SOUTHEAST TEXAS ARCHEOLOGY

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INTRODUCTION

This report presents a synthesis of the archeology of Southeast Texas, covering all geographic areas and prehistoric time periods of human habitation in this region. Some consideration is also given to historic Indians, although details are limited in relation to prehistoric Indians. A detailed synthesis of the archeology of Southeast Texas is now possible because of recent rapid accumulation of archeological survey and excavation data. The availability of significant amounts of published archeological data for this region is demonstrated by two computerized data bases (Patterson 1989a,b) and the latest regional bibliography (Patterson 1995a). Many of the pieces needed for a regional archeological synthesis of Southeast Texas have already been published. This report follows a less detailed summary of the archeology of Southeast Texas published by the author (Patterson 1995b), where space did not allow the use of detailed data such as are presented here. All data given here are from mid-1995 updates of the computerized data bases (Patterson 1989a,b).

The use of specialized archeological terms and jargon has been kept to a minimum in this volume, in favor of using common English as much as possible. This publication is not intended for use only by archeologists, but also by a more general public audience with interest in regional archeology.

The nature of a synthesis should be understood. A regional archeological synthesis is simply a set of data, interpretations and models that attempts to give a good summary of the current status of available knowledge. There are no absolutely correct answers, as new data and new interpretations remain possible. A regional archeological synthesis not only summarizes current knowledge, but also serves as a base for further refinements of models and explanations.

Abstract theory is avoided in this report, in favor of interpretive models that can be related to available data. Archeological data is mainly descriptive and historical (Hole 1973:303). Syntheses are interpretive organizations of the data. This report seeks to present a balanced interpretation of various subjects and viewpoints. For example, both local innovation and diffusion of technological traits should be considered.

The partial nature of archeological data limits the detail of interpretation of prehistoric lifeways. Because organic materials are poorly preserved, few data are available to study prehistoric shelters, clothing, complete weapon systems, wood artifacts, and floral food resources. Even with these limitations in data, the prehistory of Southeast Texas can be presented in considerable detail. Interpretations can be made based on existing data, without need for unsupported speculation. There is a popular concept that archeology is mainly an excavation activity. It may be seen throughout this publication that data from surface collections at specific sites are at least as important as data from excavated sites. A major point here is that all types of data must be considered to develop a meaningful regional synthesis.

As may be seen in the Table of Contents, this volume is organized along the lines of common research topics in archeology, starting with chronology and then proceeding into the details of prehistoric technology, lifestyles, and social organization. Technological change is viewed within the basic continuity of a conservative nomadic hunting and gathering lifeway that characterized the entire prehistory of this region. The development of complex cultural traits was limited and sporadic in Southeast Texas, as reflected in the data and interpretations given here. It is hoped that this report will contribute to a better understanding of the prehistory of Southeast Texas and will serve as a catalyst to encourage future research.

HUNTER-GATHERER THEORY

Published theories on hunter-gatherers are refered to only occasionally in this report, because most hunter-gatherer theory is not useful or significant. There are two major problems in the development of hunter-gatherer theory. One problem is the limited nature of archeological data, which does not allow the detailed reconstruction of prehistoric lifeways. The other problem is the diversity of hunter-gatherer adaptions (Kelly 1995). Even simple hunter-gatherer lifeways are complex, non-linear systems, where small changes in variables can cause different outcomes. Therefore, it is difficult to formulate any general rules for the behavior of hunter-gatherer groups, because rules of this type will usually have many exceptions.

It is hoped that this report causes discussion and debate concerning various topics related to hunter-gatherers. Development of theory on hunter-gatherers is still a very dynamic subject (Bettinger 1991, Price and Brown 1985). The leading edge of scientific research always involves controversy. If an archeological theory is completely proven, there is little need for further research on the subject, but this is seldom the case. Controversy in itself is seldom constructive, however. Debates should be accompanied by the use of substantive data, and flexibility to accept new concepts as new data become available. It is to be expected that current models and theories will be refined in the future, as more data becomes available.

HISTORY OF REGIONAL RESEARCH

Before 1950, little was known about the prehistory of Southeast Texas. Significant archeological research in this region covers a period of slightly over 40 years, with a rapid increase in the rate of publication of archeological data after 1970. As late as 1979, it would not have been possible to do a very detailed synthesis of this region that would have covered all prehistoric time periods and geographic subregions (Patterson 1979). Significant archeological research in Southeast Texas started with work by Wheat (1953) during reservoir construction at some prehistoric sites west of Houston. He demonstrated that there were sites in this region with considerable time depth in occupation sequences, and presented the first relative chronology for artifact types in preceramic and ceramic time periods. Wheat's (1953) report still remains a good reference source for the inland portion of Southeast Texas. Another early investigation was at the Caplen site (41GV1), a Late Prehistoric burial site on Bolivar Peninsula (Campbell 1957).

Research in this region in the 1960s was mainly done as various projects of the Texas Archeological Salvage Project (now Texas Archeological Research Laboratory) of the University of Texas at Austin. Shafer (1968) conducted excavation and survey work in the Lake Conroe area, and McClurkan (1968) did the same for the Lake Livingston area. Ambler (1970,1973) and Shafer (1966, 1972) conducted research on the coastal margin subregion. Aten (1967) and the Houston Archeological Society did an excavation of a stratified prehistoric site in Liberty County.

In the 1960s and early 1970s, Aten did research at various sites on the coastal margin that culminated in Aten's (1983) synthesis of the coastal margin subregion. Aten's book on shell midden sites of the coastal margin, mainly after the Late Archaic time period, has become a standard reference, and should be used if more details on the archeology of the coastal margin are desired than are given here.

From about 1975 until present, Texas A&M University has been the main educational institution with interest in the archeology of Southeast Texas, resulting in numerous survey and excavation reports, including excavated sites in Polk (Ensor and Carlson 1988) and Harris (Ensor and Carlson 1991) Counties. Several contract archeological firms have conducted investigations in this region, such as Prewitt and Associates, Coastal Environments, Moore Archeological Consulting, and Espy, Huston and Associates (see Patterson 1995a for listing of reports by these firms).

Hall (1981) has published results of excavations at prehistoric sites in the Allens Creek area in Austin County. These stratified sites include data from the Middle Archaic through the Late Prehistoric time periods, including a detailed description of a Late Archaic mortuary tradition that occurs in the western portion of Southeast Texas.

Much of the data on the archeology of Southeast Texas, especially the inland subregion, has been produced by field programs of the Houston Archeological Society, and by work of individual HAS members. This has resulted in a large number of publications of data from excavated sites and intensive surface collections. Most of the research on the Paleo-Indian and Early Archaic time periods in Southeast Texas has been done by the Houston Archeological Society. The HAS publishes the only journal devoted to the archeology of this region, as well as a continuing series of bibliographies (Patterson 1995a), and hard copies of computerized data bases for this region (Patterson 1989a,b). Individual members of the HAS have discovered and recorded a large proportion of the archeological sites in Southeast Texas. The Houston Archeological Society is a good example of how an avocational society can successfully conduct a wide range of regional archeological research activities (Patterson 1991f).

The U.S. Army Corps of Engineers sponsored a study of the archeology of the Gulf Coastal Plain (Story et al. 1990), which covers East Texas from the coastal margin to Arkansas, including Southeast Texas. While this publication is not a complete synthesis of the archeology of such a large geographic area, it does constitute a large collection of data with interpretive comments on many subjects. This publication accomplishes its intended goal of being a data source for the Gulf Coastal Plain, and it has become a standard reference. The Corps of Engineers has sponsored a number of archeological sites studies for clearances on construction projects in Southeast Texas, especially in the coastal margin subregion.

This section has given only some highlights in the history of archeological research in Southeast Texas. Extensive publication on the archeology of this region (Patterson 1995a) has resulted in a data base that is one of the best for a region in Texas.

GEOGRAPHIC AND ENVIRONMENTAL SETTING

Southeast Texas as defined here covers a 21 county area (Figure 1). This region is an interface between the Southern Plains and the Southeast Woodlands. This interface of environmental areas is reflected in the distributions of artifact types within this region (Patterson 1990a,1990h), as will be further discussed. Southeast Texas is essentially an area bounded by the Colorado River on the west, the Sabine River on the east, and includes an inland area to about 120 miles from the Gulf Coast shoreline.

The inland portion of Southeast Texas is a mixture of coastal prairie and woodlands, with coniferous trees (piney woods) being most numerous in the northeastern part of this region. A dense band of piney woods runs across the northern counties of this region, including Montgomery, Polk, San Jacinto, Tyler, and Jasper. This band of piney woods extends over most of the eastern Gulf coastal plain (Larsen 1980:35) as a distinct ecological zone with a low productivity of natural food resources. Much of the woodlands in this region are a mixture of coniferous and deciduous tree types. Nut trees, such as pecan and hickory, are especially numerous in the lower Colorado and Brazos Rivers drainage systems, in the western part of Southeast Texas. The Big Thicket ecological area is found in the eastern part of this region. Numerous freshwater streams of inland Southeast Texas flow mainly to the southeast, into the Gulf of Mexico.

The coastal margin of Southeast Texas occupies a band along the Gulf Coast from the shoreline to about 15 miles inland. This geographic area is a mixture of coastal prairie, woodlands, wetlands, brackish water lakes, and river deltas. Freshwater streams discharging into the Gulf become brackish in the coastal margin due to saltwater from tidal flow. The brackish water lakes are generally remnants of former river channels. A high proportion of the archeological sites on the coastal margin are *Rangia cuneata* brackish water shell middens. Some oyster shell middens are found on the coastline in a true marine saltwater environment. The general Galveston Bay area, including San Jacinto, Trinity and East Bays, is particularly well-known for Rangia shell middens.

Although periodic variations in average rainfall and temperature have occurred throughout the Holocene period, after 11,000 years B.P., there is little evidence available to define changes in the overall floral and faunal communities during this time period in Southeast Texas. Subsistence patterns appear to have remained similar throughout the Holocene period, which covers most of the human occupation sequence of this region. The range of faunal food resources utilized by prehistoric Indians in this region is discussed in the section of this publication on subsistence patterns. Vegetation zones in Southeast Texas are shown in Figure 2.

REGIONAL GEOLOGY

Southeast Texas can be divided into two geological areas (Oetking 1959). From the Gulf coastline to about 80 miles inland the surface geology is of Quaternary age, consisting of recent deposits, with Beaumont and then Lissie formations in stratified deeper deposits. From about 80 to 120 miles inland the surface geological deposits are of Tertiary age, with Pliocene, Miocene, and Oligocene deposits stratified in order of depth.

Most of the archeological excavations in Southeast Texas are done in the first few feet from the soil surface in Pleistocene materials that have been redeposited in the Holocene period, after 11,000 years ago. Holocene period soils overlie older deposits, such as the Beaumont Formation. While there seems to have been much changing of river channels near the coast (Aten 1983:Chapter 8), channels of smaller inland streams seem to have been less subject to change. Many Indian sites along inland streams in this region have long occupation sequences, from about the beginning of the Holocene period through the Late Prehistoric period. This implies stability of stream channel locations.

Holocene period soils in Southeast Texas are generally sandy, with varying amounts of clay and organic materials. Because of the uniformity of soil deposits at many site locations, natural soil stratigraphy is only occasionally useful as a relative time marker at archeological excavations. Of course, natural stratigraphy should be studied when present in a definite form, especially as an indicator that undisturbed stratigraphy exists. Local depositional histories are usualy difficult to determine at sites in this region. Therefore, this report does not give a detailed discussion of the geology of this region. Perhaps future research will result in more useful geological analytical methods for archeological use. A number of references can be consulted for details of the geology of Southeast Texas, such as Aten (1983:Chapter 8), Fisher et al. (1972, 1973), and Bernard et al. (1970). It is common to see descriptions of regional geology in archeological site reports that are not used in any other portion of the text.

Aten (1983:Chapter 11) has been able to identify the depositional histories of some coastal margin archeological sites, such as stream channel levee deposits and indications of marsh and floodplains. These types of data are useful in determining the site environment at the time of occupation. The placement of shell midden sites is usually apparent without geological indicators, however. This type of site was located at the edges of lakes and stream channels, wherever Rangia beds occurred. The relationship of depositional history to cultural factors of site formation is seldom considered in site reports, except as a chronological sequence, because cultural factors for formation processes of shell midden sites are not well understood.

At some sites in this region, there can be false indications of "A" horizon remnant paleosols, such as in Stratum 2 at site 41WH19 (Patterson et al. 1987). In this situation, dark lines are observed that have been apparently caused by leaching rather than being actual "A" horizons. The vertical distribution of soil particle size is occasionally used to study possible disturbance of natural stratigraphy (Ensor 1987).

There is a major problem in interpretation of the geology of inland Southeast Texas, that of missing natural strata. It is common to find archeological sites in this region where artifacts dating from 11,000-10,000 years ago are found on the surface of Beaumont clay, which is not supposed to date later than 30,000 years ago (Aronow 1971:51). At many locations, about 20,000 years of geological deposits seem to be missing, possibly due to a major erosional event caused by extended heavy rainfall after 25,000 B.P. and no later than 9,000 B.P. as noted by Aten (1983:133). Therefore, Southeast Texas would generally be a poor area to look for pre-Clovis materials, before 12,000 years ago, although a systematic study of remnant Pleistocene terraces has not been conducted.

After the Pleistocene period, sea level on the Gulf of Mexico continued to rise. By 4500 years ago, sea level was probably within 15 feet of its present level (Paine and Morton 1986:9). Sea level stabilized at its present level about 3500 years ago (Gagliano 1977:1). Coastal margin archeological sites older than 3500 years B.P. would now be underwater. Therefore, a full chronological sequence for human occupation is only available for the inland portion of this region. An interesting situation can be observed at some sites on the coastal margin, where rising sea level changed the site environment from freshwater to brackish water, with a corresponding change in subsistence pattern. Examples of sites of this type can be found on upper San Jacinto Bay, where the sites were formerly on the bank of the San Jacinto River (Patterson and Marshall 1989). Conditions favorable for Rangia growth may have developed at different times at different locations along the coastal margin. For example, at site 41HR618 there is a radiocarbon date of 450 +/-80 years B.P., A.D. 1500, (I-15275) for the lowest level of the Rangia midden (Patterson and Marshall 1989:2). At this site, Rangia utilization did not start until the beginning of the Historic Indian period, even though there were earlier occupation components at this location. Gagliano (1977) has discussed late Holocene coastline formation processes.

There is little doubt that prehistoric sites exist on the submerged continental shelf. Finding sites of this type is extremely difficult because of probable low site density, high cost, and only partially developed methodology. Coastal Environments conducted a search for underwater sites in the submerged relict channel of the Sabine River, offshore Texas (Pearson 1988), using core samples. A possible Rangia shell midden was found dating to 8800 B.P. The sample included charred wood, nut hulls, seeds, fish scales, and bone. No human artifacts were found, but this is not surprising, because core samples test very small areas (Patterson 1981). This project made a significant contribution to the knowledge of the geology of this underwater area. Because of high cost, it is not likely that much research of this type will be done in the future.

PALEOCLIMATES

Climatic conditions are often discussed as affecting the adaptive success of hunter-gatherers. It is assumed that a wet climate without temperature extremes encourages good floral and faunal food resources. As Aten (1983:131-137) notes, reconstruction of paleoclimates can only be done in a general way for long time periods. His summary of paleoclimates which might apply to Texas is:

Late Glacial (before 10,000 B.P.): mild winters, cool summers, and high precipitation.

Boreal (10,000-8500 B.P.): more divergent temperatures, and less rainfall than in the Late Glacial period.

Atlantic (8500-5000 B.P.): Generally high temperatures and dry climate. Extreme intensification of these conditions has not been detected on the Texas coast.

Sub-Boreal to Present (after 5000 B.P.): Oscillating climatic conditions, but generally modern conditions.

There are few data available to directly discuss paleoclimates in Southeast Texas. Pollen types are used as an indicator of climatic conditions, but there is little preservation of pollen in this region. Continuing studies of species of snail and mussel at inland sites in this region may yield important indications of paleoclimates (Neck 1986, 1991). Data on paleoclimates from other regions cannot be directly applied to Southeast Texas, as environmental change in each region can be different (Bryant and Shafer 1977:19). The presence of caliche at Archaic period sites in Southeast Texas may indicate dry conditions during some parts of this period. The formation of carbonate concretions (caliche) is associated with semi-aridity or seasonal drought conditions (Aten 1983:134). Aten proposes that caliche formation in this region generally occurred after 9000 B.P., perhaps during an interval of 7500-3500 B.P.

At site 41FB42 (Patterson et al. 1993c), a thin carbonate layer occurred at about the start of the Early Archaic period (7000 B.P.), slightly above the location of an Angostura point and below Middle Archaic dart point types. Caliche was found at Late Archaic site 41FB3 (Patterson et al. 1993d). At site 41AU36, carbonates were found in both Middle Archaic and Late Archaic context (Hall 1981:40). Caliche is not found at all stratified sites in this region, and when caliche does occur it can be from different time intervals within the Archaic period. There is no general agreement among geologists on the exact mechanism of the formation of caliche deposits in Southeast Texas. At some inland sites, leached calcium carbonate from shells could be the source of the carbonate layer that is observed in the lower soil layers (Neck 1991:17). Story (1990:244) has assembled data from east-central Texas, north of this region which indicates a moist period from 2400 B.P. to some time after A.D. 100, followed by a shift to a dryer climate up to modern time.

Both Story (1990:25) and Aten (1983:136) have mentioned Antevs (1955) model of paleoclimates, which postulates a Thermal Maximum interval (7000-5000 B.P.) during the Archaic period. Bryson, Baerreis, and Wendland (1970:55) note that there are major difficulties to the concept of a Thermal Maximum, because this concept is too general to apply to specific geographic regions.

The question of climatic impact on adaptive success would be difficult to assess from material remains at archeological sites, especially tool kits. There is no archeological case for causally related technological or behavioral readjustments to climatic fluctuation (Butzer 1982:301).

REGIONAL DATA BASES

In developing a regional synthesis, it is essential to have a complete regional data base, in a manageable form. Otherwise, conclusions are likely to be impressionistic rather than substantive. Many regional studies are based on the use of key type sites. There is nothing wrong with reference to specific sites as examples, but when the bulk of regional data is ignored, conclusions are generally not well-supported. Even worse, important data are often overlooked, leading to incorrect conclusions.

As shown in Table 1, several thousand prehistoric sites have been recorded for Southeast Texas in the files of the Texas Archeological Research Laboratory (TARL) as of early 1995, but information on only about 15% of these sites has been published. Unpublished site records seldom describe the nature of each site in much detail. Therefore, the two computerized data bases for this region (Patterson 1989a,b) have been limited to published site reports. A summary of the original 1989 data base for the inland subregion has been published (Patterson 1990h). The analysis of unpublished site reports would be a good future research project. A summary of sites in the inland and coastal margin data bases is given in Table 1. As of mid 1995, the inland data base covers 298 sites (110 excavated, 188 surface collections), and the coastal margin data base covers 201 sites (57 excavated, 144 surface collections). Intensive surface collections are an important part of each data base. While intensive surface collections for specific sites are important, some archeologists choose to ignore this type of data. One major excavation report in this region did not even reference previously published surface collections for the site. As may be seen in Table 1, coverage of various counties is far from uniform. On the coastal margin, published sites are concentrated in Chambers and Harris Counties, so that the entire length of the coastal margin has not been well-investigated. For the inland subregion, only 6 of 21 counties have over 10 published archeological site reports. The number of site reports published in a county does not necessarily reflect the recorded site density of the county, but rather the relative amount of archeological investigation that has been done. For example, there are over 200 recorded prehistoric sites in Fort Bend County, but only 22 site reports have been published. A major goal should be to obtain a more uniform archeological survey of all counties in Southeast Texas, to obtain a more representative published sample of archeological resources. It should be noted that, from a statistical viewpoint, regional data bases are samples where the total population of data cannot be accurately estimated. There is some assurance of a representative sample, however, if a large data base is obtained.

The two computerized data bases for the inland and coastal margin subregions of Southeast Texas are updated on a periodic basis, with data added for new archeological site reports. Each data base contains several files for categories such as basic site data, projectile point types, ceramic types, general lithic artifacts, radiocarbon dates, burial sites, faunal remains, etc. The Paradox relational data base program for the IBM PC has been used. A relational data base allows complex queries to be made by linking tables. There is a separate record in each file for each archeological site. These two data bases are valuable tools for generating data to answer research questions. The data bases can also be used as sophisticated bibliographic search tools. Sites with specific characteristics can be found by data base queries. Published references for desired sites can then be found by use of an available cross-index of site numbers and references. Persons doing archeological research in Southeast Texas should consider use of the two computerized data bases, which are available through the Houston Archeological Society. Use of computerized data bases can facilitate studies that might otherwise be avoided because manual methods would require too much time for data collection and analysis.

While computerized data bases cannot contain all of the fine details of each archeological site report, it is possible to computerize all of the basic data from each site. Computerized data bases enable data from an entire region to be available for a maximum number of investigators. Many site reports are not easily available to many people, who do not have the time or resources to visit the few libraries where site reports may be available. It is generally not possible for an investigator to obtain copies of many site reports, which are out-of-print or which are CRM reports that have a very limited distribution. Much published archeological data is "lost" for practical purposes.

CHAPTER 2

CHRONOLOGY AND TECHNOLOGICAL TRADITIONS

GENERAL CHRONOLOGY

Data on human habitation of Southeast Texas covers a time interval of approximately 12,000 years. The prehistoric Indian period starts at about 10,000 B.C. and ends about A.D. 1500, with first European contact. Time periods used here are the same as used in some previous publications (Patterson 1979, 1983, 1995b), as follows:

period	years before present	B.C./A.D.
Early Paleo-Indian	12,000-10,000	10,000-8,000 B.C.
Late Paleo-Indian	10,000-7,000	8,000-5,000 B.C.
Early Archaic	7,000-5,000	5,000-3,000 B.C.
Middle Archaic	5,000-3,500	3,000-1,500 B.C.
Late Archaic	3,500-1,900	1,500 B.C.-A.D. 100
Early Ceramic	1,900-1,400	A.D. 100-600
Late Prehistoric	1,400-500	A.D. 600-1,500
Prot-Historic	500-300	A.D. 1500-1700
Historic Indian	300-200	A.D. 1700-1800+

Several details should be noted for the above chronological sequence. The names of the time periods are traditional in the literature of the U.S. However, the date divisions are for Southeast Texas alone, based more on artifact type time ranges than on any differences in lifestyles. A nomadic hunting and gathering lifeway was practiced throughout all prehistoric time periods in this region. Even when the same names are used for time periods, the time intervals may be different for Southeast Texas than for adjacent regions. For example, the time intervals generally used for the Archaic and Late Prehistoric periods are different in Central and Southeast Texas, and there is no Early Ceramic period in Central Texas.

The Early Paleo-Indian period is based on the chronologies of Clovis and Folsom points in other parts of Texas. It is now known that several other point types also occur in Southeast Texas during the same time period as Folsom (11,000-10,000 B.P.). The Late Paleo-Indian period represents the presence of Plains types of lanceolate projectile points in Southeast Texas, even though several types of non-lanceolate points were also present during this time period. The Late Paleo-Indian period in Texas corresponds to the Early Archaic period in the eastern states.

The Archaic time period in Southeast Texas starts at the end of the Late Paleo-Indian period and ends with the start of pottery at about A.D. 100 (Aten 1983:297). An arbitrary division of the Early, Middle and Late Archaic subperiods has been made. The Early Ceramic period begins with the start of pottery and ends with the approximate start of bifacial arrow point types (Aten 1983:306). The Late Prehistoric period follows until the time of European contact at about A.D. 1500. The Proto-Historic period of A.D. 1500-1700 is a period without much European contact. Major European contact in Southeast Texas started about A.D. 1700, and the Historic Indian period then lasted somewhat over 100 years.

A chronological sequence provides a basic framework for other types of archeological studies. The exact time intervals chosen for each period should not be used in a rigid manner. Time ranges for specific artifact types do not necessarily fit into single arbitrary chronological periods, especially because of slow technological change by conservative hunter-gatherers. In many types of studies, relative chronological sequences for artifact types are more important than absolute chronologies. Another consideration is that complete time ranges for artifact types, such as projectile points are not always well-determined (Patterson 1989c).

HISTORIC INDIAN SITES

It is often not possible to distinguish between Late Prehistoric and Historic Indian sites, because no historic artifact types are present at some Historic Indian sites. For example, site 41WH19 (Patterson et al. 1987) has a protohistoric radiocarbon date of A.D. 1585, but no historic artifact types are present. At site 41WH8 (Hudgins 1984), historic artifacts included glass scrapers,a Spanish coin, and a projectile point made from an iron keyhole plate. Judged by the large quantity of Rockport pottery, this site may be a historic inland Karankawa site, similar to inland Karankawa sites noted by Gatschet (1891). Loop handles on pottery indicate the Historic Indian period in Southeast Texas. Perttula (1992:24) illustrates that the historic Alabama/Coushatta Indians used pottery with loop handles in the northern part of Southeast Texas. Loop handles from pots were found at Historic Indian site 41WH8 (Hudgins 1984:Figure 16). Loop handles at site 41CH161 (Kindall and Patterson 1993) on the coastal margin may represent the Historic Indian period. Glass beads have been found at a few Indian sites in both the coastal margin and inland subregions, including 41PK69 (Ensor and Carlson 1988), 41CH20 (Ambler 1970:29), 41Ch53 (Ambler 1970:29), 41CH103 (Ambler 1970:29), 41CH161 (Kindall and Patterson 1993), 41GV66 (Ricklis 1993), 41CH110 (Aten 1983:268), and 41LB4 (Aten 1983:268). The largest amount of data on glass beads is from the Galveston Bay Area. Gunflints and early Anglo potsherds are also occasionally found on Historic Indian sites.

Ricklis (1993,1994) has found historic Indian burial groups at site 41GV66 on Galveston Island, identified by European trade goods, including glass beads, a brass bell, iron tool fragments, and flat glass. Glass trade bead types are assignable to the early to mid-18th century.

Care must be taken in analysis when a site has had occupations by Indians and early Anglo settlers, such as site 41WH40 (Patterson and Hudgins 1989). In this situation, historic type artifacts may not represent use by Indians. As another consideration, in the northern part of Southeast Texas, a variety of Euro-American trade goods can be found at Alabama/Coushatta historic Indian sites (Perttula 1992:23).

Tunnell and Ambler (1967) have published an archeological investigation at the Spanish Presidio San Agustin de Ahumada in the Galveston Bay area, with evidence of Indian contacts. Fullen (1978) has described the El Orcoquisac Archeological District as follows: Site 41CH57 includes Joseph Blancpain's trading post, Village de Atakapas (1754), the first location of the Spanish Presidio San Agustin de Ahumada (1756-1766), and the first location of Mission Nuestra Senora de La Luz (1756-1759). Site 41CH54 is the second location of Mission de La Luz (1759-1771), and site 41CH22 is the Orcoquiza Indian Rancheria associated with the mission. Site 41CH53 is the second location of Presidio Ahumada. Many other historic Indian, Spanish, and French sites mentioned in the historic record for this region have not yet been located, in spite of some intensive search efforts by various members of the Houston Archeological Society. Although the presence of Indians in this region in the Historic Indian period is well-attested in the historic record, the archeology of the Historic Indian period is not well-developed. Newcomb (1961) and Aten (1983) may be consulted for more details on historic Indians in this region. The diary of

Cabeza de Vaca (Covey 1961, Hedrick and Riley 1974) provides the main ethnographic description of the lifestyle of Indians in this region.

Karankawa Indians of the Coco tribe are thought to have occupied the coastal margin of this region as far west as the western half of Galveston Island and the corresponding mainland area (Aten 1983:Figure 3.1). Judged by the scarcity of Rockport pottery at sites east of the Brazos River, the presence of Karankawa Indians as far east as Galveston Island may be a rather late movement of this ethnic group in the Late Prehistoric period. Gilmore (1974:59) states that asphalt coated pottery of the Rockport type started during the Old River period, after A.D. 1350 (Aten 1983:Table 14.2), at site 41CH110 in Chambers County on the Southeast Texas coastal Margin.

With a few exceptions, historic Indian sites in Southeast Texas are not well connected with the ethnographic record (Story 1990:258). It is even more difficult to relate the ethnographic record to prehistoric Indians groups in this region, because of historic movements and restructuring of social groups. Aten (1983:figure 3.1) shows reconstructed territories of native groups in the early eighteenth century, including Coco (Karankawa?), Tonkawa, Bidai, Akokisa, and Atakapa. These reconstructed territories cannot be used, however, with any certainty for the study of group territories in prehistoric time periods. As an example, the presence of the Tonkawa in Southeast Texas may be due to a rapid expansion from Central Texas in the seventeenth century (Newcomb 1993:27).

European settlement of Southeast Texas did not seriously disrupt the lifeway of Indians until after A.D 1700. The first half of the eighteenth century was the period in which the fur trade and mission system, as well as the first effects of epidemic diseases, began to seriously disrupt and stress the native cultural and social systems (Aten 1983:322). By the time that heavy settlement of Texas began in the early 1800's, the Indian population was already greatly diminished. The Alabama-Coushatta Indians in Southeast Texas are migrants, displaced from the east, without relations to indigenous prehistoric groups (Newcomb 1961:25).

Characteristics of skeletal remains of site 41GV66 on Galveston Island indicate that the remnants of some Historic Indian groups may have consolidated after the impact of European diseases (Ricklis 1994:501).

In summary, Indian sites from A.D. 1500 to 1800 are difficult to distinguish from Late Prehistoric sites, unless radiocarbon dates or European trade goods were obtained. After A.D. 1700, historic Indian sites are scarce because of a low population level.

RADIOCARBON DATES

Radiocarbon dates for the inland portion of Southeast Texas are summarized in Table 2, and radiocarbon dates for the coastal margin are summarized in Table 3. The larger number of radiocarbon dates for the coastal margin subregion reflects the availability of Rangia shell for dating. The smaller number of radiocarbon dates for the inland subregion is a result of less datable materials being found. At inland sites, charcoal samples large enough for conventional radiocarbon dating methods are not common. Freshwater mussel shell samples suitable for radiocarbon dating are available at a limited number of inland sites.

All radiocarbon dates in Table 2 are years B.P., with a standard zero years B.P. of A.D. 1950. Several calibrations have been published to refine radiocarbon dates to absolute dates, based on tree ring growth dates, such as given by Stuiver and Kra (1986). Calibrated radiocarbon dates have not been used here, however, because use of calibrated dates is not consistent throughout the literature.

Many more radiocarbon dates from stratified inland sites will be required to define the complete time ranges for each artifact type, especially projectile points. There are some radiocarbon dates from inland sites for each broad time period, however. These dates tend to support the placement of many artifact types into the time periods used here. Available radiocarbon dates also support the finding that there are many sites in Southeast Texas with long occupation sequences. All of the radiocarbon dates given here have been integrated into the interpretation of individual sites. Some of these dates will be discussed further in relation to chronologies of various artifact types.

PROJECTILE POINT CHRONOLOGIES

GENERAL COMMENTS

Chronologies of projectile points in Southeast Texas are summarized in Table 4. It should be realized that projectile point chronologies are continuously refined, as new data become available. It would be ideal to have sufficient radiocarbon dates to establish a definitive time range for each projectile point type, but this is generally not possible. Instead, the time range for each projectile point type is generally estimated, with varying degrees of accuracy, by use of some radiocarbon dates, data from excavations, data from surface collections, and published chronologies from adjacent regions.

There are generic problems in establishing estimates for projectile point chronologies. These include: (1) chronologies from adjacent regions do not always apply, (2) some investigators attempt to force individual types into artificially narrow time ranges, (3) data on chronological sequences from single stratified sites are seldom conclusive on total time ranges of point types in a region, and (4) many investigators fail to consider the entire body of data for a region. Also, it is not unusual for investigators to disagree on the classification of projectile point types. Chronologies previously given for arrow points (Patterson 1991c) and dart points (Patterson 1991b) in Southeast Texas are used here with some refinements, based on new data. Suhm and Jelks (1962) and Turner and Hester (1985,1993) have given detailed descriptions of most types of projectile points found in Texas.

Unless designated as arrow points, projectile point types discussed here are spear points. Spear points are called dart points when the spear is used with the spearthrower (atlatl). It is presumed that the spearthrower was widely used, although remains of wooden spearthrowers are not preserved. A spearthrower acts as an extension to the throwing arm, with a large mechanical advantage resulting in greater energy delivered by the spear at impact.

Paleo-Indian and Early Archaic sites are relatively less numerous than sites in later perhistoric time periods, because of low population levels in early time periods. Many sites with substantial numbers of Paleo-Indian and Early Archaic projectile points are now known, however, in the context of specific sites rather than as isolated finds. One of the best examples found so far is site 41HR343 in Harris County (Patterson et al. 1992a), with 106 Paleo-Indian points.

EARLY PALEO-INDIAN PROJECTILE POINTS (12,000-10,000 B.P.)

Although there are no applicable radiocarbon dates for the Clovis point in Southeast Texas, it is presumed that this is the earliest projectile point type found in this region. Haynes et al. (1984) and Willig (1991) place the Clovis point in a time range of about 12,000-11,000 B.P. in the western U.S., extending to as late as 10,500 B.P. at some sites in the eastern U.S. The Clovis culture is not yet well-defined in this region, especially since most Clovis point specimens are surface finds. In other words, the initial occupation of this region is not well-understood. The presence of Clovis points simply indicates that Southeast Texas was occupied about as early as other parts of North America, with few details yet available on the initial local adaptation of the first inhabitants. No Clovis points have yet been found in Southeast Texas in a stratified excavated sequence, except for 41HR5 (Wheat 1953), where the Clovis specimen is not in the expected position in the sequence.

There are some sites in Southeast Texas where Clovis seems to be part of a much longer occupation sequence. These sites include 41HR343 (Patterson et al. 1992a), 41HR731 (Patterson et al. 1992b), 41HR571 (Patterson 1986), and perhaps 41HR5 (Doering site, Wheat 1953). Single Clovis points in Harris County have also been reported by Suhm and Jelks (1962:177) and Ring (1994). A large number of Clovis points have been found on a long shoreline at McFaddin Beach near Beaumont. Long (1977) reported 14 Clovis specimens, and a recent meeting with collectors revealed over 60 Clovis points from this location (Banks 1992, Hester et al. 1992). Huebner (1988) has reported a Clovis point found on the beach of Bolivar Penninsula in Galveston County. This appears to be a similar situation to the Clovis points found at McFaddin Beach farther east. It would appear that in the Southeast Woodlands, the Clovis culture forms part of the overall occupation sequence at many sites, rather than being a more isolated manifestation found at western sites. For example, Clovis points in Alabama are usually surface collected from sites having multiple components (Ensor 1992:3). There is still a debate on whether the Clovis point originated in the Southeastern United States or in the western United States (Bonnichsen 1991:325). Early radiocarbon dates of 12660 +/-970 B.P. (TX-6999) and 11950 +/-110 B.P. (TX-7454) at a Clovis site in Tennessee suggest that the Clovis point originated in the eastern United States (Wisner 1993). There is also a body of evidence that supports the concept that Clovis was not the first stone projectile point type in the New World (Bonnichsen 1991). Because of the geographic position of Southeast Texas, future research may show that this region has a mixture of the western and eastern adaptation patterns of Clovis groups. Meltzer and Bever (1995) have presented a survey of the distribution of Clovis points in Texas.

After the Clovis period, occupation of Southeast Texas becomes more visible in the time interval of 11,000-10,000 B.P., with the occurrence of several projectile point types. The Plains tradition is represented in this region by Folsom and Midland points. Folsom is generally dated to 11,000-10,000 B.P. (Largent et al. 1991, Haynes et al. 1984). Both of these point types are rare in Southeast Texas, and are best regarded as outliers from Central Texas. The rarity of Folsom and Midland points in Southeast Texas may be due to limited availability of bison in this region during this time period. The lack of bison in Southeast Texas in the late Pleistocene-early Holocene given by Munson (1990:Figure 3) fits well with the scarcity of Folsom points in this region discussed by Story (1990:189).

