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SETTLEMENT PATTERN ANALYSIS OF THE LATE MISSISSIPPIAN PERIOD IN PIEDMONT GEORGIA

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PREFACE

This dissertation is just a beginning of the long journey toward the understanding of the past.

I am convinced this study could not have been completed without the contribution of many individuals to whom I am indebted. First and most of all, I wish to express my sincere gratitude to my former major professor, the late Dr. Joseph R. Caldwell, for his scholarly, as well as personal guidance during my graduate work.

I wish also to express my deep appreciation to the members of my advisory and reading committees: Dr. Wilfrid C. Bailey for his direct and indirect help during my graduate study at the University of Georgia; Dr. Donald A. Graybill for his actual assistance and advice throughout the entire course of the preparation of the dissertation; Dr. David J. Hally for his criticisms and comments; Dr. Michael D. Olien and Dr. Louis DeVorsey for their constant encouragement. I am also grateful for and acknowledge the computer time supplied by the Department of Anthropology, the University of Georgia.

It is with pleasure that I extend my thanks to my graduate school colleagues for their comments and suggestions during the various stages of the preparation of this

work. They include Sharon Goad, Charles Pearson, Ernest Seckinger, Richard Zurel, Chester DePratter and Dean Wood. Sharon Goad and Charles Pearson are especially thanked for the aid they provided me throughout the writing of this manuscript. Appreciation is also expressed to Mrs. Suzanne K. Fish who provided comments and suggestions to improve the quality of the manuscript.

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CHAPTER I

INTRODUCTION

Scope of Discussion

The purpose of this study is to investigate the spatial distribution of Late Mississippian (ca. A.D. 1400 - A.D. 1700) sites in Piedmont Georgia and to reconstruct some aspects of Late Mississippian adaptive systems. An archaeological survey in Morgan, Greene, and Putnam Counties, Georgia (Fig. 1) during the summers of 1973 and 1974 and a subsequent nine-month (1974-1975) field project in the proposed Wallace Reservoir resulted in the identification of 149 Late Mississippian sites. Utilizing the data obtained from these surveys, hypotheses regarding the Late Mississippian adaptive system can be formulated within an ecological frame of reference and tested. As a consequence of this analysis, this study may be a contribution in two ways: first, an understanding and reconstruction of Late Mississippian adaptations to their natural and socio-cultural environments may be developed, and second, a stochastic model for the prediction of and location of Late Mississippian sites may result from this work.

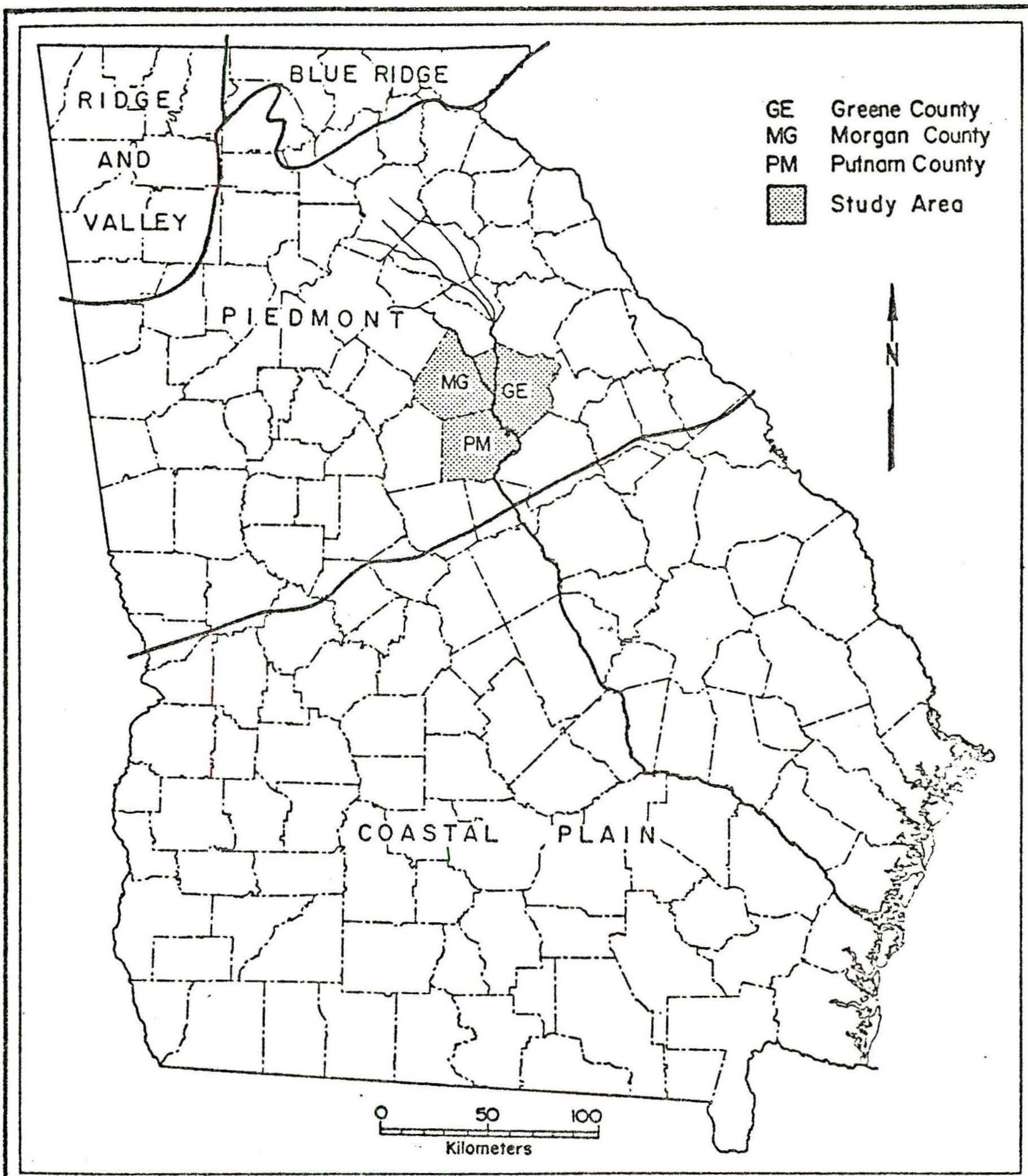

Fig. 1. Location of the study area

It is generally accepted that settlement archaeology is a useful concept in archaeological research. The term settlement pattern refers to the distribution of man's cultural activities over the landscape and can serve as part of the data used in the interpretation of prehistoric cultural dynamics. Theoretically, such a settlement pattern embodies two kinds of systems, socio-cultural and ecological, and provides a record of the relationship among them (Chang 1972; Rouse 1972). These relationships are: (1) man's relationship to his environment (man-land), and (2) man's relationship to his neighbor (man-man). These man-man and man-land relationships may be used in the study of cultural process and past life-ways. Some settlement archaeologists study one or both relationships simultaneously, while others deal with culture history in one form or another since human behavior is the expression of a particular period of time in a cultural tradition. Most studies of settlement archaeology are concerned with the utilization of an ecological frame of reference in the analysis of data as a means of interpreting and reconstructing instances of prehistoric cultural behavior and process.

Within the latter framework, this settlement pattern study deals with both the man-man and the man-land relationships of prehistoric populations in the study area. The rigorous research design used in studying the adaptions of a prehistoric population to its natural and socio-cultural environments may yield a model capable of predicting site locations. This model may in turn answer the questions that archaeologists so frequently face: "Where were prehistoric sites?" or perhaps "Why did the prehistoric populations live where they did?" The results of this study, viewed as a model for settlement pattern archaeology will contribute not only to the Late Mississippian prehistory of the study area but also to the prehistory of other areas with similar environments.

Organization

For organizational purposes, this dissertation consists of seven chapters. The introductory chapter elaborates upon the assumptions, concepts and definitions concerning settlement pattern analysis. In Chapter II, the study area is defined and previous research in the area is briefly discussed. The methods for collecting data are described and hypothesis formulations and analytical procedures are discussed.

The following two chapters, III and IV, deal, respectively, with the natural environment and the prehistory of the study area. Chapter V provides a brief overview of the ethnographic descriptions of aboriginal settlement systems within the area. This chapter also discusses Late Mississippian subsistence patterns. Since the archaeological investigation yielded limited information on subsistence activities, much of this discussion has its basis in ethnographic data.

Chapter VI presents the analysis of the Late Mississippian settlement pattern. This chapter deals primarily with the relationships between sites and environmental variables and with sites with respect to cultural variables. The final chapter presents a summary of the results of the study, and comparisons, inferences, and suggestions for future study.

Assumptions

The Late Mississippian period in the study area is treated as a static entity. No chronological subdivisions of the culture period are considered. It is assumed that the present data is a representative sample of the Late Mississippian population, since the study area has been well investigated by three years of archaeological survey. It is also assumed that the factors of the present environment in the study area such as vegetation, climate, precipitation, landform and soil types are essentially the same as the natural environment of the Late Mississippian period, i.e., from approximately A.D. 1400 to A.D. 1700. Although an effort was made to gather information concerning the contemporary conditions of vegetation and soil types, there are limitations on obtaining data concerning the exact state of those environmental factors.

Concepts and Definitions

Terms that are critical to this study will be defined or described in a precise manner in the following paragraphs.

Culture. The view of culture is among the most critical of this study. One generally accepted view of culture is that it is man's extra-somatic means and ways of adaptation, as well as a self-regulating system (White 1959). As an adaptive system, culture relates a population to its environment and to its neighbors for the purpose of serving the needs of that population. As a self-regulating system, culture undergoes changes of content as well as alterations of the system as it is necessary (Binford 1965; Steward 1955; White 1959). The function and purpose of culture as an adaptive system is, therefore, to maintain and perpetuate the population of the area.

Settlement Pattern. Settlement pattern generally refers to the distribution of man's cultural activities over the landscape. This distribution reflects the "natural environment, the level of technology on which the builders operated, and various institutions of social interaction and control which the culture maintained" (Willey 1953:1). Willey later described settlement pattern in the following terms:

> In settlement, man inscribes upon the landscape certain modes of his existence. These settlement arrangements relate to the adjustments of man and culture to environment and to the organization of society in the broad sense (Willey 1956:1).

In this study settlement pattern refers to the spatial arrangement of the Late Mississippian sites in the study area, as this may reflect the interrelationship of man and his socio-cultural environment, and of man to his natural environment. Some archaeologists distinguish settlement pattern from settlement system, which refers only to the functional relationship among a contemporaneous group of sites within a single culture area (Parson 1972; Winters 1969).

Site. A site is defined as "any location characterized by the deposition of the remains of human activity; it may contain such things as artifacts, facilities, debris and so forth" (SARG 1974:110). The term site in this study refers to any location in which archaeological remains have been found.

Phase. In the Midwestern Taxonomic System, McKern (1939:308) defined the phase as "the traits that are shared by all aspects within the phase to make up the phase complex take on a more general character." Willey and Phillips (1958) defined the phase as follows:

> An archaeological unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultures of civilization, spatially limited to the order of magnitude of a locality or region and chronologically limited to a relatively brief interval of time (1958:22).

Modifying Willey and Phillips' definition into brief terms, it could be said that the phase is an archaeological unit having traits sufficiently characteristic to distinguish it from others for the purpose of archaeological classification in terms of spatial and temporal arrangements. In this case spatial and temporal limits would be anything that encompasses the characteristic traits, but is neither too broad in terms of area nor too long a temporal span.

CHAPTER II

ARCHAEOLOGICAL PROCEDURES

The Extent of the Study Area

The study area consists of Morgan, Greene and Putnam Counties, Georgia (see Fig. 1). These counties are located in the north-central part of Georgia and lie wholly within the Piedmont Plateau which extends from northern New Jersey to eastern Alabama. The study area is irregular in shape. Its greatest length from north to south is approximately 65 kilometers and its greatest width from east to west is about 60 kilometers. As archaeological survey did not cover the outlying portions of the area, the extent of the area with which this study is concerned is smaller than the dimensions given above. Other features of the area such as physiography, drainage systems and other specific environmental features are discussed in Chapter III.

Data Sets

The present study of Late Mississippian settlement pattern analysis is based on data obtained from archaeological surveys conducted during the summers of 1973, 1974 and 1975 (DePratter 1976; Wood and Lee 1973).

These surveys examined a majority of the exposed areas, such as plowed fields, road beds, powerline rights of way, logging roads and other accessible areas. Where dense ground cover made surface examination impossible, posthole digger and small shovel tests were employed. It should be noted, however, that the survey was not very successful in areas that were heavily wooded or completely covered by bushes or in areas not readily accessible.

Table 1 lists the number of sites recorded during the surveys. The total number of sites exceeded 340. After careful examination of the artifact collections from each site, 149 sites were classified as Late Mississippian, Lamar phase sites and several attributes of these sites, including artifactual content, site size and environmental conditions. The ceramic and lithic artifacts collected from each site comprise the artifactual data set for each site (see Appendix II for artifact collections). The lithic material is divided into the following categories: debitage and tools. The Lamar phase ceramics include Lamar Plain, Lamar Complicated Stamped, Lamar Bold Incised and others. Site sizes were measured in square meters. The limits of the sites were defined by the distribution of surface artifacts. An additional attempt was made to define the limits of sites through posthole tests and test pit excavations where dense ground cover made surface examination impossible. It is assumed that site locations and estimated site dimensions are accurate in most cases.

Table 1. Frequency of sites by counties and years of survey

	Frequency of Sites by Counties				
Year of Survey	Greene	Morgan	Putnam	Hancock	Total
Prior to 1973	(6)*	(1)	-	-	(7)
1973	64 (35)	24 (14)	29 (13)	-	117 (62)
1974	11 (7)	23 (11)	54 (21)	2 (-)	90 (39)
1975	79 (23)	11 (4)	47 (14)	3 (-)	140 (41)
Total	154 (71)	58 (30)	130 (48)	5 (-)	347 (149)

*Numbers in parentheses are frequencies of Lamar phase sites.

General Hypothesis

The basic proposition of this study is that settlements are located in such a way as to minimize the effort expended in dealing with the environment. The underlying concept of this proposition is that of minimization-maximization. Mini-max behavior may be basic to all human activity (Cancian 1966, Morrill 1970, Zipf 1949). One useful aspect of the concept of optimization, i.e., mini-max, is that in any given situation people tend to make similar settlement selections in order to adapt to their environment (Plog and Hill 1971:13). Plog and Hill further argue that "...some site locations were more appropriate in a particular natural and social environmental setting and by conscious and unconscious processes were selected for" (Plog and Hill 1971:13). The resultant pattern of sites to their natural and socio-cultural environmental setting may then be a reflection of a pattern of behavior shared by that population and, in turn, shared human behavior may be predictable or patterned to the least cost way of life. One ethnographic account has already described this propensity of least effort:

> These ancient plantations were located in rich valleys where a generous soil yielded with least labor the most remunerative harvest, upon islands, and in the vicinity of streams where the products of the earth were readily supplemented by the fishes of the waters and the game of the forests (Jones 1883:6).

The concept of min-max utilized in this study is considered to be useful for generating specific hypotheses concerning the present analysis. This does not mean that other theories or concepts would not be useful for the present study. The notion of optimization utilized in this research involves a number of variables that are used to depict the patterns(s) of the settlement system. It should be noted that variables other than those discussed here may or may not be critical to this study. These variables have been excluded due to the limitations of the data.

In terms of applying this notion of mini-max behavior to the current study, a proposition, or law-like generalization, can be briefly stated as follows (Plog and Hill 1971: 11-12):

(1) Late Mississippian sites are located so as to minimize the effort expended in acquiring food resources (man-land relationship).

(2) Late Mississippian sites are located so as to minimize the cost of resource and information flow between sites (man-man relationship).

Specific variables of the cultural and natural environments are used in the present study in order to operationalize these propositions. The following section provides a discussion of each of these variables.

<u>Soil Types</u>. The importance of soil types for a settlement pattern study has often been neglected by archaeologists, even though early studies by Grimes (1945) and Wooldridge and

Linton (1933) emphasized the use of soil types for settlement pattern study and urged the use of soil survey maps. This study uses soil types as variables in the analysis of settlement pattern. Soil types are examined for each site by using early soil survey maps.

Soil types such as (fine) sandy loam and silt loam have characteristic of a highly friable texture. These types of soil were best suited for the intensive maize agriculture given at the level of the Late Mississippian technology. If sites are located on or near these types of soils then the inhabitants could minimize their agricultural production. The variable of soil types may, then, in conjunction with other environmental factors, be one indicate of Late Mississippian site locations.

Landforms. The environmental attributes of site location may have been critical to prehistoric populations. It is necessary to determine whether settlement location is either functionally important in coping with the areas of food resources and of easy access of communication, or practically important for several reasons. Functionally the ideal place to settle is probably a place where there is; (1) easy access to food resources, (2) ease of communication with other localities, and (3) a better defensive location from enemies. Practically, the ideal place to settle is: (1) a place that will not always be flooded, (2) a place where it is easy to construct a hut or house, and (3) other conditions.

It is obvious that no one likes to build a hut or house on a frequently flooded spot or on a steep slope, except for a special purpose. Rather sites may be located on ridge tops or terraces where the prehistoric population would not have to worry about a flood. Sites may also be located on large flood plains where floods do not occur so frequently as to interfere with their farming. Sites may also be located at intermediate locations such as terraces and slopes. Such a location would allow the inhabitants to exploit resources at diverse loci with less cost in terms of the amount of time and energy expenditure.

In order to delineate the landforms of each site, the topography of each site location is examined using USGS Quadrangle maps and field observations. It is assumed that the paleo-landforms were basically similar to the present day landforms, although some minor changes may have occurred during the past several hundred years.

Water Resources. The prehistoric population of the study area exploited riverine food resources such as fish and shellfish. A few shell middens have been found along the Oconee River. The most common fish of the river are minnows, catfish, perch, bass, and sunfish (Dahlberg and Scott 1971). Some sites along the river may have been fishing camps, but it is not necessary to consider all the sites near the Oconee drainage as fishing camps. They may have been year-round settlements. The water resources of this area are not as critical as those in a desert or arid area because precipiation is high (annual average-over 1190 mm: Carter 1974) and other drainage systems are found throughout the area. Nevertheless, it is still important that sites tended to be located near the Oconee River and its major tributaries. Such a location would enable the prehistoric population to utilize the river especially during the lower precipiation months of October and November (average-approximately 63 mm per month) and would provide a means of communication. The distance from a site to the nearest drainage is measured using USGS Quadrangle maps.

The rank of the nearest drainage is another useful variable. The rank ordering of a drainage network employs the Strahler system (Strahler 1964). This numerical system is discussed in Chapter VI. The Strahler system is an attempt to examine the distances from sites to their nearest drainages according to their rank so that any patterns in the relationship between sites and drainages can be detected. If sites are located near the higher ranking drainage networks, then we may assume that the exploitation of this water resource would have been maximized by the inhabitants. Higher ranking drainage networks are navigable and may have been used as a means of communication.

Distances Between Sites. An attempt was made to examine the distances between each hierarchical class of sites in order to detect any regularity that might exist between sites in terms of agglomeration. Prehistoric populations in the study area could better achieve their social and economic goals by minimizing the distance they had to travel. This could be best accomplished by the agglomeration of sites. An example of agglomeration in early days is the semi-communal activity at villages. Similar phenomenon should be detected in the study area if the prehistoric population in the area had attempted to use space efficiently. This phenomenon may be expressed in the arrangement of sites, large sites with similar functions being found in similar physical and cultural environments. Large sites shoudl also be regularly spaced along the Oconee River system and may also be speced further apart than secondary sites. Secondary sites may be further apart than tertiary sites.

The arrangement of the large sites may possibly be determined by three factors, i.e., socio-political organization, food resources and transportation, which together act on the landscape. The degree of efficiency of these three factors combined may determine territorial boundary that can be efficiently controlled. When an equilibrium break is brought about by over population or other factors, change should come in the forms of migration, warfare or other mechanisms. Therefore, no prehistoric settlement distribution can be considered truly random since the location of a settlement is related to the above factors. The regular spcaing of the large sites helped maintain a locational equilibrium by confining the surrounding local populations within areas whose dimensions prevented conflicts with adjacent large sites.

Site Size. Site size is an important factor in the locational analysis of prehistoric settlements because site size is considered a reflection of a site's adaptation to the total environment. The analytical units used in the present research are site classes based on site size and artifact collections. It is considered that settlement size and artifact collection may be meaningful indicator of the functional activities of any given site.

Ceramics. The ceramic collections from each site were counted and classified according to the traditional types defined by Southeastern archaeologists. In considering Lamar phase ceramic types as reflective of cultural activity, the ceramics are analyzed in light of their variability across the analytical units, i.e., site classes.

Lithics. The lithic materials were divided into two broad categories: debitage and tools. The debitage category includes angular fragments and flakes. Tools were classified according to descriptive categories. Lithics, along with the variables of site size and ceramics, are considered meaningful indicators of the functional range of any given site.

Fauna and Flora. The natural distribution of fauna and flora are also examined. These distributions are critical to this study because the prehistoric population depended heavily on food resources consisting of various kinds of game animals, plants, seeds, and nuts. Since the present archaeological survey did not yield enough fauna and flora samples, the only meaningful fauna and flora variable is its natural distribution as well as its value as a food resource.

Other Environmental Variables. Other environmental variables such as climate, precipiation, temperature and geomorphological features provides a general sketch of the environment of the study area. Where paleo-environmental data is not available, it is assumed that the paleo-environment is not very different from that of today. These environmental factors assist in our understanding of the Late Mississippian population's adaptation to their natural environment.

Data Analysis

The statistical analysis of the data seeks to reveal how variables correlate with each other and the degree of their relationships. In order to test the hypotheses and to develop the models, several statistical techniques such as simple percentage tables, Chi-square, the contingency coefficient, cluster-analysis, t-test, and the correlation coefficient are employed. In order to use these statistical techniques all of the relevant variables and information are recorded on computer cards. The actual computations were performed on an IBM 360 and Cyber 70 at the University of Georgia. Much of the analysis was accomplished using the

Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner and Bent 1975). Other programs of the analysis utilized in this study are described where discussed.

Sources of Error

It is necessary to point out the potential sources of error for future study as well as to provide a critical evaluation of the results of the present study. Some potential sources of error in this study are sampling and classification errors and errors in the interpretation of the paleo-environmental conditions.

Although it is assumed that our data is a representive sample of the total population, it should be pointed out that there is possible sampling error. Locations and boundaries of sites may have been distorted or altered by natural events such as alluviation and erosion, and by post-contact human activities such as deforestation, irrigation, cultivation, herding and vandalism. Although such elements of error exist, it is assumed that site locations and estimated dimensions of sites are accurate in most cases, and that errors can be minimized by consistently measuring site boundaries.

Potential errors also exist in the classification of artifacts and site types. These classification errors probably stem from the use of weathered ceramics, small artifact sample size and the relocation of artifacts by disturbance.

Another possible source of error is in the area of paleo-environmental conditions. Even though factors of the natural environment during the Late Mississippian period are critical to this study there are limitations on obtaining exact data pertaining to them. The information on these factors comes partly from ethnographic sources and partly from research in other fields.

CHAPTER III

ENVIRONMENT OF THE STUDY AREA

This section presents detailed information on the natural resources and environmental conditions of Piedmont Georgia. Since the settlement pattern as well as the subsistence and land use patterns of the aboriginal population of the area is hardly reconstructable without knowledge of the environmental setting of the study area is essential for a prehistoric settlement pattern study. In archaeology the interrelationships between the prehistoric aboriginal populations and their environment may be viewed from an ecological perspective, but in the archaeological context. Odum defines ecology as "...the study of the interrelations between living organisms and their environments" (Odum 1971: 3).

The information provided in this chapter is intended to delineate an assessment of the exploitable resources and environmental conditions of the Late Mississippian period (ca. A.D. 1400-A.D. 1700). One of the important assumptions in reconstructing past environments, i.e., paleo-environments, is that past environments have modern analogies: "Most paleoecologic studies rely heavily on modern environmental processes and phenomena to support inferences about the geologic past" (Laporte 1968:70). It is not only difficult to reconstruct the paleoenvironment but it is also difficult to demonstrate the validity of these reconstructed paleoenvironments. For this problem, Laporte suggests the following:

> We can never definitely prove the truth of our assertions about past environments and communities or organisms. The validity of our paleo-ecological interpretations are, first, the internal consistency of multiple sets of independent data which lead to the same final conclusions, and, second, the geologic and biologic sense our interpretation makes when compared to present-day environments and organisms (Laporte 1968:71).

The environmental reconstruction utilized in this research is a compilation of data from several types of sources. The present environment is examined and, when feasible, is supplemented by early historic accounts. In addition, several recent studies on the environmental conditions of the pre and post contact period are reviewed.

Physiography of the Area

The study area lies within the Piedmont Plateau, a belt approximately 160 kilometers wide. It is approximately 70 kilometers from the extreme northern corner of Morgan County to the Appalachian Mountains which represent another physiographic region. The Fall line, beginning about 23 kilometers south of Putnam County, separates the Piedmont Plateau from the Coastal Plain. The rocks are mostly metamorphic with complex structures truncated by the Plateau surface. The majority of the rocks in the Piedmont Plateau are gneiss, schist, marble and quartzite, and were derived by the metamorphism of older sedimentary and volcanic rocks. Other rocks in the Piedmont area include slate and granites (Hunt 1967).

The topography of the area is the result of the long erosional period of an old, smooth plain. The general nature of the topography of the area is typical; the uplands are cut by the larger drainages into major divides, which are, in turn, subdivided into smaller drainages. As a consequence, the whole area is a series of ridges with the surface varying from undulating to gently rolling; rolling, and hilly (Carter 1974).

Along the major drainages there are level bottom lands or flood plains of varying width and extent. Terraces or old flood plains exist along the Oconee River in several places. These are smooth and even surfaced. The highest elevation of the area where sites are found is 191 meters above sea level and the lowest elevation of the area where sites are located is 108 meters above sea level. The drainage of the three counties is carried almost entirely by the Oconee River system. The Appalachee and Little Rivers form the branches of the Oconee River system.

Environmental Variables

Climate. Figure 2 presents a summary of climates of the area. An examination of this figure indicates that the study area is characterized by a short, mild winter (average

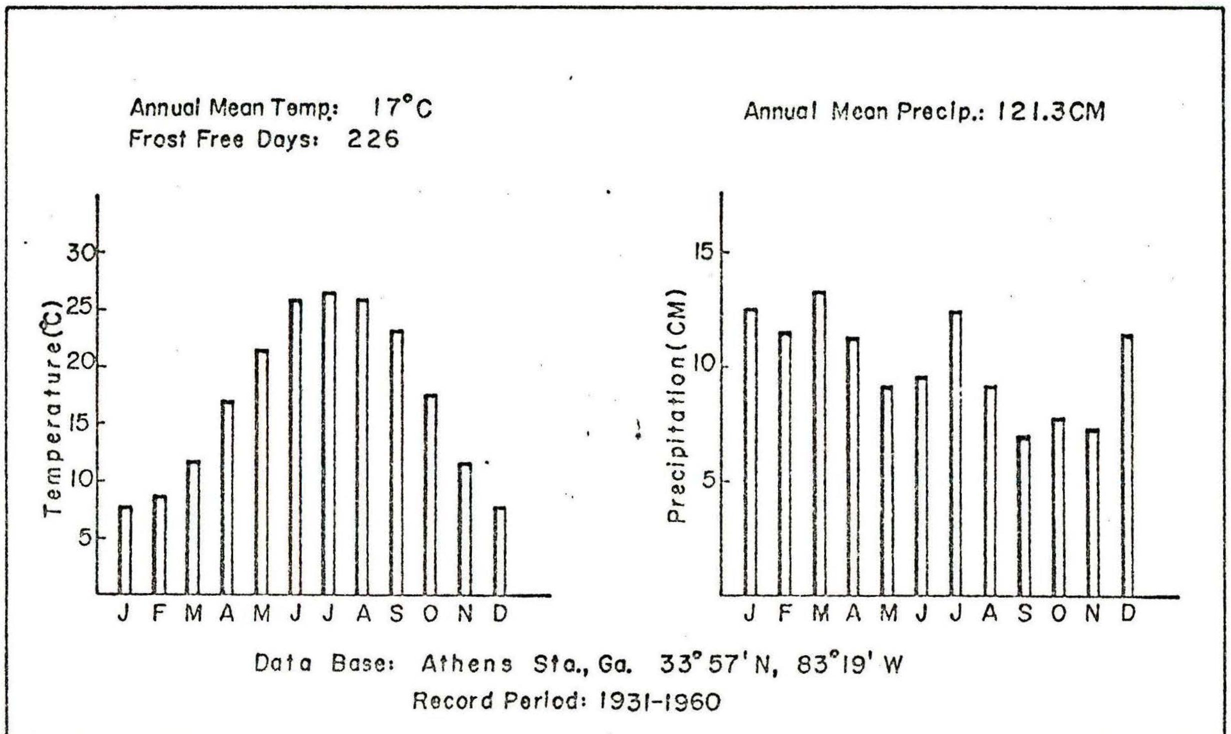

Fig. 2. Temperature and precipitation data (after Carter 1974)

temperature-over 8 Centigrade) and a long, warm to hot (average temperature-over 25 Centigrade), humid summer season. All four seasons are apparent, but the spring and fall seasons are usually short (Carter 1974).

