12-1981

An Analysis of Residential Camp Site Structure !or Two Early Archaic Assemblages from Rose Island (40MR44), Tennessee

Larry R. Kimball
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To the Graduate Council:

I am submitting herewith a thesis written by Larry R. Kimball entitled "An Analysis of Residential Camp Site Structure !or Two Early Archaic Assemblages from Rose Island (40MR44), Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

Jefferson Chapman, Major Professor

We have read this thesis and recommend its acceptance:

Charles H. Faulkner, Gerald F. Schroedl

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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

Best Wishes,

Thanks for your help and
encouragement in this endeavor.
I appreciate your support over
the last six years.

Sincerely
Larry Kimball

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Vice Chancellor
Graduate Studies and Research

AN ANALYSIS OF RESIDENTIAL CAMP SITE STRUCTURE FOR TWO EARLY ARCHAIC ASSEMBLAGES FROM ROSE ISLAND (40MR44), TENNESSEE

A Thesis

Presented for the

Master of Arts

Degree

The University of Tennessee, Knoxville

Larry R. Kimball

December 1981

ACKNOWLEDGEMENTS

This study was possible through the help and encouragement of a number of persons, both known and unknown to me. To those I neglect to mention and to those whose ideas or data I may malign, I offer my sincere appreciation. By the same token, I accept the sole responsibility for the interpretations presented herein.

My sincere gratitude goes out to my thesis committee: Dr. Jefferson Chapman (chairman), Dr. Gerald F. Schroedl, and Dr. Charles H. Faulkner. These archeologists provided a special blend of patience, tolerance, and wisdom that allowed the successful completion of this research. Dr. Jefferson Chapman allowed me total access to the Rose Island and other Early Archaic site collections from his investigations in Tellico Reservoir. Jeff also arranged financial support for the earlier lithic analysis of these collections. I will always be amazed by Jeff's endurance of my often contrary attitudes about the practice of archeology.

I realize an equally special debt to Dr. Gerald Schroedl, who has always supported the pursuit of alternative methods of archeological inquiry. Gerald was always available for argument and has often stressed the importance of conducting one's research in the mainstream of modern archeology. Gerald provided the philosophical environment for the baptism of several "born again" archeologists in 1977. I consider it an honor that Gerald has come to treat me as a colleague.

Dr. Charles Faulkner has often reminded me of the importance of culture history and has stressed the significance of the scholarly

achievements of our predecessors in the discipline. Dr. William Bass (Department Head), Dr. Fred Smith, and Dr. Richard Jantz of the Department of Anthropology at The University of Tennessee have provided encouragement and support over the past six years.

The measurement and coding of the lithic assemblages were performed by Nancy Bell, Cliff Boyd, Brett Riggs, and Tom Whyte. Marla Baden entered these data onto DECsystem-10 files and Bill Baden transformed, edited, and managed these computer files. I am especially grateful for Bill's advice, quantitative expertise, and friendship over the years. Neal Brun drafted Figures 1-2, 7-8, and 11-17. Tom Whyte drew Figures 3 and 4. Miles Wright photographed and printed Figures 5 and 6. Nancy Bell typed the first draft and translated sections of Leroi-Gourhan and Brézillon (1972) for me. Steve Davis suffered through the original draft of this thesis. I am grateful for his sage and candid advice. Collectively, these colleagues provided the ideal climate in which to conduct archeological research.

The statistical manipulation, computer mapping, and final thesis typing were performed using the facilities of the University of Tennessee Computer Center. Alice Beauchene, Bill Baden, and Dr. Richard Jantz have provided much appreciated guidance in the proper use of various computer facilities and statistical methods. Dr. Richard Jantz, Bill Baden, and Steve Davis reviewed the quantitative sections.

The excavation, processing, and original report (Chapman 1975) of the Rose Island collections were funded by the Tennessee Valley Authority (contract TV 38339A) and the National Park Service (contract CX 500041306) with Dr. Alfred K. Guthe as principal investigator. The

analysis of the two assemblages used in this thesis was partially supported by the Tennessee Valley Authority through contract TV 56255A as an adjunct study of the Tellico sampling survey (Davis et al. 1980). Dr. Jefferson Chapman served as principal investigator.

Finally, and most importantly, I thank my wife, Diane Morris. You made it all possible.

ABSTRACT

The site structure of two Early Archaic period assemblages is defined through spatial analysis of artifact and facility distributions at the Rose Island site (40MR44) in the lower Little Tennessee River valley. These assemblages derive from well controlled excavation of deeply buried alluvial deposits attributable to LeCroy (c. 6100-6500 B.C.) and St. Albans (c. 6600-7000 B.C.) temporal units. Spatial patterning is detected using multivariate statistical analysis of formal implement, instant tool, and debitage categories. The observed spatial patterns are interpreted through a comparison with expected spatial patterns generated from an a priori model of hunter-gatherer residential camp activity structure. The results of the analysis allow the proposal of a general model of Early Archaic residential camp site structure. The model identifies activity areas based upon densities and spatial relationships of artifact categories for an assemblage. The reconstructed activity structure describes the location of the family hearth as occurring in front of the opening of the shelter. A wide range of activities are localized around the family hearth. More specialized activities, such as flintworking, hideworking, and the roasting of game, are conducted near the shelter, but apart from the family hearth.

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CHAPTER I

INTRODUCTION

The purpose of this study is to evaluate certain aspects of the spatial dimension of Early Archaic culture. This is accomplished through an analysis of site structure for two assemblages from the Rose Island site (40MR44) using an a priori model of hunter-gatherer activity structure. The model is defined by a set of propositions that generalize the spatial organization of residential camp activities observed among contemporary hunter-gatherers. In addition, the expected spatial patterning of the material residues of these activities, referred to as material correlates, are described for each proposition. This approach permits the definition of observed spatial patterns for Early Archaic data in light of known spatial patterns of observed hunter-gatherer behavior.

The origin and evolution of the concept of a general Archaic pattern for the eastern United States has been chronicled by Haag (1942), Byers (1959), Swanson (1974), and most recently, Chapman (1981). Accordingly, the first use of the term Archaic is attributed to Ritchie (1932a,1932b), who used the capitalized form to describe the preceramic occupation at the Lamoka Lake site in New York. Another preceramic unit that was important in the original formulation of the Archaic pattern is the Stalling's Island site in Georgia, reported by Claflin (1931). The data base of preceramic sites was greatly increased by the federally sponsored salvage excavations in the Southeast during the 1930s. Particular emphasis was placed upon the investigation of shell middens

along the Tennessee and Green Rivers (Webb 1939,1946,1950a,1950b; Webb and Haag 1939,1940,1947; Webb and DeJarnette 1942,1948a,1948b,1948c; Lewis and Kneberg 1947,1959; Lewis and Lewis 1961).

Systematically defining an Archaic pattern that used these newly generated data posed a major problem for Southeastern archeologists. No concensus was evident for the acceptance of a general Archaic pattern or the use of the term Archaic, itself (Haag 1942; Griffin 1946; Sears 1948). The major problems in the identification of the Archaic pattern were:

1. The lack of stratified contexts needed to establish local sequences;
2. The lack of adequate dating techniques;
3. The a priori acceptance of contemporaneity for all artifacts found within an archeological deposit. This assumption of the Midwestern taxonomic system did not allow the recognition of occupation overlap at an archeological component. (This problem was discussed by Coe [1964:8] concerning his own erroneous cultural reconstruction using the scheme); and
4. The expectation that the artifactual residues of an archeological culture would be invariant from site to site (Webb and DeJarnette 1948c:11-15).

The basic methodology of the times was to identify the appearance of a new trait (artifact type) and then to trace the occurrence of the trait across temporal and spatial units. If the artifact type exhibited a restricted temporal context, then it could be established as a

temporal marker. And if the type had a restricted spatial context, then it was forwarded as a diagnostic trait of a focus. Such comparisons of assemblages from a number of sites (often hundreds of miles apart) became the method used to establish the temporal and spatial parameters of various Archaic units (Fairbanks 1942; Lewis and Kneberg 1947, 1959; Webb and Haag 1947). Interestingly enough, two of these studies (Fairbanks 1942; Lewis and Kneberg 1959) utilized Kroeber's (1940) similarity coefficient to statistically evaluate inter-site assemblage variability. These were unique analyses in that the nature of assemblage variability was investigated using empirical data in order to determine how significant (read diagnostic) traits of assemblages were to be defined. Also, these later studies marked the heyday of the acceptance of the Midwestern taxonomic system.

In contrast with the long history of Archaic studies, the Early Archaic has only recently been defined as a regional archeological unit. This is primarily due to:

1. The excavation of deeply-stratified cave and alluvial sites beginning in the early 1950s (Coe 1952,1964; Logan 1952; Fowler et al. 1956; DeJarnette et al. 1962; Broyles 1971; Griffin 1974; Chapman 1975);
2. The availability of radiocarbon dating in the late 1950s; and
3. The recognition by Joffre Coe that most of the Archaic sites excavated during the 1930s represented multiple occupations in accretional middens with considerable time depth. Consequently, many artifact categories, specifically projectile points that were used as diagnostic traits, exhibit

morphological variability that is artificial — i.e., a consequence of natural rather than cultural processes.

In contrast with the status quo, Coe (1964:9) suggested that "when an occupation zone can be found that represents a relatively short period of time the usual hodgepodge of projectile point types are not found — only variations of one specific theme." Coe's observations and investigations at the Hardaway and Doerschuk sites in North Carolina demonstrated this point and provided the stimulus for locating similar stratified sites in the Southeast. The tone was set for the subsequent emphasis given to the development of temporal sequences of projectile point formal variability, which have become synonymous with the reconstruction of culture histories (Broyles 1971; Gardner 1974; Griffin 1974; Chapman 1975).

The initiation of Early Archaic research in Tellico Reservoir was a historical accident. During the investigation of the Woodland component at the Rose Island site (40MR44) in 1973 by Jefferson Chapman, an Early Archaic LeCroy projectile point was recovered in a test pit stratigraphically below the Woodland zone. Further testing revealed stratified Early Archaic deposits. Chapman's research goals then shifted from the investigation of Woodland to the investigation of Early Archaic. The remainder of the summer of 1973 was spent at Rose Island. Chapman returned to the site in the summer of 1974 to open larger areas of the site, to recover larger collections of artifacts, and to excavate two units by piece-plotting the artifact proveniences. The final site report (Chapman 1975) provided a local chronology for the Early Archaic

period in the lower Little Tennessee River valley and an examination of the occurrence of bifurcate projectile points elsewhere in the East. Subsequent investigations in Tellico Reservoir include:

1. Excavation of the Early Archaic components at the Icehouse Bottom (Chapman 1977), Patrick (Chapman 1977), Bacon Farm (Chapman 1978), and Calloway Island (Chapman 1979) sites. These sites were investigated to provide comparative collections and to determine the validity of the sequence defined at Rose Island; and
2. A survey of the first terraces of Tellico Reservoir with backhoe excavation using an opportunistic, non-probabilistic sampling design in order to obtain preliminary data concerning the quantity and comparability of buried Early Archaic sites in the lower Little Tennessee River valley (Chapman 1978).

Collectively these Early Archaic investigations have provided assemblages of lithic artifacts, features, botanical remains, and faunal elements that have proved indispensable in the reconstructon of prehistoric lifeways. The analysis of these materials has largely followed the traditional pursuit of temporal marker recognition and the use of general models of seasonal hunter-gatherer settlement-subsistence systems to explain variability observed in the lithic or botanical sub-assemblages. These reconstructions are organized and interpreted from vertical, stratigraphic units. Very little research has been undertaken to evaluate non-temporal dimensions of Early Archaic culture or to use the assemblage as the basic analytic unit in the delineation

archeological units. More specifically, questions regarding spatial variability have not been addressed.

Two Early Archaic assemblages from Rose Island are reanalyzed in this study to investigate the spatial dimension of Early Archaic culture. This is pursued through a reconstruction of the activity structure that led to the identified site structure pattern. The results of this analysis provides new information about Early Archaic culture and contributes to the general body of knowledge of hunter-gatherers.

CHAPTER II

SITE DESCRIPTION AND GEOLOGIC CONTEXT

The data used in this study derive from materials collected in excavations at the Rose Island site (40MR44) by Chapman (1975) between 1973 and 1974 in concert with the University of Tennessee salvage archeology program in Tellico Reservoir. The site is situated at the downstream tip of Rose Island and exhibits stratified, artifact bearing deposits dating from Early Archaic through Early Woodland periods (Chapman 1975). The site extent was determined by inspection of the stratigraphy in eight backhoe trenches and five hand-excavated test pits (Figure 1). The portion of the total excavation area used in the study represents approximately 4.2% of the minimum site area (c. 33,810 ft) as estimated by Chapman (1976).

The land surface upon which the Early Archaic inhabitants lived is an alluvial formation created during the early Holocene by rapid aggradation of sediments flushed from the Appalachian Mountains to the east (Delcourt 1980). Although some evidence for limited erosion of select Early Archaic strata was observed at the Icehouse Bottom site (Foley and Chapman 1977), alluvial deposition and stability are considered to be the dominant geologic processes that created and preserved these archeological contexts.

The Early Archaic strata at Rose Island are most clearly segregated coincident with the downstream tip of the island and the study area. Strata contents of charcoal and cultural debris increase as one moves toward the south (grid) edge of the island and downstream (Jefferson

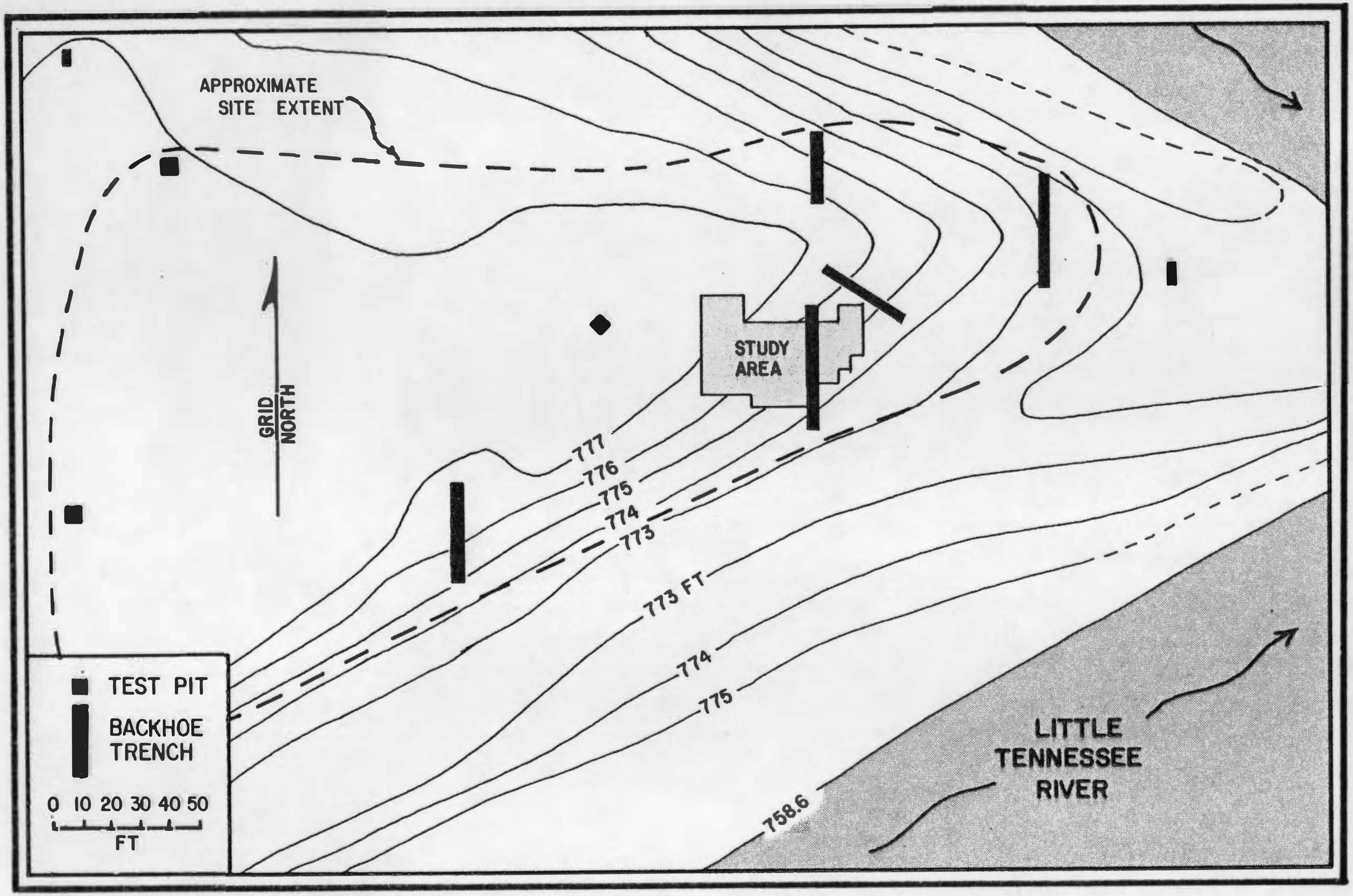

Figure 1. Map of the study area, Rose Island (40MR44).

Chapman, personal communication 1981). Detailed description of the stratigraphy of the study area is provided by Chapman (1975).

