley
1989 A Nontypological Approach to Debitage Analysis. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 117-136. BAR International Series 528.

Inizian, M.L., H. Roche, and J. Tixier
1992 Technology of Knpaped Stone. CREP, Meudon.

Isaac, B.L.
1987 Introduction. In Research in Economic Anthropology, Volume 9, edited by B.L. Isaac, pp. 1-17.. JAI Press, Greenwich.
1990 Economy, Ecology, and Analogy: The !Kung San and the Generalized Foraging Model. In Research in Economic Anthropology, Supplement 5, edited by K.B. Tankersley and B.L. Isaac, pp. 323-336. JAI Press, Greenwich

Isaac, G.L.
1978 Food Sharing and Human Evolution: Archaeological Evidence from the Plio-Pleistocene of East Africa. Journal of Anthropological Research 34:311-325.

Jelinek, A.J.
1991 Observations on Reduction Patterns and Raw Materials in Some Middle Paleolithic Industries in the Perigord. In Raw Material Economies Among Prehistoric Hunter-Gatherers, edited by A. Montet-White and S. Holen, pp. 7-32, University of Kansas Publications in Anthropology, 19.

Jeske, R.J.
1992 Energetic Efficiency and Lithic Technology: An Upper Mississippian Example. American Antiquity 57:467-481.

Jeter, M.D.
1977 Archaeology in Copper Basin, Yavapai County, Arizona: Model Building for the Prehistory of the Prescott Region. Arizona State University Anthropological Research Paper No. 11, Tempe.

Jochim, M.A.
1989 Optimization and Stone Tool Studies: Problems and Potential. In Time, Energy and Stone Tools, edited by R. Torrence, pp. 106-111, Cambridge University Press, Cambridge.
1991 Archaeology as Long-Term Ethnography. American Anthropologist 93:308-321.

Johnson, J.K.
1983 Poverty Point Period Blade Technology in the Yazoo Basin, Mississippi. Lithic Technology 12(3):49-56.
1987 Cahokia Core Technology in Mississippi: The View from the South. In The Organization of Core Technology, edited by J.K. Johnson and C. Morrow, pp. 187-206. Westview Press, New York.

1989 The Utility of Production Trajectory Modeling as a Framework for Regional Analysis. In Alternative Approaches to Lithic Analysis, edited by D.O. Henry and G.H. Odell, pp. 119-138. Archaeological Papers No. 1, American Anthropological Association, Washington, D.C.
1993 Lithics. In The Development of Southeastern Archaeology, edited by J.K. Johnson, University of Alabama Press, Tuscaloosa.

Johnson, J.K. and C.A. Morrow (editors)
1987 The Organization of Core Technology. Westview Press, New York.

Julig, P. J., L. A. Pavlish, and R. G. V. Hancock
1989 Aspects of Late Paleoindian Lithic Technological Organization in the Northwestern Lake Superior Region of Canada. In Eastern Paleoindian Lithic Resource Use, edited by C.J. Ellis and J.C. Lothrop, pp. 293-322. Westview Press, New York.

Justice, N.
1987 Stone Age Spear and Arrow Points of the Midcontinental and eastern United States: A Modern Survey and Reference. Indiana University Press, Bloomington, Indiana.

Keeley, L.H.
1980 Experimental Determination of Stone Tool Uses. University of Chicago Press, Chicago.
1982 Hafting and Retooling: Effects on the Archaeological Record. American Antiquity 47:798-809.
1988 Hunter-Gatherer Economic Complexity and "Population Pressure": A Cross-Cultural Analysis. Journal of Archaeological Research 7:373-411.

Keeley, L.H. and M.H. Newcomer
1977 Microwear Analysis of Experimental Flint Tools: A Test Case. Journal of Archaeological Science 4:29-62.

Kelly, R.L.
1983 Hunter-Gatherer Mobility Strategies. Journal of Anthropological Research 39:277-306.
1988 The Three Sides of a Biface. American Antiquity 53:717-734.
1992 Mobility/Sedentism: Concepts, Archaeological Measures, and Effects. Annual Review of Anthropology 21:43-66.
1995 Hunter-Gatherers: Variability in Ecology, Economy and Society. Manuscript in possession of the author, to be published by Smithsonian Institution Press.

