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**A Cultural Resource
Survey of the
Continental Shelf
from Cape Hatteras
to Key West**

Final Report

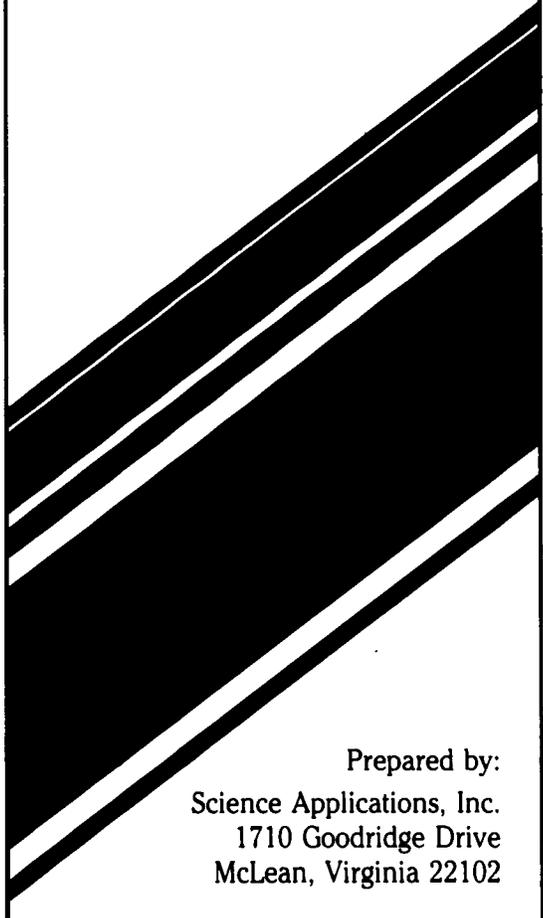
Volume IV:
Conclusions and
Recommendations

June 1981

PROPERTY OF
ATLANTIC

LOWER

COAST



Prepared by:
Science Applications, Inc.
1710 Goodridge Drive
McLean, Virginia 22102

**A Cultural Resource Survey
of the Continental Shelf from
Cape Hatteras to Key West**

FINAL REPORT
June 30, 1981

Volume IV

**Conclusions
Recommendations**

Contract Number AA551-CT8-40

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**Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street
New Orleans, Louisiana 70130**

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5.0 EXECUTIVE SUMMARY

A survey and evaluation of the cultural resources on the Continental Shelf of the southeastern United States was conducted to access the research needed to support the cultural resource management plan. The results and conclusions of this survey will serve as a framework for the management of those cultural resources.

Discovery of reliable evidence of human prehistoric occupation on the Southeastern United States Continental Shelf has never been reported. Therefore, the population distribution of prehistoric man on the shelf, if he ever lived there, is unknown. In contrast, the location of many shipwrecks throughout the study area is known, but the location of many more is unknown. The study design for addressing these two unknowns was to develop models to predict the location of these cultural resources.

Both predictive models are based on the controlling physical environmental parameters. The prehistoric model uses Coastal Plain settlement patterns of early populations in the Atlantic Coastal Plain and adjacent areas as an analog to a shelf settlement pattern. The shipwreck model uses socioeconomic and political conditions during various time periods in addition to environmental parameters to predict shipwreck population distribution.

The approach to the model development was to conduct a comprehensive survey and review of existing data related to the past and present physical environment, prehistoric archeology, and shipping of the southeastern United States. An extensive bibliography of published and unpublished literature has been assembled and reviewed. The sources included university, public, and private libraries, computerized bibliographies, libraries of state and Federal agencies, private company reports, and museum libraries. Archeological and paleontological data in museum and private collections was examined.

Interviews were conducted with researchers, museum curators, state and Federal officials, and salvage operators, as well as avocational archeologists and divers.

The physical environmental parameters that came together to form habitats attractive to Paleoindian through Late Archaic populations are the same parameters that can preserve or destroy the record of his presence. Similarly, geography, geomorphology, and climate, at least in part, control the distribution of shipwrecks. Geological processes can also destroy or preserve the physical integrity of wreck sites, depending on the nature and intensity of the processes involved.

The modern Continental Shelf, south of Cape Hatteras, is relatively shallow before the slope increase marks the edge of the Continental Shelf. This slope break varies from less than 60 metres south of Cape Hatteras to less than 10 metres south of Palm Beach, Florida. In contrast the shelf break off New York exceeds 140 metres.

The significance of this relatively shallow shelf is that sediment transport and deposition on the whole is quite active. In some areas of the shelf, bedrock is exposed with little or no sediment to protect historic or prehistoric artifacts from destruction by wave energy or currents. In both areas, the surface of the shelf is not the same surface that was exposed during lower sea levels. The subaerial surface has either been destroyed or buried, although locally it might periodically be exposed.

There are only certain environments where prehistoric sites could have survived the high energy beach zones as sea level rose. These environments are where post-habitation sediment deposition was greater than the erosion that has occurred at the sites since habitation. The erosion that occurred could have been on the shoreface during sea level rise or modern submarine scour. The flood plain or delta of a river and a back-barrier lagoon beach all have a potential for high rates of sedimentation.

The preservation potential for shipwrecks is highest in areas of low energy and/or high rates of sedimentation. Such environments would be found in a river or harbor, or near an inlet margin, where scouring activity is minimal.

Geological factors that were critical to earliest prehistoric populations were rivers and outcrops of rock suitable for the manufacture of stone tools. Rivers were an obvious source of freshwater, but also attracted game, and - depending on origin and course - might contain gravel and cobbles for toolmaking. Evidence for ancient river channels on the shelf is sparse, but what could be interpreted from the data as continuous rivers were plotted on maps.

Outcrops of cryptocrystalline rock such as chert, jasper, or flint occur most commonly in the Piedmont, far from the Continental Shelf. Some chert outcrops, however, do occur in the inner Coastal Plain of South Carolina but cryptocrystalline rock has not been reported on the shelf.

It is proposed in this study that a new sea-level curve be adopted for the shelf south of Cape Hatteras. The proposed curve is based on a reassessment of old data combined with new data. According to this curve, sea level in this area had a maximum low level of 60 metres below present level. Because the shelf is shallow, the area exposed is nearly the same for both curves, but the duration of potential habitation is shorter for the new curve.

The shelf off the Georgia and South Carolina coast appears to have the greatest potential for supporting human habitation. This area of the shelf also has the greatest potential for site preservation based on environmental parameters. The river channels that once flowed on this portion of the shelf could have provided all of the required environmental conditions for habitation. Preservation of these sites is probable since a relatively thick sedimentary sequence has been deposited since shelf exposure.

Pollen records and climatological models have been used by others to reconstruct the climatic zones of the southeastern United States. These zones indicate that large game animals were contemporary with Paleoindians. These animals include mammoth, mastodon, bison, sloths, camels, and deer. These animals were a potential food source, but whether they were actually exploited as such in the southeast has not been unequivocally proven.

This study has demonstrated that the availability of certain types of lithic materials was a critical element in the adaptive system of Paleoindians. The population density therefore decreased as the distance from the source of suitable rock increased. Terrestrial archeological data indicate that through time, population concentrations approached the present day shoreline from the Piedmont. This does not rule out occupation on the shelf at any time, but it does suggest that whatever the availability of faunal resources, the lack or limited distribution of other variables critical to the adaptation of early populations discouraged intensive occupations in this area. By the time the modern Coastal Plain became inhabited to any great extent, sea level was within several metres of the present level. Therefore, those submerged environments that had the greatest number of critical necessities near the present shoreline seem to have the greatest potential for containing archeological data (assuming preservation at those sites).

Based on patterns of hurricane landfall and geomorphic promontories, the areas that should contain the greatest shipwreck population density are Cape Hatteras and southern Florida. This is supported by existing records of ship losses. The distribution of shipwrecks throughout the study area is highest within the 20-metre isobath. Shipwreck data throughout the study area varies in completeness. Records of ship losses is strongly dependent on, among others, the type of ship, the coastal population, the time period, cause of sinking, and the care given to preserving records.

Within the study area, the North Carolina coast has the greatest density of known shipwreck sites. Wreck sites of the later periods are clustered along the shoals of Cape Hatteras, Cape Lookout, and Cape Fear. The second highest density is along the beaches between Tubbs Inlet and Carolina Beach, along Bogue Banks and between Cape Lookout and Cape Hatteras.

In South Carolina, the most archeologically sensitive area is Charleston Harbor and the shoals at the entrance to the harbor. Other highly sensitive shipwreck areas include Port Royal Sound, St. Helena Sound, the Port Royal and Beaufort Anchorages, Cape Romain, Winyah Bay, and the Georgetown Anchorage. Relatively few sites are reported beyond the 20-metre isobath.

In the past, relatively little attention has been directed toward determining the extent of the shipwreck population along the Georgia coast. During a recent literature search conducted by the Savannah District U.S. Army Corps of Engineers, an inventory of over 120 ships was compiled for the Savannah River and Brunswick area. Most of the sites appear to date from the late 19th to early 20th century. There is little reliable data on ships lost during the 16th and 17th centuries despite extensive Spanish colonial activity. The shipwreck predictive model suggests the likelihood of a number of shipwrecks dating from the late 16th to mid 18th century which have gone unrecorded along the shallow coastal waterways in vicinities such as Cumberland Island, Brunswick, and St. Simons Island.

The record of ships lost along the east Florida coast is more complete. Shipwreck clusters were identified off St. Augustine, Cape Canaveral Shoals, St. Lucie Inlet to Sebastian Inlet, and Biscayne Bay. The shipwreck distribution model predicted that most of these wrecks would date between the 17th and 18th century in these areas. It was also predicted that 19th and 20th century wrecks would occur in other areas, such as the St. Johns River, Amelia Island, Cape Canaveral, and the Palm Beach-Jupiter coast. This has been largely confirmed by the literature search.

The clustering of early sites along the Florida Keys is not as apparent as it is off the east coast. The reason is that numerous citations on 16th and 17th century wrecks simply state that a ship was lost "off the Florida Keys." Another reason for lack of wreck clusters is that there were no ports in the Keys during the 16th, 17th, and early 18th centuries where the loss of ships might have been reported. From 1821, when Key West was founded, shipwrecks began to be reported more regularly along the outer reef tract and shoal, areas which are hazardous to navigation throughout the Keys, from Biscayne Bay to Key West.

Key West Harbor is another area of high shipwreck concentration for all periods. Although infilling and dredging of various areas of the harbor has destroyed many wrecks, several known sites of historic interest exist which should be protected from further adverse impact.

The technical limitations of various remote-sensing systems for detecting cultural resources have been evaluated. Prehistoric artifacts for the most part cannot be detected using existing systems. These sites are probably small and are often hard to detect even on land. If a submerged shell midden existed under certain conditions it could be imaged by a side-scan sonar system, sub-bottom profiler, and possibly by a magnetometer. The fact that interpretive keys have not been developed for these systems means that the anomalies created by the midden or other archeological features could resemble many other physical environmental features.

Video and fixed-frame camera systems can be used to document a site discovered by other means but are not practicable for reconnaissance because of high cost and slow tow required. Shipwrecks in general are easier to detect using existing systems. Magnetometers can be used to detect ferrous objects, and side-scan sonar and depth recorders can record wrecks projecting from the bottom. The most cost-effective system

would be an array of instruments, such as a magnetometer, side-scan sonar, sub-bottom profiler, and a video system. A multiple-sensor system with real time data display provides the advantages of each system with the option to verify anomalies as they appear.

It is clear from the data analyzed during this study that there are many deficiencies in the physical environmental, prehistoric archeological, and shipwreck archeological data bases. Well-planned studies are needed to address the deficiencies before refinements to the cultural resource management plan can be made. For example, site specific studies at shipwrecks should be conducted to determine what variables affect the distribution of artifacts and the physical integrity of hull structures in various depositional environments; the interrelationship between underwater cultural resources and the surrounding natural environment; and the present physical integrity and archeological potential of selected wreck sites. The objective of this reasearch should be to provide data for the refinement of the predictive model outlined in this study.

Additional research should be directed towards studying the remnants of terrestrial and fluvial environments on the near-shore shelf. A specific area such as the Savannah River would be a prime area to conduct detailed stratigraphic and sedimentological surveys. This river drains areas that would have been a primary source of lithic raw materials. The gravel in the submerged stream-bed should contain some of these rocks.

This study had several objectives but the most important was to provide a framework for the development, and recommendations for the implementation, of a cultural resource management plan. The framework prepared in this study is based on the predictive models for prehistoric and shipwreck archeology. The maps that have been prepared for this study display most of the data upon which the models are based.

The recommended approach for management of cultural resources on the shelf is to consider the total resource base rather than isolated sites. Within this approach the three goals outlined in Executive Order No. 11593 for the management of cultural resources can be accomplished. These goals include the identification, protection, and enhancement of resources. The prehistoric archeology model is based on the distribution of environmental variables, the correlations of those distributions with archeological resources during the various prehistoric archeologic periods, and the information available within the appropriate areas of each state. The interrelationship of these factors was the basis for three archeological sensitivity zones. Within the limits of the data, Sensitivity Zone 1 corresponds to Management Zone I, since submerged prehistoric resources have the highest probability of occurrence within this zone. Active surveys should be required in this zone before development of any type is permitted. It is expected that prehistoric cultural resources within Zones 2 and 3 do not exist or cannot effectively be identified or preserved. Therefore, these two zones comprise Management Zone II where no surveys should be required.