The annual rainfall averages 121.3 centimeters and is well distributed throughout the year. Maximum rainfall occurs during the winter and early spring, and also during mid-summer. Minimum rainfall occurs in fall, with a secondary minimum in May. Snowfall is light in the area and of no significance (Carter 1974). Average annual rainfall seems to be sufficient for most plants. Sufficient humidity is also of great significance for agriculture.

The average annual temperature is 17 Centigrade with the mean temperature for the summer season being about 25.6 Centigrade. Generally, summer days are hot. Temperatures of 35 Centigrade or higher often occur during this season (Carter 1974). Winter temperatures show more variation than those of summer. The winter season begins late in November and lasts until early March. This season is usually short, alternating with periods of relatively mild temperature. The average annual number of days with a temperature of zero degrees Centigrade or less is around fifty days, with a temperature of six degrees below zero Centigrade or lower expected for only about five days. The frost free growing season of the area is approximately 226 days and usually extends from late in March to early in November (Long 1922).

As in the case of rainfall, the temperature variable in agriculture determines time limits for plant growth. As shown in Figure 2, the range of rainfall and temperature makes the climate of the study area suitable for growing a wide variety of plants.

Soils. The soils are usually directly derived from the underlying rocks. Thus, the character of the soil types follows closely certain characteristics of the underlying rocks (Hunt 1967). In the study area, the wide differences in soils are due to the differences in the mineralogical composition of the rocks (Long 1922).

Soils which have similar profiles make up a soil series. Many of these soil series contain soils that differ in the texture of their surface layer. It is according to these differences in texture that different soil types are named. The following discussion of soils of the study are is based on several soil surveys conducted at various time periods (Long 1922, Perkins and Ritchie 1965, USDA 1965).

The soils derived from the light colored, acidic rock, such as granites, gneisses, schists, and quartz-mica schist, are usually red or yellow in the subsoil. The four soil series belonging to this group are: Cecil, Durham, Appling, and Madison. The second group of soil series consists of Iredell, Mecklenburg, and Davison. These soil series are derived from the dark colored rocks belonging to the Roan gneiss formation which vary in texture and structure from massive and fine grained to schistose and medium grained. The Wilkes sandy loam belongs to another series. The rocks composing this series are light colored gneisses or granites. This soil type has a gray surface soil and an upper subsoil that is from yellow sandy loam to light sandy clay. The Molena series is of unknown origin. The surface of this soil type is dark brown to reddish brown, and the subsoil is a red to dark red and friable sandy clay. The terrace soils include the Wickham and Altavista series. The Wickham series is a light brown surface soil with a fine sandy clay to clay subsoil; the Altavista series has light gray surface soils and a sandy clay subsoil. The alluvial soil types are formed through stream action, and the soils composed of these types are deposited by streams and rivers. These alluvial types vary widely in texture and are subject to change resulting from stream overflow. The first bottom alluvial soils include the Congaree series and Meadow.

For the mechanical analysis of soils, several grades have been established. Gravel is composed of the largest particle size and this term includes all particles of a sediment ranging from small boulders to stones at 2 milimeter in diameter. The next grade below gravel is sand which, is, followed by silt, and graded down to clay. The following is a summary of the metric scale of grades and is presented for later reference (Cornwell 1972:123):

Stones or Cobbles		> 60 mm
Gravel		60 - 2.0
Sand -	coarse	2.0 - 0.6
	medium	0.6 - 0.2
	fine	0.2 - 0.06
Silt -	coarse	0.06 - 0.02
	medium	0.02 - 0.006
	fine	0.006 - 0.002
Clay		< 0.002

The organic materials contained by the soil are the remains of decomposed plants and animal bodies. The climate has a great effect on the percentage of organic materials found in the soil. The chemical properties of the soil are largely determined by the chemicals found in associated rocks. Other factors affecting soil are slope and drainage. Sloping soils are often subject to erosion and drainage is the property of allowing water passage through a soil. Well drained soil does not retain much water and is not well suited for farming. The size of the particles determines the make-up of the soils. There are usually three divisions according to the size of particles--sand, silt and clay. These soil divisions in the study area will be examined in Chapter VI.

Flora. Piedmont Georgia lies within the oak-hickory-pine forest vegetation zone (Kuchler 1964). This potential natural vegetational zone is one of three major vegetational zones in the southeastern deciduous forest biome. This zone includes medium tall to tall forest of broadleaf deciduous and needleleaf evergreen trees. These consist of such major species as hickory (*Carya* sp.), shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), white oak (*Quercus alba*) and post oak (*Quercus stellata*). Common plants in the ravines of the Piedmont are beech (*Fagus sylvatica*), tulip-tree (*Lirodendron tulipifera*), holly (*Ilex opaca*), redbud *Cercis canadensis*), magnolia (*Magnolia grandiflora*), pecan (*Carya illinoensis*) and deodar cedar (*Cedrus deodara*). Piedmont river bottoms support a mixed hardwood forest of oak, (*Quercus* sp.) sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*) and elm (*Ulmus americana*).

Other components of vegetation of Piedmont Georgia include various species of vines, shrubs and trees. Provided here are a number of species which are presently available in the area (Wingginton 1959, 1963):

Vines	26
Grasses	16
Short shrubs	15
Medium shrubs	28
Large shrubs	37
Trees	61

Altogether approximately one hundred eighty-three species of plants are recognized today in Piedmont Georgia. Of these, the most common species utilized by the prehistoric population are numerous. Ethnographic data indicates that the aboriginal population in the Southeast used various species of plants as food resources as well as for ceremonial purposes. A number of species of plants and their usages by the prehistoric population will be discussed later in this chapter.

Fauna

Mammals. According to Golley (1962) the mammal fauna in Georgia has remained essentially unchanged during the past one thousand years except for displaced or locally extinct species which include bison (*Bison bison*), elk (*Cervus canadensis*) and wolf (*Canis niger*). The cougar (*Felis concolor*), bear (*Euarctos americana*), beaver (Castor *canadensis*) and deer (*Odocoileus virginianus*) have been reduced greatly in numbers. The mammal fauna of Georgia is typical of the Austroriparian biotic community. The present day fauna of Georgia includes sixty-nine species of terrestrial mammals. Of these, seven are restricted to the Appalachian Mountains, six to the Appalachian Mountains and Piedmont, four to the Piedmont, five to the Piedmont and Coastal Plain, and ten to the Coastal Plain. The remaining thirty-seven are state wide in their distribution (Golley 1962, Jenkins 1953). The most common species of mammal fauna in the Piedmont are, among others, cottontail rabbit (*Sylvilgagus floridanus*), gray squirrel (*Sciurus carolinesis*), beaver (*Castor canadensis*) and whitetailed deer (*Odocoileus virginianus*).

Birds. The Atlantic Flyway passes over the Piedmont Plateau and the Plateau's relatively mild winter makes the area an important winter resort for waterfowl, providing resting and feeding stops for migrating ducks (*Aix sponsa*) and geese (*Branta canadensis*) (Jenkins 1953). Other common species of birds include the wild turkey (Meleagris gallo-paro), and several other subspecies of duck and goose. The passenger pigeon (Ectopistes migratorius) is now extinct but was available for the aboriginal population.

Amphibians and Reptiles. The number of species of amphibians and reptiles of Georgia are (Martof 1956):

Amphibians	
Salamanders	35
Frogs, Toads	28
Reptiles	
Turtles	23
Crocodilians	3
Lizards	13
Snakes	40

Altogether one hundred forty-two species of amphibians and reptiles are known today in the State of Georgia. Among these amphibians and reptiles, the prehistoric peoples exploited turtles and the tortoise. In Piedmont Georgia, several species of turtle/tortoise are known today. These include the common musk turtle (Sternotherus odoratus), the common box turtle (Terrapene carolina carolina), the yellow bellied turtle (Pseudemys scripta scripta), and the gopher tortoise (Gopherus polyphemus).

Fish and Shellfish. Dahlberg and Scott (1971) list twenty-four species of freshwater fish in the Oconee River drainage. Among these species, the most common fish in the drainage are: catfish (Ictalurus sp. and Noturus sp.), perch (Ethenstoma sp.), bass (Micropterus sp.), shad (Alosa sapidissima), sunfish (Lepomis sp.), redhorse (Moxostoma sp.), suckerfish (Hypentelium nigricans) and minnows (Notropis sp.).

Invertebrates known in the Piedmont include clams and snails. Freshwater clams (Elliptio sp., Lampsilis sp., Marginella sp. and Olivella sp.) are common in the Oconee River drainage. These fresh-water clams are also called 'mussel' although the true mussel is found on the coast. Several different species of snails are known in the Piedmont. These include Amicola sp., Goniobasis sp., Campeloma sp., Zonitoides sp. and Helicodiscus sp. (Wood and et al. 1973).

Early Observations on Environment

The earliest records on the natural environment of Piedmont Georgia date back to the travels of DeSoto in 1540. The DeSoto expedition took place between 1539 and 1543 (Sauer 1971). During the spring of 1540, DeSoto travelled from Apalache (southwest Florida) to Cofitachequi, near Augusta, Georgia. He observed during his travels in middle Georgia that the people had many fine field, pretty streams and hills covered with various species of trees. Trimble (1974) states that erosion on the Piedmont was minimal immediately prior to European settlement, and that Piedmont streams were generally clear in early colonial times. Bartram (Harper 1958) also noted, while traveling in Piedmont Georgia during the spring of 1773, the clarity of streams and the rocky stream beds.

He mentioned in particular that the Oconee River was clear and pretty; "We came to the banks of that beautiful river (Oconee River). The cane swamps, of immense extent, and the oak forests, on the level lands, are incredibly fertile; which appears from the tall reeds of the one, and the heavy timber of the other" (Harper 1958:28). It would seem that Bartram noticed not only a beautiful river but also fertile land and a rich forest. He further described a scene of the Piedmont in the following terms:

> ...we entered an extensive fertile plain, bordering on the river, and shaded by trees of vast growth, which at once spoke its fertility. Continuing some time through these shady groves, the scene opens, and discloses to view the most magnificent forest I had ever seen. We rise gradually a sloping bank of twenty or thirty feet elevation, and immediately entered this sublime forest; the ground is perfectly a level green plain, thinly painted by nature with the most stately forest trees, ...that many of the black oaks measured eight, nine, ten, and eleven feet diameter five feet above the ground, as we measured several that were above thirty feet girt, and from hence they ascend perfectly strait, with a gradual taper, forty or fifty feet to the limbs; but below five or six feet, these trunks would measure a third more in circumference... (Harper 1958:24).

He went on to say that "The land rises almost insensibly by gentle ascents, exhibiting desert plains, high forest, gravelly and stony ridges, ever in sight of rapid rivulets" (Harper 1958:25). On another occasion he described the Piedmont as "...the soil is a deep, rich, dark mould, on a deep stratum of reddish brown tenacious clay, and that on a foundation of rocks, which often break through, both strata, lifting their backs above the surface" (Harper 1958:24).

Less than a hundred years later, Lyell (1849) noted the turbidity of the Oconee River. He noted the transformation of the Piedmont streams from clear to turbid. The following observation was made during December of 1845:

> As our canoe was scudding through the clear waters of the Altamaha, Mr. Couper mentioned a fact which shows the effect of herbage, shrubs, and trees in protecting the soil from the wasting action of rain and torrents. Formerly, even during floods, the Altamaha was transparent, or only stained of a darker color by decayed vegetable matter, like some streams in Europe which flow out of peat mosses. So late as 1841, a resident here could distinguish on which of the two branches of the Altamaha, the Oconee or Ocmulgee, a freshet had occurred, for the lands in the upper country (Piedmont), drained by one of these (the Oconee) had already been partially cleared and cultivated, so that that tributary sent down a copious supply of red mud, while the other (the Ocmulgee) remained clear, though swollen. But no sooner had the Indians been driven out, and the woods of their old hunting ground begun to give way before the ax of the new settler, than the Ocmulgee also became turbid (Lyell 1849:256).

However, according to Trimble (1969, 1974), there were few significant changes in Oconee River valley morphology until the end of the nineteenth century. The significant morphological change began to appear in the early twentieth century in some low-gradient stream channels. The appearance of sediment in these streams coincided with an increase in acreage of crops and with a decrease in the acreage of forests. The increasing amount of sediment transported by streams filled many stream channels. The stream bed and natural levees were often aggraded until the stream was at a higher level than the valley floor, and then, innundating valley floors. Consequently, the morphology of the Oconee River valley underwent changes during the relatively recent years (Trimble 1969, 1974).

There are several excellent descriptions of the early vegetation of the Piedmont Georgia. DeSoto noticed many species of trees such as hickories (Carya sp.), oak trees (Quercus sp.), pines (Pinus sp.) live oaks (Quercus virginia), and many cedars (Cedrus sp.) (Dockstader 1928). Bartram gave a more detailed description on the early vegetation of the area (Harper 1958:24):

> The forest trees are chiefly of the deciduous orders, as, Quercus tinctoria, A. Lasciniata, Q. alba, Q. rubra, Q. prinus, with many other species; Celtis, Fagus sylvatica, and, on the rocky hills, Fagus castania, Fag. pumila, Quercus castania; in the rich vales, Juglans nigra, Juglans cinerea, Gleditsia triacanthos, Magnolia acuminata, Lirodendron, Platanus, Fraxinus excelsior, Cercea, Juglans, exaltata, Carpinus, Morus rubra, Calycanthus, Halesia, Aesculus pavia, aesculus arborea.

He noticed that the general composition of the forest was pine (Pinus sp.) mixed with red and black oak (Quercus sp.), and hickory (Carya sp.).

In the late eighteenth century in Greene County, the ratio of these three major trees was roughly three (oak-hickory) to one (pine)(Nelson 1957). The Morgan County forest seems to have been slightly different: fewer oaks (Quercus sp.) and pines (Pinus sp.) occurred and more hickories (Carya sp.), poplars (Populus alba), dogwoods (Cornus florida), and sweetgums (Liquidambar styraciflua) were present. The original forest of Putnam County was shortleaf pine (Pinus echinata), oak (Quercus sp.), hickory (Carya sp.), poplar (Populus alba) and ash (Fraxinus americana). Chestnut disease in the Piedmont during the early twentieth century (Nelson 1957).

Early documents indicate that there was a high correlation between the vegetation and certain land types (Nelson 1957). That is, different soil types seem to have had distinctive roles that allowed selective adaptations of certain native trees on certain types of soils. Land types described in the early literature can be grouped into four classes: red lands, flatwoods, gray, sandy and gravelly soils, and granite lands (Nelson 1957). The red lands supported a forest composed of hardwoods with little or no pine. A small amount of acreage was in flatwoods with a black-jack oak growth. The gray and sandy lands supported a mixed pine-hardwood forest. The dominant vegetation of the Piedmont was the oak-pine-hickory having a ratio of about 53: 23: 8, respectively (Plummer 1975).

In general, the floristic composition of Piedmont Georgia has remained basically the same for the past several hundred years, except that the trees now are much smaller and the land is somewhat drier with more pine trees (Nelson 1957, Plummer 1975).

A large number of species of wild plants were utilized by the aboriginal population of the Southeast. Early ethnographic literature describes many such wild plants and how those plants were utilized by the aboriginal population. Table 2 lists those flora species which were probably used as a food resource or had other usages (Adair 1930, Bartram 1853, Harper 1958, Hawkins 1848, Swanton 1928a, 1928b, 1946).

Some plants were multi-purpose; for example, the aboriginal population used oak for the four logs forming the sacred fire, for mortars, fish traps, and boat frames as well as utilizing the acorn as a food. Poplar trees were used for canoes, stools and in house construction (Harper 1958; Swanton 1946). The fruits of the red and black sumac were bruised to make a drink. The black drink was made from the leaves of the yaupon or native holly (*Ilex vomitoria*) which contain caffeine. Drinking this tea was believed to purify both body and soul. The roots of the devil's shoe string (*Cracca virginia*) were used as fish poison (Harper 1958; Hawkins 1848; Swanton 1928a, 1928b, 1946). Most of the other palnts listed in Table 2 were, however, used primarily for food. This will be discussed in Chapter V.

Table 2. List of wild plants used as food resources and for other purposes.

Common Name	Scientific Name
Arum	*Peltandra virginica*
Blackberry	*Rubus* sp.
Black sumac	*Schmaltizia copallina*
Blue palmetto	*Rhapidophyllum hystris*
Cane	*Arundinaria* sp.
Chestnut	*Castanea mollissima*
Chicksaw plum	*Prunus angustifolia*
China briar	*Smilax pseudo china*
Chinquapin	*Castanea nana*
Devils shoe string	*Cracca virginia*
Dogwood	*Svida* sp.
Grape	*Vitis campestris*
Ground nut	*Apio apios*
Gumwood	*Nyssa* sp.
Hickory	*Carya* sp.
Huckleberry	*Gaylussacia* sp.
Maple	*Acer* ap.
Morning glory	*Ipomoea pandurata*
Oak	*Quercus* sp.
Live oak	*Quercus virginia*
Persimmon	*Diospyros virginia*
Pine	*Pinus* sp.
Poplar	*Populus* sp.
Red sumac	*Rhus glabra*
Spatter dock bonnets	*Nymphaea* sp.
Strawberry	*Fragaria* sp.
Sweet gum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Walnut	*Juglans* sp.
Water chinquapin	*Nelumbo lutea*
Wild rice	*Ziaia aquatica*
Wild sweet potato	*Ipomoea* sp.
Wild yam	*Dioscoila bulbifera*
Yaupon	*Ilex vomitoria*

As it was pointed out in this chapter, the mammal fauna of the Piedmont area has remained basically the same during the past one thousand years. The only differences in the composition of the mammal fauna today are the local extinction and decrease of several species of animal. Today, bison (Bison bison), elk (Cervus canadensis) and wolf (Canis niger) are completely displaced, and cougar (Felix concolor) and bear (Euarctos americana) are rare in Georgia.

According to the early ethnographic records, all of the above mammals were present and were numerous in the past. A ranger, who traveled with General Oglethorpe from 1739 to 1742, said that the Indians provided an abundance of venison, turkey, buffalo meat, and wild honey, and stated that "We crossed the river (Oconee River) and killed two buffaloes of which there are abundance, we seeing several herds of sixty or upwards in a herd" (Mereness 1916:219). Bear (Euarctos americanus) was an important game animal and probably numerous because it is frequently mentioned by Swanton (1946:249). Bartram observed this about bear:

> The bears are yet too numerous: they are a strong creature, and prey on the fruits of the country, and will likewise devour young calves, swine and sheep, but I never could learn a well attested instance of their attacking mankind; they weigh from five hundred to six hundred weight when full grown and fat, their flesh is greatly esteemed as food by the natives (Harper 1958:176-177).

On another occasion during his travels in Georgia, Bartram observed "heaps of white gnawed bones of the ancient buffaloe, elk and deer" (Bartram 1958:204). Wolf (Canis lupus lycaon and Canis niger) was also noted on many occasions during Bartram's travels in Georgia (Harper 1958). As for other animal species, Bartram described them in the following words:

> Of beasts the otter (lutra) is common, but more so in West Florida, towards the mountains. The several species of mustela are common, as the mink, weasel and polecat (Putorius); racoons and opossums, are in great abundance, these animals are esteemed delicious and healthy food. There are two species of wild-rate, but neither of them near as large as the European house-rat, which is common enough in the settlements of the white people: here are very few mice...There are yet a few beavers in East Florida and Georgia, but they abound most in the north of Georgia (Harper 1958:176).

The mammal fauna that are listed in Table 3 probably affected the prehistoric subsistence pattern in the area. This list is compiled from ethnographic literature (Adair 1930; Bartram 1848, Harper 1958; Hawkins 1848; Mereness 1916; Swanton 1928a, 1928b, 1946).

The mammal fauna remains from several archaeological sites in Georgia and Tennessee have been identified as the same fauna that occurs in the area today. These sites include the Etowah and Nacoochee sites in Georgia, and Hiwassee Island in Tennessee (Lewis and Kneberg 1946, Parmalee 1960; Wauchope 1966). So far as the limited ethnographic and archaeological data indicate, the mammal fauna in Piedmont Georgia has remained essentially the same since the Late Mississippian period, the mammal fauna playing an important role in the subsistence strategy of the cultural

Table 3. List of the wild animal used as food

Common Name	Scientific Name
Bear	*Euarctos american*
Beaver	*Castor canadensis*
Bobcat	*Lynx ruffus floridanus*
Bison	*Bison bison*
Elk	*Cervus canadensis*
Fisher	*Martes pennanti*
Gray Fox	*Urocyon cinereoargentus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethica*
Opossum	*Didelphis virginiana*
Puma	*Felis cougar*
Cottontail rabbit	*Sylvilagus floridanus*
Raccoon	*Procyon lotor*
River Otter	*Luntra canadensis*
Gray squirrel	*Sciurus carolnensis*
Weasel	*Mustela longicanda*
Whitetail deer	*Odocoileus virginianus*
Wolf	*Canis niger*

system of the Late Mississippian period.

Bartram observed only a few species of birds which were native to Georgia. Instead, numerous species of birds were "bred in Pennsylvania, pass in the spring season through these regions (Carolina and Georgia) in a few weeks time, making but very short stages by the way; and again, but few of them winter there, on their return southerly" (Harper 1958:179). He continued to describe these birds:

> ...most of these beautiful creatures who annually people and harmonize our forests and groves in the spring and summer seasons, are birds of passage from the southward. The eagle, i.e., falco leucocephalus, or bald eagle, falco maximus, or great grey eagle, falco major cauda ferrugninio... or pheasant of Pennsylvania, tetrao minor sive soturnix, or partridge of Pennsylvania, picus, or woodpeckers of several species, corvus carnivorus, or raves, cornus frugivora, or crow...or blue jay...or marsh wren...are perhaps nearly all the land birds which continue theyear round (Harper 1958:179).

In addition, the listed various species of birds. Among these, the birds listed in Table 4, are those that were used primarily for food resources. The feathers of some birds such as the golden eagle (Aquila chrysaetos)and the bald eagle (Haliaeetus leucocephalus) were used as ornaments. The feathers of turkey and crane were also used as ornaments. The feathers of turkey and crane were also used as ornaments on clothing and in headdresses. Eagles were killed only during fall and winter, and buzzards were occasionally used as a medicine. Owls were avoided and were killed because of their association with witchcraft (Swanton 1928a, 1928b, 1946).

Table 4. Lists of birds, fish and turtles used as food.

Common Name	Scientific Name
Birds	
Eastern wild turkey	Meleagris gallopavo americana
Wild pigeon	Columbia migratoria
Passenger pigeon	Columba migratoria
Goose	Anser branta sp.
Duck, teal, mallard	Anas family
Fish	
Catfish	Ictalurus sp. and Noturus sp.
Perch	Ethenstoma sp.
Bass	Micropterus sp.
American shad	Alosa sapidissima
Sunfish	Lepomis sp.
Redhorse	Moxostoma sp.
Suckerfish	Hypentelium nigricans
Minnows	Notropis sp.
Reptiles	
Large fresh-water turtle	Pseudemys scripta
Small land box turtle	Terrapene carolina
Gopher tortoise	Gopherus polyphaemus
Musk turtle	Sternootherus odoratus
Soft shell turtle	Amyda ferox

Traveling in Georgia, Bartram observed the various species of fish, amphibians and reptiles. Concerning fish in Putnam County, Georgia, he says:

> The mud fish is large, thick or round, and two feet in length; his meat white and tender, but soft and tastes of the mud, and is not much esteemed. The great devouring trout and catfish are in abundance; the golden bream or sunfish, the red bellied bream, the silver or white bream, the great yellow and black or blue bream, also abound here (Harper 1958:111-112).

Table 4 also lists fish which were used as food during prehistoric times. Turtles and tortoises were also regarded as good food: "Both species (fresh-water tortoises) are food for mankind and esteemed delicious" (Harper 1958:176). Turtles and tortoises that probably were consumed as food during the prehistoric time are listed in Table 4.

Conclusion

In this chapter an attempt has been made to present the recent environmental conditions of the study area. An effort has also been made to delineate the past environment of the area, with particular emphasis on the Late Mississippian period, as accorded by the various ethnographic records. This pursuit is augmented by several recent studies on past environment.

One object in delineating the present and past environment is to understand the paleo-ecology of the area for the time period A.D. 1400 to A.D. 1700. As defined, ecology is the study of interrelationships between living organisms and their abiotic communities. The present is the base for understanding the past, and this is the reason why present environmental information is given in this chapter. With this present environmental information, past environment, as delineated in this chapter, can be compared and evaluated. Since it is a goal of this study to analyze the settlement pattern and subsistence patterns of the Late Mississippian site distributions their environmental milieu must be considered. If the reconstructed paleo-environment of the study area seems to be valid, then the Late Mississippian settlement pattern of the study area can be analyzed using those variables of paleo-environment.

As Butzer (1964:337-340) suggested for environmental reconstruction, the regional environment must be understood in terms of the climate, vegetation, soil and geomorphology. In addition to these variables, faunal composition is also examined in this study. As a result of this brief study on present and past environment, it is considered that the past environment of the study area was not drastically different from the present day environment.

The present landforms or morphology of the area have remained basically the same during the past several hundred years except for the morphology of the Oconee River Valley where change began to appear at the end of the nineteenth century or early twentieth century. The most drastic changes have occurred during the period when culturally accelerated sedimentation appeared, i.e., <u>circa</u> 1890 to 1940 (Trimble 1969). As a whole, although climatic fluctuations occurred in the Southeast during the past millenium, none appear to have been severe enough to cause extensive erosion. The soils also remain essentially the same except in areas where heavy natural and culturally accelerated sedimentation and erosion occurred. In an attempt to use a soil classification which is more pertinent to pre-contact soil conditions than post 1940 soil surveys, an early soil survey (carried out between 1910 and 1919) is utilized here.

Even though minor climatic fluctuations have occurred, present climatic conditions can be extended back over the past three thousand years (Baerreis and Bryson 1965). A warmer Neo-Atlantic like episode terminated around the mid-1500s and, then, a climatic cool episode (the Neo-Boreal), occurred during the mid-1500s to the mid-nineteenth century, and brought colder, moister conditions to much of the mid-continent. These minor climatic episodes, however, have had little affect on the southern climate. Vegetation of the piedmont has probably not responded to any climatic changes during the past several hundred years. Evidently, the vegetation of the piedmont described by Bartram resembles that occurring today in the study area, except that short-leaf pines came into dominance after contact. Palynological study in southern Georgia also indicates that there was no significant climatic change during the past five thousand years (Watts 1971). Zoological and archaeological evidence indicates that the faunal composition has also remained basically the same during the past one thousand years with the exception of a few extinct mammals. This is supported by the ethnographic records.

This chapter has provided information concerning the natural resources and environmental conditions of the study area. The lists of natural resources given in this section are considered to be exploitable resources that would have supplied food for the aboriginal inhabitants in the area. It is argued here that the present day environmental conditions in the study area can generally be extended back for several hundred years, or at most, several thousand years. Therefore, this settlement study regards the present day environmental variables as being the same as that of the Late Mississippian period. The data presented in this chapter is used later for inference and analysis of the Late Mississippian settlement pattern.