Kelly, R.L. and L.C. Todd
1988 Coming into the Country: Early Paleoindian Hunting and Mobility. American Antiquity 53:231-244.

Kent, S.
1991 The Relationship Between Mobility Strategies and Site Structure. In The Interpretation of Archaeological Spatial Patterning, edited by E.M. Kroll and T.D. Price, pp. 33-59. Plenum Press, New York.

Kimball, L.R.
1982 Lithic Artifact Analysis. In An Archaeological Survey and Assessment of Aboriginal Settlement within the Lower Little Tennessee River Valley, edited by R.P.S. Davis, L.R. Kimball, and W.W. Baden, pp. 85-192. Technical report submitted to the Tennessee Valley Authority, Norris.
1985 The 1977 Archaeological Survey: An Overall Assessment of the Archaeological Resources of Tellico Reservoir. Tennessee Valley Authority, Norris, Publications in Anthropology 39.
1992 Early Archaic Settlement and Technology: Lessons From Tellico. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 143-181, Council of South Carolina Professional Archaeologists.
1993 Rose Island Site Revisited: The Detection of Early Archaic Site Structure Using Grid-Count Data. Southeastern Archaeology 12:93-116.

Kintigh, K.W.
1989 Sample Size, Significance, and Measures of Diversity. In Quantifying Diversity in Archaeology edited by R.D. Leonard and G.T. Jones, pp. 25-36, Cambridge University Press, Cambridge.

Koldehoff, B.
1987 The Cahokia Flake Tool Industry: Socioeconomic Implications For Late Prehistory in the Central Mississippi Valley. In The Organization of Core Technology, edited by J.K. Johnson and C.A. Morrow, pp. 187-206. Westview Press, New York.

Kuhn, S. L.
1989 Hunter-Gatherer Foraging Organization and Strategies of Artifact Replacement and Discard. In Experiments in Lithic Technology, edited by D. S. Amick and R. P. Mauldin, pp. 33-48, BAR International Series 528.
1991 "Unpacking" Reduction: Lithic Raw Material Economy in the Mousterian of West-Central Italy. Journal of Anthropological Archaeology 10:76-106.
1994 A Formal Approach to the Design and Assembly of Mobile Toolkits. American Antiquity 59:426-442.

Lange, F.W.
1980 Prehistory and Hunter-Gatherers: The Role of Analogs. Midcontinental Journal of Archaeology 5:133-147.

Larson, M.L.
1994 Toward a Holistic Analysis of Chipped Stone Assemblages. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 57-69. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Larson, M.L. and E.E. Ingbar
1992 Perspectives on Refitting: Critique and a Complementary Approach. In Piecing Together the Past: Applications of Refitting Studies in Archaeology, edited by J.L. Hofman and J.G. Enloe, pp. 151-162. BAR International Series 578.

Lee, R.B.
1979 The !Kung San: Men, Women, and Work in a Foraging Society. Cambridge University Press, Cambridge.
1992 Art, Science, or Politics? The Crisis in Hunter-Gatherer Studies. American Anthropologist 94:31-54.

Lee, R.B. and I. DeVore (editors)
1968 Man the Hunter. Aldine, Chicago.

Leonard, R. and G. Jones
1987 Elements of an Inclusive Evolutionary Model for Archaeology. Journal of Anthropological Archaeology 6:199-219.

Lothrop, J.C.
1989 The Organization of Paleoindian Lithic Technology at the Potts Site. In Eastern Paleoindian Lithic Resource Use, edited by C.J. Ellis and J.C. Lothrop, pp. 99-138, Westview Press, New York.

Lothrop, J.C. and B. Koldehoff
1992 Technological Organization and Settlement Mobility: A Critical Evaluation. Paper Presented at the 57th Annual Meeting of the Society for American Archaeology, Pittsburgh.

Lyman, R.L.
1991 Subsistence Change and Pinniped Hunting. In Human Predators and Prey Mortality, edited by M.C. Stiner, pp. 187-199. Westview Press, New York.

MacDonald, G.F.
1968 Debert: A Paleo-Indian Site in Central Nova Scotia. National Museum of Man, Anthropology Papers, No. 16.