Three management zones have been identified for historic shipwrecks. Each zone represents varying levels of archeological sensitivity and has a different recommended survey procedure. The recommended survey intensity is commensurate with the archeological sensitivity of the known and/or predicted sites within the respective zones.

The management of archeological resources on the South Atlantic Continental Shelf is based on a limited data base and the formulation of predictive models. It should be recognized that resource management is a continuous process, and that management plans and procedures should be responsive to newly developed information. This is particularly true in any area about which so little is known. The conclusions developed here should be regarded as only the first step in developing a comprehensive archeological resources management plan for the South Atlantic Continental Shelf.

6.0 CONCLUSIONS

6.1 PHYSICAL ENVIRONMENT

The physical environmental parameters that came together to form habitats attractive to early human populations are the same parameters that can preserve or destroy the record of his presence. Similarly, geography, geomorphic factors, and climate, at least in part, control the distribution of shipwrecks while the processes that destroy, may, under different conditions, preserve the physical integrity of wreck sites.

The analysis of the physical environment focused on identifying and describing the importance of those features and processes of the prehistoric Continental Shelf environment that may have been attractive to man. The assessment of potential prehistoric site occurrence in association with, or as a result of, these processes and features is discussed in Volume II of this report.

6.1.1 Geology

The conclusions drawn in this report with regard to geology address the preservation/destruction potential of environments and the attractiveness of an area based on geological features.

The age and activity of sand and sand bodies on the shelf is significant in terms of the preservation potential for archeological sites or artifacts. If these sand bodies are recent and periodically active, the subaerial surface available to prehistoric man may either be buried or destroyed by erosion. Although this surface may have been destroyed in many locations and the artifacts, if they exist, moved out of context, a single projectile point may still survive occasional movement and by its own properties, could contribute information to the archeological record. Moving sand is also capable of burying shipwrecks. Repeated burial and excavation by wave and current activity can diminish the archeological data base importance by moving artifacts or damaging the structure of the wreck.

Most of the sediments on the shelf are palimpsest, that is, relict in age and composition but partly modern in texture. This is important because it indicates that sedimentation rates are very low and that reworking of old surfaces could easily move artifacts out of context.

In some areas such as Onslow Bay between Cape Lookout and Cape Fear the unconsolidated sediment cover is very thin to nonexistent. In this environment the potential for artifact destruction from abrasion and impact on hard substrate is high. The same potential for destruction of historic and prehistoric artifacts exists in hard ground areas which occur elsewhere throughout the study areas.

The shelf off Georgia and South Carolina has the thickest Holocene sediment accumulation within this study area. This is due, in part, to greater terrigenous influx from Coastal Plain and Piedmont rivers, and in part to the lower wave-energy. Because of rapid sediment influx in the Georgia Bight, artifacts that may have been lost or discarded on the shelf by man may be buried in the sediment up to several metres.

The preservation potential in the carbonate sediment environments of Florida and the Keys is, in general, greater than for other portions of the study area. The alternating ridges and reefs provide low energy, sediment-covered swales in which prehistoric and historic artifacts may be buried. These geomorphic features formed after sea level rise and probably are not relict landforms. The reef areas would be a significant factor in ship grounding and subsequent break-up.

Also in this environment are sinkholes which are remnants of subaerial karst topography. As groundwater dissolution of limestone proceeds there is frequent collapse of overburden left unsupported by limestone erosion. This is the process which often results in the formation of surface sinkholes. These areas could have been natural wells with freshwater that may have attracted prehistoric populations. If cultural remains do occur in these sinkholes the preservation

potential would be excellent since there is no chance for destruction by wave energy.

In areas where coral reefs have been active for the last 5,000 to 10,000 years the preservation potential should be high. As sea level rises the reefs grow vertically. The forereef receives and absorbs nearly all of the open ocean wave-energy and the lagoon areas behind the reef line are relatively low energy environments. Cultural remains along the lagoon area are likely to have been buried by carbonate sediments and coral reefs. As sea level rises the reef may also migrate slowly landward. The forereef would then die in deeper water and be broken apart exposing a stratigraphic surface that may once have been inhabited by Early Man.

Along the North Carolina coast there are several rivers flowing from the Piedmont that are likely to have traversed portions of the now submerged shelf. With their relatively high discharge rates they would have been capable of transporting cryptocrystalline cobbles and gravel, which have been demonstrated to be essential to the hunting subsistence strategy of prehistoric man. The rivers also provided a source of fresh water and attracted game. The vegetation in the flood plain could have provided shelter and, during periods of flood, sediment deposition might have buried and therefore preserved artifacts. At least two North Carolina rivers, the White Oak and the Cape Fear, are known to have flowed on the submerged shelf.

Other rivers in North Carolina also flowed onto the shelf, and it has been proposed in previous work that modern day Capes are remnants of Holocene river deltas. The ancient Neuse River may have flowed on the shelf to form the delta which later became Cape Lookout, and the Roanoke River may have formed the delta at Cape Hatteras.

In South Carolina the Santee River is associated with Cape Romain. The Santee Channel has been traced onto the shelf where it might have formed a particularly attractive habitat, especially since it flows through outcrops of the Allendale Chert.

In Georgia the Paleo-Savannah and Altamaha River channels have been identified on the shelf by seismic profiles. The flood plains of these rivers could have provided suitable habitats for early human populations. Both rivers originate in the Piedmont and have the potential for carrying lithic raw materials.

In Florida only two Coastal Plain rivers may have flowed onto the shelf, the St. Johns and St. Marys River. However, these two areas would be less attractive because of the lack of cryptocrystalline rock.

Recent sedimentological studies have identified widespread evidence for sediments of fluvial origin on the shelf. The record however is discontinuous and difficult to correlate with any reliability. The exact origin and size of most of these Paleo-rivers which contributed the sediment is unknown. Terrestrial habitats surrounding the rivers could be inferred but without data continuity, areas of high archeological potential cannot be inferred.

Other shelf data indicates that certain areas have been, or are, subject to severe submarine scour. These areas would have very low archeological potential, but again large archeologically insensitive areas cannot be drawn due to lack of data continuity.

The potential for preservation by burial is high along interior estuarine systems located far from the migrating barrier island system. During transgression any existing sites would have initially been covered by the encroaching marsh system. Even if most of the marsh has been eroded away during later submergence, the basal peats and underlying preexisting surface would probably survive the migration of the estuarine beach zone. Once covered by estuarine water, accumulation of muds could be deep enough so that the site would not be exposed during migration of the barrier beach. The site could then remain beneath active Holocene sediments.

These estuarine environments can be identified by the recovery of peat samples during coring operations on the shelf. The peat could be inferred to mark a stratigraphic horizon which is contemporaneous with prehistoric archeologic data.

Tidal inlet migration is a much more rapid process than barrier island migration. It was common for ships lost in an inlet to be completely buried within a short time. Conversely strong tidal currents can also move wrecks causing them to break apart. The preservation potential of shipwrecks at an inlet is highly dependent on site-specific conditions.

Hurricanes have been the cause of many shipwrecks (Millas, 1968). Hurricanes striking or passing near the mainland have two areas of concentration: Cape Hatteras and southern Florida. The fewest tropical storms occur in Georgia and northern Florida. Indeed, archival data indicated that there is a far greater number of shipwrecks located at Cape Hatteras and extreme southern Florida than wrecks along the Georgia coast. Intense wave activity during hurricanes can further destroy and disperse shipwrecks and prehistoric artifacts or bury and preserve them.

Overwash associated with hurricanes would have made such low-lying nearshore areas as the Florida Keys, the Georgia Sea Islands, and the Carolina Outer Banks inhospitable to prehistoric populations. This is coupled with the fact that there are no raw materials for toolmaking, generally little fresh water, and few game animals (a prime food resource) to make barrier islands an attractive habitat.

Extra-tropical storms have similar effects on the preservation and destruction potential of prehistoric and historic archeological sites. The North Carolina coast is the most storm-dominated within the study area. The shelf width is narrow in both North Carolina and Florida which allows higher wave-energy to impinge on the shore. However the Florida coast is somewhat protected from large oceanic

waves by the Bahama platform. Along the Georgia and South Carolina coast the shelf is wide and much of the wave energy is dissipated before reaching shore.

Based on a reassessment of previously collected data combined with an analysis of new data, a new sea-level curve for the Continental Shelf south of Cape Hatteras is proposed in this report. According to the new curve, at its lowest point sea level was 60 metres below the present level. Because the southern shelf lies at a depth that is mostly shallower than 60 metres, the actual exposed shelf area available to late Pleistocene/early Holocene man is only slightly smaller than that calculated using the previous curves. With the new curve however, the duration of potential habitation of the shelf was shorter. Using the new curve the time interval that man could have lived near the shelf edge is only 3,000 years compared to estimates of 11,000 years based on previous sea-level curves.

The preservation potential for submerged cultural resources is lowest along the North Carolina and Florida coastal areas based on coastal response to sea level change. These coasts experienced erosional transgression which may have cut below the depth at which prehistoric sites were buried in lagoonal estuaries. The Georgia/South Carolina coasts, however, underwent depositional transgression of the shoreface. This implies that the preservation potential may be high for prehistoric artifacts, although they may be inaccessible due to depth of burial.

Many areas of the Continental Shelf have single environmental features that are important to the occurrence and preservation of archeological data. Few, however, have all of the factors which, in combination, control site distribution.

The few areas of the shelf that appear to have all of the critical environmental factors in combination occur off the coast of Georgia and South Carolina where the Savannah and Altamaha Rivers have been traced onto the shelf. These rivers, in addition to being a

fresh water source for man and game, also flow through, and presumably transported, lithic raw materials from the only cryptocrystalline rock sources in the Coastal Plain. There is a high preservation potential for both shipwrecks and prehistoric artifacts in this area because of the thick Holocene sedimentation in a relatively low wave-energy environment.

6.1.2 Paleoenvironment

The succession of floral and faunal transitions as the Wisconsin Glaciation receded was determined primarily by climatic changes resulting from the general warming trend. These changes, marked by a general warming and the attendant rise of sea level as the Laurentide Glacier melted, reached their climatic optimum at the end of the Atlantic Period, about 10,000 - 9,500 B.P. The end of the Late Pleistocene period is marked by a simultaneous transition in vegetative types in the southeast, and by changes in prehistoric cultural patterns as evidenced by archeological remains. The recession of boreal environmental conditions in the north and west intensified during this period.

Previously, full-glacial conditions had resulted in a southward biome boundary shift of approximately 1,000 km to the south. This resulted in spruce and mixed forests, and scrub and grassland vegetation occurring in the periglacial region to the south. Average temperatures were 10°C and 15°C cooler than present in summer and winter, respectively.

These full-glacial conditions, apparently extending outward from the present shoreline across the then-exposed shelf, resulted in a variety of megafauna in the region. The northern tundra areas supported mammoth, caribou and walrus, while the more central grasslands and forests supported bison, horses, and camelids in addition to mammoth and mastodon. The southern Savannah attracted subtropical fauna such as sloths and tortoises.

The replacement of cooler Pleistocene conditions by warmer, drier early Holocene climates provided for the succession of new faunal types into the region. As the southern boundary of the boreal zone migrated north, from Georgia at 16,000 B.P. to Cape Hatteras at 13,000 B.P., a rapid change in species composition in the southeast ensued. It can be presumed that the widely-noted rapid extinctions at the end of the Pleistocene, along with other factors, caused some readjustment in human cultural patterns to fit the non-availability of traditional food animals later during the Archaic. Maritime settlement, which took advantage of marine and estuarine fisheries may have replaced hunting societies in the region, while the type and numbers of tools may also have been changed to accommodate new food supplies. It was during this era that modern food animals such as deer, bison, and shellfish and finfish emerged.