Strata VIIA and VIIC, as defined by Chapman (1975), were chosen for study, because they contain dense concentrations of cultural materials and are easily followed across the excavation area. Furthermore, these strata contain fired clay hearths for which there are archaeomagnetic assays. These units apparently represent stabilized land surfaces during the Early Archaic period. Occupation succession and overlap are evident within both strata as reflected by variations in feature elevations and preliminary archaeomagnetic data indicating temporal differences. Each stratum was divided into upper and lower portions in order to control the temporal span of assemblage content. These divisions were made by comparing the average elevation of excavation levels at the four corners of the grid unit with the average elevation of the top, middle, and bottom of the geologic strata. These divisions represent the same stratigraphic context across the study area. The kind of resolution represented by artifact assemblages derived from these contexts is referred to as coarse-grained by Binford (1980). The assemblages used in this study represent the upper divisions of Stratum VIIA and Stratum VIIC, dating to the LeCroy (c. 6100-6500 B.C.) and St. Albans (c. 6600-7000 B.C.) periods respectively.

The recovery technique was to skim-shovel and hand-trowel the artifact bearing strata in 0.2 ft levels that followed the dip of the natural stratigraphy, as revealed in backhoe trenches adjacent to the excavation blocks. The excavated dirt was waterscreened through 1/4 in mesh and the lithic artifacts, charred botanical remains, and fired clay

hearth fragments were bagged. The fill from feature excavation was waterscreened through 1/16 in windowscreen and occasionally floated for the separation of charred botanical remains. The basic excavation unit was a 5x5 ft square, although four 5x6 ft units were excavated east of the backhoe trench in the study area. The study area is composed of 56 grid units so defined and can be divided into three blocks (Figure 2).

The central block, called Unit A by Chapman (1975), was excavated by trowel, point-plotting artifact proveniences. Originally, I thought this block could be analyzed separately using point pattern quantitative methods, such as nearest neighbour analysis. Quadrat analysis of grid count data would then be applied using different grid sizes in order to evaluate the sensitivity of these methods for the recognition of spatial patterning. This approach was rejected when preliminary work showed that less than half the artifacts had been point-plotted. This resulted from the difficulty of detecting each flake and fire-cracked rock in situ during excavation. Statistical analysis of this incomplete data set using point pattern techniques would not be productive. Consequently, the analysis proceeded using the 5x5 ft grid unit as the basic analytic unit and quadrat analytic methods. The artifact counts for the 5x6 ft grid units were transformed by multiplying the frequency of each artifact category by 0.833 in order to make these data comparable with the category counts of the 5x5 ft grid units. Fire-cracked rock was not collected from the other two excavation blocks and this category of lithic artifact was therefore not considered in the spatial analysis.

Artifact preservation is largely determined by soil pH at Rose

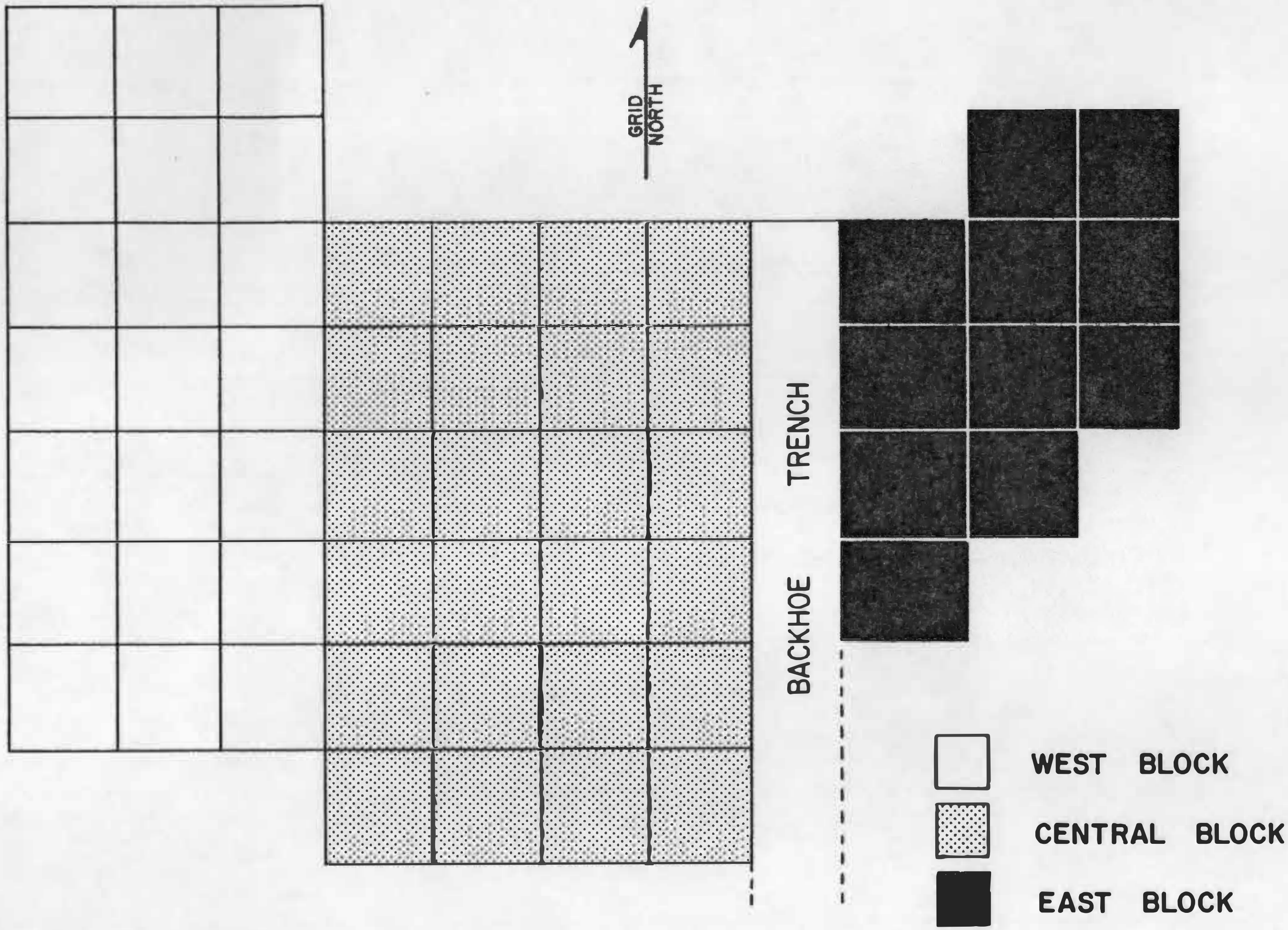

Figure 2. Map of study area showing block units.

Island. The soil pH is 6.1 and 5.5 for Stratum VIIA and VIIC respectively (Chapman 1975). So most of the recovered items are lithic artifacts. Due to the geologic formation processes of these strata, facilities such as surface hearths, rock ovens, and smudge pits containing wood charcoal and charred nut fragments are also preserved. It is argued that relatively little context disruption has occurred given the good fit between the distributions of wood charcoal and parent hearths for both of these contexts.

CHAPTER III

SITE CONTENT

Artifacts

A total of 9452 lithic artifacts, 35 facilities, and 2003 grams of charred botanical remains constitute the total site content for the study area. The lithic sub-assemblage represents discarded residues of raw material procurement, implement manufacture, and tool use. The artifact identification system employs a classification model based upon unique tri-variate combinations of attribute states for working edge, implement or debitage blank (following the use of blank by Bordaz 1970), and lithic raw material dimensions, as developed by Kimball (1980a). In addition, the condition of the artifact is identified — i.e., whether the item is complete, broken in use, broken in manufacture, recycled, or unmodified. An example is an end scraper on a blade of Knox Black Chert broken in use (Figure 3D). Detailed descriptions of the attribute states and classification categories are provided in Kimball (1980a,1980b). Examples of lithic artifacts exhibiting representative attribute combinations of manufacture methods, working edge modifications, tool conditions, recyclings, and secondary uses for the study assemblages are presented in Figures 3 and 4. Tool design and states of working edge maintenance for projectile points from the study assemblages are portrayed in Figures 5 and 6. This constitutes all projectile points from the assemblages except small projectile point fragments and one Upper Kirk corner notched projectile point, which is assumed to be intrusive.

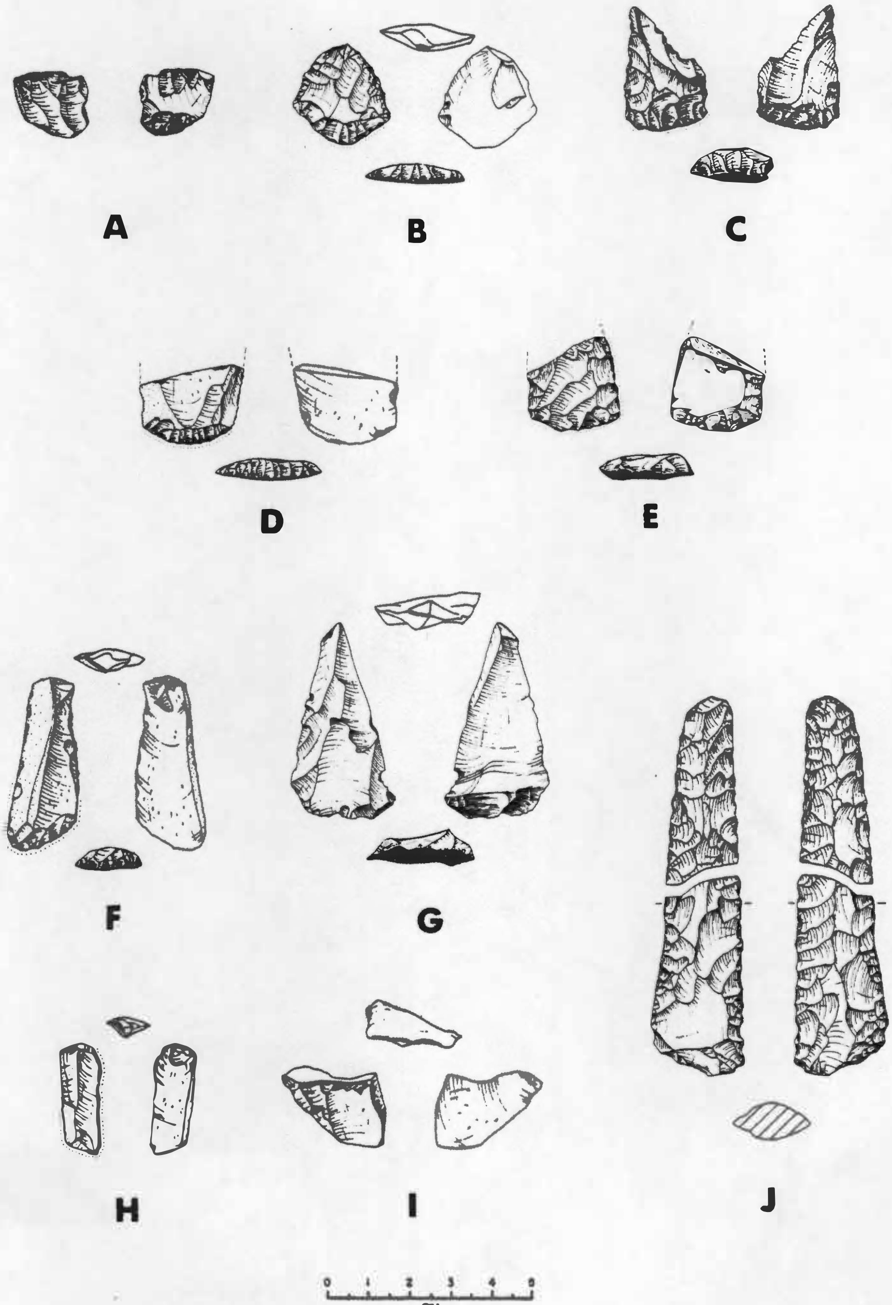

Figure 3. Early Archaic end scrapers, blade debitage, and drill preform. (A) pièce esquillée on flake, secondary use; (B) end scraper on special blank; (C) perforator and exhausted end scraper, recycled; (D) end scraper on blade, broken in use; (E) exhausted end scraper with bifacial edge rejuvenation, broken in use or resharpening; (F) end scraper on blade; (G) outrepassé blade, unmodified; (H) utilized edge on blade; (I) blade core rejuvenation flake, unmodified; and (J) drill preform, broken in manufacture.

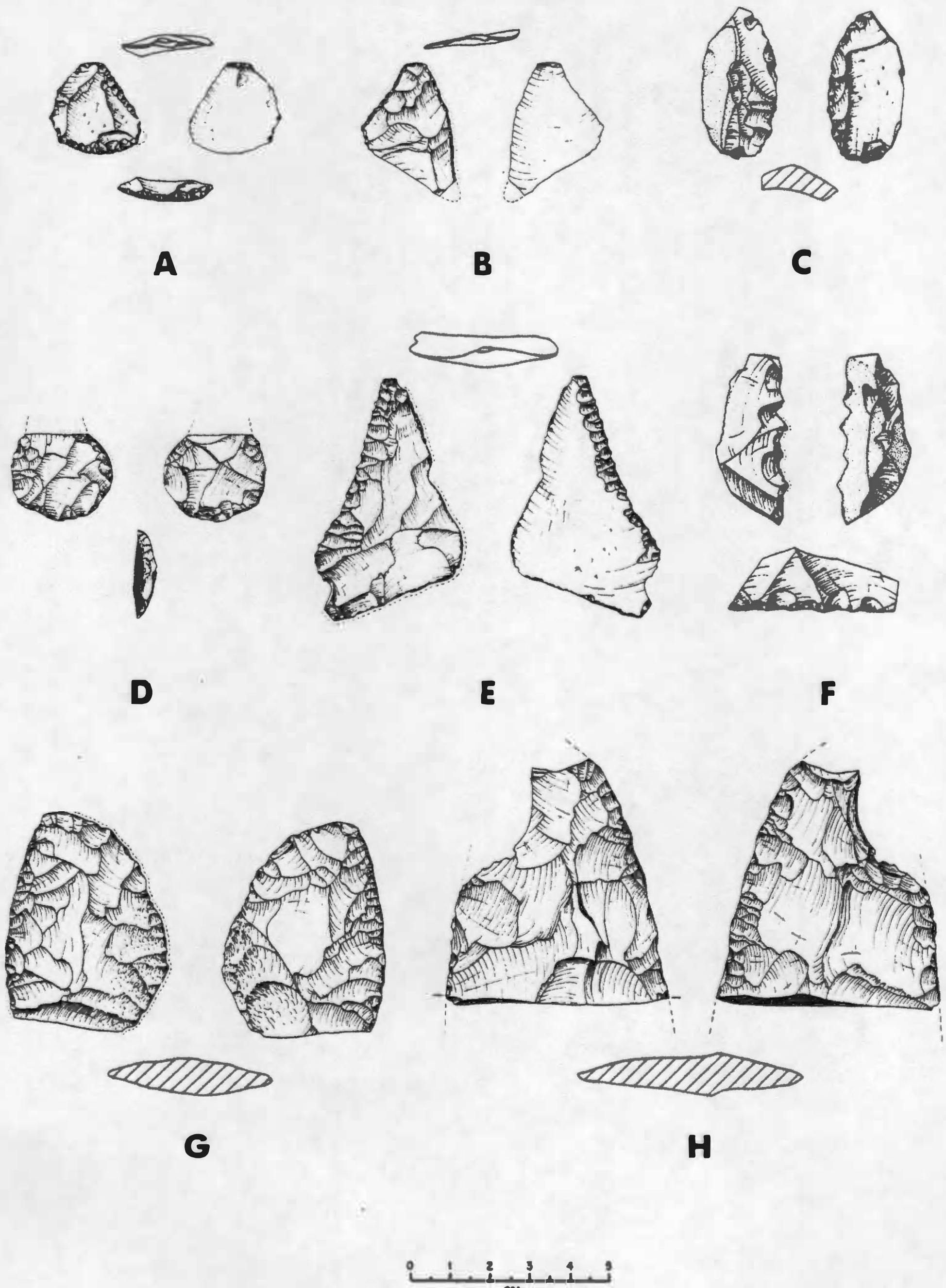

Figure 4. Early Archaic biface tools, bifacial preforms, and secondary use debitage. (A) utilized edge on bifacial thinning flake, secondary use; (B) utilized edge on bifacial thinning flake; (C) <u>pièce esquillée</u> on projectile point preform, recycling; (D) utilized edge on projectile point preform, recycling; (E) knife on bifacial thinning flake, secondary use; (F) denticulate on shatter fragment, secondary use; (G) bifacial knife; and (H) bifacial knife preform, broken in manufacture.