Single Folsom points have been found at sites 41WH19 (Patterson et al. 1987), 41HR624 (Patterson, Marriott and Marriott 1990), 41HR343 (Patterson et al 1993a) and McFaddin Beach (Banks 1992). The presence of Midland points in Southeast Texas is a recent discovery. Three Midland points were found at site 41HR571 (Patterson 1986:Figure 2), but were classified as Plainview-like since no Midland points had been previously reported in this region. Midland point specimens at sites 41HR343 (Patterson et al. 1993a) and 41HR732 (Patterson et al. 1993b) now leave little doubt that Midland points are present in Southeast Texas as a rare type. There is a possible technological relationship between Folsom and Midland points (Amick et al. 1989). Midland points are often called "unfluted Folsom". Clovis, Folsom and Midland points found in Southeast Texas are generally made of Edwards Plateau flint. This implies wide-ranging settlement patterns for these cultures. All Folsom and Midland point specimens found in this region are from surface collections at specific sites, except for a Folsom point from the same excavation level as a Early Side-Notched point at site 41WH19 (Patterson et al. 1987). There is an associated radiocarbon date of 9920 +/-530 B.P. (AA-298) for this excavation level.

Several other projectile point types were also present in Southeast Texas during the same time period as Folsom, including Dalton, Big Sandy, San Patrice and Early Side-Notched. All of these point types continue into the early portion of the Late Paleo-Indian time period. Dalton and Big Sandy points are not common in this region, and probably are outliers. Dalton points are commonly found to the north of Southeast Texas (Story 1990:Figure 27), and have been dated to as early as 10,500 B.P. (Goodyear 1982). Big Sandy points are more common in areas to the north and east of this region. The Big Sandy point has been dated as early as 10,500 B.P. (8500 B.C.) in northern Alabama (Boyd 1992). Dalton points have been found in Southeast Texas at McFaddin Beach (Long 1977), and at sites 41HR343 (Patterson et al. 1993a) and 41HR731 (Patterson et al. 1993b). Dalton points found at site 41HR343 in Harris County cover the range of Dalton subtypes illustrated by Morse and Morse (1983:Figure 4.2) for the Central Mississippi Valley. Big Sandy points have been found in this region at sites 41HR19 (Patterson et al. 1987), 41HR343 (Patterson et al. 1993a) and 41HR354 (Patterson et al. 1993b). No Dalton points have been found in excavated context in Southeast Texas. Morse and Morse (1983:71) place the Dalton point in a time range of 8500 to 7500 B.C. Big Sandy points in the Southeast Woodlands start as early as 10,500 B.P. (8500 B.C.) but continue until about 8000 B.P. (6000 B.C.) according to Justice (1987:61).

San Patrice and Early Side-Notched point types are both common in Southeast Texas (Patterson 1989a). Story (1990:202) provisionally dates the San Patrice point between 10,300 and 9,300 B.P. As noted above, there is a radiocarbon date of 9920 +/-530 B.P. for a Early Side-Notched point at site 41WH19 (Patterson et al. 1987, Patterson and Hudgins 1985), but this same point type has been found in earlier context at a site in Bee County at an excavation level below Folsom (Sellards 1940). There remains a question as to whether or not the Early Side-Notched point overlaps the time period of the Clovis point (Patterson 1989d). San Patrice and Early Side-Notched points found in Southeast Texas are usually made of local lithic materials, as would be expected for point types common to this region. Both of these point types represent technological traditions of the Greater Southeast Woodlands (Patterson 1991a), and these point types often occur together (Webb et al. 1971). Early Side-Notched points illustrated by Webb et al. (1971:Figure 6) are sometimes classified as Keithville (Turner and Hester 1993:134), but this classification does not cover the full range of Early Side-Notched point varieties. In fact, the Keithville classification only applies to variety B side-notched points illustrated by Webb et al. (1971), and does not even apply to all Early Side-Notched point types at this single site in Louisiana. San Patrice and Early Side-Notched points are clearly established in the earliest part of the occupation sequence of Southeast Texas, and represent the main occupation component of this region during the same time period as Folsom. In Central Texas, Early Side-Notched points have been found at the Wilson-Leonard site (Weir 1985) and Horn Shelter No. 2 (Forrester 1985, Redder 1985), in both cases earlier than Plainview points in the Paleo-Indian period. This situation was also found at site 41WH19 (Patterson et al. 1987) in Southeast Texas, where several Early Side-Notched points were earlier than a Plainview point specimen.

The Albany side-notched hafted scraper (Turner and Hester 1993:277) is commonly found with San Patrice and Early Side-Notched point types (Webb et al. 1971). The Albany scraper is found from Southeast Texas to the Atlantic coast, and is another demonstration of Southeast Texas sharing in technological traditions of the Greater Southeast Woodlands. The Albany (Edgefield) scraper has a continuous geographic distribution from Southeast Texas to South Carolina (Patterson 1991d).

LATE PALEO-INDIAN PROJECTILE POINTS (10,000-7,000 B.P.)

The end of the Late Paleo-Indian period has been chosen as 7000 B.P. to match Prewitt's (1981) chronology for the end of the latest Plains tradition Paleo-Indian points, which are Angostura and Scottsbluff. The Plains Tradition is represented in Southeast Texas during this time period by Plainview, Meserve, Scottsbluff and Angostura point types. Many Meserve specimens, however, may be resharpened Plainview points. Plainview points have been found in Southeast Texas in the Late Paleo-Indian strata at sites 41WH19 (Patterson et al. 1987) and 41HR315 (Patterson 1980a). Most Scottsbluff specimens in Southeast Texas are from surface collections, and the collections are generally multicomponent, such as Location "A" of site 41WH19 (Patterson et al. 1987). Scottsbluff points are not common in this region. This point type may represent an influence from farther north where Scottsbluff points are common (Story 1990:Figure 29). This point type is commonly made of exotic lithic materials from the Edwards Plateau (Story 1990:210), which implies a wide-ranging settlement pattern similar to Clovis and Folsom. An excavated example of a Scottsbluff point was found at site 41HR5 (Wheat 1953:Plate 38a). Paleo-Indian point types representing both the Southern Plains and Southeast Woodlands traditions are often found at the same sites.

Most Angostura specimens from this region are from multi-component surface collections. The stratigraphy at site 41FB42 (Patterson 1993c) seems to place the Angostura point in the later part of the Late Paleo-Indian period, consistent with Central Texas chronology. This same chronological placement has been found for Angostura points at site 41FB223 (Patterson et al. 1994). Most Plainview, Meserve, and Angostura points found in Southeast Texas are made of local cherts, which implies a more localized settlement patterns than that of earlier Paleo-Indians of the Plains tradition.

The Southeast Woodlands technological tradition is represented in Southeast Texas during the Late Paleo-Indian period by Dalton, Big Sandy, Early Side-Notched, Early Corner-Notched and San Patrice point types. As noted above, except for Early Corner-Notched, these point types also occur in some portion of the Early Paleo-Indian period. All of these point types, except Dalton, were found in Late Paleo-Indian excavation levels at site 41WH19 (Patterson et al. 1987). Early Stemmed points are also found in this time period that seem to be a non-standardized regional innovation. Early Stemmed points were identified for this time period at sites 41WH19 (Patterson et al. 1987:Figure 8) and 41HR315 (Patterson 1980a:Figure 5). Similar Early Stemmed point specimens have been illustrated by Shafer (1977:Figure 4). Early Stemmed points are less common than early notched points. Early Side-Notched and San Patrice points were found in the earliest part of the Late Paleo-Indian period at site 41WH19 (Patterson et al. 1987:Table 4). At this site, the Early Side-Notched point type apparently evolved into the Early Corner-Notched type during this time period. This is consistent with the change from side-notched to corner notched points during this time period throughout the Southeast Woodlands (Fagan 1991:310). All Early and Late Paleo-Indian points commonly have ground basal edges. Excavations at site 41PK69 support the placement of Early Side-Notched and Early Corner-Notched point types in the Late Paleo-Indian period (Ensor and Carlson

1988:Tables 18,19). It should be noted that classification of a specimen as side-notched or corner-notched can be somewhat arbitrary, as one type grades into the other.

As previously noted (Patterson 1991a:Table 2), various Early Notched projectile point specimens found at site 41WH19 in Wharton County have morphological correlates with point types found in the Greater Southeast Woodlands. Some Early Side-Notched point specimens from 41WH19 are like Greenbriar, Hardin, Big Sandy, and Hardaway Side-Notched point types of the Southeast Woodlands (Justice 1987). The Hardaway Side-Notched point type is the morphological correlate of the San Patrice point type. Some Early Corner-Notched point specimens from 41WH19 are like Decatur, Kirk Corner-Notched, and Palmer point types of the Southeast Woodlands (Justice 1987).

A few Early Stemmed Lanceolate points were found at site 41HR343 (Patterson et al. 1993a) that can be placed in the Late Paleo-Indian period (Turner and Hester (1985:88). Miscellaneous lanceolate points with ground basal edges are generally placed in this time period in Texas. In Southeast Texas, miscellaneous lanceolate points are similar to Plainview but are sometimes wider than 30 mm, which is greater than the maximum width for typical Plainview specimens shown by Suhm and Jelks (1962:Plate 120). A variety of miscellaneous lanceolate points has been shown by Shafer (1977:Figure 4). There is no exact temporal placement for miscellaneous lanceolate points in this region, and this remains a subject for future research. Many specimens in this point type category may be Plainview or Dalton type variants. In Texas, the Plainview type is often used as a catch-all classification for stemless lanceolate points other than Angostura. The Plainview classification covers lanceolate points that do not have much or any contraction of the basal edges, as does Angostura. No analytical criteria have yet been developed to more rigorously subdivide the rather broad Plainview category, if this would really be justified.

EARLY ARCHAIC PROJECTILE POINTS (7000-5000 B.P.)

The Early Archaic time period in Southeast Texas is represented by Bell, Carrollton, Morrill, Trinity, Wells and Early Stemmed point types. The Bell point is the only one of these types that is closely associated with lithic traditions of the Southern Plains. Bell points are found occasionally in the western and central portions of Southeast Texas, and are generally made of flint types that can be found in Bell County, which is the heartland for this projectile point type. Bell points found in Southeast Texas that are made of exotic materials implies a wide-ranging settlement or trade pattern for Indians using this point type. Bell points found in Southeast Texas were probably manufactured in Central Texas rather than locally. The Brazos River would have been a natural "highway" for Bell points coming from Central to Southeast Texas. Bell points with deep basal slots are sometimes called Andice or Calf Creek. This nomenclature is somewhat artificial, as a study of attributes shows that variations form a single manufacturing continuum (Weber and Patterson 1985). Much of the variation in Bell points appears to be due to variations in the skill of individual craftsmen in the ability to make deep notches. The best examples of Bell points in Southeast Texas are 6 specimens from site 41HR354 (Patterson et al. 1993b:Figure 2). Prewitt (1981) places the Bell point in a time interval of 6000-5000 B.P. in Central Texas. Since Bell points found in Southeast Texas were imported from Central Texas, it is appropriate to use Central Texas chronology for this point type, rather than looking for a separate chronology in Southeast Texas.

In the Early Archaic period, notched point forms were replaced by stemmed point forms, which corresponds to the point type sequence of the Southeast Woodlands (Fagan 1991:310). Stemmed point styles of the Early Archaic may have evolved from Early Stemmed points of the Late Paleo-Indian period. Carrollton, Morrill, Trinity and Wells stemmed points are found throughout East Texas, and extended into some parts of Central Texas (Turner and Hester 1985). All of these point types occur in the Early Archaic period and may continue into some portion of the Middle Archaic. Carrollton and Wells points are fairly common in Southeast Texas. Trinity and Morrill points are not common in this region, with larger numbers of these point types found in Northeast Texas. The Morrill point is placed in the Early and Middle Archaic by Turner and Hester (1985:129). The only excavated example of Trinity points in Southeast Texas are from the Early Archaic at site 41HR315 (Patterson 1980a:Table 3), although Turner and Hester (1985:154) place this point type in the Middle Archaic.

Carrollton and Wells point types seem to be most common in the Early Archaic period, but extend into some portion of the Middle Archaic. There is a radiocarbon date of 6490 +/-120 B.P. (I-15333) for a Carrollton or Carrollton-like point at site 41FB37 (Patterson 1988), in the early part of the Early Archaic period. A Wells point is also present at 41FB37 at a slightly higher excavation level in the Early Archaic. Excavations at site 41HR315 (Patterson 1980a) indicate continuation of the Carrollton point from the Early Archaic into some portion of the Middle Archaic. Excavations at site 41HR315 (Patterson 1980a) and 41AU37 (Hall 1981) indicate continuation of the Wells point from the Early Archaic into some portion of the Middle Archaic.

A variety of Early Stemmed points with ground basal edges was found in the Early Archaic period at site 41WH19 (Patterson et al. 1987. Some of these specimens are very large Bulverde-like points (Patterson et al. 1987:Figure 7A,C). Miscellaneous stemmed points from the Early Archaic are probably not recognized for their temporal significance in many collections. Early Stemmed points have also been found in Early Archaic excavation levels at site 41FB223 (Patterson et al. 1994).

The practice of grinding (smoothing) basal edges of projectile points has a very general time-diagnostic value. At site 41WH19 in Wharton County (Patterson et al. 1987), it was found that most projectile points had ground basal edges from the Paleo-Indian until the Middle Archaic periods. During the Middle Archaic period the practice of grinding of basal edges became uncommon. The reason for smoothing of basal edges of projectile points is not clear, but is related to hafting techniques. This might be related to hafting fit or less wear on binding materials. Smoothing of basal edges may have been considered more important for large projectile points, and the practice was dropped as projectile points became smaller in later time.

MIDDLE ARCHAIC PROJECTILE POINTS (5000-3500 B.P.)

As noted above; Wells, Carrollton, Morrill and perhaps Trinity point types appear to continue from the Early Archaic into the Middle Archaic in this region, based on limited data. Other projectile point types found during the Middle Archaic in Southeast Texas include Bulverde, Lange, Pedernales, Williams, Travis and the Gary-Kent series. The temporal placements of Morrill and Williams point types are based on references by Turner and Hester (1985). Lange and Travis points were found in the Middle Archaic at site 41AU37 (Hall 1981). Travis-like points were found in both the Middle and Late Archaic periods at site 41WH19 (Patterson et al. 1987:Table 3). It is sometimes difficult to distinguish between Travis and Kent point types.

Bulverde points have been found in the Middle Archaic period at sites 41HR315 (Patterson 1980a) and 41FB42 (Patterson et al. 1993c). Specimens fairly close to the Bulverde type were found in the Middle Archaic at site 41WH19 (Patterson et al. 1987). Prewitt places the

Bulverde point in a time interval of 4000-3400 B.P. in Central Texas, and Turner and Hester (1985:73) give a time range of 5000-4500 B.P. for this point type.

The Pedernales point is found in both the Middle and Late Archaic periods. This point type was found in the Middle Archaic period at sites 41AU37 (Hall 1981), 41AU1 (Duke 1982:Figure 2) and 41FB34, with a radiocarbon date of 5210 +/-110 B.P. (I-15510) at site 41FB34 (Patterson 1989e). The Pedernales point occurs in the Late Archaic at sites 41FB42 (Patterson et al. 1993c) and 41AU1 (Duke 1982:Figure 2). In Central Texas, various investigators have given time ranges for the Pedernales point that start as early as 4000 B.P and end as late as 2600 B.P. (Prewitt 1981, Turner and Hester 1985:139). When all of the available data are considered, the Pedernales point may have a time range as long as 5000-2600 B.P.

Even though the Morhiss point is commonly found in adjacent South-Central Texas, this point type is rare in Southeast Texas. There might be an occasional identification problem, where possible Morhiss points are classified as other stemmed types, but this does not change the conclusion that the Morhiss point is not common in Southeast Texas. Turner and Hester (1993:158) place the Morhiss point in the Late Archaic period, ca. 800 B.C. At site 41FB223 (Patterson et al. 1994) a Morhiss point was found in a Late Archaic excavation level.

The Gary-Kent series of straight and contracting stem points starts in the Middle Archaic at sites 41AU37 (Hall 1981), 41PK69 (Ensor and Carlson 1988), 41HR315 (Patterson 1980a) and 41HR5 (Doering site, Wheat 1953). A large body of data exists for these point types then continuing through the Late Archaic, Early Ceramic and some portion of the Late Prehistoric. Concurrent use of the spear and bow and arrow in the Late Prehistoric period is discussed below. Gary and Kent points tend to be smaller in the Early Ceramic and Late Prehistoric periods (Ensor and Carlson 1991, Keller and Weir 1979), Patterson 1980a). Because of the long time span of Gary and Kent points, these point types are not good temporal markers, but do demonstrate technological continuity. Gary and Kent point types are considered here as a morphological series because these two point types are often found together at the same excavation levels at archeological sites, and because of the morphological overlaps that frequently occur. It is often an arbitrary choice in classifying a specimen as Gary or Kent. Some early projectile point types of Southeast Texas are shown in Figure 3.

LATE ARCHAIC AND EARLY CERAMIC PROJECTILE POINTS (3500-1400 B.P.)

Most projectile point types of the Late Archaic (3500-1900 B.P.) also occur in the Early Ceramic (1900-1400 B.P.) in Southeast Texas (Patterson 1989f). These types include Gary, Kent, Darl, Yarbrough, Ensor, Ellis, Fairland, Palmillas and Marcos. The Ponchartrain point is a minor dart point type in this region from Louisiana that occurs in the Late Archaic period, at a few sites such as 41HR315 (Patterson 1980a). The chronology of Fairland and Marcos points used here is based on references by Turner and Hester (1985). Both Marcos and Fairland are Central Texas point types. Hall (1981) has data from the Allens Creek sites for Fairland points in the Late Archaic.

Gary, Kent, Darl, Yarbrough, Ensor, Ellis and Palmillas dart points occur in both the Late Archaic and Early Ceramic periods (Patterson 1989f), and these various point types are often found at the same archeological sites (Patterson 1990b). The covariation of these point types is possibly some combination of hafting methods, stylistic preferences, and a high degree of contact between bands in a period of high population. Because dart point styles are often mixed at individual sites during these time periods, it would be difficult to identify individual social groups by use of point types (Patterson 1990b). It may be seen in Table 8 that Gary and Kent dart points were the dominant types in this region during these time periods, as previously noted by Shafer (1975).

One of the reasons for covariation of stemmed dart point types at archeological sites in this region, including Kent, Gary, Darl, Yarbrough, and Palimillas types, is that some specimens of these point types may be manufacturing variants of the same point type. For example, the removal of only a few flakes will change a Kent type to a Gary type. Due to the manufacturing variables involved in the flintknapping process, such as raw material quality and shape, and flintknapper skill, there will be some morphological variation in a point type made by an individual craftsman. The manufacturing variation will be even greater when many craftsmen are involved in a region. Thus, there are inherent limitations to the diagnostic value of typology of Gary and Kent points.

The use of bone dart points is fairly common during the Early Ceramic period on the coastal margin (Aten 1983:262). This reflects the lack of lithic materials in this subregion.

LATE PREHISTORIC DART POINTS (1400-500 B.P.)

On the coastal margin of Southeast Texas, the use of the spear was mostly discontinued during the Late Prehistoric (Aten 1983:306), in favor of use of the bow and arrow. Cabeza de Vaca (Covey 1961:61) stated that the bow and arrow was the only weapon system used by Indians in the coastal margin area of Galveston Bay. The spear and spearthrower (atlatl) continued to be used together with the bow and arrow in the inland subregion, as shown at many excavated sites (Aten 1967, Keller and Weir 1979, Ensor and Carlson 1991, McClurkan 1968, Patterson 1980, Patterson et al. 1987, Shafer 1968, Wheat 1953). There is ample evidence to show that concurrent use of the spear and bow and arrow occurred in the Late Prehistoric period. This conclusion is not likely to have been affected by stratigraphic mixing at all of the excavated sites involved. Small Gary and Kent dart points are the principal types found in the Late Prehistoric in this region, as well as a few Ellis and Ensor specimens. Some Indians in the central and eastern part of the Gulf coastal plain are also known to have used both the spear-spearthrower and bow and arrow weapon systems (Hudson 1976:76), with ethnographic examples available. In A.D. 1543, Spaniards recorded use of the spear-thrower with six-foot spears on the Gulf coast at the mouth of the Mississippi River (Hudson 1976:116). Use of two weapon systems may have given some adaptive advantage. For example, the bow and arrow is not a good wet-weather weapon system. Bowstrings do not work well when wet, especially if made of sinew (Pope 1974:36).

Some late projectile point types of Southeast Texas are shown in Figure 4.

ARROW POINT CHRONOLOGIES

INTRODUCTION OF THE BOW AND ARROW

There seems to be some agreement that the bow and arrow was introduced into southern North America from the Old World (Ford 1974:402, Feidel 1987:146). There is little interest, however, concerning the diffusion and local adaptation processes for this weapon system. This is surprising since many archeologists state interest in processual studies. There seems to be an accepted dogma that the bow and arrow started at A.D. 500-700 throughout most of the U.S. (Patterson 1982,1992a). There is increasing evidence, however, that the bow and arrow started earlier in southern North America, near the start of the Late Archaic period (Aikens 1970, Odell 1988, Patterson 1982,1992a). The impact of the possible early use of the bow and arrow seems to have been generally overlooked. Wenke (1990:565) has noted a sharp increase in population in eastern North America from about 800 B.C to A.D. 800. Based on Odell's (1988) study of early use of the bow and arrow with unifacial points, Wenke (1990:568) then notes that "The use of such projectile points seems to have increased dramatically after about four thousand years ago, and by the first few centuries A.D. the bow and arrow may have been adding enough extra production to some economies that significantly higher population densities were possible." The bow and arrow is not only a more efficient hunting weapon than a spear, but the bow and arrow also allows hunting of a wider range of animals, especially smaller species. As Hayden (1993:Figure 6.12) has noted for the Eurasian Mesolithic, technological innovation, such as the bow and arrow, allowed hunter-gatherers to exploit a wider range of food resources.

There is an open question for proponents of late introduction of the bow and arrow. If the bow and arrow started at about A.D. 600 in Southeast Texas, at the start of the Late Prehistoric period, why was there a significant decline in population at the same time (Figure 10), when the bow and arrow, a more efficient hunting weapon, should have helped to sustain the population level?

I have proposed that diffusion of the bow and arrow initially included small prismatic blade technology and the use of unifacial arrow points (Patterson 1973, 1982, 1992a). Industries to manufacture small prismatic blades occur in increasingly later time as a diffusion pattern from the Arctic southward into southern North America (Patterson 1973, Hester 1976:Figure 13-5). Unifacial arrow points are generally marginally retouched flakes. Excavation stratigraphy at site 41HR315 (Patterson 1980a) indicates that unifacial arrow points started some time near the start of the Late Archaic period (1500 B.C.). Some examples of unifacial arrow points are shown in Figure 5. These specimens are similar to specimens published by other investigators in Southeast Texas (Ensor and Carlson 1991:Figure 42 S,T, McClurkan 1968:Figure 48). The start of bifacial arrow point styles at about A.D. 600, such as Scallorn in Central Texas and Perdiz in Southeast Texas, suggests the standardization of types rather than the introduction of the bow and arrow. Unifacial arrow points are fairly common in Southeast Texas as shown in Table 5. One indication that unifacial points were used as arrow points is that single specimens from sites 41HR210 (Patterson 1975b) and 41WH73 (Patterson and Hudgins 1993) had asphalt on the basal portions of the points, which would indicate hafting. This type of artifact is often overlooked in lithic flake collections (Patterson 1994a). Many archeologists in North America associate arrow points only with bifacial forms. This is surprising, considering that unifacial arrow points were the main type used in the Eurasian Mesolithic, which would have been part of the bow and arrow technology introduced into the New World.

GENERAL COMMENTS ON BIFACIAL ARROW POINTS

The time ranges of major arrow point types in Southeast Texas are not well-defined with radiocarbon dates, compared to the Scallorn-Perdiz sequence in Central Texas. Only the Perdiz point on the Southeast Texas coastal margin has a series of radiocarbon dates that cover the complete time range for use of this point type. For the inland portion of Southeast Texas, excavation sequences and a few radiocarbon dates must be used to study the chronologies of arrow point types.

There are two common errors made by investigators in developing arrow point chonologies in Southeast Texas. The first is the tendency to use the Scallorn-Perdiz chronological sequence of Central Texas for Southeast Texas. There are no data to support this assumption, but much data to refute it. The second common error is to attempt to force a chronological sequence of arrow point types with little temporal overlap between types, when there are no supporting data. It appears to be wishful thinking that all arrow point types fall into a serial chronological sequence. No serial sequence has yet been found for major arrow point types in this region.

Lithic traditions in Southeast Texas can only be understood if consideration is given to this region as an interface between technological traditions of the Southern Plains and Southeast Woodlands. This is shown in Table 6 for the geographic distributions of arrow point types within inland Southeast Texas. The Perdiz point appears to be the only really indigenous arrow point type in this region, with a fairly uniform geographic distribution in all zones. The Scallorn point is essentially a Central Texas type, with a sharp decrease in frequency of occurrence in the eastern part of Southeast Texas. Catahoula and Alba points are essentially Louisiana types, with sharp decreases in occurrences in the western portion of Southeast Texas. The mix of arrow point traditions in Southeast Texas has likely given this region a separate arrow point chronology, compared to adjacent regions.

PERDIZ POINT CHRONOLOGY

Aten (1983:306) states that the bow and arrow started at about A.D. 600 on the Southeast Texas coastal margin, based on bifacial arrow point types. The time range for radiocarbon dates associated with the Perdiz point at this location is A.D. 640-1560 (Aten 1983, Patterson 1989b). Most of the radiocarbon dating is from Rangia shell samples. Although stratigraphic location of the earliest arrow point specimens at inland site 41HR273 has been dismissed as due to soil disturbance (Ensor and Carlson 1991:219), these specimens (Catahoula and Perdiz) may actually give support to Aten's (1983:306) starting date of about A.D. 600 for bifacial arrow points in this region. The deepest excavated arrow point at site 41HR273 (Mueller-Wille, Ensor, and Drollinger 1991:Table 16) is a Perdiz point. The latest time for the start of arrow points, including the Perdiz point, at this site is about A.D. 800 (Ensor and Carlson 1991:215). At site 41WH12 (Patterson and Hudgins 1989a), a radiocarbon date shows that the Perdiz point started earlier than A.D. 900 in the Western Zone of Southeast Texas, again demonstrating that the Perdiz point started earlier in Southeast Texas than its start in Central Texas at about A.D. 1200 (Turner and Hester 1993:227). At site 41PK8 in Polk County, radiocarbon dates indicate that the Perdiz point could have started as early as A.D. 540, or shortly thereafter (McClurkan 1968:11).

While there are not enough radiocarbon dates to define the time range for the Perdiz point in all areas of inland Southeast Texas, there are several excavation sequences to show that the Perdiz point was used throughout the entire Late Prehistoric period and into the Historic Indian period. The data also show that the Perdiz arrow point started as early as any other arrow point type in this region. Wheat (1953:Table 5) demonstrates that the Perdiz point was being used throughout the Late Prehistoric portions of the excavated sequences at the Kobs and Doering sites in Harris County. The Perdiz point was also found throughout most or all of the Late Prehistoric period at sites 41HR315 (Patterson 1980a:Table 6) in Harris County, 41WH19 (Patterson et al. 1987) in Wharton County, 41PK69 in Polk County, 41HR273 (Mueller-Wille, Ensor and Drollinger 1991:Table 16) in Harris County, and 41FB42 (Patterson et al. 1993a) in Fort Bend County.

A radiocarbon date of A.D. 1585 +/-80 (SI-6455) for site 41WH19 (Patterson et al. 1987) in inland Southeast Texas indicates that the Perdiz point was still being used during the Historic Indian period. In the computerized data bases, all Cliffton arrow points have been classified as Perdiz, as Cliffton points appear to be simply crude examples of the Perdiz point type (Turner and Hester 1985:169).

SCALLORN POINT CHRONOLOGY

There are not enough radiocarbon dates available to conclusively show the starting date of the Scallorn point in Southeast Texas. The Scallorn point starts about A.D. 600 and terminates about A.D. 1300 in Central Texas, shortly after the introduction of the Perdiz point at about A.D. 1200 (Prewitt 1983:Table 1). The time range for the Scallorn point is different in Southeast Texas than in Central Texas. As Hall (1981:103) has observed, Scallorn arrow points commonly date between A.D. 900 and A.D. 1600 along the Texas Coast (Aten 1971, Corbin 1974). Data indicate that the Scallorn point was introduced into Southeast Texas from Central Texas somewhat later than the A.D. 600 starting date for the Perdiz point, but perhaps not much later. Hall (1981:103) shows Scallorn points occuring earlier than Perdiz points at site 41AU37 in Austin County, but the earliest date for the Scallorn point is A.D. 920, which is too late for the Scallorn point to start earlier than the Perdiz point in Southeast Texas. A radiocarbon date at site 41WH12 (Patterson and Hudgins 1989) demonstrates that the Perdiz point was present in the western part of Southeast Texas before A.D. 900.

Data from excavations indicate that the Scallorn point was in use throughout most of the Late Prehistoric period and continued into some portion of the Proto-Historic period in Southeast Texas (Wheat 1953:Table 5, Hall 1981:103, site 41FB42 (Patterson et al. 1993c) Late use of the Scallorn point in Southeast Texas is shown by radiocarbon dates of A.D. 1480 +/-80 (TX-2126) at site 41AU37 (Hall 1981:103) in Austin County and A.D. 1585 +/-80 (SI-6455) at site 41WH19 (Patterson et al. 1987) in Wharton County.

CATAHOULA AND ALBA POINT CHRONOLOGIES

There are no radiocarbon dates to define the start of Catahoula and Alba arrow point types in Southeast Texas. These point types start about A.D. 600 in Louisiana (Jeter and Williams 1989:148), in the Troyville Culture of the lower Mississippi valley. Data from some excavated sites in Montgomery County show that the Catahoula point starts before the Perdiz point (Shafer 1988). However, data from other excavated sites do not support the conclusion that the Catahoula point starts before the Perdiz point. At site 41PK8 in Polk County (McClurkan 1968:Table 6), Alba, Catahoula and Perdiz points all start at about the same time and all of these point types continue through most of the Late Prehistoric period. At site 41PK88 (McClurkan 1968:Table 32), Perdiz and Alba points start earliest, with Catahoula points found only in later excavation levels. At the Kobs site (Wheat 1953:Table 5) in Harris County, Catahoula and Perdiz points start at about the same time and continue throughout the Late Prehistoric. At the Doering site (Wheat 1953:Table 5), the Perdiz point starts at the beginning of the Late Prehistoric and continues through this period, while the Catahoula point is found only in upper later excavation levels of this time period. It should be noted that Wheat refered to the Catahoula point type as "Alba Barbed." At site 41HR273 (Ensor and Carlson 1991:Tables 15-17) in Harris County, Alba and Catahoula points are found throughout most of the excavation sequence for the Late Prehistoric.

ARROW POINTS IN THE HISTORIC INDIAN PERIOD

Data above suggest that the Perdiz and Scallorn point types were used in the Proto-Historic Indian period. There are data from Wharton County to show use of other arrow point types in the Historic Indian period. At site 41WH8, (Hudgins 1984), Cuney, Fresno, Guerrero and Bulbar Stem arrow points occur in a large surface collection that definitely represents the Historic Indian period. None of these arrow point types from 41WH8 are major types in

Southeast Texas. Of these four arrow point types, only Guerrero occurs exclusively in the Historic Indian period (Turner and Hester 1993:216), with the other three types found in both Late Prehistoric and Historic Indian period contexts.

ARROW POINT CHRONOLOGICAL SUMMARY

It is proposed here that the Perdiz point is probably the only indigenous arrow point type in Southeast Texas, and that this point type starts at least as early as any other major arrow point type in this region. It is also concluded that all four major arrow point types in Southeast Texas (Alba, Catahoula, Perdiz, Scallorn) were in concurrent use over most of the Late Prehistoric period. This is probably a disappointing conclusion for many archeologists who were hoping for a well-defined serial sequence of arrow point types in Southeast Texas for use as a chronological guide to subperiods within the Late Prehistoric. There is a good scenario for the general lack of a chronological sequence of major arrow point types in this region. The situation is due to there being only one indigenous arrow point type (Perdiz), with other arrow point types introduced from adjacent regions and then all being used concurrently. There are a number of excavated sites where the major arrow point types occur continuously or almost randomly in various portions of the Late Prehistoric. Examples are sites 41HR5,6 (Wheat 1953:Table 5), 41HR273 (Mueller-Wille, Ensor and Drollinger 1991:Tables 15,16,17), 41MQ6 (Shafer 1968:Tables 3,4,5,6), 41PK8 (McClurkan 1968:Table 6), 41HR315 (Patterson 1980a:Table 6), and 41WH19 (Patterson et al. 1987:Table 2). The body of data is now too large to simply dismiss because of possible stratigraphic mixing.

Another indication of the concurrent use of the four major arrow point types in Southeast Texas can be shown by the frequencies of point type occurrences at individual sites, either with more than one point type together or with one type alone (Patterson 1991c:Table 2). For the entire inland portion of Southeast Texas, the Perdiz point is found alone at only 32% of the sites having this point type. The proportion of sites that have only Scallorn points is 27%, the proportion of sites with only Catahoula points is 9%, and those with only Alba points is 8%. Thus, there is a much higher proportion of sites where major arrow point types occur together than alone. There appears to have been much interaction between cultural groups of this region and adjacent regions during the Late Prehistoric time period. Aside from the four major arrow point types in this region, a number of minor types are summarized in Table 6.

GEOGRAPHIC DISTRIBUTIONS OF PROJECTILE POINT TYPES

The geographic distributions of many projectile point types are not uniform throughout Southeast Texas. It has been noted above that Southeast Texas is an interface for technological traditions of the Southern Plains and Southeast Woodlands, and that some projectile point types in Southeast Texas demonstrate influences from the north. There are also some projectile point types found in this region that belong to more localized technological traditions. There are both major and minor technological influences on Southeast Texas. Major technological influences are probably the result of contacts of local bands with external social groups and by social groups from adjacent regions becoming established in Southeast Texas. Justice (1987) has shown that projectile point traditions can diffuse over wide geographic areas. Some projectile point styles in the Southeast Woodlands can be found with continuous distributions from East Texas to the Atlantic coast (Patterson 1991a). Technological traditions can have much broader geographic distributions than ethnic traditions. This is also true of the Albany scraper, that is usually found with San Patrice and Early Side-Notched point types (Patterson 1991a, 1991d). As noted above, some major projectile point styles in Southeast Texas have the same chronological sequence as found in the Greater Southeast Woodlands, proceeding from side-notched to corner-notched to stemmed types (Patterson 1991a, Fagan 1991:310). Some minor projectile point types in Southeast Texas may be the result of trade, of individuals from adjacent regions joining bands in this region, or simply due to the wide-ranging settlement patterns of some cultures.

Projectile point type geographic distributions in Southeast Texas are summarized in Tables 6, 7 and 8 for the inland subregion, and in Tables 9 and 10 for the coastal margin subregion. Geographic zones of Southeast Texas used here are illustrated in Figure 1. It may be seen in a quantitative manner that many projectile point types have definite east-west frequency gradients in Southeast Texas. Traditions of the Southern Plains are represented by point types with maximum concentrations in the Western Zone and decreasing frequencies to the east. The direction of frequency gradients are the opposite for traditions of the Southeast Woodlands. Traditions of the Southern Plains and Southeast Woodlands are found during all prehistoric time periods in Southeast Texas.