6.2 PREHISTORIC ARCHEOLOGY

The approach taken in this study has been to examine published and unpublished sources of data on the distributions of terrestrial archeological sites, correlate these distributions with the distributions of environmental variables which appear to be influencing site location, and express these correlations in the form of models for each cultural-historic period. During this study an attempt was made to extend these models to the Continental Shelf. Terrestrial site distribution data throughout the Southeast had been generally consistent with models developed by Gardner (1974, 1976, 1977, 1978, 1979) for the Middle Atlantic region. The details of these models for each cultural historical period are summarized in Section 4.2.1 (Figure 6.2.1 represents the distributions of prehistoric populations across the landscape, by culture period and physiographic zone, in the form of bar graphs indicating relative densities of sites). The range of occupation is illustrated in Figures 6.2.2 through 6.2.6. Although some temporal fluctuations undoubtedly took place, an overall population increase from Paleoindian times through Woodland times is hypothesized. At the same time, there is a gradual shift from west to east in both site density and occupation range. The locus of intensity for each

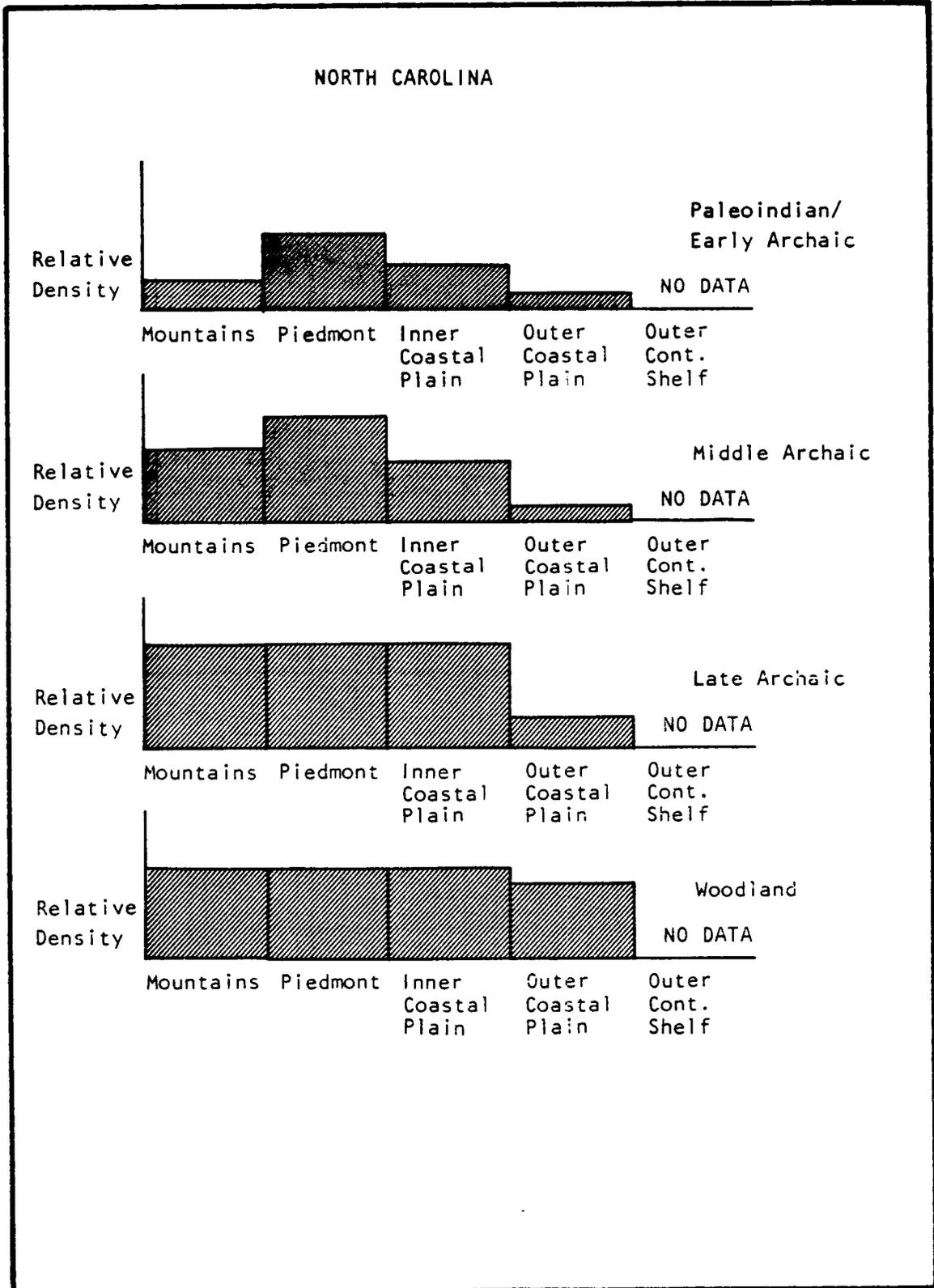


Figure 6.2.1 Relative Prehistoric Densities by Time Period and Physiographic Zone: South Atlantic

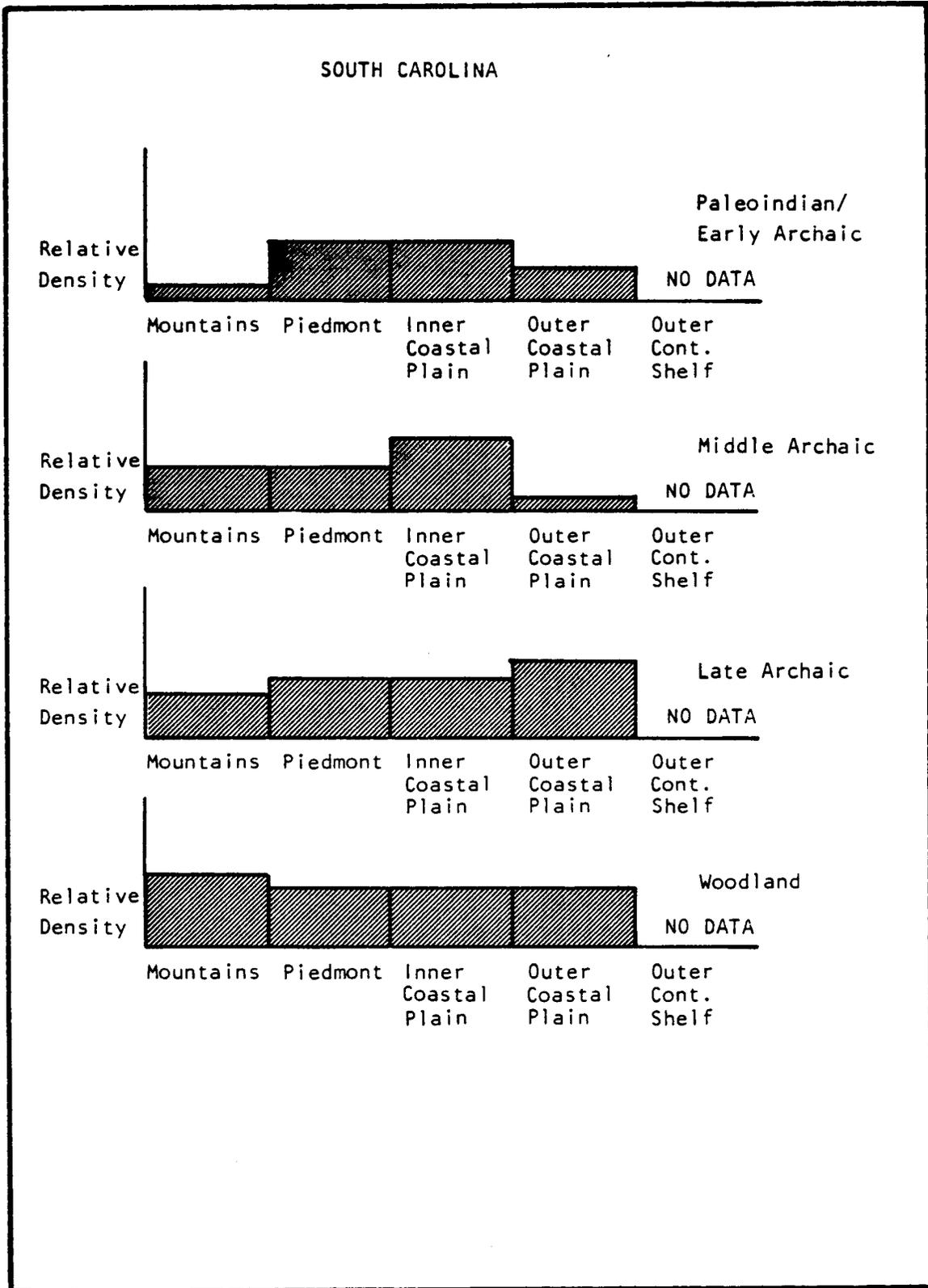


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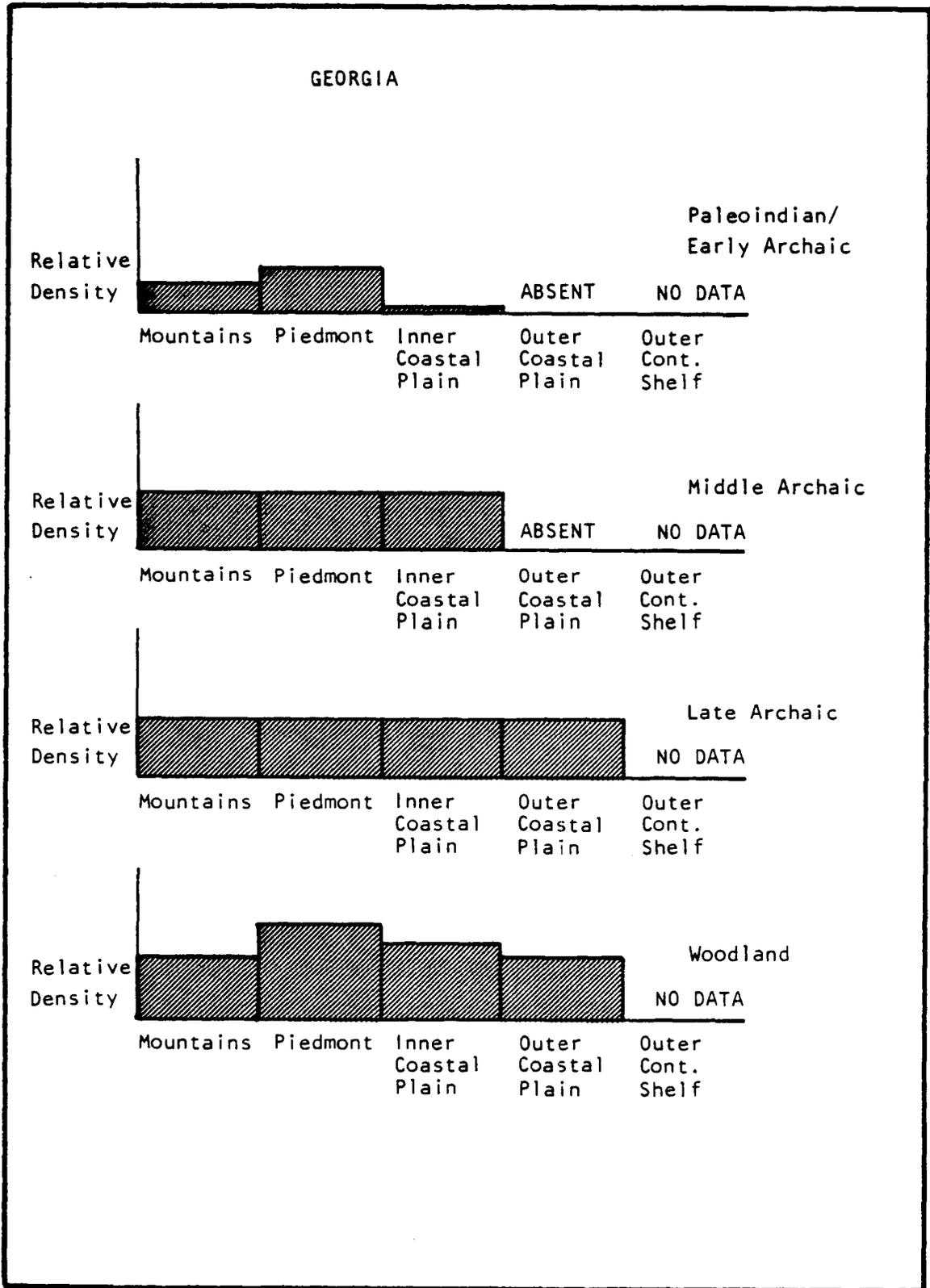