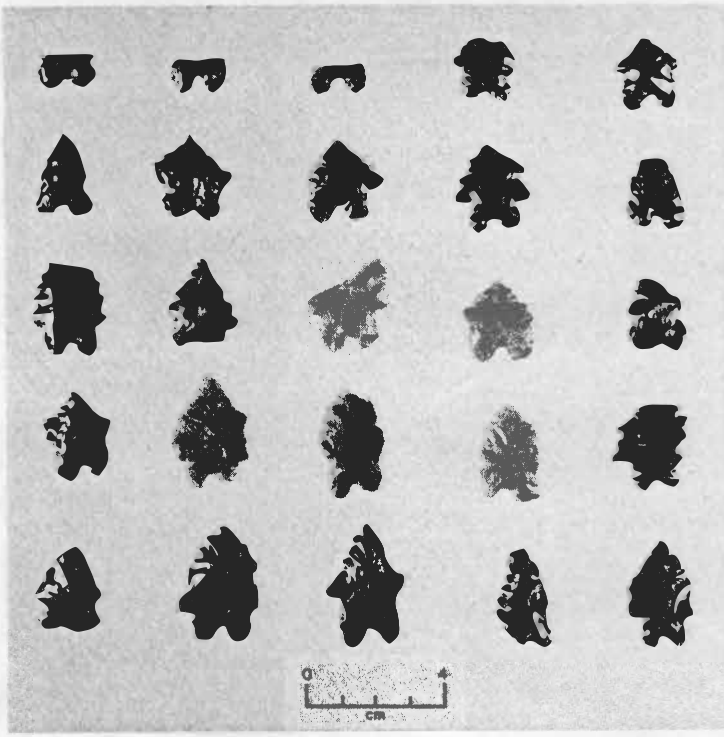

Figure 5. LeCroy assemblage projectile points.

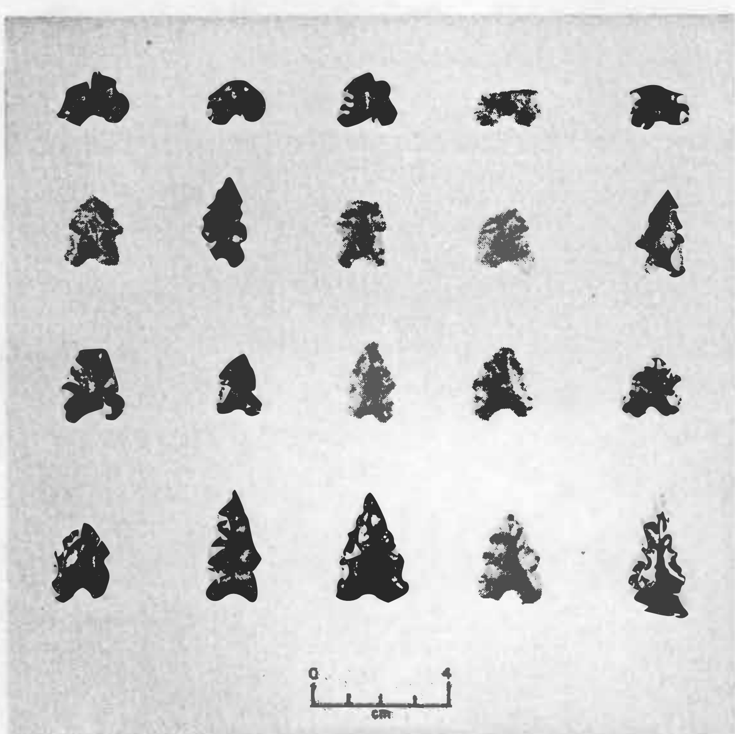

Figure 6. St. Albans assemblage projectile points.

Facilities

Three types of facilities occur in the study assemblages: (1) surface fired areas; (2)rock basin hearths; and (3) rock-free, charcoal-filled pits. Surface fired areas are composed of hard, compact, and oxidized clay, probably brought in to the site, that are the result of a surface fire (Chapman 1975:190-3, 1977:98). Rock basin hearths are shallow pits containing varying quantities of fire-cracked rock and charcoal and may have been used as ovens. Rock-free, charcoal-filled pits contain a homogenous lens of fine, compact charcoal and no fire-cracked rock. These facilities are smaller than rock basin hearths and often have constricted openings. Lack of fire-cracked rock, regularity of shape and size, finer consistency of charcoal lens, and lack of hardened, oxidized surfaces suggest that such facilities functioned differently than surface hearths or rock ovens. A possibility is that these facilities were used as smudge pits for hidesmoking. Certainly hideworking activities are evidenced by used end scrapers and end scrapers broken in manufacture. These three facility categories are herein referred to as surface hearths, rock ovens, and smudge pits.

The available botanical data represent simple gram weights of the wood charcoal and charred nut fragments recovered from general square excavation that did not pass through the 1/4 in waterscreen. None of the floated materials or the windowscreened botanical remains from feature fill contexts have been identified as to genera or species.

CHAPTER IV

METHODOLOGICAL CONSIDERATIONS

Definitions

The spatial dimension of culture can be considered at macro- and micro-levels. The macro-scale involves the patterning of inter-site distributions and inter-assemblage variability, and is most often applied to questions regarding territoriality (Wilmsen 1973; Wobst 1974) or settlement-subsistence systems (Binford 1964,1978b,1979,1980; Thomas 1971; O'Connell 1977; Gould 1980; Davis 1981). The micro-scale of spatial dimensionality involves the study of intra-site assemblage variability. Questions regarding activity structure and site structure are considered (Binford et al. 1970; Whallon 1973,1974, 1978,1979; Schiffer 1976; Yellen 1977; Binford 1978a; Smith 1978; Cahen et al. 1979; Hayden 1979a; South 1979). The questions addressed by these investigations involve evaluations of various implications of the functional variability paradigm (Binford 1972,1973,1976,1978a,1978b,1979,1980; Binford and Binford 1966).

The study of intra-site patterning is essentially an analysis of the spatial context of site content in order to define site structure and reconstruct the activity structure of an habitation area. Site structure is defined as the item or cluster distributions of artifacts and facilities that occur as residues in recognizable states of manufacture, form, use, function, condition, and size (South 1979). Binford (1978a) proposes that three major behavioral dimensions interact to produce the site structure pattern: (1) activity structure;

(2) technological organization; and (3) disposal modes. Although a set of interrelated behaviors are responsible for the creation of site structure, the observed site structure of an excavated archeological context is a static configuration of residues — a contemporary fact (Binford 1977a:6,1978a:348).

Activity structure is defined as the performed activities and their performance frequencies (Schiffer 1972:157). Because activity structure is not directly observable in an archeological context, material correlates of specific activities must be discovered to allow a sensible interpretation of the archeological record. Ethnographic observations and ethnoarcheological studies, such as those by Yellen (1976,1977), Binford (1978a,1978b,1979), Gould (1980), O'Connell (1977), and Hayden (1979a), provide material correlates for various hunter-gatherer activity structures that can be used to construct analogical models to be compared with the archeological record.

Assumptions

Several assumptions predicate the modeling of Early Archaic site structure. It is assumed that recent models of hunter-gatherer site structure are appropriate analogues for the Early Archaic. Furthermore, the general spatial organization of tool manufacture, use, maintenance, and discard observed among ethnographic hunter-gatherers is a behavior pattern that occurred, at an unspecified level of probability, among prehistoric hunter-gatherers. The settlement context of the occupations under consideration at Rose Island is considered a residential base (following Binford 1980). Although an evaluation of the overall

settlement system is beyond the scope of this study, preliminary analyses of Early Archaic inter-site assemblage variability support this identification (Kimball 1978; Kimball and Baden 1980; Davis 1981). These residential settlements are assumed to have been occupied at least during the fall in a near climax, mixed mesophytic forest (Chapman 1975:224,230,272). This is based upon the presence of charred acorn and hickory nut fragments and the expectation that seasonal flooding of the site would have been most likely during the winter and spring. Lastly, it is assumed that fauna, such as deer, turkey, and rabbit, were hunted from and consumed at these sites, although no identifiable bone or antler elements are preserved.

CHAPTER V

PROPOSITIONS AND MATERIAL CORRELATES

The range of activities expected on Early Archaic residential camps include: shelter construction and use; hearth use; preparation and consumption of plant and animal resources; hideworking; manufacture of bone, antler, wooden, and lithic implements; and the use and maintenance of tools. Direct and indirect evidence for the performance of these activities is provided in the individual Early Archaic site reports by Chapman (1975,1977,1978,1979). A set of propositions and associated material correlates for these activities is developed from ethnoarcheological studies, recent ethnographic summaries, ethnohistoric accounts, and archeological site reports. The expected material correlates only consider patterning related to the kinds of lithic items and charred botanical remains that were preserved and recovered at Rose Island.

Dry Climate/Season Shelter and Hearth Use

Sources. Yellen (1977:87,100); Hayden (1979a:172-3; DeMontmollin (1980:18-20); Gould (1980:25); Peña (1980:107); Smiley (1980:162-3); Wills (1980:90-1).

Propositions. In general, two distinct spatial patterns are observed for hunter-gatherers, and both are climate and season dependent. In dry, warm climates or during dry, relatively warm seasons in colder climates, shelters consist of family huts constructed with

limited construction input. The family hearth and its associated general work area are located outside the hut. The hut may or may not be used for sleeping by the family units. Very little debris accumulates inside the shelters because manufacturing, cooking, eating, and socializing activities are conducted around the outside hearth. Personal items, such as site furniture and the family's food cache, are stored inside the hut.

Material correlates. The material correlates of the dry climate hut are:

1. A hearth surrounded by the debris of general activities, such as lithic debitage, discarded tools, charred wood and plant food refuse used as fuel; and
2. An area adjacent to a general activity hearth with a low density of such debris that may include site furniture that was stored or cached in anticipation of future reuse as well as discarded choppers and impact fragments off celts used in hut construction.

Cold Climate/Season Shelter and Hearth Use

Sources. Klein (1974); Binford (1978a:349); DeMontmollin (1980:17); Gregg (1980:126); Ives and Sinopoli (1980:31-3); Jackson and Popper (1980:51); Moore (1980:71); Roček (1980:142); Smiley (1980:160-3); Wills (1980:89).

Propositions. In cold or wet climates and during cold or wet seasons in warmer climates, shelters consist of single- or multi-family structures exhibiting greater construction efforts. Hearths exist both inside and outside the structure. Internal structure space may be divided into family and male-female areas. Sleeping, eating, storage of food and personal items, and some tool manufacture are conducted within the structure. Tool manufacture is also conducted around hearths situated outside the structure. Craft activities performed by casual work groups, particularily unrelated men, are conducted around outdoor hearths.

Material correlates. The material correlates of the cold climate hut include:

1. Concentrations of debitage and discarded tools around two or more hearths that are relatively close to one another;
2. The dispersion of interior hearth area debris tends to be more concentrated and may exhibit a segregation of cached site furniture and hideworking tools (women's tools), lithic debitage (men's manufacturing activity waste), and discarded choppers or impact flakes off celts used in construction activities;
3. Debris around the exterior hearth is more dispersed than around the interior hearth, and contains larger lithic waste and no site furniture;
4. Charred wood and nut fragments are concentrated around both hearths; and

5. Quantities of fire-cracked rock are greater around the outdoor hearth or in an outdoor dump area, which should also contain large size debitage and discarded tools, and charcoal.

Food Preparation and Use of Site Furniture

Sources. Crabtree (1968:470); Yellen (1976:65-9,1977:87,92-7); Binford (1978a:339,345-7,1978b:152-65,1979:263-4); Hayden (1979a:11, 141,143,146,154,157,161-3); Gould (1980:8-10,23,25-7,71-5,131); Ives and Sinopoli (1980:30); Jackson and Popper (1980:55); Peña (1980:107); Wills (1980:90,94).

Propositions. The preparation of plant and animal resources for consumption is carried out using various kinds of equipment. Plant foods, nuts in this case, are cracked and milled using nutting stones, pounders, grinding slabs, and manos. This activity is usually performed by women around the family hearth. Animals are butchered using formalized hunting knives as well as flake knives. Bones are processed for marrow and bone grease extraction using chopper/scrapers and anvil stones. Collectively, these implements function as site furniture (Binford 1978a:339,1979:263-4) and are usually placed in the vicinity of the activity area or stored at the shelter. Upon camp abandonment useable site furniture is cached at the structure in anticipation of future use. In fact, the first task of women during the founding of a new camp is to relocate the grinding slabs from the old huts. The butchering and preparation of large game is conducted away from the structure hearth area and usually involves the use of a roasting oven,

with or without a rock lining. Although cooking containers are not preserved in Early Archaic assemblages, stone boiling in baskets, clay-lined baskets, and animal stomachs are ethnographically observed cooking methods. Meat may be roasted on coals, on rocks in ovens, or simply placed on sticks over the camp fire.

Material correlates. The material correlates of food preparation include:

1. Disposal of used flake knives, bifacial knives (hafted butchering knives) broken in use or lost in the general area of large game butchering;
2. Anvil stones are placed in the general vicinity of the last bone processing session, usually near a hearth;
3. Nutshell debris from nut processing will be preserved near hearths when burned for fuel;
4. Milling stones are stored or cached in the vicinity of a shelter; and
5. Cached site furniture occurs in the vicinity of a shelter.

Food Consumption

Sources. Yellen (1977:91); Binford (1978a:345,350,356); Gould (1980:72,131).

Propositions. Food consumption is an activity that is generally localized around family hearths on residential camps, and is consequently interrelated with the use of indoor and outdoor hearths,

depending upon the season or climate. The major exceptions to this generalized pattern are snacking and community feasting, each resulting in a different spatial manifestation.

Material correlates. The material correlate of food consumption is the discard of instant tools (following Gould 1980:72) tossed about the eating area and localized around a family hearth. These tools include: (1) utilized decortication and bifacial thinning flakes and (2) utilized blades and bipolar flakes that are large enough to be hand-held and possess a naturally sharp cutting edge. Retouch on these tools might indicate edge rejuvenation to prolong use.

Stone Tool Manufacture and Use

Sources. Binford (1973,1977b:30-6,1978a,1979:263-8); Yellen (1977:91); Cahen et al. (1979); Hayden (1979a); Gould (1980); Gregg (1980:131); Ives and Sinopoli (1980:31); Jackson and Popper (1980:54); Roček (1980:145); Smileu (1980:163); Wills (1980:94).

Propositions. The manufacture of formalized implements, such as projectile points, hafted end scrapers, bifacial knives, bifacial drills, and celts, is usually conducted to replace these worn-out or broken personal items or to gear up (following Binford 1979:268) in anticipation of future needs. Because these tools were hafted, their discard is expected at the place where replacements were manufactured, not where the tools were used. This may not necessarily be true in all cases. Situational behavior as described by Binford (1979:264-6) would be such a circumstance. But as a generalization for the disposal and

replacement of personal gear at a residential camp, this seems justifiable. The manufacture of blades, bipolar flakes, and _pièces esquillées_ occurs as immediate or short-term anticipated needs arise. These items are considered intended products of lithic reduction. Exhausted cores, core rejuvenation flakes, decortication flakes, shatter fragments, bifacial thinning flakes, biface fragments, preform fragments, and implements broken in manufacture constitute the debitage produced during the manufacture of the above tools. Lithic tool maintenance is usually accomplished by edge resharpening. In the Early Archaic assemblages unifacial, bifacial, serrated, and denticulated retouch states are observed on formalized, blade, bipolar flake, and instant tools. End scrapers were often resharpened unifacially until the edge angle was very steep or multiple hinging accrues. The working edge was rejuvenated by a final bifacial retouch or a bipolar blow (Figures 3C, 3E). Formalized tool manufacture occurs around outdoor hearths. The use of heat is often required when the replacement of hafted tools is performed. Hearths also provide a source of warmth, a general focal point of these and other manufacturing activities, and fire for cooking while knapping. Binford (1978a:345) observes that hand-held items are usually tossed upon the completion of their use and that items detached (in Binford's study, bone splinters) from the held mass drop to the ground. When translated to stone tool manufacture, detached flakes would be allowed to drop and the objective piece being flaked or the used tool being replaced would be tossed. This pattern is observed in several ethnoarcheological studies and by personal experience during flintknapping experiments. The manufacturing activity

area would be defined by a cluster of unmodified debitage of the same reduction method with used tools and aborted products lying around the periphery.

Recycling of tools and the secondary use (following Schiffer 1976:38) of debitage is recorded in ethnographic and archeological contexts. Most instant tools are considered secondary use of otherwise unmodified waste. Instant tools and some recycled implements are thrown away where used. The differential discard of formalized versus recycled, instant, and debitage tools is a consequence of the cognitive distinction between curate and expedient tool use (Binford 1977b:33-6). An additional, spatial implication of this distinction, with regard to curate technological organization, is the postulate — "the discard of personal gear related to the normal wearing out of an item was generally done inside a residential camp, not in the field where the activity in which the item was used occurred" (Binford 1979:263). Early Archaic lithic technology exhibits both curate and expedient components.

Material correlates. The proposed material correlates of stone tool manufacture and use include:

1. Stone tool manufacture occurred around outdoor hearths and will exhibit a semi-circular concentration of unmodified waste with worn-out tools (that are being replaced), biface fragments, aborted preforms, implements broken in manufacture, hand-held cores, and rejected nodules scattered around the periphery of the debitage concentration;

2. When activities that only required expedient tools, such as eating and wood working, are conducted in the knapping area, instant tools or recycled tools will be used and then tossed away from the knapping area. These items will exhibit the same distribution as replaced tools and aborted objective pieces tossed during implement manufacture;
3. Non-tool manufacture activities, such as eating, hide cutting, and bone working, that were conducted away from the general work areas will exhibit a scatter of instant tools, the frequency of which will depend upon performance intensity;
4. A distinct activity area requiring the use of a formalized hafted implement, normally curated, will be manifest by edge-sharpening flakes and distal ends of broken tools; and
5. Overlapping activity areas of tool replacement, formalized tool use, or instant tool use will exhibit an aggregate of all these spatial patterns.