CHAPTER IV

THE LATE MISSISSIPPIAN PERIOD: THE LAMAR PHASE

The following sections provide a broad overview of the Late Mississippian period known as the Lamar phase. This information is presented here for the purpose of providing further insight into the Lamar phase. Previous research on the Lamar phase is abundant but limited in scope to ceramic studies. The ceramic classification of the present study is based on the ceramic types established by archaeologists during the past several decades. This ceramic type classification is briefly reviewed in this chapter. Settlement and subsistence patterns of the Lamar phase are known from only a limited amount of archaeological work. However, whenever it is possible, information related to the settlement and subsistence patterns of the Lamar phase are also provided in this chapter.

Previous Archaeological Work

During the past several decades the Lamar phase culture has been one of the favorite topics among Southeastern archaeologists, yet many questions still remain with no substantial answers.

During 1933 and 1934 the Lamar type site was excavated by J. A. Ford and this work was summarized by A. R. Kelly (1938). Excavations and surveys were continued at the site in the following years by Kelly in 1936, G. F. Willey in 1937, and C. H. Fairbanks from 1938 through 1941 (Smith 1973). The site is located 4 kilometers from the Macon Plateau site and was a palisaded village on a low natural rise in the river swamp. It consists of a village with two mounds, a large truncated pyramidal mound, and a small flat top conical mound with a spiral ramp. The large mound is situated approximately 275 meters east of the Ocmulgee River and the small mound is 137 meters east of the large mound.

The intensive archaeological work of the 1930's and early 1940's in the Macon area produced a majority of our knowledge about Lamar phase ceramics (Caldwell and McCann 1941; Fairbanks 1940, 1946; Jennings and Fairbanks 1939; Kelly 1938; Smith 1973). The continued extensive archaeological investigations in the Southeast have provided valuable information on the distribution of Lamar phase sites which are found throughout the Southeast including most of Georgia and parts of Alabama, Florida, South and North Carolina and eastern Tennessee (Caldwell 1953; Chase 1955; Fairbanks 1952, 1955; Ferguson 1971; Hally 1970; Kelly 1971; Sears 1952, 1958; Wauchope 1966; Willey and Sears 1952).

Previous archaeological investigations for the study area have been conducted by various persons, both professionals and amateurs, at different times. C. C. Jones (1878) traveled through Georgia and reported on aboriginal earthern structures which included Scull Shoals mound (9Ge 4) in Greene County. In the late 1930's and early 1940's, Wauchope (1966) carried out an archaeological survey of north Georgia and reported four sites in Greene County, thirteen sites in Putnam County, and the Shoulderbone mound sites (9Hk 1) in Hancock County.

According to the University of Georgia Laboratory of Archaeology County site files, Sheila K. Caldwell conducted an archaeological survey in Putnam County during the late 1940's and located fourteen sites. Several years later Vincenzo Pertrullo conducted a survey in Putnam County and located twenty-two sites. An additional thirty-four sites were located in Putnam County by B. B. Thomas' survey of the 1950's. E. B. Mell located two sites in Morgan County in the 1950's. In the 1960's, Marshall Williams located thirty-four sites in Morgan County. During the summer of 1971, an extensive archaeological survey was conducted by Archie Smith which located a total of sixty-two sites in the proposed Wallace Reservoir area (Smith 1971).

Most of the previous surveys left only very brief records concerning each site and little information about the environmental condition of the site. Consequently, little effort has been made to understand the aboriginal culture of the area utilizing data obtained from those surveys.

An archaeological survey of the study area was undertaken by the University of Georgia Laboratory of Archaeology during the summers of 1973, 1974 and 1975. The summary of this survey work is presented in Chapter II (see Table 1).

Lamar Phase in the Southeast

Since the Lamar phase became the most familiar subject discussed in the Southeast, many archaeologists have attempted to define the Lamar phase in various ways. Some of the works are shown in the following selected remarks.

Fairbanks has defined the Lamar phase in the following manner:

> ...the Lamar period is characterized by structural mounds, palisaded villages usually in river bottoms, elaborate pottery pipes with human faces, complicated stamped and incised pottery, and, on some sites, the elaborate shell work of the Southern Cult (Fairbanks 1946:103).
>
> ...Lamar is fairly homogenous but that regional and probably temporal differences do occur. At one time studies were underway to set up a Lamar aspect on the basis of trait comparisons for the various sites. It was realized that this would be largely a study in virtuosity as the temporal position of Lamar was pretty generally established and the addition of aspectual and focal terminology would simply becloud the issue (Fairbanks 1952:297).

Caldwell described the Lamar phase in the following terms:

> Sites in the southeastern area where Lamar Complicated Stamped and Lamar Bold Incised, or their variants, are found, have been called Lamar sites, are often assigned to a Lamar period. Though certain major and minor traits have been noted again and again at Lamar sites pottery remains the index by which they have been identified, and is the

> basis upon which their present relationships are indicated (Caldwell n.e.:343).

Although there are regional differences in Lamar ceramic series, the entire ceramic series is often regarded as the South Appalachian manifestation of the Late Mississippian (Caldwell 1958; Dickens 1970; Ferguson 1971; Sears 1952). In the present research, the Lamar phase is considered as being a regional manifestation of the Late Mississippian occurring in central and north Georgia excluding the other regional variants. These variants are being assigned to different phase designations and are briefly discussed later in this chapter.

Lamar Phase Ceramics

Lamar phase pottery types are well described in early publications. Formal type discriptions of Lamar Complicated Stamped and Lamar Bold Incised have been written by Jennings and Fairbanks (1939). Caldwell (1952:316) later added the type Lamar Plain. These three pottery types are considered the major types of the phase and may vary considerably with time and space, but the following general description applies to most of the Lamar ceramic series (Caldwell n.d.: 344):

> Lamar Complicated Stamped: Usually a flaring rim, round bottom jar with a faint overall stamping of various complicated design.
>
> Lamar Bold Incised: Usually a hemispherical (Cazuela) bowl, more often with an incurving rim, with a border of incised decoration in the shoulder area.

Lamar Plain: Usually of the same form as the incised type, but sometimes jars are more frequent.

Other minority types have been added to the Lamar ceramic series (Smith 1973; Wauchope 1966). A recent study of ceramics from the Lamar type site shows eleven different design motifs of stamping which include rectilinear, figure nine, curvilinear, concentric circle, simple stamp, check stamp and others (Smith 1973). While check stamped (0.44%) and simple stamped (0.05%) are very minor elements in the Lamar Mound type site, a surface collection (Smith 1973) suggests that check stamping is a more frequent motif (11.1%) in North Georgia (Wauchope 1966).

Incised design motifs also consist of linear, rectilinear, and curvilinear. Combinations of incising and stamping are usually grouped with incised design. The most frequent applied designs are a series of superimposed plateaus or tables separated by nested U's or scrolls, and concentric circles. Fifteen different designs are found in the Lamar village site surface collection (Smith 1973:19).

Jennings and Fairbanks (1939) described the tempering of Lamar phase ceramics as usually sand and grit while shell tempered sherds are rare. At the Lamar type site grit tempered sherds were most popular. Over 96% of the sherds from the village site surface collections and 99% from the Mound A surface collection were grit tempered. Mica, limestone and shell tempered sherds were also found in small numbers (Smith 1973). In North Georgia stamped and incised sherds are exclusively grit-tempered but some shell-tempering occurs in plain sherds (Wauchope 1966:79-87).

Rim treatment for the stamped and plain ceramics is one of the characteristic features for the ceramic series. Eighteen different rim treatments are noted at the Lamar type site (Smith 1973:20). Applique reed punctate and applique pinched rims are the most popular decoration. Plain and unmodified rims also occur frequently. Applique plain, plain pinched, noded, and folded rims are also characteristic features but occur less frequenlty. Occasionally, the rim bears modeled human facial effigies. Rim treatment on incised vessels is very rare. Strap handles occur on the ceramics, as do more unusual types, such as an owl effigy handle on a complicated stamped vessel from the Walter F. George Reservoir (Broyles 1971a:58).

Most of these ceramic types are encountered during the survey and are further discussed later in Chapter VI.

Spatial and Temporal Variation

The widespread Lamar phase is known solely by ceramic distribution. Kelly (1971:61) mentions six variants without naming each. With regard to rim treatments and stamping, Sears (1956:55-56) suggests eight regional variations. According to Fairbanks (1952) the Lamar phase shows "late period Middle Mississippian" elements along with the stamping tradition of Swift Creek. He also points out that although the Lamar phase is homogeneous regional and temporal differences do occur.

Although the Lamar phase shows similar traits throughout the entire Southeast, site variations do occur. We may sum up by region the differences of the Lamar phase ceramics series in Georgia as follows:

Central and Western Georgia

Curvilinear design predominant; particularly concentric circle, figure 8's and 9's
Filfot cross is rare
Common rim treatment: applique and applique reed punctate
Less check stamped sherds
Less shell-tempered sherds except a few sites (e.g., Neisler site)

Northern Georgia

More rectilinear design (especially in Northeast)
More check stamped sherds
Incised at rim area and stamped below shoulder (Northeast)
More shell tempered sherds (Northwest)
Rim treatment: reed punctated common at several sites

The above mentioned regional characteristics of Lamar phase ceramics are not applicable to all sites, but these common attributes have been suggested by several archaeologists (Caldwell 1952, n.d.; Fairbanks 1952; Russell 1975).

In addition to the aforementioned Lamar phase ceramics of Georgia, similar ceramic types throughout the Southeast have been labeled as Lamar phase variants. These include Qualla from the Appalachian summit (Dickens 1970; Ferguson 1971), Caraway and Pee Dee from North Carolina (Coe 1964; Dickens 1970; Ferguson 1971) and Irene from the Georgia coast (Caldwell and McCann 1941).

Table 5 presents the suggested temporal ranges of the Lamar phase and its variants. When examining the table, it becomes clear that the temporal range of the Lamar phase and its regional variants differ depending upon the geographical location or individuals who projected the time range. This is partly due to a limited number of absolute dates; since most of the research has been devoted to the study of the Lamar phase ceramics, only a few absolute dates being available.

It has been suggested that the Lamar phase is later than the Southern Cult (A.D. 1300-1400), but cult materials are present on many Lamar phase sites, especially with Lamar phase burials (Fairbanks 1952). The Southern Cult, then, was present during at least the early part of the Lamar period (A.D. 1400-1700). If we accept this time span for the Southern Cult we may assume that early Lamar is contemporaneous with the latter part of the Southern Cult development. This estimation is not at all unreasonable when we consider the radiocarbon dates from both the Tugalo and Little Egypt sites (see Table 5). Previous estimates for the beginning of the Lamar phase include an A.D. 1200 date by Smith (1973) and an A.D. 1100 date by Ferguson (1971). The termination of the phase varies by region, but, in most cases, is defined by the appearance of European trade goods. By a conservative estimation based on these documents (Dickens 1970; Ferguson 1971; Smith 1973; Willey and Sears 1952) and one radiocarbon date (Brandau

Table 5. Suggested temporal ranges of the Lamar phase by archaeologists

Area	Culture Phase or Site	Temporal Range	Source	Reference
C. Georgia	Lamar	1540-1650	Speculation	Fairbanks 1946
General	Lamar	Post De Soto	Speculation	Caldwell 1953
E. Tennessee	Dallas	Around 1540	Speculation	Lewis & Kneberg 1946
N. Georgia		15th-18th C.	Speculation	Sears 1956
Appalachian	Qualla	ca. 1500-1800	C^{14}	Dickens 1970
C. Georgia	Lamar	1100 - ?	Speculation	Ferguson 1971
C. Georgia	Lamar	1200 - ?	Speculation	Smith 1973
N.W. Georgia	Lamar (Little Egypt)	1415-1664	C^{14}	Hally 1976
N.E. Georgia	Lamar (Tugalo)	1480 ± 65	C^{14}	Brandaur & Nokes 1972

All dates are in A.D.

and Noakes 1972) the Lamar phase in Georgia terminates at around A.D. 1700.

Aboriginal occupation at some sites is considered to have continued up until the late 18th or early 19th century (Willey and Sears 1952), but the inhabitants seem to have been acculturated by white contacts during later stages.

The temporal span of the Lamar phase is considered to be from circa A.D. 1400 to A.D. 1700, although there are regional variations.

Subsistence and Settlement

There are a limited number of archaeological reports which provide data concerning the flora and fauna utilized for food during the Late Mississippian period. Although the limited amount of subsistence information makes it difficult to define or to assess specific patterns of floral and faunal exploitation, the presently available archaeological data can be utilized for the consideration of general patterns of subsistence practices of the Late Mississippian period.

Table 6 lists the subsistence information compiled from three Late Mississippian sites in order to provide a general perspective of the overall Late Mississippian subsistence system. The three sites are the Lamar type site (Smith 1973), Little Egypt (Hally 1976) and Hiwassee Island (Lewis and Kneberg 1946). An examination of this table suggests that maize (Zea mays), which is found at all three sites, may

Table 6. Subsistence data from the Lamar phase sites

	Lamar	Little Egypt	Hiwassee Island
Flora:			
Maize (*Zea mays*)	X	X	X
Acorn (*Quercus* sp.)	X	X	
Walnut (*Juglans* sp.)		X	
Hickory nut (*Carya* sp.)		X	
Beans (*Phaseolus vulgaris*)	X		
Fauna:			
Bear (*Euarctos americanus*)	X	X	X
Beaver (*Castor canadensis*)	X	X	X
Bobcat (*Lynx ruffus floridanus*)	X	X	X
Elk (*Cervus canadensis*)			X
Gray Fox (*Urocyon cinereoargentus*)		X	
Eastern Mole (*Scalopus aqualicus*)		X	
Muskrat (*Ondatra zibethica*)		X	
Opossum (*Didephis virginiana*)	X	X	X
Puma (*Felis cougar*)			X
Cottontail Rabbit (*Sylvilagus floridanus*)	X	X	X
Raccoon (*Procyonlotor elucus*)	X	X	X
River Otter (*Luntra canadensis*)		X	
Gray Squirrel (*Sciurus carolinensis*)		X	X
Whitetail Deer (*Odocoileus virginianus*)	X	X	X
Woodchuck (*Marmota monax*)		X	
Dog (*Canis familiaris*)	X		
Wild turkey (*Meleagris gallopavo*)	X	X	X
Unidentified bird	X	X	
Large Freshwater Turtle (*Pseudemys scripta*)	X		
Small Land Box Turtle (*Terrapene carolina*)	X	X	
Unidentified Reptiles	X	X	X
Catfish (*Ictalurus* sp. & *Noturus* sp.)		X	
Freshwater Drumfish (*Aplodinotus grunniers*)		X	X
Unidentified Fish	X	X	
Invertebrates:			
Shellfish (*Pleurocera canaliculatum*)			X
Shellfish (*Io spinosa*)			X
Unidentified Shellfish	X	X	

have been intensively cultivated during this period. The animals found at all three sites include bear (Euarctos americanus), beaver (Castor canadensis), bobcat (Lynx ruffus floridanus), oppossum (Didelphis virginiana), cottontail rabbit (Sylvilagus floridanus), raccoon (Procyonlotor elucus) and whitetail deer (Odocoileus virginianus). Among these animals, whitetail deer is most abundant. Wild turkey (Meleagris gallopavo) is also present as well as turtles and shellfish.

It is evident from these reports that the Late Mississippian population exploited diverse resources for their diet. The presence of maize suggests the practice of horticulture but does not demonstrate the degree of reliance on maize as their major crop. Floral remains from the Lamar type site may provide more information on the exploitation of maize and acorns (Smith 1973). Thirty-five small acorns (Quercus sp.) were reported, and the maize was described as having "...14 rows, slight doubling and with a diameter of 1.5 cm" (Smith 1973:15). Smith further states that "Both the cobs and kernels seem to fit the Eastern complex corn type...The corn range from 8 rows to 14 rows, with one 16 rowed specimen, all falling within the Eastern complex range" (Smith 1973:15).

Since there is no direct evidence for the degree of dependence on maize by the prehistoric population, it is difficult to infer the composition ratio of their diet.

Early historic accounts may supplement information concerning the cultigens and other flora and fauna exploitation. Chapter V discusses these early historic accounts.

A number of archaeological reports make use of settlement data but few have attempted to analyze the entire settlement system as a whole. Most, if not all, archaeological reports provide information on a single structure or a single settlement unit (Fairbanks 1940; Lewis and Kneberg 1946; Sears 1958). Due to the limited scope of these works, such sources are precluded from further discussion. Early historic accounts are considered to provide more reliable insights for the understanding of the settlement pattern. These early accounts are provided in the following chapter.

Although an attempt has been made here to understand the Late Mississippian period as a culture system, the discussion has been somewhat limited because most of the previous research has been restricted to ceramic analysis. This early research indicates that ceramic types vary considerably with time and space. The geographical distribution and temporal span of the Lamar phase has been suggested in this chapter. The available information on subsistence and settlement patterns has been briefly presented and discussed.

The present review indicates that a more rigorous research of the other aspects of the Lamar phase culture system is necessary for a better explanation of the cultural system operant during the Late Mississippian period.

CHAPTER V

SETTLEMENT AND SUBSISTENCE

The following sections present a broad overview of the early descriptions of historic settlement and subsistence patterns of the Southeastern Indians. These ethnographic accounts are provided here for the purpose of a later comparison with the results of the prehistoric settlement pattern analysis. The section on the subsistence pattern is supplemented by available archaeological and ecological information.

Many of the early travelers, explorers, traders, missionaries and others left records of their observations and experiences during the time they spent in the Southeast. These domuments were the main sources for ethnographers who have attempted to reconstruct the way of life of the Southeastern aborigines. One of the difficulties of using ethnographic information is that it does not deal uniformly with one region. The ethnographic descriptions are usually restricted to the area where the early explorers travelled, and, accordingly, they pertain to only a portion of the area within a limited time period.

Even though there is general consent that a uniformity does exist in ethnographic descriptions on the Southeastern Indians (Swanton 1946), it is argued here that such "uniformity" is probably due to the perceptions of the observers. In many cases, early historic accounts of the Southeastern aborigines are either too generalized or too subject specific to use as inferences for the present study. Indiscrete use of such information may be misleading in portraying the aboriginal way of life. In order to avoid such possible misrepresentation, the present research uses information drawn primarily from the descriptions of inland Georgia. The ethnographic descriptions are considered to increase in reliability as the location of the description approaches the study area.

Early Descriptions of Settlement

The general land usage and the location of aboriginal towns are described in the following terms:

> Their habitations or towns are for the most part by the rivers, or not far distant from fresh springs,...,that they may overlook the river, and take every small thing into view which sturrs upon the same... About their houses they have commonly square potts of cleared ground, which serve them for gardens, some one hundred some two hundred foote square... (Strachey 1849:72)

According to the early accounts, it appears that several different levels of settlement existed. The first level of settlement was represented by the presence of a large mound. Bartram describes these early mounds: "...wherever the ruins of ancient Indian towns appear, we see always beside these remains one vast, conical-pointed mound" (Bartram 1853:57). He describes new towns in the following terms: "In the lately built, or new Creek towns, they do not raise a mound for the foundation of their rotundas or public squares" (Bartram 1853:53). The Creeks retained, however, public buildings where the MICO and other high status persons live (Bartram 1853:53). It is evident from the ethnographic information that the first level settlements are likely to have been the foci of social, political and religious activities.

The next level of settlement is assumed to consist of villages. One ethnographic account describes one of the Apalachee villages in the following words:

> The Indians had fortified it in the following manner. In the middle of a very large and very dense forest they had cleared a space where the Curaca and his Indians had their lodgings. As an entrance to this plaza they had opened through the same woods a narrow alley more than half a league in length. All along this alley at in-intervals of a hundred páces they had made strong palisades with thick logs which commanded the passages (Garcilaso quoted in Swanton 1946:434).

Some villages may have been located near the fields that required preparation, maintenance, and protection while the crops grew:

> ...corn, beans, pumpkins, and a few other vegetables were raised, and the fields where these grew usually determined the sites of the towns. This was because they required labor and protection and because most of the crops was stored for later consumption (Swanton 1946:256).

As a village grew larger, a segment of the population split off and established a new independent village (Swanton 1922: 229).

The third level of settlement includes temporary camps. These temporary camps are scattered according to the required exploitation activities:

> In March and April they live much upon their fishing wares, and feed on fish, turkies and squirrels. In May and June they plant their fields, and live most of acornes, walnuts and fish. But to mend their diet, some disperse themselves in small companies, and live upon fish, beasts, crabs, land tortoyses, strawberries, mulberries and such like (Swanton 1946:257-258).

For the exploitation of riverine sources, the aborigines probably built camps near the river:

> Here the annual spring runs of herring and other fish, brought about concentrations of population at fishing stations on the rivers, particularly those at the edge of the Piedmont Plateau (Swanton 1946:257).

Thus, the functions of each temporary camp may be different. Bartram also states that "In the hunting season, that is in autumn and winter, the men are generally out in the forests" (Bartram 1853:31), or sometimes "...families left the village in winter forming base hunting camps" (Swanton 1928a:405). Temporary camps were also built by families near their fields at harvest time since each family was responsible for the harvest of its own plot (Bartram 1853:40; Swanton 1922:268). Different kinds of temporary camps were erected for different purposes such as fishing and hunting camps (Swanton 1928a:692; 1946:335-342).

Subsistence Pattern

In attempting to understand the prehistoric settlement pattern, studies are often focused on the diverse adaptations of prehistoric people to their natural environment. This inquiry is not only relevant to an understanding of settlement patterns but also pertinent to an understanding of subsistence patterns. A prehistoric subsistence pattern is the way in which a prehistoric population exploits its available food resources. These food procurement activities are closely related to the surrounding natural environment. Prehistoric people were probably well acquainted with their surroundings both through long experience and through their diverse adaptations to the natural environments which, consequently, made their survival possible. The optimization of site location was a result of diverse adaptative relationships to the natural environment and, therefore, settlement arrangements were closely related to the range of subsistence activities.

Considering the propensity of man's "mini - max" behavior pattern, the subsistence pattern of a prehistoric population can be best understood in terms of their efficiency in their means of energy extraction. The efficiency of the subsistence activity in the study area is primarily concerned with food resources and procurement procedures. For an analysis of the subsistence pattern, the general aspects of food resources and procurement have to be taken into consideration prior to further analysis:

1. Level of technology - basic economic pattern of a given society at a given time. Three general patterns are found during prehistoric times; hunting/gathering, food production and a combination of both in varying degrees.

2. Distribution of natural resources - an understanding of the distribution of the natural resources (both floral and faunal) is critical to prehistoric people, especially to hunters and gatherers.

3. Conditions of climate and soils - at any level of technology, climate and soils are critical factors, but they are particularly critical to agriculturalists.

4. Site location - site location is also considered to be an important aspect in terms of topography, hydrology and other features which are all related to economic activity.

5. Other aspects - food storage techniques, food consuming habits and other factors.

Information concerning aspects is not always available, and seldom constitutes complete evidence. Theoretically, however, the complexity of the subsistence strategy of a given prehistoric society can be understood by analyzing each of these aspects. The evidence for prehistoric subsistence activities is tangible. Artifacts related to the subsistence activity are usually limited in number. There is also limited information on paleo-ecology, and the validity of reconstructed paleo-ecology is often questionable. Therefore, a complete understanding of a prehistoric subsistence pattern should be considered as an ideal goal rather than as a goal which can actually be achieved.

Available information on prehistoric subsistence activity, together with an understanding of paleo-ecology has led archaeologists to explain subsistence patterns as what prehistoric people ate and how they adapted to their environment. In the following section, an attempt is made to depict subsistence strategy during the Late Mississippian period. This requires an understanding of paleo-environments and the means of energy extraction. Energy extraction is primarily related to food procurement activity. Because of the lack of archaeological data, the present attempt will take into consideration all other available information. This includes ethnographic, paleo-environment and evidence from contemporaneous sites outside of the study area.

Prior to an examination of food procurement activity, it seems logical to define the level of technology of the Late Mississippian period. Griffin defines the socio-economic system of the Late Mississippian cultural tradition in the following terms:

> It was the gradual shift to a substantial dependence on agriculture for food that tied the societies to specific localities, emphasized territoriality and ownership of land, provided a supply of storable food that allowed marked increase in population, permitted specialization of labor, provided markets for the exchange of goods, and led to the development of elaborate religious ceremonies centered around crop production, in which whole tribal groups took part (Griffin 1967:189).

Ferguson also discusses the Late Mississippian subsistence pattern, stating "Lamar style was associated with other changes in the cultural systems which better enabled the people to adapt an agriculturally based economic system to the South Appalachian environment" (Ferguson 1971:24).

On the other hand, archaeological as well as ethnographic data indicates that the Late Mississippian population efficiently exploited their natural resources as a means of food procurement. Thus, even though food procurement activity was primarily based on farming, it was probably supplemented by hunting and tathering. It is assumed that the type of economy practiced during the Late Mississippian period was a combination of food production and hunting/gathering economy.

Subsistence Strategy

Farming. The primary subsistence pattern during the Late Mississippian period was based on food production, i.e., farming. This was recorded in the early ethnographic literature (Adairs 1930; Bartram 1853; Harper 1958; Hawkins 1848; Mereness 1916; Swanton 1922, 1928a, 1946). Archaeologists also speculate, on the grounds of archaeological evidence, that the Late Mississippian population may have been supported by an intensive form of agricultural production (Fairbanks 1952; Ferguson 1971; Griffin 1967; Lewis and Kneberg 1946; Willey 1966). This speculation concerning aboriginal farming practice has been summed up in the following words:

> ...Southeastern Indians adapted to their environment by developing a highly specialized farming system. This system was intensive in the sense that large quantities of food could be and were produced from a relatively small quantity of land by virtue of four techniques: multiple cropping, intercropping, riverine location of fields, and a combination of plants well suited to the environment and to each other. By combining these factors, they were able to obtain a substantial amount of vegetable food with a minimum of effort. The system was consistent with the rest of the culture, allowing the advantages of relative permanency and at the same freedom to pursue other tasks during the warm months, between the time of planting and the time of harvesting (Murphy and Hudson 1968:29).

Other than ethnographic records, there is, however, little direct archaeological information pertaining to specific agricultural practices during the Late Mississippian period. According to early descriptions, the native population of the Southeast relied primarily on maize (Zea mays) agriculture for subsistence. In addition to maize, beans (Phaseolus vulgaris), squash (Cucurbita pepo), sunflowers (Helianthus annua) and gourd (Lagenaria siceraria) were regarded as important cultigens (Swanton 1946). Thomas Harriot who traveled along the Virginia and Carolina coast during A.D. 1585-1587 gave an excellent description of the various types of plants cultivated by the Algonquian groups in the Sound Region of North Carolina.

> Then they sow the seed. For corn they begin in one corner of the plot and make a hole with a pecker. They put four grains into each hole, about an inch apart, taking care

> that they do not touch one another, and cover them with soil. The seeds are planted in rows, each row spaced half a fathom or a yard from the last, and the holes in each row are the same distance apart. Thus, there is a yard of spare ground between the holes, where the natives sometimes set beans and peas or plant _macocqwer_, _melden_, and sunflower. The planted ground, compared with an English acre of forty rods in length and four in breadth, yields at least two hundred London bushels of corn, beans, and peas, in addition to the crop of _macocqwer_, melden, and sunflowers. In England we think it a large crop if an acre gives forty bushels of wheat... Besides the many ways it may be used for food, the yield is so great that little labor is needed in comparison with what is necessary in England (Lorent 1946:244).

Several varieties of corn are known in the east. Among these, popcorn (_Zea mays everta_), the smallest corn species, has a short growth period. This crop provided the aborigines with their early summer food until the other corn varieties matured at the end of the sumer. Other corn varieties include the old white dents (_Zea mays indentata_) and the flint corn (_Zea mays indurata_) whose ears are eight to ten rowed, long and slender. Corn harvesting usually occurred in June or July for the early corn and in August or September for the late corn. Swanton provides additional information on early corn:

> Corn is their chief produce, and main dependence. Of this they have three sorts. One of these, a small variety, usually ripens in two months, from the time it is planted; though it is called by the English, the six weeks corn. The second sort is yellow and flinty, which they call hommony-corn. The third is the largest, of a very white and soft grain, termed breadcorn (Swanton 1946:289) ...There were

> three principle varieties of corn: the little corn of the nature of popcorn, which was first to mature; the flint or hominy corn, the kernels of which were hard and smooth and were of various colors - white, yellow, red and blue; and the flour or dent corn with corrugated kernels (Swanton 1946:296).