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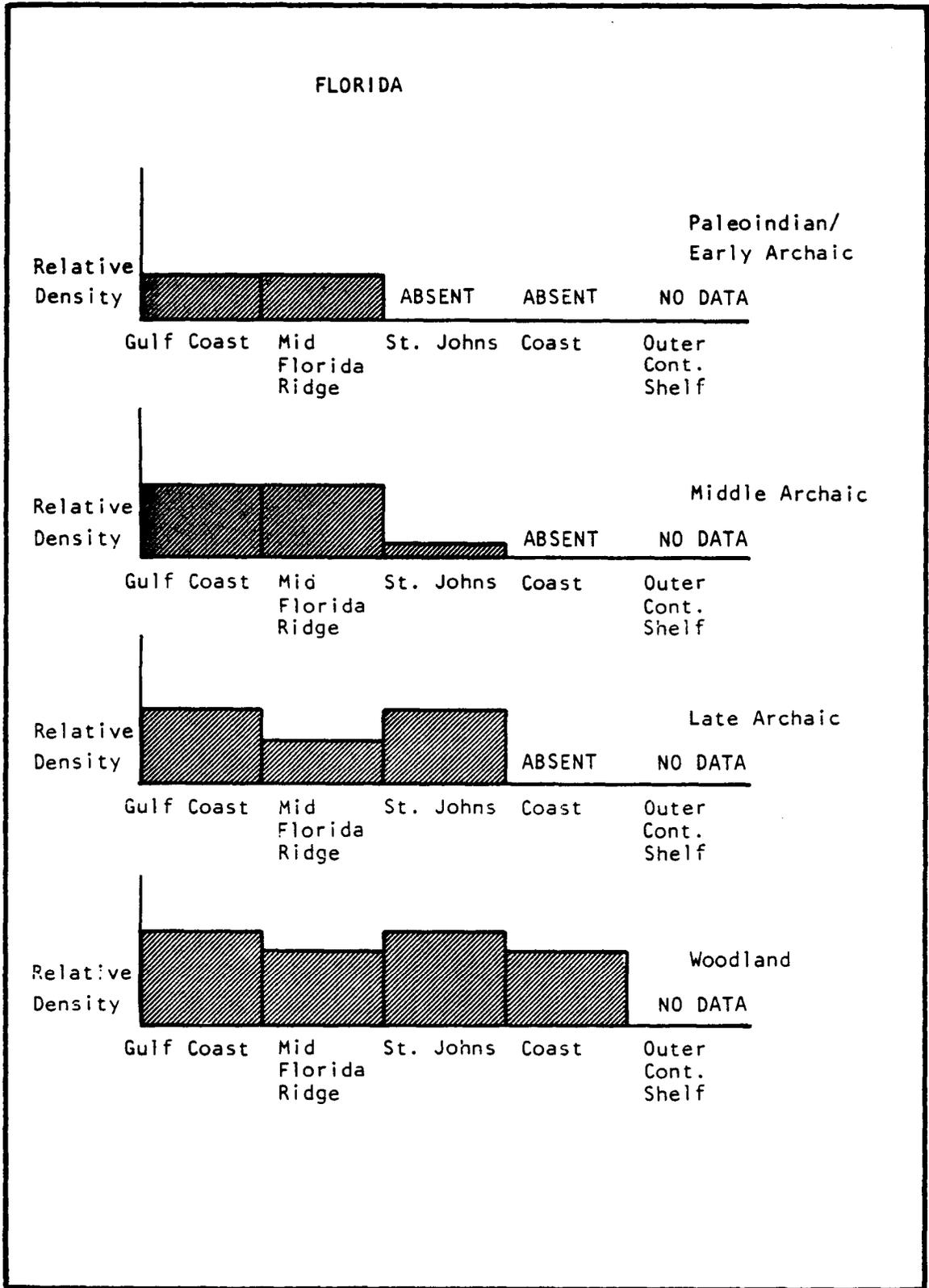


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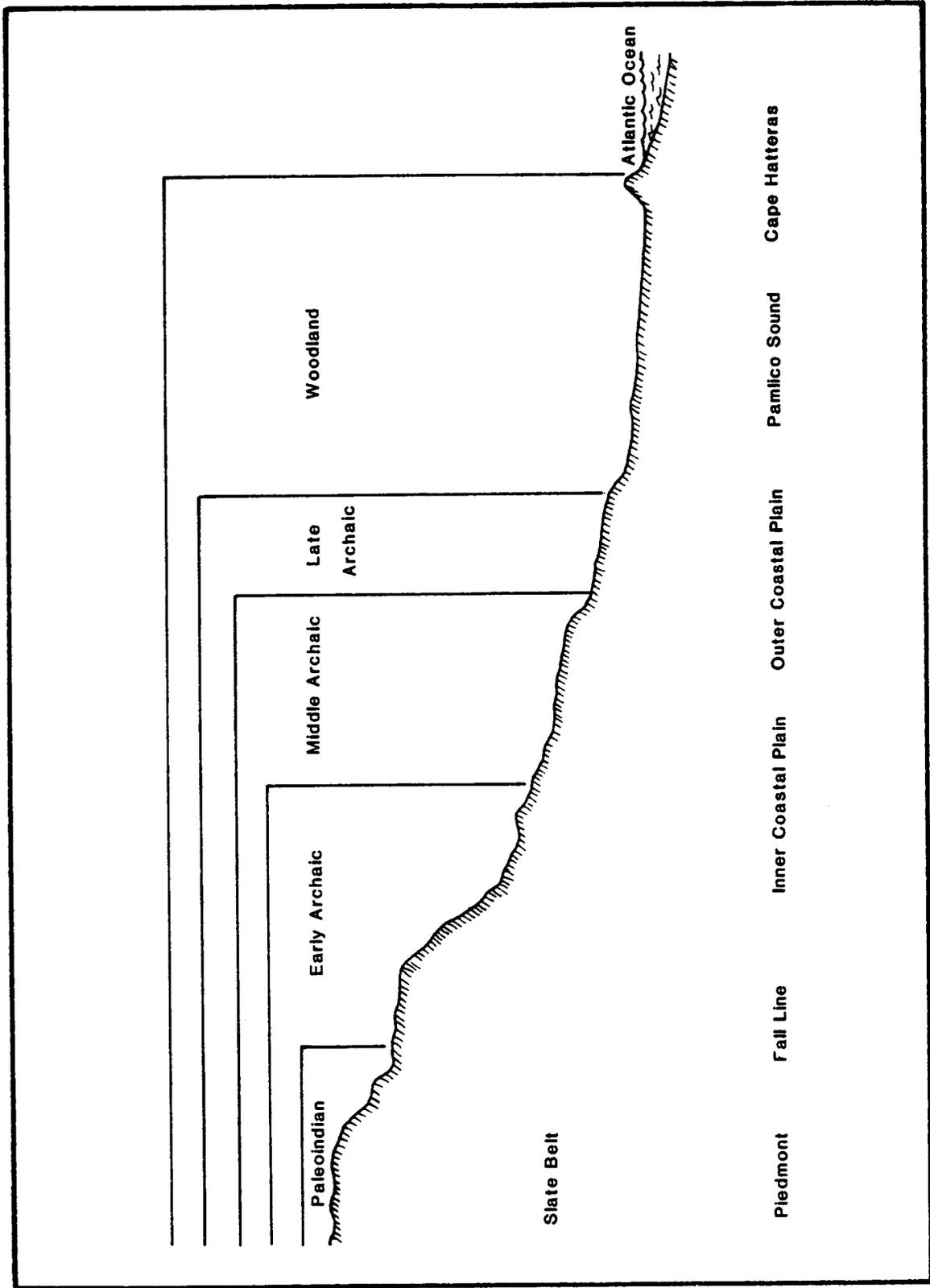


Figure 6.2.2 Schematic Cross Section - Northern North Carolina Piedmont to Atlantic Ocean Showing Approximate Limits of Site Distribution by Periods

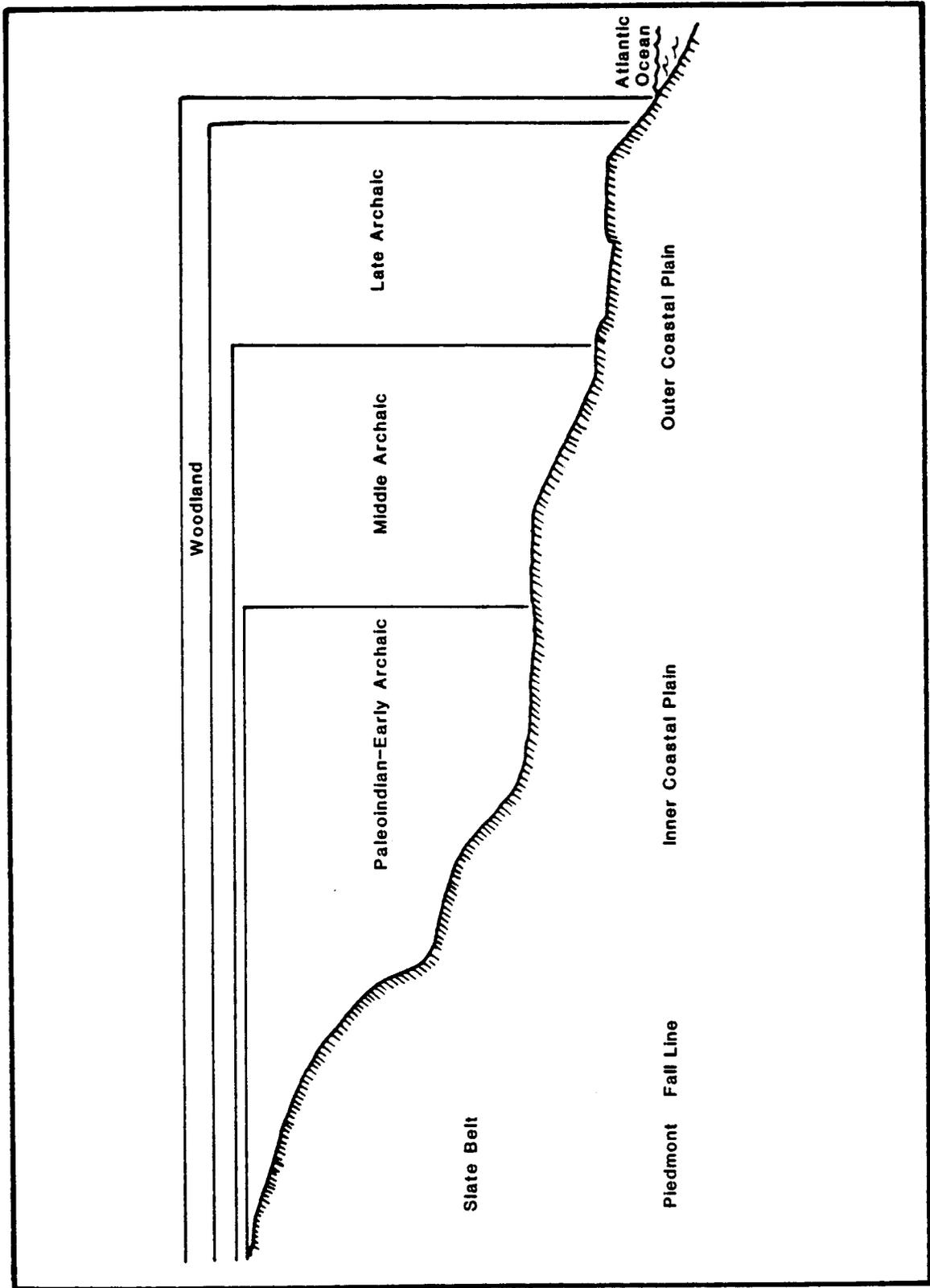


Figure 6.2.3 Schematic Cross Section - Carolina Beach to Charlotte, North Carolina Showing Approximate Limits of Site Distribution by Periods

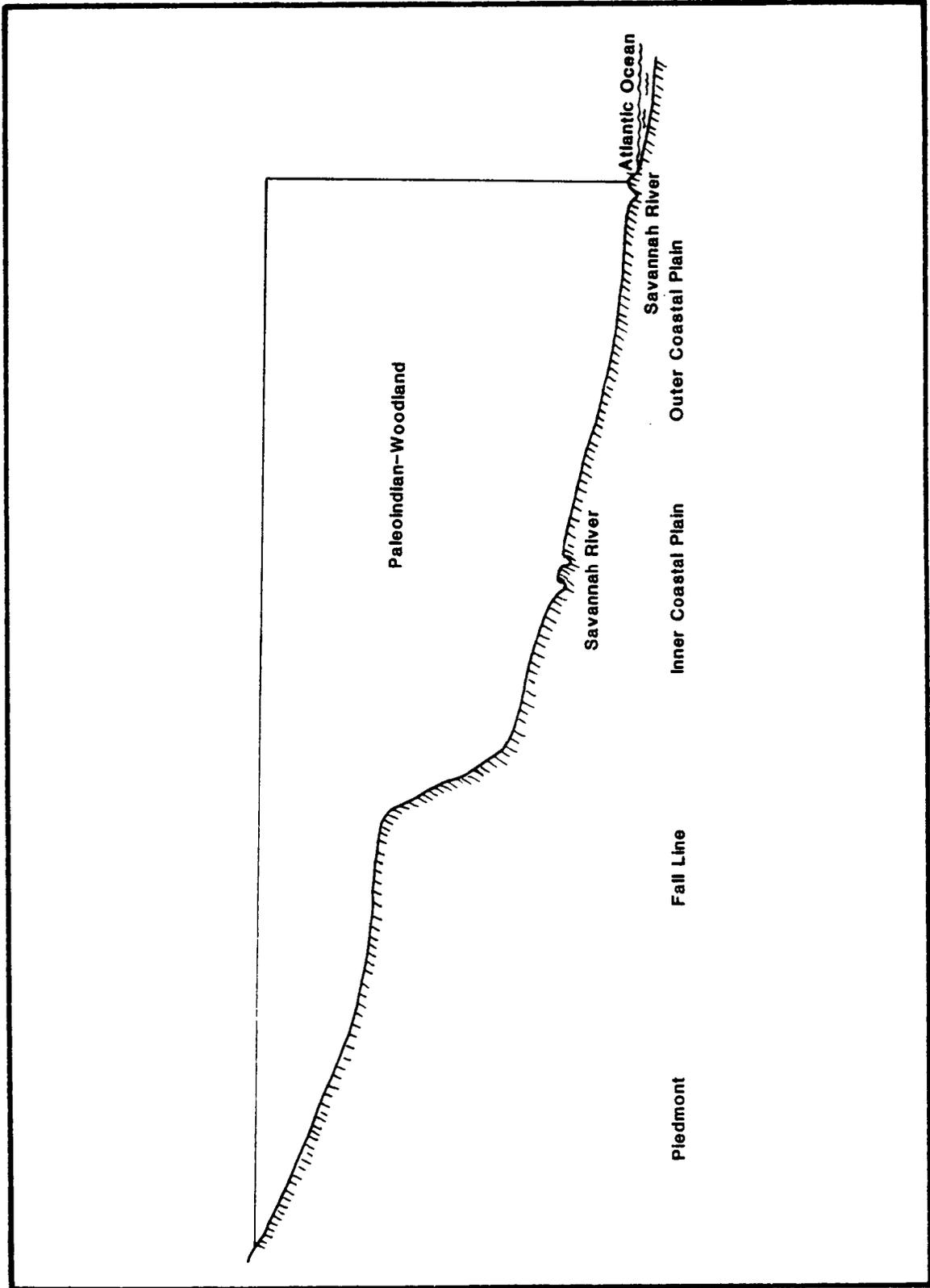


Figure 6.2.4 Schematic Cross Section - Tybee Island (Mouth of Savannah River) through Augusta to Anderson, South Carolina Showing Approximate Limits of Site Distribution by Periods