Magne, M.P.R.
1985 Lithics and Livelihood: Stone Tool Technologies of Central and Southern Interior British Columbia. Mercury Series No. 13, National Museum of Man, Ottawa.
1989 Lithic Reduction Stages and Assemblage Formation Processes. In Experiments in Lithic Technology, edited by D. S. Amick and R. P. Mauldin, pp. 15-32. BAR International Series 528.

Martin, M. K.
1974 The Foraging Adaptation: Uniformity or Diversity? Addison-Wesley Module in Anthropology 56.

Mauldin, R.P. amd D.S. Amick
1989 Investigating Patterning in Debitage from Experimental Bifacial Core Reduction. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 67-88. BAR International Series 528.

McAnany, P.
1988 The Effects of Lithic Procurement Strategies on Tool Curation and Recycling. Lithic Technology 17:3-11.

1989 Stone-Tool Production and Exchange in the Eastern Maya Lowlands: The Consumer Perspective from Pulltrouser Swamp, Belize. American Antiquity 54:332-346.

McDonald, M.M.
1991 Technological Organization and Sedentism in the Epipalaeolithic of Dakhleh, Egypt. The African Archaeological Review 9:81-109.

McMillan, R.B. and W.E. Klippel
1981 Post-Glacial Environmental Change and Hunting-Gathering Societies of the Southern Prairie Peninsula. Journal of Archaeological Science 8:215-245.

Meltzer,D.J.
1989 Was Stone Exchanged Among Eastern North American Paleoindians? In Eastern Paleoindian Lithic Resource Use, edited by C.J. Ellis and J.C. Lothrop, pp. 11-39, Westview Press, New York.

Metcalfe, D. and K.R. Barlow
1992 A Model for Exploring the Optimal Trade-Off between Field Processing and Transport. American Anthropologist 94:340-356.

Michie, J.L.
1992 The Taylor Site: An Early Occupation in Central South Carolina. In Paleoindian and Early Archaic Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 208-241, Council of South Carolina Professional Archaeologists.

Montet-White, A,
1991 Lithic Acquisition, Settlements and Territory in the Epigravetian of Central Europe. In Raw Material Economies Among Prehistoric Hunter-Gatherers, edited by A. Montet-White and S. Holen, pp. 205-221, University of Kansas Publications in Anthropology, 19.

Morrow, C.A.
1987 Blades and Cobden Chert: A Technological Argument for Their Role as Markers of Regional Identification During the Hopewell Period in Illinois. In The Organization of Core Technology, edited by J.K. Johnson and C.A. Morrow, pp. 207-238, Westview Press, New York.

Murdock, G.P.
1967 The Ethnographic Atlas: A Summary. Ethnology 6(2).

Myers, F. R.
1988 Critical Trends in the Study of Hunter-Gatherers. Annual Review of Anthropology 17:261-282.

Nelson, M.C.
1991 The Study of Technological Organization. In Archaeological Method and Theory Vol.3, edited by M. Schiffer, pp. 57-100, University of Arizona Press, Tucson.
1992 Technological Strategies Responsive to Subsistence Stress: Analysis of Prehistoric Southwestern Hunting Weaponry. Paper Presented at the 57th Annual Meeting of the Society for American Archaeology, Pittsburgh.
1994 Technological Strategies Responsive to Subsistence Stress. Manuscript in possession of the author.

Nelson, M.C. and E.L. Camilli
1984 The Relationship Between Prehistoric Technological Organization and Land Use. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland, Oregon.

Nelson, M.C. and H. Lippmeier
1993 Grinding-Tool Design as Conditioned by Land-Use Pattern. American Antiquity 58:286-305.

Newcomer, M.
1979 Comment on Stone Tools, Toolkits, and Human Behavior in Prehistory. Current Anthropology 20:675.

Newcomer, M., R. Grace, and R. Unger-Hamilton
1986 Investigating Microwear Polishes with Blind Tests. Journal of Archaeological Science 13:203-217.

Nicholson, A. and S. Cane
1991 Desert Camps: Analysis of Australian Aboriginal Proto-Historic Campsites. In Ethnoarchaeological Approaches to Mobile Campsites, edited by C.S. Gamble and W.A. Boismer, pp. 263-354. International Monographs in Prehistory, Ann Arbor.