Hideworking

Sources. Stevens (1870:53); Mason (1891); Murdock (1892:294-9); Nelson (1901:116-8); Mathiassen (1928:109-14); Lowie (1935:75-7); Swanton (1946:442-8); Clark (1954); Hoebel (1960:62); MacDonald (1968); Leroi-Gourhan and Brézillon (1972); Catlin (1973:454-6); Goodyear (1974); Klein (1974); Nissen and Dittemore (1974); Gallagher (1977); Yellen (1977:85-97); Brink (1978); Wilmsen and Roberts (1978); Cahen et al. (1979); Hayden (1979b); Ives and Sinpoli (1980:30); Keeley (1980).

Propositions. The processing of hides requires defleshing, soaking to loosen the hair, removing the hair, tanning, drying, and final softening by scraping. Antler, bone, or wooden scrapers are usually employed in defleshing. Tanning is usually accomplished by smoking the sewn-up hide over specially prepared smudge pits. The final softening is usually performed with a hafted stone scraping tool, although the use of bone and metal scrapers has also been observed. The direct observation of hafted stone scrapers is widely recorded in ethnohistoric and ethnographic accounts. Furthermore, recent use-wear analysis of ethnographic specimens confirms the hide scraping function for hafted end scrapers (Nissen and Dittemore 1974; Brink 1978; Hayden 1979b). The functional equation of ethnographic specimens with archeological specimens was made early in the history of anthropology (Stevens 1870:53) and is deeply entrenched in traditional archeological typologies. It seems very fortunate that the functional association of formalized, hafted end scrapers with hide scraping is almost a world-wide pattern. This pattern is verified more and more frequently by modern use-wear studies. In the study sample, all tools defined as end scrapers exhibit a distinctive wear pattern described as "edge rounding with polish" under low-magnification. Lawrence Keeley (personal communication 1980), upon inspecting several of these specimens, commented that this wear pattern is most probably the result of dry hide scraping and represents a very consistent pattern that is observed just about everywhere in the world from Acheulean times on.

The cutting, scraping, and smoking of hides would require an open area and a smudging fire. It is probable that this work would be

conducted somewhat away from the family hearth area but near the shelter. Several end scrapers would be required and working edges would probably be resharpened during hide processing. If hafted (assumedly the case with Early Archaic end scrapers that exhibit regular, lateral edges and extensive, dorsal surface retouch — such as those shown in Figures 3B, 3C, 3E), then an exhausted end scraper would be tossed either at the hideworking area or at the knapping area, where the replacement tool was manufactured. The best indicator of the location of hide scraping would be edge resharpening flakes exhibiting hide polish, because these flakes would be dropped at the place of this activity. However, these flakes were probably not recovered at Rose Island because of the screen size (1/4 in). A less reliable indicator might be the concentration of used end scrapers in an area away from the hearth and shelter. Conversely, a scattered distribution of used end scrapers around a hearth or within a knapping area might indicate end scraper discard upon tool replacement. The spatial association between end scrapers and knapping areas, as evidenced by the concentration of debitage and discarded, used implements, is evident at several hunter-gatherer archeological sites where spatial distributions are reported (Clark 1954; MacDonald 1968; Leroi-Gourhan and Brézillon 1972; Goodyear 1974; Wilmsen and Roberts 1978). Cahen et al. (1979:663-6) adduce that the manufacture, use, and discard of a cluster of refitted end scrapers occurred in the same location at Meer II in Belgium. Unfortunately, the observation of lithic end scraper discard, as it relates to the locations of hideworking and tool

manufacture/replacement, has not been documented for hunter-gatherers by modern ethnoarcheological studies.

Associated with hide processing is decoration. Several ethnohistoric accounts of the use of pigments for hide decoration are recorded for Southeastern Indian cultures (Swanton 1946:442-7). Also, it is proposed by Keeley (1980:170-2) that ochre observed on many Paleolithic sites, when associated with hide scraping tools, was used as a pigment and rubbed into the hides during the final scraping. Certainly, the association of end scrapers and ochre is well represented in the archeological record of hunter-gatherers (Clark 1954; MacDonald 1968; Broyles 1971; Bordes 1972; Leroi-Gourhan and Brézillon 1972; Goodyear 1974; Griffin 1974; Klein 1974; Cook 1976; Wilmsen and Roberts 1978; Cahen et al. 1979).

<u>Material correlates.</u> The material correlates for hideworking activity include:

1. Exhausted end scrapers, end scrapers broken in use, unhafted end scrapers, useable end scrapers , working edge resharpening flakes, and hematite used for pigment are discarded in the vicinity of hide scraping work area and are generally aggregated at a location outside the shelter;
2. Exhausted, hafted end scrapers and end scrapers broken in manufacture were tossed from the knapping area where replacement tools were manufactured;
3. Hide tanning activity would be represented by smudge pits with perforating and cutting tools discarded nearby; and

4. When end scraper manufacture, hide scraping, and hide tanning occurred at the same location, end scrapers in used, broken, and useable conditions, perforators, and flake knives are concentrated around or near smudge pits.

Non-Lithic Implement Manufacture

Sources. Thomson (1964); Gould et al. (1971); Hayden (1977,1979a,1980); O'Connell (1977); Cahen et al. (1979); Miller (1979); Gould (1980); Keeley (1980).

Propositions. The manufacture of non-lithic implements, such as tool handles, spears, atlatls, fleshers, and fishhooks, is usually conducted to replace these worn-out or broken personal items or to provide for anticipated needs. The manufacture and repair of these items would be expected to occur at the residential camp and are characteristic of maintenance tasks (following Binford and Binford 1966:249,259). However, the actual use of these tools may not occur at the residential camp. For example, spears, atlatls, and fishhooks are tools that would be used away from the residential camp in extractive activities. Although ethnographic and ethnoarcheological observation of the spatial organization of non-lithic implement manufacture is limited, this activity is expected to occur around outdoor hearths, indoors in cold climates or cold weather. The observation of this behavior in modern ethnoarcheological studies is made difficult by the rarity of full-time, stone using groups and the fact that the uselife (following Schiffer 1976) of atlatls, spears, scraper handles is measured in

months. Thus the manufacture of these items, unless prompted by the investigator, occurs infrequently (Gould 1978,1980; Hayden 1979a).

Specialized and instant stone tools would be employed in the manufacture of non-lithic implements. Specifically, the flake adz, drill, denticulate, <u>pièce esquillée,</u> and flakes with steep, resistent working edges are observed in the study assemblages. The identification of actual and potential use patterns for these tool designs has been clarified through ethnoarcheological observation and use-wear experimentation. The determination of the actual use of individual specimens and adduced functional generalizations of formal tool categories are separate analytic positions in lithic analysis. In this analysis several functional attributes are observed for each artifact. This allows the general assessment of tool use for individual implements as well as the constructed category in general (outlined in Davis et al. 1980:Appendices 2,4). The inferred functional relationships, or rather, the tasks for which these tools are useable, for the categories observed in the study assemblages include:

1. Drill — drilling hard substances such as wood or bone;
2. Flake adz or steeply retouched shatter fragment — scraping and planing hard substances;
3. <u>Pièce esquillée</u> — scoring and splitting hard substances, as opposed to grooving and wedging as distinguished by Hayden (1980); and
4. Several types of denticulates, less-regularized edge retouch, and use of unmodified edges resulting in extensive working edge damage — indicative of the manipulation of hard substances in an unspecified manner.

Material correlates. The material correlates of non-lithic tool manufacture and use are:

1. Used, hafted implements, such as bifacial drills, will be discarded in the vicinity of the knapping area where the tool, in an exhausted state or proximal fragments broken in use, was replaced — drills or drill preforms broken in manufacture will be found in this same context;
2. Distal fragments of used, hafted tools (bifacial drills) will be discarded at the work area; and
3. Instant and unhafted tools, such as pièces esquillées, denticulates, flake adzes, and steeply retouched flakes, will be discarded in the vicinity of the area of non-lithic tool manufacture or maintenance.

More General Considerations

It is assumed that different discard patterns will occur depending upon whether tools are hafted or unhafted. Furthermore, tools that require greater manufacturing investment in terms of preforming, working edge definition, haft element definition, and edge resharpening potential, such as bifacial knives, projectle points, and drills, will possess greater inherent uselife. Consequently hafted tools will exhibit a different discard pattern from that of instant tools, such as secondary use debitage tools. Specifically, these tools will be curated and discarded in the replacement manufacturing area. The converse is also expected to be true. The implication of this and the propositions discussed previously is that the recognition of specific activity

performance, except tool manufacture, will be correctly identified more often if the tools used in the task are of an expedient, rather than a curate, nature (Binford 1978a:356). A summary of the material correlates for the expected Early Archaic residential camp activities is provided by Tables 1 and 2.

Table 1. Association of material residues and artifacts used in Early Archaic residential camp activities.

Activity	Preserved Materials Used in Activity	Material Residues of Performed Activity at Activity Area
Shelter construction and use	Celt, chopper	Loss of impact flakes off celts, discard of choppers, caching of personal items; and one or more hearths with surrounding work debris may also be observed
Sleeping	————	General absence of cultural debris
Fire Use		
Warmth	Surface hearth	Surface fired areas surrounded by charred wood and nut fragments
Cooking	Rock oven, surface hearth	Basin filled with charred wood, charred nut fragments, and fire-cracked rock
Hide smoking	Smudge pit	Small pit with charred wood but without fire-cracked rock
Food preparation		
Animal	Bifacial knife, utilized blades and flakes, chopper/scraper	Discard of bifacial knives broken in use and flake tools; chopper/scraper placed nearby
Plant	Milling stone, mano, pitted cobble, hammerstone	Charred nut fragments if nut processing occurred near hearth, site furniture placed nearby
Lithic tool manufacture	Hammerstone, pitted cobble	Discard of instant tools and exhausted blades
Hideworking	End scraper, perforator, hematite	Discard of hematite, perforators, distal ends of hafted scrapers, unhafted end scrapers, and edge rejuvenation flakes
Wooden tool manufacture	Drill, adz, retouched steep-angle working edges	Discard of distal end of used, hafted drill, flake adzes, and instant tools
Bone/antler tool manufacture	Pièce esquillée, retouched steep-angle working edges	Discard of pièces esquillées and instant tools

Table 2. Systemic context, discard mode, and spatial context for preserved Early Archaic artifacts.

Preserved Items	Systemic Context	Discard Mode	Spatial Context
Unmodified manufacture waste			Within knapping area if abandoned
Chert nodule	Procured raw material	Abandoned or cached	Within domestic area if cached
Primary decortication flake	Primary lithic reduction waste	Dropped	Within knapping area
Secondary decortication flake	Secondary lithic reduction waste	Tossed	Within knapping area
Shatter fragment	General lithic reduction waste	Tossed	Within knapping area
Amorphous core	General lithic reduction waste	Tossed	Within knapping area
Bifacial thinning flake	Bifacial tool manufacture waste	Tossed	Within bifacial tool manufacture area
Biface fragment	Stage I projectile point manufacture waste	Dropped	Around periphery of projectile point manufacture area
Projectile point preform	Stage II projectile point manufacture waste	Dropped	Around periphery of projectile point manufacture area
Projectile point fragment (broken in manufacture)	Stage III projectile point manufacture waste	Tossed	Within projectile point manufacture area
Blade	Blade manufacture waste	Tossed	Within blade manufacture area
Blade core	Blade manufacture waste	Tossed	Within blade manufacture area
Blade core rejuvenation flake	Blade manufacture waste	Tossed	Within blade manufacture area
Bipolar flake	Bipolar reduction waste	Tossed	Within bipolar manufacture area
Bipolar core	Bipolar reduction waste	Tossed	Within bipolar manufacture area
Drill preform	Drill manufacture termination	Dropped	Around manufacture area of drills
Bifacial knife preform	Bifacial knife manufacture termination	Dropped	Around manufacture area of bifacial knives
Utilized/retouched working edge on formalized implement/intended product			
Projectile point (broken in use, resharpened, exhausted)	Uselife termination/tool replaced	Dropped	Around projectile point manufacture area
Blade tools (K, ES, SS, P, G, RE, UE)*	Uselife termination/hafted ES replaced	Dropped	Around tool use area (except hafted ES)
Bifacial knife	Uselife termination/tool replaced	Dropped	Around bifacial knife manufacture area
Bipolar flake tools (ES, SS, RE, UE)	Uselife termination	Dropped	Around tool use area
Pièce esquillée	Uselife termination	Dropped	Around tool use area
Celt	Uselife termination/tool replaced	Dropped	Around celt manufacture area
Flake adz (SS or RE on shatter fragment)	Uselife termination	Dropped	Around tool use area
Pitted cobble	Abandoned	Placed/cached	Around hearth or near use area (placement), at shelter (cache)
Hammerstone	Abandoned	Placed/cached	Around hearth or near use area (placement), at shelter (cache)
Mano	Abandoned	Placed/cached	Around hearth or near use area (placement), at shelter (cache)
Milling stone	Abandoned	Placed/cached	Around hearth or near use area (placement), at shelter (cache)
Chopper/scraper	Abandoned	Placed/cached	Around hearth or near use area (placement), at shelter (cache)
Recycled formalized implements			
End scraper on projectile point	Recycling of implement for different function	Tossed	Around final use area
Pièce esquillée on projectile point	Recycling of implement for different function	Tossed	Around final use area
Utilized/retouched working edges on manufacturing waste (secondary use)			
Primary decortication flake (K, RE)	Secondary use of waste for specific function	Tossed	Around tool use area
Secondary decortication flake (K, ES, PE, RE, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Shatter fragment (K, ES, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Amorphous core (RE, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Bifacial thinning flake (K, G, P, PE, SPS, RE, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Biface fragment (ES, P, PE, RE, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Blade core rejuvenation flake (RE, UE)	Secondary use of waste for specific function	Tossed	Around tool use area
Used implement resharpening or impact flakes			
End scraper rejuvenation flake	Working edge maintenance	Dropped	Within tool use area
Projectile point resharpening flake (not recovered)	Working edge maintenance	Dropped	Within tool use area
Retouched implement resharpening flake (not recovered)	Working edge maintenance	Dropped	Within tool use area
Celt impact flake	Use damage residue	Dropped	Within tool use area

* K = knife ES = end scraper SS = side scraper G = graver P = perforator PE = pièce esquillée SPS = spokeshave RE = retouched edge UE = utilized edge.

CHAPTER VI

OBSERVED SPATIAL PATTERNS

The general propositions and their material correlates provide a model that describes the expected pattern of Early Archaic site structure at Rose Island given the site preservation and performed activity parameters mentioned. The model provides criteria for the <u>definition</u> of spatial phenomena and functions as an instrument to make sensible anthropological observations of archeological data in the context of observed behavioral patterns among modern hunter-gatherer cultures. The degree of fit between observed and expected spatial patterns is effected by four factors that we cannot further control at present: (1) sampling bias; (2) "noise" induced by non-cultural transformations of the archeological context (following Schiffer 1976); (3) pattern disturbance caused by occupation overlap; and (4) basic differences between Early Archaic and contemporary hunter-gatherer spatial organizations.

Although these factors significantly affect our ability to interpret the archeological record, it is justifiable to proceed with this spatial analysis because:

1. The study assemblages derive from archeological contexts representing a relatively large portion (4.2%) of the estimated total site area. Also, these contexts were carefully excavated;
2. Preliminary geomorphological analysis of Early Archaic stratigraphy in Tellico Reservoir (Chapman 1975; Foley and

Chapman 1977) indicates that post-occupation disturbance of the archeological materials is probably minimal;

3. Occupation overlap can probably be detected by the presence of an inordinate number of facilities, i.e., hearths and pits. Pattern disturbance caused by reoccupation can subsequently be analyzed through comparison with contexts exhibiting fewer facilities and assumedly less occupation overlap; and

4. The only way we can determine that there are basic differences between Early Archaic and contemporary hunter-gatherer spatial organization is to compare the material correlates of a model derived from studies of the latter with the spatial patterning of material residues of prehistoric hunter-gatherer cultures. This is precisely what this study attempts.

Pattern Extraction Method

The preceeding discussion and recent re-evaluations of intra-site spatial analysis (Yellen 1977; Binford 1978; Whallon 1979) require that extraction methods of meaningful spatial patterns consider activity areas to be of variable size, composition, density, and shape. Ideally, one would prefer point-plotted provenience data and would proceed to define artifact clusters without the constraint, and hence the bias, of an arbitrary excavation grid. This luxury is impossible for the study data.