Evidence from the study area indicates that corn was cultivated during the Late Mississippian period. At the Dyar mound site (9 Ge 5), corn cobs (Zea mays) have been found. The remains of corn cobs from the Lamar type site indicate that the corn was probably fourteen rowed, with slight doubling and a diameter of 1.5 centimeters (H. Smith 1973). Fairbanks (1952) also mentions burned corn cobs at Lamar sites. At the Carter's Dam site, "...maize was encountered in a small deposit alongside the wall of a large 25 by 25 foot Lamar period house" (Kelly 1965:53). At the Kasita site, two types of corn were identified: a broad-kerneled flour corn (probably Zea mays indentata) and the smaller one as a type of flint corn (Zea mays indurata) (Willey and Sears 1952:10). Other archaeological sites in Georgia which have yielded evidences of corn include Nacoochee and Roods Landing, all Late Mississippian sites.

The other crops which were grown together with corn varied in importance. Along with corn, beans and squash were considered the crops of primary importance. Other crops were probably considered as secondary by aboriginal population (Swanton 1946). Corn, beans and squash formed the basic diet of the aborigines, and they were usually grown in the same field--intercropping--as had been noticed by Harriot (Lorant 1946).

Although beans (Phaseolus vulgaris) are adapted to a wide range of soil and climate, their growing season is relatively short. Beans contain protein and minerals which supplement the maize diet. Beans are a better storage crop than corn. Squash (Cucurbita pepo) has a high fat content which also compliments corn and beans in terms of nutrition. Squash could also be stored after drying. Harriot noted that beans and sunflowers were planted in the same fields with other major crops (Lorant 1946). Pumpkins and gourds, which were often mentioned as early domestic cultigens along with squash, all belong to the same family. Evidence of beans from the Lamar type site (Smith 1973) and burned beans from several other Lamar sites (Fairbank 1952), indicate that beans were cultivated during the Late Mississippian period.

Although these cultivated crops supplied the necessary nutritional requirements of proteins, minerals, fats and carbohydrates to the diet of the aboriginal population, hunting and gathering subsistence activities were continued as a supplement to the diet. Agricultural products harvested during the fall season may not have been sufficient to last until next harvest season:

> As the harvest was seldom sufficient to last - nor was it expected to last - until another crop came in, the Indians were obliged to seek natural food supplies elsewhere and, since such supplies were not usually concentrated,

> this meant that the people themselves scattered about in camps where they remained until planting time (Swanton 1946:256-257).

Since most game animals were available during the winter season and wild plants were available during most months except winter, all these available food resources were exploited to supplement the crops. The spring months, after the hunting season and before the early harvesting season, were considered to be the most difficult months (Swanton 1946). Fishing, shellfish collecting and early wild plant collecting were conducted during these months.

Seasonality. According to the ethnographic literature, the Creek were sedentary farmers (Swanton 1922, 1928a, 1928b, 1946). As they focused on farming for their subsistence base during the summer and fall seasons, they could afford to selectively capture other energy sources such as edible nuts and berries to supplement these agricultural products. During the winter months, they exploited game animals in their surrounding habitat. They did not, however, exploit all of the available energy sources as long as their stored food and supplemental resources could maintain their diet. Factors involving selectivity and seasonal availability probably influenced their choice of energy capture. During the spring season, lasting probably until the first harvest, they exploited all of the available energy sources as there was a scarcity of food during the months of this season. Spring exploitation included the collection of edible plants and shellfish and fishing. This seasonal exploitation is reflected in the aboriginal designations of the months (Swanton 1928a).

Summer and early fall were the primary farming seasons. Other cultigens and edible wild plants available during these summer months include the folowing species (see Chapter III for further discussion): chicksaw plum (Prunus angustifolia), blackberry (Rubus sp.), china briar (Smilax pseudo china), cane (Arundinaria sp.), wild rice (Ziaia aquatica) and many other species. During the summer months, the wild plants played a minor role in the subsistence subsystem because of the abundance of energy sources. A large portion of the summer crops were stored for later use.

During the late fall and winter, subsistence activities were focused on hunting and gathering in order to supplement the summer crop. The range of hunting and gathering activities extended beyond the agricultural activity boundary. Yet the Creek secured these resources by exploiting the surrounding niches within the range of their settlements since the forest of the piedmont provided a sufficient species of game animals, nuts and fruits. Models of these activity ranges will be discussed in Chapter VI.

The most preferred game animal was the deer (Odocoileus virginianus). Bison (Bison bison) and bear (Euarctos americana) were also preferred. The bear fat was separated from the flesh and used for various purposes (Swanton 1946). Other mammals that were used primarily for food resources were elk (*Cervus canadensis*), rabbit (*Sylvilagus* sp.), beaver (*Castor canadensis*), racoon (*Procyon lotor*), squirrel (*Sciurus* sp.), muskrat (*Ondatra zibethica*), opossum (*Didelphis virginiana*) and others (Adair 1930; Harper 1958; Swanton 1928a, 1928b, 1946). Archaeologically, numerous deer bone fragments were encountered during the survey. At Hiawassee Island, the bone fragments of elk were found in the top midden layer (Lewis and Kneberg 1946). The bones of the bear are found at numerous Late Mississippian sites but there are few reported occurrences of bison.

Birds were also an available food resource during the Late Mississippian period in the piedmont where birds using the Atlantic flyway passed over. The species of birds included: wild turkey (*Meleagris galloparo americana*), pigeon (*Columba* sp.), goose (*Anser branta* sp.), and duck (*Anas* family). Among these, the turkey was most valued as a food item to the aborigines (Swanton 1946). Birds were usually exploited twice during the year: fall and spring. This does not mean that these species were killed only during the seasons described above, but that concentrated exploitation took place during these seasons as a supplement to the other energy sources.

The forest of the piedmont provided not only game animals but also nuts and other fruits during fall and winter. These included acorns (*Quercus* sp.), hickory nuts (*Carya* sp.), walnuts (*Juglans* sp.), chestnuts (Castanea mollissima), pecans (Carya pecan) and persimmon (*Diospyros virginiana*).

Nuts and dried meats were easily stored. Those not consumed immediately were stored for later use. At the Dyar mound site (9 Ge5), hickory nut shells and acorns were found in the posthole tests. The Lamar type site yielded 35 acorns (Smith 1973).

When the spring came, most of stored food resources had been consumed and new plants were yet to be grown. During these difficult months, the aborigines exploited all possible energy sources such as migratory birds and fish. Since the streams were usually flooded during the winter and summer months, spring was considered the proper season for fishing. In addition to fishing, they also collected fresh-water clams and turtles as they came out of winter hibernation. As soon as the wild plants were matured, they exploited various species of plants - berries, roots and leaves.

The common species of fish in the Oconee River drainage include catfish (*Ictalurus* sp. and *Noturus* sp.), perch (*Ethenstoma* sp.), bass (*Micropterus* sp.) and sunfish (*Lepomis* sp.). The Hiawasee Island site yielded catfish bones (Lewis and Kneberg 1946). During the salvage excavation at the Lamar village site (9 PM 137) in Putnam County, unidentified fish scales were encountered in the abdominal area of a burial.

Freshwater clams (*Elliptio* sp.) were common in the Oconee River drainage. Ethnographic literature indicates that clams were one of the favored food resources. Numerous shell middens with few bones and scattered clam shells were observed during the survey in the study area. The Hiawasee Island, Hollywood and Chauga sites yielded various species of fresh-water clam shells. Turtles (*Pseudemys scripta*, *Terrapene carolina*, *Sternootherus odoratus*, *Amyda ferox*) and tortoise (*Gopherus polyphaemus*) were considered good foods. Numerous turtle shells were also observed during the survey.

A wide variety of wild plants would have been available during the spring season. The following species of plants were available as food resources (Harper 1958; Swanton 1946):

Blackberry (*Rubus* sp.)
Blue palmetto (*Rhapidophyllum hystris*)
Cane (*Arundinaria* sp.)
China brier (*Smilax pseudo china*)
Chinquapin (*Castanea nana*)
Indian turnip (*Arisaema tirphyllum*)
Morning glory (*Ipomoea pandurata*)
Red mulberry (*Morus rubra*)
Spatter dock bonnets (*Nymphaea* sp.)
Strawberry (*Fragaria* sp.)
Water chinquapin (*Nelumbo lutea*)

When the planting season came, the fields were sowed with seeds that had been saved from the previous year's crop. Figure 3 presents a summary of the seasonality of energy source exploitation.

Summary and Discussion

The basic subsistence pattern practiced during the late Mississippian period was a combination of food production and a hunting/gathering economy, with primary emphasis on agriculture. Environmental conditions during the Late Mississippian period were favorable for agriculture; 226 frost-

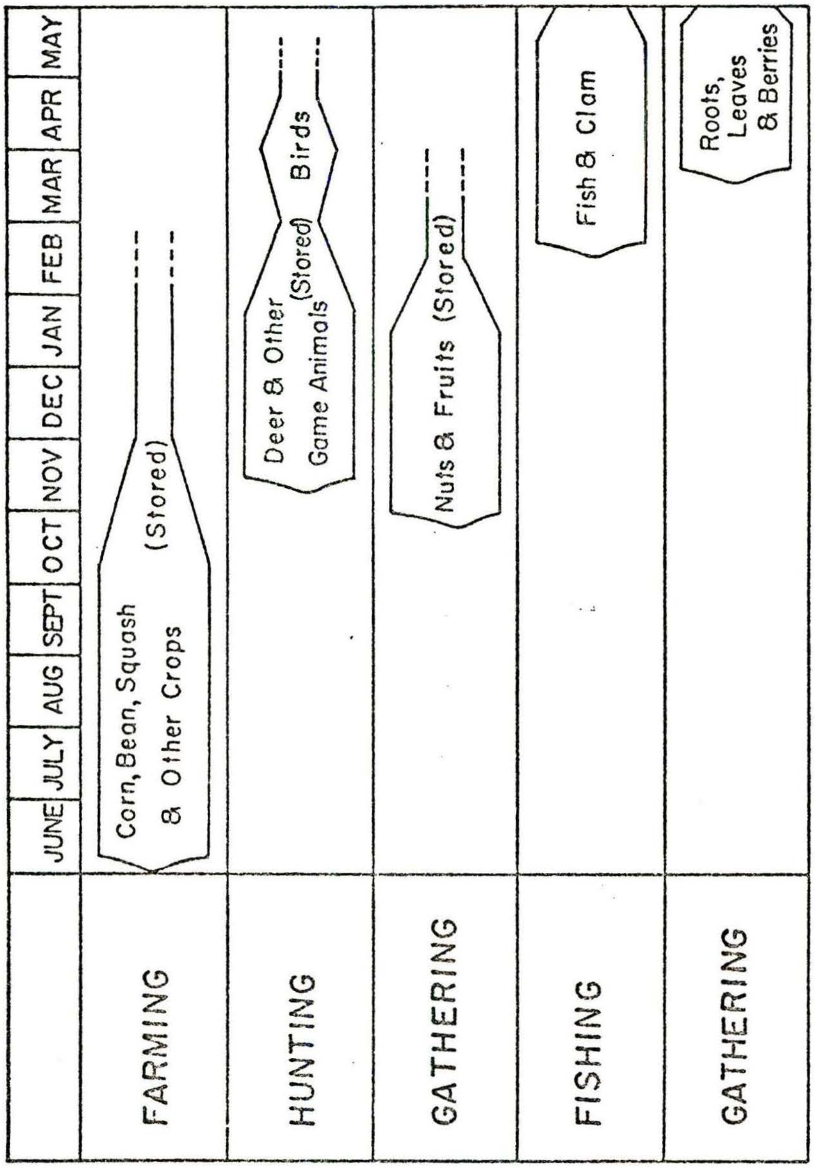

Fig. 3. Seasonality on resource exploitation

free days, warm to hot summer months, and fertile land made possible both the practice of multicropping and intensive yields from small areas of land (Lorant 1946). The aborigines also made most efficient use of their field space by planting crops which complemented each other in both growing requirements and nutritional dietary requirements.

Maize, beans and squash, among others, were the most important crops for the aboriginal diet. Early corn, which matured within two months after planting, probably relieved the aborigines from a food shortage. Adair described this corn, "...and the smaller sort of Indian corn, which usually ripens in two months, from the time it is planted" (Adair 1930:435). This subsistence pattern may have been reflected in the settlemetn pattern; for example, as ethnographic descriptions have shown, villages were possibly sedentary year round settlements which were maintained by storable surplus agricultural crops. When agricultural fields were located at a distance, it was necessary to build temporary farming camps near the fields.

The edible parts of noncultivated plants such as leaves, roots and seeds were available at various times during the late spring, summer and fall, and even the early winter. Nuts and fruits were available during fall and early winter. These hunting/gathering activities may have also been reflected in the settlement pattern as described in the early accounts: small sites located in the forest were probably specialized hunting activity stations occupied for a short time span.

Although stored foods, crops, meats and nuts may have lasted until the spring season, the aborigines underwent hardships during spring months due to the virtual absence of plant resources. Fish along with migratory birds would have been critical resources to aboriginal diets during these months. Fishing and shellfish collecting stations resulted from such subsistence activities, probably being utilized during the spring season. Thus, aspects concerning the availability and fertility of cultivable field and territory for hunting/gathering probably dictated the choice of sites for villages and camp stations.

If the subsistence strategy is an important system affecting site location, then the subsistence pattern outlined in this section would have been reflected in the settlement patterning which is under investigation. The following chapter will analyze the Lamar phase settlement pattern based on data obtained from the archaeological survey and the results of this analysis will be viewed in light of the subsistence strategy discussed in this chapter.

CHAPTER VI

LATE MISSISSIPPIAN SETTLEMENT PATTERN ANALYSIS

Introduction

The study of prehistoric settlement pattern has been one of the major approaches in American archaeology since Willey's Prehistoric Settlement Patterns in the Viru Valley, Peru (1953), and there is general agreement among archaeologists and anthropologists that "...settlement pattern studies are worth doing" (Hole and Heizer 1973:355). Although the result of Willey's study is the description and reconstruction of culture history, he considered settlement pattern archaeology to be more than culture history stating: "Settlements are a more direct reflection of social and economic activities than are most other aspects of material culture available to the archaeologist" (1956:1). Until recently, such ideas were not directly involved in archaeological research designs concerning settlement patterns and archaeology in general.

During the last decade a number of archaeologists have focused their attention on cultural adaptation to the environment in archaeological research, particularly in settlement pattern studies. In settlement pattern study, information concerning patterned behavior can be learned from the settlement data, as patterned behavior is the result of a social system's response to the cultural and natural environment. Thus, the understanding of prehistoric adaptive systems is dependent upon a knowledge of the archaeological data within an ecological frame of reference. In this study, the basic idea in understanding the resultant responses of prehistoric populations to their cultural and natural environments is based on the "principle of least effort":

> ...the principle of least effort means, for example, that a person in solving his immediate problems will view these against the background of his probable future problems, as estimated by himself. Moreover he will strive to solve his problems in such a way as to minimize the total work that he must expend in solving both his immediate problems and his probable future problems. That in turn means that the person will strive to minimize the probable average rate of his work-expenditure (over time). And in so doing he will be minimizing his effort, by our definition of effort. Least effort, therefore, is a variant of least work (Zipf 1949: 1).

People tend to expect maximum results with minimum effort. This principle of least effort or "mini-max" has been extensively referenced by geographers and archaeologists. This concept also underlies many recent studies in prehistoric settlement patterns. Since the principle of least effort is basic to human behavior, the present study will utilize this proposition in hypothesizing that the location of sites were intended by prehistoric populations to minimize the effort required in solving pertinent problems.

The adaptive behavior of prehistoric populations to the cultural and natural environment is patterned and motivated by reason (Cancian 1966). This patterned behavior of the prehistoric population is reflected in the archaeological remains within the context of the environment. The resultant behavior pattern can be interpreted as an attempt by prehistoric peoples to optimize their use of the environment. If people are optimizing their environmental use, then their behavior patterns will maintain a particular form. This settlement pattern study is an attempt to describe such patterns or regularities in accordance with archaeological and environmental data.

There are numerous variables which are critical to an understanding of prehistoric settlement patterns. Examination of these variables and the relationships among them should reveal particular kinds of regularities in settlement patterning. If we can discover such patterns or regularities in the archaeological and natural environmental data, then the resultant findings should lead to an understanding of a portion of the Late Mississippian adaptive system in the study area.

To operationalize the data, all the pertinent variables were converted to numbers. This numerical conversion facilitated the use of statistical techniques for the analysis of data. Statistical methods in archaeology have three general uses: first, as an efficient means of data representation;

second, for formulating hypotheses; and, third, for testing hypotheses (Watson, LeBlanc and Redman 1971).

In this chapter, I will discuss the natural environmental and cultural variability that would seem to be most useful in understanding settlement patterning during the late Mississippian period, i.e., the relationships between sites, the spatial arrangements of sites, and the natural environmental variability of the locations of sites.

Analytical Unit

The analytical units in this analysis are site classes based on site size and artifactual content. Settlement size and artifactual content are considered to be meaningful indicators of the functional range of any given site. Although an estimation of population size is more desirable than an estimation of site size, it is difficult to estimate the population size for each Lamar phase site given the present archaeological data. All ceramic and lithic artifacts comprise the artifactual data set for each site. The lithic material is divided into the following categories: angular fragments, flakes and tools. Site sizes are listed in Appendix I and artifact collections are listed in Appendix II.

The grouping of sites into site classes according to site size and artifactual content is accomplished by the use of a cluster analysis. Site sizes were measured in square meters for this analysis. The number of artifacts recovered from each site was converted into a percentage of the total assemblage values. Site size and percentage of artifact categories per site were utilized as the variables in the cluster analysis.

Cluster Analysis. Cluster analysis is a "powerful tool for discovering homogeneous groups in data sets. This characteristic can be used to advantage as an informal test of homogeneity for a given group..." (Anderberg 1973:190). The particular computational method used in this study is Ward's method. This hierarchical clustering method is based on within group variance, with hierarchic fusion merging at each stage which maximizes an objective function. The object of Ward's method is "...to find at each stage those two clusters whose merger gives the minimum increase in the total within group error sum of squares" (Anderberg 1973: 143). The procedure is that of attempting to group each individual case, i.e., sites in this study, into a broader class of progressive fusion ending with the total population. Ward's method is regarded as effective because it attempts to minimize the total sum of squared distances between each individual case and the centroid of the cluster to which it is assigned, and, on the other hand, to maximize the sum squared distances between the cluster centroids. In other words, it attempts to minimize the variation within a cluster while maximizing the difference between the clusters. This method is useful for discovering these groups of sites which appear to be homogenous within the total sample in terms of site size and artifact component.

For this analysis, euclidean distance coefficient matrices were calculated. These matrices were utilized in the actual cluster analysis. Figure 4 is a dendrogram of the result of the cluster analysis. Examination of the dendrogram indicates that a three cluster solution appears best. Table 7 shows the number of sites in each cluster. Cluster membership lists of individual sites are listed in Appendix I.

Table 7. Number of sites by cluster

Cluster No.	No. of Sites	Percentage
Class I	9	6%
Class II	23	15%
Class III	117	79%
Total	149	100%

In addition, an average frequency of each variable for each cluster is calculated in order to examine the co-occurrence of variables in each of the three clusters. Table 8 represents a result of the computation. Examination of Table 8 indicates several patterns for each cluster. These patterns are:

(1) The average site size of Class I is larger than that of Class II and the average site size of Class II is larger than that of Class III.

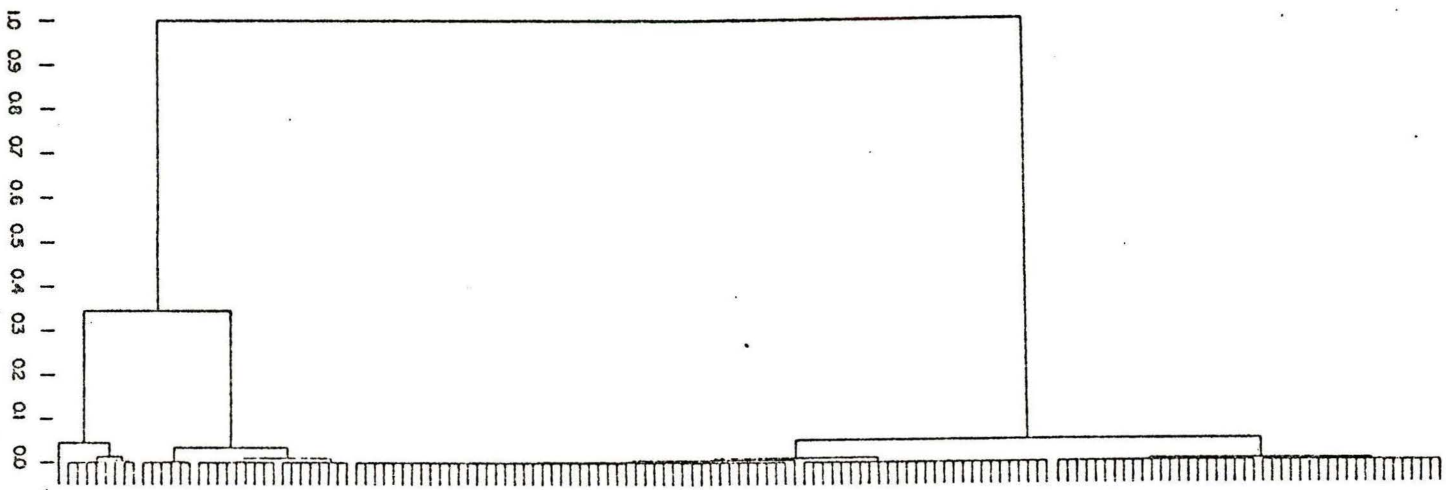

Fig. 4. Dendrogram from cluster analysis

Table 8. Average site size and average percentage of artifacts for each cluster

Cluster No.	No. of Sites	Average Site Size (Sq.m)	Average Percentage: Ceramic	Average Percentage Lithic			
				Angular Fragment	Flake	Tool	Total
Class I	9	28,055	81.67	0.00	15.05	3.28	18.33
Class II	23	11,889	76.98	6.61	9.28	7.13	23.02
Class III	117	2,919	75.92	3.68	8.92	11.48	24.08

(2) The average percentage of ceramics at Class I site is higher than Class II and the average percentage of ceramics at Class II site is higher than Class III.

(3) The average percentage of lithic tools is inversely proportional to that of ceramics and site size.

(4) The average percentage of lithic artifacts is inversely proportional to that of ceramics and site size.

As the above summary indicates, Class I sites are large sites and include such large mound sites as Scull Shoals (Ge 4), Dyar (Ge 5) and Little River (Mg 46). Artifact collections from Class I sites show a higher average percentage of ceramics and flakes than occur in Class II and Class III sites while the average percentages of tools and total lithic artifacts from Class I sites are lower than those of Class II and III sites. Class II sites are relatively large sites and are assumed to have been villages or clusters of individual houses. Sites belonging to Class III may have been small individual homesteads or specialized camp sites. The average percentage of lithic tools and total lithic artifacts of Class III sites are higher than those of Class I and II. This may indicate that Class III sites were specialized activity camp sites. This three class hierarchy of the analytical units will be utilized throughout the subsequent analysis of the Lamar phase settlement pattern.

Site Class

The hierarchical relations of the site classes produced by the cluster analysis generates the hypothesis concerning the probable functional role of each site class in the settlement system under study. This inductive assumption regarding the function of site class is, therefore, hypothetical, but, considered necessary for the further analysis of settlement data. Similar hierarchical arrangements of early historical settlements are recorded by ethnographers as discussed in Chapter IV.

Later in this chapter site class relationships to various cultural and environmental data are discussed. The assumption underlying this discussion is that observed differences in cultural and environmental variables between site classes are reflections of differences in the adaptive activity that each site class followed.

In order to understand the hierarchy of site classes and the hypothesized functional positions of each site in the settlement, a brief description and discussion of each site class is provided here.

Class I. This class consists of 9 sites. Three of these are mound sites (Ge 4, Ge 5 and Mg 46). Other than the following description, the majority of the information on mound and non-mound sites is listed in Appendix I.

The Scull Shoals mound site (Ge 4) consists of three mounds and an associated village located in an area of extensive floodplain. Mound A, the largest mound, is a rectangular platform mound. This mound is approximately 9.95 meters high and 46.5 meters in diameter at its base.

Wauchope (1966) mentions another mound, Mound C, but it was not located during the investigation. The Dyar mound site (Ge 5) consists of a large mound and a village. Its platform mound is about 9.3 meters high and 53 meters in diameter at the base. The mound appears to have had a substantial structure on its summit. The Little River mound site (Mg 46) consists of three mounds. The largest mound is 1.5 meters high, 18.5 meters wide and 25.9 meters long. Mound B is located 131 meters east from the Mound A. Mound B has dimensions of 4.6 meters in height and 7.4 meters in diameter at the base. Mound C, another small mound, is located about 58 meters west of Mound A. The dimensions of this mound are 0.6 meters in neight and 18.5 meters in diameter at the base.

Non-mound sites include Ge 52, Ge 89, Mg 28, Mg 73, Mg 89 and Pm 153. Five of them (Ge 89, Mg 28, Mg 73, Mg 89 and Pm 153) have been partially excavated and have yielded a large number of ceramics. It is interesting to note that four burials have been found at Pm 153 during the salvage excavation. Bartram (1853) notes some Creek towns which had no mounds or public square, but had public buildings, occupied the same functional position as towns which had mounds and public squares.

The average size of Class I sites is 28,055 m^2 (ranging from 20,400 m^2) which is much larger than sites in Class II and III. Mean frequency of ceramics (104 per site) and lithic tools (16 per site) from Class I sites is higher than the other two site classes (see Table 10). The high mean frequencies of artifacts may be reflected by either a large population at class I sites or a long period of occupation.

The data would seem to indicate that Class I sites played a more important role in the settlement system than did Class II or III sites. According to this data, the first hierarchical settlements, i.e., Class I sites, are hypothesized to have been the major centers of the area. These sites are likely to have been permanent, year-round settlements and centers of many social, economic, political and religious activities.

Class II. Class II consists of 23 sites constituting the second level of the settlement hierarchy. The average size of Class II sites is 11,889 m^2 to 18,000 m^2). Mean frequency of ceramics and lithic tools per site is 53 and 12, respectively. These figures of mean frequency are lower than those of Class I sites, but higher than those of Class III sites (see Table 10).

These sites are considered to have been villages or clusters of individual houses and it is assumed that the functional role of these sites is less important than that of the Class I sites. Class II sites are also assumed to have been year-round settlements, with the possible exception of winter hunting season: "At their huntings they leave their habitations, and reduce themselves into companies"

(Swanton 1946:258). The location of the villages seems to have been determined by the availability of suitable agricultural land (Swanton 1946:256).

Class III. This class consists of 117 sites which form the third level in the settlement hierarchy. The average size of the Class III sites is 2,919 m^2 (ranging from 15 m^2 to 6000 m^2). This settlement size is much smaller than that of the Class I and II sites. The mean frequency of ceramics (49 per site) and lithic tools (3 per site) of the Class III sites is also lower than the other two classes of sites (see Table 9).

Of the 19 shell midden sites, 18 sites are in Class III. Eleven of the 13 sites located near shoals are Class III sites. All 5 of the sites located on islands are also in this class. The data presented in the remainder of this chapter would seem to indicate that Class III sites are less important than Class I and II sites in terms of diversity of functional activity and represent the location of rather specialized functional activities. If so, they were probably seasonally occupied settlements. Swanton (1946) describes such specialized activity sites in the following term: "...to mend their diet, some disperse themselves in small companies, and live upon fish, beasts, crabs, oysters, land tortoyses, strawberries, mulberries and such like" (Swanton 1946:258).

Discussion. The Chi-square statistic is used to determine the association between the site classes and the artifact content: i.e., whether the observed differences of mean frequencies of ceramics and lithic tools signify differences among site classes or whether the differences are merely due to chance variations. The non-parametric Chi-square test is considered the appropriate technique for measuring the extent of association of these two sets of variables. Sietel (1956:196-202) gives a more detailed discussion of this subject.

Table 9, the result of the Chi-square test, indicates that there is a significant statistical difference in the artifact content of the three site classes. The artifactual content along with site size is thus considered to be a meaningful indicator of site classification.

This statistic, however, does not provide information on the functional role or activity range of each class. The following section is more informative on this subject.

Site Classes and Cultural Variability

This section presents an analysis of cultural variables in conjunction with the site classes. The assumption underlying this analysis is that observed differences in ceramics and lithics between site classes are reflections of differences in adaptive activity occurring at sites.