O'Connell, J.F.
1979 Room to Move: Contemporary Alywara Settlement Patterns and their Implications for Aboriginal Housing Policy. In A Black Reality: Aboriginal Camps and Housing in Remote Australia, edited by M. Heppell, 97-120. Australian Institute of Aboriginal Studies, Canberra.

O'Connell, J.F. and K. Hawkes
1981 Alywara Plant Use and Optimal Foraging Theory. In Hunter-Gatherer Foraging Strategies: Ethnographic and Archeological Analyses, edited by B. Winterhalder and E.A. Smith, pp. 99-125. University of Chicago Press, Chicago.

O'Connell, J.F., K. Hawkes and N.B. Jones
1991 Distribution of Refuse-Producing Activities at Hadza Residential Base Camps: Implications for Analyses of Archaeological Site Structure. In The Interpretation of Archaeological Spatial Patterning, edited by E.M. Kroll and T.D. Price, pp. 61-76. Plenum Press, New York.

Odell, G.H.
1979 A New and Improved System for the Retrieval of Functional Information from Microscopic Observations of Chipped Stone Tools. In Lithic Use-Wear Analysis, edited by B. Hayden, pp. 329-344. Academic Press, New York.
1979 Comment on Stone Tools, Toolkits, and Human Behavior in Prehistory. Current Anthropology 20:676-677.
1981 The Morphological Express at Function Junction: Searching for Meaning in Lithic Tool Types. Journal of Anthropological Research 37:319-342.
1993 Economizing Behavior and the Concept of "Curation". Paper presented at the Tulsa Conference on Theory in Lithic Analysis, Tulsa Oklahoma.
1994a Assessing Hunter-Gatherer Mobility in the Illinois Valley: Exploring Ambiguous Results. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 35-44. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.
1994b Prehistoric Hafting and Mobility in the North American Midcontinent: Examples from Illinois. Journal of Anthropological Archaeology 13:51-73.

Odell, G.H. and F. Odell-Vereecken
1980 Verifying the Reliability of Lithic Use-Wear Assessments by "Blind Tests:" The Low-Power Approach. Journal of Field Archaeology 7:87-120.

O'Steen, L.D.
1992 Paleoindian and Late Archaic Settlement Along the Oconee Drainage. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 78-95, Council of South Carolina Professional Archaeologists.

Parry, W.J.
1994 Prismatic Blade Technologies in North America. In The Organization of Prehistoric North American Chipped Stone Tool Technologies, edited by P. Carr, pp. 87-98. International Monographs in Prehistory Archaeological Series No. 7, Ann Arbor.

Parry, W.J. and R.L. Kelly
1987 Expedient Core Technology and Sedentism. In The Organization of Core Technology, edited by J. Johnson and C. Morrow, pp. 285-304. Westview Press, New York.

Parkington, J. and G. Mills
1991 From Space to Place: The Architecture and Social Organization of Southern African Mobile Campsites. In Ethnoarchaeological Approaches to Mobile Campsites, edited by C.S. Gamble and W.A. Boismer, pp. 355-370. International Monographs in Prehistory, Ann Arbor.

Pelegrin, J.
1993 A Framework for Analyzing Prehistoric Stone Tool Manufacture and a Tentative Application to Some Early Stone Industries. In The Use of Tools by Human and Non-human Primates, edited by A. Berthelet and J. Chavaillon, pp. 302-317. Clarendon Press, Oxford.

Prentiss, W.C. and E.J. Romanski
1989 Experimental Evaluation of Sullivan and Rozen's Debitage Typology. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 89-99. BAR International Series 528.

Price, D.P., and J.A. Brown
1985 Aspects of Hunter-Gatherer Complexity. In Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity, edited by D.P. Price and J.A. Brown, pp. 3-20, Academic Press, San Diego.

Purdy, B.
1975 Report on Thermal Alteration and Flaking Experiments Conducted on Chert from MR44 and MR45. Report on file, McClung Museum, University of Tennessee, Knoxville.

Roth, E.A.
1981 Sedentism and Changing Fertility Patterns in a Northern Athapascan Isolate. Journal of Human Evolution 10:413-425.