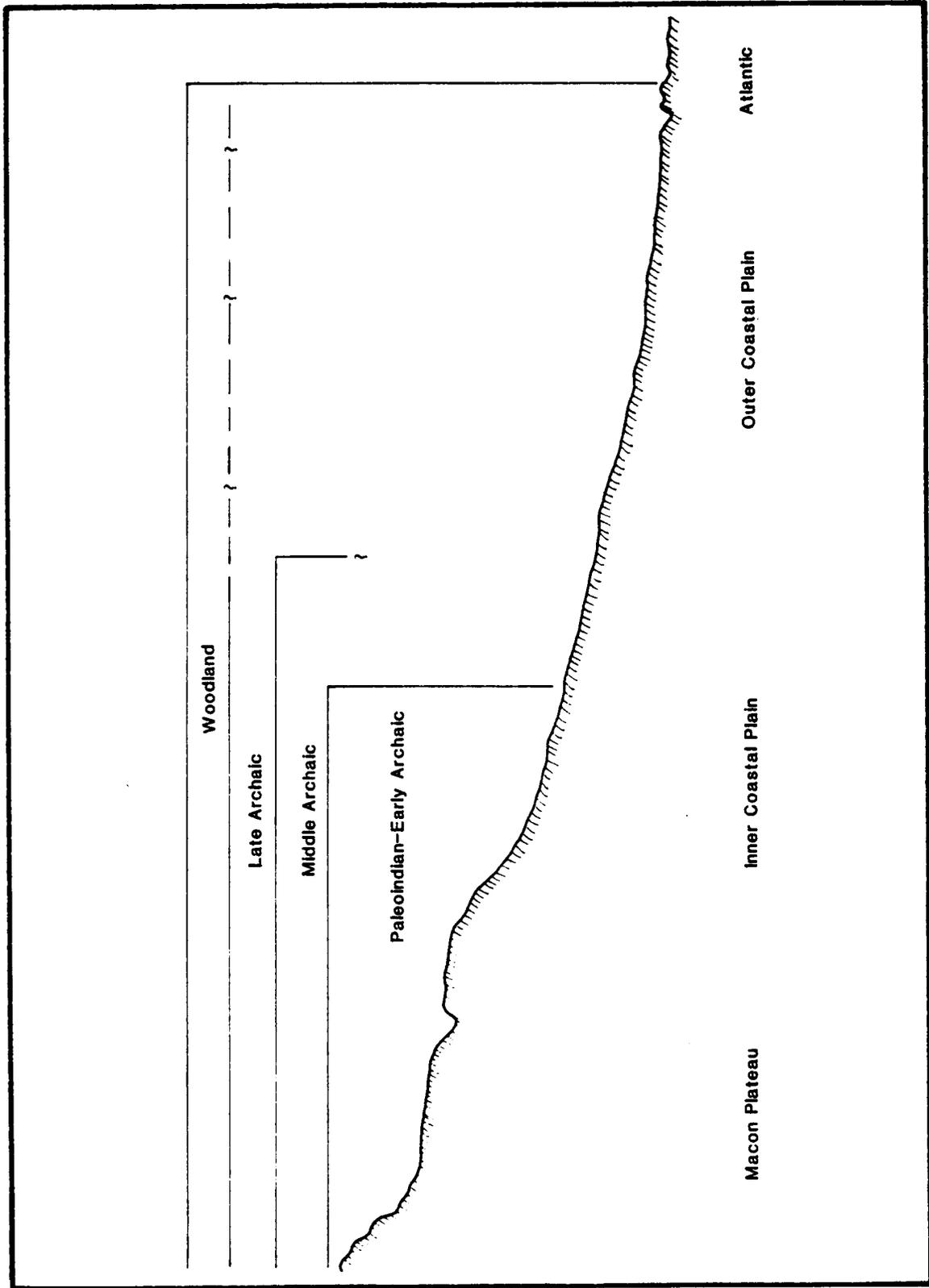


Figure 6.2.5 Schematic Cross Section - Brunswick to Macon, Georgia Showing Approximate Limits of Site Distribution by Periods

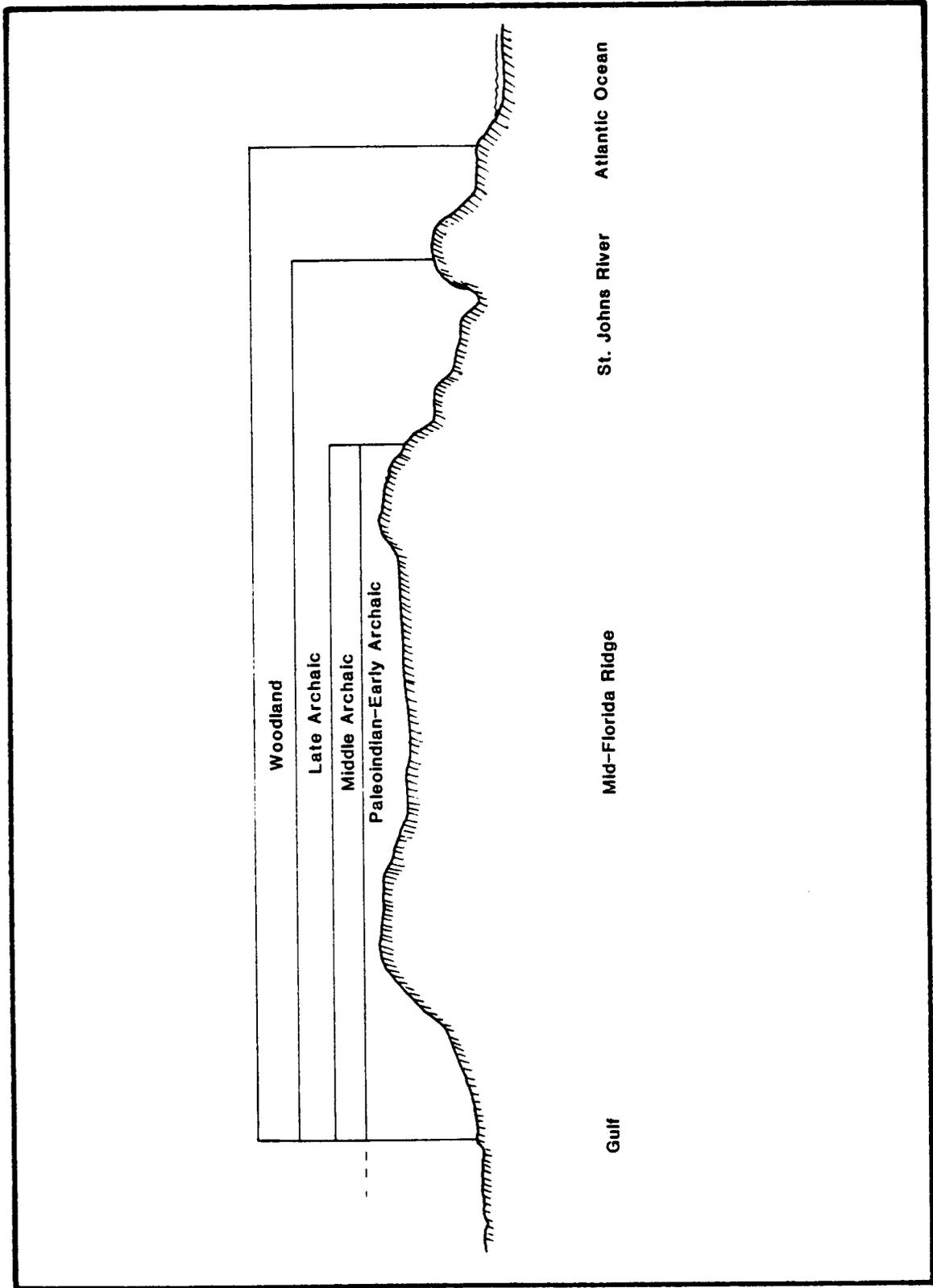


Figure 6.2.6 Schematic Cross Section - Central Florida Gulf of Mexico to Atlantic Ocean Showing Approximate Limits of Site Distribution by Periods

period exhibits some variation from state to state, but in general, occupation in the outer Coastal Plain is absent or relatively limited until at least the Late Archaic period. As we have indicated in the environmental summary (Section 4.2.2), sea level during this period was only slightly lower than at the present.

Archeological data appears to indicate that at least the concentrations of population were approaching the position of the present shoreline from the west as the shoreline approached this location from the east. This does not, of course, rule out occupation on the extended Coastal Plain at any time, but it does suggest that whatever the availability of faunal resources (see Section 4.2.2) the lack, or limited distribution, of other variables critical in the adaptations of Paleoindians and Archaic peoples discouraged intensive occupations in this zone. To the degree that food and other resources were present on the extended Coastal Plain (even in sub-optimal amounts), prehistoric populations probably used them, at least to a limited degree. It may also be expected that their remains will be distributed in patterns similar to those identified in presently exposed terrestrial settings.

As indicated in the previous discussion, the lack of solid evidence for even the existence of a pre-Paleoindian occupation, much less any knowledge of their adaptive or site distribution patterns, precludes the effective prediction of site locations from this period. This study has demonstrated that during the Paleoindian period the availability of particular kinds of lithic resources for tool manufacture (primarily cryptocrystalline rocks) was a critical element in the adaptive system of Paleoindians. East of the primary outcrops of these materials, the only available sources would have been river cobbles. Thus, sites on the submerged shelf with significant amounts of archeological remains will be expected in close proximity to the channels of rivers which, at some time, drained areas of primary outcrops of cherts, jaspers, and silicified slates. Rivers are also important for the diversity of habitats, and therefore food resources, found in

proximity to them. These factors are also important during the Archaic period, following the decline of the Paleoindian big game hunting tradition.

Archaic populations exploited a wide variety of resources, and their remains are widely distributed across the landscape. In addition to river flood plains, they seemed to favor such resource-rich habitats as swamps, back swamps, and minor tributaries. Toward the end of the Archaic period, anadromous fish became an important element in adaptive strategies, and the availability of these fish would have depended on the relative position of sea level (the extent of saline penetration into the estuaries) and the geometry and characteristics of the river channels. By the end of the Archaic period, sea level was within a very few metres of its modern position and the only exposed terrestrial surface available for occupation would have been found immediately adjacent to modern shorelines. The relative slow rate of rise in sea level since that time would have exposed these surfaces to more intense mechanical erosion and resorting. The possibility that estuarine and shoreline exploitation began somewhat earlier in the Archaic should not be ignored. Evidence for this would be inundated, but minor post-8,000 B.P. stillstands may have been long enough for a sufficient sediment cover to accumulate at these sites, which would have protected them from the effects of shoreline transgression. To some degree this must remain a hypothesis to be tested, but, for the purposes of resource management and agency decisionmaking, there is no alternative to the use of models based on available empirical data.

The ability to identify and predict the location of inundated archeological sites will depend on mapping environmental variables critical to the various prehistoric adaptive systems. Available terrestrial evidence indicates that sites were located in response to rather specific localized combinations of environmental factors. Thus, according to models based on currently available data the more precisely the distribution of these factors can be delineated, the more precisely the location of archeological remains can be predicted. Obviously,

this approach is based on an assumption of continuity of adaptive strategies and settlement systems between presently exposed land surfaces and those inundated by post-Pleistocene sea level rise.

Unfortunately, the data base for the distribution of terrestrial environmental variables on the submerged Continental Shelf is extremely limited. This is primarily because neither pure nor applied research has been directed to answering questions concerning these distributions, at least with the level of precision and at the scale necessary for the identification of archeological sites. The designation of sensitivity zones, which reflect the likelihood of the presence of archeological resources, has therefore necessarily been carried out at the scale of generality reflected in the data available on the distribution of critical environmental variables. That level of generality is quite broad when compared with comparable situations on land, where much more precise information is available. As indicated above, there is no practical alternative to this approach.