Although it has been pointed out in Chapter II, it must be noted here again that some potential errors are involved

Table 9. Chi-square contingency table for mean frequency of ceramic and lithic tool

Artifact Type	Mean Frequency Class I	Class II	Class III	Total
Ceramic	104 (104.30)	53 (56.50)	49 (45.20)	206
Lithic Tool	16 (15.70)	12 (8.50)	3 (6.80)	31
Total	120	65	52	237

Numbers in the parenthesis are expected values
Chi-square=53.56 with 2 degrees of freedom
Significance=0.001

in the present analysis. Most of the ceramics and lithic artifacts used for this analysis are from surface contexts. These surface samples from each site may differ significantly in the representation of original cultural remains. This problem may result from several factors such as insufficient sample size, natural events and post-contact human activities. Artifact collections of numerous sites are, for example, from plowed fields and this may result in a distortion of artifact compositions. Low frequencies of artifacts from some of the Class III sites may have resulted from the poor conditions found on these sites, such as natural and cultural disturbances or dense ground cover.

Other potential errors in the analysis exist in the classification of artifacts. Some ceramics may have been sorted incorrectly due to weathering; e.g., a slight weathering on faintly stamped ware may result in its being classified as plain. It is also necessary to point out that the difficulty of assigning some lithic artifacts to chronological periods may have resulted in the misclassification of some lithics at multi-component sites.

Every possible effort has been made to minimize these potential sources of error, but given the nature of the data, certain errors probably inherent in the analysis are inevitable.

<u>Ceramic Variability</u>. As has been presented in Chapter IV, the ceramic classification utilized in the present

research uses the ceramic types defined by early works. Initial ceramic type descriptions of Lamar Complicated Stamped and Lamar Bold Incised were established by Jennings and Fairbanks (1939:11-15). Lamar Plain was added later by Caldwell (1952:216). Lamar Burnished Plain (Wauchope 1966: 86-87), Lamar Pinched (Sears 1958:175) and other minority types (Punctated, Corncob Marked and others) have also been added to the Lamar phase ceramic series (Fairbanks 1955; Smith 1973; Wauchope 1966). Table 10 presents data on frequencies and variations of the ceramic collections used here. The summary counts of types per site are listed in Appendix II. One particular ceramic type made ceramic classification difficult and this problem requires additional comments.

A number of Ocmulgee Fields Incised ceramics were recovered during the survey. Although this ceramic type is well documented in the literature (Fairbanks 1952, 1958; Kelly 1938), it is often difficult to distinguish Ocmulgee Fields Incised from Lamar Bold Incised because of their similarity in design motifs and incising. The criteria for distinguishing between these two types has been mainly based on the width of lands and grooves in the incising; Lamar Bold Incised having wider lands and grooves than Ocmulgee Fields Incised. Initial observation of the ceramic collection seemed to support this distinction in that several sites containing incised pottery with narrow

Table 10. Total Lamar phase ceramic variation

Ceramic Type	Total Count	Percentage
Lamar Plain	6283	78.67
Lamar Bold Incised	852	10.67
Lamar Complicated Stamped	363	4.54
Ocmulgee Fields Incised	274	3.43
Lamar Burnished Plain	111	1.39
Lamar Pinched	68	0.85
Lamar Punctated	31	0.39
Lamar Corncob Marked	3	0.04
Lamar Cross Hatched	1	0.01
Lamar Line Blocked	1	0.01
Total	7987	100.00

lands and grooves, i.e., Ocmulgee Fields Incised rarely contained pottery with wide lands and grooves, i.e., Lamar Bold Incised. In order to test if this was a consistent and legitimate distinction, 200 incised ceramics from 2 differnet sites (9Mg 28 and 9Ge 4) were randomly chosen and the widths of lands and grooves were measured. Table 11 presents the results of this analysis. The t distribution was used to see if the widths of lands and grooves were significantly different in ceramics from each site. The indications are that there is, in fact, a significant difference between incised ceramics from the Mg 28 site and the Ge 4 sites in terms of the widths of lands and groove. The majority of incised pottery from Mg 28 is considered to be Ocmulgee Fields Incised while that from Ge 4 is Lamar Bold Incised (Lee and Wood 1975). These measurements were used whenever difficulties were encountered in classifying other incised ceramics.

As Table 10 shows, the most common pottery type occurring is Lamar Plain comprising 78.67% of the total ceramic collections. The next most common pottery types are Lamar Bold Incised and Lamar Complicated Stamped. These two types make up 10.67% and 4.54% of the ceramic collection, respectively. These three pottery types are considered the major pottery types of the phase and together comprise 93.88% of the total ceramic collection.

Site class variability is expected to be associated with ceramic variability. The chi-square statistic was used to determine if there was a statistically significant difference between the ceramic composition of each site class. Table 12 presents results of the computation. As Table 12 indicates, there is a significant difference in the ceramic composition of the three site classes using the three major ceramic types. This ceramic variation may be considered as a reflection of the functionally different activities of each site class.

Table 13 presents ceramic type variability by site classes and the mean frequency per site of each ceramic type. This additional examination of ceramic composition by site classes tends to support the contention that there are significant ceramic type differences between site classes. Mean composition of ceramics for Class I sites is 73.62% Lamar Plain, 11.49% Lamar Bold Incised and 12.55% Lamar Complicated Stamped per site. Class II sites have a lower percentage of Lamar Plain (66.10%) and Lamar Complicated Stamped (3.65%) than Class I sites and a higher percentage of Lamar Bold Incised (22.30%). Class III sites have a greater percentage of Lamar Plain ceramics (82.15%) with only a small percentage of decorated ceramics. Class I and II sites contain more decorated ceramics, although the ratio of composition is different for each class. Class II sites have 7.06% Ocmulgee Fields Incised per site while

Table 11. 95% confidence limits for means of width of land and groove using t distribution

	Sites	$\bar{x}$	s
Width of Land (mm)	Mg 28	3.65	1.48
	Ge 4	4.78	1.59
Width of Groove (mm)	Mg 28	1.20	0.72
	Ge 4	2.55	0.88

	Mg 28	Ge 4
Confidence Limits of Land	$3.404 < u < 3.896$	$4.407 < u < 5.153$
Confidence Limits of Groove	$1.080 < u < 1.320$	$2.343 < u < 2.757$

Table 12. Chi-square contingency table for ceramics

Pottery Type	Class I	Class II	Class III	Total
Lamar Plain	692 (769.24)	815 (951.08)	4776 (4562.67)	6283
Lamar Bold Incised	108 (104.31)	275 (128.97)	469 (618.72)	852
Lamar Complicated Stamped	118 (44.44)	45 (54.95)	200 (263.61)	363
Total	918	1135	5445	7498

Numbers in the parenthesis are expected values

Chi-square = 378.23 with 4 degrees of freedom

Significance = 0.001

Table 13. Lamar phase ceramic variation by site class

Ceramic Type	Class I			Class II			Class III		
	Total Count	Mean Frequency	%	Total Count	Mean Frequency	%	Total Count	Mean Frequency	%
Lamar Plain	692	76.89	73.62	815	35.43	66.10	4476	40.82	82.15
Lamar Bold Incised	108	12.00	11.49	275	11.96	22.30	469	4.01	
Lamar Comp. Stamped	118	13.10	12.55	45	1.96	3.65	200	1.71	3.44
Ocmulgee Fields Incised	8	0.89	0.85	87	3.78	7.06	179	1.53	3.08
Lamar Burnished Plain	2	0.22	0.21	0	-	-	109	0.93	1.87
Lamar Pinched	5	0.56	0.53	8	0.35	0.65	55	0.47	0.95
Lamar Punctated	5	0.56	0.53	3	0.13	0.24	23	0.20	0.40
Lamar Corncob Marked	1	0.11	0.11	0	-	-	2	0.02	0.03
Lamar Cross Hatched	0	-	-	0	-	-	1	0.01	0.02
Lamar Line Blocked	1	0.11	0.11	0	-	-	0	-	-
Total	940	104.44	100.00	1233	53.61	100.00	5814	49.69	100.00

Class III sites have 3.08%. Other minority ceramics are too small in quantity to include in this discussion.

This assessment of ceramic composition among site classes is supportive of the contention that ceramic variation exists between site classes. Table 13 also shows overall mean frequency for each class: 104.44 for Class I sites, 53.61 for Class II sites and 49.69 for Class III sites. The differences of mean frequency for each class are also, as mentioned earlier, indicative of site class variability.

Lithic Variability. In this section lithic materials are used in analyzing site class variability. Lithic materials collected during the survey are divided into two broad categories: debitage and tool. Debitage consists of angular fragments and flakes. Frequency, weight and amount of cortex are utilized as variables on debitage to measure site class variability. Tools were subdivided into 7 broad descriptive types (Broyles 1971b; Cambron and Hulse 1964; Coe 1964). These types are projectile points, biface, unifacial sidescraper, bifacial sidescraper, endscraper, drill and unclassifiable utilized lithics. Table 14 presents raw data on the lithic categories utilized.

The most common lithic category encountered during the survey were flakes. Flakes comprise 74.83% of the total lithic collection. The majority of these flakes are quartz (83.91%). Quartz is a locally available lithic resource in

Table 14. Total lithic artifact variation

Lithic Artifact	Total Count
Debitage	
Angular Fragments	504
Flakes	3966
Total	4470
Tools	
Projectile Points	291
Bifaces	146
Unifacial Sidescrapers	128
Bifacial Sidescrapers	93
Endscrapers	44
Drills	24
Others	104
Total	830
Total	5300

Piedmont Georgia and sources are common in the research area. Although there are no local sources for chert in the study area, 16.09% of the total flakes are made out of chert. The nearest sources for chert are in Washington and Burke Counties. This means that the aboriginal population in the study area had to obtain this raw material from over 60 miles away.

Lithic artifact collections were initially lumped into three broad categories (angular fragments, flakes and tools) and the chi-square statistic was used to determine if there was a significant difference in lithic artifact composition between site classes. Table 15 presents the result of the chi-square computation and indicates that there is a significant difference in the lithic artifact composition of the three site classes. Of these three lithic categories, flakes and tools are further analyzed to examine variability of lithic artifacts between site classes. Discussion of these analyses is presented below.

Table 16 presents the lithic tool variability by site classes. This table reveals that the Class I sites have a higher mean frequency of total lithic tools (16.67 per site) than do the Class II sites (12.13) and Class III sites (3.43). Examination of mean frequency of individual tool types by site classes indicates some interesting relationships be-ween site class and tool type composition. Mean frequency of projectile points for Class I sites is 7.56, 4.39 for Class II sites and 1.04 for Class III sites. The same

Table 15. Chi-square contingency table for lithic artifacts by site class

Lithic Artifacts	Class I	Class II	Class III	Total
Angular Fragments	21 (38.04)	376 (241.92)	107 (224.04)	504
Flakes	229 (299.32)	1889 (1903.68)	1848 (1763.00)	3966
Tools	150 (62.64)	279 (398.40)	401 (368.96)	830
Total	400	2544	2356	5300

Numbers in the parenthesis are expected values
Chi-square=214.55 with 4 degrees of freedom
Significance=0.001

Table 16. Lithic tool variation by site class

Tool Types	Class I			Class II			Class III		
	Total Count	Mean Frequency	%	Total Count	Mean Frequency	%	Total Count	Mean Frequency	%
Projectile Points	68	7.56	45.33	101	4.39	36.20	122	1.04	30.42
Bifaces	35	3.89	23.33	33	1.43	11.83	78	0.67	19.45
Unifacial Sidescrapers	11	1.22	7.33	65	2.83	23.30	52	0.44	12.97
Bifacial Sidescrapers	9	1.00	6.00	37	1.61	13.26	47	0.40	11.72
Endscrapers	2	0.22	1.33	23	1.00	8.24	19	0.16	4.74
Drills	24	2.67	16.00	0	-	-	0	-	-
Others	1	0.11	0.67	20	0.87	7.17	83	0.71	20.70
Total	150	16.67	100.00	279	12.13	100.00	401	3.43	100.00

pattern is shown for bifaces; 3.89 for Class I sites, 1.43 for Class II sites and 0.67 for Class III sites. For other tools, only Class I sites have drills. Class II sites, however, have more unifacial sidescrapers than Class I and Class III sites. In general, total number and variability in tool types per site is related to site class membership with Class I sites having more tools than Class II sites and Class II sites having more tools than Class III sites. Though not statistically tested, it may be considered that this tool variation may reflect the range of different activities occurring in each class of sites.

Flakes are divided into two sub-categories: cortical and non-cortical. Table 17 presents a chi-square contingency table for these two types by site classes. The result of the computation indicates that there is a statistical difference at the 0.001 level of significance in the flake type composition of the three classes. These two subcategories of flakes are further divided according to the lithic resources (quartz and chert). Table 18 presents data on flake variability by site classes.

Table 18 indicates that the mean weight of quartz flakes is greater than those of chert flakes. Mean weights of flakes not only differ according to raw material but also differ by site classes. Figure 5 illustrates these differences. Flakes found in the Class I sites are the heaviest while flakes found in the Class III sites are lightest.

Table 17. Chi-square contingency table for flake types by site class categories

Flake Type	Site Class I	II	III	Total
Cortical	11 (5.14)	16 (42.39)	62 (41.47)	89
Non-cortical	218 (223.86)	1873 (1846.61)	1786 (1806.53)	3877
Total	226	1889	1848	3966

Numbers in the parenthesis are expected values

Chi-square = 34.03 with 2 degrees of freedom

Significance = 0.001

Table 18. Mean weight of cortical and non-cortical flakes by site class

Flake Type	Class I				Class II				Class III				Total		
	Freq-uency	Total* Weight	Mean Weight	%	Freq-uency	Total Weight	Mean Weight	%	Freq-uency	Total Weight	Mean Weight	%	Freq-uency	Mean Weight	%
Quartz															
Cortical	11	173.80	15.80	4.93	9	108.99	12.11	0.54	26	283.40	10.90	1.81	46	12.31	1.31
Non-cortical	212	1256.34	5.93	95.07	1661	2960.51	1.78	99.46	1409	2312.72	1.64	98.19	3282	2.32	98.62
Sub-total	223				1670				1435				3328		
Chert															
Cortical	0	-	-		7	31.80	4.54	3.20	36	132.04	3.67	8.72	43	3.81	6.74
Non-cortical	6	17.20	2.87	100.00	212	277.10	1.31	96.80	377	436.37	1.16	91.28	595	1.23	93.26
Sub-total	6				219				413				638		
Total	229		6.32		1889		1.93		1848		1.56		3966		

*Weights are in grams

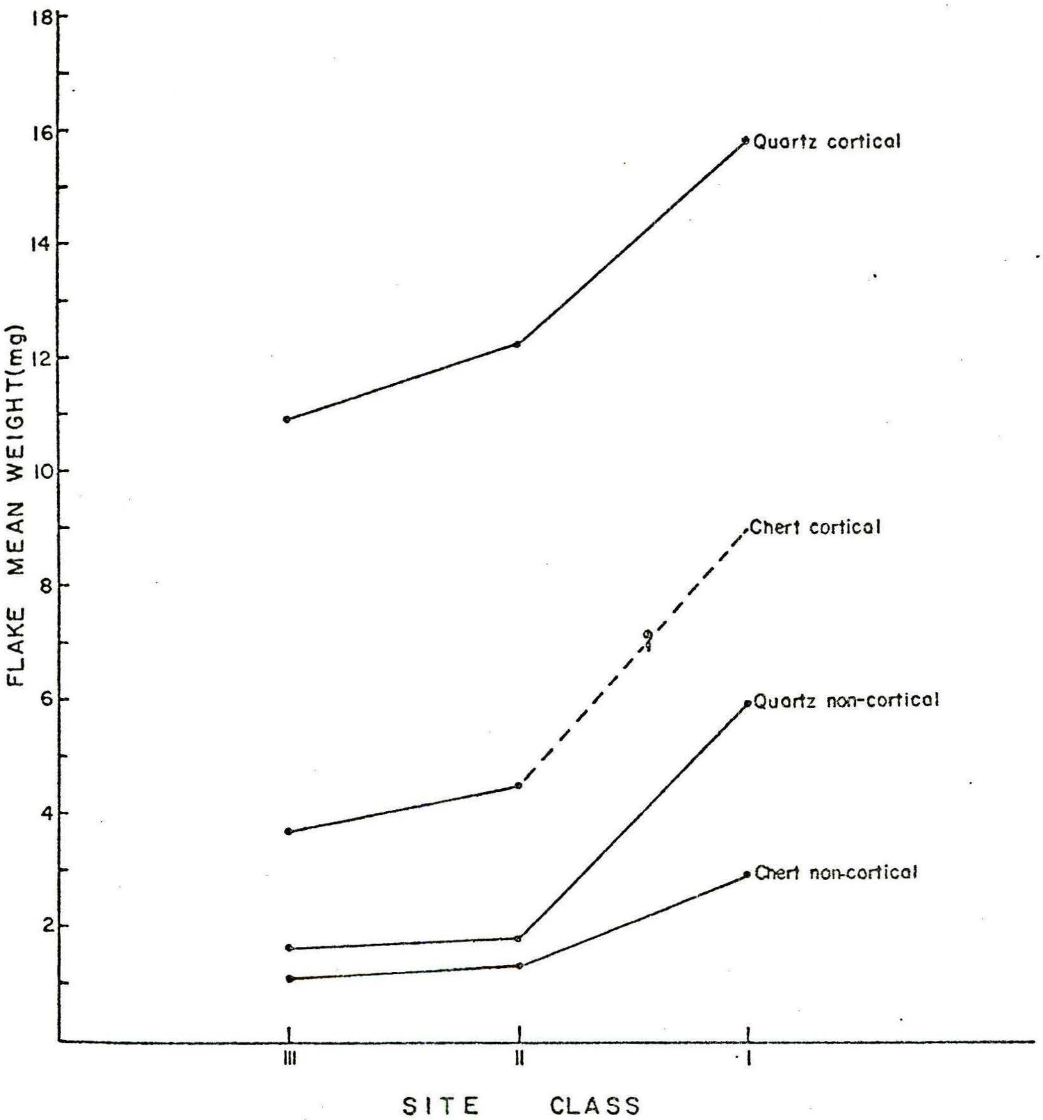

Fig. Graph of site class versus mean weight of flakes

The figure shows a sharp increase of mean weight for Class I sites. This pattern may indicate that initial lithic artifact manufacturing processes were carried out at Class I sites or Class I sites represent major activity stations where primary production of lithic tools took place. The Class II sites may be interpreted as secondary sites where lithic tools were probably retouched. The Class III sites have lightest flakes and this may be reflective of a flow pattern of lithic artifacts in the settlement system where once used lithic tools, which are brought from Class I or II sites, are retouched for another use at the Class III sites.

The examination of ceramic and lithic collections presented here is seen as potentially useful in indicating site class variability. It is, however, difficult to formulate more rigorous statements about the adaptive system which may have operated with the present ceramic and lithic data.

Discussion. General indications from the examination of ceramic and lithic collections suggest that Class I sites were the most important settlements in the system, possibly representing long periods of occupation, and likely acted as centers of many sociocultural activities for the region. Artifactual data as well as site size suggest that the Class II sites were less important than the Class I sites but are interpreted to have been permanent settlements. Class III sites are probably short term or specialized activity stations.

The functional role of individual Class III sites is difficult to discern. One means of assessing proposed Class III site variability is through the analysis of artifacts from sites of various locations.

Table 19 presents mean frequency of ceramics and lithic tools for Class III sites of various locations. The number of ceramics from the island sites is unusually high compared to the average for Class III sites. A possible interpretation is that the island sites were occupied for a relatively longer period than other Class III sites because of their isolated situation. A probable functional activity performed at these sites was the exploitation of nearby riverine resources. Table 20 presents ceramic variation for the island sites and Table 21 gives lithic variation for these same sites; both are compared with other Class III sites. Apparent difference of artifact composition between the island sites and other Class III sites shown from these tables is that mean frequency of ceramics from the island sites is higher than that of the other Class III sites. Although the sample size of the island sites, five, is small, the differences of artifact composition may be considered as a reflection of a different activity which involved the riverine resource exploitation.

Sites located near shoals have a lower frequency of ceramics. Table 22 shows the less diversified ceramic types. This may be reflective of limited activity or a brief occupation of sites. Table 23 presents the lithic tool variation

Table 19. Mean frequency of ceramics and lithic tools by sites near shoals, shell midden sites, island sites and overall Class III sites

	Sites near Shoal (N-11)	Shell Midden Sites (N=18)	Island Sites (N=5)	Overall Class III Sites
Ceramics	27.91	50.22	134.60	49.69
Lithic Tools	3.36	3.72	5.00	3.43

Table 20. Ceramic variation: Island sites versus Class III sites

Pottery Type	Island Sites (N=5)			Class III Sites (N=112)		
	Freq-uency	%	Mean Frequency	Freq-uency	%	Mean Frequency
Lamar Plain	530	78.73	106.00	3846	81.12	34.34
Lamar Bold Incised	38	8.62	11.60	411	8.67	3.67
Lamar Comp. Stamped	44	6.54	8.80	156	3.29	1.39
Ocmulgee Fine Incised	1	0.15	0.20	178	3.75	1.59
Lamar Burnished Plain	35	5.20	7.00	74	1.56	0.66
Lamar Pinched	4	0.59	0.80	51	1.08	0.46
Lamar punctated	1	0.15	0.20	22	0.46	0.20
Lamar Corncob Marked	0	-	-	2	0.04	0.02
Lamar Cross Hatched	0	-	-	1	0.02	0.01
Lamar Line Blocked	0	-	-	0	-	-
Total	673	100.00	134.60	4741	100.00	42.33

Table 21. Lithic tool variation: Island sites versus Class III sites

Tool Type	Island Sites (N=5)			Class III Sites (N=112)		
	Freq-uency	%	Mean Frequency	Freq-uency	%	Mean Frequency
Projectile Point	6	24.00	1.20	116	30.85	1.04
Biface	5	20.00	1.00	73	19.41	0.65
Unifacial Sidescraper	1	4.00	0.20	51	13.56	0.46
Bifacial Sidescraper	0	-	-	47	12.50	0.42
Endscraper	0	-	-	19	5.05	0.17
Drill	0	-	-	0	-	-
Others	13	52.00	2.60	70	18.62	0.63
Total	25	100.00	5.00	376	100.00	3.36

Table 22. Ceramic variation: Sites near shoals versus Class III sites

	Sites Near Shoals (N=11)			Class III Site (N=106)		
Pottery Type	Freq-uency	%	Mean Frequency	Freq-uency	%	Mean Frequency
Lamar Plain	236	76.87	21.45	4540	82.26	42.83
Lamar Bold Incised	36	11.73	3.27	460	8.33	4.34
Lamar Comp. Stamped	31	10.30	2.82	169	3.06	1.59
Ocmulgee Fine Incised	16	0.33	0.09	163	2.95	1.54
Lamar Burnished Plain	2	0.65	0.18	107	1.94	1.01
Lamar Pinched	1	0.33	0.09	54	0.93	0.51
Lamar Punctated	0	-	-	23	0.42	0.22
Lamar Corncob Marked	0	-	-	2	0.04	0.02
Lamar Cross Hatched	0	-	-	1	0.02	0.01
Lamar Line Blocked	0	-	-	0	-	-
Total	307	100.00	27.91	5519	100.00	52.07

Table 23. Lithic tool variation: Sites near shoals versus Class III sites

Tool Type	Sites Near Shoals (N=11)			Class III Site (N=106)		
	Freq-quency	%	Mean Frequency	Freq-uency	%	Mean Frequency
Projectile point	12	32.43	1.09	110	30.22	1.04
Biface	4	10.81	0.36	74	20.33	0.70
Unifacial Sidescraper	20	54.05	1.82	32	8.79	0.30
Bifacial Sidescraper	0	-	-	47	12.91	0.44
Endscraper	1	2.70	0.09	18	4.95	0.17
Drill	0	-	-	0	-	-
Others	0	-	-	83	22.80	0.78
Total	37	100.00	3.36	364	100.00	3.43

for sites located near the shoals and shows a relatively high frequency of unifacial sidescrapers (1.82) compared to the other Class III sites (0.30). This data may be indicative of some special activity involving unifacial sidescrapers occurring at the sites near the shoals.

Table 24 and 25 present ceramic and lithic variations for the shell midden sites. A comparison of ceramics between shell midden sites and the other Class III sites reveals that the shell midden sites have a higher percentage of Lamar Burnished Plain ceramics (5.75%) than the other Class III sites (1.15%). It can be speculated that the aboriginal population used more plain pottery at the shell midden for cooking shellfish. Lithic composition of shell midden sites differs little from that of the other Class III sites.

An attempt has been made to examine ceramic and lithic variability between site classes. Resultant analysis indicates that there are patterned differences in ceramics and lithics between site classes. These differences may be considered as reflections of differences in activities and adaptive strategies for each site class, even though it is difficult to depict the specific functional role of each site with the data at hand.

Site Classes and Environmental Variability

This section examines several environmental variables that are considered in this study as critical factors for site location. It is expected that an analysis of environ-

Table 24. Ceramic variation: Shell midden sites versus Class III sites

Pottery Type	Shell Midden Sites (N=18)			Class III Sites (N=99)		
	Frequency	%	Mean Frequency	Frequency	%	Mean Frequency
Lamar Plain	682	75.44	37.89	4094	83.38	40.90
Lamar Bold Incised	58	6.42	3.22	411	8.37	4.15
Lamar Comp. Stamped	59	6.53	3.28	141	2.87	1.42
Ocmulgee Fine Incised	44	4.87	2.44	135	2.75	1.36
Lamar Burnished Plain	52	5.75	2.89	57	1.15	0.58
Lamar Pinched	8	0.88	0.44	47	0.96	0.47
Lamar Punctated	0	-	-	23	0.47	0.23
Lamar Corncob Marked	1	0.11	0.06	1	0.02	0.01
Lamar Cross Hatched	0	-	-	1	0.02	0.01
Lamar Line Blocked	0	-	-	0	-	-
Total	904	100.00	50.22	4910	100.00	49.60

Table 25. Lithic tool variation: Shell midden sites versus Class III sites

	Shell Midden Sites (N=18)			Class III Sites (N=99)		
Tool Type	Frequency	%	Mean Frequency	Frequency	%	Mean Frequency
Projectile Point	30	44.78	1.67	92	27.54	0.93
Biface	8	11.94	0.61	70	20.96	0.71
Unifacial Sidescraper	11	16.42	0.61	41	12.28	0.41
Bifacial Sidescraper	0	-	-	47	14.07	0.47
Endscraper	5	7.46	0.28	14	4.19	0.14
Drill	0	-	-	0	-	-
Others	13	19.40	0.72	70	20.96	0.71
Total	67	100.00	3.72	332	100.00	3.37

mental variables will supplement the results of the analysis of cultural variables presented in the previous section. The environmental variables utilized in this study are soil types, landforms and water resources. These variables are not mutually exclusive. Following sections provide a discussion and analysis of each of these variables.

Relationships Between Sites and Soil Types. The importance of soil types as a determining factor for locating prehistoric sites has been emphasized in British archaeology (Grimes 1945; Wooldridge and Linton 1933) and the use of soil survey maps and the examination of soil types and their relationships to archaeological sites has been suggested.

A recent trend in settlement study in the United States is the increasing awareness of the importance of soil types (Butzer 1964). Several studies have attempted to utilize soil types in explaining Mississippian settlement distribution in the Southeast. It has been shown that soil types are a determining factor in Mississippian site location (Ward 1965), and it has been suggested that Mississippian sites are usually located on fine sandy loam or silty loam soils. This argument is based on the assumption that the primary subsistence base for the Mississippian period was horticultural with an emphasis on the production of maize, although the type of economy practiced during the Late Mississippian period was a combination of food production and hunting/gathering economy (Fairbanks 1952: Griffin 1967;

Lorant 1946).