Sassaman, K.E.
1992 Lithic Technology and the Hunter-Gatherer Sexual Division of Labor. North American Archaeologist 13:249-262.
1992 Early Archaic Settlement in the South Carolina Coastal Plain. In Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective, edited by D.G. Anderson, K.E. Sassaman, and C. Judge, pp. 49-67, Council of South Carolina Professional Archaeologists.
1994 Changing Strategies of Biface Production in the South Carolina Coastal Plain. In The Organization of Prehistoric North American Chipped Stone Tool Technologies, edited by P. Carr, pp. 99-117. Archaeological Series No. 7. International Monographs in Prehistory, Ann Arbor.

Sassaman, K., G. Hanson, and T. Charles
1988 Raw Material Procurement and the Reduction of Hunter-Gatherer Range in the Savannah River Valley. Southeastern Archaeology 7:79-94.

Savelle, J.M.
1987 Collectors and Foragers: Subsistence-Settlement System Change in the Central Canadian Arctic, A.D. 1000-1960. BAR International Series 358.

Schiffer, M.B.
1976 Behavioral Archaeology. Academic Press, New York.
1988 The Structure of Archaeological Theory. American Antiquity 53:461-485.

Schrire, C.
1984 Wild Surmises on Savage Thoughts. In Past and Present in Hunter-Gatherer Studies, edited by C. Schrire, pp. 1-25. Academic Press, Orlando.

Sellet, F.
1993 Chaine Operatoire: The Concept and Its Application. Lithic Technology 18:106-112.

Shott, M.
1986 Technological Organization and Settlement Mobility: An Ethnographic Examination. Journal of Anthropological Research 42:1-15.
1989 Technological Organization in Great Lakes Paleoindian Assemblages. In Eastern Paleoindian Lithic Resource Use, edited by C.J. Ellis and J.C. Lothrop, pp. 221-238, Westview Press, New York.
1991 Archaeological Implications of Revisionism in Ethnography. In Foragers in Context: Long-Term Regional, and Historical Perspectives in Hunter-Gatherer Studies, edited by P.T. Miracle, L.E. Fischer, and J. Brown, pp. 31-40. Michigan Discussions in Anthropology Volume 10.
1994 Size and Form in the Analysis of Flake Debris: Review and Recent Approaches. Journal of Archaeological Method and Theory 1:69-110.

Silberbauer, G.
1981 Hunter and Habitat in the Central Kalahari Desert. Cambridge University Press, Cambridge.

Simek, J.
1994 The Organization of Lithic Technology and Evolution: Notes from the Continent. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 118-122. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Sinopoli, C.M.
1991 Style in Arrows: A Study of an Ethnographic Collection from the Western United States. In Foragers in Context: Long-Term regional, and Historical Perspectives in Hunter-Gatherer Studies, edited by P.T. Miracle, L.E. Fischer, and J. Brown, pp. 63-88. Michigan Discussions in Anthropology Volume 10.

Smith, B.D.
1986 The Archaeology of the Southeastern United States: From Dalton to deSoto, 10,500-500 B.P. Advances in World Archaeology 5:1-92.

Smith, E.A. and B. Winterhalder
1981 New Perspectives on Hunter-Gatherer Socioecology. In Hunter-Gatherer Foraging Strategies: Ethnographic and Archeological Analyses, edited by B. Winterhalder and E.A. Smith, pp. 1-12. University of Chicago Press, Chicago.

Smith, E.A., and B. Winterhalder (editors)
1992 Evolutionary Ecology and Human Behavior. Aldine De Gruyter, New York.

Soffer, O.
1991 Lithics and Lifeways - The Diversity in Raw Material Procurement and Settlement Systems on the Upper Paleolithic East European Plain. In Raw Material Economies Among Prehistoric Hunter-Gatherers, edited by A. Montet-White and S. Holen, pp. 221-234, University of Kansas Publications in Anthropology, 19.

Solway, J.S. and R.B. Lee
1990 Foragers, Genuine or Spurious? Situating the Kalahari San in History. Current Anthropology 31:109-146.

Spencer, B. and F. Gillen
1899 The Native Tribes of Central Australia. MacMillan, London.

Speth, J.D.
1991 Foreword. In Foragers in Context: Long-Term regional, and Historical Perspectives in Hunter-Gatherer Studies, edited by P.T. Miracle, L.E. Fischer, and J. Brown, pp. vii-viii. Michigan Discussions in Anthropology Volume 10.