Projectile point traditions of the Southern Plains include: Paleo-Indian (Folsom, Midland, Plainview, Meserve, Angostura), Early Archaic (Bell), Middle Archaic (Bulverde, Pedernales, Travis), Late Archaic-Early Ceramic (Marcos, Fairland), and Late Prehistoric (Scallorn). Projectile point traditions of the Southeast Woodlands include: Paleo-Indian (Early Side-Notched, Early Corner-Notched, San Patrice, Dalton, Big Sandy), and Archaic (Gary, Kent, Yarbrough). Traditions specifically from Louisiana include: Archaic (Ponchartrain, Motley, Evans), and Late Prehistoric (Alba, Catahoula). Alba (Justice 1987:Map 103) and Catahoula (Patterson 1976b) arrow points have wide geographic distributions to the east and northeast of Southeast Texas.

Johnson (1989) has noted the occurrence of Plains types of Paleo-Indian projectile points in the eastern woodlands in eastern Texas, eastern Oklahoma, western Arkansas, and western Louisiana. Johnson's survey supports the conclusion that there is no sharp boundary between technological traditions of the Southern Plains and Southeast Woodlands, but rather a geographic zone that represents an interface between these technological traditions. A major reason for a mix of technological traditions in a zone of interface is that hunter-gatherer settlement patterns are not static, as shown by ethnographic examples given by Binford (1983).

Some projectile point types found in Southeast Texas can be regarded as outliers or fringe influences. Point types in this category include: Folsom, Midland and Bell from the west; Ponchartrain, Motley and Evans from the east; and Dalton, Scottsbluff and possibly Trinity from the north. A number of minor arrow point types in Southeast Texas, including Bassett, Bonham, Colbert, Friley, Maud, and Washita, represent fringe influences on the northern edge of this region. This is another indication that Caddo influences did not extend very far south into Southeast Texas. After the Paleo-Indian period, there are a number of projectile point types in Southeast Texas that represent shared traditions with adjacent regions, rather than traditions that are primarily centered in adjacent regions. The geographic distributions of projectile point types in the various zones of the coastal margin of Southeast Texas are similar to those of the inland subregion. Since the coastal margin lacks lithic resources, some projectile points in this subregion may be the result of trade with inland Indians.

CERAMIC CHRONOLOGIES

Pottery started at about A.D. 100 in the Galveston Bay Area (Aten 1983:Figure 14.1), probably as a westward diffusion from Louisiana. Aten and Bollich (1969) note that pottery started earlier in the Sabine Lake area at the Texas-Louisiana border, possibly by 70 B.C. (Aten 1983:297). The use of pottery seems to have diffused at a slow rate, first along the eastern portion of the coastal margin in Southeast Texas and then inland. The use of pottery generally had a slow diffusion rate. The earliest pottery in the Southeast started about 4500 B.P. in Georgia (Sassaman 1993:16), but it took nearly two millennia for pottery to become accepted throughout the Southeast (Sassaman 1993:3). Aten (1983:297) states that pottery reached the Brazos River Delta by at least A.D. 300. Aside from the Galveston Bay Area, the starting time of pottery is not well-defined in other parts of the region. Aten's (1983:Figure 14.1) sequence of pottery types in the Galveston Bay area is not totally duplicated in other parts of this region. At many sites in Southeast Texas, only Goose Creek pottery is found, which was made throughout the Early Ceramic and Late Prehistoric periods. Aten (1983) should be consulted for detailed descriptions of pottery types. Pottery types are classified mainly by paste and temper types, with subtypes for incised decoration. Only limited examples can be given here for temporal placement of pottery types within partial intervals of the Late Prehistoric and Early Ceramic periods.

Goose Creek sandy paste pottery is the main ceramic type found in Southeast Texas, during all time periods of ceramic use. This pottery type has little value in distinguishing between the Early Ceramic, Late Prehistoric and Historic Indian time periods. One rare variety of Goose Creek, Goose Creek Stamped, does indicate the early part of the Early Ceramic period (Aten 1983:Figure 14.1). Aten describes a number of subtypes of Goose Creek pottery that do not seem to have any definite temporal significance within the various time periods. There is no orderly temporal sequence of incised pattern types on Goose Creek pottery, but incised patterns may have at least some time-diagnostic value. Aten (1983:figure 12.2) shows that only simple incised patterns were used in the Early Ceramic period, while both simple and complex patterns were used in the Late Prehistoric. Black (1989) has illustrated many incised patterns for pottery in this region, but no temporal significance has been assigned. Winchell and Ellis (1991) have developed a classification system for pottery of Southeast Texas based on surface treatment. It remains to be seen if this classification method can be applied successfully to the chronological sequence of this region.

According to Aten's ceramic sequence, minor types that are found only in the Early Ceramic period include Goose Creek Stamped, Tchefuncte, Mandeville and Conway. Conway is like Goose Creek except that Conway has very coarse sand tempering, with sand grains being distinctly visible. Usually the large sand grains in Conway pottery are visible without need for magnification, often on the surface of sherds. Aten (1983:238) renamed Conway as O'Neal Plain, variety Conway, but there seems to be little advantage for use of this longer name. Tchefuncte pottery has a contorted paste without sand. Mandeville is like Tchefuncte with a contorted paste, but Mandeville paste is sandy. It has not been determined for Southeast Texas if Tchefuncte and Mandeville are separate technological entities, or simply the result of choosing different clay sources. Aten (1983:237) notes that rare sherds of Goose Creek Cord-Marked pottery are found on the coastal margin during the Early Ceramic period. Small amounts of cord-marked sherds are found at a few inland sites, such as 41HR273 (Winchell and Ellis 1991:81).

San Jacinto grog-tempered (sherd tempered) pottery occurs as a major pottery type in the Late Prehistoric period on the coastal margin of Southeast Texas, with a more limited distribution in the inland subregion. San Jacinto pottery is a good time indicator of the Late Prehistoric. There is no defined temporal sequence for incised pottery patterns on San Jacinto pottery (Aten 1983:Figure 12.2). Even though Aten (1983) names several varieties of grog tempered pottery, all grog tempered pottery is refered to here under the general San Jacinto type name, due to historic precedence in research, and the fact that all subtypes of grog tempered pottery have the same time range (Aten 1983:Figure 14.1). The subtype of grog tempered pottery that Aten (1983:241) calls Baytown Plain, variety Phoenix Lake, with abundant grog temper, is only found on the coastal margin. The occurrence of some pottery with grog temper at inland sites does not necessarily represent visits by Indians from the coastal margin. The use of abundant grog temper mainly on the coastal margin tends to support the concept that principal activities of Indians of the coastal margin were largely confined to this subregion. Aten (1983:241) did not sort varieties of grog-tempered pottery for his study of the coastal margin of Southeast Texas.

Bone-tempered pottery is a minor type throughout this region, with varying temporal placement in different parts of the region. Bone-tempered pottery was found in both Early Ceramic and Late Prehistoric context at site 41HR315 (Patterson 1980a) in the inland Central Zone of Southeast Texas. Bone-tempered pottery was found throughout the Late Prehistoric sequence at site 41WH12 (Patterson and Hudgins 1989a, 1990) in the inland Western Zone of this region, including strata with radiocarbon dates of A.D. 900 +/-80 (I-15944) and 990 +/-80 (I-16221). At this site, bone tempered pottery is probably of the Leon Plain type (Suhm and Jelks 1962:95), also found in the Colorado River Basin of Central Texas. On the coastal margin of Southeast Texas in the Galveston Bay area, bone tempered pottery is found in small quantities principally in the later part of the Late Prehistoric (Aten 1983:Figure 14.1). Caddo pottery, which is sometimes bone-tempered, is a rare ceramic type in most of Southeast Texas in the Late Prehistoric, found mainly on the northern fringe of this region (Patterson 1992d:Table 4). The largest amount of Caddo pottery has been found in Polk County (McClurkan 1968). Aten (1983:244) observes that "Bone-Tempered pottery classification is a problem to be solved elsewhere than on the upper Texas Coast".

Asphalt coated pottery is a rare type on the upper Texas coastal margin, possibly related to Late Prehistoric and Historic Indian Rockport pottery of the Central Texas coastal margin (Ricklis 1992). Rockport Plain and Asphalt Decorated pottery is found in the Western Zone of Southeast Texas, in the Late Prehistoric and Historic Indian periods as on the Central Texas coast. Suhm and Jelks (1962:135) describe Rockport pottery as having a fine sandy appearance, with no visible tempering material; occasionally, however, bone temper is added. This is a well-fired pottery type with a homogeneous appearance. Rockport pottery is associated with Karankawa Indians (Ricklis 1992).

GEOGRAPHIC DISTRIBUTIONS OF CERAMIC TYPES

Ceramic type geographic distributions in Southeast Texas are summarized in Table 11 for the coastal margin and in Table 12 for the inland subregion. Goose Creek sandy paste pottery is the most significant pottery type in all parts of the region. There is a smaller amount of Goose Creek pottery in the Western Zone than in the Central and Eastern Zones, which is consistent with Aten's (1971:Figure 10) model of the slow diffusion of pottery down the Texas coast from the Louisiana border to Corpus Christi Bay. Aten's model shows that pottery started about 600 years later at Corpus Christi Bay than at Galveston Bay. Rockport Asphalt Decorated pottery seems to have followed this east-to-west diffusion pattern down the Texas coast. Ricklis (1992:214) gives the start of Rockport pottery at about A.D. 1250 at Corpus Christi Bay, while to the northeast there is a radiocarbon date of A.D. 990 associated with Rockport Asphalt Decorated pottery at site 41WH12 in Wharton County (Patterson and Hudgins 1989a, 1990). Asphalt decorated pottery did not develop in the western part of Southeast Texas, but probably in some part of the northeast section of the Central Texas coast. Most of the Rockport pottery found in the Western Zone of Southeast Texas is from a single inland historic Indian site, 41WH8 (Hudgins 1984). Few significant amounts of Rockport pottery have been found east of the San Bernard River. Rockport pottery was found slightly east of this river at site 41BO167 in Brazoria County (Patterson and Hudgins 1988).

San Jacinto grog-tempered pottery is primarily a coastal margin type in the late Prehistoric, as shown in a comparison of Tables 11 and 12. Even the relatively small amount of San Jacinto pottery found at inland sites may be over-estimated. Analysts not familiar with coastal margin pottery types tend to see random irregularities in ceramic paste as representing grog tempering (Aten 1983:239). The geographic distribution of San Jacinto pottery will be discussed further in relation to mobility-settlement patterns of Indians of the coastal margin. Bone tempered pottery seems to have diffused into Southeast Texas from the north and from Central Texas, but not in a uniform manner.

CHAPTER 3

REPRESENTATIVE ARCHEOLOGICAL SITES

GENERAL COMMENTS

References are made throughout this volume to details from individual archeological sites. This chapter discusses some of the key sites involved. Most archeological sites in this region are campsites, with few examples of specialized task sites. There are no published examples of quarry sites, satellite hunting and gathering sites, or specialized lithic workshops. One bison kill site has been published (McReynolds, Korgel, and Ensor 1988). A few of the smaller Rangia shell middens on the coastal margin seem to have been brief visits mainly to obtain Rangia shellfish, without indications of other activities. In both the inland and coastal margin subregions, there are small sites representing short occupation stays, and larger sites representing longer occupation periods. As discussed in other report sections, it is difficult to determine whether larger sites are the result of long repeated stays by small groups, or short stays by large groups. All of the representative sites summarized here can be regarded as medium to large sites in terms of artifact quantities, unless stated otherwise.

Data from both excavated sites and surface collections from deflated or disturbed sites are important to develop a complete regional synthesis. Excavations of multi-component stratified sites provide data for chronological sequences of artifact types. Radiocarbon dates from single site components are also important to develop regional chronologies. As shown in Table 19, multi-component sites are more common than single component sites. After chronological sequences for artifact types have been established, surface collections from specific sites become important for the study of geographic distributions of artifact types and settlement patterns. In Southeast Texas, surface collections are especially important because surface collections are more numerous than excavated sites. Story (1990:211,365) has stressed the importance of data from surface collections. In this region, most of the important surface collections have been made and published by avocational archeologists. Surveys by professional archeologists locate many sites, but generally do not find many diagnostic artifacts. As Story (1990:211) observes, collectors and avocational archeologists spend more time looking for artifacts than do professional archeologists.

There is little to be said about the surface appearance of most sites in this region, other than that sites are generally located at well-drained locations near water sources, or near shellfish resources. Except for large Rangia shell middens, most archeological sites in this region have low surface visibility. There are seldom visible structural features such as mounds or earthen walls at sites in this region. Evidence of shelters is generally missing. Prehistoric sites are usually found due to natural erosion or modern disturbance of the surface. Sites are often found due to the activities of burrowing animals. The stratigraphic integrity of sites is most often destroyed by natural erosion, urban development, farming activities, and pothunting. Stratigraphic mixing can also occur at sites located on stable land forms, because of slow soil buildup.

INLAND SURVEYS AND SURFACE COLLECTIONS

Several intensive surface surveys have been done in various areas of Southeast Texas. William McClure has recorded many sites on White Oak Bayou in northern Harris County, and has published 27 of these sites. Joe Hudgins has recorded over 85 sites in eastern

Wharton County and western Fort Bend County, and has published surface collections for several of these sites. The Houston Archeological Society has excavated a number of sites that were found by Hudgins. The author has recorded over 50 sites in western Harris County, and has published many of these sites. Alan Duke has done intensive survey work in several areas of this region. Publications for all of the above surveys are referenced in the regional bibliography by Patterson (1995a).

One of the best examples of collection documentation in this region is the Andy Kyle collection (Kindall and Patterson 1986). Mr. Kyle collected from many sites in the eastern part of this region, and maintained labeled collections for each specific site. A total of 78 recorded sites in seven counties are represented by this collection. The total collection contains at least 5000 projectile points. The Kyle surveys resulted in a major contribution to the archeological data base for the otherwise poorly surveyed Eastern Zone of Southeast Texas. All prehistoric time periods are represented, from Paleo-Indian through Late Prehistoric, with many of the sites having very long occupation sequences. This collection demonstrates that there are a significant number of prehistoric sites in the Eastern Zone in all time periods.

Collections made by James Lockwood on five sites in northern Harris County are especially important because of the many artifacts from the Paleo-Indian and Early Archaic periods. There were 106 Paleo-Indian points found at site 41HR343 (Patterson et al. 1992a), including Clovis, Folsom, Midland, Dalton, Plainview, Scottsbluff, San Patrice, Early Side and Corner Notched, Angostura, and several miscellaneous lanceolate types. This site starts with Clovis and has an occupation sequence through all later time periods, into the Historic Indian period with a glass graver. Site 41HR354 (Patterson et al. 1992b) had a collection with an occupation sequence from the Paleo-Indian period through the Late Prehistoric time periods. Bell points of the Early Archaic were especially well-represented. Three other sites, 41HR730,731,732, had small collections of Paleo-Indian projectile points, and some points from later time periods.

Many surface collections of this region have now been published that have very long occupations. Some examples of sites that start in the Paleo-Indian period and continue through all later time periods into the Late Prehistoric include: 41HR182 (Patterson 1985a, 1990g), 41HR206 (Patterson 1980c), 41HR571 (Patterson 1986a), 41HR624 (Patterson, Marriott and Marriott 1990), 41HR641 (Patterson 1990f), and 41HR89 (McClure 1977). There are large collections of projectile points and ceramics from these sites, with representative point types for each time period. Some of these collections have over 100 projectile point specimens. There are 188 published surface collection for the inland subregion of Southeast Texas, which is 63% of the total archeological site reports published for this subregion.

INLAND EXCAVATED SITES

There are four excavated sites in inland Southeast Texas that have occupation sequences that cover all time periods from Paleo-Indian through Late Prehistoric. In the early 1950's, Wheat (1953) excavated several sites on the west side of Houston. One of these sites, the Doering site (41HR5), had a very long occupation sequence. This work was done before the current projectile point typology was fully established. The Doering site appears to have had stratigraphic mixing in some, but not all test pits, especially in the deepest strata. Gary points were found at excavation levels deeper than would be expected, and a possible Clovis point fragment was not found at the lowest excavation level. It is still possible, however, to show that this site clearly has four stratigraphic groups, for Paleo-Indian, Archaic, Early Ceramic, and Late Prehistoric periods. Paleo-Indian point types include a possible Clovis specimen (Plate 38l), Angostura (Plates 37s, 38b), Scottsbluff (Plate 38a), San Patrice (Plate 38m), and Early Side-Notched (Plate 37f,g,h). The Archaic period is represented by point types such as Carrollton, Bulverde, Pedernales, and Gary-Kent. There is a definite stratigraphic group for the Early Ceramic period with pottery and a variety of dart point types. There is also a definite Late Prehistoric stratigraphic group with Perdiz, Catahoula, and Scallorn arrow points. Dart points continued into the Late Prehistoric period. The Doering site is also important because of faunal remains from all excavation levels, and many lithic tool types other than projectile points.

Site 41HR315 (Patterson 1980a) in northwest Houston had an occupation sequence from the Late Paleo-Indian period through the Late Prehistoric. The deepest excavation level had Plainview, Early Stemmed, Angostura, and San Patrice points. There was an Archaic projectile point sequence starting with Carrollton, then Bulverde, Pedernales, and the Gary-Kent series. Several point types were found in both the Late Archaic and Early Ceramic periods. Perdiz arrow points were at all excavation levels in the Late Prehistoric. Fired clayballs occurred in all occupation periods. Unifacial arrow points and small prismatic blade technology were found as early as the middle level of the Archaic period. Dart points continued into the Late Prehistoric period.

Site 41WH19 (Patterson et al. 1987) in eastern Wharton County was an unusually deep, well-stratified site with an occupation sequence from the Early Paleo-Indian period until protohistoric time. Folsom and Early Side-Notched points were found in the lowest excavation level, below a Plainview point. The Late Paleo-Indian excavation levels had a San Patrice point, a variety of Early Notched points, and a few Early Stemmed points. A variety of miscellaneous stemmed points with well-ground basal edges were found in the Early to Middle Archaic levels. Gary and Yarbrough points were found in the upper Levels of the Archaic period. Early Ceramic period excavation levels had Gary, Kent,and Yarbrough dart points. Late Prehistoric excavation levels had Edwards, Perdiz, and Scallorn arrow points, as well as a few dart points. Perdiz was the earliest arrow point type.

Fired clayballs were found at all excavation levels of site 41WH19. A variety of heavy Paleo-Indian unifacial tools was found. This is the first site to clearly establish the chronological position of Early Notched point types in this region. The site chronology is bracketed by radiocarbon dates of 9920 +/-530 B.P. (AA-298) and A.D. 1585 +/-80 (SI-6455). There is a significant surface collection from an eroded area of 41WH19. Meserve and Scottsbluff points were found on the surface, together with all of the Paleo-Indian point types found in the excavations. Archaic dart point types in the surface collection include Carrollton, Bulverde, Pedernales, Travis, Nolan, Williams, Gary, Kent, Marcos, Darl, Yarbrough, Palmillas, Morhiss, and Ellis. Arrow points in the surface collection include Perdiz, Scallorn and Catahoula.

Site 41PK69 (Ensor and Carlson 1988) in Polk County had an occupation sequence from Paleo-Indian through Late Prehistoric periods. The investigators concluded that the site was first occupied between 8000 and 7000 B.C. The occupation sequence of this site is difficult to interpret because of stratigraphic mixing. Statistical analyses were used to interpret the artifact sequences. Early Notched points forms were found in the deepest excavation levels. The Gary-Kent series appears to start before 2000 B.C. Both Goose Creek and Caddo-related pottery types were found. Arrow point types of the Late Prehistoric included Alba, Catahoula, and Perdiz.

There are a number of excavated inland sites in this region with multi-component occupations in the later prehistoric time periods. Examples of excavation results from sites with occupations in the Late Archaic, Early Ceramic, and Late Prehistoric periods are: Shafer (1968) for the Lake Conroe area, and McClurkan (1968) for the Lake Livingston area. Projectile point sequences from these sites were typical for this region. Examples of excavated sites with Early Ceramic and Late Prehistoric components are 41HR273 (Ensor and Carlson 1991) and 41WH73 (Patterson and Hudgins 1993). Some details on site 41HR273 are discussed in other sections of this report.

COASTAL MARGIN SURVEYS AND SURFACE COLLECTIONS

Most archeological surveys on the coastal margin of Southeast Texas have been done in the Galveston Bay area. Shafer (1966,1972) and Ambler (1970) conducted surveys in this area that located many sites, but which recovered only small collections of artifacts. At many sites, enough diagnostic artifacts were found to estimate which chronological periods were represented. More recently, Ebersole (1991) and other members of the Houston Archeological Society have conducted a survey in the Galveston Bay area that resulted in recording over 100 additional prehistoric shell middens, but only one of these sites (41CH290) has been published so far.

Surprisingly, with all of the archeological survey work done in the Galveston Bay area, there are few published examples of intensive surface surveys, done with more than one visit to a site. A surface collection from site 41CH290 (Patterson and Ebersole 1992) demonstrates the value of intensive surface collecting on shell midden sites. This site had typical pottery and projectile point types of both the Early Ceramic and Late Prehistoric periods, and some bone tools. Faunal remains showed use of deer, turtle, and fish. Enough diagnostic artifacts were found to definitely identify the two prehistoric time periods. This site is about 200 feet long at the shore line of a brackish water lake. The site has been highly disturbed by wave action, which facilitated collection of large amounts of archeological materials.

There are 144 published surface collections for the coastal margin subregion of Southeast Texas, which is 72% of the total archeological site reports for this subregion. Only 28% of sites published in this subregion have data from excavations.

COASTAL MARGIN EXCAVATED SITES

Aten (1983:Chaper 11) has described several sites along the coastal margin that have been excavated. Ambler (1967,1973) has published data on several excavated sites in the Galveston Bay area. In general, the results of excavations of sites on the coastal margin have yielded data that are consistent with Aten's (1983) synthesis. There is considerable variation in the sizes of Rangia shell midden sites, which reflects variations in the intensity of use of the sites. Small sites represent brief visits, and large sites represent many visits with possible long time periods for each visit.

Dering and Ayers (1977) have described excavations at site 41BO126 in Brazoria County, which has a series of small areas of Rangia shell which each represent a brief site visit. Since other types of faunal remains were not reported, this site seems to have been used for short periods mainly to procure Rangia shellfish, with other portions of the diet obtained at other locations.

Gilmore (1974) has published results of excavations at a small Rangia midden in the Trinity River Delta with occupations in the Late Prehistoric and Historic Indian periods. A variety of faunal remains were recovered, with deer, turtle, fish, alligator, and rabbit being especially important.

The Boys School sites, 41HR80,85 (Aten et al. 1976) are important multi-component excavated sites, with site 41HR80 containing a Late Prehistoric cemetery which is discussed in other sections of this report. Site 41HR85 has a Late Archaic (preceramic) component, and is a Rangia and oyster shell midden. While much of the report on these sites concentrates on mortuary practices, details of excavations and recovered artifacts are given.

The Dow-Cleaver site, 41BO35, is an excavated shell midden on the Brazos River deltaic plain, at the western end of the coastal margin of this region (Aten 1971). It is estimated that the site covered 22.5 acres. Occupation appears to have started about 500 B.C., and continued until historic time. As usual with coastal margin sites, only a small amount of lithic artifacts were found, compared to thousands of potsherds. This site is important because data are given for an area outside of the Galveston Bay area.

Site 41HR82 (O'Brien 1971) is an excavated shell midden on Armand Bayou in Harris County, with Late Archaic, Early Ceramic, and Late Prehistoric components. Rangia shell predominate but there is some oyster shell. This is a small site, about 150 feet in diameter. Goose Creek sandy paste and San Jacinto grog-tempered pottery were found. Projectile points recovered included Kent dart points, and Perdiz, Scallorn, Alba, and Catahoula arrow points. The artifact content is typical of the Galveston Bay area.

Site 41HR639 (Patterson 1990d) is a small Rangia midden on Cedar Bayou at the inland edge of the coastal margin, about 12 miles inland from the coast line of Galveston Bay. This site is about 40 feet in diameter, and is a stratified multi-component site. Both ceramic and lithic artifact types indicate occupations in the Early Ceramic and Late Prehistoric periods. Faunal remains include deer, gar, miscellaneous fish, alligator, turtle, snake, opossum, rabbit, raccoon, and unidentified bird (McClure 1992). Data from more sites of this type are needed to obtain a better picture of full use of the coastal margin to determine seasonal subsistence patterns of Indians of the coastal margin of this region.

CHAPTER 4

PREHISTORIC TECHNOLOGY

LITHIC TECHNOLOGY

LITHIC PROCUREMENT

Southeast Texas is not uniformly endowed with lithic resources. It was common for inland Indians to travel 25 to 50 miles to obtain lithic materials. The only source of large pieces of chert is the Colorado River Basin, in the form of chert nodules in alluvial deposits (Patterson, Hudgins and Sebesta 1994). Smaller chert nodules and pieces of petrified wood are available in the Brazos River Basin (Weber 1991). The Trinity River Basin is a source of petrified wood. Caney Creek and the San Jacinto River (Moore 1995), north of Houston, are sources of small chert nodules and petrified wood. Basically, chert resources are located in the western part of this region and petrified wood resources are mainly located in the eastern part of the region. The geographic distributions of types of lithic materials are reflected by lithic material types found at Indian campsites in various parts of the region. At sites west of Houston, chert is the predominant lithic material, with smaller amounts of petrified wood. At sites east of Houston, petrified wood is the predominant lithic material, with small amounts of chert present. The Kyle collections (Kindall and Patterson 1986) are good examples of the predominant use of petrified wood in the eastern portions of Southeast Texas. Site 41WH19 (Patterson et al. 1987) and site 41HR182 (Patterson 1985a) are examples of the predominant use of chert west of Houston.

Hammerstones are generally made of a coarse grade of quartzite. A few softer hammerstones made of silicified limestone are also found, which can be considered as an exotic material from Central Texas. There is a fine grade of quartzite from the northern part of this region that was used to manufacture projectile points, generally as a small proportion of total lithic assemblages. At site 41HR273, in northern Houston in the Central Zone, lithic flakes were 81% chert, 14% petrified wood, and 5% quartzite (Mueller-Wille et al. 1991:132).

Most large projectile points, of the Paleo-Indian and Archaic periods, found west of the eastern border of Harris County appear to be made of cherts from the Colorado River Basin. This applies roughly to projectile points greater than 50 mm in length. In the eastern portion of Southeast Texas, large projectile points are not common because of the limitations of available petrified wood. Most cherts found in Southeast Texas can be separated only by color (Patterson 1974, 1979b), which is not a sufficient basis to distinguish chert sources. No studies have been made to distinguish chert sources by chemical analysis. Small quantities of Edwards Plateau chert are found at some sites in Southeast Texas.

The trend toward smaller dart points in the Early Ceramic period (Patterson 1980a, Ensor and Carlson 1991) may be related to Indians using nearer lithic resources. For Harris County, this would mean using smaller pieces of chert from the Brazos River, rather than obtaining large chert pieces from farther away in the Colorado River Basin. The trend toward smaller dart points is reflected in byproduct flake (debitage) sizes. At sites such as 41HR315 (Patterson 1980a:Figure 19) and 41WH19 (Patterson et al. 1987:Figure 20) there is a trend toward smaller flake sizes in later time (Figure 8).

Procurement of lithic raw materials in the western and central parts of Southeast Texas seems to have been a logistic activity, not closely embedded in residential subsistence movements. There is no correlation between intensity of lithic manufacturing at campsites and distances from lithic sources.

Only silicified varieties of petrified wood are generally suitable for making thin bifacial dart points, although crude stone tools can be made of non-siliceous types of petrified wood. Since many varieties of silicified petrified wood lack the fine crystal structure of chert, collections of dart points made of petrified wood can have a rather crude appearance. There is a large variation in the quality of various types of petrified wood for flintknapping. For example, one variety of petrified wood that local mineralogists call "golden palm" is a high quality knapping material.

The coastal margin of this region lacks significant lithic resources. Indians of this subregion chose to limit lithic procurement from remote sources, in favor of substituting bone and shell tool materials where possible. Aten (1983:Table 13.4 and page 300) has noted only small amounts of lithic flakes at coastal margin sites, which implies a low level of lithic procurement and manufacturing by coastal margin Indians. Lithic flakes are not always well-documented in site reports. A comparison can be made between inland and coastal margin sites for the relative amounts of lithic flakes, for sites where this type of data was given. In the mid 1995 computerized data bases, inland sites averaged 924 flakes per site and coastal margin sites averaged 56 flakes per site. This clearly shows the higher level of lithic manufacturing activities at inland sites compared to coastal margin sites.

There may be problems in determining the actual level of lithic manufacturing activities at coastal margin large shell midden sites. The large volume of shell would tend to dilute samples of flakes. This would be especially true in the Late Prehistoric period, when only small flakes were produced from the manufacture of arrow points. As another consideration, lithic manufacturing activities would not be expected to have occurred in all areas of large shell midden sites. Therefore, the recovery of flakes in excavation samples would not necessarily relate to the level of manufacturing activity. Still, the relatively low numbers of stone projectile points recovered at most shell midden sites does imply a low level of lithic manufacturing.

LITHIC MANUFACTURING PROCESSES

The most important lithic manufacturing process for most of the prehistoric period in Southeast Texas was the manufacture of bifacial spear points, starting with flake blanks. Flake blanks were obtained in this region by the primary reduction of chert nodules or petrified wood pieces, using a quartzite hammerstone. Since most Indian campsites have yielded few large worked cores or unbroken chert nodules, it appears that most primary reduction was done at the lithic material source. Primary reduction at the lithic source has a great advantage in testing and selecting good material, and in reducing weight of materials to be transported to remote campsites.

After producing flake blanks, the next step would have been heat treating of the blanks. There is much evidence of heat treating of chert in lithic flake collections from sites in this region. Heat treating can be identified by waxy surface luster, and sometimes by a reddish coloration if trace iron compounds are present. Reddish coloration is most often found on the surfaces of heat treated flake blanks, and a highly reduced specimen may not have any remaining surface with reddish coloration. Tan colored flints are most likely to show indication of heat treating by reddish coloration. If chert is heated to too high a temperature there can be potlid surface fracture scars, or even greater material damage. Heat treating can be done experimentally in a home oven at 530 degrees F for 3 hours (Patterson 1979c). Indians would have used a wood fire, probably using a thin covering of soil on the chert to prevent overheating. Most local cherts in Southeast Texas are very tough and difficult to flake. Heat treating lowers the tensile strength about 40% (Purdy and Brooks 1971, Patterson 1981a). There is little archeological evidence to judge if heat treating of chert was commonly done at the lithic source location or at the campsite. Since few Indian sites in this region have very much material that has been damaged by thermal exposure, there is a possibility that heat treating of chert was often done near the lithic source location. In this scenario, only successfully heat treated material would have been transported to the campsite.

Manufacture of bifacial spear points (dart points) was done mainly at campsites in this region, although initial shaping of preforms may have sometimes been done at the lithic source location. The manufacturing process can be identified by broken preforms, and by collections of bifacial thinning flakes. The majority of prehistoric archeological sites in Southeast Texas are campsites that have evidence of bifacial reduction being done. Aside from unfinished spear points, flake size distribution characteristics can give evidence of bifacial reduction (Patterson 1990c). An example of the characteristic exponential curve shape for flake size distribution from bifacial reduction has been shown for an Archaic period stratum of site 41WH19 (Patterson 1990c:Figure 4).

There are indications at many campsites that minimally trimmed flake blanks for dart point manufacture were brought from quarry locations, rather than initially shaped biface preforms. A wide range of flake sizes and remaining cortex on flakes indicates that flake blanks were brought to sites with a minimum amount of trimming and bifacial reduction done previously at the raw material source location. Also, the large number of flakes found at many campsites indicates the high degree of bifacial reduction done at the sites. Sites 41WH19 (Patterson et al. 1987) and 41HR315 (Patterson 1980a) have typical data that show the above conclusions.

Bifacial preforms for spear points are produced by percussion flaking, as many modern flintknappers can demonstrate (Weber 1991). Although hard hammerstones can be used for bifacial thinning, better control can be obtained by the use of soft percussion, such as by use of antler or silicified limestone percussors. Remains of antler percussors are seldom preserved at archeological sites, but limestone hammerstones are sometimes found, as well as harder quartzite hammerstones. A preform was generally converted into a finished projectile point by use of pressure flaking to shape the stem and point and to align the edges. Sharpened antler tines are good pressure flaking tools, but are not often preserved at sites. A complete sequence of producing dart points starting with chert cobbles has been replicated by Patterson (1981b) and Weber (1991).

Occasionally, dart points are found at sites in this region where the blade section appears to have been reworked. The reworking of blade sections is usually judged by the blade section being shorter than most specimens of a type, more beveling on edges or a more constricted shape at the tip. When blade sections of projectile points appear to have been reworked, there are two possibilities. One possibility is that the point was broken during use and returned to the campsite for reworking to restore the point. The other possibility is variation in shape due to the orginal manufacturing process, caused by small size of starting raw material or breakage of preform during manufacture with subsequent shortening of the product point.

Arrow points are smaller than spear points. The production of arrow points was done mainly by pressure flaking of thin flake blanks, usually under 5 mm in thickness (Patterson 1985b). Pressure flaking produces only small size flakes. Therefore, at Late Prehistoric sites where only arrow points were being made, mainly small flakes will be found, mostly under 15 mm square (Patterson and Sollberger 1978).

Unifacial arrow points in the form of marginally retouched flakes are easy to make. Even a flint flake can be used as a pressure flaking tool. Bifacial arrow points with deep pressure flaking require more skill to manufacture. There is a significant advantage, however, for the manufacture of bifacial arrow points by extensive pressure flaking, compared to the manufacture of marginally retouched unifacial arrow points. A much wider range of flake shapes and sizes can be used as blanks to make bifacial arrow points. The apparent evolution from unifacial arrow points to standardized bifacial forms may have been at least partially caused by the flexibility of being able to use a wider range of flake blanks. This would especially apply in situations where there was a limited supply of byproduct flakes from the manufacture of dart points that would be suitable for reuse for arrow point manufacture. Also, the greater uniformity of bifacial arrow points may have given more consistent results in hunting than the cruder unifacial forms. Conversely, it should be noted that there is an advantage to using marginal retouch to make arrow points on very thin flakes. Thin flakes tend to break when heavy pressure flaking is being done. Even standardized arrow point forms, such as Perdiz and Alba, are often found with little retouch on one face, due to limitations in flake thickness and width.

Sharp edges for cutting tools can be produced by pressure or percussion flaking. It should be noted, however, that unretouched flake edges are sharper than retouched edges. A retouched edge of a cutting tool often represents resharpening. Steep edge angles for scraping tools are easily produced by use of small hammerstones. Gravers, drills, notched tools and denticulates (saw tooth edge) were generally produced by pressure flaking. All of these tool types can be easily replicated, as produced by the author and many other experimental flintknappers.

LITHIC TOOL TYPES AND FUNCTIONS

Tool Function

A variety of stone tool types are found at sites in Southeast Texas. Other than projectile points, formal tool types are not common after the Paleo-Indian period, although many sites have yielded a few scrapers and gravers. The utilized flake was the dominant stone tool type, often casually selected from bifacial thinning debitage. The utilized flake can be fully functional for many tasks, such as butchering (Patterson 1975a) and woodworking. Tool function can sometimes be judged by edge wear patterns (Tringham et al. 1974), but some tasks such as soft meat cutting give little edge wear (Patterson 1984). Therefore, it is often not possible to judge if a flake has been used as a tool. Also, if a flake edge has been used for more than one function, such as cutting and scraping, the edge wear pattern can be confusing.

Basic functional edge wear patterns as described by Tringham et al. (1974) are easy to replicate, including wear patterns for cutting, scraping, and planing. However, the interpretation of what materials were being worked, using both macro and micro methods of analysis, is still controversial in spite of the large body of literature on this subject. For example, wear patterns on scrapers from processing bison hides developed by Schultz (1992) are not the same as found by some other investigators in performing the same task.