For this study, the soil types surrounding each site were examined using available soil survey maps. The 149 sites used in this study are located on 15 different soil types. These soil types were grouped into three categories according to soil grades as discussed in Chapter III. These three groups are: fine sandy loam, clay loam and coarse sandy loam (Table 26). Figure 6 presents a proportional distribution of three soil types in Morgan County. General soil maps of Greene and Putnam Counties are not available at the present. Several factors should be considered in selecting soil types favored by the early agriculturalists. One relates to the effectiveness of prehistoric technology in working the soils. Another is the productiveness of soils, and a third is the accessibility and quantity of such soils. According to the above criteria, fine sandy loam (Group I) and clay loam (Group II) soils are considered the most favorable soil types for maize agriculture using prehistoric technology. While coarse sandy loam (Group III) soils are not, because of their low water capacity due to their coarse, sandy nature. Table 26 shows the average corn yield per acre for the soil groups without the use of fertilizer as 21.07 bushels for fine sandy loam and 14.4 bushels for clay loam (Long 1922). These two soil type groups comprise 85.1 percent of the soils in the study area. One hundred thirty-eight sites are located on these soil types. Only 11 sites are located on the unfavorable, coarse sandy loam soils.

Table 26. List of soil types, percentage of each soil type and average corn yield per acre

Soil Group	Soil Type	Percentage	Average corn yield per acre (without using fertilizer)
I. Fine sandy loam	Congaree fine sandy loam	0.4%	30.0
	Altavista sandy loam	0.1	30.0
	Mecklenburg	0.6	20.0
	Wickham sandy loam	0.3	20.0
	Cecil sandy loam	15.9	12.5
	Molena sandy loam	0.6	15.0
	Iredell sandy laom	0.5	20.0
		18.4%	Ave. 21.07 bushels
II. Clay loam	Cecil sandy clay loam	41.4	13.5
	Davison clay loam	12.2	16.5
	Congaree silty clay loam	2.7	20.0
	Meadow	3.7	12.0
	Cecil Clay loam	6.8	10.0
		66.7%	Ave. 14.4 bushels
III. Coarse sandy loam	Cecil coarse sandy loam	2.3	0.0
	Appling sandy loam	3.8	9.0
	Wilkes sandy loam	2.9	8.0
		9.0%	Ave. 5.7 bushels
IV. Others		5.9%	

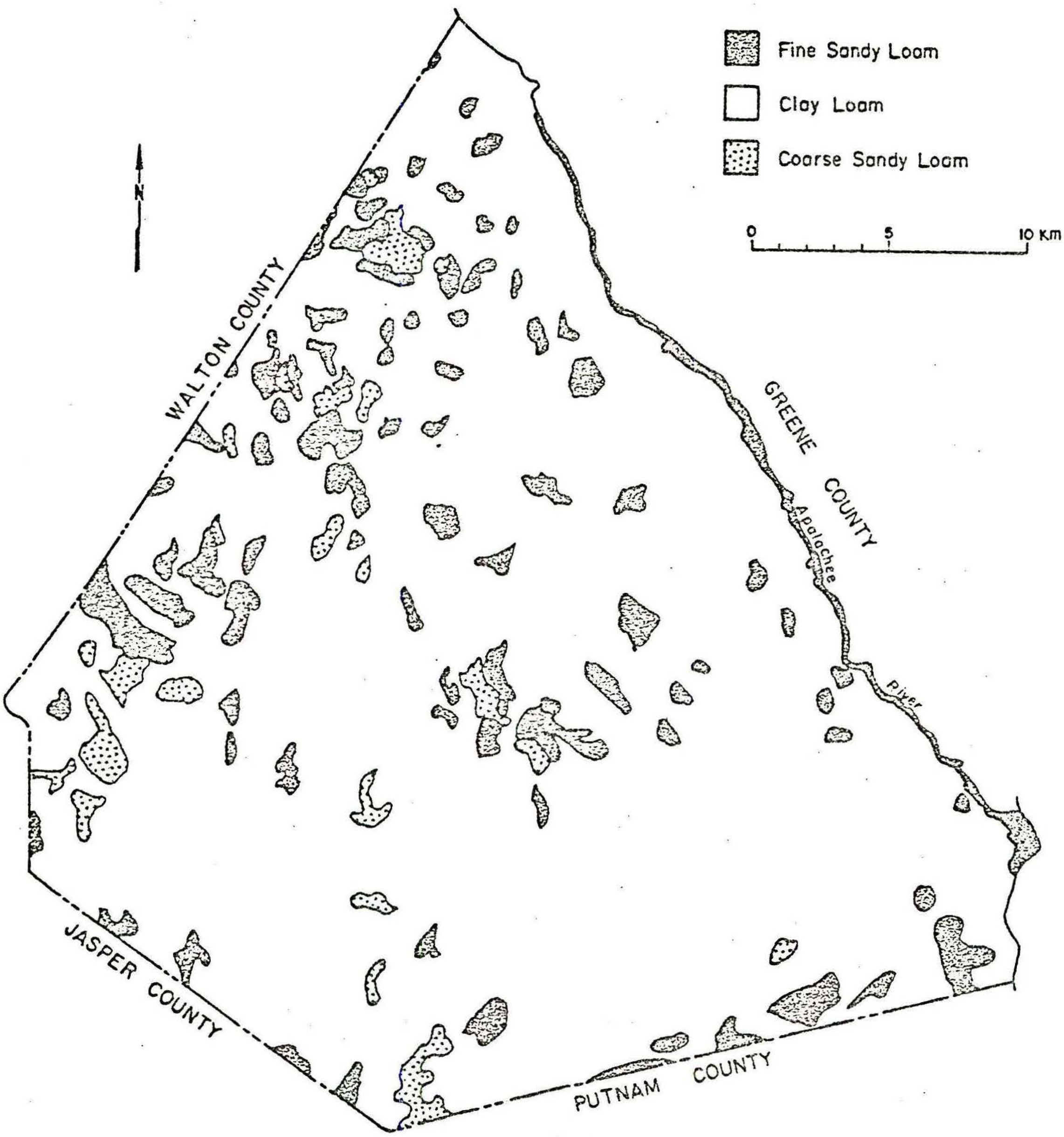

Fig. 6 Distribution of soil types in morgan county

These three groups of soil types were coded for each site (Appendix I), and a chi-square test was computed in order to test the hypothesis that the Late Mississippian sites in the study area were purposefully located on soils favorable to maize agriculture. The chi-square formula used was:

$$X^2 = \frac{(O - E)^2}{E}$$

where O is observed number of sites and E is expected number of sites according to the percentage of soil types. Table 27 presents the results of the chi-square test. These results show that the hypothesis is supported. Although this soil variation reflects and supports the general contention that sites are located on the favorable soil types for maize agriculture, the resultant computation must be considered with some caution. One of the observed values is 0 which may affect the results. The resultant computation, however, still seems to be statistically significant without the computed chi-square value of the soil type of "others".

When the figures in Table 28 are examined, it becomes clear that Class I and Class II sites tend to be located on favorable soil types (Group I and II). Only one Class II site is located on an unfavorable soil type (Group III). On the other hand, only one Class III site is located on the favorable soil type. The percentage of site distribu-

Table 27. Chi-square test for soil types

Soil Type	0	E	(0-E)	$(0-E)^2$	$(0-E)^2/E$
Sandy Loam	43	27.42(18.4)	15.58	242.74	8.85
Clay Loam	95	99.38(66.7%)	4.38	19.18	0.19
Coarse Sandy Loam	11	13.41(9.0%)	-2.41	5.81	0.43
Others	0	8.79(5.9%)	-8.79	77.26	8.79
	149	149.00 (100%)			$X^2 = 18.26$

df=3

Percentage Point of the X^2 Distribution at 0.001 = 16.266

Table 28. Site distribution by site class and soil type

	Class I		Class II		Class III		
Soil Type	Frequency	%	Frequency	%	Frequency	%	Total
Fine Sandy Loam	4	44.44	5	21.74	34	29.06	43
Clay Loam	5	55.56	17	73.91	73	62.39	95
Coarse Sandy Loam	0	-	1	4.35	10	8.55	11
Total	9	100.00	23	100.00	117	100.00	149

tion by site classes and soil types implies a selective tendency by site class for the location of sites on soil types favorable to maize agriculture.

An alternative explanation given by Larson (1970) is that the complex cultural development of the Mississippian period in the Southeast was not due to maize agriculture, but resulted from "the appearance of social mechanisms that permitted the development of large sedentary communities that could carry out the production and distribution of resources from several rich ecological zones" (Larson 1970: 25). According to Larson (1970), Mississippian sites are not distributed solely in response to the requirements of maize agriculture.

Sites and Landforms. Landform is also a critical variable in the study of settlement pattern and has been considered as one of the three major variables in settlement study by the Southwestern Anthropological Research Group (Plog and Hill 1971; SARG 1974).

The specific landforms affecting the location of Late Mississippian sites may be critical in understanding settlement pattern since topographic location is important in understanding man-land relationships. For the present study, it is hypothesized that Late Mississippian sites are located on particular landforms so as to minimize the effort required in exploiting particular segments of the natural environment. In order to test this hypothesis, the landform of each site location was examined using USGS Quadrangle maps and field observations. Late Mississippian sites in the study area are distributed across seven different landforms. The landforms of each site have been coded, a list of which can be found in Appendix I. Even though it has been discussed in Chapter III, it should be pointed out again that the paleo-landforms are assumed to be basically similar to present day landforms. Table 29 lists the number of sites associated with the seven different landforms. For the purpose of analysis, these seven landforms are lumped into two broad topographic categories - upland and riverine. Upland comprises ridge tops and slopes, and riverine includes terrace, bluff, floodplain, levee ridge and river island. Figure 7 illustrates a schematic profile of these land forms.

Small sites on the uplands, mainly ridge tops, were probably hunting, collecting or farming camps. A similar settlement configuration has been noted in the Allatoona Reservoir area of Georgia, also in the piedmont. Here, many small sites of the Galt period, belonging to protohistoric and historic Cherokee, were found in the uplands (Caldwell n.d.). Sites on intermediate locations, such as slopes and terraces, may be advantageous because from this location the inhabitants could exploit resources at diverse loci with minimum cost in terms of time and energy. Small sites near the river, particularly near the shoals, are assumed to be fishing camps.

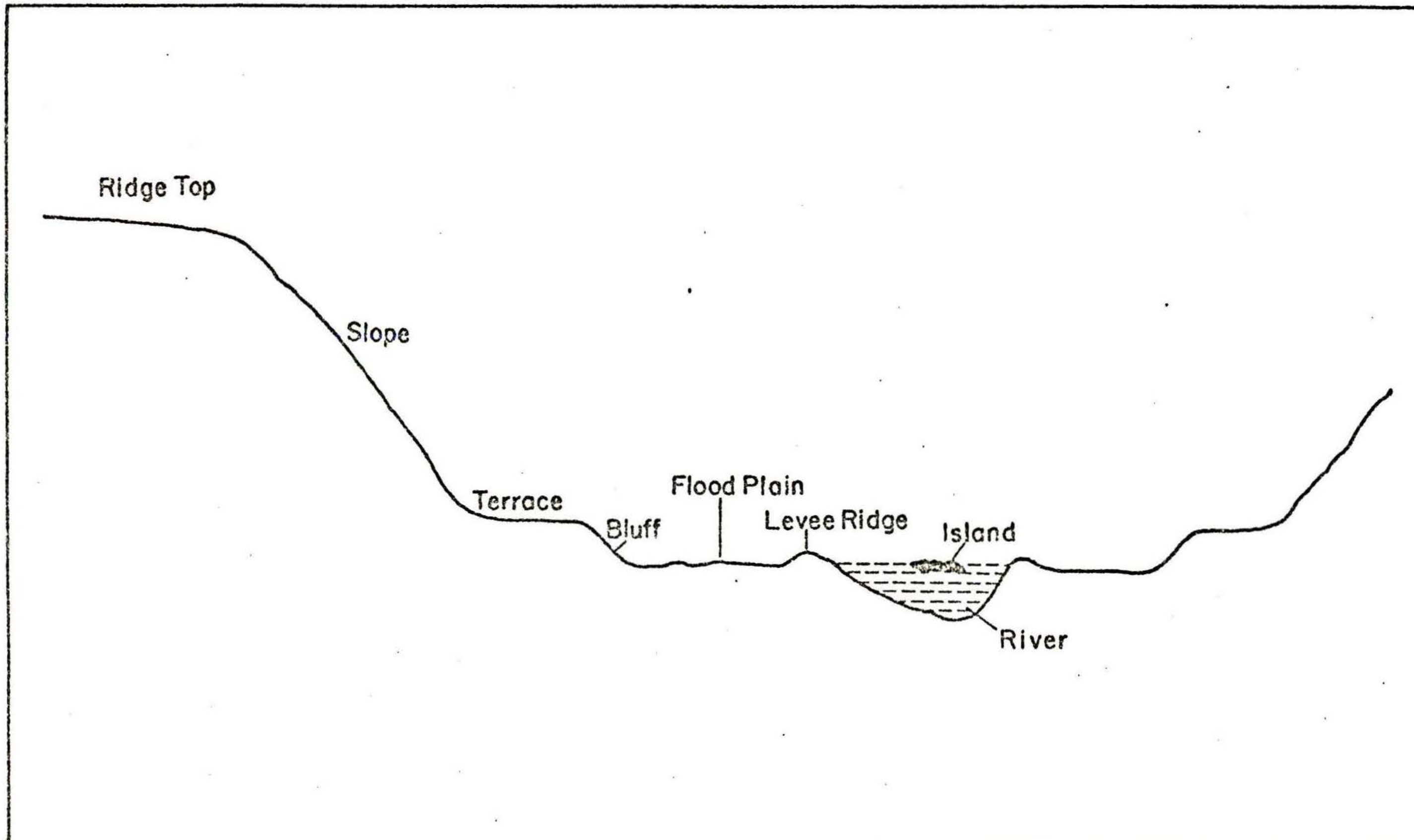

Fig. 7 Schematic profile of the landforms

To see if there was any patterned reference for locating sites of different site classes on particular landforms, a chi-square goodness of fit test was used. Table 30, the result of the computation, shows that a chi-square value of 8.38 with two degrees of freedom is significant with a probability less than the 0.02 level. This means that there is a preference of landform by site classes at the 98 percent level of statistical significance. The indications are that large sites tend to be located in the riverine landform categories while small sites are on upland landforms. Class I and II sites located in the riverine topography probably exploited available farming land along the river bottom and utilized the river not only as a source for food but also as a means of communication.

The chi-square statistic was also used to determine the association between landforms and artifact collections. Table 31 and Table 32 indicate that there are significant statistical differences in the ceramic and lithic compositions of sites on the two different landforms.

The statistical analyses performed in this section so far indicate that sites are not randomly distributed on landforms. It is suggested here that sites are located selectively on a landform according to their functional and practical purposes so as to minimize effort while maximizing adaptive activities.

Table 29. Number of sites by landform.

Landform	Number of Sites
Ridge Top	73
Terrace	22
Flood Plain	28
Levee Ridge	2
Island	9
Slope	14
Bluff	1
Total	149

Table 30. Contingency table of the frequency: Site classes by landform.

Landform	Class I	Class II	Class III	Total
Upland	1 (5.13)	13 (13.12)	71 (65.60)	85
Riverine	8 (3.87)	10 (9.88)	46 (50.26)	64
Total	9	23	117	149

Numbers in the parenthesis are expected values
Chi-Square = 8.38 with 2 degrees of freedom
Significance = 0.0151

Table 31. Chi-square contingency table for ceramic by land-form

Pottery Type	Landform: Upland	Landform: Riverine	Total
Lamar Plain	3270 (3344.29)	3013 (2938.71)	6283
Lamar Bold Incised	536 (453.50)	316 (398.50)	852
Lamar Complicated Stamped	185 (193.22)	178 (169.78)	363
Total	3991	3507	7498

Numbers in the parenthesis are expected values

Chi-square=36.37 with 2 degrees of freedom

Significance=0.001

Table 32. Chi-square contingency table for lithic tool types by landforms

Tooltype	Upland	Riverine	Total
Projectile Point	104 (100.61)	187 (190.39)	291
Biface	42 (50.48)	104 (95.52)	146
Unifacial Sidescraper	25 (44.25)	103 (83.75)	128
Bifacial Sidescraper	51 (32.15)	42 (60.85)	93
Endscraper	28 (15.21)	16 (28.79)	44
Drill	1 (8.30)	23 (15.70)	24
Total	251	475	726

Numbers in the parenthesis are expected values

Chi-square=58.27 with 5 degrees of freedom

Significance=0.001

Sites and Water Resources. Water resources in the study area are not as critical as in a desert or arid area since the annual average rainfall is in excess of 1210 milimeters and is well distributed throughout the year. Drainage systems are spread over the entire area as discussed in Chapter III. Water resources were critical in influencing site location during prehistoric times. The Oconee River and its major tributaries provided sources of food such as fish and shellfish as well as a line of communication and transport during the Late Mississippian period. Water resources were also critical for crops planted early in the growing season.

Evidence from the field survey indicates that the prehistoric population in the area utilized shellfish as one of their major food resources. Ethnographic data, on the other hand, indicates that fishing was another important seasonal subsistence activity (Harper 1958; Swanton 1946). A large scale farming practice was probably carried out in the riverine landforms according to the early accounts (Adair 1930; Harper 1958; Swanton 1928a, 1928b, 1946). Early descriptions of aboriginal people indicate that the rivers were important means for communication (Harper 1958; Hawkins 1848; Swanton 1946). All of the above activities were related to the river or its tributaries, and these activity patterns were probably reflected in the location of sites.

It can then be assumed that sites tended to be located near the river or its tributaries so as to minimize walking distance from sites to water resources. In this section, an attempt is made to analyze the locational preferences of sites in terms of distance between sites and available water resources. For the purpose of the analysis, distance from each site to the nearest drainage was measured using USGS Quadrangle maps. Another important consideration in this analysis is the rank of each drainage in terms of its size.

The rank ordering of a drainage network in this analysis employs Strahler's system (Strahler 1964). This numerical system of stream channel typology is useful for quantifying stream networks within a basin for the purpose of testing the importance of the effects of particular types of streams on the distribution of prehistoric settlements. Recent archaeological literature also suggests the use of Strahler's stream ordering system for the locational analysis of archaeological data (Plog and Hill 1971; SARG 1974; Weide and Weide 1973). There is, however, a criticism of Strahler's system for its inaccuracy of categorization or estimation of the amounts of streamflow discharge per unit of time (Graybill 1975). This numerical system has been further criticized on the actual utility or applicability: "Given the errors associated with stream length representations on relatively fine scale maps, it can be suggested that the use of maps with scales of ca. 1:100,000 or greater for ordering purposes would be of dubious utility for all but the most general of purposes" (Graybill 1975:3).

This problem can be solved by using a fine scale map, even though there are errors associated with stream length representations on fine scale maps. The present study uses USGS Quadrangle maps (7.5 minute topographic series; 1:24,000 in scale). This series of maps is based on aerial photographs taken in 1971 and field checked in 1972.

For the present study, the procedure of the Strahler system of drainage ordering in the study area is defined as follows: Strating at the beginning of the drainage, each channel is given a rank of 1. Rank 1 channels usually represent the dotted line or thin short line channels on the 7 1/2' series map. Any stream that is formed by the confluence of two or more tank 1 channels is labeled rank 2. Any stream formed by the confluence of two or more rank 2 channels is labeled rank 3. Rank 3 channels usually represent major tributaries in the area. The Appalachee and Oconee rivers are labeled rank 4. The Oconee River, the major stream in the study area, formed by the confluence of the Appalachee and Oconee rivers is labeled rank 5 (Fig. 8). The rank of each nearest drainage to a site can be found in Appendix I.

Table 33 shows the number of sites by each drainage rank. An overall view of settlement relationship to streams indicates that 61 percent, or 91 sites, are located near drainages of rank 3, 4 and 5. These are the major drainages in the area. There are 26.2 percent, or 39 sites, located near the intermediate, or rank 2, drainages.

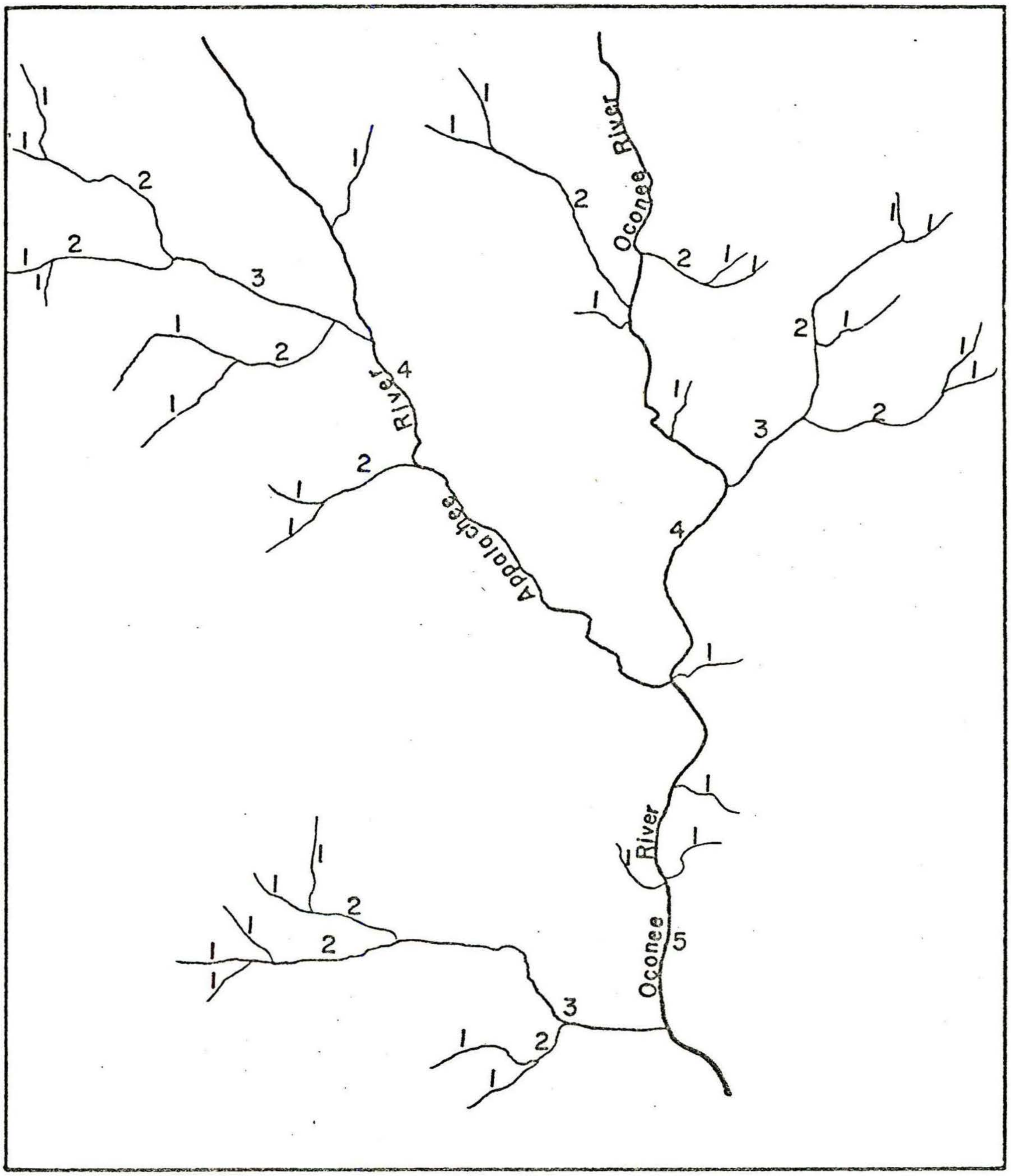

Fig. 8. The numerical system of stream order

Table 33. Number of sites by drainage ranks

Rank of Drainage	No. of Sites	Percentage
1	39	26.2
2	19	12.8
3	16	10.7
4	26	17.4
5	49	32.9
Total	149	100.0

Distance between sites and drainages ranges from several meters to several thousand meters. As Table 34 indicates, 75.2 percent, or 112 sites, are located within 300 meters of a drainage. There are 21.5 percent or 32 sites located between 300 meters and 600 meters of a drainage, while only 3.3 percent or 5 sites are located greater than 600 meters from a drainage. In other words, 96.7 percent of total sites are located within 600 meters of a drainage. The average distance between the sites and a drainage is 195.5 meters. This implies that the majority of sites are located near drainages so as to utilize their resources. It can be concluded, therefore, that Late Mississippian sites in the study area are located near water resources so that inhabitants of each site could make use of the nearest drainage in the various activities of their everyday lives without confronting any difficulties.

It was observed during the sruvey that large sites tend to be located near the major drainages. This locational preference was quantified in order to detect any significant association between site classes and drainage ranks. The measure

Table 34. Number of sites by drainage rank and distance interval

Distance to Drainage (m)	Drainage Rank					No. of Sites	
	I	II	III	IV	V	Total	%
0 - 300	30	11	12	18	41	112	75.2
301 - 600	8	7	4	7	6	32	21.5
601 or over	1	1	0	1	2	5	3.3
Total	39	19	16	26	49	149	100.00

The measure utilized in this computation was the contingency coefficient C. This method is discussed earlier in this chapter.

Table 35 shows that the association between site classes and drainage ranks is C = 0.38. The chi-square value of 24.723 with 8 degrees of freedom shows significance with a probability less than 0.0017 level. This means that major sites tended to be located near the major drainage at the 98.3 percent level of statistical significance. Even though one of the observed cell values was zero and several other observed cell values were low, the two variables are highly correlated. The consequence of this analysis indicates that large sites were purposefully located near the major drainage during the Late Mississippian period, i.e., major activity centers of the Late Mississippian settlement system were located along the Oconee River or its major tributaries.

It seems that an additional explanation is required concerming the different class site distributions along the different drainage ranks. Class I sites are located along the drainages of rank 3, 4 and 5. These drainages include the Oconee and Appalachee rivers, and other major creeks such as Richland, Sugar and Big Indian. These drainage systems may have served as a source of food resources as well as a route for communication. Class III sites along the drainages of rank 1 and 2 were located on ridge tops and probably required fewer water resources. These include such sites as

Table 35. Contingency table of the frequency: Site classes by drainage ranks

Rank of Drainage	Site Class			Total
	Class I	Class II	Class III	
1	1 (2.36)	3 (6.02)	35 (30.62)	39
2	0 (1.15)	7 (2.93)	12 (14.92)	19
3	2 (0.97)	6 (2.47)	8 (12.56)	16
4	4 (1.57)	3 (4.01)	19 (20.42)	26
5	2 (2.96)	4 (7.56)	43 (38.48)	49
Total	9	23	117	149

Numbers in the parenthesis are expected values.
Chi-square = 24.723 with 8 degrees of freedom.
Significance = 0.0017.
Contingency Coefficient = 0.38

hunting, collecting and farming camps.

So far the evidence collected during the archaeological surveys in the study area indicates that Late Mississippian sites are located near water resources and that the major sites are located near the major drainages.

Spatial Distribution of Sites

The basic assumption of this study is that settlements are located in such a way as to minimize the effort expended in dealing with the natural and socio-cultural environments. This is based on the concept of "the principle of least effort" (Zipf 1949). In a previous section, an attempt was made to examine the relationship of sites to a set of quantified natural environmental variables. In this section an attempt will be made to examine the relationship between sites during the Late Mississippian period with particular emphasis on the spatial distribution of sites. It is assumed that the spatial organization of a prehistoric society reflects an attempt by the prehistoric population to use space efficiently in order to accomplish their tasks with least effort. To detect such patterning the following approaches are applied to the data: (1) average nearest-neighbor distance analysis to test the relationship between site classes and the average nearest-neighbor distance; and (2) cluster analysis to examine the agglomeration of sites.

Average Nearest-Neighbor Distance Analysis. Man and his society try to organize space efficiently in order to locate activities and use land in an efficient way. This might be expressed in terms of the "mini-max" concept: first, maximizing the net utility of areas and places at minimum input, and secondly, maximizing the spatial interrelations at minimum cost. If there is such an underlying concept in prehistoric settlement patterning there should be an inverse relationship between the number of sites of each class and the average nearest-neighbor distance between sites of each class. This phenomenon can be hypothesized as: large sites are spaced further apart than smaller sites and the number of sites in each class is inversely proportional to the distance between those sites.

For this analysis, sites were classified into three classes by the cluster analysis discussed in the previous section. This classification seems to correspond to site size: Class I sites being the largest sites, Class II sites the next largest sites and Class III sites the smallest sites. Class I sites should then be spaced further apart than Class II sites, and Class II sites should be spaced further apart than Class III sites. If the "mini-max" behavior pattern is expressed in the Late Mississippian settlement system, the above relationship would be predicted to occur in these Late Mississippian sites.