To summarize briefly, river channels (where they can be identified) have received a high sensitivity designation, since at any time period when they were exposed and available for occupation they were likely to be the locus of occupation -- at least occupation of sufficient intensity to produce significant archeological remains. After 8,000 B.P. when the range of exploited resources expanded, sites might be expected around such interfluvial habitats as lakes, swamps, and minor tributaries. Remains of estuarine adaptations may also be present. Since data on the distribution of these environmental features are not yet available, the entire land surface within that shoreline must be regarded as sensitive. To some degree the limits of this zone have been modified in consideration of variations in terrestrial data adjacent to the present shoreline. The limit of high sensitivity has been expanded to the 12,000 year shoreline along the South Carolina and Georgia Coasts since terrestrial data indicates the relative density of sites and the ranges of occupation had expanded eastward in this area earlier than in the rest of the study area. In addition, a larger number of rivers draining areas containing outcrops

of critical lithic materials flow onto the shelf in this area. However, only limited data on their channels across the shelf are available.

Sensitivity Zone 2 is defined by the position of the 12,000 year shoreline. This definition is based on the assumption that any location on the shelf may have been occupied during that period of time for which there is good empirical data for human occupation in the eastern United States. The third Sensitivity Zone is limited by the 16,000 year shoreline (the lowest position attained by sea level during the Wisconsin Glaciation) which allows for the possibility of occupation by as yet unspecified pre-Paleoindian populations.

Improvements in data on the distribution of such environmental features as river channels, cobble deposits, and swamps should allow greater specificity in the designation of sensitive areas and an overall reduction in the size of such an area. Likewise, continued improvements in both the present terrestrial and the submerged archeological data base should allow refinement of the predictive models with the same result. Finally, direct evidence that bottom surfaces and sediments, which may at one time have contained archeological remains, have been severely disturbed or destroyed will allow the deletion of such areas from the High-Sensitivity Zone. Thus, the Sensitivity Zones designation should not be regarded as static or final. They are simply a first approximation, necessary for rational decisionmaking by resource managers. The management process will result in an improved data base and refinements in the management plan -- it should be a self improving tool.

Details of the three major resource management activities - identification, protection and enhancement - were presented above. For management purposes, the area of the South Atlantic Continental Shelf has been divided into two management zones. Management Zone I corresponds to Sensitivity Zone I. This area has been defined on the basis of specific factors of prehistoric adaptive systems, although at a very general level, consistent with the limitations of the environmental

data base. The area of this management zone may be reduced by improvements in that data base, but the principle upon which it is based should remain. It is within Management Zone I that specific action should be taken to insure the protection of potentially significant submerged archeological resources. Surveying, which may include the use of an array of remote-sensing technologies, bottom sampling, and direct inspection techniques should be carried out in locations that may be affected by petroleum exploration and production activities. When significant archeological resources are identified, measures to protect them should be taken. Archeological data extraction (such as excavation) may be considered as a protective measure when no other options exist, but this is never a desirable protective method (unless a site is otherwise threatened by natural processes). The relatively primitive state of development of underwater excavation techniques makes it an even less desirable alternative. Avoidance of significant sites should always be given first consideration as the best means of protecting them from impact.

Management Zone II includes Sensitivity Zones 2 and 3. Although the possibility of human occupation exists within this Zone, no specifically predictive basis for finding sites is available, and the terrestrial data bases suggest that the occurrence of sites within this zone is considerably less likely than in Management Zone I. No specific management activities are recommended within this zone, but if evidence for archeological sites is otherwise discovered, they should be given the same considerations for protection as in Zone I. Modifications in Management Zone II will automatically result from adjustments in the boundaries of Zone I. Ultimately, a more refined data base may suggest subdivision of each management response to assessment and protection problems.

The major point to be made about the management of submerged archeological resources is that it should be an ongoing and flexible process, responsive to the best available information at any given point in time.

It should also be recognized that decisions on the siting of petroleum extraction and transportation facilities (such as pipeline landfalls) may have major effects on existing terrestrial archeological resources, which are numerous in the immediate coastal area. This consideration was not within the scope of our study and must be the object of separate analysis. Proper and efficient resource management will obviously have to consider both sets of resources, however.

The critical examination of available data carried out for the preparation of this study suggests that while the inner portion of the Continental Shelf probably contains some significant archeological remains, the terrestrial surfaces of the shelf, taken as a whole, were not as extensively or intensively occupied as presently exposed land surfaces. This conclusion remains open to modification and adjustment by the more reliable empirical evidence to be developed from the shelf through research and management activities.

6.3 SHIPWRECK ARCHEOLOGY

This study deals primarily with an unknown population of shipwreck sites. The known population, identified by the literature search, is a small, nonrandom sample, which in many cases is strongly biased. While it is generally known why there are biases, it is impossible to measure adequately the effect they have had on the available sample. Predicting the size of the shipwreck population and its characteristics poses a statistical problem of estimation. There are statistical procedures which might be used to obtain a closer approximation of the population parameters but this is out of the scope of this study. Some of the more advanced, but relatively untested, sampling and estimation techniques should be pursued in future studies. This would facilitate a more sophisticated analysis of the shipwreck population. The shipwreck site inventory developed by this study can be utilized to further refine the predictive model which in turn would have a direct implication for future management of shipwreck sites.

Simple descriptive and nonparametric statistics have been used to perform a preliminary analysis of this shipwreck information. These analyses have helped to identify certain spatial and temporal relationships within the shipwreck site population. Defining and understanding these patterns is necessary for effective management of shipwrecks as nonrenewable cultural resources.

North Carolina

This part of the coast has the highest density of 19th and 20th century shipwreck sites within the study area. Wreck sites of all periods are clustered around the sandy shoals of Cape Hatteras, Cape Lookout and Cape Fear. All of the area within the 20-metre isobath in the vicinity of these shoals is classified as having a relatively high archeological sensitivity.

The high concentrations of sunken vessels within a short distance from the beach between Tubbs Inlet and Carolina Beach, along Bogue Banks, and between Cape Lookout and Cape Hatteras have made these areas archeologically sensitive. Although numerous ships have been lost within Ocracoke, Hatteras, and Beaufort Inlets, strong tidal action, storm surges, and dredging activities have severely damaged, if not totally destroyed, the archeological deposits. These inlets are therefore considered to be only moderately sensitive.

South Carolina

One of the most archeologically sensitive areas within the study area is Charleston Harbor and the sandy shoals at the mouth of the harbor between Folly Beach and Sullivan's Island and in the area around Fort Sumter. Although dredging and dumping activities have no doubt destroyed many sites, there are a number of wrecks from different periods, which occur outside the main shipping channels, that may still be relatively intact. Other highly sensitive areas include Port Royal Sound, St. Helena, Beaufort Anchorage, Cape Romain and the Georgetown Waterway.

The relatively few reported shipwrecks beyond the 20-metre isobath places this part of the OCS in a low sensitivity area.

Georgia

The least information is known about the Georgia shipwreck population. Relatively little attention has been directed toward determining the extent of the underwater archeological data base off the Georgia coast. The only underwater archeological work performed in this state has been a recent survey by the U.S. Army Corps of Engineers of the CSS Georgia in the Savannah River (Anuskiewicz, 1979). The CSS Georgia study has identified seven clusters of shipwreck sites: 1) the North Channel of the Savannah River; 2) the Savannah Bar; 3) Tybee Island; 4) Cumberland Island; 5) Brunswick Harbor; 6) St. Simons Sound; and 7) the Altamaha Estuary. During the literature search conducted for this survey a shipwreck inventory was compiled of some 120 sites in the Savannah River and Brunswick area (E. G. Garrison, personal communication, 1979). Most of these sites appear to date from the latter half of the 19th and early 20th centuries.

Although there were several efforts made by the French and Spanish to colonize the southern coast of Georgia during the late 16th and 17th century, there are hardly any reliable data on the loss of ships prior to 1733, when Savannah was settled. However, the predictive model suggests that there are likely to be a number of shipwrecks dating from the late 16th to mid 18th century which have gone unrecorded in the vicinity of Darien, and off St. Simons Island. Small coastal vessels such as rowed galleys and Pataches lost along the sparsely settled coastal waterways prior to the mid 18th century would quite naturally have gone unrecorded. Therefore these areas must be classified as being archeologically sensitive until proven otherwise.

The presently available evidence suggests that there are relatively few shipwreck sites along the Georgia coast beyond the 20-metre isobath. Therefore, this part of the Georgia Bight area of the Outer Continental Shelf can be considered as having low archeological sensitivity.

Florida

The total shipwreck population of the Florida Keys and East Coast has been estimated at about 3,000 sites (W. A. Cockrell, personal communications, December 1979). This would indicate that on an average there were about ten ships lost every year between 1500 and present times.

This study has documented over 800 sites. According to Cockrell's estimate, this sampling represents about 27 percent of the total population. The distribution of known shipwreck sites reflects distinct site clusters through both time and space. The plotted sites off the East Coast reflect a clustering of early sites in the following areas: 1) the approaches to St. Augustine harbor, 2) Cape Canaveral Shoals, 3) St. Lucie Inlet to Sebastian Inlet, and 4) Biscayne Bay. This pattern is similar to what would be expected, given the parameters which make up the predictive model. The pattern supports the contention that there should be a higher concentration of 17th and 18th century shipwrecks within the vicinity of seaport settlements, anchorages, and shoals. Later period wrecks of the 19th and early 20th century appear to have a somewhat different distribution. Discrete clusters can be identified in the following areas: 1) the St. Johns River, 2) Amelia Island, 3) Cape Canaveral, and 4) the Palm Beach - Jupiter Inlet coast. It is uncertain as to whether this clustering of sites reflects a real distribution pattern, or perhaps an exploration bias. This distribution suggests that as these areas became more important commercially during the 19th century, more ships were lost along these parts of the coast than during earlier times. The growth of maritime trade and naval maneuvers prior to and during the Civil War can certainly account for an increased number of ships lost during these times. Cape Canaveral is also an area of high shipwreck concentration. The shipwreck cluster south of Cape Canaveral reflects the increased coastal and inland maritime commerce which developed along this part of the Florida coast in the late 19th and early 20th centuries.

The clustering of sites along the Florida Keys is not as apparent as it is off the East Coast. This is probably explained, at least partially, by a number of factors: 1) there are very few documented sites in the literature prior to the early 18th century. Though there are numerous citations in the literature concerning the loss of 16th and 17th century ships within the Florida Straits, site locations are only occasionally specific enough to permit plotting with any reliability. Therefore, shipwreck locations listed as "off the Florida Keys" have been listed but not plotted (Plates 2-5, Volume V); 2) there appears to be a better representation of known early wreck sites off the East Coast than there is off the Florida Keys. This is probably due to the fact that there was better communication along this part of the coast between Spanish settlements, and thus wreck sites were recorded with more precision than they were along the Keys. However, there is no reason to suppose that there were any fewer ships sailing near the Keys than there were off the East Coast; in fact the reverse may be the case.

It is evident from intensive archival research that many ships were lost along the Florida Keys during the 16th and 17th centuries (E. Lyon, personal communication, March 1979). Imprecise locational data makes it impossible to plot these sites. Though more underwater exploration has been carried out in the Keys since the 1950's than anywhere else in the country, as of yet no 16th century wreck has been verified in the Keys. The earliest archeologically documented shipwreck in the Florida Keys is the Nuestra Senora de Atocha which is known to have sunk off the Marquesas Keys in 1622 (Lyon and Mathewson, 1975). Potentially earlier wreck sites are presently being salvaged by commercial companies on American Shoals and off Fort Pierce. The American Shoals site has produced four bronze cannon, an iron Verso, and a small artifact assemblage which suggests a late 16th or early 17th century date. The wreck site being salvaged off Fort Pierce was thought to be one of the 1715 wreck sites (originally known as the "Green Cabin Wreck") but is now believed to date to 1618 (D. L. Horner, and John Brandon, personal communication, 1979).

The shipwrecks plotted off the Florida Keys have produced a site distribution which is heavily biased towards the larger ships involved in offshore maritime traffic since the mid 18th century. These parts of the reef tract have been classified as areas of high archeological sensitivity, as well as the waters surrounding Indian Key and the 1733 wreck site which is believed to be San Jose. This is the only wreck site in Florida listed on the National Register of Historic Places. The outer reef tract from Fowey Rocks at the tip of Elliot Key southwest towards Sand Key near Key West harbor is replete with wreck sites of all periods. Along this reef there appear to be discrete concentrations of shipwrecks. These site clusters document the extent to which certain areas of this reef tract were serious navigational hazards to shipping along the Gulf Stream. Shipwrecks in the Upper Keys appear to cluster on Long Reef, Carysfort Reef, and the area from Molasses Reef to Davis Reef. In the Middle Keys, shipwrecks are more numerous in the areas of Crocker Reef, Alligator Reef, Coffins Patch, Delta Shoal, and Sombrero Key. Shipwrecks in the Lower Keys are found to be more numerous in the vicinity of Looe Key, American Shoal, Middle Sambo Key and Eastern Dry Rocks. As permanent lighthouses were developed in the early 1850's along this reef tract, the occurrence of ships wrecking on this coast line began to decrease in number.

The area beyond the outer reef tract at this part of the Outer Continental Shelf is an area of low archeological sensitivity due to the small number of known wreck sites.

Key West Harbor is another area of heavy shipwreck concentration. This sheltered, deepwater harbor, with easy access to a freshwater spring has been used as a safe anchorage by ships sailing the Gulf Stream since the latter half of the 16th century. Although there is a high density of shipwreck material in Key West harbor, intense dredging activity over the years has destroyed many of the shipwrecks, thereby reducing the relative sensitivity.