Edge wear from longitudinal cutting is characterized by longitudinal scallops on the edge and polish on the high points of the scallops (Tringham et al. 1974:Figure 5, Patterson 1975a). It takes much use of a flake for cutting to develop a full wear pattern. Initially, cutting produces a series of nibbled flake scars on the tool edge. Use of a flake for scraping produces a uniform series of unifacial flake scars, much like the flake scar pattern when purposeful retouch is used to make a scraper, but with generally smaller flake scars than from purposeful retouch. Planing action also produces a series of unifacial flake scars, but generally less pronounced than from scraping, and with more of a nibbled pattern.

A utilized flake is simply a lithic flake that has been used without having been retouched to a formal shape. Many flakes are suitable for cutting, scraping, and planing functions without any shaping retouch. A newly made chert flake can have an edge sharper than a steel knife, although the edge of a chert flake will become dulled faster than a steel knife. Patterson (1975a) has completely butchered a deer using a single chert flake, with no problem in tool edge damage during this experiment. The utilized flake was the dominant stone tool type at most sites in Southeast Texas.

Edge-wear patterns discussed here are based on observation with low-power magnification (10x-80x). Studies of edge-wear patterns using high-power magnification (Keeley 1980), such as 200x, have not been done in Southeast Texas. Edge-wear studies using high-power magnification require special equipment, special training, and extensive specimen cleaning. This type of analysis is too slow to be suitable for use in the limited time usually available for the analysis of large lithic collections. Also, the interpretation of different types of microwear polish remains somewhat controversial (Yerkes and Kardulias 1993:103).

Formal Tool Types

Formal lithic tool types are not numerous at inland sites in this region, as shown in Table 13, and even less common at coastal margin sites, as shown in Table 14. Paleo-Indian formal tool types seem to be somewhat more common than formal tool types in later periods, such as at site 41WH19 (Patterson et al. 1987:Figures 14-18). The Albany hafted scraper is a classic example of a Paleo-Indian tool type (Patterson 1991a, 1991d). Another typical Paleo-Indian tool type is the combination scraper-graver. Paleo-Indian unifacial tools in Southeast Texas are generally thicker and heavier than unifacial tools of later time periods. At site 41WH19 (Patterson et al. 1987:Tables 8,9), many of the Paleo-Indian stone tools had thicknesses of over 10 mm. It would appear that many Paleo-Indian unifacial tools were made on flakes specifically manufactured to make these tools. This is in contrast to unifacial tools from later time periods, where flakes for unifacial tool manufacture were casually selected from bifacial thinning debitage. The actual function of a stone tool cannot be rigorously proven by the type designation, as many stone tool specimens could have been used for a variety of tasks. Designation of formal tool types has analytic value, in any case, for the comparison of lithic collections. Formal lithic tool types found in Southeast Texas include unifacial cutting tools, bifacial knives, scrapers, notched tools, denticulates (saws), perforators, choppers, etc, as summarized in Table 13. Various stone tool types can perform the same range of tasks as modern metal hand tools.

Some possible functional uses of unifacial tool types can be itemized, based on activities that probably occurred at campsites in this region. Possible functions of unifacial tool types include: (1) scrapers: hide preparation and woodworking, (2) denticulates: sawing of wood and bone, (3) notched tools: woodworking, (4) perforators: drilling holes in wood, bone and ceramics, (5) chopping tools: butchering and plant processing, and (6) bifacial knives and unifacial cutting tools: butchering and woodworking. Ethnographic examples can be useful in showing at least some of the uses of a stone tool type. Use of notched flakes as spokeshaves by Australian aborigines has been illustrated by Hayden (1977:Figure 5). Surprisingly, Hayden (1977:Figure 6) also illustrates a denticulated flake being used to smooth a wooden shaft, rather than being used as a saw. This is a good example where actual tool function cannot be predicted from tool form.

In summary, formal unifacial tool types and edge wear patterns on flakes demonstrate that stone tools were being used at a site. In most cases, however, the actual task that was performed cannot be identified. In any event, it is useful to show that a variety of tasks were being performed with stone tools at a site, as is typical of campsites in this region. Indications of tool use may give some indication of intensity of site use.

Prismatic Blades

Two types of prismatic blades are found in Southeast Texas, large Paleo-Indian blades and later small prismatic blades (Sollberger and Patterson 1976). Prismatic blades are flakes with lengths at least twice the widths, with parallel lateral edges, and with at least one flake scar ridge on the dorsal face parallel to the lateral edges. The purposeful production of prismatic blades is a specialized process, where force is applied at an established ridge on a core face. The fracture plane follows the ridge to produce a long flake with parallel lateral edges (Sollberger and Patterson 1976). The best indication of a prismatic blade industry is the polyhedral core. Small amounts of prismatic blades can be produced fortuitously during bifacial reduction operations. Therefore, to identify a true prismatic blade industry, it is important for a significant number of prismatic blades to be present and/or polyhedral cores with parallel flake scars. Prismatic blade technologies are particularly applicable to the study of functional uses of product flakes. The production of prismatic blades is a specialized flintknapping technique that is not likely to have been employed unless there were specific uses for this specialized type of product flake.

There are rare finds of Paleo-Indian large prismatic blades in this region, such as at sites 41HR343 (Patterson et al. 1993a:Figure 6), 41HR642 (Patterson 1990b:Figure 2), and 41HR332 (McClure and Patterson 1989). There is little evidence for Paleo-Indian blades having been manufactured in Southeast Texas. Specimens of this type are often made of Edwards Plateau flint, and were probably manufactured in Central Texas. Several sites with the manufacture of large Paleo-Indian type prismatic blades are known in Central Texas, such as the Gault site (Collins and Headrick 1992, Collins, Hester and Headrick 1992), the Pavo Real site (Henderson and Goode 1991), and site 41ME3 (Patterson 1977, 1981d). A Paleo-Indian tool kit made of Edwards Plateau chert was found at site 41HR343, including a unifacial point, an end scraper and and a perforator made on prismatic blades, and a combination scraper-graver made on an ordinary flake. These types of unifacial tools are in the Paleo-Indian tool tradition of the Great Plains (Irwin and Wormington 1970). Paleo-Indian prismatic blades generally have widths over 20 mm (Sollberger and Patterson 1976:529). Paleo-Indian prismatic blade manufacture seems to be connected with the manufacture and use of highly curated unifacial tools, possibly related to a very mobile lifeway. The manufacture of large prismatic blades did not continue into the Archaic period, which had a somewhat less mobile lifeway, and an emphasis on the production of bifacial projectile points. Prismatic blade technology is not particularly advantageous for lithic manufacturing processes primarily related to bifaces (Patterson 1979e), as prismatic blades are not good blanks for the manufacture of symmetrical bifaces. Also, byproduct flakes from dart point manufacture would yield a good supply of flakes for unifacial tool manufacture, without need for a specialized prismatic blade industry.

Industries to produce small prismatic blades have been found at a number of sites in Southeast Texas, such as 41HR184 (Patterson 1973,1994b), 41HR206 (Patterson 1980c), and 41HR182 (Patterson 1985a). At site 41HR315 (Patterson 1980a), the production of small prismatic blades starts at the same time as the production of unifacial arrow points at this site, at about the start of the Late Archaic period. Blade production at this site then continues through the Early Ceramic and Late Prehistoric time periods. Small prismatic blades were most often used in this region to make unifacial arrow points, perforators, gravers, and unifacial inset blades for compound arrow points (Patterson 1973,1994b). A study of prismatic blades from site 41HR184 in Harris County (Patterson 1994b) shows that small prismatic blades were also used as utilized flakes, with specimens having typical edge-wear patterns of cutting and scraping functions. Odell (1994:105) has shown a similar pattern of several functions for small prismatic blades in the Middle Woodland period of the midwestern United States. Small prismatic blades found in Southeast Texas generally have widths that group around 12 mm (Sollberger and Patterson 1976:Figure 5). A width range of 10-15 mm is ideal for the manufacture of unifacial arrow points. Where there are definite prismatic blade industries at sites in Southeast Texas, the distributions of blade widths are bell-shaped curves (Sollberger and Patterson 1976:Figure 5; Patterson 1994b:Figures 1,2). This reflects the limited range of blade sizes desired. Industries to manufacture small prismatic blades at sites in this region have both blades and polyhedral cores to demonstrate the manufacturing process. Some polyhedral cores from site 41HR184 are shown in Figure 6, and small blades from this site are shown in Figure 7. Prismatic blade technology is a specialized manufacturing technique, that was used to make specific stone tool product types. It has been noted by Patterson (1973) that small blade cores in Southeast Texas have a variety of geometrical forms. For example, cores in Figure 6A,C have single platforms, and the core shown in Figure 6B has multiple platforms. Hester and Shafer (1975) have discussed small blade technologies for the central and southern Texas coast.

Projectile Points

One analytical problem for stone projectile points is to distinguish between large arrow points and small dart points. A study (Patterson 1985b) shows that arrow points in this region generally weigh under 2.3 grams, have thicknesses under 5 mm, and have stem neck widths under 9 mm.

At many sites in this region, more dart point basal fragments are found than other types of dart point fragments. Indians returned to the campsite with spears having broken points. Spear points were then replaced at the campsite and basal fragments discarded at this location. (Patterson 1980b). Asphalt was sometimes used for hafting of stone (Patterson 1980a:4; Shafer 1968:53) and bone (Duke 1982b:6) projectile points, with traces of asphalt occasionally found on projectile point basal areas. The exact source of asphalt cannot be determined, but it is known that pieces of asphalt can be found on coastal margin beaches. Asphalt pieces are sometimes found at Indian campsites.

Bifacial Knives

Bifacial knives are occasionally found at sites in Southeast Texas, and seem to be somewhat more common in the Late Prehistoric. The amount of bifacial knives in this region is probably over-estimated, as dart point preforms can sometimes be mis-classified as knives. There is evidence in Wharton County of bifacial knives being brought to the area by Indians from farther to the northwest, possibly by trips down the Colorado River Basin (Patterson et al. 1987, Patterson and Hudgins 1989a). The use of bifacial knives in the Late Prehistoric has been attributed to the increased presence of bison during the Toyah Phase in Central Texas. This may be a factor for bifacial knives in the Western Zone of Southeast Texas during the Late Prehistoric, but there is also another technological explanation. In the Late Prehistoric, with the predominance of the bow and arrow, there were few large size byproduct flakes that could have been used as butchering tools. The use of curated bifacial knives may have been a response to the lack of large flakes suitable for tool use.

Corner-tang knives have been found at sites in the Western Zone of Southeast Texas at site 41AU36 in the Late Archaic (Hall 1981:Figure 18), and at site 41WH19 in the Late Prehistoric (Patterson et al. 1987:Figure 4). This artifact type is usually placed in the Late

Archaic period in Central Texas (Turner and Hester 1993:250), but it should be remembered that the Late Archaic period terminates much later in Central Texas than in Southeast Texas. The two very long, well-made corner-tang artifacts at site 41AU36 were found as grave goods, and do not seem to have been made for functional use, because of the very large size. In contrast, the corner-tang artifact from site 41WH19 is not as well-made and was in campsite context, with probable functional use.

Aten (1983:Figure 13.2) has illustrated unifacial and bifacial lithic tools found on the coastal margin. Both the limited range of tool types, mainly scrapers and perforators, and the small sizes of these tools probably reflect the scarcity of lithic resources. Non-lithic tools of bone and shell were used as an alternate to lithic tool types.

CERAMIC TECHNOLOGY

POTTERY MANUFACTURE

Most research in ceramics in Southeast Texas has concentrated on analyses to establish chronological sequences. Little research has been done on the actual manufacturing process, such as clay sources, firing techniques, etc. Black (1988) has conducted some experiments to replicate Goose Creek pottery, using some local types of clay. Black notes that pottery in this region was typically made by coiled construction with rounded pot bottoms. He also notes that firing of pottery with a wood fire will generally not be hot enough to cause vitrification, but the ware will be water tight.

Ceramic vessel shapes are typically conical, but cylindrical shapes are sometimes found (Patterson 1990d). Vessel rim cross-sections vary from square to feathered, but no temporal significance has been established for rim shapes. Rims are sometimes incised or notched. The quality of pottery in this region is highly variable. Sherds in a large collection will vary from well-fired (hard) to very soft. At inland sites, it is common to see sherds disintegrating in-situ. Coastal margin pottery generally seems to be better fired than inland pottery. It would appear that some social groups were more skillful than others in manufacturiing pottery. Coastal margin Indians placed more emphasis on pottery than inland Indians.

Pottery in Southeast Texas lacks the type of sequence found in adjacent Louisiana, with types that can be assigned to fairly narrow time periods. Aten (1983:Figure 14.1) has been successful in defining a chronological sequence of ceramic types in the Galveston Bay area that covers some broad time ranges in the Early Ceramic and Late Prehistoric periods. Research by various investigators has concentrated on the study of pottery subtypes in an effort to obtain more detailed chronological sequences. Variations in ceramic subtypes are usually related to paste type, tempering materials, vessel thickness, and surface finish. Studies of ceramic subtypes have not yet produced more detailed chronological sequences for this region. For example, Goose Creek Red-Filmed pottery was produced for a very long time period (Aten 1983:Figure 14.1). Another example is that vessel thickness does not seem to be time-diagnostic. At site 41WH36 (Patterson and Hudgins 1989:17), the thickness range for sherds of 4 to 10 mm was about the same for all excavation levels of the Early Ceramic and Late Prehistoric periods. Therefore, this report has generally avoided ceramic subtypes in relation to chronology. Remarks made here on pottery subtypes have not been made to discourage further research, but instead to summarize the current status of research. The naming of pottery subtypes by various investigators can be confusing. For example, Winchell and Ellis (1991) have used some names for sandy paste varieties that do not incorporate the Goose Creek designation that is used by most investigators.

Conway pottery has very coarse sand temper, with sand grains often rounded. It would appear that this type of sorted sand temper was purposefully added, and is not a component of the natural clay (Aten 1983:238). Goose Creek sandy paste pottery is classified by Aten (1983:231) as untempered, which means that sand in this pottery type is a component of the natural clay. Aten states that the sand grain sizes in Goose Creek pottery are rarely well-sorted into a specific size. There is a possibility that sand temper may have been added to at least some Goose Creek pottery, but a knowledge of the properties of source clays would be needed to make a definite determination.

Shell tempering of pottery is very rare at coastal margin sites, even though much shell material was available. Shell tempering was used extensively in the Mississippi Valley by the Mississippian Culture. The low use of shell tempering in Southeast Texas may have been a cultural choice or there may be technical reasons why shell tempering was not used. For example, Rangia shell might not be a good type of tempering material, local clays might not respond well to shell temper, or the manufacture of shell tempered pottery may require special firing techniques not developed by Indians of the Texas coast. O'Brien and Holland (1992:51) state that "The key to successful use of shell tempering is controlling firing temperatures below about 700 degrees C- the point at which calcite, upon cooling and hydration, changes to calcium hydroxide."

W. M. Black (personal communication) found that bone temper could not be prepared without first burning the bone to make the material friable. Brewington (1992:4) has reached the same conclusion. Black also found that bone temper in the interior of the vessel wall is likely to remain a dark color, while bone temper on the vessel surfaces will become white due to higher firing temperature. Brewington (1992:4) reaches the same conclusion. Therefore, bone temper in sherds from archeological sites can range in color from black to white.

Aten (1983:Chapter 12) has named subtypes of fired clay (grog) tempered pottery on the amounts and different physical properties of the grog temper. It is not clear, however, that these subtypes of grog tempered pottery were made by different social groups or rather were simply manufacturing variations. Potsherds can be pulverized to different particle sizes for preparation of grog temper, depending on how much effort is made in the pulverizing process. Varying amounts of temper can be added to the paste as another manufacturing variable, which need not be viewed as a cultural preference. Grog tempered pottery of the coastal margin often has particles that can be recognized as sherd fragments (Aten 1983:239). After describing subtypes of grog tempered pottery, Aten (1983:241) did not sort these subtypes for his study of pottery on the upper Texas coast. Although subtypes of grog tempered pottery do not appear to have temporal significance, there may be significance for geographic distribution, as discussed above, with the use of Baytown Plain pottery confined to the coastal margin of this region.

POTTERY FUNCTION

Functions of pottery in this region are poorly understood. Pottery could have been used for cooking, food storage and water storage, but there is a lack of direct archeological evidence. Lace holes to repair vessels show that some pottery was used for storage where a water-tight vessel was not necessary. The poorly fired quality of pottery, especially in the inland subregion, gives the impression that poor quality pottery would not have been durable for cooking use. Seasonal storage of food materials may have been an important function of pottery.

On the coastal margin, there is a scarcity of freshwater sources. Pottery may have been important for water storage in this subregion. Boiling to process shellfish and other marine foods may have been another important use of pottery on the coastal margin.

Pottery was a useful item for a number of possible functions. Shafer (1975:250) has noted, however, that in East Texas ceramic technology had no apparent effect on either settlement pattern or stone technology. The use of pottery may have increased subsistence efficiency, but did not significantly alter the general lifestyle.

FIRED CLAYBALLS

Fired clayballs are found at some inland sites in this region (Patterson 1986b, 1989g). At site 41WH73 (Patterson and Hudgins 1993) in Wharton County, 4661 clayballs were recovered from strata of the Early Ceramic and Late Prehistoric periods. Clayballs varied from 15 to 75 mm in diameter, and had an average weight of 6.0 grams. At site 41WH19 (Patterson et al. 1987), fired clayballs were recovered from excavation levels of the Late Paleo-Indian through the Proto-Historic periods. At site 41WH19, the earliest radiocarbon date associated with clayballs is 7970 +/-530 B.C., and the latest radiocarbon date associated with clayballs is A.D. 1585 +/-80. There is a radiocarbon date of A.D. 1670 +/-80 directly dating an earth oven with fired clayballs at site 41HR206 in Harris County (Patterson 1994c). While fired clayballs have a wide geographic occurrence in this region, the frequency of sites with clayballs is relatively low. There are 38 sites (13%) with clayballs of the 298 sites in the mid 1995 computerized data base for inland Southeast Texas. As shown in Table 15, only a few sites with clayballs have large numbers of this artifact type. At some sites, clayballs and pieces of natural caliche are found together in hearth features. At the Allens Creek complex (Hall 1981:281), roasting hearths were composed of carbonate concretions (caliche) and sandstone pieces, without fired clayballs. In this case, there was no need to make fired clayballs, as naturally occurring materials were available to perform the same function.

The probable function of clayballs was as heating elements for use in roasting food materials in earth ovens. This is the explanation usually given for use of this type of object at sites of the Poverty Point culture in Louisiana (Ford and Webb 1956:44). Gibson (1975:202) states that "There is now little doubt the Poverty Point objects were used in pit baking, a mode of cooking common to the period between 1500-600 B.C. in the Lower Mississippi Valley and contiguous areas". Hudgins (1993) has conducted cooking experiments with clayballs in pits. In these experiments, fired clayballs were made from moist clay by baking on the hot coals of a wood fire. These fired clayballs were then used to roast meat, such as chicken, after heating the clayballs on a wood fire in a pit. After placing meat on the hot clayballs, the pit was covered with soil to hold in the heat. A chicken was thoroughly roasted in 2.5 hours by this method. Hudgins (1993:50) found that clayballs heated to 425 degrees F retained a temperature level of 275 degrees F after one hour, and a temperature level of 180 degrees F after two hours. In comparison, hot coals alone from a wood fire cooled to 220 degrees F in one hour, and then cooled to just above ambient temperature at the end of two hours. Hudgins concluded that the primary factor in the effectiveness of using heated clayballs appears to be in their ability to retain heat.

At the Late Archaic Poverty Point site in Louisiana, Haag (1986:24) has described fired clayball use by filling a pit with clayballs with a fire built on top to heat the clayballs, then sweeping the fire remains aside and cooking directly on the hot clayballs. It is doubtful that this presumed procedure is correct. Only a fire under the clayballs would thoroughly heat several layers of clayballs. Several tons of fired clayballs have been found at the Poverty Point site, with many specimens having formal shapes (Webb 1982:Figure 19). As shown by many sites in Southeast Texas, the use of fired clayballs for cooking started much earlier than the Late Archaic on the greater Gulf coastal plain. It is curious that knowledge gained from making fired clayballs did not lead to the early invention of pottery in Southeast Texas. The close resemblance between soapstone vessels and early ceramic vessels on the Atlantic coast (Sassaman 1993:21) gives the possibility that pottery was invented first as a substitute for soapstone vessels.

Sassaman (1993:133) notes that fired clayballs were used in Georgia and South Carolina, but became obsolete after 3700 B.P. when pottery was in-use. Sassaman (1993:135) has concluded that fired clayballs would be ineffective as a substitute for boiling stones, due to poor resistance of clayballs to thermal shock. Huebner (1986:36) has concluded from experimental use of fired clayballs that clayballs were not used for boiling technology in Texas.

The relatively low frequency of sites with clayballs indicates that cooking with clayball hearths was not a generally prefered method. Meat can easily be cooked with an open fire, but cooking of some types of plant materials is probably better done by roasting over clayballs rather than an open fire. It has been proposed (Patterson 1989g) that sites with clayballs represent specialized processing of plant foods, probably on a seasonal basis, with perhaps some use of clayballs for cooking meat at the same sites.

GROUND STONE ARTIFACTS

Two classes of ground stone artifacts are found in Southeast Texas, artifacts made of local sandstone and artifacts made of exotic materials. Artifact types made of local sandstone include mano-metate grinding sets and abrading tools. Sandstone can be found locally at outcrops in deeply cut stream channels, such as the San Bernard River. Mano-metate sets were used for grinding pigments and possibly for food processing, although this artifact type is found only occasionally at campsites. At site 41FB3, (Patterson et al. 1993b), traces of red ochre were found on manos, metates, and grinding slabs, with red ochre used at this site with burials. Sandstone abraders are found at sites in both the inland and coastal margin subregions. Possible uses of sandstone abraders include projectile point shaft smoothing, edge grinding in lithic manufacturing, pigment grinding for burial ceremonies and body decoration, manufacture of bone tools, and manufacture of bone and shell non-utilitarian artifact types.

Ground stone artifact types found in this region made of exotic materials include bannerstones (Duke 1989), beads, boatstones (Hall 1981), gorgets (Hall 1981), and very rare plummets (Hartman 1963) from the Poverty Point Culture (Webb 1982:Figure 27). Tubular ground stone beads were found with a burial at site 41FB42 (Patterson et al. 1993c).

BONE AND ANTLER TOOLS

A variety of bone tools are found on both inland and coastal margin sites in this region. Tools types include projectile points (Duke 1982b:6, Aten 1983:Figure 13.3), awls (Hall 1981), fishhooks (Duke 1982b:6, Aten 1971:Figure 7), needles (Duke 1982b:6) and pins (Vernon 1989). In regard to fishhooks, Cabeza de Vaca (Hedrick and Riley 1974:76) noted that protohistoric coastal margin Indians had nets, presumably used for fishing. Non-utilitarian bone artifact types are discussed in another section of this report. Bone tools are under-represented at sites in this region because of poor preservation. Deer bone is the main material used for tool manufacture. Bone tools were especially important in the lithic-poor coastal margin subregion. Judged by the range of point sizes illustrated by Aten (1983:Figure 13.3), bone points were used as both dart points and arrow points on the coastal margin of this region. For example, a bone point from site 41CH290 (Patterson and Ebersole 1992:Figure 2D) has a weight of 2.1 grams, which is light enough for arrow point use. Long-bone implements have been found at several sites in this region, as summarized by Hall (1988a:Figure 1). Hall (1988a:172) has concluded that sharply pointed long-bone implements were used as awls, but that specimens with blunt ends had other functions, such as use for hairpins, head scratcher/louse crushers, or sweat scrapers.

Tools were also made of deer antler, such as occasional finds of pressure flaking tools made of antler tine (Vernon 1989, Aten et al. 1976:41). Projectile points were sometimes made of antler (Aten et al 1976:40). Antlers were also probably used as batons for soft-percussion flaking of chert, but evidence is seldom preserved. Antler seems to have been preserved even more poorly than bone in this region.

SHELL TOOLS

Shell tools in this region are found exclusively on the coastal margin. Oyster shell was the material of choice, possibly because oyster shell is large, thin, and harder and flatter than Rangia shell. Shell tools were a substitute for stone tools in a lithic-poor area. Oyster shell tools were used for scraping and cutting (Aten 1983:264). Aten (1983:Figure 13.2) illustrates some oyster shell scrapers. Oyster shell tools, used for cutting and/or scraping, were recovered in both Early Ceramic and Late Prehistoric levels of coastal margin site 41HR639 (Patterson 1990d:3). Site 41HR639 is a small Rangia midden on Cedar Bayou about 12 miles inland from the coastline of Galveston Bay. Oyster shell tools were imported to this site from the nearby coast. The use of oyster shells as tools can be judged by edge wear and by purposeful edge flaking retouch. J.O. Dwyer reported that he had several oyster shells used as knives by the Karankawa in lieu of flint (Dyer 1920, Aten 1983:265). Another substitute for stone tools in the lithic-poor coastal margin was the use of cane and reed knives, as reported by Swanton (1946:565) for historic Indians along the Gulf coast.

Neck (1991:17) has noted that freshwater mussel shells were used as tools and ornaments at site 41FB32 in Fort Bend County. Evidence for the use of shell as tools is in the form of shell edges worn to a sharp edge. Indications that shell was used for ornaments is shown by shell fragments that appear to have man-made holes.

NON-UTILITARIAN ARTIFACTS AT CAMPSITES

Prehistoric non-utilitarian artifact types are generally found in this region as grave goods at burial sites, with rare finds at campsites. Some examples of prehistoric non-utilitarian artifact types found outside of mortuary context at inland sites include: shark teeth and bone pendants at site 41HR315 (Patterson 1980a), a piece of galena and a quartz crystal at site 41WH2 (Patterson and Hudgins 1980), and copper beads and galena at site 41WH273 (Ensor and Carlson 1991). Non-utilitarian artifact types are even rarer at prehistoric campsites on the coastal margin of this region. Non-utilitarian items do not seem to have been very important in the daily lives of hunter-gatherer bands of this region. However, non-utilitarian artifacts may be under-represented at campsites due to poor preservation. Non-utilitarian artifacts as grave goods will be discussed in the section on mortuary practices.

Technology for making fired clay objects was well-established in Southeast Texas, for fired clayballs and pottery. Ceramic technology was seldom used for non-utilitarian artifacts. Aten (1983Figure 13.3) has illustrated a ceramic turtle effigy from a coastal margin site, but this is a rare find. Apparently, the use of clay figurines as artistic grave goods did not develop as a tradition.

TECHNOLOGICAL CHANGE AND CONTINUITY

In Southeast Texas, there are not a large number of examples of technological change over the thousands of years of prehistoric human occupation. Spear point styles tended to change over long time intervals, but this type of change had little effect on lifestyles. It is not clear what factors were important for changes of spear point types. Some possibilities are cultural preference, hafting methods, and lithic material availablity. As noted above, formal tools types were somewhat more important in the Late Paleo-Indian period than in later time periods. After the Paleo-Indian period, there is little indication of technological change shown by stone tool types other than projectile points. Formal unifacial tool types, such as scrapers, have not in general been found to be time-diagnostic. This is another indication of the continuity in lifestyle over time in this region. Activities at campsites were similar in all prehistoric time periods.

After introduction of a new technology to a region, there is generally a period of local adaptation to the new technology. In Southeast Texas, a period of local adaptation for the bow and arrow can be shown by a long period of use of unifacial points before the use of standardized forms of bifacial arrow points, when the bow and arrow became the predominant weapon system in the Late Prehistoric period. Another example of time required for local adaptation of a new technology is the slow rate of diffusion of pottery down the Texas coast. The use of grog tempered pottery on the coastal margin is another example of an adaptation period followed by major use of the technology (Aten 1983:Figure 14.1). Seriation patterns for artifact use over time generally show this type of adaptation pattern very well.

The introduction of the bow and arrow was an important technological change for hunting efficiency, but a fairly long period of adaptation was required, starting with unifacial arrow points and ending with standardized bifacial arrow point types. Cressman (1977:106) has noted a similar long period for local adaptation of the bow and arrow in the Great Basin. Another important technological change in this region was the introduction of pottery. After introduction, a high use level for pottery was maintained on the coastal margin, but pottery has a mixed history at inland sites. In the inland subregion, the use of pottery peaked sometime in the Early Ceramic period, with decreased use of pottery in the Late Prehistoric that accompanied a more mobile lifestyle (Patterson 1976, 1980a, Patterson and Hudgins 1993). This will be discussed further in relation to mobility-settlement patterns.

Some possible types of technological change will never be known, because perishable materials were involved. This would include items such as clothing, shelter and non-ceramic containers. Not many significant technological changes made by prehistoric Indians are found in the archeological record of this region, because hunter-gatherers tend to be conservative to preserve successful adaptive patterns. It is probably characteristic of the hunter-gatherer lifeway that a technological change is accepted only if it makes a significant contribution to efficiency and survival probability of a lifeway. Some of the more sophisticated traits of complex cultures would be of little value to the basic hunter-gatherer lifeway.

Technological continuity is as important as technological change in the lifestyles of hunter-gatherers. One good example of technological continuity in Southeast Texas is the Gary-Kent dart point series that was apparently used for about 5000 years. The trend toward smaller dart points in later time noted above was a slow evolutionary development. This is matched by a trend toward a higher proportion of smaller flake sizes in later time, as shown in Figure 8 for site 41WH19 (Patterson et al. 1987:Figure 20). A smooth trend toward smaller flake sizes is shown over an interval of at least 10,000 years, without any breaks that would show sudden technological changes. This is illustrated in Figure 8 by showing flake size distributions at various excavation levels.

The use of fired clayballs in inland Southeast Texas from the Late Paleo-Indian through the Proto-Historic time periods demonstrates long technological continuity in this region. This is the longest time interval for use of fired clayballs so far published in North America.

It should be noted that technological change does not necessarily indicate other types of cultural change. Jennings (1989:26) has observed that "There is an unproved assumption that changes in details of the attributes of artifacts are an index to significant changes in other aspects of the culture where the objects had their original value. The observed slight change in material specimens may equally well document a certain rigidity, arguing cultural stability rather than cultural change."

The "processual" school of archeology emphasizes the study of why cultural and technological changes have occurred. This is easier said than done, however. Technological change can be described, but reasons for change are often elusive. Technological change can occur for a number of reasons, but available data seldom support any firm conclusions. Technological change may be caused by factors such as changes in climate and subsistence patterns, cultural preference, technological innovation, and diffusion of technological ideas.

DIFFUSION AND LOCAL INNOVATION

Diffusion of ideas and local innovation are both possible causes of technological change, and both mechanisms of change should be considered in balanced studies. Diffusion of technology can result from exchange of ideas and/or actual migration of people. More often than not the origin of a specific technological trait is difficult to determine.

There are two principle indicators for the location of the origin of a technological trait. One indicator is chronology. The region with the earliest date for a trait is possibly the origin point of the trait. The other indicator is density of geographic distribution of a trait. The region with the highest concentration of a trait, such as a projectile point type, can possibly be the origin point of the trait. In some cases, where both the earliest date and the highest concentration of a trait are in the same region, there is a higher probability that this may be the region of origin of the specific trait.

It is often not possible to determine any exact point of origin of a technological trait. An example is the Pedernales point, where the earliest two radiocarbon dates for this point type are in Southeast Texas (Patterson 1989e), but the highest concentration of this point type is in Central Texas. The Pedernales point could have started in Southeast Texas, but it is more likely that chronological data for this point type in Central Texas are not adequate to reach a conclusion on this issue.

The Perdiz arrow point is an example where the earliest radiocarbon dates occur in Southeast Texas, and there is also a high concentration of this artifact type (Table 6) in this region. There is a good possibility that Southeast Texas is the location of first development of the Perdiz point, because there are no conflicting data from adjacent regions to challenge this conclusion. The late adoption of the Perdiz arrow point in regions of Texas adjacent to Southeast Texas is a possible example of diffusion of technology from Southeast Texas. The increased presence of bison in Central and South Texas in the Late Prehistoric period may have caused some movement of peoples from Southeast Texas into these other regions during this time period, as bison were never really plentiful in Southeast Texas. It is proposed that movement of people from Southeast Texas may account for the Perdiz arrow point being distributed over much of Texas by A.D. 1200 (Turner and Hester 1985:187), from the former smaller area of distribution in Southeast Texas.

In Southeast Texas, the bow and arrow and pottery are examples of the diffusion of major technologies into this region, as discussed in other sections of this report. The introduction of pottery from the east and its slow diffusion down the Texas coast is a particularly good example of the diffusion of technology. Shafer (1975:250) has concluded that the adoption of pottery was made by indigenous populations in East Texas, rather than introduction by migrating people, which supports the concept that the spread of pottery to the west was by diffusion. This does not preclude indications that initial introduction of pottery in the eastern part of the coastal margin of Southeast Texas could have involved some migration of people from Louisiana.

A specimen of pottery from the Late Prehistoric at site 41WH12 may be an example of diffusion of an artistic idea. The sherd (Patterson and Hudgins 1989a:Figure 2F) is bone tempered and has a Caddo-like design with many vertical lines from the rim edge ending with a horizontal line, and a row of large irregular punctations below. The design elements seem typical of Caddo pottery (Suhm and Jelks 1962:Plate 80). However, these design elements are not arranged in an overall pattern that is typical of Caddo pottery (Dee Ann Story, personal communication). It appears that bone tempered incised sherds from this site are Leon Plain type pottery, with the unusual attribute of being incised, using borrowed Caddo design elements. Leon Plain bone tempered pottery is only found in the Western Zone of Southeast Texas, and is probably a trait introduced to this region from Central Texas via the Colorado River drainage system. In this specific case, it is concluded that the Caddo-like pottery design is not the result of trade. No other example of incised bone-tempered pottery has been found in this general area, and long-distance trade of bulky pottery is not a very viable concept for mobile hunter-gatherers.

In considering the transfer of lithic traits from Central Texas to Southeast Texas, there seems to be a tendency for at least a few Central Texas artifact types to persist later in the Western Zone of Southeast Texas than in Central Texas. There is a cultural transition zone between Central and Southeast Texas along the Colorado River Basin south of the Balcones fault line and as far east as the Brazos River. Turner and Hester (1993:250,243) place the corner-tang biface and the "butted knife" biface in the Late Archaic period in Central Texas, but these artifact types have both been found in the Late Prehistoric period at sites in Wharton County in the Western Zone of Southeast Texas. A corner-tang biface was found at site 41WH19 (Patterson et al. 1987:Figure 4), and "butted knife" bifaces were found at site 41WH12 (Patterson and Hudgins 1989a:Figure 4), all in Late Prehistoric context. These Late Prehistoric specimens from Southeast Texas are not as well-made as Late Archaic counterparts from Central Texas. Further research is needed to establish a more definite relationship between these artifact types in Central and Southeast Texas. Also, as noted in this report, the Scallorn arrow point persists longer in Southeast Texas than in Central Texas. Bement et al. (1989:163) have noted that the cultural transition zone between Central Texas and East Texas is also found somewhat farther north than Southeast Texas. There are not rigid boundaries of a transition zone for technological traditions. It would appear, however, that the strongest technological influences from Central Texas are found in Southeast Texas roughly between the Colorado and Brazos Rivers, which is about the same as the Western Zone of Southeast Texas shown in Figure 1. The east-west distributions of projectile point types support this conclusion.