The following analysis was used to test the above hypothesis. All sites were located on USGS Quadrangle maps (7.5 minute series) and the location of each site was recorded using the Universal Transverse Mercator grid system (Appendix I). The linear distance between each Class I site and its nearest Class I site was calculated. Similarily, the linear distance from each Class II site to its closest Class II site and the linear distance between Class III nearest neighbor sites were calculated.

The mean of the series of linear distances for each class was obtained. Table 36 presents the resultant computations for the average nearest-neighbor distances for each class.

Table 36. Average nearest-neighbor distance

Class	No. of Sites	Average Distance (m)
I	9	3926
II	23	1926
III	117	820

The Spearman's rank-order correlation coefficient (r_s) was performed to detect the existence of an inverse relationship. I have used the statistic

$$r_s = 1 - \frac{6\ di^2}{N^3 - N}$$

where di is the raw difference between rankings of numbers of sites and average distances, and N is the number of classes. Spearman's r_s ranges from + 1.0 for a perfect positive correlation to -1.0 for absolute negative correlation. A Spearman's rank-order correlation coefficient of -1.0 significant at the 0.05 level was obtained from the following computation;

$$r_s = 1 - \frac{6(8)}{3^3 - 3} = -1.0$$

Thus, the hypothesis that there is a significant inverse relationship between the number of sites in each class and the average nearest-neighbor distance between sites within each class is supported. The table also indicates the presence of the predicted inverse relationship between the site classes and the average nearest-neighbor distances for each site class.

As a consequence, this analysis shows that the Late Mississippian sites in the study area seem to reflect an efficient settlement distribution designed to cope with both the socio-cultural and natural environments. In other words, major center, i.e., Class I sites, are further apart than sites of other classes and this patterning of distribution seems to be more advantageous because benefits would be evenly distributed between major centers and conflict between major centers would be reduced if not completely eliminated.

This inverse relationship of site class and the average nearest-neighbor distance indicates that the Late Mississippian population in the study area was efficiently adapted to their environment and, therefore, it may be said that sites are located on landforms in such a way as to combine maximum interests with a minimum of effort.

Cluster Analysis. It is expected that economic and social activities of the Late Mississippian population could get maximum benefits through agglomeration of sites. If sites were located in an agglomerated fashion the total distance that the prehistoric inhabitants of an area would need to travel would be greatly reduced, and joint acitivites or common goals of clustered homesteads, such as defense, could be achieved in the most efficient way.

For the present study, an attempt was made to investigate the spatial distribution of sites in order to detect the agglomeration of these sites. The method employed in this analysis was cluster analysis using map coordinates as variables. These coordinates express the exact location of sites and are measured in meters using the Universal Transverse Mercator system.

The computational method used for this analysis is Ward's method (Anderberg 1973). This particular method has already been discussed earlier in this chapter. The coordinates of each site were utilized as variables for this analysis. This cluster analysis provides an objective grouping of sites in terms of their location.

Figure 9 presents a dendrogram of the results of the cluster analysis. An examination of this dendrogram indicates that a 4 cluster solution appears best. The number of sites in each cluster are: cluster I, 22 sites, cluster II, 43 sites, cluster III, 34 sites, and cluster IV, 50 sites. This suggests that the Late Mississippian sites in the study area are agglomerated into 4 clusters (Fig. 10). An examination of Figure 10 shows that sites are agglomerated along the river system and that there are spatial gaps between the clusters. These clusters of sites reflect an agglomeration possibly based on social, economic and geographic considerations. Not only does agglomeration of sites reduce the total distance travelled, satisfying a geographic goal, it also makes possible the satisfaction of socio-economic goals with least effort. The benefits of agglomerating individual sites into clusters are probably related to socio-economic and geographic efficiency. It can be said from this analysis that the agglomerations shown in Figure 10 reflect probable social and/or economic units operant during the Late Mississippian period.

If these four clusters are probable settlement units, there should also be an inverse relationship between the number of sites of each class and the average nearest-neighbor distance between sites of each class within each cluster. Examination of Table 37 indicates that such an inverse

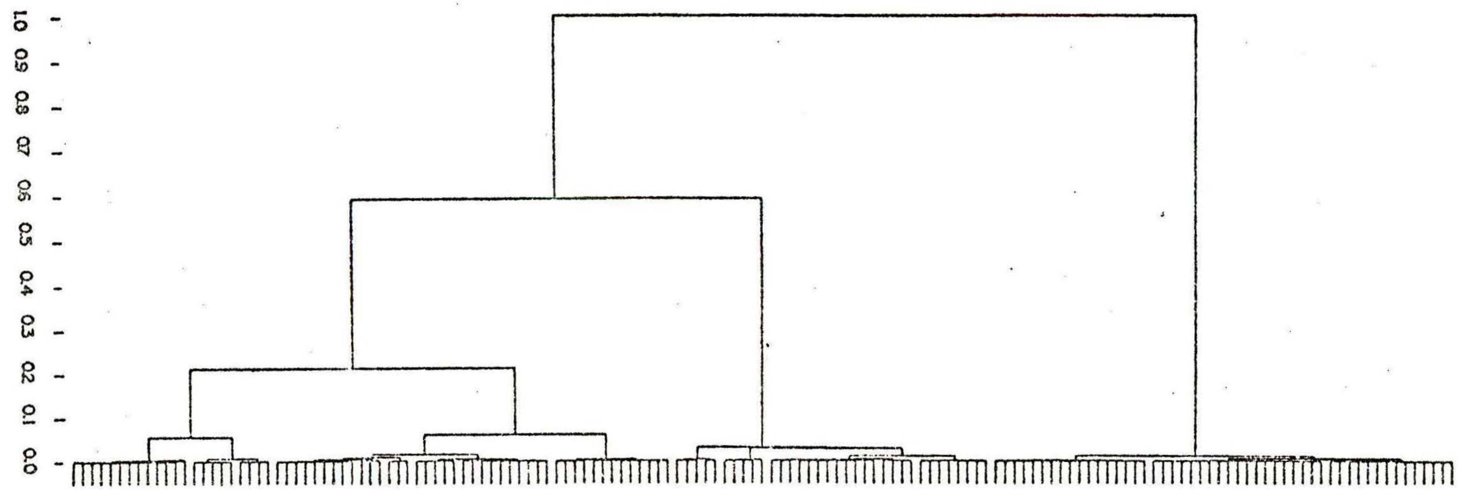

Fig. 9. Dendrogram showing clusters of locational distribution of sites

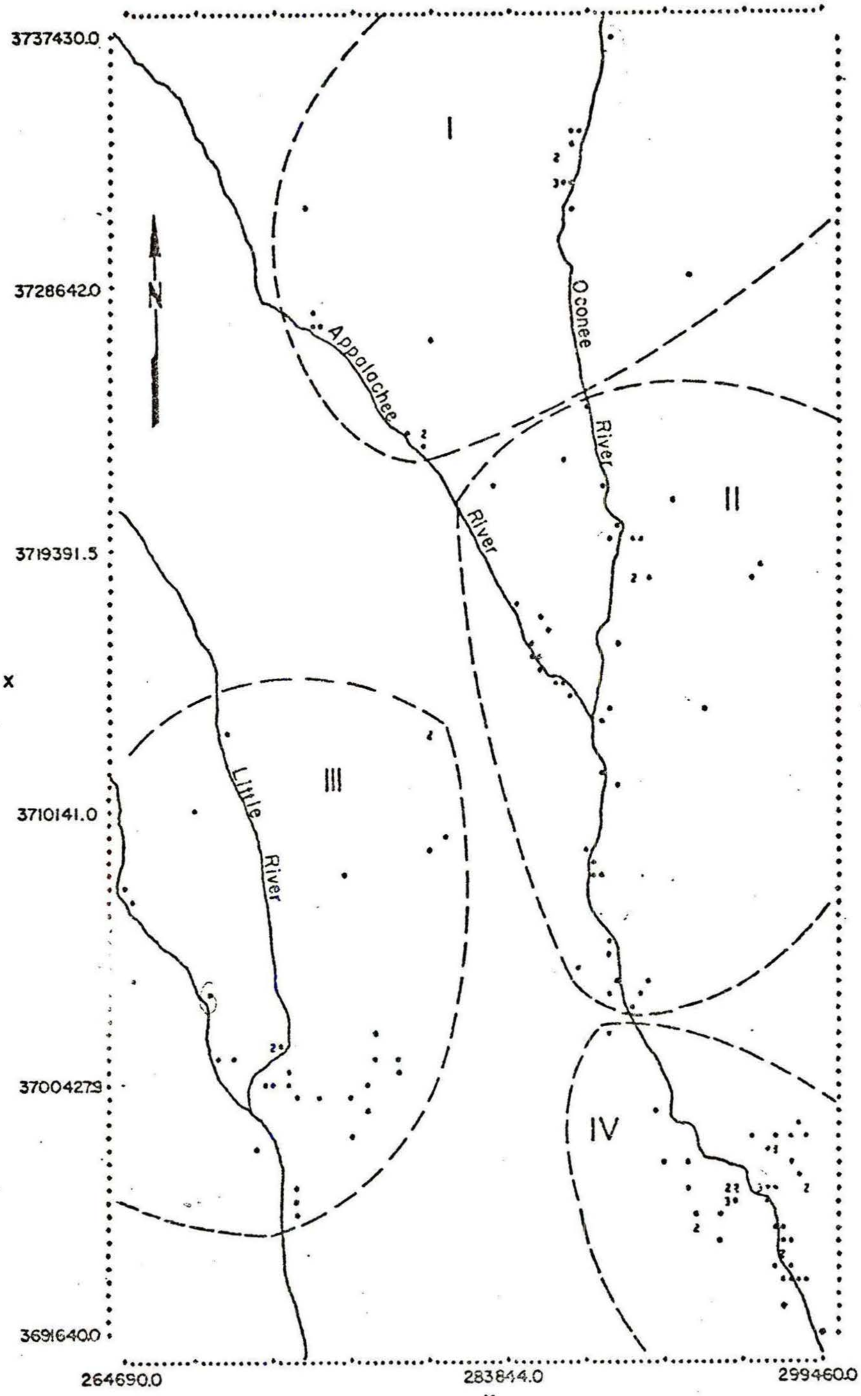

Fig. 10. Agglomeration of sites

Table 37. Average nearest-neighbor distance by site clusters

Site Class	Cluster I No. of Site	Cluster I Average Distance	Cluster II No. of Site	Cluster II Average Distance	Cluster III No. of Site	Cluster III Average Distance	Cluster IV No. of Site	Cluster IV Average Distance
I	-	-	-	-	-	-	-	-
	10	691	5	3162	4	3062	4	2533
III	10	633	34	1064	28	1199	45	431

Distances are in meters

relationship does exist between the number of sites and the average nearest-neighbor distance between sites within each class by clusters. Class I sites were excluded in the computation because the number of Class I sites in each cluster is so small that the results of the analysis might be meaningless. Although the present analysis implies that during the Late Mississippian period there could have been four autonomous settlement units operant in the study area, the results of the average nearest-neighbor distance and cluster analysis must be considered with some caution. As Figure 10 shows, both cluster I and cluster IV seem to represent only portions of total settlement units. Examination of Table 38 indicates that the average nearest-neighbor distances of cluster I and cluster IV are unusual and this is probably due to their being incomplete clusters. On the other hand, Cluster II and Cluster III based on the analysis may be considered as complete, discrete settlement units. Other problems involved in the present analysis are sampling error and lack of distinct physiographic boundaries.

It is evident from the result of the present analysis that arbitrary archaeological survey boundaries which do not coincide with cultural or natural boundaries influence the results of settlement pattern analysis. Settlement units near the margins of the study area may be truncated by the arbitrarily defined boundaries, while settlement units nearer the center of the study area have a higher probability of representing intact cultural and natural units.

Even though such problems exist, the results of the average nearest-neighbor distance and the cluster analysis provide some information on the patterning of the Late Mississippian settlement system in the area: (1) the number of sites in each class is inversely proportional to the distance between those sites; (2) the sites are agglomerated into four units which are considered to have acted as autonomous units on, at least, some socio-economic levels; (3) aspects of the adaptation of the area's of Late Mississippian population to their socio-cultural surroundings in terms of spatial organization, i.e., the sites tend to be located so as to maintain an equilibrium between sites and to maximize benefits with least effort is demonstrated.

In summary, site classes, the basic analytical units in this research, are grouped into the three classes according to site size and artifactual content through the use of a cluster analysis. The result of this cluster analysis suggests that a hierarchical arrangement of Lamar phase sites existed in the area. An examination of the ceramic and lithic variability seems to indicate that the differences in ceramics and lithics existing between site classes may be considered as reflections of the differences in activities and adaptive strategies for each site class.

An analysis of site location to its environmental variation shows that each level of the site hierarchy, i.e., each site class, is associated with a different set of quantified environmental variables. This can be summed up in terms of locational preferences: most sites tend to be located on soil types favorable for farming; large sites tend to be located on the riverine landforms and small sites (Class III sites) on upland landforms; most sites tend to be located near drainages, with larger sites (Class I sites) located along the major drainages.

The optimization of site location is also evidenced by the spatial organization of Late Mississippian settlements in that sites are distributed so as to use space efficiently. It appears that the distribution of Late Mississippian sites is not random. Sites were located with regard to particular sets of resources (man-land) and relationships between sites (man-man) so as to adapt to the socio-cultural and natural environments. Thus, Late Mississippian sites in the area are located according to the needs of survival within the concept of maximizing profits and minimizing effort.

CHAPTER VII

CONCLUSION

The first section of this chapter presents a brief summary of a Late Mississippian settlement pattern analysis. The succeeding section provides a discussion of the results of the analysis and includes a comparison of the resultant prehistoric settlement phenomena in the study area with other studies related to Mississippian settlement. This comparison is extended to include ethnographic descriptions. The final section of this chapter provides a conclusion, an inference statement and suggestions for future research on Mississippian settlement pattern study.

Summary

This study was designed to investigate the Late Mississippian settlement pattern in terms of the adaptation of the prehistoric population in the study area to their natural and socio-cultural environments.

At the initial stage of the analysis a three level site hierarchy was developed based on archaeological data. Each hierarchical level was used throughout the study as an analytical unit. Class I sites, the largest sites are considered to be the foci of many, if not most, of the socio-cultural activities of the area. The Class II sites are best described as year-round settlements. The Class III sites are seen as small, temporary resource exploitation camps. Examination of the ceramic and lithic variability between site classes indicates that there are patterned differences in ceramic and lithic compositions across the site classes. These differences are considered reflections of differences in the various activities and adaptive stratigies for each site class. It is suggested that artifactual content and site size are important indicators of the nature of socio-cultural activities occurring at sites as well as a site's position in the overall regional settlement system.

The present analysis demonstrates that certain generalities exist in terms of site location in relation to sets of quantified environmental variables: most sites were located on soil types favorable for farming; sites tended to be located near drainages; and large sites tended to be located on the riverine landforms and along the major drainages.

The analysis indicates that variability in site location does exist and that this variability is related to a site's position in the proposed hierarchy. It also appears that the site classes do demonstrate variability in relation to certain environmental variables and it has been suggested That this variation reflects the function of the site in the total settlement pattern.

An examination of the spatial relationships between sites revealed several patterns supportive of the proposed hierarchical arrangement: (1) large sites were spaced further apart than smaller sites and the number of sites in each class is inversely proportional to the distance between those sites; (2) sites tended to be agglomerated; and (3) sites tended to be located so as to maintain locational equilibrium.

The analysis of the spatial distribution of sites also suggested that in the research area, four possible autonomous socio-economic systems might have been operant during the Late Mississippian period.

Discussion

This section provides a comparison between the results of this analysis and that of other studies related to Mississippian settlement. Ethnographic accounts of early historic settlements are also included. In Chapter V, three levels of settlements were defined according to the early ethnographic descriptions. These are town, village and temporary camp. Of these, towns contained mounds and/or public buildings where the important persons lived. Villages were sedentary permanent farming settlements, and temporary camps were considered to be specialized resource exploitation stations.

These three levels of settlement observed by the early explorers seem to correspond to the proposed three level hierarchy of Late Mississippian sites: Class I sites would be equivalent to towns, Class II to villages and Class III to temporary camps.

It can then be considered that the Class I sites represent the socio-economic and political centers for their surrounding area. The Class II sites are considered to be sedentary farming villages, probably consisting of several to more than 20 houses. These sites were closely related to Class I sites in terms of socio-economic and political subordination. Class III sites are seen as temporary camps. Small groups consisting of a small number of people, probably a family or certain members from each family, dispersed from Class I and II sites to Class III sites for resource exploitation. The types of settlement described in the ethnographic accounts conform to the Late Mississippian settlement system as demonstrated by the archaeological data from the study area.

Recent studies on Mississippian settlement systems analysis should provide comparative insight for the present research. These studies include Peebles (1971), Winters (1967) and Sears (1968). Peebles' data on the Moundville settlement pattern involves three levels of settlement: a regional center, secondary ceremonial centers and villages. It would seem that the Class I sites of the present analysis correspond to Peebles' secondary ceremonial centers and Class II sites to this villages.

Sears has presented a three level hierarchy of sites for the Southeast in general. These are: major ceremonial structures, minor ceremonial structures and dwellings. The three level hierarchy of sites established by Sears is identical to that of Peebles. It appears that Class I sites in Piedmont Georgia correspond to Sears' minor ceremonial structures and Class II sites to dwellings.

Winters (1967) proposes that the Mississippian settlement system along the Wabash River involves a central political and religious center with platform mounds, dispersed farmsteads and temporary camps for resource exploitation. The settlement system demonstrated by Winters is the most similar of the three studies to the hierarchy of sites established for Late Mississippian settlement in Piedmont Georgia. This three level hierarchy of settlement represents the patternings most often encountered in early historic accounts. There is no evidence that regional centers such as those at Moundville and Etowah existed in the study area.

This study presents a comparison of the settlement system which offers a clear illustration of the hierarchical settlement system operant in Piedmont Georgia during the Late Mississippian period.

Conclusion

The present settlement analysis has focused on the Late Mississippian period, i.e., the Lamar phase. Previous research on this phase though abundant has been limited in scope to ceramic analysis. The approach used in this study is different from previous ones in that it has been directed at analyzing the Lamar phase settlement pattern within an ecological frame of reference.

The results of this study suggest that Lamar phase sites were located with regard to particular sets of resources. This study also suggests that the spatial organization of the Late Mississippian society in the research area was the outcome of the prehistoric population's attempt to use space efficiently in order to accomplish their adaptative tasks with least effort. In general, there tends to be a selection for site location where the potential for resource utilization and spatial organization were optimized. One ethnographic account tends to support this trend of site location in terms of "least labor" (Jones 1883:6).

The optimization of site location is probably true in order for all human groups to survive. Survival through struggle--struggle not only between human beings but also with the natural surroundings--requires such an optimization of location of sites.

The patterns of settlement suggested by this study have been used in explaining why sites were located where they were and to develop a stochastic model for the location of sites. From the regularities and patterns in settlement that are discussed, it may be seen that settlement reflects an adjustment to patterns of activities carried out at particular environmental loci. It is understood among modern social scientists that there is a recognized and predictable pattern in some forms of modern human behavior. It can also be said from this analysis that there was a predictable pattern of prehistoric behavior which was reflected in the settlement pattern.

Inference. It is possible to abstract the Late Mississippian subsistence pattern in terms of the annual ecological cycle of exploitation based on the available environmental and ethnographic information presented in Chapter V. Figure 11 presents the proposed model of the annual ecological cycle which complements the analysis of settlement pattern presented in Chapter VI. This model illustrates the interrelationship between farming and the seasonal exploitation of natural resources in the subsistence cycle. The subsistence cycle, combined with its interrelationships with other segments of the cultural system, served to maintain and perpetuate the population of the Late Mississippian period.

Whether the intensive agricultural practices and abundant natural resources led to population growth, evidenced by large sites and an increased number of sites when compared to the previous Etowah phase, or whether increasing population pressures led to cultivation of new land is a problem that cannot be solved using the present data. It can be stated with reasonable confidence, using the present study and ethnographic information, that throughout the study area the Late Mississippian population tended to be distributed along the landscape according to the available energy sources.

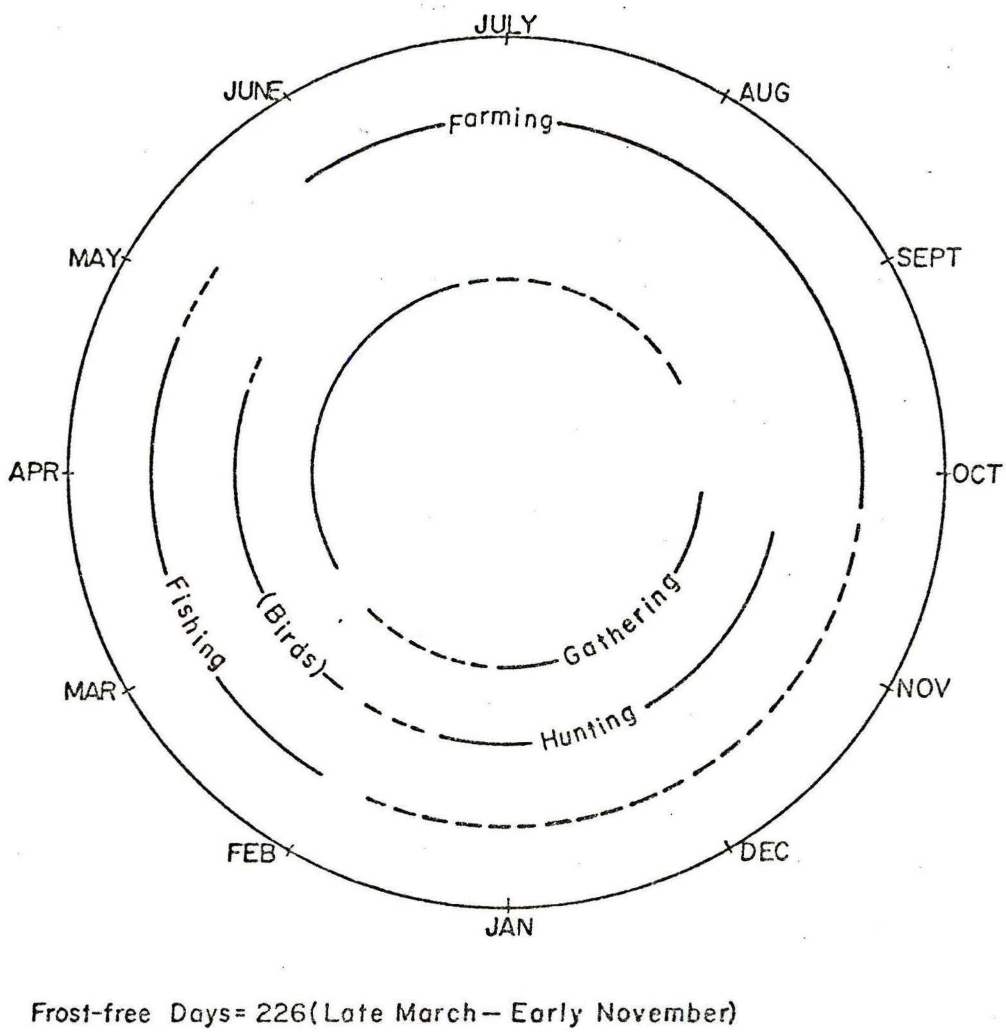

Fig. 11. Hypothetical scheduling of subsistence activity

The combined use of cluster analysis and the average nearest-neighbor distance analysis indicates that four possible socio-economic systems existed in the area. Each system is probably a self-supported and discrete unit in terms of socio-economic level. In addition to Class I sites, each system contains Class II and III sites in a socio-economic sphere. This whole system of the Late Mississippian period in Piedmont Georgia may have been only a portion of a higher socio-political and religious unit. It so, then these four systems are probably areal centers subordinate to a higher regional center.

Suggestions for Future Research. The present research was conducted utilizing both archaeological and natural environmental data, but other types of data were not considered by this study. This additional data includes the faunal and floral remains from sites which could be related to the seasonality of site occupation. The proposed hierarchy of sites and the four discrete settlement systems are tentative. Further ceramic and lithic artifact analysis may provide conclusive evidence for hierarchical and functional differences between sites of the same and different classes. It is necessary to conduct test excavations at several sites of each class of the proposed hierarchy in order to obtain data necessary in understanding the function of each class of sites as a part of an adaptive unit within the settlement system.

The sudden increase in the number of the Lamar phase sites compared to the number of sites of the preceeding Etowah phase is another problem to be considered in future research. This problem, together with the suggestions outlined above, requires a great amount of time, but it is necessary in order to investigate Mississippian cultural adaptation and its change through time in Piedmont Georgia. Toward that prospect, the results of the present study provide an initial effort toward the long-awaited but necessary pursuit of the problem of the Mississippian adaptive system.

APPENDIX I

ENVIRONMENTAL DATA

Appendix I presents various site unit and environmental data. The following pages present the code used for this data. The categories presented below are fully discussed in various sections of the text.

Column A:

This column lists the site designations as recorded in the county files at the Laboratory of Archaeology, Department of Anthropology, the University of Georgia.

Column B:

The numbers in this column refer to the nature of the sites.

1 - Mound

2 - Shell midden

3 - Rock shelter

4 - Surface

5 - Buried

6 - Surface and buried

Column C:

The numbers in this column refer to the topography of site locations.

1 - Ridge top

2 - Terrace

3 - Flood plain

4 - Levee ridge

5 - Island

6 - Slope

Column E:

This column presents the shortest vertical distance from a site to the nearest drainage. Distances are given in meters.

Column F:

This column presents the areal size of sites in m^2.

Column G:

The numbers in this column refer to the soil types upon which sites are located. Discussion of these soil types are presented in Chapters III and VI.

1 - Fine Sandy Loam

2 - Silty or Sandy Clay Loam

3 - Coarse Sandy Loam

Column H:

The numbers (1-6) in this column refer to the present condition of sites.

Column I:

The numbers in this column indicate site class membership. Discussion of these site classes is presented in Chapter VI.

1 - Class I

2 - Class II

3 - Class III

Column J:

This column presents elevation of site locations. Elevations are given in meters.

Column K:

This column presents the Universal Transverse Mercator north reading for each site.

Column L:

This column presents the Universal Transverse Mercator east reading for each site.