Inspection of the grid counts for individual artifact categories shows that there is considerable range in the frequency occurrence of

different categories. Unmodified debitage categories occur frequently and in high densities. Most formalized tools and utilized debitage categories occur infrequently and exhibit relatively low grid counts. A commonly used method to evaluate the interrelationships among such categories in an assemblage context is correlation. Correlation analysis has been shown to be of questionable validity when raw data consists of values near zero when correlated with very large values — i.e., the low to high density variability of the study data (Carroll 1961; Cowgill 1970; Speth and Johnson 1976). In addition, correlation analysis assumes that the relationships among artifact categories are the same across the site area, disallowing the possibility of different patterns of covariation for two or more categories within multiple activity areas. Such an a priori assumption appears unjustified given current knowledge of site structure as revealed in recent ethnoarcheological studies (Whallon 1979). Principal components and factor analytic methods were ruled out as pattern extraction methods because both methods are based upon the manipulation of a correlation matrix. For these reasons, a two-step pattern extraction method was selected:

1. Ward's HGROUP single-linkage hierarchical clustering technique is used to group grid units into "like" clusters (Ward 1963; Veldman 1967). The number of clusters accepted for further evaluation is determined by inspection of a scree test of the sum-squared error among clustered groups.
2. An analysis of variance is used to determine if statistically significant differences are evident in assemblage composition

among the clusters of grid units. Furthermore, if statistically meaningful, inter-cluster variability is demonstrated, then significance tests are performed for individual artifact categories to determine which categories account for the intra-site spatial pattern. The GLM procedure of SAS (Barr et al. 1979) is used to perform an unbalanced, multiple, oneway analysis of variance.

This two-step pattern extraction method provides an analytical treatment of spatial distributions of artifacts in a manner that allows: (1) the interrelationships of artifacts located in the same general space to be recognized (cluster analysis) and (2) the key artifact categories that define the major spatial structure of the study area to be identified (multiple analysis of variance). Additionally, each artifact category distribution is described and visually inspected by a series of isoplethic, computer-generated SYMAPS (Dougenik and Sheehan 1975). The description of spatial data using this hueristic technique is informative, inexpensive, quick, and relatively easy to produce. However, the visual interpretation of these spatial representations is not without its problems (Jermann and Dunnell 1979). Trend surface analysis (Chorley and Haggett 1965) is an alternative method which was applied to the study data. This method suffers from the restriction of evaluating one category (univariate) at a time and therefore could not provide the kind of spatial information desired (multivariate) in step one. A continuous, contour SYMAP results from nearest neighbor interpolation by the computer, averaging seven data points. The exact

contour intervals for each SYMAP can be found by dividing the category range by the number of contours generated by the SYMAP program. For example, the contour interval for unmodified primary decortication flakes of the LeCroy assemblage is found by 22/3 = 7.3. Because the grid counts are even integer values, the actual contours are 0-7, 8-14, and 15-22 for the labels 1, 2, and 3 respectively. This is the equal-step option of the SYMAP program. The number of contours used was determined by evaluation of frequency histograms. In the discussion of analysis results, each assemblage is considered separately.

LeCroy Assemblage Spatial Pattern

The distributional data for the LeCroy assemblage are presented in Figures 7-10. The sample total, mean, variance, and range for each artifact category are included in Figures 9 and 10. The study area encloses two surface hearths, five rock ovens, and three smudge pits. The distribution of charred botanical remains (Figure 10J) indicates three concentrations that mark the locations of surface hearths and rock ovens (Figure 7). The two, large smudge pits at the center of the study area do not exhibit the same association. This may reinforce the contention that these facilities represent a function distinct from cooking or warmth. The surface hearth at the lower portion of the central block is not surrounded by a high density of botanical remains. This is probably due to erosion isolated at the front edge of the terrace (Chapman 1975:Figure 3F).

The assemblage site furniture includes eight pitted cobbles, four milling stones, and six hammerstones (Figure 7). Site furniture tends

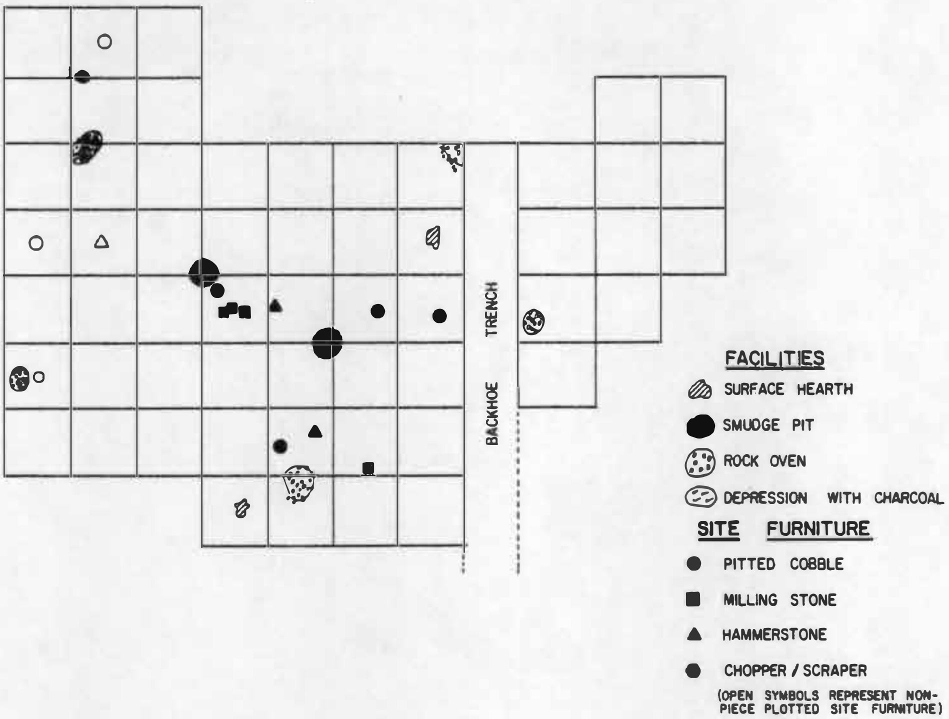

Figure 7. Distribution of facilities and site furniture for the LeCroy assemblage.

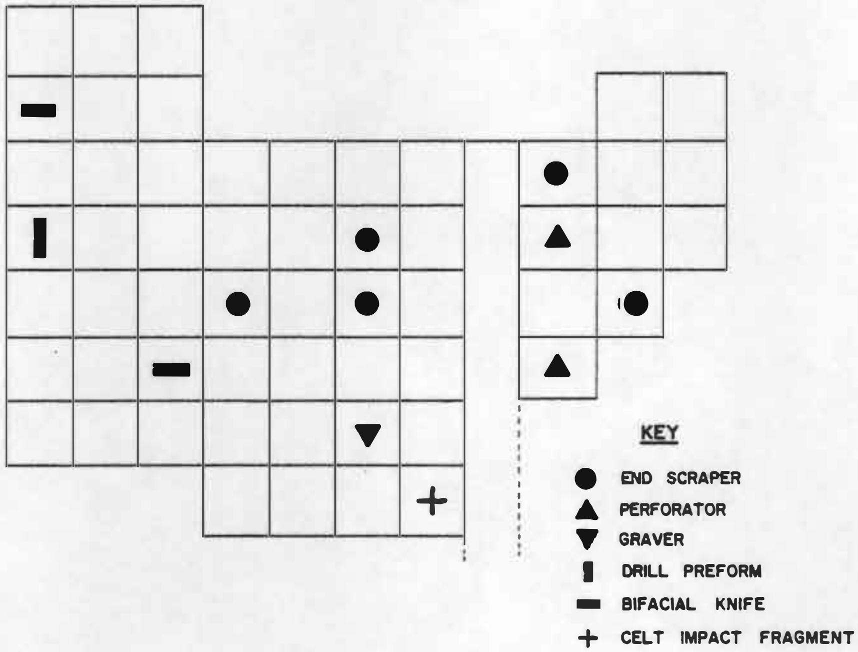

Figure 8. Distribution of formalized tools for the LeCroy assemblage.

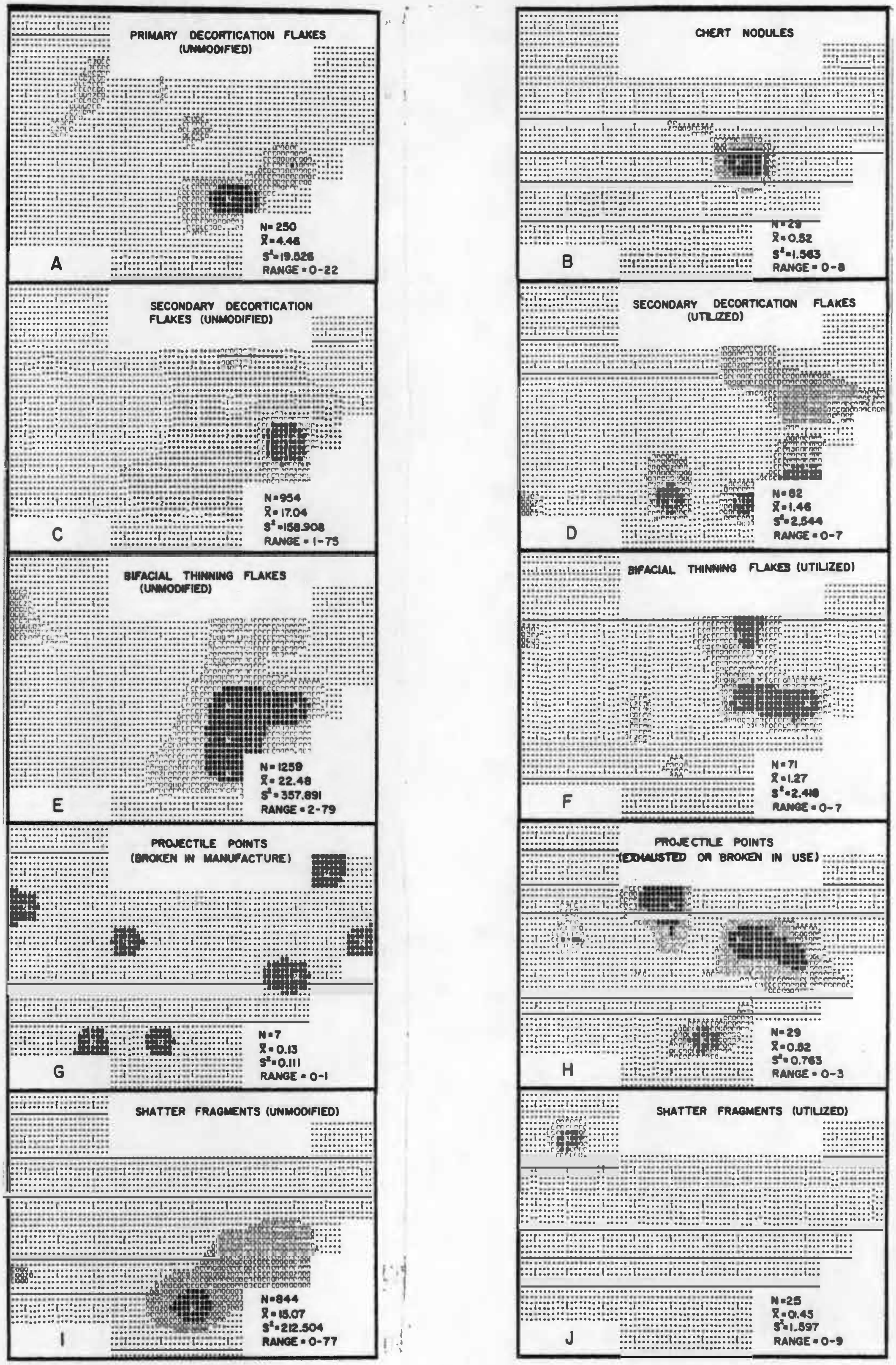

Figure 9. SYMAP distributions of Group I artifact categories for the LeCroy assemblage.

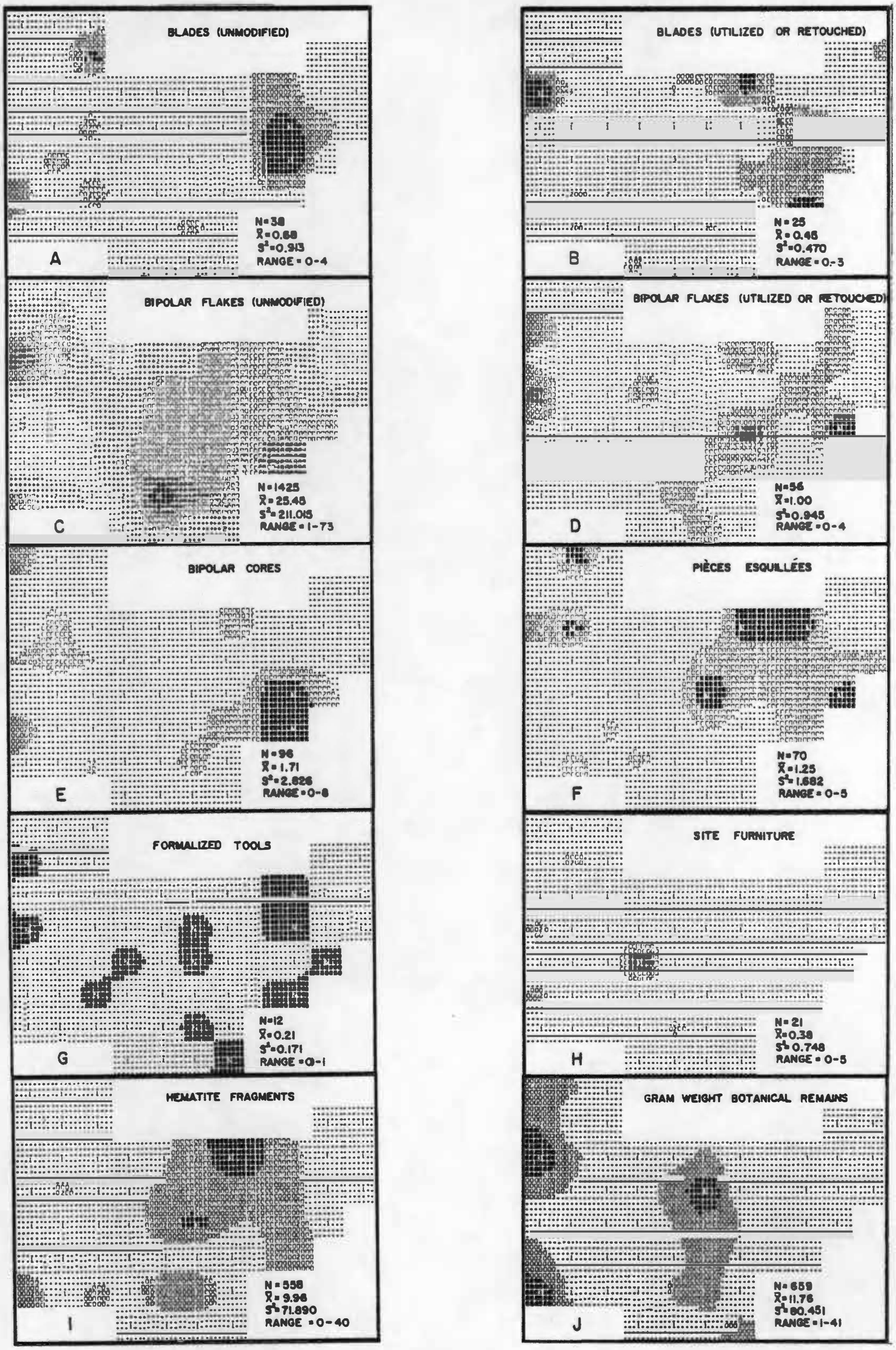

Figure 10. SYMAP distributions of Group II artifact categories for the LeCroy assemblage.

to be located near facilities. In the upper portion of the west block, three hammerstones and a pitted cobble were recycled as elements of a rock oven. As one would expect, more site funiture is observed in the central block where there are more facilities. A cluster (cache ?) of three milling stones, a pitted cobble, and a hammerstone is observed near one of the large smudge pits. No site furniture is observed in the east block. The distribution of formalized tools reflects a general association with features (Figure 8). And there is a general, spatial distinction between end scrapers and perforators in the central and east blocks, and bifacial knives and drills in the west block. A SYMAP of this distribution is provided by Figure 10G.

An inspection of individual category distributions (Figures 9 and 10) provides the following observations:

1. The three largest artifact categories, unmodified secondary decortication, bifacial thinning, and bipolar flakes, exhibit similar spatial patterns — specifically, a large concentration in the central and east blocks and a small concentration in the west block;
2. Other categories of unmodified debitage — chert nodules, primary decortication flakes, shatter fragments, and bipolar cores, occur in less quantity and are concentrated in smaller areas, but are subsumed within the two larger debitage concentrations;
3. Modified (secondary use) debitage (Figures 9D, 9F, 9J, and 10D) exhibit distributions different from that of the parent (unmodified) categories;

4. Blade waste (Figure 10A) exhibits a pattern different from primary, bifacial, and bipolar reduction debitage;
5. Blade tools (Figure 10b) are distributed adjacent to, but not totally within, the concentration of blade manufacture waste;
6. Pièces esquillées exhibit a distribution distinct from bipolar cores and used bipolar flakes, but are observed within the larger bipolar waste concentrations;
7. Projectile points (broken in manufacture and use), formalized tools, and site furniture are distributed along the periphery of or apart from the major debitage concentrations;
8. Hematite fragments, pièces esquillées, and end scrapers exhibit similar distributions; and
9. Pitted cobbles are observed within the dense concentrations of charred botanical remains as well as the bipolar debitage concentrations.