CHAPTER 5

LIFEWAYS

SUBSISTENCE PATTERNS

It is not possible to reconstruct the complete diet of prehistoric Indians in this region, because there is little preservation of floral remains, and many sites lack adequate preservation of faunal remains. There are enough data on faunal remains, however, to describe the range of animals that were used as foods. Preservation of faunal remains is best at shell midden sites, both inland and on the coastal margin, because of the alkaline soil condition at this type of site. Examples of good faunal preservation at inland shell midden sites are in reports by McClure (1986, 1987 ,1991). The best examples of faunal preservation at coastal margin shell middens have been given by Dillehay (1975) and McClure (1994).

For Southeast Texas, a summary of types of terrestrial faunal remains is given in Table 16, and a summary of aquatic faunal remains is given in Table 17. Except for the possible association of Paleo-Indians with extinct Pleistocene animals in surface collections from McFaddin Beach near Beaumont (Long 1977), there is no evidence for hunting of extinct megafauna in this region, as was done by Paleo-Indians in some areas of North America. It appears that a broad-based subsistence pattern was practiced in this region during all prehistoric time periods, even during most of the Paleo-Indian period (Patterson et al. 1987). As may be seen in Tables 16 and 17, Indians of the inland and coastal margin subregions were practically omnivorous, utilizing a wide variety of faunal resources. As shown in Table 16, Indians of the inland and coastal margin subregions utilized the same types of terrestrial faunal resources. The main difference in faunal utilization between inland and coastal margin Indians was the use of brackish water and marine food resources by coastal margin Indians. Deer and turtle were the most important animals utilized by inland Indians, such as at site 41HR273 (Baker et al. 1991:161). Deer and turtle were also very important to coastal margin Indians. The range of faunal resources utilized by Indians of this region ranged from small animals, such as rat, raccoon, opossum, and rabbit, to large animals, such as deer and bison. Antelope remains have been identified at a few sites.

Even though bear would have provided a good meat source, Table 16 shows that this animal was not a major food source in this region. Larson (1980:174) concludes that bear was not a major food source throughout the greater southeastern coastal plain. He states that "With the kinds of missile weapons the Indians had at hand, it must have been very difficult and certainly very dangerous to attempt to kill a free-ranging bear."

Aquatic faunal food resources were used in both inland and coastal margin subregions, as may be seen in Table 17. Aside from shellfish; alligator, fish, and water turtles were important aquatic food resources. Inland freshwater fish types include gar, catfish, drum, bass, bowfin, and sunfish. Coastal margin brackish water and marine fish types include gar, catfish, drum, bowfin, shark, sea trout, and sheepshead. Some remains of water birds, such as duck and geese, have been found at both inland and coastal margin sites. Aside from a few specimens of fishhooks, there is litle evidence on how fish were procured. There is no evidence preserved for the use of nets. In addition to use of fishhooks, large fish may have been speared or shot with arrows. Small fish may have been scooped by hand from shallow water locations, and fish traps may have been made in shallow water locations.

The concept of specialized hunting of now extinct megafauna by Paleo-Indians does not seem to apply to this region. Faunal remains from Paleo-Indian components of excavated sites have only modern faunal types (Patterson 1980a, Patterson et al. 1987). As Bryant and

Shafer (1977:20) state, "We seriously doubt that big game hunting would have been economically sound as a major subsistence pattern in any of the parkland and woodland areas of eastern Texas where the species of big game were probably dispersed or not present in large numbers." There is a perception by some archeologists that adaptation to local food resources is a gradual process that requires a long time period. This may be true for some food resources, but as a general scenario, hunter-gatherer groups either adapt rapidly to local food resources or perish or move. The Shawnee-Minisink site in Pennsylvania is a good example of where even the earliest Clovis inhabitants adapted to local floral and faunal resources (McNett 1985:322). Meltzer (1993:306) has observed that available evidence does not show a single Clovis adaptation, but many Clovis adaptations to a wide range of plant and animal resources.

Rangia cuneata brackish water shellfish was an important food resource for coastal margin Indians. Rangia shell middens can be very large. Site 41HR74 (Duke 1981) is a Rangia midden over 1000 feet long. Rangia shells were apparently spread out to pave and repave campsites. Aten (1983:Chapter 11) has described the details of several Rangia shell midden sites. A high proportion of the sites in the coastal margin data base are Rangia shell middens (Patterson 1989b), with considerable variation in size. While Rangia was a major food item for coastal Indians, the importance of Rangia in the daily diet should not be over-estimated, as Rangia meat is not a rich food material. Erlandson (1988) noted that the importance of shellfish in prehistoric economies has been the subject of continued debate. A Rangia sample from Trinity Bay gave an average weight of 3 grams of meat per specimen (Patterson, Ebersole and Kindall 1991:27). Using a value of 0.78 calories per gram from general data on clams (Chaney 1943:394), a person would need to consume 1068 Rangia to obtain the daily minimum requirement of 2500 calories. Using a protein content of 6.2% and a minimum requirement of 60 grams per day (Dering and Ayers 1977:59), a person would need to consume 323 Rangia to obtain the minimum daily protein requirement. Byrd (1976) has reached the same conclusion on the low food value of the Rangia clam.

Experimental studies show that Rangia shells are tightly sealed when harvested (Patterson, Ebersole and Kindall 1991), and are difficult to open for meat extraction. Processing of large amounts of Rangia required some type of heat, which would open the shell and cook the meat at the same time. Use of heat for Rangia processing could have been by roasting, steaming or boiling. Roasting is a good candidate because some burnt shell is found at many shell middens. Neck (1991:17) has noted that burnt shell would be under-represented, because burnt shell disintegrates more rapidly than unburnt shell due to conversion of burnt shell from calcium carbonate to calcium hydroxide. Sassaman (1993:65) has concluded that heat was used to process shellfish along the Atlantic coast. The author has used boiling to process Rangia, which can be done in a few minutes. Rangia has a taste similar to Atlantic saltwater clams.

With respect to Texas coastal margin adaptations, marine foods may have been a secondary resource, especially emphasized after A.D. 100. Yesner (1981:445) states that "Population growth appears to have played a significant role in further intensification of maritime adaptation (especially exploitation of more diversified marine resources) in late Holocene times in many areas". Perlman (1980) comments that people "locate in terms of critical resources and then adjust those 'optimal' locations to allow access to secondary resources in order to minimize risk."

A variety of freshwater shellfish types are found in inland Southeast Texas (Neck 1986, 1991), but distribution is not uniform throughout the region. Most inland shell midden sites are found in the Western Zone, such as along the San Bernard River. An excavation program in this area by the Houston Archeological Society has given a good picture of prehistoric exploitation of freshwater shellfish (Patterson and Hudgins 1986, 1987a, 1987b, 1989a, 1989c). Freshwater shellfish at various sites were utilized from the Early Archaic through the Late Prehistoric, with shell midden site 41FB37 (Patterson 1988a) having an early radiocarbon date of 6690 +/-120 B.P. (I-15206). Inland freshwater shell middens do not have the size of the large Rangia shell middens on the coastal margin. The locations of availablity of freshwater shellfish seem to have varied through time along inland streams in this region, evidently due to changing environmental conditions of the streams, such as sandbar locations, and water depth and flowrate.

The exploitation of freshwater shellfish in the Early Archaic (Patterson and Hudgins 1987a) and Middle Archaic (Patterson and Hudgins 1986) time periods tends to show that a broader use of food types by hunter-gatherers is not always correlated with either a high population level or an increased knowledge of secondary food resources in later prehistoric time periods. Freshwater shellfish is definitely a low-value secondary food resource that was utilized in early time periods in this region, when population levels were low. There are not enough data to determine if a broader range of food types was utilized during the high population levels of the Late Archaic and Early Ceramic periods in this region, or instead there was simply a higher intensity of exploitation of traditional food types.

The writing of Cabeza de Vaca provides some historic information that applies to the subsistence activities of Indians of the coastal margin of Southeast Texas. De Vaca mentions that Indians of this region ate nuts and roots, and a variety of small faunal types, such as rat, snake, lizard, frog and insects, as well as fish (Hedrick and Riley 1974:43). De Vaca describes deer hunting by driving them to the shoreline (Hedrick and Riley 1974:44). Coastal Indians seem to have moved along the coast and somewhat inland to gather nuts and prickley pear (Hedrick and Riley 1974:43-45).

Even though remains are not often preserved, nuts and acorns were probably an important part of the prehistoric diet in this region. Shafer (1975:250) has noted the presence of charred walnut shells at sites in the Lake Conroe area. Pignut shells were found at site 41WH73 (Patterson and Hudgins 1993) in Wharton County. The Western Zone of Southeast Texas is particularly well-known for large quantities of pecan trees.

Acorns from various types of oak trees would have been widely available as a food source in Southeast Texas, but it cannot be determined to what extent acorns were actually used by prehistoric Indians of this region. Swanton (1946:273,293) mentions that acorns were widely used by Indians of the Southeast, and Ricklis (1992:221) notes the historic use of acorns by Karankawa Indians on the central Texas coast. Goodchild (1984:22) states that "Some kinds of acorns were simply roasted, but most acorns are bitter and slightly toxic because they contain tannic acid, and a number of methods were used to get rid of the tannin. As a general rule, acorns of the white-oak group (with rounded lobes to the leaves) contain less tannin than those of the black-oak group (with pointed lobes) and require litle or no treatment." Larson (1980:188) also notes that acorns from the white oak species lack tannin and can be eaten without unpleasant effects. Goodchild (1984:23) states that "Acorns were eaten roasted, boiled, or crushed into flour to make bread, and oil was extracted from the acorns of live oak (*Q. virginiana*), a southeastern species." Experiments by the author have shown that tannin in acorns is not in the form of tannic acid. Water from boiling acorns has a neutral pH. Removal of tannin in acorns can be done by boiling of whole acorns, or cold water extraction of crushed acorns. Acorns remain a good candidate for a prehistoric food source in this region.

Bison were present in Southeast Texas, but probably not continuously. Bison had a limited regional geographic distribution and were not present in large numbers (Patterson 1992c). Dillehay (1974) has noted that bison were generally available only during some time periods in the Southern Plains. The distribution of bison remains in Southeast Texas is shown in Figure 9 for sites of all time periods. Bison did not penetrate the Big Thicket or piney woods areas that cover much of the region, but confined occupation to the more open coastal prairie areas. Thus, bison remains occur mainly in the Western Zone and the southern portion of the Central Zone in Southeast Texas. Sites with bison remains found in this region are summarized in Table 18. There is an indication of an increase in bison in the Late Prehistoric, but the data set is not large. The distribution of bison remains at sites west of the Colorado River that is shown in Figure 9 is based on data by Huebner (1991). Huebner (1991) has proposed a corridor of bison migration to the south between the Colorado and Brazos Rivers, but there is little evidence to support this corridor as a prefered route for bison coming into South Texas, based on the geographic distribution of bison remains at archeological sites. It seems likely that bison coming into South-Central and South Texas did this by routes west of the Colorado River (Patterson 1992c). The coastal prairie environment of Southeast Texas was not optimal for bison use, as bison prefer short grass environments instead of the long grass environments found in this region. There does not appear to have been large herds of bison in Southeast Texas during any time period.

The hunter-gatherer subsistence pattern was successful in Southeast Texas for a long time period, from the Paleo-Indian through the Late Prehistoric time periods. Agriculture was not practiced in this region in prehistoric times, even though the Caddo Indians practiced some agriculture in an adjacent region to the north during the Late Prehistoric period. Hudson (1976:76) notes that agriculture was widespread in the Mississippian culture in the Southeast Woodlands, but that some Indian groups remained as hunter-gatherers. The choice to practice agriculture is not always inevitable. Agriculture may not have been a viable subsistence option for much of prehistoric Southeast Texas (O'Brien and Spencer 1976). Soils of the Gulf coastal plain are not well-suited for agriculture without use of modern farming practices. Larson (1980:222) states that "There is rather substantial ethnohistorical evidence to indicate that agriculture was almost completely absent on the Coastal Plain west of the Apalachicola River." It is significant that intensive prehistoric agriculture was practiced only in interior regions of the Gulf coastal Plain, north of the band of piney wood that runs along the eastern Gulf coastal plain. Some acculturated historic Indians practiced agriculture in the northern part of Southeast Texas (Pettula 1992). Some historic Indians in Wharton County were known as "fish-eaters", because they lived on the creeks and rivers, depending for food almost entirely on fish and shellfish (Hudgins 1984:29).

Larson (1980:226) has concluded that meat and shellfish were a minor portion of the total calories in the diet of prehistoric Indians on the southeastern coastal plain. He states that "It would seem that it was necessary for the Indians to depend upon plant food in order to maintain a reasonable nutritional level even though this level did not reach that deemed necessary at the present time."

Huebner and Boutton (1992) have carried out stable carbon isotope analyses of human skeletal remains from site 41AU36 in the Western Zone of Southeast Texas. C3 food resources, mainly nuts and deer, were the principal dietary component of Indians at this site in the Late Archaic period. C4 grass species were a minor part of the diet. Future studies of this type could give more details on subsistence patterns in this region.

MOBILITY-SETTLEMENT PATTERNS

Mobility-settlement patterns are considered here separately for the inland and coastal margin subregions. Settlement patterns are, of course, tied to subsistence patterns. As Story

(1990:260) notes, there is difficulty in determining seasonality and duration of a stay at an inland campsite. Other aspects of mobility-settlement patterns can be considered, however, for inland sites. Some of the characteristics of inland sites are as follows (Patterson 1991e):

1. Sites are usually discrete locations, with fairly well-defined boundaries. Site dimensions typically range from 30 to 100 feet in diameter, although some larger size sites are known.

2. The majority of sites are multi-component, often with long occupation sequences (Patterson 1983), indicating frequent reuse of site locations.

3. Most sites are found near a water source, such as a stream or lake edge (Patterson 1979d).

4. There is little evidence of satellite activity areas and separate base camps. Most archeological sites simply indicate residential use.

5. Specialized subsistence activities do not generally occur in isolation at separate locations. Evidence for specialized subsistence activities, such as shellfish gathering, usually occurs together with indications of other subsistence activities at specific sites, such as hunting.

There is no model for mobility-settlement patterns of hunter-gatherers that is likely to fit precisely for a specific region (Ebert and Kohler 1988:112). However, the above characteristics for inland sites in Southeast Texas can be compared to two models given by Binford (1980) which represent two extremes in the spectrum of mobility-settlement strategies (Ebert and Kohler 1988:113). In one of Binford's models, the more mobile hunter-gatherers are called "foragers," with residential bases that are moved frequently and other poorly defined diffuse subsistence activity locations. Ebert and Kohler (1988:113) note that "Given a foraging adaptation, it is clear that, in much of the contempory archeological record, discrete 'sites' will not be apparent." In Binford's other model, the less mobile hunter-gatherers are called "collectors." In this model, there are well-defined residential bases and satellite locations that tend to be reused (Ebert and Kohler 1988:113). Collectors are characterized by logistically organized subsistence activities, using specially organized task groups (Binford 1980:10).

The characteristics of prehistoric sites of inland Southeast Texas seem to fall between the two extremes for mobility of Binford's two models. The lack of visible satellite activity locations fits the forager model, but the high reuse of sites fits the collector model. In Southeast Texas, there appears to have been employed a general foraging strategy, but on a highly scheduled basis. A single model of mobility-settlement pattern should not be used. As Story (1990:269) notes, "Much of the success of hunters and gatherers surely rested in their ability to implement a number of different economic responses, to be able to adjust to the good as well as the bad times. The tendency for archeologists to reduce an economic system to one model runs the risk of stripping the system of its main mechanism for survival".

The degree of mobility of hunter-gatherer groups cannot be determined by the types of data in the archeological record. Mobility is related to several independent variables, such as distances of moves, frequency of moves, and types of movement (residential and logistic). There is no single scale of mobility (Kelly 1995:149). It appears to be time for archeologists to move away from attempts to precisely define hunter-gatherer mobility, and instead concentrate on more productive subjects. The classification of hunter-gatherer groups as "foragers" or "collectors" in regard to mobility is seldom a useful exercise, because most hunter-gatherer groups act as both "foragers" and "collectors" in their seasonal rounds.

The use of nuts is a good example of where alternate subsistence strategies would have been necessary. Nuts are a good food source, but as Cabeza de Vaca (Hedrick and Riley 1974:43) noted, good nut crops are not available every year. Other food resources would have been needed in some years to take the place of nuts in the diet.

The reuse of sites in the inland subregion is indicated by the quantity of artifacts found at each site (sometimes thousands of lithic specimens) and the high proportion of multi-component sites. Table 19 shows that 90% or more of sites are multi-component from the Paleo-Indian through the Late Archaic periods. The proportion of single-component sites increases somewhat in the Early Ceramic and Late Prehistoric periods, but the majority of sites associated with these time periods are still multi-component. There are 44 published sites in this region with occupations from the Late Paleo-Indian period through the Late Prehistoric period. The high reuse of sites demonstrates scheduling and restricted mobility even during the Paleo-Indian period, which is sometimes considered to have had a more mobile lifeway. There are somewhat higher proportions of single component sites during the Early Ceramic and Late Prehistoric periods, showing a tendency for more dispersion and mobility. There is evidence that Indians were more mobile in the Late Prehistoric period (Patterson 1976:185), with less use of pottery and smaller sites. This tendency may have started in the last part of the Early Ceramic period, perhaps due to high population. Cohen (1977:83) has proposed that people may settle down to agriculture or become more mobile to obtain food when population pressures increase. Higher mobility of Indians in the Late Prehistoric did not change the general geographic settlement pattern, however. The same types of sites were being used as in previous time periods, but site locations apparently changed more often and with a more dispersed pattern. The higher degree of mobility of Indians in Southeast Texas during the Late Prehistoric period did not approach the high degree of mobility of Binford's (1980) forager model.

In Southeast Texas, only a few Paleo-Indian and Early Archaic cultures show evidence of a very mobile lifeway, including users of Clovis, Folsom, Midland, Scottsbluff, Dalton and Bell point types. In this region, these point types are mainly made of exotic Edwards Plateau flints, and are associated with a limited number of stone tool types. With the possible exception of Clovis, all of the highly mobile cultures are outliers in Southeast Texas, with concurrent less mobile Paleo-Indian groups well-established in this region, possibly as early as 11,000 B.C. Even the highly mobile Clovis and Folsom cultures did not depend solely on subsistence from extinct types of megafauna (Johnson 1977). Story and Guy (1990:426) see various degrees of mobility of different Paleo-Indian cultures as degrees of variation in emphasis on hunting or gathering, rather than distinctly different lifestyles. Scheduled subsistence patterns and a more limited mobility of Paleo-Indian groups in Southeast Texas appears to be related to adaptation to local resources, with no higher population levels. A more scheduled lifeway occurred in this region before significant population increases later in the Archaic period (Figure 10). Most Paleo-Indian occupations in Southeast Texas seem to be more related to a fairly settled lifeway of Paleo-Indians in the Southeast Woodlands rather than the highly mobile lifeway of western Paleo-Indians.

While much reuse of sites may indicate that Indians in this region had a scheduled subsistence pattern, details are not available on seasonal rounds, because a complete list of food resources is not available, and because it is difficult to determine in which seasons sites were occupied. Also, there is not a uniform distribution of food resources within the region, with differences in areas such as coastal prairies and piney woods. Specific types of plant foods would have been available only on a seasonal basis. Some types of hunting activities may have been more intense during certain seasons. In the Southeast Woodlands, Hudson (1976:275) states that "Several aspects of the deer's seasonal cycle led the Indians to hunt them most avidly and most successfully in late fall and winter."

Story (1990:177) has noted that the absence of stone hearths in Paleo-Indian context on the Gulf Coastal Plain may be related to fluidity of group movement. At site 41WH19, fired clayballs were found at all excavation levels, including Paleo-Indian levels (Patterson et al. 1987:Table 12). Use of clayball hearths for roasting food, comparable to use of stone hearths, may be another indication that Paleo-Indians in Southeast Texas had somewhat restricted movement for subsistence scheduling, compared to more wide-ranging Clovis and Folsom groups.

Coastal margin Indians appear to have used a zone about 15 miles wide along the upper Texas coast (Patterson 1990e, 1993). There seems to be a rather sharp boundary between inland and coastal margin type sites in the Galveston Bay area. Coastal margin type sites are usually Rangia middens with few lithics, oyster shell tools, large quantities of pottery, many bone tools, and with Baytown Plain pottery and no dart points in the Late Prehistoric period. Rangia shell middens can be found up to 15 miles inland from the coastline on streams with tidal flow, which causes increased salinity. Inland type sites are characterized by modest amounts of pottery, fired clayballs at some sites, much lithic material, no shell tools, no Baytown Plain pottery, and concurrent use of the bow and arrow and spear in the Late Prehistoric period.

Inland and coastal margin type sites can be found within a few miles of each other on Cedar Bayou and the Trinity River. For example, in the Trinity River Basin, sites 41LB54 and 41LB55 (Nash and Rogers 1992), and site 41LB2 (Aten 1967) are 16 to 25 miles from the coastline, and all of these sites are of the inland type. Closer to the coastline on the Trinity River, there are many Rangia midden sites that are of the coastal margin type.

Based on a seasonality correlation by Aten (1981) for growth ring patterns on Rangia shell, Rangia collecting was a regularly scheduled warm weather activity that began in late spring and ended in mid-summer (Story 1990:260). This seasonality model has now come into question. The actual dates for live Rangia samples from Trinity Bay do not give a good match with dates for the samples calculated by Aten's correlation (Patterson and Gardner 1993), and it has been noted that Aten's correlation is not suitable for mixed samples of Rangia collected during different months (Patterson, Ebersole and Kindall 1991). Based on the measurement of growth rings for right-hand shells from live Rangia samples taken in Trinity Bay, a late-February sample gave a mid-July correlation estimate, a late-May sample gave a late-June correlation estimate, and an early-October sample gave a mid-July correlation estimate. Thus, Aten's correlation tends to give mid-year results, regardless of when the actual live Rangia sample was taken. Story (1990:267) notes that the complete annual coastal/interior economic cycle remains to be identified or at least to be fully analyzed. A mobility-settlement pattern model is proposed here, where Indians used the entire coastal margin zone over the entire year, regardless of season. Inland portions of the zone may have been used somewhat more often in warm months to harvest plant materials, while sites on the coastline may have been used somewhat more in colder months when marine food resources would have been more reliable than inland food resources. Another consideration is that Indians of the coastal margin may not have taken many trips to the inland subregion during winter months, as the climate is more moderate on the coastal margin during this season. This proposed model is consistent with Ricklis' (1992) findings for the coastal margin at Corpus Christi Bay, where Indians did not use either the coastline or inland areas of the coastal margin exclusively during single seasons, but did spend more time at shoreline sites during the winter months.

There is some ethnographic support for use of shoreline sites during the colder months. Ricklis (1992:225) has observed that "Cabeza de Vaca was clearly describing a fall to winter emphasis on shoreline fishing, supplemented by gathering of roots that probably supplied a high-starch complement to the protein-rich fish diet. He also noted that the islanders moved to the mainland during the spring, where they consumed shellfish and terrestrial fauna and flora." The large amounts of pottery found at large Rangia shell midden sites on the upper Texas coast implies that this type of site was used for fairly long time intervals, because the use of pottery would not be emphasized in a highly mobile settlement pattern. Many coastal margin shell middens are multi-component sites. As with inland sites, the reuse of sites on the coastal margin indicates scheduling and restricted mobility. There is evidence that Indians of the coastal margin of this region may have been less mobile than their inland counterparts, but this is a matter of degree rather than a different lifestyle.

While contrasts have been given here between mobility-settlement patterns of the inland and coastal margin subregions, future research may generate enough data to show a finer distinction between different ecological areas within the inland subregion. The piney woods zone in the northern counties of this region should have a settlement pattern that reflects that fewer locations were occupied due to environmental limitations, compared to a denser occupation level of the more open areas of the inland subregion. There are locations in the piney woods of relatively high productivity of food resources, in this ecological zone of generally low productivity. The piney woods zone of the northern part of this region has not been well surveyed compared to the more open areas of coastal prairies and mixed woodlands.

The concept of seasonal aggregation and dispersal of social groups of the coastal margin has been considered for some time, but various investigators have reached different conclusions on this subject. It is difficult to determine from archeological data whether social aggregation occurred at a site. A larger site size can be due to short-time occupation by a large group or long-time occupation by a small group. Story (1990:268) finds the same type of difficulty in using mortuary data to determine social aggregation at sites versus longer occupation by small groups. A cluster of nearby sites might indicate a village or seasonal aggregation of bands, but data are generally not available to determine if this is the case. The uncertainty of individual radiocarbon dates is such that it cannot be determined if multiple sites were really concurrent in occupation.

The importance of water travel for Indians of Southeast Texas cannot be determined, because remains of watercraft have not been preserved. Use of watercraft would have facilitated travel thoughout the region, including on streams, and coastal lagoons and inlets. Karankawa Indians were known to have had dugout canoes, propelled by means of poles (Newcomb 1961:67). There is little evidence of heavy woodworking tools at archeological sites that would indicate manufacture of canoes. Newcomb (1961:67) states that "One side of a log was trimmed flat, its end blunted, and then it was hollowed out, probably with the aid of fire and much scraping".

SITE STRUCTURE AND FORMATION PROCESSES

There are a number of questions that can be asked about the structure and formation processes of sites of nomadic hunter-gatherers. Questions include details of physical layout and use of sites, length of stays, and number of people in an occupation. Binford (1983:Chapter 7) has noted that these types of questions should be addressed, but the development of better analytical and interpretive methods is needed for these types of studies. The nature of the archeological record precludes obvious answers to these types of questions.

Site layout at both inland and coastal margin hunter-gatherer sites may have been structured in use by occupants, but archeological remains generally do not permit detailed analysis. Archeological remains at this type of site are usually randomly patterned, such as the distribution of hearths, lithics and ceramics. Little data is generally available for this region concerning the relative positions of hearths, shelters, and work spaces. It may be the nature of hunter-gatherers to use randomly placed work areas, where most convenient for expedient purposes, but confined to fairly definite site boundaries.

Inland sites in Southeast Texas usually have fairly definite boundaries. It is not clear why occupations were confined to rather restricted areas of reuse, when scheduling practices could have involved only the return to general areas, without relocation on the same exact site. One reason for high reuse of inland sites may have been the availability of lithic materials, such as bifacial thinning flakes, in locations that had no immediate access to lithic raw materials. Some of the large coastal margin shell midden sites show that various occupation events were more spread out in space than at inland sites.

The study of site formation processes could offer another method to address questions about sites, such as group size and length of stay. Site formation processes are seldom a subject of research in this region. The potential for significant results from this type of study is presently unknown. An example of the possible interpretation of the site formation process is for large coastal shell middens. The use of Rangia shell to pave and repave campsite areas gives the superficial impression of occupations by large groups. However, only a small part of the total site area may have been in use at a specific time. Detailed studies of the formation processes of large shell midden sites are not yet available. Paving of sites in wetlands and on the sticky "black gumbo" soils of the coastal margin would have given a better campsite surface.

Aten (1983b) has given results of excavations of two small unstratified shell midden sites in the Trinity River Delta. He observes that each habitation episode had two features, a hearth and a shell refuse pile. Aten concludes that there is a strong correlation between increasing hearth area and corresponding increase in area asociated with the shell refuse pile for small shell midden sites. Aten (1983b:84) is not sure of how to interpret habitation features of large stratified shell midden sites. Even at small sites, such as these two, there is evidence of exploitation of mammal and fish foods as well as Rangia shellfish.

Occasionally, a large inland site can be found where different areas of the site were used during different time periods. In this case, the large site cannot be related to large occupation groups. Site 41HR206 (Patterson 1980c:13) is an example of this type, with dimensions of 300 by 500 feet, and a distinct concentration of Late Prehistoric materials on one side of the site.

The study of site formation processes includes the study of site disturbance processes. Many sites in this region with long occupation sequences are totally deflated by erosion, modern construction, and farming practices. Some sites, such as 41HR315 (Patterson 1980a) are located on stream banks, where some areas of the site are disturbed and other areas are intact. Site disturbance by burrowing animals is another common occurrence in this region. Careful analysis of each excavation unit is often sufficient to detect locations where stratigraphy is not intact.

When several types of projectile points are found in the same excavation level, it should not be automatically assumed that there has been stratigraphic mixing. This is especially true for the Late Archaic, Early Ceramic, and Late Prehistoric periods, where several projectile point types were used during the same time period. In many cases, however, stratigraphic mixing can be shown to be likely by a mix in artifact types, for example a mixture of Middle Archaic dart points and potsherds. Sometimes animal burrows are evident by soil color differences. A single animal burrow can displace a few artifacts without disturbing most of a site.

INTERPRETATION OF SITE ACTIVITIES

One of the goals of archeological research is to reconstruct prehistoric lifeways in as much detail as possible. This includes the interpretation of activities at sites. A site must first be classified as to general type, such as kill site, mortuary site, quarry site, or campsite. In Southeast Texas, the most common type of site is the campsite.

There are many limitations to the interpretation of site activities, because of the lack of preservation of perishable materials, and the difficulty in determining the exact function of some artifact types, such as ceramics and unifacial tools. Some possible site activities can be assigned a fairly high degree of certainty, however. A bison kill site is sometimes apparent, such as site 41HR541 (McReynolds, Korgel and Ensor 1988). Mortuary sites are also obvious. Projectile points and faunal remains certainly represent hunting activities. Accumulations of lithic flakes represent lithic manufacturing, and hearths generally represent cooking activities. The few types of activities that can be detected at campsites in this region all indicate a generalized hunting and gathering lifeway. There is no way to describe a large number of activities at a specific campsite, however. A somewhat more detailed picture of the range of activities at campsites can be obtained when data from all sites in a region are considered.

These comments on the interpretation of activities at archeological sites are not made to discourage detailed studies, but rather to point out that limitations in interpretation must be considered. In various archeological site reports, investigators may or may not have good reasons for concluding that certain activities took place at the site. It is not always clear what degree of certainty is represented in conclusions in a site report. Therefore, conclusions on possible activities at archeological sites must always be regarded with some degree of caution. There is no reason to lament this situation, however. It is simply the nature of archeological research.

POPULATION DYNAMICS

It is not possible to reconstruct a detailed picture of prehistoric population dynamics for this region, because precise temporal data are not available to show short-term population changes. Even radiocarbon dating, seldom available, has an accuracy of only about plus or minus 100 years. Significant short-term population changes due to factors such as disease, drought or food shortage cannot be assessed for available data. Long-term relative population changes in Southeast Texas can be studied, however. This is done by calculating the average number of sites per year for each archeological time period. Relative population levels for the inland and coastal margin subregions of Southeast Texas are summarized in Table 20, based on data from the mid 1992 data bases. The Relative Population Factor (RPF) is the number of site components of a period divided by the number of years in the period times 100. These data are shown graphically in Figure 10.

Population is discussed here in terms of relative population levels during various time periods. Data are not available to estimate absolute population levels. Archeology is essentially a sampling activity. There is no way to accurately estimate what portion of the total population is represented by the regional data base for any prehistoric time period.

As may be seen in Figure 10, the population growth rate of the inland subregion was low from the Late Paleo-Indian through the early part of the Late Archaic. Population growth rate accelerates greatly during the later part of the Late Archaic into the Early Ceramic, and population then declines in the Late Prehistoric. The decrease in population level of the Late Prehistoric in inland Southeast Texas did not return to a level as low as in the Archaic period. There was no "crash" in population level in the Late Prehistoric period, but there was a significant adjustment in population level. There seems to have been a decline in population in Central Texas during the same time period (Prewitt 1983:Figure 6).

Aten (1983:154) proposed that there was a reduction in population level in the Early Archaic period, compared to the Paleo-Indian period, because of climatic change to drier conditions. Subsequent research has shown that this impression is more apparent than real, largely due to poor recognition of Early Archaic artifact types, and previous lack of radiocarbon dates. Aten (1983:155) did note that further research might change his conclusion, as now shown. As a similar example of previous lack of data, Hall (1981:269) observed that there was not much evidence of occupations in the lower Brazos River valley before the Middle Archaic period. Data now show sites in this area with very long occupation sequences, starting in the Paleo-Indian period, including site 41FB95 (Patterson and Hudgins 1987c) and site 41FB198 (Patterson and Hudgins 1991), with a variety of Late Paleo-Indian and Early Archaic dart point types. Excavations by the Houston Archeological Society at site 41FB223 (Patterson et al. 1994) have shown that this site started in the Late Paleo-Indian period and continued through all portions of the Archaic period, as another example of early occupations in the lower Brazos River valley. Sites of all prehistoric time periods have been found on high terraces above the floodplain of the lower Brazos River Valley, but few sites are known on the floodplain. Sites on the floodplain in this area may be covered with alluvium or may have been destroyed by floods (Hall 1981:269).

It has previously been estimated that the population growth rate was about 0.02% per year during the Late Paleo-Indian, Early Archaic, Middle Archaic, and early portion of the Late Archaic, and that the growth rate increased to about 0.1% per year in the later part of the Late Archaic and in the Early Ceramic periods (Patterson 1991f). The population growth rate of 0.02% per year for the earlier time interval is somewhat higher than several estimates of up to 0.003% per year for Pleistocene population growth rate (Cohen 1977:52), which might be expected for a milder post-Pleistocene climate. The population growth rate of 0.1% per year for the later time interval in this region is very high for hunter-gatherers, and is comparable to the population growth rate of the more sedentary Neolithic of the Middle East (Cohen 1977:53). Fagan (1991:334) has noted a "sudden takeoff in population densities" in the eastern Woodlands sometime after 4000 B.C.

Several factors could be considered for the high population growth rate in the Late Archaic and Early Ceramic periods. These factors might include: (1) a wetter high productive climate, (2) increased hunting efficiency with early use of the bow and arrow, (3) introduction of pottery for food storage, (4) availability and adaptation to a greater range of food resources, and (5) migration of people into the region. The high population growth rate is possibly due to more than one factor. The sharp increase in population in Southeast Texas occurred during the same period of 800 B.C to 800 A.D (Wenke 1990:565) as also happened throughout eastern North America, and the same factors may have caused a population boom from Central Texas to the Atlantic coast. The possible impact of early use of the bow and arrow has been discussed above, and Story (1990:244) has noted that the climate probably became more moist during the Late Archaic and Early Ceramic periods in this region. The introduction of pottery could be considered a contributing factor for population growth by allowing food storage to sustain a higher population. However, a similar increase in population growth rate in Central Texas at the same time was not accompanied by the introduction of pottery.

One explanation of the population decrease from the Early Ceramic to the Late Prehistoric is that of over-population. Biological over-population is generally followed by a decline (Gleick 1988:62). Available natural food resources would not be expected to sustain a very high population growth rate. Another explanation is that climate deterioration caused a more mobile, diffuse subsistence pattern with a lower population level. Story (1990:246) has noted a shift to a drier climate over the last 2000 years. There is evidence for a more mobile lifeway in the Late Prehistoric in inland Southeast Texas (Patterson 1976), which could have resulted in a lower population level. It has been observed that in hunting-gathering societies, fertility rates are suppressed significantly simply due to maternal mobility (Wenke 1990:262). One method used by hunter-gatherer groups for population control was infanticide. Cabeza de Vaca (Hedrick and Riley 1974:76) observed that Indians of the coastal margin sometimes killed female babies.

It is shown in Figure 10 that population growth rate in the coastal margin subregion increased rapidly from the Late Archaic into the Early Ceramic periods, similar to the inland subregion. However, on the coastal margin the population growth rate leveled-off in the Late prehistoric instead of declining as in the inland subregion. The leveling off of population growth rate for the Late Prehistoric period in the coastal margin subregion does not match Aten's (1990:Figure 17.1) hypothetical model or Patterson's (1986:Figure 2) model based on an older, smaller data set. On the coastal margin, the response to over-population and climatic deterioration was a leveling-off of population growth rate rather than a decline, probably because of good availablity of marine food resources. According to Cabeza de Vaca (Hedrick and Riley 1974:40) coastal margin Indians were less hungry than inland Indians.