A	B	C	D	E	F	G	H	I	J	K	L
GE 4	1	3	4	70	42000	2	4	1	139	3737430	288730
GE 5	1	3	4	150	25900	2	1	1	135	3720820	288430
GE 10	1	3	4	100	16000	2	1	2	133	3720210	289200
GE 33	2	2	5	50	2250	2	1	3	142	3707930	286310
GE 34	6	3	5	30	400	2	1	3	130	3707520	283400
GE 35	4	2	5	200	6000	1	4	3	135	3693790	293360
GE 52	4	2	4	160	25200	1	1	1	142	3726520	279930
GE 57	4	1	4	310	2750	1	1	3	154	3721930	288570
GE 59	6	2	4	240	4500	1	2	3	139	3722790	285740
GE 62	5	3	4	320	3500	2	4	3	133	3714000	288840
GE 63	4	1	1	150	1350	2	3	3	163	3715310	290510
GE 64	4	1	4	280	3600	1	3	3	160	3715450	290210
GE 65	4	1	4	120	2100	1	3	3	154	3714590	290200
GE 67	4	2	2	90	12500	1	2	2	139	3732570	286380
GE 69	4	1	1	70	1500	2	1	3	142	3721550	292070
GE 70	4	1	2	60	5400	2	5	2	167	3715540	293450
GE 71	4	3	4	140	12500	1	2	2	139	3732450	286720
GE 72	4	3	4	30	9100	2	2	2	133	3732610	286790
GE 74	4	2	4	480	1400	1	2	3	133	3733930	287190
GE 77	6	1	4	330	6000	1	2	3	146	3733620	286550
GE 80	4	3	4	90	4500	1	2	3	133	3731280	285950
GE 83	4	3	1	30	12600	1	2	3	142	3732540	286100
GE 84	4	3	1	70	11200	1	2	3	145	3732400	285040
GE 85	4	2	4	720	1500	2	5	3	142	3734400	285910
GE 86	4	1	1	200	4000	2	4	3	145	3695740	298670
GE 87	4	1	1	40	50	2	4	3	142	3696530	295570
GE 89	4	1	3	250	28000	2	1	1	142	3697040	296150
GE 91	4	1	2	360	12500	1	2	2	146	3733450	286310
GE 92	4	3	1	360	13000	2	2	2	133	3733070	286190
GE 93	4	1	2	280	3400	3	2	2	157	3724120	293020
GE 95	4	1	1	40	2400	1	3	3	142	3711140	289450
GE 96	4	3	2	30	9900	2	2	2	145	3713790	293540
GE 99	4	1	1	600	4400	2	3	3	154	3694090	298250
GE100	4	1	1	260	1350	2	3	3	145	3698590	298040
GE102	4	1	1	230	3000	2	5	3	135	3697680	297930
GE103	4	1	3	360	300	2	5	3	145	3698670	297240
GE104	4	1	3	240	4900	2	5	3	148	3695260	297310
GE105	4	1	3	140	700	2	5	3	136	3698020	297140
GE106	4	6	3	120	210	2	5	3	123	3696040	297020
GE109	4	2	5	550	750	1	5	3	136	3705450	286950
GE112	4	1	1	430	2100	2	3	3	154	3696790	293550
GE115	2	7	2	30	15	1	1	3	160	3718330	296140
GE117	2	6	5	90	20	2	4	3	123	3696500	294330
GE118	4	1	5	30	25	2	4	3	117	3696520	294810
GE120	4	3	1	20	600	2	3	3	176	3721650	283160
GE121	6	3	4	45	1200	2	1	3	133	3724600	287750
GE122	4	1	4	500	1500	2	1	3	157	3717250	285450
GE124	4	2	4	300	3000	1	2	3	139	3716600	285540
GE126	2	1	5	550	400	2	4	3	154	3704000	290540
GE131	4	1	5	70	3300	2	3	3	130	3693360	296550

A	B	C	D	E	F	G	H	I	J	K	L
GE139	4	1	4	100	2000	2	2	3	167	3714070	290040
GE147	5	4	5	10	50	1	3	3	120	3699430	293230
GE148	4	1	5	500	2000	2	3	3	138	3693500	297070
GE153	2	5	5	100	2500	2	4	3	117	3695400	294540
GE154	5	2	5	50	30	1	3	3	117	3695090	295130
GE155	2	2	5	15	20	2	3	3	117	3696450	294930
GE157	1	5	5	80	3348	3	5	3	114	3674910	297360
GE159	4	5	5	130	3500	3	3	3	125	3690210	297500
GE160	4	5	5	130	1500	3	3	3	117	3695040	297590
GE162	4	5	5	70	15000	1	5	2	110	3693720	297950
GE163	2	1	5	160	30	1	4	3	142	3703490	290430
GE164	4	1	5	120	4000	1	3	3	139	3703690	290240
GE167	4	2	5	120	1000	1	3	3	133	3704910	289910
GE169	4	1	3	160	2400	2	4	3	148	3693600	296030
GE171	4	5	5	70	5400	2	3	2	130	3695240	296070
GE175	2	3	5	30	300	1	4	3	117	3695400	295720
GE177	2	2	5	40	500	1	4	3	117	3695050	290740
GE180	6	4	5	40	15000	2	3	2	133	3711450	288430
GE181	4	2	1	10	3500	2	3	3	136	3714590	290520
GE186	5	3	1	10	1900	2	1	3	155	3715950	289400
GE190	4	5	5	20	1370	1	3	3	107	3693250	295250
MG 28	5	3	5	30	30000	1	1	1	133	3712300	286300
MG 43	4	3	4	150	1600	2	1	3	133	3715570	285430
MG 44	4	1	4	120	300	2	1	3	135	3715530	285190
MG 46	4	1	3	100	22000	2	4	1	137	3704330	265190
MG 47	4	1	4	10	3500	2	3	3	136	3717740	264120
MG 52	4	1	2	160	11200	2	5	2	165	3712790	259590
MG 53	4	2	2	460	3500	2	1	3	157	3712720	280070
MG 54	4	1	1	260	1800	2	1	3	179	3712720	280070
MG 56	4	1	1	240	3500	2	5	3	154	3715190	285520
MG 58	4	2	4	40	2400	2	3	3	150	3714910	285190
MG 59	4	5	3	240	1500	2	3	3	145	3723530	279520
MG 60	4	1	3	330	5600	2	3	3	151	3723510	279460
MG 61	4	6	3	260	6000	2	3	2	146	3723400	279330
MG 62	5	6	3	340	11000	2	5	2	148	3723430	276930
MG 63	4	1	1	330	5000	2	2	3	167	3709000	260350
MG 69	4	1	3	80	13000	2	2	2	154	3727240	274430
MG 71	4	1	3	120	12100	2	2	2	154	3727550	273930
MG 72	4	1	3	130	15600	2	2	2	154	3727450	274090
MG 73	6	2	4	70	28500	1	2	1	136	3714570	286690
MG 74	4	1	1	120	1200	2	2	3	197	3731540	273520
MG 77	4	1	2	130	5500	2	2	3	173	3707600	275620
MG 81	4	1	2	210	7000	2	2	2	176	3705600	279800
MG 84	4	3	1	10	1200	2	2	3	160	3707070	265140
MG 85	4	1	1	250	4600	2	5	3	176	3707330	264690
MG 86	4	1	1	300	5100	2	2	3	175	3703600	265910
MG 88	4	1	2	430	6000	2	2	3	179	3710510	268550
MG 89	4	3	5	70	27000	1	1	1	136	3705660	287930
MG 91	4	2	5	190	6400	1	2	2	133	3708150	253144
MG 94	4	3	4	90	3375	1	2	3	139	3714450	285610

A	B	C	D	E	F	G	H	I	J	K	L
MG 08	4	1	4	200	3400	2	1	3	151	3710140	295040
PM115	4	1	5	700	2400	2	2	3	154	3702510	295530
PM116	4	1	5	120	2700	2	2	3	136	3699520	291450
PM117	4	1	5	520	6000	2	3	3	143	3697450	292910
PM119	4	2	5	240	11050	2	3	2	130	3696170	293020
PM122	4	1	5	450	5200	1	3	3	154	3693930	297190
PM125	4	6	5	300	2800	1	5	3	145	3694260	297400
PM126	4	5	5	200	4500	3	3	3	136	3694210	297400
PM130	4	1	5	170	3000	3	2	3	130	3695230	297720
PM131	4	6	5	130	3500	3	3	3	123	3695240	297070
PM133	4	1	2	140	525	2	6	3	150	3694520	275950
PM137	4	1	1	280	14400	2	4	2	191	3701330	275550
PM140	4	1	1	240	1800	3	3	3	154	3692400	297500
PM141	4	3	2	80	152	3	1	3	136	3704500	237550
PM144	4	1	1	250	450	1	2	3	186	3701510	277240
PM146	4	1	1	240	3000	1	2	3	155	3702430	277250
PM148	4	1	1	210	4400	2	2	3	191	3700210	275740
PM153	4	1	1	210	23400	2	4	1	185	3700510	273170
PM155	4	6	1	80	1500	1	5	3	154	3696430	275540
PM158	4	1	1	120	2400	2	5	3	173	3700190	275210
PM160	4	5	1	300	4500	2	3	3	167	3700140	274640
PM161	4	1	1	250	5400	2	2	3	182	3700040	273460
PM162	4	1	1	200	4900	2	5	3	152	3700670	272750
PM163	4	1	1	160	3400	2	5	3	182	3700520	272740
PM164	4	1	1	500	2000	2	2	3	185	3701580	272120
PM165	4	1	1	260	2000	2	2	3	165	3701720	272350
PM166	4	1	1	400	2000	2	2	3	185	3701560	272250
PM172	4	1	1	190	2250	1	5	3	160	3696190	271190
PM179	4	1	2	340	5500	2	2	3	150	3701240	269430
PM181	4	5	2	240	2400	2	5	3	154	3701310	270190
PM182	4	1	1	220	11200	2	5	2	173	3700600	272120
PM183	4	1	2	160	3600	2	1	3	163	3700430	271690
PM187	4	1	2	400	3850	2	3	3	160	3696500	273350
PM188	4	1	2	600	1200	2	5	3	157	3695560	273140
PM190	4	1	2	400	2400	2	4	3	146	3695910	273210
PM202	4	3	5	130	2500	1	5	3	123	3695190	293250
PM205	6	3	5	70	5500	2	5	3	120	3695070	294450
PM206	4	6	5	250	1500	2	5	3	130	3695640	294350
PM207	4	6	5	30	3750	1	5	3	123	3695090	294910
PM208	4	5	5	10	100	2	1	3	114	3695580	295190
PM209	6	5	5	5	2800	1	1	3	117	3696520	295310
PM211	3	3	5	70	32	2	6	3	117	3696640	296430
PM214	4	3	5	20	100	3	6	3	117	3696520	296500
PM215	4	3	5	100	2200	1	5	3	108	3691640	294460
PM220	2	2	5	75	200	2	6	3	123	3697480	291620
PM222	6	5	5	17	700	3	1	3	110	3694090	297540
PM226	4	2	5	800	4000	2	4	3	130	3703640	269020
PM228	4	2	5	500	5500	2	2	3	126	3703930	269160
PM237	5	5	5	10	100	1	1	3	114	3696744	296520

APPENDIX II

ARTIFACT COLLECTIONS

The following pages list artifact collections for each of the Late Mississippian sites used in this research. Artifact collections listed below comprise ceramics and lithics.

Items numberd 1 through 57 in the first column refer to artifact categories in accordance with the following list. It should be noted that not all artifact categories listed below have been utilized in analyses. Categories not used include 12 - 32, 43 and 54 - 57. They are included here to provide information on the total inventory of artifact collections from all sites.

Site designations are listed across the top of each page. Counts of artifacts are listed below site designations in accordance with the categories listed in column 1.

1 - Ocmulgee Field Incised

2 - Ocmulgee Brushed

3 - Lamar Cross Hatched

4 - Lamar Complicated Stamped

5 - Lamar Bold Incised

6 - Lamar Plain

7 - Lamar Burnished

8 - Lamar Line Blocked

9 - Lamar Corn Cob Marked

10 - Lamar Punctated

11 - Lamar Pinched

12 - Residual decorated

13 - Residual plain

14 - Disc

15 - Other ceramic object

16 - Savannah Complicated Stamped

17 - Etowah Complicated Stamped

18 - Etowah Red Film

19 - Etowah Plain

20 - Etowah Check Stamped

21 - Etowah Incised

22 - Woodstock Complicated Stamped

23 - Napier Complicated Stamped

24 - Swift Creek Complicated Stamped

25 - Cartersville Check Stamped

26 - Cartersville Linear Check Stamped

27 - Cartersville Simple Stamped

28 - Cartersville Plain

29 - Dunlap Fabric Marked

30 - Stallings Island Punctated

31 - Swift Creek Plain

32 - Fiber tempered

33 - Quartz debitage flake

34 - Quartz debitage core

	GE 4	GE 5	GE 10	GE 33	GE 34	GE 35	GE 52	GE 57	GE 59	GE 62	GE 63	GE 64
1	1	1	0	0	0	2	3	1	0	0	32	25
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	36	9	2	0	1	0	6	1	0	0	0	0
5	13	13	11	2	1	10	1	0	1	4	0	0
6	178	100	1	66	2	114	0	0	0	35	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	0	0	0	0	0
9	0	1	0	0	0	0	0	0	0	0	0	0
10	1	0	7	1	1	1	0	0	0	0	0	0
11	0	0	1	0	0	1	0	0	0	0	0	0
12	26	1	175	2	5	10	0	0	17	2	24	0
13	0	0	1120	14	0	0	0	21	132	0	299	164
14	2	0	3	0	0	0	0	0	0	0	0	0
15	0	2	1	0	0	0	91	0	0	1	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	10	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	1	0	0	0	0	0	0	0	0	0
24	0	0	7	0	0	0	0	0	11	0	0	0
25	0	0	4	0	0	0	0	0	0	1	0	0
26	0	0	5	0	0	0	0	0	0	0	0	0
27	0	0	11	0	0	0	0	0	3	0	7	0
28	0	0	5	0	0	0	0	0	0	0	0	0
29	0	0	1	0	0	0	0	0	0	0	0	0
30	0	0	1	0	0	0	0	0	0	0	0	0
31	0	0	5	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	457	30	74	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	170	13	10	1	0	0	0	0	0	0
36	4	0	5	6	0	0	1	0	0	0	1	1
37	0	4	0	1	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	7	0	0	0	0	0	4	0	0	0	0
40	0	0	17	0	0	0	0	0	0	0	0	10
41	0	0	13	1	1	0	0	0	0	0	1	0
42	14	6	11	4	1	0	1	2	3	0	2	3
43	25	2	0	0	0	0	0	0	0	0	0	0
44	0	0	171	0	5	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	9	2	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	7	0	0	0
48	0	0	0	0	0	0	0	0	1	0	0	0
49	0	0	2	0	0	0	0	0	0	0	0	0
50	0	0	2	0	0	0	0	0	0	0	0	0
51	0	0	2	0	0	0	0	0	0	0	0	2
52	1	0	4	0	0	0	0	0	0	0	0	0
53	0	0	1	0	0	0	0	0	1	0	0	4
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	3	0	0	0	0	0	0	1	0	0
56	0	0	19	0	0	0	0	0	0	0	0	0
57	0	0	9	0	0	0	0	0	4	0	0	0

	GE 65	GE 67	GE 69	GE 70	GE 71	GE 72	GE 74	GE 77	GE 80	GE 83	GE 84	GE 85
1	4	3	9	0	46	17	1	27	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	3	0	2	0	0	0	0	2	2	0	1
6	0	0	0	8	0	0	0	0	10	0	15	17
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	4	0	0	0	0	0
11	0	0	0	0	0	0	1	0	0	0	0	0
12	1	2	2	0	3	0	0	0	0	4	0	0
13	45	102	69	0	105	229	53	89	0	28	0	0
14	0	0	0	0	0	1	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	1	0	0	0	0	0	0	0
24	0	0	0	0	0	3	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	1	0	0	0	0	0	0	0
27	0	0	0	0	7	5	0	0	0	0	0	0
28	0	0	0	0	2	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	2	4	0	1
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0
36	0	1	0	0	1	0	1	0	1	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	1	6	0	0	0	0
39	2	0	0	0	0	2	0	0	0	0	0	0
40	2	0	0	0	27	0	0	6	0	0	9	0
41	0	0	7	0	0	0	0	0	0	0	0	0
42	2	3	0	2	17	2	3	6	0	0	5	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	1
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	1	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	2	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	2	0	0	0	1	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	1	0	0
57	0	0	1	0	0	3	1	0	0	0	0	0

35 - Quartz debitage angular

36 - Quartz biface

37 - Quartz drill

38 - Quartz end scraper

39 - Quartz side scraper

40 - Quartz retouched flake

41 - Quartz utilized flake

42 - Quartz projectile point

43 - Daub

44 - Chert debitage flake

45 - Chert debitage core

46 - Chert debitage angular

47 - Chert biface

48 - Chert drill

49 - Chert end scraper

50 - Chert side scraper

51 - Chert retouched flake

52 - Chert utilized flake

53 - Chert projectile point

54 - Unknown lithic object

55 - Steatite object

56 - Rhylite object

57 - Other lithic object

	GE 86	GE 87	GE 89	GE 91	GE 92	GE 93	GE 95	GE 96	GE 99	GE100	GE102	GE103
1	0	0	0	0	0	1	0	2	2	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	67	0	0	0	0	0	0	0	13	0
5	1	2	53	16	2	6	1	4	8	2	0	4
6	0	0	223	0	0	0	0	0	0	0	63	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	83	0	0	9	0	0	3	0	2	4
13	43	10	290	136	15	85	10	93	162	35	0	34
14	0	0	2	0	1	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	3	0	0	0	0	0	0	0	0
24	0	0	0	0	2	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	1	0	0
27	0	0	0	7	0	0	0	0	0	0	5	0
28	0	0	0	0	0	0	0	0	0	0	1	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	3	0	0	0	0	0	0	0	0	0	13	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	10	0
36	0	0	0	0	0	0	0	0	0	0	1	0
37	0	0	0	0	0	0	0	0	0	1	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	3	0	0	0	0
41	0	0	0	0	0	0	6	0	0	0	1	0
42	0	0	0	0	1	0	0	2	0	0	2	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	1	2
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	2	0	0	0	1	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	1	0
53	0	0	0	1	0	0	0	0	0	1	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	1	0	0	0	0	0	0	0

	GE104	GE105	GE106	GE109	GE112	GE115	GE117	GE118	GE120	GE121	GE122	GE124
1	7	2	5	0	0	1	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	3	2	0	1	2	2	1	0	2
6	0	0	0	0	0	0	16	0	8	23	10	0
7	0	0	0	0	0	0	0	0	0	3	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	2	0
11	0	0	0	0	0	0	0	0	0	1	0	0
12	3	0	3	0	2	3	0	1	1	0	0	2
13	65	35	56	17	14	15	0	10	0	0	0	15
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	9
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	1	0	0	1
39	0	0	0	0	0	0	0	0	0	0	0	0
40	7	6	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0
42	2	1	0	0	0	0	0	0	0	0	2	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	1	0	0	1	0	0	2
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	3	2	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	1	0	0	0	0	0	0	0	0	0
56	0	1	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	1	0	0	0	0	0

	GE125	GE131	GE139	GE147	GE148	GE153	GE154	GE155	GE157	GE159	GE160	GE162
1	0	0	0	0	0	0	0	0	0	0	1	2
2	0	0	0	0	0	0	1	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	4	0	0	0	6	0	0
5	5	4	0	4	2	9	1	3	0	0	6	12
6	0	0	64	25	10	76	30	36	9	19	1	124
7	0	0	0	11	0	20	2	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	1	0	0	2	0	0	0	0	0	3
11	0	0	3	0	1	1	0	0	0	0	1	2
12	6	3	24	1	5	9	3	5	2	0	12	192
13	71	25	0	0	0	0	0	0	3	0	233	526
14	0	0	1	0	0	0	0	0	0	0	0	0
15	0	0	1	0	0	1	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	5	3
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	1
20	0	0	0	0	0	0	0	0	0	0	8	10
21	0	0	0	0	0	0	0	0	0	0	0	1
22	0	0	0	0	0	0	0	0	0	0	0	6
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	3	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	8	165	3	1	12	1	2	0	23	2	13	649
34	0	0	0	0	0	0	0	0	0	0	0	0
35	4	46	0	0	4	0	0	0	0	0	4	174
36	0	3	0	0	0	0	0	0	0	2	0	22
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	2
40	0	0	0	0	0	0	0	0	0	0	0	5
41	0	0	0	0	0	0	0	0	0	0	0	32
42	0	7	0	0	1	0	0	0	2	0	0	44
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	61	0	0	6	0	0	0	6	0	5	280
45	0	0	0	0	3	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	7
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	1	0	0	0	0	0	0	0	0	0	4
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	1
52	0	2	0	0	0	0	0	0	0	0	0	10
53	0	0	0	0	0	0	0	0	0	0	0	6
54	0	0	0	0	0	0	0	0	0	2	0	12
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	3
57	0	0	0	0	0	0	0	0	0	0	1	8

	GE163	GE164	GE167	GE169	GE171	GE175	GE177	GE180	GE181	GE186	GE190	MG 28
1	5	0	1	6	3	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	31	0	2	1	0	0	0
5	4	1	2	13	2	18	0	0	2	0	1	17
6	39	31	25	175	84	152	8	1	1	0	0	81
7	17	0	0	0	0	16	0	0	0	1	0	2
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	2	0	3	0	0	0	0	0	3
11	0	0	0	3	2	0	0	0	0	0	0	1
12	0	3	0	16	7	1	2	6	17	2	10	8
13	0	0	0	0	0	0	0	14	41	13	36	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	2	0	6	0
18	0	0	0	0	0	0	0	0	0	0	1	0
19	0	0	0	0	0	0	0	0	0	0	1	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	2	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	4	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	1	3	3	4	14	0	0	0	1	1	16	7
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	2	2	2	2	0	0	0	0	0	4	2
36	0	1	1	0	3	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	2	0	0	0	0	1	3	0
42	0	0	0	0	2	0	0	0	0	0	1	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	1	0	0	0	0	0	4	1
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	1	1	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	1	0
57	0	0	0	0	0	0	0	0	0	0	0	0

	MG 43	MG 44	MG 46	MG 47	MG 52	MG 53	MG 54	MG 56	MG 58	MG 59	MG 60	MG 61
1	0	0	0	0	8	0	2	0	0	0	0	5
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	1	0	0	2	0	0	0
5	0	1	1	3	0	2	0	1	0	3	3	0
6	34	28	2	29	5	3	12	0	4	29	31	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	4	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	2	0	2	0	0	0	0	0	0	0
13	0	0	18	0	76	61	0	10	72	0	0	15
14	1	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	1
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	2	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0
36	1	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	2	4	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	6	1	0	0	0	0	0	2	0
41	1	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	1	0	0	1	0	2	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	6	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	1	1	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	7	0	0	6	0	0	0
52	1	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	1	0	0	1
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	3	0	0	0	0	3	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	1	0	0	0

	MG 62	MG 63	MG 69	MG 71	MG 72	MG 73	MG 74	MG 77	MG 81	MG 84	MG 85	MG 86
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	12	15	8	0	0	4	6	2	0	0
5	40	131	0	2	2	9	2	0	5	2	2	6
6	338	698	7	58	0	103	13	18	0	7	12	32
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	1	0	0	0	0	0	0
11	0	0	0	0	0	4	0	2	3	0	0	0
12	2	0	0	0	0	16	0	0	0	0	0	1
13	0	0	0	0	60	0	0	0	50	0	0	0
14	0	2	0	0	0	0	0	0	0	0	0	0
15	0	12	0	0	0	0	0	0	0	1	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	2	1	4	55	0	4	0	0	0	3
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	26	0	0	0	0	0	0
36	0	0	0	0	0	18	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	11	0	1	1	0	0	0	0	0	0
39	0	0	0	0	0	0	0	1	1	0	0	0
40	0	0	0	0	0	1	3	0	0	0	0	0
41	0	0	0	0	0	5	0	0	0	0	0	0
42	0	0	0	0	0	14	1	2	1	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	5	8	2	0	0	0	0	0	1
45	0	0	0	0	2	0	0	0	0	0	0	0
46	0	0	0	0	0	2	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	1	0	3	0	0	1	0	0	0	0	0	0
50	0	0	0	0	0	0	1	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	1	0	0	0	0	0	0
53	0	0	0	0	1	3	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	4	0	0	0	0	0	0
56	0	1	1	0	0	0	0	0	0	0	0	0
57	0	0	0	2	0	4	0	0	0	0	0	0

	MG 88	MG 89	MG 91	MG 94	MG 98	PM115	PM116	PM117	PM119	PM122	PM125	PM126
1	0	0	0	0	0	0	5	13	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	7	0	15	0	0	1	0	0
5	1	1	2	7	4	12	7	0	34	32	6	4
6	19	0	32	30	45	0	131	4	15	225	8	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	5	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	1	10	9	7	0	1	1	4	1	33	7	4
13	0	32	0	0	0	130	0	110	163	0	72	26
14	0	0	0	0	1	0	1	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	10	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	78	48	9	4	0	0	0	1	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	16	14	8	2	0	0	0	0	0	0	0
36	0	0	0	3	0	0	0	0	0	0	0	4
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	1	2	4	0	0	0	0	0
41	0	5	4	2	0	0	0	0	0	0	0	0
42	0	4	3	2	0	0	1	0	0	7	0	1
43	0	0	0	0	0	0	0	0	2	0	0	0
44	0	0	2	3	1	0	0	0	1	0	1	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	1	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	1	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	1	0	2	0	0	0	0	0	3	0	3
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	2	0	0	0	0	0	0	0	0
56	0	1	0	1	0	0	0	0	0	0	0	0
57	1	0	0	0	0	0	0	0	0	0	1	0

	PM130	PM131	PM133	PM137	PM140	PM141	PM144	PM146	PM148	PM153	PM155	PM158
1	12	0	2	0	4	0	0	0	0	2	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	0	0	0	1	0
5	5	3	0	29	0	1	4	3	5	0	2	2
6	87	25	19	187	46	19	23	43	66	0	14	9
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	3	0	0	1	0	0	0	0	0	0	0	0
12	4	4	0	0	4	1	0	0	0	22	0	0
13	0	0	0	0	0	0	0	0	0	60	0	0
14	0	0	0	1	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	1	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	52	0	0	0	0	12	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	5	0	0	0	0	10	0	19	12	10	7	13
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	3	0	0	0	0	0	0
36	0	0	0	0	0	1	0	0	0	0	2	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	1	0	0	0	0	0	0	0	0	0	0	0
39	0	4	0	0	0	0	1	0	0	0	0	0
40	0	0	0	0	2	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0
42	0	6	0	1	1	0	1	1	0	0	0	0
43	2	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	1	0	1	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	1	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	3	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	1	0	0	0	0	0	0	0	0	0	0
54	0	12	0	0	0	0	0	0	0	0	0	0
55	0	2	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	1	0	0	0	0	0	0	0

	PM160	PM161	PM162	PM163	PM164	PM165	PM166	PM172	PM179	PM181	PM182	PM183
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	13	0	0	1	0	2	5	1	0	1	0	0
5	20	4	2	10	4	6	5	5	2	3	3	3
6	117	35	0	42	20	31	2	0	27	7	55	26
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1	0	0	0	0	0
11	0	0	0	0	0	0	5	0	1	0	0	1
12	0	0	9	0	0	0	0	15	0	0	19	0
13	0	0	37	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	2	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	0	6	0	0	3	0	0	1	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	1	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	22	0	1	0	0	0	0	0	0	1	0
40	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	1	0
43	0	0	0	0	0	0	0	0	0	0	1	0
44	1	0	0	0	0	0	0	1	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	1	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0

	PM187	PM188	PM190	PM202	PM205	PM206	PM207	PM208	PM209	PM211	PM214	PM215
1	0	0	0	0	0	0	1	0	0	4	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	1	0	0
4	0	1	0	0	0	3	4	0	36	12	13	0
5	6	4	1	3	0	6	0	4	38	28	2	7
6	54	23	20	68	44	18	0	6	454	359	40	31
7	0	0	0	0	0	0	0	0	4	0	1	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	0	0	0	1	0	1	0
11	0	2	4	1	1	0	1	0	4	3	1	0
12	0	0	0	4	1	0	4	0	9	6	0	1
13	0	0	0	0	0	0	80	2	3	0	0	0
14	0	0	0	0	0	0	0	0	1	0	1	1
15	0	0	0	0	0	0	0	0	1	1	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	1	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	1	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0
33	4	2	0	61	26	4	54	236	222	0	0	18
34	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	6	1	0	6	2	2	0	0	8
36	0	0	0	1	1	0	1	3	1	0	0	4
37	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	1	0	0	0	1	0	0	0	0
41	0	0	0	0	0	1	3	3	1	0	0	0
42	0	0	0	3	2	0	12	3	1	0	0	0
43	0	0	2	0	0	0	0	0	0	0	0	0
44	1	0	1	25	12	2	21	180	1	0	0	6
45	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	1	0	0	0	0
47	0	0	0	0	0	0	0	1	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	1	0	0	0	0	0
51	0	0	0	0	0	0	1	0	0	0	0	0
52	0	0	0	0	0	0	3	6	0	0	0	0
53	0	0	0	2	0	0	1	0	0	0	0	0
54	0	0	0	0	0	0	2	5	2	0	0	1
55	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	1	1	0	0	0	0
57	0	0	0	0	1	0	1	0	0	0	0	0

	PM220	PM222	PM226	PM228	PM237
1	1	1	0	2	0
2	0	0	0	0	0
3	0	0	0	0	0
4	4	3	1	0	0
5	2	15	4	2	0
6	50	447	49	138	23
7	0	31	0	0	4
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	1	0	1	4	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	0	0	0	0
33	0	0	4	111	0
34	0	0	0	0	0
35	0	0	6	57	0
36	0	0	1	12	0
37	0	0	0	0	0
38	0	0	0	0	0
39	0	0	0	1	0
40	0	0	0	0	0
41	0	0	0	3	0
42	0	0	0	2	0
43	0	0	0	0	0
44	0	0	3	15	0
45	0	0	0	0	0
46	0	0	0	2	0
47	0	0	0	0	0
48	0	0	0	0	0
49	0	0	0	0	0
50	0	0	0	0	0
51	0	0	0	0	0
52	0	0	1	2	0
53	0	0	0	4	0
54	0	0	0	0	0
55	0	0	0	0	0
56	0	0	0	0	0
57	0	0	0	0	0

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