In order to provide a less subjective evaluation of the multivariate relationships of the data, a cluster analysis of the frequency data for the 23 artifact categories was performed using the grid unit (N = 56) as the classification variable. Clusters of grid units are defined by a minimization of the within-cluster variance. A four cluster grouping was accepted based upon an inordinate (relative) increase in the within-cluster error sum of squares at the three group clustering. The provenience of the clustered grid units is presented in Figure 11.

Although the spatial proximity of the clustered units is a positive

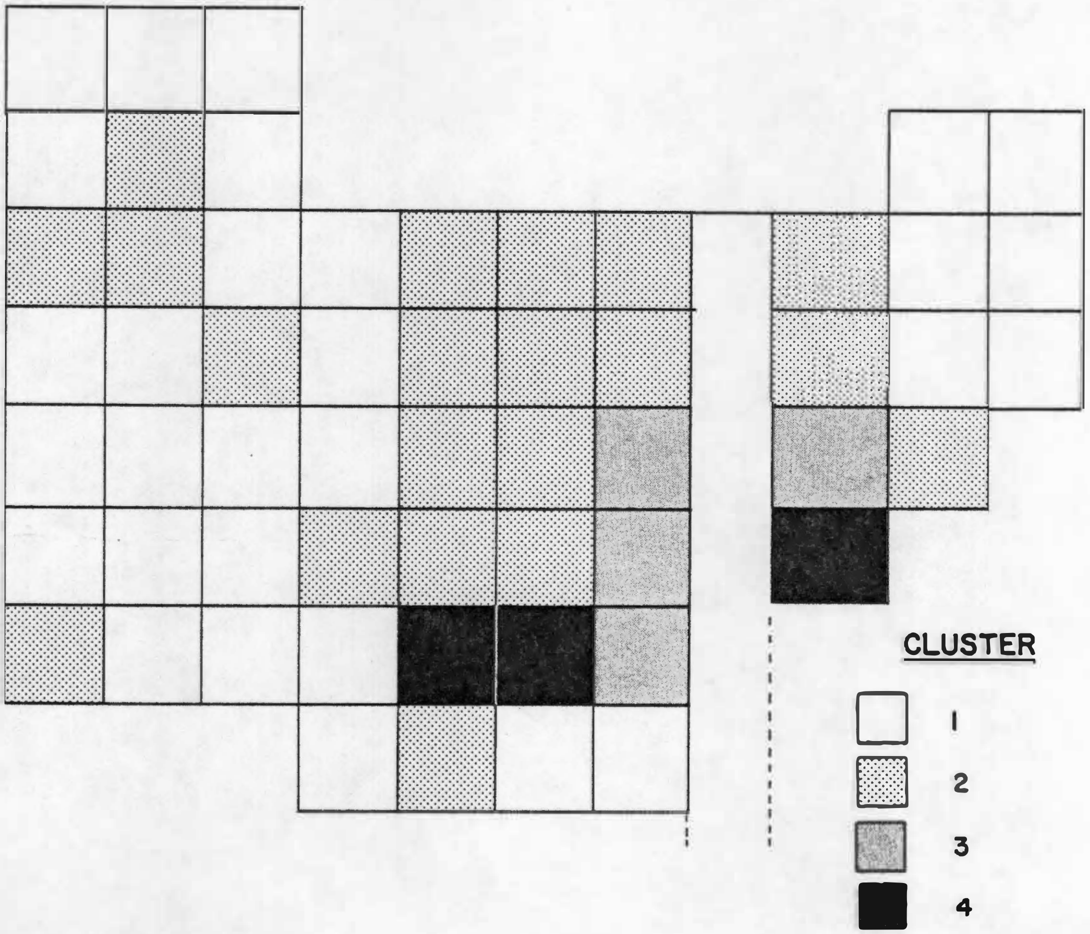

Figure 11. Distribution of grid units by cluster for the LeCroy assemblage.

indication of meaningful information in the cluster structure and consequently of interpretability for the observed spatial pattern, a multiple analysis of variance was performed to determine if statistically significant variability exists in the cluster solution (Table 3). The overall significance test, Wilks' lambda, suggests that significant ($p < 0.0001$) multivariate variability is evident among the four clusters. This justifies further discussion of the spatial pattern. An inspection of the F-ratios for each artifact category allows the identification of the categories that exhibit significant inter-cluster variability (indicated by an asterisk in Table 3) and therefore define the spatial pattern. Of the 23 categories considered, ten categories exhibit significant variability and consequently best characterize the clusters. These categories are: chert nodules, primary decortication flakes, secondary decortication flakes, utilized secondary decortication flakes, bifacial thinning flakes, utilized bifacial thinning flakes, shatter fragments, bipolar flakes, bipolar cores, and hematite fragments. These categories are considered diagnostic variables of the cluster pattern. The remaining 13 categories exhibit non-significant patterns of variability across the clusters and are therefore considered error or "noise" in the cluster structure.

A comparison of the mean and variance for the artifact categories by cluster (Table 3) allows an intuitive appreciation of the pattern revealed in the statistical tests. Specifically, four relationships are evident:

Table 3. Descriptive statistics of clustered groups and summary data of multiple analysis of variance for LeCroy assemblage.

Item Category	Cluster I (n=29)			Cluster II (n=20)			Cluster III (n=4)			Cluster IV (n=3)			MANOVA **	
	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	F Ratio	Significance
Chert nodules	0.28	0.278	8	0.45	0.892	9	2.75	12.917	11	0.33	0.333	1	5.90	0.0016 *
Primary decortication flakes	2.52	8.259	73	5.60	15.937	112	10.25	75.583	41	8.00	3.000	24	6.94	0.0006 *
Secondary decortication flakes	9.38	28.672	272	21.50	46.474	430	38.25	628.917	153	33.00	252.000	99	19.83	0.0001 *
Secondary decortication flakes (utilized)	0.83	1.005	24	1.90	1.358	38	2.00	8.000	8	4.00	13.000	12	6.00	0.0015 *
Bifacial thinning flakes	11.76	62.547	341	24.60	101.095	492	75.75	27.583	303	41.00	63.000	123	70.58	0.0001 *
Bifacial thinning flakes (utilized)	0.62	0.672	18	1.50	2.158	30	4.00	8.667	16	2.33	0.333	7	9.32	0.0001 *
Biface fragments	0.34	0.234	10	0.35	0.555	7	0.75	0.917	3	0.33	0.333	1	0.51	0.6793
Projectile points (broken in manufacture)	0.14	0.123	4	0.05	0.050	1	0.25	0.250	1	0.33	0.333	1	0.92	0.4375
Projectile points (broken in use)	0.21	0.313	6	0.70	1.063	14	1.25	0.250	5	1.33	2.333	4	3.84	0.0148
Shatter fragments	8.55	53.828	248	13.60	32.463	272	39.75	114.250	159	55.00	363.000	165	46.12	0.0001 *
Shatter fragments (utilized)	0.21	0.200	6	0.70	4.011	14	1.00	0.667	4	0.33	0.333	1	0.87	0.4631
Amorphous cores	0.17	0.148	5	0.55	0.576	11	0.50	1.000	2	1.00	1.000	3	2.62	0.0596
Blades	0.55	0.756	16	0.70	0.747	14	1.25	3.583	5	1.00	1.000	3	0.75	0.5284
Blades (utilized)	0.24	0.200	7	0.60	0.779	12	0.75	0.250	3	1.00	1.000	3	2.26	0.0912
Blade core rejuvenation flakes	0.10	0.096	3	0.25	0.197	5	0.25	0.250	1	0.33	0.333	1	0.79	0.5079
Bipolar flakes	13.97	38.892	405	34.60	39.095	692	38.75	30.917	155	57.67	180.333	173	70.70	0.0001 *
Bipolar flakes (utilized)	0.69	0.793	20	1.30	0.958	26	1.50	1.667	6	1.33	0.333	4	2.23	0.0944
Bipolar cores	1.21	1.741	35	1.70	1.063	34	3.75	9.583	15	4.00	9.000	12	5.95	0.0015 *
Pièces esquillées	0.90	0.882	26	1.85	2.661	37	1.25	0.917	5	0.67	1.333	2	2.55	0.0650
Bipolarized tools	0.14	0.123	4	0.15	0.134	3	0.25	0.250	1	1.00	1.000	3	4.14	0.0105
Formalized tools	0.17	0.148	5	0.25	0.197	5	0.00	0.000	0	0.67	0.333	2	1.77	0.1627
Site furniture	0.38	1.101	11	0.30	0.326	6	0.25	0.250	1	1.00	1.000	3	0.59	0.6300
Hematite fragments	6.24	19.047	181	13.00	108.421	260	10.75	37.583	43	24.67	5.333	74	7.89	0.0002 *
Subtotal			1728 (29.2%)			2524 (42.7%)			941 (15.9%)			721 (12.2%)	N=5914 (100%)	

*Artifact categories exhibiting significant inter-cluster variability using Bonferroni technique for dividing overall α level (.05): $(.05 \div 23) = .002$ (α level for independent variable).

**Overall test: Wilks' Lambda = 0.003, F approximation (69,90) = 7.66, $p < 0.0001$.

1. The average grid unit density of chert nodules, primary decortication flakes, secondary decortication flakes, bifacial thinning flakes, and utilized bifacial thinning flakes increases concurrently from Cluster 1 to 2 to 4 to 3;
2. The average density of utilized secondary decortication flakes, shatter fragments, bipolar flakes, bipolar cores, and hematite fragments increases concurrently from Cluster 1 to 2 to 3 to 4;
3. The average density of total artifacts (N = 5914) increases from Cluster 1 (59.6/grid unit) to 2 (126.2/grid unit) to 3 (235.3/grid unit) to 4 (240.3/grid unit); and
4. The average density of the remaining 13 categories overlap or vary inconsistently among the four clusters.

The four clusters can be characterized as follows:

Cluster 1 includes a relatively large portion of the study area that is relatively free of manufacturing waste, instant tools, formalized tools, hematite fragments, and facilities. Site furniture includes a cache of four milling stones and a pitted cobble in the second highest mean grid unit density for the four clusters. This may represent an important aspect of the cluster profile, even though the inter-cluster differences are not statistically significant.

Cluster 2 includes two small areas in the west block and one large group of units which enclose Clusters 3 and 4. Moderate densities of both bifacial and bipolar manufacturing waste, blade tools and waste, instant tools, and formalized tools are observed. Site furniture is infrequent and is largely represented by four items used in a rock oven. The highest densities of pièces esquillées, end scrapers, and facilities

are observed within the cluster. Hematite fragments are densely concentrated in the large group of units in the upper portion of the central block.

Cluster 3 includes four grid units surrounded by Clusters 2 and 4. Manufacturing waste is densely represented with bifacial debitage and chert nodules occurring in the highest average density for the assemblage. High densities of utilized bifacial thinning flakes and utilized shatter fragments are observed with only moderate representation of other instant tools. Formalized tools, except projectile points, are absent. Only one facility, a rock oven, is observed.

Cluster 4 includes three grid units that flank Cluster 3 and are surrounded by Cluster 2. Manufacturing waste is dense, as with Cluster 3, with bipolar debitage and shatter fragments occurring in the highest density for the assemblage. High densities of formalized tools, projectile points, blade tools, bipolarized tools, utilized bipolar flakes, utilized decortication flakes, and site furniture are observed. A concentration of hematite fragments is observed in the central block. Facilities are absent.

The behavioral implications of the LeCroy assemblage cluster patterns in the context of the developed model are as follows:

Cluster 1 units represent areas where relatively little lithic and non-lithic tool manufacture, use, and discard occurred. A concentration of milling stones and a pitted cobble placed at the edge of the largest group of units may represent a cache of site furniture stored for future use. The large number of contiguous units in the west half of the study

area may represent the location of a warm climate shelter without an interior hearth. The surface hearth in the upper portion of the central block may represent the associated outdoor family hearth. If this is true, then the location of this hearth and the cache of site furniture, assumedly stored near the shelter entrance, would place the entrance of the proposed shelter toward the east.

Cluster 2 units represent three areas where lithic and non-lithic tool manufacture, a variety of instant and formalized tool use, and instant tool and replaced formalized tool discard occurred. These activities were centralized around surface hearths and rock ovens. Hideworking may have been conducted within or adjacent to the large area of Cluster 2 units in the upper portion of the central block based upon high densities of used end scrapers and hematite fragments, and the presence of smudge pits. Plant food processing probably occurred in these areas given the density of botanical remains in the three Cluster 2 areas. If we accept the interpretation of the large Cluster 1 area as a shelter, then the large group of Cluster 2 units to the right of the proposed shelter could represent a generalized work area with associated family hearth in front of the shelter. This is proposed given the large size of the area, homogeneity of assemblage composition, and the range as well as kind of activities observed for this activity space. The smaller areas in the upper left and lower left edges of the west block may represent work areas for similar activities conducted with less intensity. In addition, more specialized activities, such as butchering and preparation of large game, may be represented in both areas, as evidenced by rock ovens. These activities are expected outside the

area may represent the location of a warm climate shelter without an interior hearth. The surface hearth in the upper portion of the central block may represent the associated outdoor family hearth. If this is true, then the location of this hearth and the cache of site furniture, assumedly stored near the shelter entrance, would place the entrance of the proposed shelter toward the east.

Cluster 2 units represent three areas where lithic and non-lithic tool manufacture, a variety of instant and formalized tool use, and instant tool and replaced formalized tool discard occurred. These activities were centralized around surface hearths and rock ovens. Hideworking may have been conducted within or adjacent to the large area of Cluster 2 units in the upper portion of the central block based upon high densities of used end scrapers and hematite fragments, and the presence of smudge pits. Plant food processing probably occurred in these areas given the density of botanical remains in the three Cluster 2 areas. If we accept the interpretation of the large Cluster 1 area as a shelter, then the large group of Cluster 2 units to the right of the proposed shelter could represent a generalized work area with associated family hearth in front of the shelter. This is proposed given the large size of the area, homogeneity of assemblage composition, and the range as well as kind of activities observed for this activity space. The smaller areas in the upper left and lower left edges of the west block may represent work areas for similar activities conducted with less intensity. In addition, more specialized activities, such as butchering and preparation of large game, may be represented in both areas, as evidenced by rock ovens. These activities are expected outside the

shelter but away from the family hearth area.

The Cluster 3 units represent a concentration of intensive primary, bifacial, and bipolar lithic reduction. Bifacial implement manufacture and the secondary use of bifacial debitage are the most important activities in terms of density. The latter may represent ad hoc tools used in snacking or in hafting manufactured implements. A concentration of exhausted and used projectile points (Figure 9H) in the work area suggests that weapon maintenance was conducted here. The lack of other formalized tools, site furniture, and facilities suggests that the Cluster 3 area represents a rather specialized work area.

The Cluster 4 units represent an extension of the Cluster 3 knapping area where proportionately more bipolar reduction was conducted. Instant tools, some formalized tools, and hematite fragments were assumedly used and discarded in slightly greater densities than in the Cluster 3 work area. Clusters 3 and 4 collectively represent a work area where primary, bifacial, bipolar, and blade reduction was intensely performed over a relatively small area. Unmodified debitage was used for ad hoc functions. Food preparation and consumption were not activities of primary importance. If we were to assume that flintknapping was a predominately male activity at this site, then the combined cluster (3 and 4) space might be interpreted as an outdoor men's work area. Furthermore, this activity would be spatially distinct from the more generalized family hearth area (Cluster 2). The homogeneity and concentration of this knapping activity area may be explained by the dropping discard mode for the majority of these items.

St. Albans Assemblage Spatial Pattern

The distributional data for the St. Albans assemblage are presented in Figures 12-15. The study area encloses 13 surface hearths, three rock ovens, nine smudge pits, and two relatively large, charcoal-laden depressions. The distribution of charred botanical remains (Figure 15J) reflects concentration around surface hearths. The density of smudge pits is negatively associated with charred wood and nut concentrations. Again, this pattern supports the functional distinction argued for this facility. The total site furniture includes four pitted cobbles, one milling stone, four hammerstones, and five chopper/scrapers. Site furniture is located in the vicinity of facilities and is scattered across the study area. Formalized tools appear to be clustered with like categories (Figure 13). Gravers appear distinctly clustered in the west block.