There are very few Rangia shell midden sites on the coastal margin dated before 500 B.C. (Aten 1983:158), even though the sea level is thought to have stabilized about 1000 years earlier at 1500 B.C. Aten (1983:158) states that it is possible that significant expansion of the coastal margin population did not occur until the onset of the fully modern climate of the Sub-Atlantic episode. Climatic change might correspond to a greater availability of Rangia shellfish. Other environmental factors in the formation of brackish water wetlands might be considered. After sea level stabilization, some time may have elapsed before suitable environmental conditions developed for widespread establishment of Rangia colonies, in terms of proper salinity and shallow water sedimentation. After shoreline stabilization it may take some time for a sizeable Rangia population to become established. Also, the formation of barrier islands after sea level stabilization would result in lower salinity in bays later than the time of sea level stabilization. There may be an alternate cultural explanation for low occupation of the coastal margin of Southeast Texas for about 1000 years after sea level stabilization. The coastal margin of this region may have been fully occupied only after migration to the area of peoples from Louisiana who already had an orientation to marine food resources. Possible migrations from the Louisiana coast to the upper Texas coast are discussed further in the section on Social Organization. The low occupation of the coastal margin from 1500-500 B.C. implies that the coastal margin may not have had much use by earlier populations at earlier coastline positions.

BIOARCHEOLOGY

Bioarcheology, the study of human skeletal remains, provides evidence on the health and welfare of prehistoric Indians, especially as an indication of the degree of success for local patterns of adaptation. Bioarcheology is foremost a study of evidence of stress, which can be due to causes such as disease, high population density, human conflict, and malnutrition. The actual cause of death is seldom established, except where there is direct evidence of trauma from violence. Bioarcheological studies are seldom complete because of generally poor preservation of skeletal remains in this region. There are some exceptions, however, where soil conditions have allowed better preservation of bone. Most investigators (Powell 1988, Reinhard, Olive and Steele 1990) agree that bioarcheology in Southeast Texas is still in a preliminary stage. As will be seen in the following discussion, few general conclusions on this subject are currently possible.

Several bioarcheological studies have been made for individual sites in this region, such as Vernon (1989), Wesolowsky and Malina (1976), Copas (1984), Powell (1990), and Malina and Bramlett (1981). Current bioarcheological syntheses include the eastern and western parts of Southeast Texas. Burnett (1990) shows a general paucity of data for the eastern part of Southeast Texas, mainly the piney woods area. There is a small data base on this subject for the western part of Southeast Texas (Reinhard, Olive and Steele 1990). Most studies for this region simply itemize pathological conditions found on skeletal specimens. Only Powell (1988) has attempted to integrate data to reach some general conclusions on the adaptive success of Indians in the Late Prehistoric period. For studies in this region, few conclusions have been reached on the relative success of adaptations in various time periods.

Pathological conditions mentioned in various studies include classes of disease that indicate degenerative disease, metabolic disease, infectious disease and dental disease (Reinhard, Olive and Steele 1990:Tables 128-132). Degenerative disease is the result of aging and stressful lifestyle. Metabolic disease is related to nutrition. Infectious disease is most often related to the degree of contact between people, with factors such as population density and social aggregation. Dental disease is related to diet and dental wear from eating gritty materials. Indications of pathology can vary greatly at individual sites, from a high incidence of pathology (Powell 1990, Copas 1984) to sites with little indication of pathology, such as 41FB3 (Patterson et al. 1993), showing general good health of individuals.

Powell (1988) has developed a set of models describing a group's success in preventing environmental stress from affecting its members. As a preliminary conclusion, Powell 1988:262) states that "From the tests, it appears that the Inner and Outer Coastal Plain groups have moderate success in buffering stress, although they may experience stress at random or during seasonal intervals". Life expectancy is probably one of the best measurements of adaptive success. As examples, average life expectancy was 24 years at the Crestmont site and 32 years at Witte Group 2 (Vernon 1989:37) from the Late Archaic period. Some individuals lived over 50 years during this time period (Black, Patterson and Storey 1992). Aten et al. (1976:Table 13) give an average age for adults of 29 years at the Boys' School Cemetery and 39 years at the Jamaica Beach site on Galveston Island.

Evidence of trauma is mainly in the form of indications of violent death due to projectile points, such as at sites 41AU36 (Hall 1981), the Crestmont site (Vernon 1989), the Peikert site (Kindall 1980, Copas 1984), and 41FB42 (Patterson et al. 1993a). At site 41FB42, a dart point was imbedded in a human femur, just above the knee joint. At the Crestmont site (Vernon 1989:Figure 6), dart points were found in the right humerus and rib cage of a skeleton. At site 41AU36, dart points were found imbedded in the skeletal elements of five individuals, probably resulting in their deaths (Hall 1981:60). Possible causes of violence are discussed in the section on social organization.

Powell (1994) has analyzed a large quantity of human skeletal material from site 41GV66 on Galveston Island. There was a wide range of disease, dental problems, and trauma. Death of one Late Prehistoric individual was caused by an arrow wound. The frequency of trauma increased from prehistoric to historic time. The mean age of death was 28 years for prehistoric burials and 20 years for historic burials. The lower mean age of death in historic time may be due to epidemic deseases and/or socioeconomic stress. Heterogeneous skeletal attributes suggest that the historic population at 41GV66 was not typical of other groups along the Texas coast.

CHAPTER 6

SOCIAL ORGANIZATION

GENERAL

Most data for hunters and gatherers indicate that social organization was on the band level, usually representing a family or extended family. Hayden (1993:154) states that band size can vary between 6 and 12 people where resources are scarce, and between 25 and 50 people where resources are more plentiful. Band composition of hunter-gatherers can be fluid, with a high frequency of shifting group affiliations (Lee and DeVore 1968:153). Since it is not possible to detect individual bands in this region by artifact types or site patterns (Patterson 1990b), discussion here will focus on general aspects of social organization that may be detectable in the archeological record, such as trade, mortuary practices, sporadic evidence of greater social complexity, and perhaps broad social affiliation within subregions.

Aten's (1983:316) contention that archeological sets should approximate the spatial distribution of ethnic groups may have at least limited application in Southeast Texas. The inland and coastal margin subregions each have some distinctive traits. The archeological record seems to indicate a relative isolation between these two subregions, basically caused by geographic subsistence patterns. This probably resulted in distinct cultural affiliations, although the basic level of organization remained on the band level in both subregions. There may have been some ethnic differences due to migration of cultural groups. As Aten (1983:297) has shown, ceramics were introduced into Southeast Texas from the east. If movement of ceramic technology was accompanied by movement of people from the wetland areas of Louisiana, the upper Texas coastal margin may have been at least partially populated by ethnic groups that were distinct from their inland counterparts in ceramic time periods. The case for Indians from the east moving into the upper Texas coastal margin is somewhat supported by data that indicate more intense use of shellfish starting at the same time as the introduction of ceramics. In any event, the relative isolation between inland and coastal groups was possibly reinforced over time by social organization as well as by geographic subsistence and settlement patterns. The geographic areas of historic Indian groups in Southeast Texas (Aten 1983:Figure 3.1) are not very helpful in defining any geographic areas for prehistoric ethnic groups, unlike some adjacent areas such as the Caddo to the north and the Karankawa on the central Texas coast.

Aten (1983) has given a brief discussion of ritual and cognition that might be applied to this region, but his model (Aten 1983:Figure 6.1) seems to be generally too abstract to apply to archeological data. Hayden (1993:163-169) feels that ritual and social aggregation were important features of hunter-gatherer societies. Aside from mortuary data, however, there is little in the archeological record of this region to indicate evidence of ritual and belief systems. Hayden (1993:213) also notes that material aspects of lifestyles may be more important than social institutions in determining the characteristics of a culture and cultural changes. In actual practice, hunter-gatherers do not always separate belief systems from the material aspects of culture. For example, religious beliefs of the Australian aborigines contain symbols that aid in navigational and subsistence activities in the desert (Pfeiffer 1982:158). Social complexity is best considered in terms of specific aspects. For example, a hunter-gatherer society can have a relatively simple level of technology, subsistence, and social organization; but can have a complex belief system.

Social aggregation of groups within a region is difficult to detect in the archeological record. Various groups within a region do not usually have distinctively different artifact types that would indicate that different groups were meeting at a site. Also, as already noted, site size is not a reliable indication of social aggregation, since site size may be a function of length of stay by a group. Coastal margin pottery types found at sites in the inland subregion could indicate social aggregation, or instead could simply be the effect of exchange of women or of variation in settlement-subsistence patterns.

There is an inland site in this region with evidence of aggregation of Indians from adjacent regions. Site 41WH12 (Patterson and Hudgins (1989a) has artifact types that represent 3 adjacent regions in the Late Prehistoric period. These artifact types include Rockport pottery and a Catan dart point from the Central Texas coast, San Jacinto grog tempered pottery from the coastal margin, and lithic artifact types typical of the adjacent Central Texas region. This site also has the earliest published time for Rockport pottery, between A.D. 900 +/-80 (I-15944) and 990 +/-80 (I-16221).

The trend toward smaller dart points in later time may have some social basis. A higher population density may have restricted movement for lithic procurement, to cause more use of smaller, more local types of lithic raw materials in later time. Higher population density can have several social consequences for hunter-gatherers, such as a trend toward more social compexity, lower availablility of food resources, and a generally more stressful lifestyle. A more stressful lifestyle could in turn cause more inter-group and intra-group conflict.

It should be realized that the area of Southeast Texas is an artificial modern designation with boundaries that do not specifically define any limits of cultural affiliation or technological traditions. Also, it is difficult to relate many technological traditions to ethnic traditions, as some technological traits can have very large geographic distributions, perhaps caused by broad, ill-defined interactions between bands. Story (1990:256) has proposed a "Mossy Grove" cultural tradition for Southeast Texas and somewhat farther to the north, based on the distribution of Goose Creek sandy paste pottery. It is a rather tenuous concept, however, to base a cultural tradition mainly on a single technological trait. As may be seen from the geographic distributions of projectile point types, this region is a heterogeneous interface between technological traditions to the east and west. There would seem to be too many differences in technological traits in different parts of Southeast Texas to define the region as a single cultural tradition, such as Story's "Mossy Grove" proposal. The geographic distributions of technological traits can far exceed the geographic distributions of ethnic groups relating to specific social traditions.

In general, details of social organization given in the ethnographic record cannot be detected archeologically. As noted above, seasonal social aggregation noted in ethnographic accounts (Aten 1983:Chapter 5) is difficult to detect from archeological data, so that the idea of tribes of loosely associated bands cannot be tested. Archeological data are not useful in identifying specific prehistoric ethnic groups or in identifying geographic boundaries of prehistoric social groups in this region. The ethnographic record is consistent with archeological data concerning Southeast Texas as an interface between traditions of the Southern Plains and the Southeast Woodlands. As shown by Aten (1983:Figure 3.1), Tonkawa bands associated with Central Texas were present in the western part of Southeast Texas, and Akokisa and Atakapa groups in the eastern part of Southeast Texas can be associated in general with cultural traditions of the eastern Gulf coastal plain.

MORTUARY PRACTICES

Details of ancient cultures can often be found at burial sites that cannot be found at campsites. At some mortuary sites in Southeast Texas, indications of trade, social status, and organized burial practices can be found. In most of this region in most time periods, mortuary practices were not organized, with mostly isolated burials without grave goods. There are two major organized mortuary traditions in Southeast Texas, in the Late Archaic period in the inland Western Zone (Hall 1981) and in the Late Prehistoric period (Aten et al. 1976:Figure 16) on the coastal margin. These two mortuary traditions are not related culturally, but perhaps there are some common factors in the formation of these complex mortuary traditions. For example, for the Late Prehistoric mortuary tradition on the coastal margin, Aten (Aten et al. 1976:100) states that "It therefore appears that technological factors could have resulted in longer stays at fewer localities within a stable scheduling framework and in conjunction with these longer periods of residence that burial aggregates were created." It is difficult to demonstrate from archeological data that a more sedentary lifestyle was connected with the complex mortuary traditions of this region. In any event, an affluent subsistence pattern is implied, as complex cultural traits would not likely develop during shortages of food resources. A more affluent subsistence pattern does imply a less dispersed, less mobile lifeway. This appears to be true for the Late Archaic mortuary tradition of the inland Western Zone in and between the lower Brazos and Colorado River valleys. This geographic area was well-endowed with food resources, such as nuts, deer, and a variety of other floral and faunal resources.

Late Archaic Mortuary Tradition

The Late Archaic mortuary tradition in the western part of Southeast Texas (Austin, Wharton,Fort Bend Counties) has sites that are highly variable in size, from 2 individual burials (Black, Patterson and Storey 1992) to well over 100 individual burials (Hall 1981). All of the sites have exotic grave goods, showing long-distance trade. A list of sites of this type is shown in Table 21, including a list of 8 sites tabulated by Story (1990:Table 54) and 3 more recent site discoveries. The most common types of exotic grave goods in this mortuary tradition are marine shell pendants and beads. Other exotic grave goods found at some sites include lithic artifacts made from Edwards Plateau flint, and a variety of ground stone items, such as boatstones, bannerstones, and gorgets. Items made of bone, such as awls and pins (Hall 1981:Figure 51), are also commonly found as grave goods of this mortuary tradition. These types of bone artifacts are probably of local manufacture, rather than representing exotic trade goods.

In the Late Archaic mortuary tradition, there is evidence of violent deaths from projectile points at sites 41AU36, 41FB42, 41WH14, 41WH39, and perhaps 41AU1. Increased violence may have been the result of stress caused by higher population density and increased social complexity. Whether or not violence is due to inter-group or intra-group conflict has been discussed by Patterson (1988b) and Hall (1988b). Hall (1981:308) has proposed that a gradually hotter, drier climate at the end of the Late Archaic period, and/or encroaching bands of bison hunters from the Southern Plains, may have caused an expansion of peoples from Central Texas into Southeast Texas. This population range expansion resulted in increased inter-group conflict and "raiding." As a contrasting view, Patterson 1988b) has noted that intra-group personal conflict is common among historic hunter-gatherers, such as examples by Bower (1988). Much of the intra-group violence seems to have revolved around control of sexual relations (Bower 1988:91, Chagnon 1988:986). Evidence of violent death appears dramatically among the skeletal remains of more complex foragers (Price and Brown 1985:12). Burial grounds serve to denote territorial claims, and territorial behavior is identified by increased identity signaling and boundary defense (Price and Brown 1985:12). However, intra-group conflict is also well-known among more hunter-gatherer groups (Chagnon 1988, Patterson 1988b, Steward 1968), so types of violence in complex hunter-gatherer groups remains a good subject for further research. Increasing population density at the end of the Late Archaic period would have possibly caused increasing violence, due to both inter-group and intra-group increased stresses. Ethnographic data indicates that hostilities between historic Indian groups was frequent (Covey 1961:66, Newcomb 1961:323).

Hall (1981) has given the most detailed description of sites in the Late Archaic mortuary tradition of the Western Zone of Southeast Texas. At site 41AU36, the tradition of group burial actually started during the Middle Archaic. The most organized expression of organized burial practices, however, is during the Late Archaic, since this is the period when the most significant amounts of grave goods were used. In the Group 2 (Late Archaic) burials at site 41AU36, exotic grave goods included marine shell pendants and beads, shark teeth, stingray spines, boatstones, large corner-tang knives, stone gorgets, and a marine shell atlatl weight. Bone and antler grave goods, such as long-bone implements, may have been made locally. Exotic grave goods in this mortuary tradition indicate trade with several other regions, such as Central Texas, Arkansas, and Louisiana.

At site 41AU36, there was a Middle Archaic burial Group 1 of an estimated 61 individuals (Hall 1981:54). Grave goods were found with seven individuals, including pointed bone artifacts and a large Pedernales projectile point. Thus, the concept of using grave goods started in the Middle Archaic period, but reached full elaboration during the Late Archaic period with a variety of exotic grave goods. After the Late Archaic, small Burial Groups 3 and 4 (10 and 13 individuals, repectively) that represent the Early Ceramic and Late Prehistoric periods did not have significant grave goods, but some organized burial practices did continue.

Consistency of burial type and position are taken as indications of organized behavior related to a specific tradition. In several of the sites in the Late Archaic tradition, a northerly head orientation is common, such as at site 41AU36 (Hall 1981:Figure 53) and 41FB3 (Patterson et al. 1993b). At site 41AU36, each burial group of a different time period had a different average head orientation direction, possibly indicating change in social preference or belief system. Head orientation for Group 1 burials (Middle Archaic) was to the southeast, for Group 2 burials (Late Archaic) was north to northeast, for Group 3 burials (Early Ceramic) was to the northwest, and for Group 4 burials (Late Prehistoric) was to the southeast. Data from sites 41AU36 and 41FB3 indicate a shifting direction of head orientation of burials from southeast in the Middle Archaic to north in the later part of the Late Archaic. Middle Archaic Group 1 burials at 41AU36 with radiocarbon dates of 2610 +/-140 B.C. (TX-2453) and 1530 +/-90 (TX-2127) had a predominant head direction to the southeast. A burial at 41FB3 with a radiocarbon date of 1280 +/-170 B.C. (I-17333) had a head direction to the east. Later burials of 41AU36 Group 2 with radiocarbon dates of 520 +/-130 B.C. (TX-2451) and A.D. 360 +/-80 had head directions from north to northeast, and a burial group at 41FB3 with a radiocarbon date of 630 +/-130 B.C. (I-16513) had head directions to the north. Burial orientation may have been related to the position of the rising and setting sun (Hall 1981:282). While predominant orientation did change from one burial group to another over time in the Allens Creek complex, cultural preference can only be noted, without being able to describe any associated belief system. Supine extended and semi-flexed burials are most common for this burial tradition (Hall 1981:Figures 18-23), and some bundle burials occur (Hall 1981:Figure 17). Bundle burial is a form of organized activity, where bone defleshing is done before burial. Red ochre was used with burials in this tradition (Hall 1981:182, Patterson et al. 1993b).

Higher social status of some individuals is indicated by the selective use of grave goods in burials of the Late Archaic tradition, such as at site 41AU36 (Hall 1981). At site 41FB42 (Patterson et al. 1993c), there were more than 4 burials, but only 1 burial had exotic grave goods, in the form of wrist and ankle bracelets made of shell and stone beads. There were 16 burials at site 41FB3 (Patterson et al. 199b), but only 3 burials had grave goods, in the form of long-bone implements with 1 burial and shell pendants with 2 burials. The exact meaning of higher social status in a hunter-gatherer society is generally not clear, as formal leaders are not present. Higher social status may be due to group respect of certain individuals, "big men", or spiritual leadership, "shamans."

Hall's (1981) burial sites at Allens Creek and site 41FB3 (Patterson et al. 1993d) are also campsites, with data available on a wide range of faunal remains. These data support the concept that the organized mortuary tradition was connected with a good subsistence base that may have allowed a more sedentary lifestyle.

Late Prehistoric Mortuary Tradition

Aten et al. (1976) have given details on a Late Prehistoric mortuary tradition of the coastal margin of this region, with sites having organized burial patterns and a wide variety of grave goods. Story (1990:261-265) has also discussed this subject. A summary of Late Prehistoric coastal margin sites with grave goods is given in Table 22. Story (1990:262) feels that site 41BO2 and perhaps 41GV5 should be put into a burial cluster associated with the western part of the upper Texas coast, separate from the Galveston Bay mortuary tradition. Her opinion is because of different skeletal characteristics at 41BO2 (taller individuals associated with the Karankawa body type).

A detailed view of a cemetery site for the coastal margin has been given by Aten et al. (1976) for the Harris County Boys' School site (41HR80). A wide variety of grave goods were found, including marine shell beads and pendants, bird bone flutes, bone dice, bone awls, fishhooks, projectile points, and a possible rattle. Red ochre was used with some burials. The burials were generally flexed or semi-flexed in side positions, with a variety of head directions. The Late Prehistoric mortuary tradition of the Galveston Bay area had a degree of organization similar to the inland Late Archaic mortuary tradition, except that long-distance trade was not generally involved in the coastal margin tradition.

Ricklis (1993,1994) has found three burial groups at site 41GV66 on Galveston Island, with one group from the Late Prehistoric period and two groups from the Historic Indian period. Grave goods here seem typical of the Late Prehistoric mortuary tradition of the Galveston Bay area, including bone and shell beads, bird bone flutes, and perhaps a rattle. A variety of European trade goods were found along with items of Indian manufacture with two of the burial groups. Ricklis (1994) presents extensive data on burial practices in the Late Prehistoric period, and provides data on the little known burial practices of the Proto-Historic and Historic Indian periods. Burials include primary interments, secondary interments, and cremations.

Other Burial Sites

Some examples of prehistoric inland burial sites not associated with a mortuary tradition are: 41HR5 and 41HR7 (Wheat 1953), 41HR273 (Ensor and Carlson 1991), and 41WH19 (Patterson et al. 1987). Mortuary sites without large group burials are difficult to discover. Steele and Olive (1990:157) estimate that less than 2% of recorded sites in this region have documented human skeletal material. They also note that 50% of the number of sites with recorded burials had more than one burial, and 16% had 10 or more. Story (1990:258) observes that for Early Ceramic and Late Prehistoric period burials, in most cases the burial is an isolated interment or part of a small aggregate of burials. Steele and Olive (1990:Table 32) have tabulated burial sites in this region from both published and unpublished data.

SOCIAL COMPLEXITY

Higher degree of social complexity for hunter-gatherers is usually considered by evidence for organized behavioral patterns aside from basic subsistence. Social complexity among hunter-gatherers has been considered by a variety of indicators, such as: population density, permanent shelter, permanent ceremonial grounds, art styles, differences in burials due to grave wealth, and energy invested in grave preparation (Price and Brown 1985:437). Social complexity often increases with a more affluent, sedentary lifestyle. Soffer (1985:265) has observed that social complexity of hunter-gatherers does not usually follow a continuous evolution to higher complexity, but instead follows a fluctuating trajectory. Apparently, social complexity of hunter-gatherer societies is an adaptive mechanism that flourishes only under certain conditions in response to security in subsistence (Price and Brown 1985:436). "Decreased mobility retards flexible response to stress and engages more institutional structures as essential solutions" (Price and Brown 1985:438).

Social complexity in Southeast Texas can be studied mainly at mortuary sites, with evidence of long-distance trade, differences in burials due to grave wealth, evidence of violence and patterned burial practices. The concept of fluctuating levels of social complexity is supported by the archeological record in Southeast Texas. Organized practices are not developed in all time periods, but appear sporadically in time and geographic location.

It is probably an over-simplification to attribute increase in social complexity only to an abundance of food resources that allows a more sedentary lifestyle. As Price and Brown (1985:439) observe "Increased complexity appears in too many diverse and historically unconnected places to be a result of a single factor." For example, it is not clear in terms of indicators, such as site numbers and sizes and faunal remains, that the lifestyle associated with the Late Archaic mortuary tradition of the Western Zone of this region was significantly more affluent or sedentary than the lifestyle of Late Archaic Indians of the adjacent Central Zone. One possibility is that food resources may have been more concentrated in the Western Zone than in adjacent geographic areas. This would have allowed a more sedentary lifestyle in the Western Zone, although not necessarily a better lifestyle in terms of a sufficient diet. Some increase in social complexity may have been caused by attributes of social organization that are not preserved in the archeological record.

The higher degree of social complexity indicated by the Late Archaic motuary tradition in the western part of inland Southeast Texas may not be related to a more sedentary lifestyle, but could still indicate marking of territory to claim rights to resources of an area. Alternately, this higher degree of social complexity may simply represent a belief system, possibly resulting from a mix of cultural traditions of Central and Southeast Texas.

The same ideas apply to the Late Prehistoric mortuary tradition of the coastal margin in the Galveston Bay area. For example, there is no indication that there were differences in lifestyle in the area of the Boys' School Cemetery (Aten et al. 1976) than in other areas of Galveston Bay where organized burial practices are not evident. The sporadic nature of increased social complexity of hunter-gatherers in Southeast Texas, and the partial nature of archeological remains, seems to preclude an exact analysis of causes of social complexity. In some cases, for a given lifestyle, some groups of people may tend to become more socially organized than other similar groups.

The Allens Creek archeological complex (Hall 1981) offers an interesting sequence of indicators of social complexity. As noted in the section on mortuary practices, at this location there were organized burial practices in the Middle Archaic, Late Archaic, Early Ceramic, and Late Prehistoric periods, unlike adjacent areas of Southeast Texas. This reflects a long period of greater social organization, as indicated by the organized burial practices. However, the large-scale use of exotic grave goods only occurred in the Late Archaic period. It is not clear why imports of exotic grave goods into the Western Zone of Southeast Texas either started or ended during this time period. Hall (1981) has offered some ideas on this subject, based on external influences. However, both internal and external causes for changes in this trade pattern can be proposed, including internal change in social practices.

In the discussion here on population dynamics, it has been noted that there are indications of a more mobile settlement pattern in the inland region at the end of the Early Ceramic period and in the Late Prehistoric period that is possibly due to high population density. Population density is one of the major factors to consider in the study of cultural change in this region. Change in settlement pattern can be noted directly in the archeological record. However, high population density can also cause a number of social stresses that are not easily detected by archeological data. These social stresses can include limited territorial access, internal conflict, external conflict, and a decline in organized social behavior due to the cumulative effect of individual stress factors. Since hunter-gatherer societies are not highly organized, this type of organization may be easily influenced by stress to adjust social organization to a more beneficial adaptive pattern. The ability of hunter-gatherer societies to rapidly change adaptive patterns is a key to the success of this lifestyle over long time periods. In contrast, highly organized societies often lack adaptive ability to sense impending problems and then react with adaptive changes. As a result, there has been a repeated pattern of the decline of civilizations through the ages.

INTER-REGIONAL TRADE

Much of the evidence of long-distance trade in prehistoric Southeast Texas is found in the form of exotic grave goods, but some evidence is also found at campsites. Inter-regional trade is most evident for the Late Archaic mortuary tradition in the inland portion of the Western Zone of this region. Site 41AU36 (Hall 1981) is a prime example. Large corner-tang knives are examples of trade with Central Texas. Central Texas was the center for the manufacture of corner-tang knives (Patterson 1936, Hall 1981:Figure 55). Marine shell beads and pendants may be an example of long-distance trade, as no shell manufacturing sites have been found on the adjacent coastal margin. Hall (1983:214-222) has considered marine shell items as coming into Southeast Texas from locations such as Corpus Christi Bay and as far away as Florida. Florida is known to have been a center for long-distance trade in marine shell items.

Ground stone items are found at several mortuary sites of the Late Archaic tradition. Artifacts of ground stone include tubular beads (Patterson et al. 1993a), bannerstones (Duke 1982b), stone gorgets (Hall 1981), and boatstones (Walley 1955, Hall 1981). As previously noted (Patterson 1989g), all of these artifact types can be found in the Poverty Point lapidary industry (Webb 1982), and participation of Indians of Southeast Texas in the widespread exchange system that included Poverty Point may be indicated. While stone beads were made at the Poverty Point site in northern Louisiana, the tubular stone beads found at site 41FB42 have a closest match with stone beads manufactured at the Cad Mound site in East-Central Louisiana (Gibson 1968). The Cad Mound site had a familiarity with the trade network well established by Poverty Point times (Gibson 1968:15). Although boatstones are an item of the Poverty Point exchange system, they may have been manufactured in Arkansas (Hall 1981:Figure 55). Much of the material of ground stone artifacts seems to have originated in Arkansas, although manufacturing of finished artifacts could have been at different locations than the raw material source.

As Hall (1981:Figure 55) has shown, Indians of Southeast Texas were involved in several trading spheres in the Late Archaic period, with each trade sphere concerned with a specific type of goods. The individual trading spheres seem to have been linked to a generally high level of trade throughout the eastern United States in this time period (Webb 1982). Winters (1968) has shown that active long-distance trade had developed in the eastern United States even earlier in the Late Archaic than the Poverty Point period. Hall (1981:294) has noted that imports into the western part of Southeast Texas are well-documented for the Late Archaic period, but exports from this area are not evident. Therefore, a complete import-export system cannot be defined. Perhaps the Western Zone of Southeast Texas was an intermediate trade point for down-the-line trading of goods from several intersecting trade spheres. However, the Western Zone of Southeast Texas does not seem to be geographically well-placed to act as an intermediate trade point for the types of goods that were being traded. It can be concluded that long-distance trade mechanisms, and associated belief systems, for Southeast Texas in the Late Archaic period are not well-understood. One possibility is that perishable types of items were being exported from Southeast Texas in exchange for exotic goods from other regions. Hall (1988a:Figure 1) shows a wide distribution of long-bone implements in Texas, with the center of manufacture in Southeast Texas being a possibility.

Hall (1981:299-309) has proposed that trade between Southeast Texas and eastern areas, such as Poverty Point, was interupted at the end of the Late Archaic by hostile groups from Central Texas that reduced the trading sphere area, or by a similar type of interruption in Northeast Texas that blocked trade routes to the east. After the Late Archaic period, there is not much evidence for inter-regional trade, except for isolated examples in this region. Evidently most of the effort for inter-regional trade was caused by the demand for grave goods and other status symbols. An alternate to hostile interruption of trade would be a scenario where demand for exotic goods simply decreased due to changes in social organization, such as a more mobile lifestyle. Highly mobile hunter-gatherers have little use for many non-utilitarian items.

The detailed patterns of long-distance trade are generally difficult to study. Renfrew and Bahn (1991:322) have summarized 10 different trade patterns, including simple patterns such as direct or down-the-line trading, and more complex redistribution processes. Redistribution processes probably do not apply to trade practices of Indians in Southeast Texas, where social organization was at the band level. The band level of social organization usually does not allow individuals to accumulate wealth that could be used for redistribution. It is especially difficult to analyze a trade pattern where imports of exotic goods appear in an isolated location, rather than in a continuous geographic distribution from a possible trade source. This is certainly true of the Late Archaic mortuary tradition of the Western Zone of Southeast Texas. Here, possible sources of exotic goods are located at distances of several hundred miles, without intermediate geographic areas that have data to show a specific type of trade pattern.

There is some evidence of long-distance trade during the Late Prehistoric period. Gahagan bifaces at sites 41PK69 (Ensor and Carlson 1988) and 41PK88 (McClurkan 1968) in Polk County possibly show trade with Caddo Indians on the northern edge of Southeast Texas, or trade with Central Texas locations of manufacture of this artifact type. Long-distance trade, possibly with with Caddo Indians, is shown at site 41HR273 (Ensor and Carlson 1991) in Harris County by a Gahagan biface, copper beads and galena. Contact between Southeast Texas Indians and Caddo Indians to the north during the Late Prehistoric period was not at a high level. Although Caddo pottery is sometimes cited as a trade item (Suhm and Jelks 1962:95), it is doubtful that the rare examples of Caddo potsherds found very far from the Caddo area are due to trade. Pottery is heavy and bulky, and not suited to transport over long distances. Two possible Caddo type sherds found at site 41HR616 (Moore 1989:Figure 16) and a Caddo type sherd found at site 41HR81 (Brewington 1990) in Harris County are more likely to be due to exchange of women between social groups rather than trade. Larson (1980:228) has concluded that the band of piney woods along the Eastern Gulf coastal plain restricted cultural contact. This appears to apply to contacts between Caddo Indians north of the piney woods belt and Indian groups south of the piney woods in Southeast Texas.

Most grave goods found in sites on the coastal margin of this region during the Late Prehistoric period seem to be of local manufacture. Possible exceptions are marine shell pendants and beads, with manufacturing locations yet to be determined, and inter-regional trade remaining a possibility.

Single specimens of galena and quartz at site 41WH2 (Patterson and Hudgins 1980) in Wharton County possibly indicate small amounts of trade between Southeast and Central Texas before the Late Archaic period. Bannerstones (Duke 1989) and boatstones (Hartman 1963) found at campsites in Southeast Texas are additional indications of long-distance trade on an occasional basis, not directly connected with the Late Archaic mortuary tradition. Paleo-Indian and Early Archaic projectile points found in Southeast Texas made of Edwards Plateau flint might be examples of inter-regional trade, or may have entered this region with bands having a very mobile lifestyle. There are few data on inter-regional trade in Texas during these time periods.

There is a possible example of very long-distance trade that might be related to the Late Archaic mortuary tradition discussed here. A large surface collection from the Smithers Lake area of Fort Bend County contains a ground stone bar amulet of a type made in the mid-west during the same time period as the Late Archaic in Southeast Texas (Patterson et al. 1995:Figures 29,30). Perhaps this artifact represents down-the-line trade from as far away as Illinois.

INTRA-REGIONAL TRADE

There are not many archeological data to show relationships between the inland and coastal margin subregions of Southeast Texas. Aten (1983:Table 5.2) has noted some items of trade between the two subregions, but evidence is seldom found at archeological sites, as many of these items must have been perishable materials, such as fish, bird feathers, and sinew. Aten's tabulation of trade items between the two subregions is mainly based on ethnographic references. It is not known how well ethnographic data can be extrapolated to prehistoric periods. Lithic materials were probably the main import into the coastal margin from inland, including chert, petrified wood, red ochre, and sandstone. Items exported from the coastal margin subregion that are visible in the archeological record include asphalt pieces, shark teeth and stingray spines. Marine shell beads and pendants found in the inland subregion may be from intra-regional or inter-regional trade. The small amounts of lithic materials found at coastal margin sites may indicate a low level of trade between the coastal margin and inland subregions, or that other types of trade materials were involved.

Ethnographic evidence demonstrates some aspects of prehistoric trade patterns. Cabeza de Vaca (Covey 1961:66) became a trader between coastal margin and inland Indians. He traded marine shells and mesquite beans from the coastal margin to inland Indians in exchange for animal skins, red ochre, deer tail tassels, and materials for arrows, including cane, flint, sinew, and cement. Cabeza de Vaca (Covey 1961:66) observed that trade between Indian groups in this region in protohistoric time was not frequent because of continuing hostilities.

There is a possibility that finished dart points were traded from the inland subregion to the coastal margin subregion during the Late Archaic and Early Ceramic periods. At some coastal margin sites having dart points, such as 41HR74 (Duke 1981a), few lithic flakes were found, and those found were not large enough to indicate that dart points were being manufactured locally.

CHAPTER 7

SUMMARY AND FUTURE RESEARCH

SUMMARY

This volume has attempted to provide a current summary of information on the material remains and related cultural aspects of prehistoric Indians of Southeast Texas. It has been well established that the basic lifestyle was that of nomadic hunter-gatherers for the entire prehistoric period. Traits of a conservative lifeway usually associated with hunter-gatherers are shown in the prehistoric archeological record of this region. In general, technological changes occurred on a gradual basis, a highly scheduled, stable subsistence pattern was maintained over a very long time period, and there were only sporadic changes in social complexity. Many sites have very long occupation sequences, indicating scheduled subsistence patterns. While scheduling of resource exploitation is shown, details of subsistence patterns are not well-known, because the complete prehistoric diet cannot be reconstructed. It can be demonstrated by the geographic distributions of artifact types that Southeast Texas was an interface between technological traditions of the Southern Plains and the Southeast Woodlands. Some of the differences in cultural traits between inland and coastal margin sites may reflect development tied to restricted territorial usages. Population level seems to have peaked during the Early Ceramic period in the inland subregion and then declined during the Late Prehistoric. On the coastal margin, population leveled-out during the Late Prehistoric. In both subregions, there was a rapid increase in population growth rate during the Late Archaic and Early Ceramic periods. In summary, Indians of this region seem to have had a successful adaptation over a long time period. In fact, before the advent of modern medicine and farming practices, hunter-gatherers had about the same average lifespan as more civilized populations of the same time periods.

Prehistoric human occupation of Southeast Texas covers a timespan of about 11,000 to 12,000 years. There are data, in varying degree of detail, for all time periods within this long prehistoric time interval. Occupation sequences can be followed on a continuous basis in this region. The lack of artifact types that can be used to define narrow time intervals in this region is lamented by many archeologists. However, this is not a real obstacle in the study of many topics related to hunter-gatherers, because cultural and technological change occurred on a gradual basis. As shown in this publication, Southeast Texas has an archeological data base that can contribute to the general interpretation of the hunter-gatherer lifeway.