Steponaitis, V.P.
1986 Prehistoric Archaeology in the Southeastern United States, 1970-1985. Annual Review of Anthropology 14:363-404.

Steward, J.
1955 Theory of Culture Change: The Methodology of Multilinear Evolution. University of Illinois Press, Urbana.

Stoltman, J.B. and D.A. Bareis
1983 The Evolution of Human Ecosystems in the Eastern United States. In Late Quaternary Environments of the United States, Part 2, The Holocene, edited by H.E. Wright, Jr., pp. 252-268, University of Minnesota Press, Minneapolis.

Sullivan, A.P. and K.C. Rozen
1985 Debitage Analysis and Archaeological Interpretation. American Antiquity 50:755-779.

Teltser, P.A.
1991 Generalized Core Technology and Tool Use: A Mississippian Example. Journal of Field Archaeology 18:363-375.

Tennessee Valley Authority
1979 Environmental Statement, Tellico Project, Volumes I, II, III. Office of Health and Environmental Science, Chattanooga.

Testart, A.
1982 The Significance of Food Storage Among Hunter-Gatherers: Residence Patterns, Population Densities, and Social Inequalities. Current Anthropology 23:523-537.
1988 Some Major Problems in the Social Anthropology of Hunter-Gatherers: Residence Patterns, Population Densities, and Social Inequalities. Current Anthropology 23:523-530.

Thomas, D.H.
1981 How to Classify the Projectile Points from Monitor Valley, Nevada. Journal of California and Great Basin Anthropology 3:7-43.
1983 The Archaeology of Monitor Valley. 2. Gatecliff Shelter. Anthropological Papers of the American Museum of Natural History 59(1). New York.
1986 Contemporary Hunter-Gatherer Archaeology in America. In American Archaeology Past and Present, edited by D.J. Meltzer, D.D. Fowler, and J.A. Sabloff, pp. 237-256. Smithsonian Institution Press, Washington, D.C.
1989 Archaeology, Second Edition. Holt, Rhinehart and Winston, Inc., Fort Worth.

Thornwaite, E.W.
1948 Climates of North America According to a New Classification. Geographaphical Review 21:633-655.

Tomka, S.A.
1989 Differentiating Lithic Reduction Techniques: An Experimental Approach. In Experiments in Lithic Technology, edited by D.S. Amick and R.P. Mauldin, pp. 1-14. BAR International Series 528.

Torrence, R.
1983 Time Budgeting and Hunter-Gatherer Technology. In Hunter-Gatherer Economy in Prehistory, edited by G. Bailey, pp. 11-22. Cambridge University Press, Cambridge.
1989 Tools as Optimal Solutions. In Time, Energy, and Stone Tools, edited by R. Torrence, pp. 1-6. Cambridge University Press, Cambridge.
1994 Strategies for Moving on in Lithic Studies. In The Organization of North American Prehistoric Chipped Stone Tool Technologies, edited by P.J. Carr, pp. 123-131. International Monographs in Prehistory, Archaeological Series 7, Ann Arbor.

Torrence, R. (editor)
1989 Time, Energy, and Stone Tools. Cambridge University Press, Cambridge.

Trigger, B.G.
1967 Settlement Archaeology - Its Goals and Promises. American Antiquity 32:149-160.

Ward, T.H.
1983 A Review of Archaeology in the North Carolina Piedmont: A Study of Change. In Prehistory of North Carolina: An Archaeological Symposium, edited by M.A. Mathis and J.A. Crow, pp. 53-81. North Carolina Division of Archives and History, Department of Cultural Resources.

Webb, W.S. and D.L. Dejarnette
1942 An Archaeological Survey of the Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi, and Tennessee. Smithsonian Institution Bureau of American Ethnology Bulletin 129. Washington, D.C.

White, J.W.
1982 An Integration of Late Archaic Settlement Patterns for the South Carolina Piedmont. An Unpulished M.A. Thesis, Department of Anthropology, University of Arkansas, Fayetteville.

Wiessner, P.
1982 Beyond Willow Smoke and Dogs' Tails: A Comment on Binford's Analysis of Hunter-Gatherer Settlement Systems. American Antiquity 47:171-178.
1983 Style and Social Information in Kalahari San Projectile Points. American Antiquity 48:253-276.