An inspection of the individual category distributions (Figures 14 and 15) allows the following observations:

1. Virtually all artifact categories, except utilized bipolar flakes, site furniture, perforators, and blade tools, exhibit overlapping distributions centered around the linear concentration of surface hearths and around two smudge pits in the upper portion of the west block;
2. A small concentration of instant tools and blade tools, distinct from parent debitage concentrations, is observed in the upper portion of the east block;
3. Primary, bifacial, bipolar, blade reduction debitage exhibits a similar distribution; and

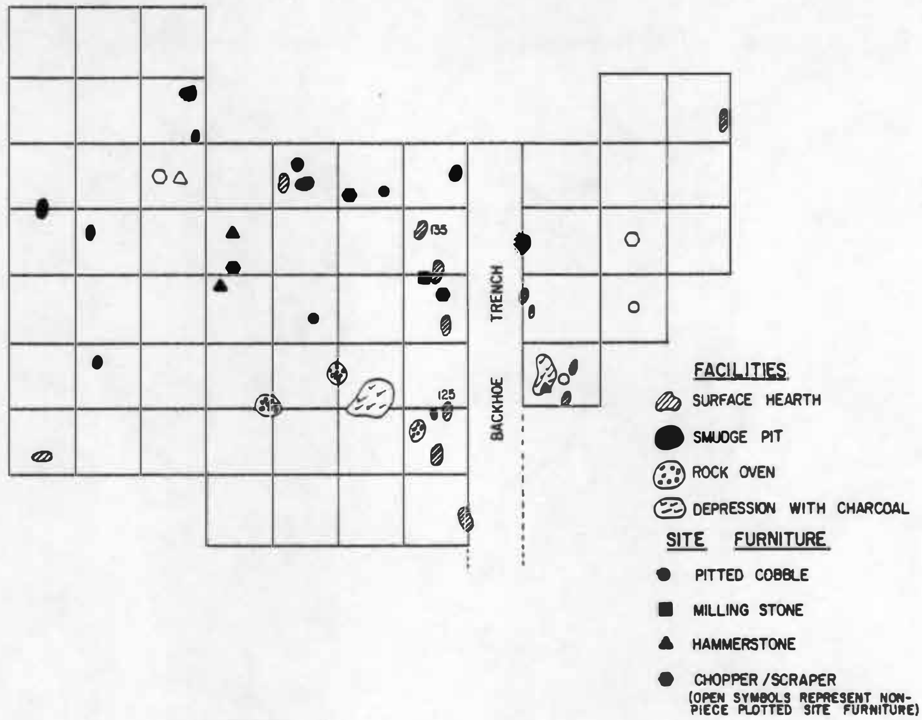

Figure 12. Distribution of facilities and site furniture for the St. Albans assemblage.

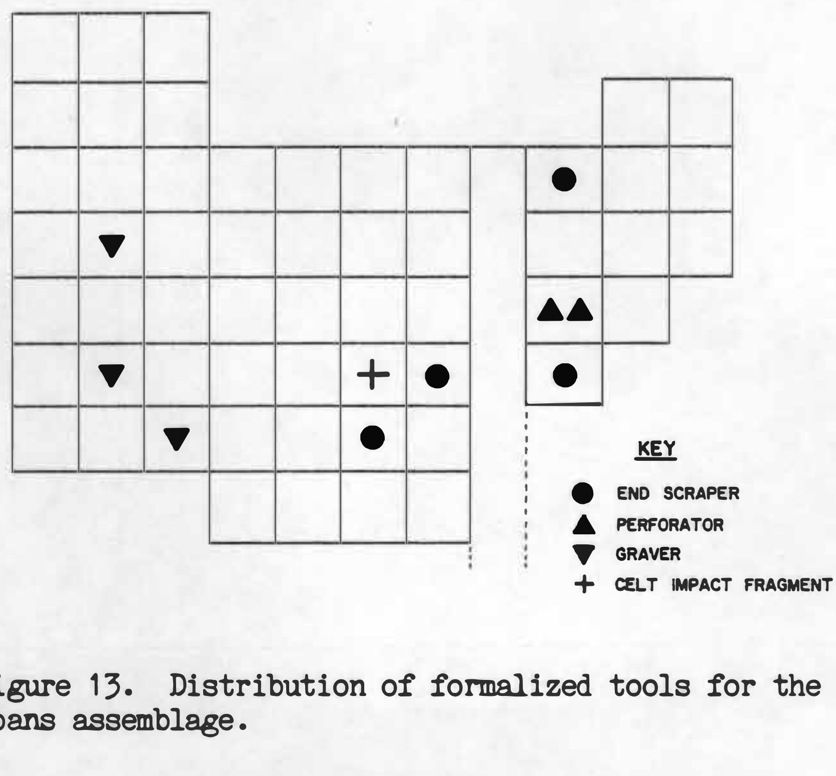

Figure 13. Distribution of formalized tools for the St. Albans assemblage.

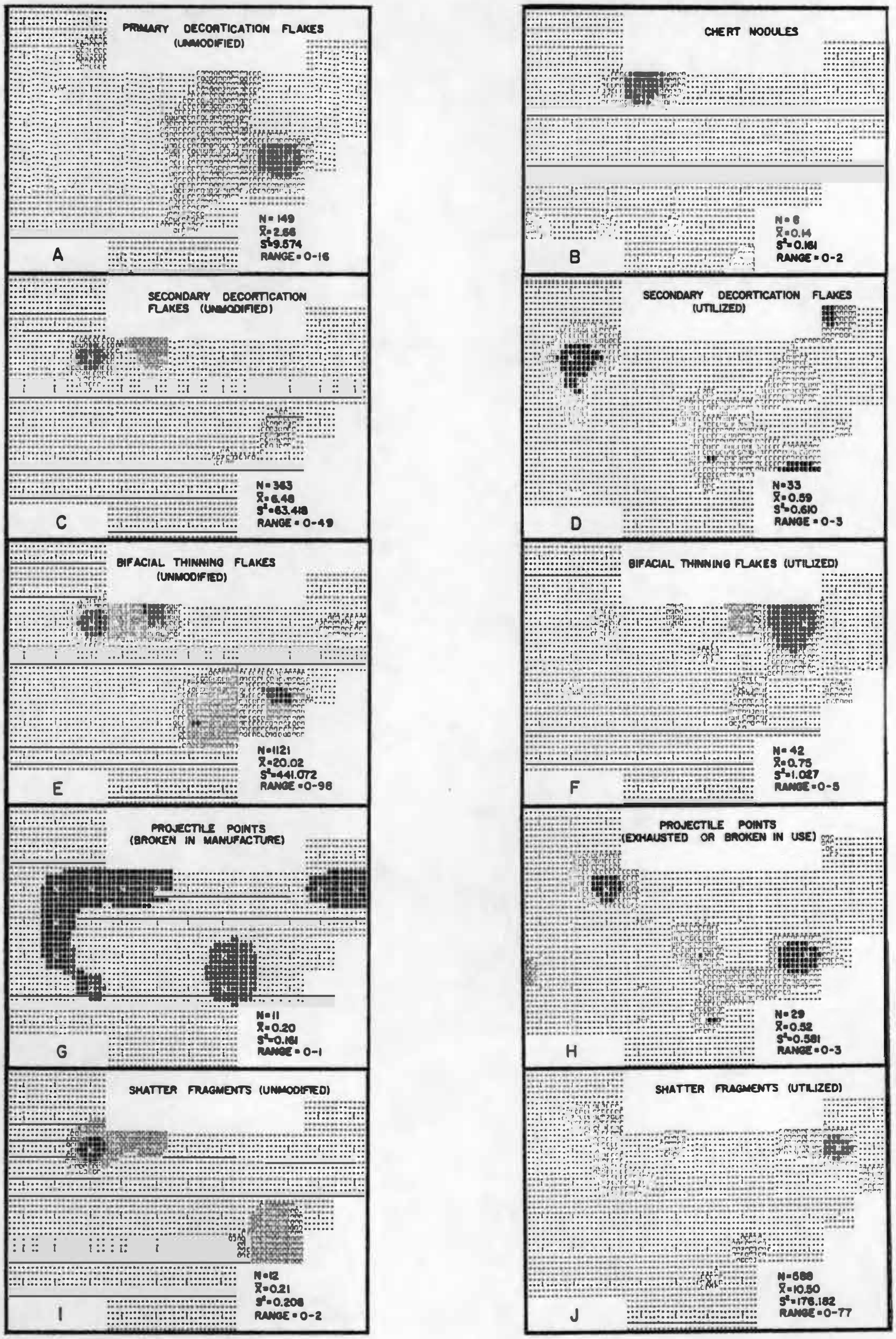

Figure 14. SYMAP distributions of Group I artifact categories for the St. Albans assemblage.

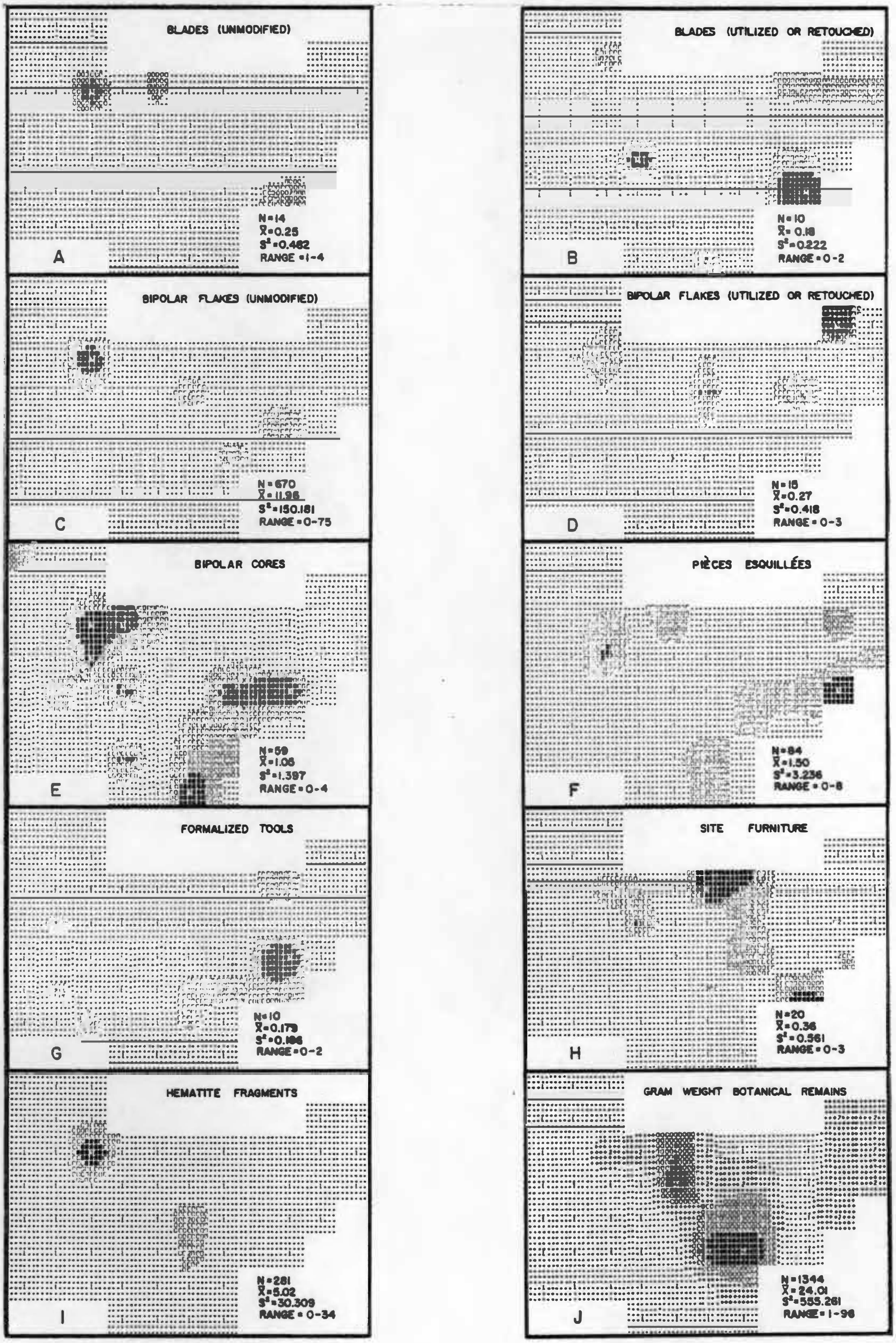

Figure 15. SYMAP distributions of Group II artifact categories for the St. Albans assemblage.

Table 4. Descriptive statistics of clustered groups and summary data of multiple analysis of variance for St. Albans assemblage.

Item Category	Cluster I (n=26) $\bar{x}$	Cluster I (n=26) s^2	Cluster I (n=26) n	Cluster II (n=16) $\bar{x}$	Cluster II (n=16) s^2	Cluster II (n=16) n	Cluster III (n=9) $\bar{x}$	Cluster III (n=9) s^2	Cluster III (n=9) n	Cluster IV + V (n=5) $\bar{x}$	Cluster IV + V (n=5) s^2	Cluster IV + V (n=5) n	MANOVA ** F Ratio	MANOVA ** Significance
Chert nodules	0.12	0.106	3	0.19	0.296	3	0.00	0.000	0	0.40	0.300	2	1.18	0.3254
Primary decortication flakes	1.35	2.075	35	2.31	3.963	37	3.00	5.000	27	10.00	14.500	50	26.27	0.0001 *
Secondary decortication flakes	2.50	3.860	65	6.06	18.063	97	8.44	18.778	76	25.00	201.500	125	28.34	0.0001 *
Secondary decortication flakes (utilized)	0.27	0.285	7	0.50	0.400	8	1.33	0.750	12	1.20	1.200	6	6.99	0.0005 *
Bifacial thinning flakes	6.12	15.306	159	29.38	93.050	470	13.56	34.778	122	74.00	207.500	370	128.33	0.0001 *
Bifacial thinning flakes (utilized)	0.35	0.315	9	0.63	0.517	10	1.56	2.778	14	1.80	0.700	9	6.75	0.0007 *
Biface fragments	0.12	0.106	3	0.06	0.063	1	0.11	0.111	1	0.80	0.200	4	7.46	0.0003 *
Projectile points (broken in manufacture)	0.12	0.106	3	0.25	0.200	4	0.11	0.111	1	0.60	0.300	3	2.45	0.0723
Projectile points (broken in use)	0.27	0.205	7	0.50	0.533	8	0.56	0.278	5	1.80	1.700	9	7.71	0.0003 *
Shatter fragments	3.15	7.175	82	14.38	49.850	230	6.78	29.444	61	43.00	369.500	215	46.27	0.0001 *
Shatter fragments (utilized)	0.08	0.074	2	0.31	0.363	5	0.22	0.194	2	0.60	0.300	3	2.40	0.0773
Amorphous cores	0.08	0.074	2	0.13	0.112	2	0.22	0.194	2	0.00	0.000	0	0.69	0.5650
Blades	0.04	0.038	1	0.25	0.333	4	0.33	0.250	3	1.20	3.200	6	4.79	0.0052
Blades (utilized)	0.08	0.154	2	0.38	0.383	6	0.11	0.111	1	0.20	0.200	1	1.43	0.2444
Blade core rejuvenation flakes	0.04	0.038	1	0.06	0.063	1	0.11	0.111	1	0.00	0.000	0	0.32	0.8131
Bipolar flakes	5.27	15.805	137	9.63	27.050	154	23.00	37.500	207	34.40	573.300	172	24.85	0.0001 *
Bipolar flakes (utilized)	0.04	0.038	1	0.19	0.163	3	1.00	1.250	9	0.40	0.800	2	6.67	0.0008 *
Bipolar cores	0.77	0.825	20	1.19	1.629	19	0.67	1.000	6	2.80	1.200	14	5.69	0.0020 *
Pièces esquillées	0.50	0.580	13	2.00	2.267	32	2.33	7.500	21	3.60	2.800	18	8.44	0.0001 *
Bipolarized tools	0.04	0.038	1	0.06	0.063	1	0.00	0.000	0	0.00	0.000	0	0.27	0.8477
Formalized tools	0.12	0.106	3	0.13	0.117	2	0.11	0.111	1	0.80	0.700	4	4.54	0.0068
Site furniture	0.08	0.154	2	0.75	1.000	12	0.22	0.194	2	0.60	0.800	3	3.64	0.0185
Hematite fragments	3.12	7.626	81	6.38	20.650	102	3.67	7.750	33	13.00	161.500	65	6.58	0.0008 *
Subtotal			639 (18.1%)			1211 (34.2%)			607 (17.2%)			1081 (30.5%)	N=3538 (100.0%)	

*Artifact categories exhibiting significant inter-cluster variability using Bonferroni technique for dividing overall α level (.05): (.05 ÷ 23) = .002 (α level for independent variable).

**Overall test: Wilks' Lambda = 0.004, F approximation (69,90) = 7.21, $p < 0.0001$.

Comparison of the mean and variance for the 23 artifact categories by the four reduced clusters reveals the following patterns:

1. The average grid unit density of primary decortication flakes, secondary decortication flakes, bipolar flakes, pièces esquillées, blades, exhausted projectile points, and utilized bifacial thinning flakes increases concurrently from Cluster 1 to 2 to 3 to 4;
2. The average grid unit of density of bifacial thinning flakes, projectile points broken in manufacture, shatter fragments, bipolar cores, utilized shatter fragments, formalized tools, and hematite fragments increases concurrently from Cluster 1 to 3 to 2 to 4;
3. The average density of total artifacts (N = 3538) increases from Cluster 1 (24.6/grid unit), to 3 (67.4/grid unit), to 2 (75.7/grid unit), and finally to 4 and 5 combined (216.2/grid unit); and
4. The average density of the remaining nine categories are rank ordered in various other combinations.

The four clusters can be characterized as follows:

Cluster 1 includes a large portion of the west half of the study area. The cluster exhibits low densities of all artifact categories, relatively few facilities, and relatively little site furniture. All three gravers of the assemblage are observed in the cluster.

Cluster 2 includes a linear block of grid units in the center of the study area, superimposed over the linear concentration of surface hearths. Also, there is a small block of units at the right edge of the

study area lacking facilities. Moderate densities of all categories of debitage, instant tools, formalized tools (including two of the four recovered end scrapers), and hematite fragments are observed. Average grid unit densities of site furniture and facilities, especially surface hearths, for the linear block are relatively high.