This synthesis is largely historic and descriptive. The general aspects of lifeways of hunter-gatherers can be described in considerable detail, based on available archeological and ethnographic data (Hayden 1993:Chapters 5,6). However, "It is very difficult to make universal laws about human behavior that are not either very trivial, or untrue" (Renfrew and Bahn 1991:416). Because of the apparent simplicity of hunter-gatherer lifeways, the general public and many archeologists are usually more interested in more complex forms of prehistoric society. Since the hunter-gatherer lifeway was practiced for several million years, while more complex lifeways developed over the last 10,000 years, it would seem that the study of hunter-gatherers is a basic consideration in study of the evolution of mankind.

Hayden (1993:210) has proposed that only two major forces have been responsible for directional changes in human adaptations, "resource stress" and "competition." Refrew and Bahn (1991:406) note, however, that descriptions of specific patterns of events are common in archeology, while generalization is rare. In this synthesis of regional prehistory, consideration of cultural and technological change is given in terms of specific descriptive patterns. The basic regional lifeway was established during the Paleo-Indian period, and remained the same until historic time. There are few indications of sudden technological or cultural change. Changes in artifact styles, such as dart point types, were not accompanied by detectable changes in basic lifeway. Even introductions of major new technologies, ceramics and the bow and arrow, were gradual and had little effect on other aspects of regional adaptation.

Population change can be studied with archeological site data for this region. Population density remained low throughout the Paleo-Indian, Early Archaic, and Middle Archaic periods. The causes of rapid population increase in the Late Archaic and Early Ceramic periods remain to be explained. Possible causes of this rapid population growth include climatic change and introduction of the bow and arrow during the Late Archaic period. Population decrease or leveling-out in subregions of Southeast Texas in the Late Prehistoric period also remain to be explained in more detail than simply noting that a pattern exists. The high population level of the Early Ceramic period is an important indicator of adaptive success. Subsequent effects of overpopulation, such as change to a more mobile lifestyle, are then seen in the Late Prehistoric.

Throughout the prehistory of this region there were external influences on technology from the Southern Plains and the Southeast Woodlands. In the western part of Southeast Texas, some of the projectile point chronological sequence for Central Texas can be seen, starting with lanceolate forms of Paleo-Indian points, and progressing through several stemmed types of dart points, followed by the Scallorn arrow point. Throughout Southeast Texas, in decreasing amounts to the west, dart point styles can be found that are shared with the Southeast Woodlands. For the Southeast Woodlands dart point styles found in Southeast Texas, there is a chronological sequence from side-notched to corner-notched to stemmed types, followed by Alba and Catahoula arrow points. In contrast to projectile point styles that may have been introduced into Southeast Texas from adjacent regions, the Perdiz arrow point seems to have started first in Southeast Texas, and then spread to other regions of Texas.

Some lithic artifact types that are associated with traditions of Central Texas persist longer in Southeast Texas. It appears that a few lithic traits introduced into Southeast Texas from Central Texas remained popular in Southeast Texas after the end of use of the artifact types in Central Texas. Use of the Scallorn arrow point terminated in Central Texas at about A.D. 1200 (Turner and Hester 1993:230), but continued in use in Southeast Texas until the Historic Indian period. Corner-tang bifaces are placed in the Late Archaic in Central Texas (Turner and Hester 1993:250), but have been found in Late Prehistoric context in the Western Zone of Southeast Texas.

Pottery was introduced into Southeast Texas at about A.D. 100, mainly from the east, although bone tempered pottery was probably introduced from the north. It may have taken up to 300 years for the use of pottery to diffuse throughout this region in a western direction, with the slow diffusion of pottery continuing down the Central Texas coast. The functions of pottery in this region are not well understood.

Intra-regional trade is not well defined for Southeast Texas, but inter-regional long-distance trade can be described in some detail. Inter-regional trade is most evident in the Late Archaic period in the Western Zone of this region. Exotic grave goods were imported from several other regions, including corner-tang bifaces from Central Texas, ground stone objects from Arkansas and Louisiana to the northeast, and marine shell ornaments from unknown sources. Some of this long-distance trade may be connected with the Poverty

Point exchange system. While imports into Southeast Texas can be listed, it is not apparent what export items were involved.

Differences in adaptation patterns can be seen for the inland and coastal margin subregions of Southeast Texas. Similar terrestrial faunal resources were exploited in both subregions, but different aquatic faunal resources were utilized in the two areas. Coastal margin sites are especially characterized by Rangia shell middens, with few lithic artifacts and much pottery. Inland sites are characterized by many lithic artifacts and modest amounts of pottery for the same time periods. The mobility-settlement pattern of the coastal margin seems to be largely confined to a zone about 15 to 20 miles wide along the coastal margin. Seasonal subsistence rounds are not well-defined.

Increases in social complexity occur in this region in a sporadic manner over time, largely defined by organized burial practices. Changes in belief systems and social organization connected with greater social complexity cannot be determined with available data. Highly organized burial practices are only evident in the Late Archaic in the western inland subregion, and in the Late Prehistoric, Proto-Historic, and Historic Indian periods on the coastal margin in the Galveston Bay area.

It is likely that most cultural and technological changes in this region had a positive adaptive advantage. Hunter-gatherer groups tend to be conservative and adopt change only if there is an advantage. Many traits of complex societies would have no value to hunter-gatherers. While hunter-gatherer groups are more conservative than complex societies, hunter-gatherer groups are more flexible to make adaptive change than complex societies, because hunter-gatherer groups do not maintain sophisticated logistic systems or multiple levels of management.

Certain Paleo-Indian and Early Archaic projectile point types made of exotic lithic materials appear to be outliers in this region from adjacent regions. These point types include Clovis, Folsom, Midland, and Dalton of the Paleo-Indian period, and Bell of the Early Archaic period. These point types may represent groups with highly mobile lifeways occasionally entering Southeast Texas, inter-regional trade, or individuals from one band joining another band. It is significant that most projectile points made of exotic materials, such as Edwards Plateau chert, have been found at sites that also contain other types of points made of more local materials, although possible cultural contacts are not clear. It is especially not clear what significance the geographic distribution of Clovis points has in this region. There is a large concentration of Clovis points in the McFaddin Beach area near Beaumont, and only a few Clovis points at other sites, mainly in the Central Zone of this region. No Clovis points have been found so far in the Western Zone of Southeast Texas.

A broad-based hunting and gathering lifeway started very early in this region, normally with a scheduled subsistence pattern and restricted mobility, compared to concurrent highly mobile Paleo-Indian groups of the Southern Plains, such as Folsom and Midland. Present data indicates that the broad-based hunting and gathering lifeway started in this region between 11,000 and 10,000 years ago, with a variety of side-notched projectile points being associated with this type of adaptation. With the possible exception of the McFaddin Beach area, there is little evidence that hunting of now extinct types of megafauna, such as mammoth, was ever a principal subsistence pattern in Southeast Texas. Some evidence for hunting extinct megafauna may now be underwater, due to rising sea level after the Pleistocene, but there is little evidence for this type of hunting in the current land area of Southeast Texas.

Determining details of this lifeway can be rather complex, due to the partial nature of the data, and there are seldom conclusive answers. Archeological research has made rapid progress in Southeast Texas in the last 20 years, from a small archeological data base to becoming one of the best reported and published regions of Texas. Hopefully, the present rate of site publication will continue.

FUTURE RESEARCH

There are several areas for future research that are obvious. Not all areas of this region are well-surveyed, and this subject should be given priority. A more representative sample of all archeological resources in this region is needed. Survey should include recording and publishing of more surface collections (Story 1990:365). Unfortunately, many archeologists are not interested in the research potential of surface collections. One major excavation report for a site in this region did not even reference previously published surface collections for the site. More sites should be published as well as recorded. Unpublished site reports are seldom adequate for research use. More excavations of stratified sites, and related radiocarbon dates are needed to refine the chronologies of artifact types. The explanatory framework (theory) of archeological data should be continuously refined. Unfortunately, there does not seem to be much general interest in regional synthesis, which should be a basic goal. It may be seen in various sections of this report that there are many subject areas open to future research. Archeological research in Southeast Texas has the potential of making basic contributions to the description and theory of hunter-gatherer societies, including lifeways and cultural change. The goal of processual archeology to explain why technological and cultural changes occur is seldom possible, however. Explanation and theory building should be closely tied to the archeological data base or the effort can be a futile gesture. In regard to research on specific subjects, priority should be given to subjects where suitable data are available, instead of simply using a "laundry list" of topics.

Traditionally, archeological research in Texas has been divided along arbitrary regional lines, for convenience and because each region does have some cultural differences. At some point in time, archeological research in Texas should concentrate on larger geographic areas, such as Story (1990) has done for all of East Texas. Many research topics can only be addressed in an adequate manner if large land areas are considered, surpassing regions within a state and even state boundaries. Archeological syntheses for large geographic areas remains a future goal, because data gaps are present, and because data for regions are not often well-organized..

Throughout this synthesis, topics for future research have been mentioned. A few examples include: better surveys of the piney woods and all of the Eastern Zone to define adaptations to various ecological areas, development of a better definition of the mobility-settlement patterns of the coastal margin, more data to develop models on trade and social complexity, and a more detailed picture of the earliest Paleo-Indian adaptations in this region. While increasing the archeological data base is still important, more attention should be given to explicit problem oriented research related to aspects of regional synthesis. The results of individual site reports must be integrated to obtain a good view of regional prehistory.

Much of the archeological work in the U.S., including Texas, is currently funded and controlled by cultural resource laws and regulations for clearance of construction projects on private lands. This is primarily a bureaucratic process oriented toward locations of modern construction projects, rather than oriented toward archeological research goals. As Story (1990:365) observes "Intensive archeological surveys and tests carried out to meet CRM laws and mandates, on the whole, are producing relatively little useful information." Government direction is an inadequate way to conduct archeological research. Since archeological clearance is only required for federally permitted projects on private lands, only a small portion of archeological resources on private lands is addressed by the CRM process. Future regional research could be improved by: (1) establishing a good archeological survey group, independent of the cultural resource clearance process and directed by academic institutions, and (2) by developing a larger body of serious avocational archeologists who do research on private lands not addressed otherwise, and who do much site discovery, and most of the recording and publishing of surface collections. Establishment of more local archeological societies should be promoted. The Texas Archeological Stewardship Network of the Office of the State Archeologist is another method of obtaining increased coverage of archeological resources. Archeological resources on private lands are being rapidly destroyed by erosion and modern activities, and all available resources of both professional and avocational archeologists are needed to minimize this loss. Preservation of archeological site data cannot be accomplished by more laws and regulations that restrict land use. Only active archeological research and survey programs are appropriate to obtain the best possible sample of archeological resources.

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Table 1

SITES IN SOUTHEAST TEXAS DATA BASES (mid 1995)

County	no. of inland sites	no. of coastal margin sites	TARL recorded sites
Austin	9	N.A.	80
Brazoria	4	12	183
Chambers	0	148	356
Fort Bend	22	N.A.	223
Galveston	0	6	137
Grimes	13	N.A.	403
Hardin	5	N.A.	16
Harris	127	31	751
Jefferson	2	0	67
Jasper	6	N.A.	123
Liberty	17	2	86
Montgomery	32	N.A.	127
Newton	0	0	88
Orange	2	2	84
Polk	11	N.A.	173
San Jacinto	5	N.A.	154
Tyler	2	N.A.	39
Walker	5	N.A.	123
Waller	5	N.A.	21
Washington	4	N.A.	64
Wharton	27	N.A.	88
total	298	201	3386

N.A.- not applicable

Table 2

RADIOCARBON DATES FOR INLAND SITES IN SOUTHEAST TEXAS

site	radiocarbon years B.P.	laboratory number
41AU1	4530+/-80	Shell-8205
41AU36	1650+/-70	TX-2452
41AU36	2460+/-70	TX-2451
41AU36	3270+/-70	TX-2127
41AU36	4120+/-100	TX-2453
41AU37	440+/-70	TX-2126
41AU37	1070+/-60	TX-2125
41AU38	450+/-70	TX-2065
41FB3	2580+/-130	I-16513
41FB3	3230+/-170	I-17333
41FB34	5210+/-110	I-15510
41FB35	3030+/-90	I-16965
41FB37	6490+/-120	I-15333
41FB37	6690+/-120	I-15206
41GM166	8660+/-70	BETA-63144
41GM166	7100+/-60	BETA-66040
41GM166	2840+/-90	BETA-63145
41GM166	2080+/-60	BETA-74553
41GM224	1450+/-80	BETA-62676
41GM224	1750+/-70	BETA-62675
41GM224	1240+/-70	BETA-63182
41GM224	2470+/-70	BETA-63181
41GM281	640+/-60	BETA-70755
41GM281	610+/-60	BETA-70756
41GM281	600+/-60	BETA-70757
41GM281	710+/-60	BETA-69002
41GM281	910+/-60	BETA-69003
41GM282	970+/-80	BETA-64928
41GM282	700+/-100	BETA-64929
41GM282	1100+/-90	BETA-64930
41GM282	2740+/-60	BETA-64931
41GM282	620+/-60	BETA-64932
41GM282	130+/-50	BETA-64933
41GM282	540+/-110	BETA-64934
41HR206	280+/-80	I-18006
41HR273	1070+/-90	BETA-28092
41HR273	1280+/-70	BETA-27535
41HR273	1380+/-80	BETA-17072
41HR273	1400+/-90	BETA-27536
41HR273	1480+/-120	BETA-17566
41HR530	680+/-350	TX-5900
41HR530	1291+/-455	SMU-1506
41HR530	1460+/-60	(A)
41HR530	1460+/-80	(A)
41HR541	640+/-100	BETA-25927
41HR541	680+/-80	BETA-17073

Table 2, continued 1

site	radiocarbon years B.P.	laboratory number
41HR644	1440+/-180	BETA-33693
41PK8	390+/-100	TX-330
41PK8	810+/-80	TX-335
41PK8	970+/-120	TX-325
41PK8	1410+/-190	TX-336
41PK69	4000+/-110	BETA (A)
41PK69	6240+/-80	BETA (A)
41PK88	1070+/-70	TX-539
41WH12	1050+/-80	I-15944
41WH12	960+/-80	I-16221
41WH12	1930+/-80	I-15954
41WH19	9920+/-530	AA-298
41WH19	365+/-80	SI-6455

(A)- lab number not published

Table 3

RADIOCARBON DATES FOR THE COASTAL MARGIN OF SOUTHEAST TEXAS

site	radiocarbon years B.P.	laboratory number
41BO15	180+/-60	TX-1116B
41BO15	860+/-50	TX-1116A
41BO35	1250+/-70	TX-1115
41BO35	1330+/-50	TX-1205
41BO35	1680+/-70	TX-1167
41BO35	1830+/-80	TX-1117
41BO35	2360+/-60	TX-1066
41BO35	2370+/-80	TX-1067
41BO50	1650+/-90	TX-1259A
41BO50	1870+/-70	TX-1259B
41BO79	600+/-80	BETA-32024
41BO81	910+/-70	BETA-31709
41BO81	990+/-70	BETA-31710
41BO126	1440+/-60	TX-2785
41BO126	1450+/-60	TX-2783
41BO126	1800+/-60	TX-2784
41BO159	1080+/-45	UGA-5507
41BO160	950+/-40	UGA-5508
41CH9	1650+/-70	TX-1050
41CH13	2280+/-90	TX-345
41CH13	1890+/-100	TX-343
41CH13	1840+/-90	TX-342
41CH13	1560+/-100	TX-344
41CH13	1990+/-100	TX-341
41CH13	2070+/-110	TX-346
41CH16	2020+/-80	TX-450
41CH16	2180+/-90	TX-457
41CH16	2540+/-100	TX-397
41CH16	2240+/-90	TX-389
41CH16	1900+/-90	TX-396
41CH16	2040+/-90	TX-392
41CH16	1890+/-90	TX-393
41CH16	1780+/-100	TX-401
41CH16	1400+/-110	TX-402
41CH16	1880+/-90	TX-400
41CH16	1810+/-90	TX-394
41CH16	1950+/-80	TX-449
41CH16	2150+/-60	TX-388
41CH16	1740+/-100	TX-399
41CH16	1890+/-150	TX-398
41CH16	1950+/-70	TX-455

Table 3, continued 1

site	radiocarbon years B.P.	laboratory number
41CH16	2260+/-110	TX-395
41CH16	2010+/-90	TX-456
41CH16	2010+/-90	TX-390
41CH16	2220+/-80	TX-460
41CH20	820+/-60	TX-528
41CH20	840+/-60	TX-527
41CH20	1550+/-60	TX-529
41CH24	1560+/-80	TX-1051
41CH32	2880+/-110	TX-1892
41CH32	1870+/-80	TX-1893
41CH36	720+/-90	TX-946B
41CH36	1300+/-70	TX-947A
41CH36	1100+/-70	TX-946A
41CH36	1470+/-70	TX-948
41CH36	1120+/-110	TX-947B
41CH46	1120+/-70	TX-949B
41CH46	1740+/-70	TX-949A
41CH46	1070+/-70	TX-1891
41CH47	1480+/-80	TX-1894
41CH47	2230+/-110	TX-1895
41CH53	290+/-80	TX-458
41CH56	2665+/-60	UGA-5536
41CH56	2665+/-55	UGA-5537
41CH56	2800+/-50	UGA-5538
41CH56	2780+/-50	UGA-5539
41CH56	2680+/-50	UGA-5540
41CH56	2640+/-50	UGA-5554
41CH56	2605+/-50	UGA-5555
41CH57	3670+/-90	TX-1113
41CH62	1529+/-58	UGA-5849
41CH62	1866+/-48	UGA-5850
41CH63	3007+/-53	UGA-5846
41CH63	2909+/-54	UGA-5845
41CH63	2732+/-67	UGA-5844
41CH63	1155+/-74	UGA-5848
41CH63	1524+/-64	UGA-5847
41CH63	2902+/-62	UGA-5843
41CH70	1140+/-50	BETA-72721
41CH70	640+/-70	BETA-72719
41CH70	939+/-50	BETA-72722
41CH98	1310+/-60	TX-951B
41CH98	1060+/-90	TX-951A

Table 3, continued 2

site	radiocarbon years B.P.	laboratory number
41CH110	880+/-60	TX-2029
41CH110	560+/-50	TX-2030
41CH110	800+/-80	TX-2024
41CH110	620+/-60	TX-2031
41CH110	740+/-70	TX-2027
41CH110	760+/-60	TX-2025
41CH110	500+/-60	TX-2022
41CH110	390+/-50	TX-2023
41CH110	410+/-60	TX-2026
41CH161	1660+/-80	I-17532
41CH161	700+/-80	I-17614
41CH165	1510+/-80	TX-1057
41CH170	1110+/-50	TX-953
41CH172	3270+/-80	TX-1058
41CH252	2250+/-60	BETA-72713
41CH252	1800+/-60	BETA-72715
41CH252	959+/-50	BETA-72712
41CH273	1041+/-45	UGA-5802
41CH273	1427+/-51	UGA-5803
41CH273	1120+/-60	BETA-49768
41CH273	750+/-60	BETA-49769
41CH273	780+/-40	BETA-49770
41CH274	2530+/-50	BETA-49771
41CH274	2640+/-50	BETA-49772
41CH274	2768+/-57	UGA-5804
41CH357	900+/-60	BETA-72725
41CH357	930+/-50	BETA-72726
41CH357	1140+/-60	BETA-72727
41CH357	750+/-50	BETA-72728
41CH357	1030+/-60	BETA-72729
41CH357	920+/-80	BETA-72723
41CH357	670+/-60	BETA-72724
41GV1	380+/-140	TX-6100
41GV1	810+/-120	TX-6101
41GV5	430+/-150	Shell Dev. NA103
41GV5	490+/-100	Shell Dev. ?
41GV5	450+/-110	Shell Dev. SB108
41GV5	670+/-120	Shell Dev. SB108
41GV5	830+/-120	Shell Dev. SB108
41GV10	2450+/-70	TX-691
41GV10	740+/-70	TX-690
41GV66	780+/-150	TX-2605
41GV66	230+/-70	TX-2598
41GV66	510+/-50	TX-2606
41GV66	980+/-60	BETA-64565
41GV66	870+/-90	BETA-58747
41GV66	570+/-50	BETA-64564
41GV66	280+/-50	BETA-55867

Table 3, continued 3

site	radiocarbon years B.P.	laboratory number
41GV66	650+/-90	BETA-55863
41GV66	440+/-70	BETA-58746
41GV66	430+/-110	BETA-64563
41GV66	650+/-170	BETA-55862
41GV66	610+/-80	BETA-53673
41GV66	380+/-70	BETA-53672
41GV66	220+/-50	BETA-64566
41GV66	190+/-70	BETA-55870
41GV66	150+/-80	BETA-55865
41GV82	895+/-60	UGA-5389
41GV82	666+/-83	UGA-6227
41GV82	551+/-80	UGA-6228
41GV82	332+/-43	UGA-6229
41GV82	659+/-89	UGA-6230
41GV82	516+/-90	UGA-6231
41GV82	1032+/-88	UGA-6232
41GV82	614+/-45	UGA-6233
41GV82	623+/-84	UGA-6234
41GV82	942+/-91	UGA-6235
41GV82	940+/-88	UGA-6236
41HR50	1510+/-60	TX-532
41HR50	850+/-60	TX-530
41HR56	950+/-50	TX-533
41HR56	1840+/-50	TX-535
41HR56	1190+/-50	TX-534
41HR61	1900+/-105	O-911
41HR61	3350+/-115	O-912
41HR80	640+/-130	TX-1059
41HR80	2140+/-380	TX-1060
41HR85	2170+/-180	TX-968A
41HR85	3670+/-80	TX-969
41HR85	1500+/-70	TX-968B
41HR618	450+/-80	I-15275
41LB4	760+/-50	BETA-72735
41LB4	660+/-50	BETA-72736
41LB4	490+/-50	BETA-72737
41LB4	210+/-50	BETA-72738
41LB4	300+/-50	BETA-72730
41LB4	680+/-70	BETA-72731
41LB4	780+/-60	BETA-72732
41LB4	1340+/-60	BETA-72733
41LB4	790+/-60	BETA-72734
41LB54	705+/-55	UGA-5806
41LB54	1159+/-198	UGA-5808
41LB54	1000+/-130	BETA-40936
41OR49	500+/-150	DuPont ?
41OR58	2260+/-100	BETA-42415
41OR58	2180+/-80	BETA-42656

Table 3, continued 4

site	radiocarbon years B.P.	laboratory number
41OR58	1530+/-70	BETA-42653
41OR58	2300+/-70	BETA-42416
41OR58	2170+/-100	BETA-42654
41OR58	1570+/-90	BETA-42417

Table 4

PROJECTILE POINT CHRONOLOGIES IN SOUTHEAST TEXAS

point type	Early Paleo	Late Paleo	E. Arch	M. Arch	L. Arch	Early Ceramic	Late Prehist
Clovis	X						
Folsom	X						
Midland	X						
Early Side-Notched	X	X					
Dalton	X	X					
Big Sandy	X	X					
San Patrice	X	X					
Plainview		X					
Scottsbluff		X					
Angostura		X					
Meserve		X					
Early Corner-Notched		X					
Early Stemmed		X	X				
Bell			X				
Trinity			X	X			
Wells			X	X			
Carrollton			X	X			
Morrill			X	X			
Bulverde				X			
Lange				X			
Pedernales				X	X		
Williams				X	X		
Travis				X	X		
large Gary				X	X		
large Kent				X	X		
Morhiss				X	X		
Ponchartrain					X		
small Gary					X	X	X
small Kent					X	X	X
Darl					X	X	
Yarbrough					X	X	
Ensor					X	X	
Ellis					X	X	
Fairland					X	X	
Palmillas					X	X	
Marcos					X	X	
unifacial arrow points					X	X	X
bifacial arrow points							X

Table 5

UNIFACIAL ARROW POINTS IN SOUTHEAST TEXAS

site	work(A)	time period(s), (B)	no. of points
41AU7	S	mixed LA, EC, LP	1
41FB223	E	MA-LA	2
41HR182	S	mixed LA, EC, LP	2
41HR183	S	mixed EC, LP	4
41HR184	S	Mixed MA, LA, EC, LP	64
41HR185	S	mixed LA. EC, LP	7
41HR206	S	mixed LA, EC, LP	24
41HR208	S	LP	1
41HR209	S	mixed LA, EC, LP	8
41HR210	S	mixed LA, EC, LP	14
41HR215	S	mixed EC, LP	1
41HR223	S	mixed LA, EC	8
41HR244	S	mixed LA, EC, LP	13
41HR245	S	mixed EC, LP	2
41HR248	S	LP	3
41HR250	S	LA	2
41HR255	S	LP	7
41HR267	S	EC	1
41HR273	E	LP	5
41HR293	S	LP	3
41HR315	E	MA, LA, EC, LP	54
41HR525	S	mixed LA, EC, LP	1
41PK88	E	LP	7
41WH12	E	LP	1
41WH19	E	LP	2
41WH37	S	mixed LA, EC, LP	1
41WH38	E	EC	1
41WH73	E	EC	2
total			241

(A) S= surface collection
E= excavated

(B) LP= Late Prehistoric
EC= Early Ceramic
LA= Late Archaic
MA= Middle Archaic

Table 6

INLAND ARROW POINT TYPE DISTRIBUTION

point type	Western		Central		Eastern	
	sites	points	sites	points	sites	points
Perdiz	34	211	50	342	37	440
Scallorn	28	88	24	62	5	9
Catahoula	3	4	27	114	26	128
Alba	5	6	21	39	31	280
unifacial	7	10	20	224	1	7
Fresno	3	34	3	4	1	1
Cuney	4	35	0	0	2	3
leaf shaped	2	2	0	0	0	0
Edwards	5	5	2	2	0	0
Bonham	0	0	1	1	3	35
Bulbar Stem	4	12	0	0	0	0
Bassett	0	0	3	5	7	25
Friley	0	0	1	1	11	30
Colbert	0	0	0	0	4	14
Livermore-like	0	0	0	0	1	17
Washita	0	0	0	0	1	1
Maud	0	0	0	0	1	1
Guerrero	2	37	2	2	0	0
gar scale	1	1	0	0	0	0

Table 7

INLAND PALEO-INDIAN AND EARLIER ARCHAIC DART POINTS

point type	Western		Central		Eastern	
	sites	points	sites	points	sites	points
Clovis	0	0	6	7	1	60+
Folsom	1	1	2	2	1	1
Midland	0	0	3	7	0	0
Dalton	0	0	3	12	1	9
Big Sandy	1	1	2	3	1	5
Early Notched	13	51	20	102	4	13
Early Stemmed	7	24	9	25	1	3
San Patrice	5	15	21	88	13	51
Plainview	13	28	12	43	1	7
Angostura	11	17	13	27	2	2
Scottsbluff	3	3	3	4	2	13
Meserve	1	1	3	8	1	1
Bell	4	4	10	16	0	0
Trinity	2	3	9	21	0	0
Carrollton	7	8	15	44	4	20
Wells	5	6	8	16	2	5
Morrill	1	1	0	0	0	0
Bulverde	18	36	20	70	19	45
Lange	4	4	0	0	1	28
Bulverde-like*	7	29	6	10	0	0
Pedernales*	23	66	16	22	2	2
Williams*	12	15	18	32	10	29
Travis*	6	12	1	1	0	0
Morhiss*	2	2	2	2	2	2
Hoxie	0	0	1	1	0	0

*- occur in both Middle and Late Archaic periods

Table 8

INLAND LATE ARCHAIC AND LATER DART POINTS

point type	Western sites	Western points	Central sites	Central points	Eastern sites	Eastern points
Gary*	36	148	66	1153	37	1112
Kent*	36	168	44	566	35	696
Ellis	22	36	19	61	22	135
Ensor	17	41	11	24	19	69
Palmillas	9	23	20	96	25	124
Yarbrough	19	49	26	71	20	147
Darl	12	23	10	26	12	56
triangular	6	13	7	14	3	3
leaf shaped	2	3	13	22	2	3
Marcos	6	7	3	4	0	0
Fairland	4	10	1	1	0	0
Ponchartrain	2	2	3	6	6	12
Evans	0	0	0	0	2	44
Motley	0	0	0	0	2	4
Marshall	2	2	0	0	0	0
Catan	1	1	0	0	0	0

*- also occur in Middle Archaic period

Table 9

COASTAL MARGIN ARROW POINT DISTRIBUTIONS

point type	Western		Central		Eastern	
	sites	points	sites	points	sites	points
Perdiz	3	7	20	267	21	58
Scallorn	3	7	3	5	1	1
Catahoula	0	0	6	7	3	3
Alba	0	0	8	27	3	5
Bassett	0	0	2	2	0	0
Fresno	0	0	0	0	1	1
leaf shaped	0	0	0	0	2	2
Bonham	0	0	4	5	0	0
Bulbar Stem	0	0	1	1	1	1
Edwards	0	0	2	2	0	0
unifacial	0	0	0	0	2	6
gar scale	0	0	0	0	1	1
Cuney	0	0	1	1	0	0

Table 10

COASTAL MARGIN DART POINT DISTRIBUTIONS

point type	Western		Central		Eastern	
	sites	points	sites	points	sites	points
Gary	0	0	14	85	7	8
Kent	1	3	18	172	9	15
bone	2	5	8	34	4	8
Yarbrough	1	2	45	12	0	0
Morhiss	0	0	2	3	0	0
Ensor	0	0	5	8	1	1
Palmillas	0	0	3	9	0	0
Darl	0	0	5	6	0	0
Ellis	0	0	4	8	0	0
triangular	0	0	2	2	0	0
leaf shaped	0	0	5	5	0	0
Fairland	0	0	1	1	0	0

Table 11

COASTAL MARGIN CERAMIC TYPE DISTRIBUTIONS

type	Western sites	Western sherds	Central sites	Central sherds	Eastern sites	Eastern sherds
Goose Creek Plain	11	2062	24	36747	90	15541
Goose Creek Incised	3	6	17	2164	39	413
Goose Creek Stamped	0	0	3	11	5	5
asphalt coated	1	1	1	186	2	467
shell tempered	1	2	1	6	11	68
San Jacinto Plain	7	238	18	10507	64	4832
San Jacinto Incised	2	2	11	2254	34	291
Tchefuncte	0	0	5	81	15	742
bone tempered	2	5	9	1427	22	145
Mandeville Plain	0	0	3	13	6	120
Conway	0	0	2	27	11	76
Marksville	0	0	0	0	1	2
Caddo	0	0	1	1	0	0

Table 12

INLAND CERAMIC TYPE DISTRIBUTIONS

type	Western sites	Western sherds	Central sites	Central sherds	Eastern sites	Eastern sherds
Goose Creek Plain	51	3586	107	13022	19	13141
Goose Creek Incised	12	43	26	264	10	183
Goose Creek Stamped	0	0	5	9	1	1
Conway	6	27	26	201	1	1
Rockport Plain	3	4836	2	2	1	5
Rockport Decorated	6	3223	1	1	0	0
bone tempered	17	258	23	181	9	209
San Jacinto Plain	8	134	24	150	14	849
San Jacinto Incised	2	2	5	12	9	138
Tchefuncte	0	0	6	23	2	9
Marksville	0	0	0	0	1	5
Caddo	4	1021	6	21	6	229

Table 13

INLAND SUBREGION LITHICS

type	Western sites	Western items	Central sites	Central items	Eastern sites	Eastern items
scraper	31	417	43	458	4	52
notched tool	2	4	14	50	2	3
denticulate	8	14	11	30	0	0
bifacial knife	16	41	13	274	2	58
graver	20	75	35	269	3	22
scraper-graver	2	11	3	3	0	0
uniface. perforator	9	40	19	143	1	1
biface. perforator	14	76	14	69	8	47
stemmed scraper	6	6	0	0	1	5
chopper	7	50	5	79	1	3
gouge	2	2	0	0	1	1
corner tang	4	5	0	0	0	0
inset blade	0	0	9	146	1	5
cutting tool	0	0	0	0	1	2
Albany scraper	2	3	7	18	0	0
small flakes	41	47455	70	74517	3	13062
large flakes	47	80615	74	37625	6	22067
large blades	5	60	18	112	0	0
small blades	9	51	38	1695	1	22
blade cores	5	8	20	166	0	0
misc. cores	23	527	27	318	4	138
exotic chert	6		7		0	
hammerstones	22	170	23	174	4	32
chert cobbles	11	221	11	104	1	3

Table 14

COASTAL MARGIN SUBREGION LITHICS

type	Western sites	Western items	Central sites	Central items	Eastern sites	Eastern items
scraper	1	1	11	40	20	71
uniface. perforator	0	0	4	9	2	2
biface. perforator	1	1	10	53	7	20
bifacial knife	0	0	8	12	3	5
misc. biface. tool	0	0	1	6	14	21
flake	5	304	20	6055	58	4903
core	0	0	3	26	0	0
graver	0	0	5	12	1	2

Table 15

CLAYBALLS AT INLAND SITES

site	number
41AU1	1
41FB32	100
41FB34	688
41FB37	100
41FB42	15188
41FB43	24
41FB95	100
41FB223	28842
41HR6	21
41HR89	50
41HR139	10
41HR184	572
41HR185	140
41HR206	113
41HR208	1
41HR210	8
41HR214	1
41HR215	5
41HR223	108
41HR226	10
41HR244	29
41HR246	3
41HR267	3
41HR273	5
41HR279	2
41HR315	1144
41LB2	11000
41SJ16	15
41SJ160	16
41WH12	21
41WH19	4443
41WH20	157
41WH21	7134
41WH25	9
41WH36	484
41WH50	100
41WH72	1145
41WH73	4661
41WH77	234
41WL15	20

Table 16

SUMMARY OF TERRESTRIAL FAUNAL REMAINS

species	inland sites	coastal margin sites
deer	49	41
land turtle	46	15
snake	16	13
rat	15	9
land bird	16	12
bison	21	10
rabbit	24	14
gopher	16	5
skunk	3	4
mouse	11	4
raccoon	11	10
opossum	15	8
badger	2	0
antelope	5	0
squirrel	4	4
beaver	5	0
bear	1	2
mink	1	0
muskrat	0	3

Table 17

SUMMARY OF AQUATIC FAUNAL REMAINS

species	inland sites	coastal margin sites
mussel	27	0
alligator	12	15
water bird	7	11
water turtle	16	23
gar	24	27
misc fish	15	26
frog	12	4
catfish	15	18
drum	15	17
bass	6	0
bowfin	10	6
sunfish	7	0
Rangia	0	200+
Oyster	0	24
shark	0	2
redfish	0	2
sea trout	0	6
sheepshead	0	6

Table 18

BISON REMAINS IN SOUTHEAST TEXAS

site and zone	time period(s)
Western Inland	
41AU4	not determined
41FB37	Early Archaic
41FB43	Late Prehistoric
41FB95	not determined
41FB223	Archaic
41WH12	Late Prehistoric
41WH14	not determined
41WH19	Late Paleo, Archaic, Early Ceramic, Late Prehistoric
41WH36	Late Prehistoric
41WH72	Late Prehistoric
41WH74	Late Prehistoric
Central Inland	
41HR5	Middle Archaic, Early Ceramic, Late Prehistoric
41HR6	Late Prehistoric
41HR7	Late Prehistoric
41HR182	not determined
41HR273	Early Ceramic
41HR278	not determined
41HR279	not determined
41HR281	not determined
41HR292	Late Archaic
41HR541	Late Prehistoric
Eastern Inland	no sites
Western Coastal	
41BO79	Late Prehistoric
Central Coastal	
41HR39	not determined
41HR50	Late Prehistoric
41HR82	Late Prehistoric
41GV66	Late Prehistoric
Eastern Coastal	
41CH16	Early Ceramic
41CH31	Late Prehistoric
41CH110	Late Prehistoric
41CH161	Late Prehistoric
41CH172	Late Archaic