Wilmsen, E.N.
1973 Interaction, Spacing Behavior, and the Organization of Hunting Bands. Journal of Anthropological Research 29:1-31.
1989 Land Filled with Flies: A Political Economy of the Kalahari. University of Chicago Press, Chicago.

Wilmsen, E.N. and J.R. Denbow
1990 Paradigmatic History of San-Speaking Peoples and Current Attempts at Revision. Current Anthropology 489-524.

Winterhalder, B.
1980 Environmental Analysis in Human Evolution and Adaptation Research. Human Ecology 8:135-170.
1981 Optimal Foraging Strategies and Hunter-Gatherer Research in Anthropology: Theory and Models. In Hunter-Gatherer Foraging Strategies: Ethnographic and Archeological Analyses, edited by B. Winterhalder and E.A. Smith, pp. 13-35. University of Chicago Press, Chicago.
1986 Diet Choice, Risk, and Food Sharing in a Stochastic Environment. Journal of Anthropological Archaeology 5:369-392.

Winterhalder, B. and E.A. Smith
1992 Evolutionary Ecology and the Social Sciences. In Evolutionary Ecology and Human Behavior, edited by E.A. Smith and B. Winterhalder, pp. 3-24, Aldine De Gruyter, New York.

Winters, H.D.
1969 The Riverton Culture. Reports of Investigation No. 13. Illinois State Museum, Springfield.

Woodburn, J.
1980 Hunters and Gatherers Today and Reconstruction of the Past. In Soviet and Western Anthropology, edited by E. Gellner, pp. 95-117. Duckworth Publishers, London.

Wobst, H.M.

1974 Boundary Conditions for Paleolithic Social Systems: A Simulation Approach. American Antiquity 39:147-178.

1978 The Archaeo-Ethnology of Hunter-Gatherers or the Tyranny of the Ethnographic Record in Archaeology. American Antiquity 43:303-309.

Wylie, A.

1990 "An Unexamined Life Is Not Worth Living": Forthright Realism and Scientific Practice in Archaeology. Paper Presented at the Meetings of the Society for American Archaeology, Las Vegas.

Yellen, J.E.

1976 Settlement Patterns of the !Kung: An Archaeological Perspective. In Kalahari Hunter-Gatherers, edited by R.B. Lee and I.DeVore, pp. 47-72. Harvard University Press, Cambridge, Mass.

1977 Archaeological Approaches to the Present: Models for Reconstructing the Past. Academic Press, New York.

1989 The Present and Future of Hunter-Gatherer Studies. In Archaeological Thought in America, edited by C.C. Lamberg-Karlovsky, pp. 103-116. Cambridge University Press, New York.

VITA

Philip James Carr was born a gemini in Kentucky in the mid 1960s. As a youngster he had an interest in digging in the dirt and finding things. Although he did not know it at the time, this started him on his career path. His first important achievement in the social sciences came in the fourth grade. He won first place in the science fair at St. Helens Catholic School for his report and diorama of a Native American village. His next big break came in the eighth grade when he won honorable mention in a writing competition for a historical-fiction diary account of the Lewis and Clark expedition. In high school, he worked diligently at a number of subjects and contemplated his major for college. After much soul searching, he made his career decision for a senior's memory book in 1984. In finishing the statement "In ten years I will be...," he wrote "making a significant contribution in the field of archaeology." His path was decided.

After being told at freshman orientation at the University of Louisville that one could not major in archaeology, Phil was somewhat dismayed. Receiving no help from the guidance office, he slipped into despair and became a geology major. He finally found anthropology and was happily pursuing his interest in archaeology. He graduated from the University of Louisville with a B.A. in 1988.

He left with his future wife, Amy Young, to pursue graduate studies in Anthropology at the University of Tennessee. He published a paper based on his M.A. thesis work in a volume he edited in 1994. This volume he considers his significant contribution in the field of archaeology. He graduated with his Ph.D. from the University of Tennessee in 1995.

Phil Carr enjoys spending time with his wife, two step children, and the extended family. The boys (Chris, Nick, and Phil) enjoy going to comic-book stores, watching videos and the comedy channel, playing Magic the card game, and a number of other things related to goofing off.