Cluster 3 includes a scatter of disconnected grid units along the periphery of the Cluster 2 block. Facilities are all but absent and site furniture occurs in low density. Moderate densities of debitage, instant tools, and projectile points are observed. The major distinctions with Cluster 2 for the categories are:

1. Higher densities are observed for primary decortication flakes, secondary decortication flakes, utilized decortication flakes, utilized bifacial thinning flakes, amorphous cores, bipolar flakes, utilized bipolar flakes, blades, and blade core rejuvenation flakes; and
2. Lower densities are observed for bifacial thinning flakes, shatter fragments, utilized shatter fragments, bipolar cores, chert nodules, projectile points broken in manufacture, utilized blades, bipolarized tools, and hematite fragments.

Cluster 4 and 5 (combined) include: (1) three adjacent units at the center of the linear Cluster 2 block, (2) an isolated unit at the upper edge of the study area, and (3) and a unit (Cluster 4) surrounded by the Cluster 2 and 3 units. This combined cluster exhibits the greatest artifact density for all categories except amorphous cores, blade core rejuvenation flakes, utilized blade, utilized bipolar flakes,

bipolarized tools, and site furniture. The average density of facilities is highest (1.0/grid unit) for the assemblage. Charred botanical remains exhibit the highest density in the Cluster 4/5 units.

The behavioral implications of the St. Albans assemblage cluster patterns are as follows:

Cluster 1 units represent a large area away from the concentration of facilities. Lithic and non-lithic tool manufacture, use, and discard, though represented, were relatively unimportant activities. The use of hearths, roasting pits, and hide smoking pits is evident, but their frequency is low relative to the size of the Cluster 1 area. The large area of Cluster 1 units, encompassing most of the west half of the study area, may represent the location of one or more, non-contemporary shelters.

Cluster 2 units represent activity areas adjacent to one or more surface hearths. Lithic and non-lithic tool manufacture, formal and instant tool use, and instant tool and replaced formal tool discard were conducted around surface hearths. Nut processing is indicated by the concentration of charred botanical remains and by the presence of a milling stone and two pitted cobbles. Bone processing may be indicated by three chopper/scrapers. The presence of end scrapers discarded after use and the two, large depressions full of charcoal (assumedly large smudge pits) suggest locations where hideworking was performed. Collectively, the range of these activities, performed within the same general area, reflect the residues expected at a general work area localized around family hearths. Given the preliminary archaeomagnetic assay (Chapman 1975:Figure 9) of an approximately 30 year difference

between surface hearth 125 and hearth 135 (Figure 12) and other archaeomagnetic data from other Early Archaic site in Tellico (DuBois 1977; Baden 1980), it apprears prudent to assume that few, if any, of these hearths were used during the same encampment. If these hearths represent family hearths, then they would be expected to be located in front of warm climate shelters. These purported shelters would be located to the left of the linear Cluster 2 block in the large Cluster 1 area.

Cluster 3 units represent the performance of lithic and non-lithic tool manufacture, formal and instant tool use, and used tool discard. This pattern is similar to the Cluster 2 pattern. However, more primary lithic reduction, blade manufacture, and instant tool use are evidenced in the Cluster 3 work areas. These activities were apparently conducted away from facilities, around the periphery of the family hearth work areas. As such, this activity pattern would represent the less mixed, or more specialized, edge of family work areas.

Clusters 4 and 5 units represent the greatest concentrations of residues from primary, bifacial, and bipolar tool manufacture as well as replaced projectile point discard for the assemblage. Hideworking is evidenced by end scrapers and the perforators, the concentration of hematite fragments, and the proximity to smudge pits. These activities were conducted within or near family hearth work areas. Given the possible number of re-occupations of the study area, it is conceivable that the Cluster 4/5 pattern is a consequence of activity area overlap.

CHAPTER VII

SITE STRUCTURE

The preceeding description of spatial patterning provides the identification of shelters, outdoor family hearths with associated work areas, roasting pits with associated activity areas, knapping areas where lithic and non-lithic implements were manufactured or replaced, and hideworking areas. The recognition of these activity patterns is more clearly established for the LeCroy assemblage because of less occupation overlap. The distinction of shelter, family hearth, flintknapping, and hideworking activity space for the St. Albans assemblage is probably only possible due to the overlap of the same activities during re-occupation, resulting from similar camp layout. This is inferred from the general segregation of surface hearths, smudge pits, and rock ovens (Figure 12) and the cluster analysis pattern.

The model site structure proposed for Early Archaic residential camps, based upon these data, is the location of surface hearth in front of the shelter. A wide range of activities, such as nut processing, food consumption, limited flintknapping, tool maintenance, hideworking, and assumedly socializing, is localized around the family hearth. Warm climate shelters were used for other activities, such as sleeping and the storage of personal possessions. Rock ovens, assumedly used for the roasting of game, are located near the family hearths or behind the shelter. Tool manufacture, use, and discard are localized, along with food consumption, around these facilities. The density and dispersion of these residues accumulate to a lesser degree than with the family

hearth activity areas. Hidesmoking pits are maintained at a distance further from the family hearths but near the shelter. The intensity of primary, bifacial, bipolar, and blade reduction varies within knapping areas. This may represent either the passage of time between episodes of tool manufacture or the simultaneous use of these knapping methods by several individuals. In either case, intense flintworking was conducted just outside the more generalized family hearth work space. This last element of the model is inferred from the LeCroy assemblage patterning. The occupation overlap of the St. Albans assemblage prevents further support for the pattern. A schematic diagram of this model is presented in Figure 17.

Although the probable re-occupation of the St. Albans habitation surface causes problems with the development of a single occupation, activity structure model, the observed spatial pattern provides important information at another level. The observation that surface hearths, smudge pits, and rock ovens were maintained in similar areas of the same occupation surface suggests that the camp plan may have been organized similarily over several occupations. It does not appear unlikely for these people to have possessed a knowledge of previous camp layout; shelter remnants, site furniture caches, and hearths provide potential benchmarks during the founding of a settlement at an old camp location. However, the apparent use of the same site structure over numerous encampments is a "surprise" not predicted by the model. This may be due to the relatively brief amount of observation time represented by most ethnographic and ethnoarcheological studies upon which the model is based.

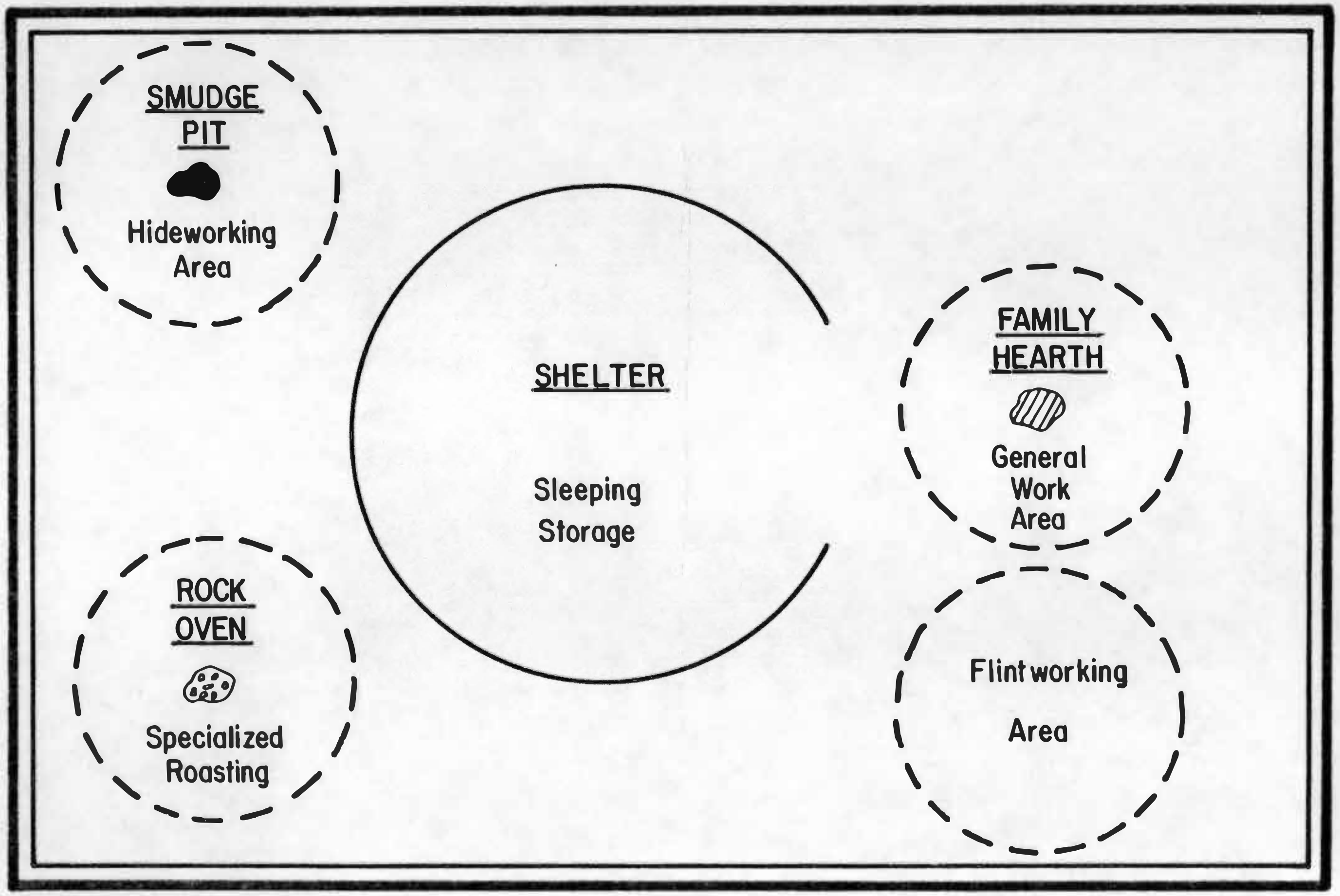

Figure 17. Model of Early Archaic residential camp site structure.

CHAPTER VIII

CONCLUSIONS

This study demonstrates that an a priori model of hunter-gatherer site structure permits an informative, behavioral interpretation of Early Archaic activity structure. This identification is made through the comparison of expected spatial patterning of material residues, derived from modern hunter-gatherer ethnography, with the observed spatial patterning of artifactual remains from an archeological context. The comparison of observed spatial patterns with expected spatial patterns allows a definition of site structure that relates more directly with generalizations evident from the majority of hunter-gatherer data. This approach avoids a posteriori modeling of site structure that tends to emphasize the pecularities of the single case. The method provides an intelligent means to make reliable statements about activities for which no direct residues are expected or preserved — for example, sleeping, the use of shelter, and food consumption.

The results of the statistical analysis indicate that the overall spatial structure of assemblages rather than selected tool categories provide information that more directly relates to present models of the use of space by hunter-gatherers. This contrasts with previous studies of intra-site spatial patterning where lithic debitage was excluded from consideration. The assumptions of the pattern extraction method assert that activity area overlap is to be expected. This pattern of activity overlap is dictated by the use of space around the family shelter and

hearth which comprises a number of different activities at one location. Furthermore, the material residues of overlapping activities result in artifact concentrations of varying composition, size, density, and shape. This follows from recent ethnoarcheological research and is supported by the findings of this analysis.

The results of the statistical analysis might also be evaluated in terms of how representative the sample is of the whole population. In other words, what is the effect of sampling bias? Sampling bias may pose a major problem in the interpretation of site structure for many Early Archaic sites, the study assemblages exhibit considerable spatial variability. With this in mind, it takes little imagination to realize how small excavation areas, large grid unit size, and small sampling fractions can distort the assemblage composition of the recovered materials. Furthermore, the analysis of inter-site assemblage variability, using materials recovered from small excavation areas representing a very small portion of the site may provide more hetereogeneity than expected if larger, and consequently more representative, samples are compared. Presently, we can only confidently state that the assemblage from one excavation area differs from the assemblage from another excavation area; we can not state that that two sites are different.

The isomorphism between the model and the observed spatial patterning is best represented in the following cases:

1. General and specialized work areas are clearly segregated;
2. The composition of artifact concentrations next to facilities is variable, apparently depending upon the function of the facility;

3. Greater quantities of relatively large size botanical residues are associated with surface hearths, rock ovens, and site furniture but not with smudge pits, which are assumed to function differently;
4. Site furniture is associated with general work areas localized around hearths or within areas with low densities of debris, interpreted as shelters;
5. Unmodified lithic debitage best identifies the size, shape, and density of activity areas;
6. The distributions of debitage representing different stages of reduction (unmodified chert nodules, primary decortication flakes, secondary decortication flakes, bifacial thinning flakes, bifaces, projectile points broken in manufacture) are observed within the same concentration;
7. Distinct distributions are observed for unmodified, recycled, and secondarily used lithic items of the same reduction method — for example, unmodified decortication flakes and utilized decortication flakes;
8. _Pièces esquillées_ and bipolar flakes, the assumed implement products of bipolar reduction, exhibit spatial patterns distinct from bipolar cores;
9. Objective pieces (such as projectile points, bifaces, and exhausted formalized tools), which are expected to have been tossed from the work place, exhibit random distributions;

10. Objective pieces are observed near but not central to the related debitage clusters, which assumedly represent the work area where the tool was produced;
11. Hideworking residues (hematite, end scrapers, and perforators) are spatially aggregated; and
12. Activity areas are composed of artifacts that exhibit a multivariate relationship, i.e., activity areas are not identifiable based upon the spatial clustering of single artifact categories.

The aspects of the observed spatial patterning of the study assemblages that were not expected or easily interpreted by the model include:

1. Hideworking residues (hematite, end scrapers, and perforators) are not associated with smudge pits, the assumed hide smoking facility. This might indicate a distinction in the spatial location of hide smoking and hide scraping activites;
2. Celt impact fragments were not observed near proposed shelter location(s) but within flintknapping areas. This might suggest their more frequent, though not exclusive, use in chopping wood for fires or in manufacturing wooden implements;
3. When occupation overlap is evident there is an inability to discriminate specific activity areas;
4. The identification of a warm or cold season shelter at the site is obfuscated by occupation overlap of the habitation surface. The proposed location of a shelter (or shelters) for the St. Albans assemblage is possible only because the site structure

of the various occupations was apparently similar. If the camp plan had not been similar (indicated by the consistent segregation of the facilities) then it would have been unlikely that an area with a low density of personal items or cached site furniture would be identified. Furthermore, Binford's (1978a:357) warning that the recognition of a shelter is a difficult matter on hunter-gatherer archeological sites should be kept in mind. In one sense, one must have a priori reason to expect a shelter at a site before deciding that every low density artifact concentration is a shelter location. One must rule out that areas of low artifact density at one side of a hearth represents the location of the down wind side of the hearth (Binford 1978a:349).

Two "surprises" were encountered in the analysis. Such observations provide new information about site structure and should be considered in future model development. First, it is very interesting that surface hearths, rock ovens, and smudge pits were clustered with like facilities but consistently apart from unlike facilities. This is most probably the result of laying out the camp in the same manner over successive occupations, i.e., placing the shelter in the same location and then building facilities and conducting outdoor activities in the same positions relative to the shelter. If the site occupants had knowledge of the camp plan from the last occupation or if remnants of the structure were observable during re-occupation, then there could be several reasons to continue to use the same camp layout. These would include:

1. The old shelter location would provide an area of low artifact density and consequently a good spot to sleep (assuming that one did not wish to sleep on piles of lithic debitage);
2. The old shelter might provide recycleable raw materials for the new shelter;
3. The shelter served as the location of cached personal items or family foods and may represent the property of a family, who wished to reuse the shelter as well as their cached materials;
4. If individuals not present at the last occupation knew the usual mode of camp activity structure on sites of this function, then they would have been able to locate food caches and useable raw materials. This is so if the location of general work area, flintknapping, site funiture cache, and food cache was predictable, i.e., patterned within the system; and
5. Specific landmarks that are not preserved in the archeological record, such as trees, forest clearings, or boat landings, may have identified the location of camps for several years between encampments. Certainly, the ability of modern hunter-gatherers to remember specific places and caches is established by current studies (Binford 1978b; Hayden 1979a).

A second pattern not expected by the model is the overlap of debitage from successive stages of bifacial reduction. Specifically, concentrations of primary decortication flakes, secondary decortication flakes, bifacial thinning flakes, bifaces, and projectile points broken

in manufacture overlap and increase in size with each stage of lithic reduction. This suggests that the entire manufacturing process occurred at the same place. Larger distributions of debitage from successive reduction stages occur because proportionally more flakes are produced with subsequent stages of reduction. A larger area of distribution of bifaces and projectile points broken in manufacture occurs because these items are tossed from the position of the knapper.

Possibly the most important aspect of this analysis is the application of a method that can be used to evaluate the material implications of ethnoarcheological propositions using archeological data. Certainly all models of prehistoric human behavior will see ephemeral acceptance as more observations and better methodologies are provided. The ethnographic and, more recently, the ethnoarcheological records provide tantalizing observations that are moving archeology forward in the development of formal theory. However, these developments mean little unless the archeological record is used to test the material implications of the propostions derived from these theories. The challenge for contemporary archeology is to continue to develop the analytic framework needed to discover and question the patterns predicted by current models of past human behavior.

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VITA

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