Table 19

SUMMARY OF SITE OCCUPATION SEQUENCES

period	inland subregion total	inland subregion single component	inland subregion % single	coastal margin subregion total	coastal margin subregion single component	coastal margin subregion % single
Late Paleo	78	9	12	0	0	0
Early Archaic	47	1	2	0	0	0
Middle Archaic	92	3	3	0	0	0
Late Archaic	140	13	9	37	11	30
Early Ceramic	175	31	18	71	12	17
Late Prehist.	183	48	26	132	75	57

Table 20

SUMMARY OF SITE COMPONENTS AND POPULATION LEVELS

period	length, years	inland no. of sites	inland RPF	coastal no. of sites	coastal RPF
Late Paleo	3000	78	2.6		
Early Archaic	2000	47	2.4		
Middle Archaic	1500	92	6.1		
Late Archaic	1600	140	8.8	37	2.3
Early Ceramic	500	175	35.0	71	14.2
Late Prehistoric	900	183	20.3	132	14.7

Table 21

SITES IN LATE ARCHAIC MORTUARY TRADITION

site	no. of burials	reference(s)
1. Goebel (41AU1)	42	Duke 1981
2. Brandes (41AU55)	3	Highley et al. 1988
3. Ernest Witte (41AU36)	145	Hall 1981
4. Leonard K (41AU37)	9	Hall 1981
5. Albert George (41FB13)	15+	Walley 1955
6. Big Creek (41FB2)	75+	TARL archives
7. Piekert (41WH14)	11	Kindall 1980, Copas 1984
8. Crestmont (41WH39)	39+	Vernon 1989
9. 41WH44	2	Black, Patterson, and Storey 1992
10. Bowser (41FB3)	16	Patterson et al. 1993b
11. Ferguson (41FB42)	4+	Patterson et al. 1993a

Table 22

LATE PREHISTORIC COASTAL MARGIN MORTUARY SITES

site	no. of burials	reference(s)
1. Harris County Boys' School (41HR80)	34	Aten et al. 1976
2. Caplen (41GV1)	65	Campbell 1957, Aten et al. 1976
3. Jamaica Beach (41GV5)	19	Aten et al. 1976
4. 41CH13	4	Ambler 1973
5. 41CH16	3	Ambler 1973
6. 41CH32	1(A)	Aten et al. 1976:Table 10
7. 41CH110	2	Gilmore 1974
8. 41CH172	1(A)	Aten et al. 1976:77
9. 41BO2	8	Hole and Wilkinson 1973
10. 41HR81	1(A)	O'Brien 1970
11. 41BO13	1(A)	Hamilton 1987:88
12. 41GV66	11+	Ricklis 1993, 1994

(A)- no grave goods

FIGURE 1

SOUTHEAST TEXAS STUDY AREA

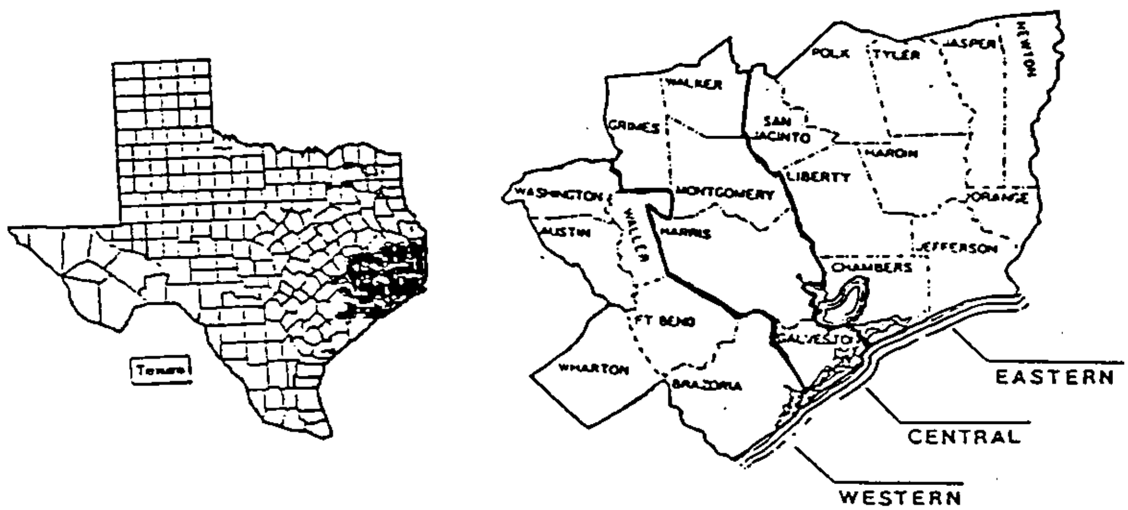
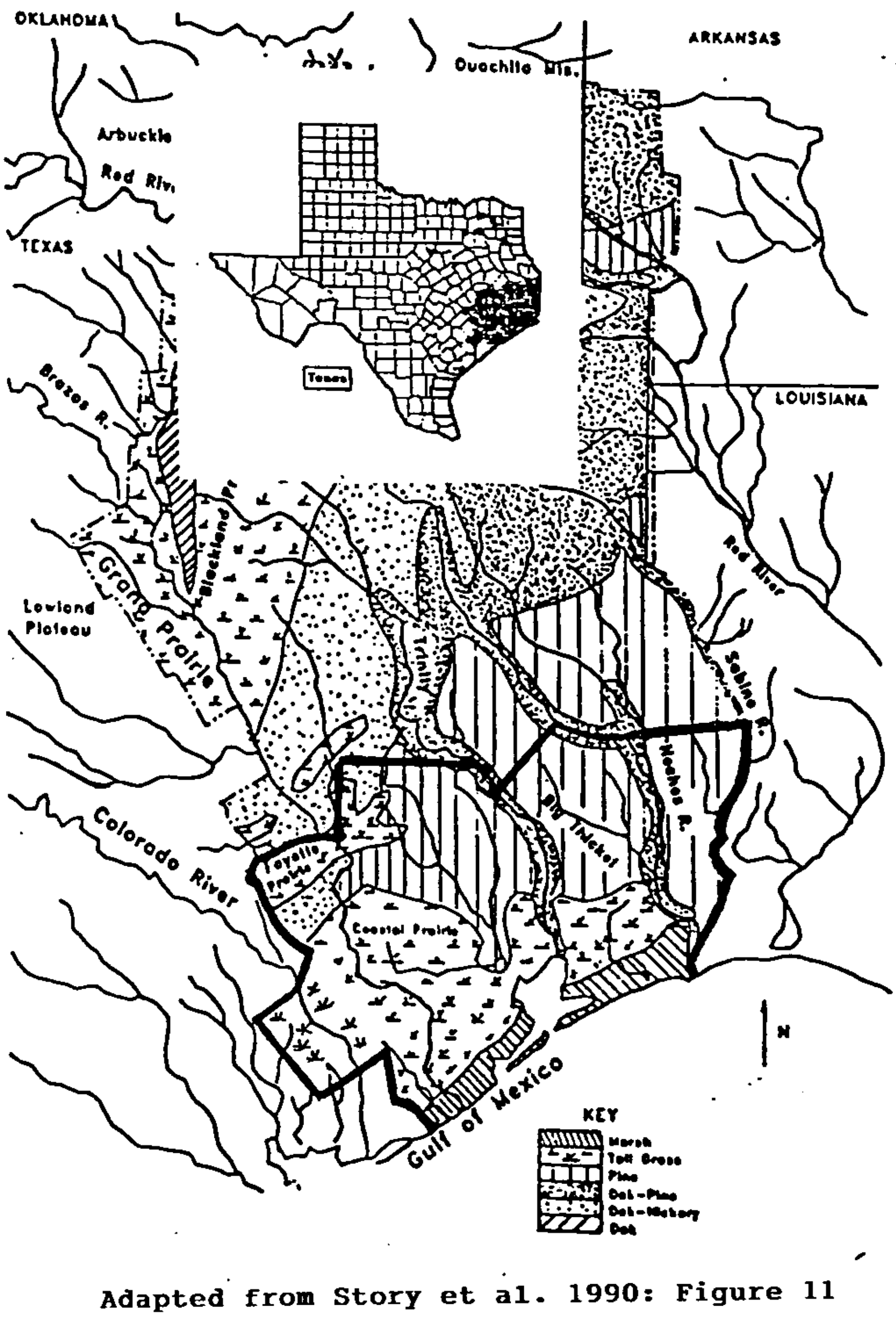


Figure 2

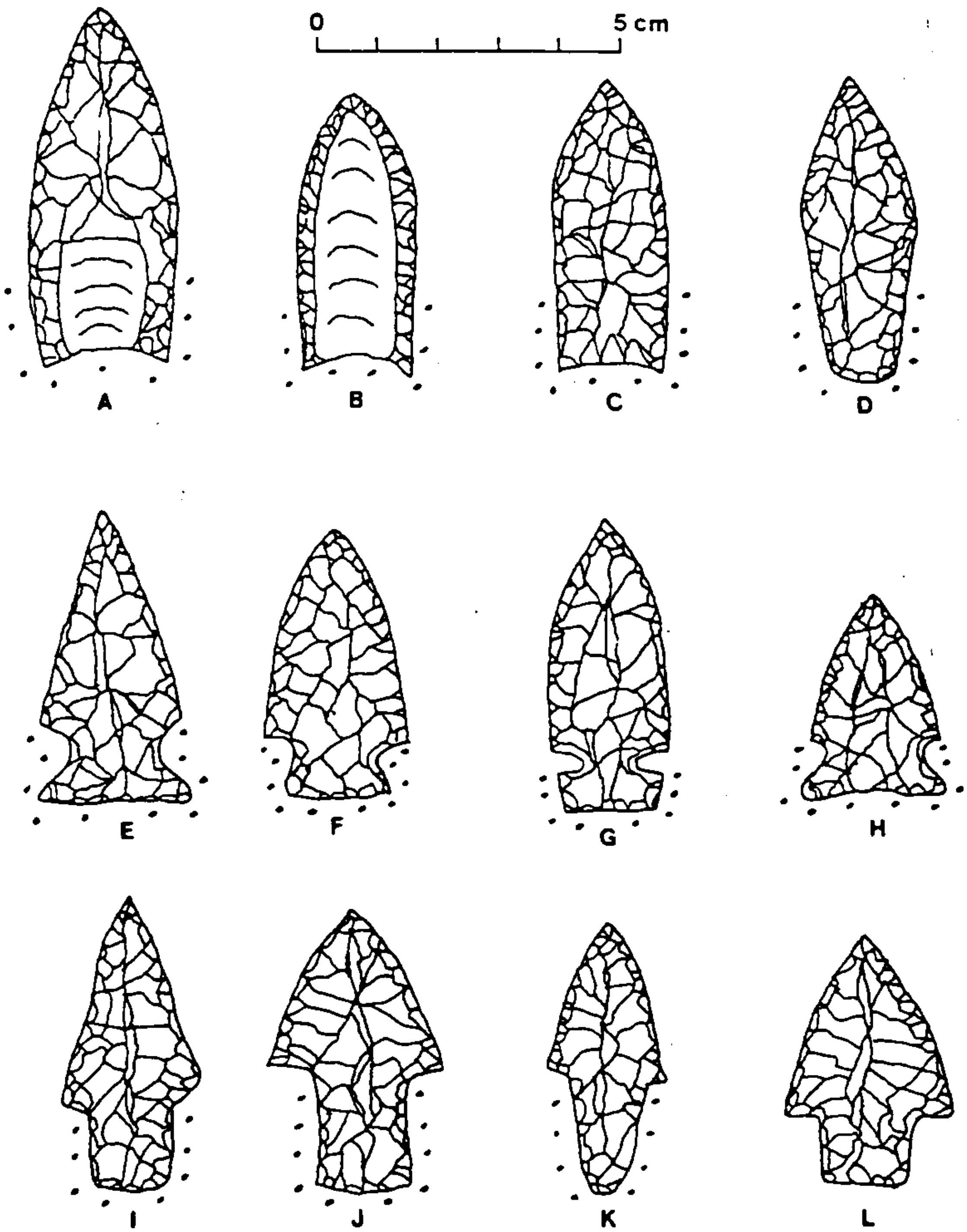
VEGETATION ZONES OF SOUTHEAST TEXAS



Adapted from Story et al. 1990: Figure 11

Figure 3

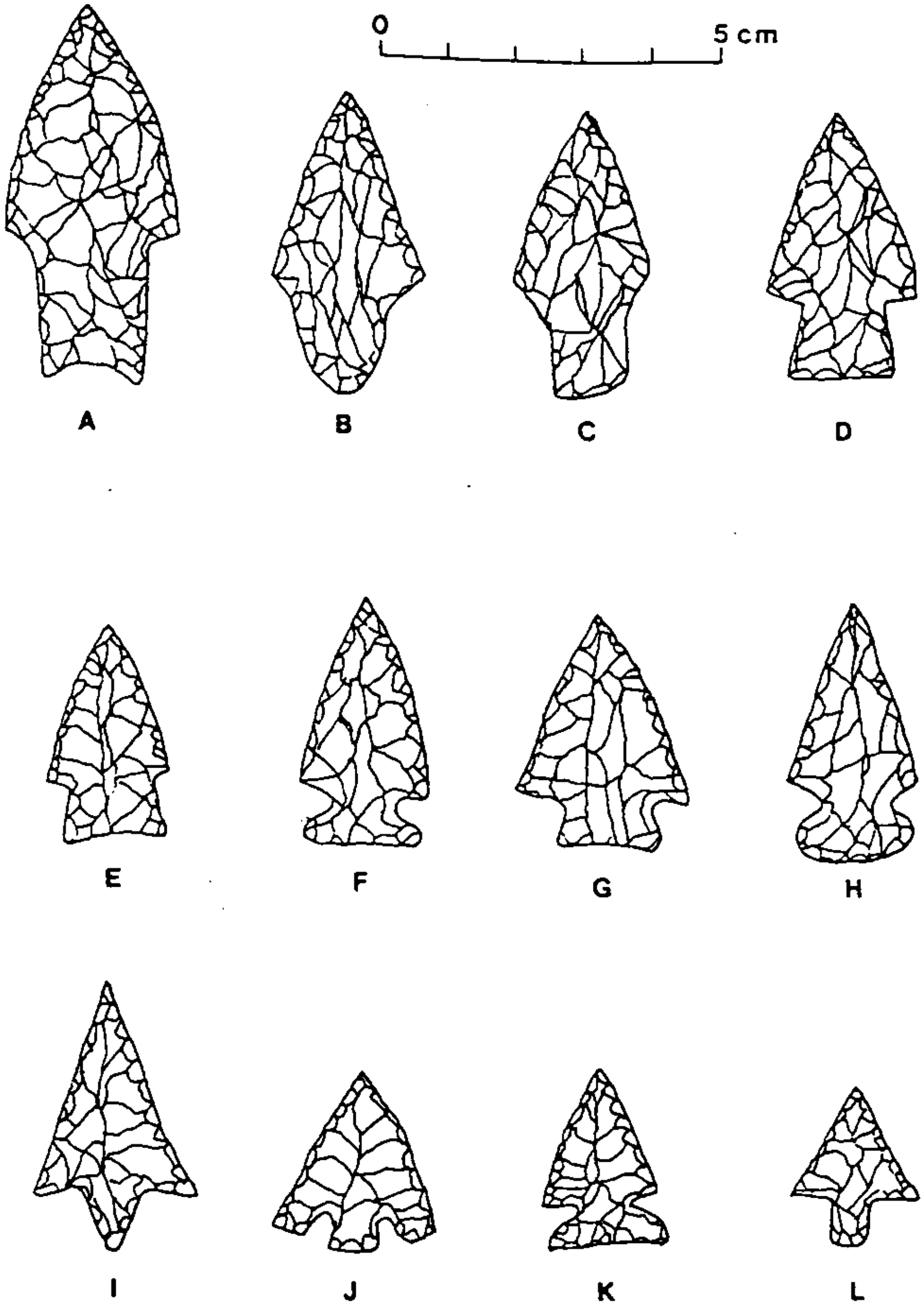
EARLY PROJECTILE POINTS



A- Clovis, B- Folsom, C- Plainview, D- Angostura, E- Early Side-Notched, F- Early Corner-Notched, G- Big Sandy, H- San Patrice, I- Early Stemmed, J- Carrollton, K- Wells, L- Bulverde, dots show ground edges

Figure 4

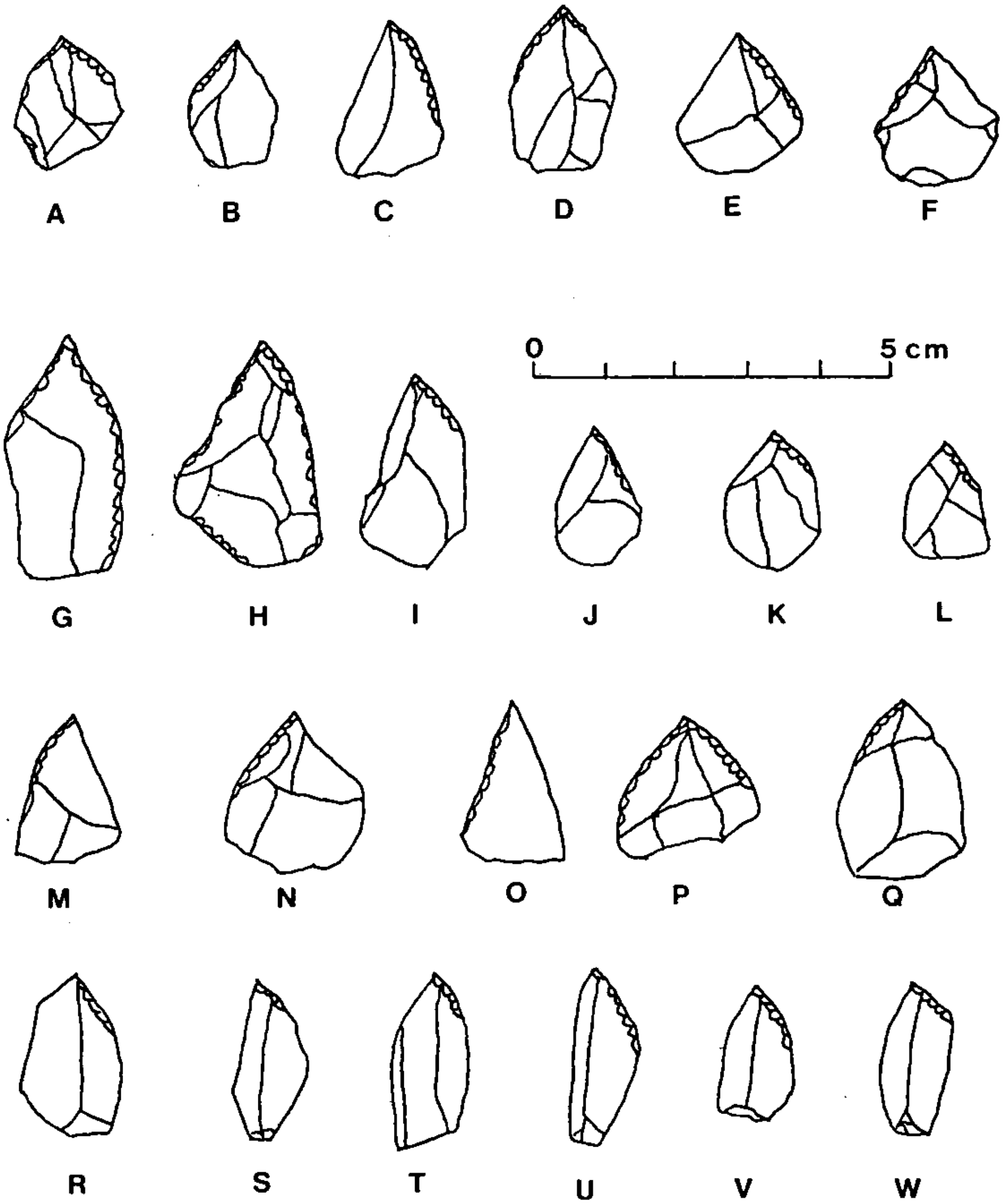
LATER PROJECTILE POINTS



A- Pedernales, B- Gary, C- Kent, D- Yarbrough,
E- Darl, F- Ensor, G- Ellis, H- Palmillas,
I- Perdiz, J- Catahoula, K- Scallorn, L- Alba

Figure 5

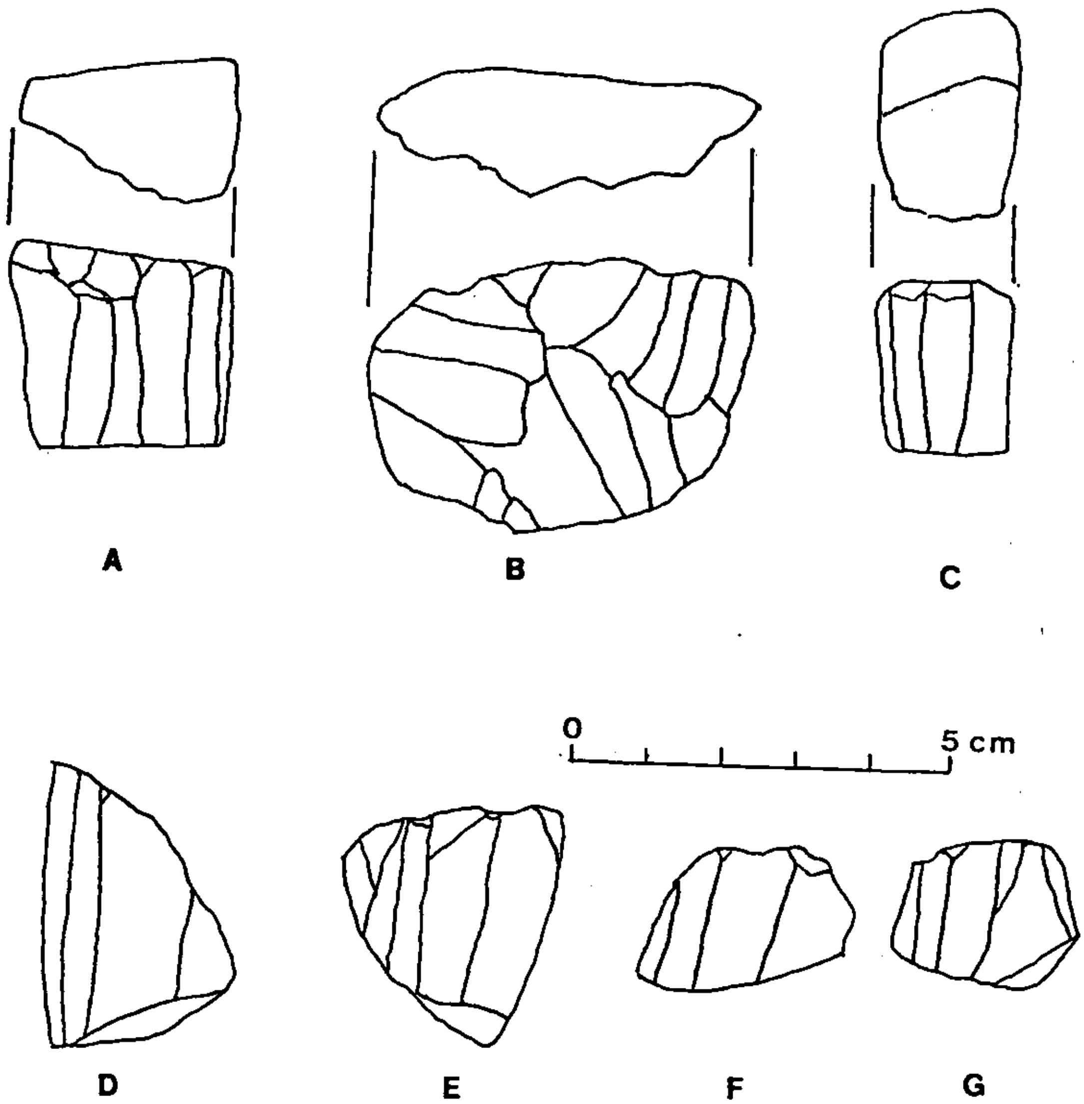
UNIFACIAL ARROW POINTS, 41HR184



A to Q- points on flakes, R to W- points on blades

Figure 6

POLYHEDRAL BLADE CORES, 41HR184



A to C- blade cores, D to G- blade core fragments

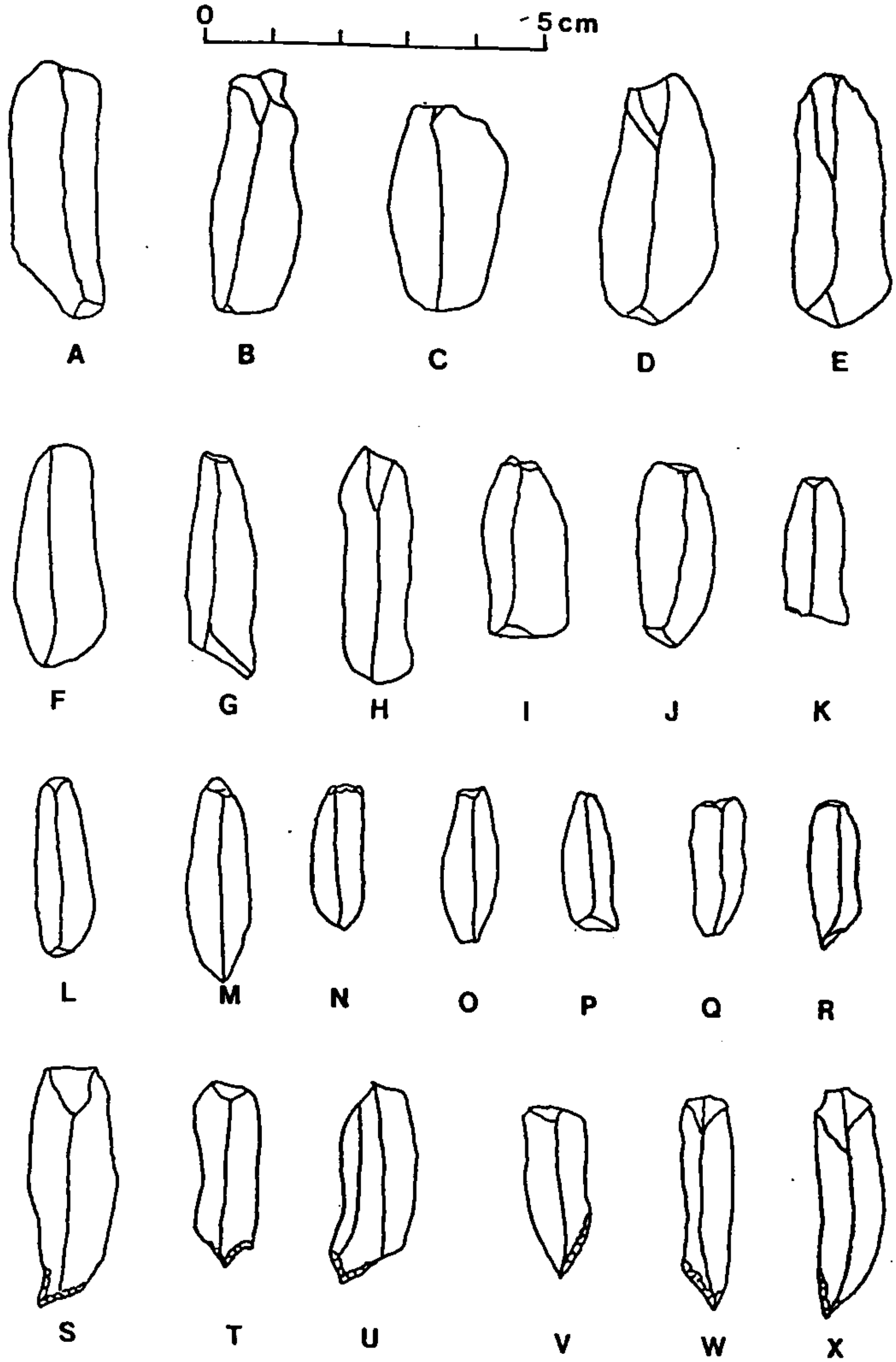


Figure 7

SMALL PRISMATIC BLADES, 41HR184

A to R- unmodified blades, S to X- modified blades

Figure 8
Flake Size by Excavation Level

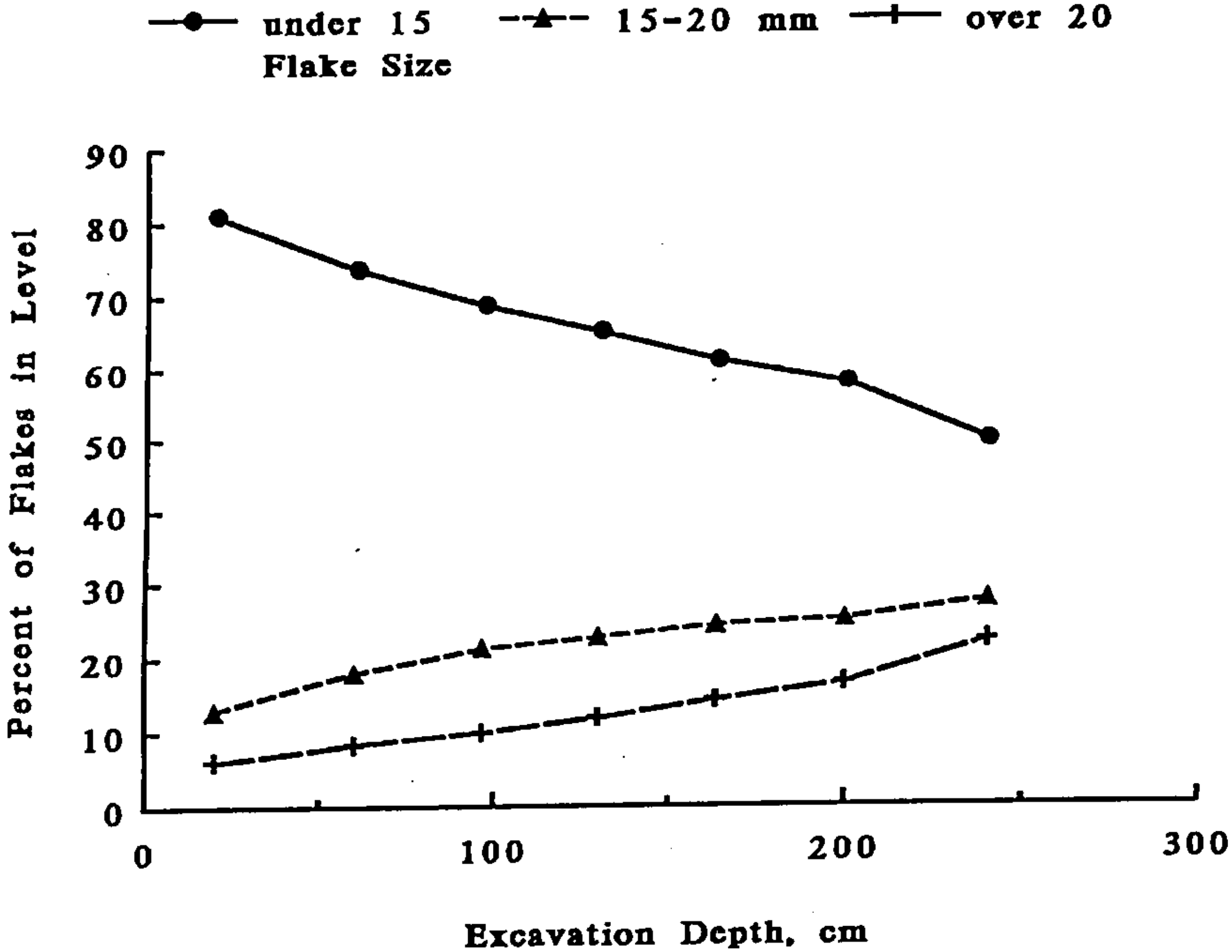


Figure 9

BISON REMAINS IN SOUTHEAST TEXAS

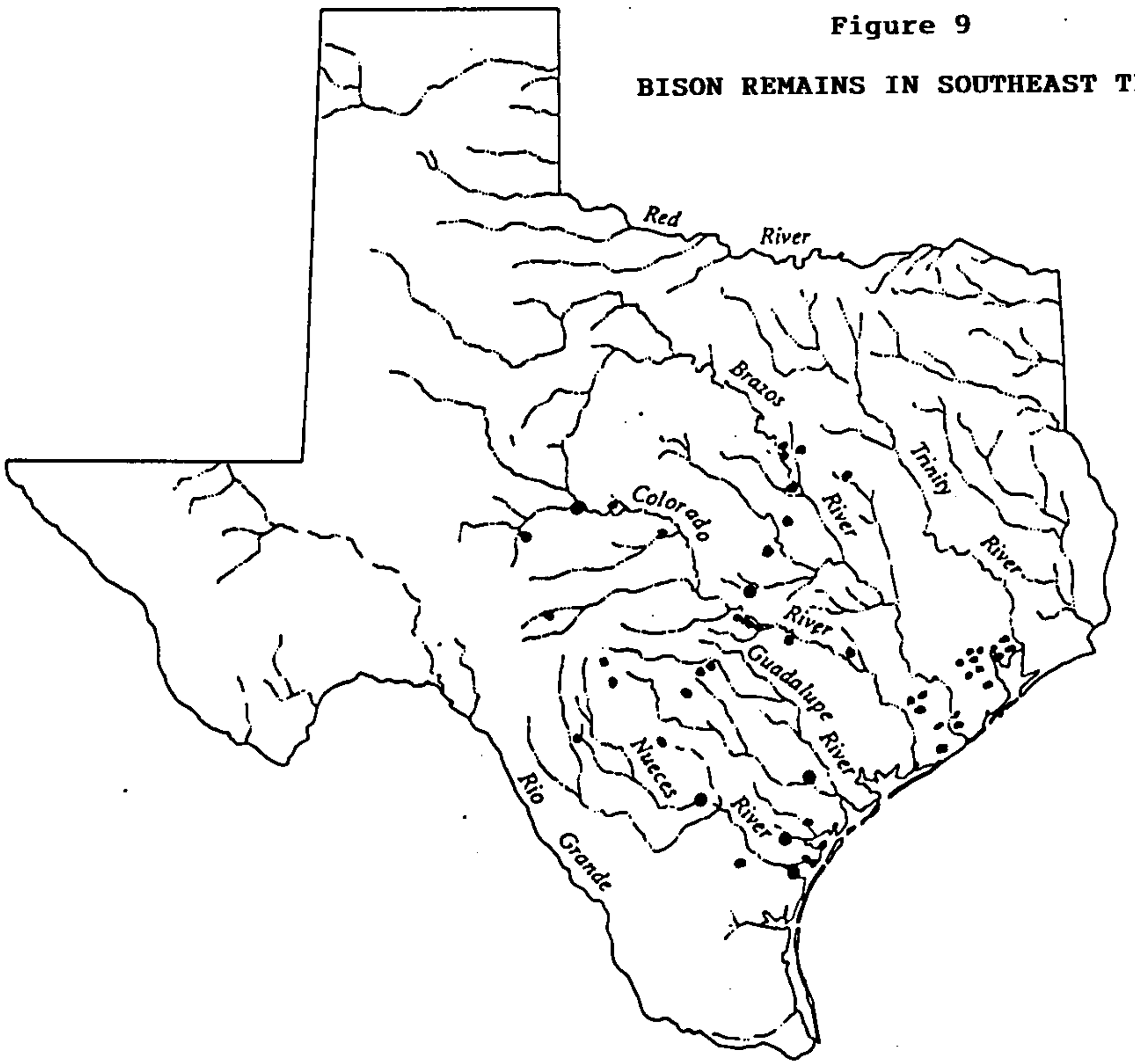


Figure 10
Regional Population Dynamics