7.0 RECOMMENDATIONS

7.1 THE MANAGEMENT OF ARCHEOLOGICAL RESOURCES ON THE
CONTINENTAL SHELF7.1.1 Introduction

The first step in planning for the management of archeological resources in a given area is to recognize that they must be dealt with as a total resource base rather than simply as isolated sites (McGimsey and Davis, 1977). Management planning is then directed toward the protection of that resource base within practical and legal constraints. One policy statement, in particular, provides a sequential outline of goals for cultural resources management: Executive Order No. 11593. In accordance with this order, three such goals must be achieved by cultural resources management: 1) identification of the resources; 2) protection of the resources; and 3) enhancement of the resources. Identification of resources must obviously take place before the other two goals can be achieved. Protection of significant resources is mandated by several policy documents that draw on the mandate provided by Congress in the National Historic Preservation Act of 1966. Enhancement is aimed at a greater public appreciation of the resources and the realization of their scientific value. For examples of the use of this outline in resource management planning, see T. Thompson (1977) and Gardner and Thompson (1978).

One mechanism for viewing archeological resources as a total resource base is the application of a regional frame of reference (R. Thompson, 1977). Such an approach has an important role in accomplishing all three of the goals listed above. The recognition that archeological resources are not distributed at random has led to the realization that prehistoric and historic populations arranged themselves within their environments according to the natural patterning of that environment (at a particular point in time) and their technological and social systems. In the case of shipwreck sites, the temporal and

spatial patterning is principally a function of hydrological variables, seafaring cultural tradition, maritime technology, and the socio-political environment.

The delineation of those cultural and environmental variables which controlled, or strongly affected, the distribution of archeological sites in particular regions allows the construction of models which can predict the location of their activity sites. Both the environment and human adaptations to it changed through time, so it is essential to analyze the diachronic variation in both. Environmental processes can affect the preservation of archeological resources, so the analysis of these processes is essential in the identification of the condition of these resources. For example, it may be possible to conclude that prehistoric sites and/or historic shipwrecks may have occupied a particular location at some point in time, but that subsequent shifts in the environment will have removed their remains, or seriously compromised the integrity of those remains.

The present distribution of environmental factors is of interest in planning for the protection of significant archeological resources once they have been identified. This is particularly true for the south Continental Shelf which has undergone a radical shift from a subglacial, terrestrial, Coastal Plain environment to a submerged marine environment within the last 16,000 years and is still undergoing constant change. It is apparent along numerous shorelines today that even archeological sites which have survived more or less intact to the present may be subject to destruction as the result of ongoing environmental processes in the ocean.

With respect to resource enhancement, regional environmental factors are no less important. Having the cultural resource information to communicate to the public depends upon scientific data extraction procedures which, in turn, are limited by the technical means available to carry them out. The sub-marine environment creates special problems for data extraction.

Rational planning for archeological resource management on the Continental Shelf, as in other regions, must address these goals and problems. Although, to some degree, identification, protection and enhancement may be regarded as sequential steps in the management process, all three must be carried out on a continuing basis. The specific procedures for accomplishing each goal must be tailored to the specific effects of each management decision which might affect archeological resources.

This is only a general background study and the conclusions and recommendations contained in it must be updated as new information becomes available. The South Atlantic Continental Shelf is treated on a regional basis. The specific effects of agency decisions that affect a particular location, such as the sale of a lease block or blocks, should be reevaluated in terms of the general sensitivities indicated here. Detailed data concerning the condition within the lease blocks, and subsequent modifications of the general predictive models are based on the ongoing assessment and research processes. For example, data may become available that indicate that the bottom environment in a specific lease block lying within a high-sensitivity zone, as mapped in this report, is such that there would be little chance that archeological resources would have survived intact in that particular location (because of rapid erosion and scouring of Pleistocene and Holocene sediments). Conversely, future research may result in the development of a predictive model which would extend or reduce the high-sensitivity zone beyond its present boundaries. This study is therefore a first step and is not a substitute for informed decision-making about the specific effects of a particular action.

7.1.2 Identification of Prehistoric Archeological Resources

The procedure followed in this study is becoming standard in archeological resource management (King, 1978). Predictive models have been developed for the location of the resources, in this case based on terrestrial data, since archeological data for the Continental Shelf beyond the shoreline are not available. The models are based on the distribution of environmental variables, the correlations of those distributions with archeological resources during the various prehistoric

archeological periods and the information available on these within the appropriate areas of each state. These have been rendered into three archeological sensitivity zones (Volume V, Maps 1-6, Plate 1). Within the limitations of the data, Zone I is of interest for management purposes, since it is within this zone that the highest reasonable expectation of locating submerged prehistoric resources is found. It is expected that resources within the outer two sensitivity zones either do not exist, or will be difficult to identify. They have therefore been combined into a second management zone.

7.1.2.1 Resource Identification, Management Zone I

The identification of specific resources within this zone will most likely result from the more general environmental characterization studies and impact assessments conducted for specific activities such as construction of drilling platforms or pipelines. It must be emphasized that various types of data collected in assessment surveys are important to the cultural resource identification process, even when specific archeological sites are not found. The environmental surveys will contribute to the refinement and specification of predictive models and the evaluation of the viability of a former terrestrial environment or the potential for site preservation in certain kinds of settings within the marine environment. Therefore, all assessment surveys have the potential to contribute to the identification of archeological resources, whether or not significant archeological sites are found in a specific location. The results of such surveys should be used to update the definitions and delineations of the management zones. The results of independent research and the pilot studies, recommended elsewhere in this report, should likewise be applied.

Pertinent environmental data from shallow geologic studies, bottom sampling, will also become available, and these may precipitate the refinement of the site identification process. Since the distribution of archeological sites is usually a response to highly localized environmental variables, greater precision in the delineation of the distribution of those variables should result in a reduction in the

amount of area classified as "high-sensitivity." This can only be accomplished if identification studies are directed at the resource base as whole, and if the identification process and the predictive models on which it is based are redefined and updated in a timely, ongoing fashion.

Specific techniques for site identification include a variety of remote-sensing methods, bottom sampling and direct inspection. The effectiveness of these methods for identifying submerged prehistoric archeological resources has yet to be tested. This is largely because they have not been used in any effective sequence. The delineation of remote-sensing "signatures" which indicate such resources has yet to be accomplished because anomalies that appear in remote-sensing records have not been evaluated (Wilburn Cockrell, personal communications, 1978). While it may not be feasible to inspect, or "ground truth" every anomaly that appears in the remote-sensing record for any impact area, a certain sample of these anomalies could be examined to establish an interpretation key and therefore increase the utility of remote-sensing techniques. It may be that in many or all cases prehistoric archeological resources will fail to register using current remote-sensing techniques. These must be supplemented, at least on a sampling basis, with more direct methods including grabs and cores (Coastal Environments, Inc., 1977) and direct observation by divers and archeologists in submersible vehicles. Water depths within Management Zone I usually do not exceed those in which divers can effectively operate.

Survey procedures specified for the Continental Shelf in the Gulf of Mexico (Notice to Lessees, Notice No. 75-3) by themselves cannot be expected to adequately account for all potential prehistoric archeological resources. Therefore, several types of remote-sensing equipment should be used in conjunction with a statistical sampling scheme.

7.1.2.2 Resource Protection, Management Zone I

The protection of archeological resources in this zone must begin with an evaluation of the potential threats to those resources.

Archeological remains that lie intact in bottom sediments are most directly threatened by the construction of pipelines and drilling platforms. Effects from such construction would include the disturbance of sediment during preparation of a trench in the shelf floor to hold the pipe as well as several secondary effects from the construction, such as the anchoring of dredge barges (Coastal Environments, 1977).

The protection of archeological sites from these effects can best be accomplished by prohibiting these activities in areas adjacent to sites. The exact margin of avoidance necessary to protect an individual site will have to be determined in each individual case, and will depend on such variables as the depth and stability of the sediments surrounding the site, prevailing currents, what the proposed activity is, and the physical setting of the site.

When a significant site is threatened by oil exploration and extraction activities, some form of mitigation will be required. The avoidance option is recommended here, as opposed to salvage excavation because of the extraordinary expense and technical problems associated with such work underwater.

One of the issues that must be considered in relation to site protection is the potential significance of the site. Only sites judged to be significant may be nominated to the National Register of Historic Places and therefore eligible for protection. But, until a clearer picture of the total resource base on the South Atlantic Continental Shelf is obtained, all evidence of human occupation should be regarded as scientifically important. It is difficult to anticipate the quality of data and the state of preservation for submerged archeological sites. It is possible however, that archeological remains may be identified which otherwise lack contextual integrity. While such remains may be of great scientific interest, there may be no point in regarding the location from which they came as particularly significant according to National Register criteria. Until patterns of distribution and preservation are more clearly defined, decisions regarding the significance of particular archeological sites defined on the Continental

Shelf must be made on a case-by-case basis as specified by the regulations of the National Register.

7.1.2.3 Resource Enhancement, Management Zone I

Direct access to submerged archeological sites for the general public, except in the immediate near-shore environment, is not to be anticipated within the current limits of recreational diving. Thus, public appreciation of submerged archeological resources will primarily be a product of scientific investigation and interpretation. Decisions to excavate submerged archeological sites should be made within the context of an overall research design for the South Atlantic Continental Shelf region. Research and conclusions in this report could provide the basis for such a plan. In general, excavation options should be approached with caution. Technical developments in underwater archeology may be expected to continue to improve, and no site should be approached with anything less than the best currently available technology. Sites presenting special problems, and that are not otherwise threatened by commercial activities, may best be left in place in anticipation of improvements in excavation technology which may allow more successful data extraction in the future.

7.1.2.4 Resource Management, Zone II

The low potential for archeological resources in this zone suggests that no special efforts need to be made to identify, protect or enhance archeological resources. The general nature of the sensitivity zones does not, however, rule out the possibility that archeological remains might be encountered. Sites that are discovered would be of particular interest because they are unexpected. The protection requirements for such sites would be the same as those indicated for Zone I. As indicated above, the primary concern for Zone II will be the adjustment of its boundaries in response to the ongoing assessment process and the clarification of the nature of the resource base for the area. Construction personnel should be encouraged to report any archeological evidence or unusual environmental conditions within this zone.

7.1.2.5 Summary

The management of prehistoric archeological resources on the South Atlantic Continental Shelf must presently be based on a limited data base and the extension of terrestrial models. It should be recognized that resource management is a continuous process, and that management plans and procedures should be responsive to newly developed information. This is particularly true in any area about which so little is known, and the conclusions developed here should be regarded as only the first step in developing a comprehensive archeological resources management plan for the shelf.

7.1.3 Identification of Historic Archeological Resources

The shipwreck population within the study area has been assessed in terms of relative archeological sensitivity. High-sensitivity areas have been identified on the basis of known and/or predicted clustering of potentially significant sites; areas of lower sensitivity are regions that are predicted to contain fewer significant shipwrecks. Archeological significance of shipwreck sites can be defined by inferring the physical integrity and potential for providing important data.

Physical integrity can be inferred in the following way:

1. The circumstances surrounding the sinking of vessels; the varying extent of destruction occurring with different types of sinking (naval action, navigation error, or storms) will affect the nature of the archeological deposits.
2. The extent of adverse impact on archeological deposits by natural forces has been projected to provide a general guide to the degree of preservation expected in different water depths within the four environmental zones identified in the study area.
3. An estimate of the amount of damage human activity has caused to the archeological deposits since the shipwreck material was deposited on the seabed. While there is little site specific data available, some general statements can be made regarding the degree to which people have disturbed the archeological data base in different parts of the study area.

In the absence of any state cultural resource management plans involving shipwreck sites, the determination of the archeological potential of these sites has been considered in this study on a comparative basis within the cultural/historical region of the Southern Gulf Stream. This regional framework is meant to provide the basis for more specific studies in the future.

Three different Management Zones are defined; each Zone represents varying levels of archeological sensitivity. The zones are delineated on the resource management map (Maps 1-5, Plate 6) in Volume V. Each zone represents the area in which certain recommended survey procedures should be carried out to protect and preserve suspected shipwreck sites from adverse impact. The survey procedures represent the minimal archeological input, involving a three-phase approach consisting of: background study, remote sensing, seabed evaluation, and assesment of significance. The recommended intensity of the survey within each Management Zone is commensurate with its respective level of potential archeological sensitivity.

7.1.3.1 Resource Identification

Anthropologists interested in historic shipwreck archeology have not yet developed a conceptual framework for the comprehensive study of shipwrecks in the New World. Without this necessary theoretical perspective, it is difficult to define the full range of research potential any one shipwreck site might produce in the future. Although the full range of possibilities can only be determined by further cultural studies of historic shipwrecks, certain basic guidelines can be offered as a general approach to defining archeological potential. The archeological potential of shipwreck sites within the study are measured against the following criteria:

1. The relative amount of archeological data which can provide new insights into historical and/or cultural systemic knowledge not otherwise obtainable. This would be the case when a shipwreck site could produce new information which would supplement and expand the archeological record derived from upland sites. For instance, shipwreck sites

can provide new dating evidence, insights into overseas trading patterns and evidence of maritime adaptations to New World cultural processes.

2. The relative amount and variety of contextual archeological data available for generating hypotheses in the investigation of maritime lifestyles and patterns of cultural change.
3. The relative amount of archeological data available to provide new architectural information on ship construction. For example, the analysis of ship structures should provide new data on the evolution of European vessels and the adaptation of ship building in America to new cultural stimuli.

The shipwreck sites with the highest archeological potential are those sites which have gone undetected or those which have been protected from human disturbance through inaccessibility or by protective legislation. By the very nature of the archeological data base associated with shipwrecks, sites with high archeological potential must have undergone a minimal amount of post-depositional disturbance.

7.1.3.2 Resource Protection

Little attention has been given in the past to defining site-specific criteria to measure the extent of post-deposition disturbance that shipwreck sites may have been subjected to. The state archeological surveys of shipwreck sites which have been carried out in the study area have not resulted in the establishment of any criteria or guidelines for measuring the physical integrity of submerged archeological deposits. Although a recent survey of the 1733 shipwreck sites off the Florida Keys made significant progress in this direction (Dunbar and Smith, 1977), a more structured approach needs to be developed before objective assessments can be made in the evaluation of relative physical integrity of shipwreck sites.

The physical integrity of any site is determined by measuring the extent to which the archeological deposits have been damaged during sinking and later disturbed by natural forces and human activity. Shipwreck sites, particularly those situated in shallow

coastal and inshore waters, are continually subjected to disturbance from environmental factors; sites are subjected to the same geological and biological processes as the surrounding sediments. Human impact on shipwreck integrity has occurred by both illicit and licensed commercial salvors. Disturbance has resulted from harbor dredging, landfill development schemes and sport diving.

The problem concerning the archeological definition of physical integrity is being initially studied by Mathewson in connection with an ongoing inventory and assessment of shipwreck sites in the Looe Key American Shoals area off the Lower Florida Keys (Mathewson, 1978). This preliminary study is being undertaken to examine the existing archeological deposits, defined in terms of post-depositional displacement of contextual data and environmental variables. Although defining potential physical integrity of shipwreck sites through the study of environmental variables is a very complex problem, Muckelroy (1978) has achieved some degree of success devising such a scheme for shipwrecks off the English coast. This type of study should be conducted in the future as part of an archeological management plan for historic shipwrecks throughout the study area.

7.1.3.3 Resource Enhancement

Shipwreck sites should not only be considered cultural resources in terms of the archeological information they can provide but also in terms of the extent to which they can be utilized for both educational and recreational pursuits. There are a number of shipwreck sites which, for a variety of reasons, do not have a high archeological potential but can still be used effectively as diving sites for recreational divers and training sites for teaching underwater scientific methodology to archeology students (Dethlefsen et al., 1979). The educational and/or recreational potential of shipwreck sites may be determined by the following criteria:

1. Relatively shallow water depositional environments with good visibility and weak currents.
2. A visible steel-hull structure and/or indestructible bottom features.
3. Easy accessibility for small dive boats.
4. Negligible archeological potential.

Some shipwreck sites can be utilized effectively for educational and recreational objectives when they are no longer of any research value. Heavily disturbed sites with little or no remaining physical integrity can, in certain cases, be used to teach underwater archeological methodology without distortion of the archeological record (Mathewson, 1978). Similarly, heavily disturbed sites and those of more recent date might be developed into archeological parks which would provide new underwater experiences for sport divers. By promoting such recreational dive sites, user pressure may be released from some of the more archeologically significant sites which are under constant threat of being irreparably damaged in the shallow water of the study area.

7.1.3.4 Management Zones for Historic Archeological Resources

In order to facilitate the decisionmaking process relative to the preservation of historic cultural resources on the Outer Continental Shelf, three Management Zones have been delineated on the basis of relative archeological sensitivity. These zones are seen as a tool to assist in setting the necessary administrative strategies and priorities for effective timely management. The rank ordering of these zones defines the relative sensitivity of shipwreck site clusters. Zone I circumscribes areas having the highest sensitivity, and this is the area with the greatest potential for adverse impact. Alternatively, Zone III delineates the areas of least sensitivity where projected impact of the seabed will have a low probability of adversely affecting significant submerged historic cultural resources; Zone II is the intermediate Management Zone representing a continuum between Zones I and III.

Areas on the Outer Continental Shelf already under the management of State and Federal agencies are not included in this scheme. These areas include marine sanctuaries, State and National parks, and archeological preserves under State jurisdiction.

The impact from oil and gas exploitation on the Outer Continental Shelf is expected to vary according to the type of development and where it is focused. The three main areas of concern are: 1) offshore waters where drilling and construction of monobuoy terminals will occur; 2) inshore waters which will be crossed by pipelines; and 3) coastal waters where storage, pumping, and support facilities will be built. All three commercial activities will result in different degrees of impact to the underwater archeological data base.

Drilling in the offshore areas on the outer shelf and slope is expected to have very little, if any, direct adverse impact on shipwreck sites, although there are a number of deepwater shipwrecks. Using magnetometer and side-scan sonar surveys, these wrecks can be avoided during drilling operations. Recommendations outlining acceptable minimal archeological input for lease block surveys are considered in Section 7.1.3.5.

Laying pipelines across the submerged bottom lands within inshore waters presents a different situation. Many more reported sites are situated within the 20-metre isobath than in deeper water. Shipwreck sites should be systematically examined in order to determine the full extent of associated cultural material. Features identified on either side of pipeline transects for at least 150 metres should be closely inspected on the seabed to confirm the presence or absence of shipwreck material. Archeological confirmation on the seabed in water depths of less than 20 metres will help to establish a sequence of investigative strategies for dealing with suspected shipwrecks in deeper water where diver bottom time is more restricted.

The construction of coastal support facilities represents the largest potential threat to the underwater archeological data

base. Although there is some geographical variance within the total shipwreck population within the study area, the available data indicate that close to 90 percent of all known shipwrecks are located within the 20-metre isobath. Along some parts of the coast, shipwrecks are found clustered in large numbers within a few hundred metres of the beach. The deepwater harbors and inlets are particularly sensitive to facility development. The Intracoastal Waterway contains a large number of potentially significant shipwrecks; rivers, estuaries and navigable channels behind the Barrier Islands should be surveyed systematically for ballast and refuse scattered from ships as well as cultural material eroding from terrestrial sites along the beach. Underwater archeological deposits within the 10-metre isobath represent the most sensitive part of the Outer Continental Shelf data base. Consequently, future efforts should be concentrated on providing archeological input to appropriate management plans which will provide adequate mitigative options to deal effectively with projected adverse impact within coastal waters.

7.1.3.5 Management of Historic Archeological Resources

The management program for historic cultural resources on the Continental Shelf should be based on as much supporting data as possible. A more complete knowledge of maritime activity within a specific geographic area and time will help to identify the areas of the shelf that have the greatest concentration of historic cultural material. Shipwrecks are not randomly distributed on the shelf; their distribution is based on physical environmental factors, ship design and construction, navigation technique, and socioeconomic and political conditions at the time of sinking. If, therefore, the management plan is based on data such as maritime historical records, charts, and interviews with local researchers, the plan will be more effective.

A plan for the management of cultural resources should include a program for detecting these resources and protecting those that are found. Whenever a significant anomaly is detected with any remote sensing system a recommendation for evaluating it should be made. Site evaluations and identification of anomalies might include

surveys with closer lane spacing to detect intrasite variability, or actual diver investigation to identify and make direct measurements of archeological features and structures. Such future study recommendations are key parameters to effective protection of cultural resources, since avoidance and impact mitigation procedures will be an outgrowth of these studies.

The results of the required surveys and the data synthesis will also help to further verify and update the predictive model. Survey requirements should be prioritized on the basis of where the most immediate impacts on the most sensitive areas will occur. Identification of survey requirements for a management zone does not mean that the entire zone must be surveyed, but a survey should be conducted when some proposed activity in an area may damage existing cultural resources in the area.

There is a danger, however, of relying too much on a predicted distribution of shipwrecks since predictions are based on limited data. If archeological data is found within areas thought to be less sensitive, it could be significant because it did not fit a predictive model. As more data is collected it may become necessary to modify the model, reevaluate the sensitivity designation of that area, and perhaps modify the survey requirements. Linking survey requirements only to those areas known to be sensitive can ignore those wrecks which do not fit a predictive model. Surveys should therefore be required in an area even though it may not be sensitive according to the prevailing model. It is not necessary that these surveys be as intense as in sensitive areas, but they should be conducted to detect at least major anomalies.

All surveys should be planned and conducted by a professional underwater archeologist and assisted by a remote-sensing instrument technician. The technician must verify the calibration and accuracy of the instruments and the archeologist should be responsible for interpreting and recording the data. Upon completion of the survey and data analysis a formal archeological report should be filed which will include a discussion of the survey procedures, methods of analysis, and conclusions regarding the archeological significance of anomalies recorded. It is

also important to describe the physical environmental parameters whenever possible, which may help to assess the physical integrity of cultural resources existing in the area.

The following are the minimal survey recommendations for detecting resources within each historic cultural resource management zone. This does not include recommendations for defining intersite and intrasite relationships.

Zone I: Conduct a survey using side-scan sonar, magnetometer and sub-bottom profiling instruments. The lane spacing should be 25 metres. An underwater video system is recommended since it could increase the effectiveness of a survey for detecting historic resources.

Zone II: Conduct a survey using side-scan sonar, magnetometer, and sub-bottom profiling instruments at a 50-metre lane spacing.

Zone III: Conduct a survey using side-scan sonar, magnetometer, and sub-bottom profiling instruments at a 75-metre lane spacing.

7.2 FUTURE STUDIES

7.2.1 Future Studies in Prehistoric Archeology

The predictive models based on terrestrial data have a certain empirical consistency throughout the study area. The primary difficulty in applying these models on the submerged Continental Shelf is the lack of detailed data on the distribution of the critical environmental variables during the appropriate time periods. This lack of shelf environmental data may be more specifically characterized in terms of a number of data needs:

- o Clearer delineation of river channel extensions and temporal control for these areas.
- o More specific data on the locations of riverine features, such as flood plains and tributary junctions and terraces.
- o Specific data on the transport of lithics in pebble and cobble size: identification and analysis of bed load materials from any time period.

- o Better data on sub-fluvial and interfluvial features such as swamps, marshes, and lakes, which may be identified by peats, among other means.
- o Better control over the distribution of Pleistocene and/or Holocene sediments, in general.
- o Data on the depositional integrity of Pleistocene and Holocene sediments, that is, where these are intact as deposited, and where they have been subsequently reworked or removed by marine processes.
- o Identification and dating of oyster shell deposits which may be of human origin, as opposed to those which are of natural origin.
- o Identification and dating of such prehistoric nearshore features as estuaries, lagoons, barrier islands, and similar features.

The purpose of delineating these features is to provide the environmental context in which archeological sites can be expected to occur. Looking for archeological remains where such features would occur would provide the test for a predictive model.

By identifying the locations of these environmental variables, the application of the predictive models may be refined, and the areas of high archeological sensitivity thus reduced. Sites discovered during the assessment process can likewise serve either to conform and refine the predictive models, or indicate modifications. Obviously, this can only be accomplished if both environmental and archeological data are collected and evaluated. The total archeological base should be viewed as a series of patterned occupations across prehistoric landscapes. An understanding of the pattern is more likely to result in the discovery and protection of archeological sites than simply looking for sites.

Specific research should be directed toward testing and refining the hypothetical model upon which initial management decisions must be made. Since most of the environmental variables that are critical to predicting prehistoric archeological sites cluster around river channels, the following investigations could be taken in the form of a pilot project:

1. Select one of the major terrestrial rivers such as the Savannah, with drainage areas containing appropriate sources of lithic materials. Terrestrial data for archeological site distribution around the Savannah are particularly good.
2. Using remote-sensing techniques and limited bottom sampling, define the Pleistocene/Holocene channel across the shelf, collecting data applicable to as many of the categories listed above as is feasible.
3. Define a sampling design centered on the river channel or channels, with an extension 2 miles on either side, beyond which sites can be expected to drop off in size and number, and in range of activities.
4. Collect and analyze data from the sampling units and:
 - a. Plot the distributions of the relevant variables on a statistical basis.
 - b. Evaluate the character and quality of the data, in particular, with respect to the question of site preservation.
 - c. Plot and sample a transverse transect, extending into the interfluvial areas approximately 15 kilometres on either side of the river channel. The ends of this transect should be sufficiently distant from the present shoreline that they extend into Sensitivity Zones 2 and/or 3 (that is, beyond the 8,000 B.P. shoreline in most locations in the study area). This should allow for at least a preliminary evaluation of the paleoenvironment outside of Sensitivity Zone 1.

These recommendations for pilot studies are necessarily general. The costs and precise procedures for these studies cannot realistically be formulated until steps 1 and 2 have been completed. These two steps may be regarded as the first phase of the study. The 40 kilometre width of the sampling design is clearly arbitrary, and may be subject to some adjustment, depending on the results of the first phase. This study is designed to test as directly as possible the predictive models which form the basis of the resource management procedures discussed above. Alternative approaches for pilot studies might be adopted. For example, a completely random sampling of the shelf might be undertaken, or sampling might be generally stratified using the sensitivity zones. It seems more reasonable and cost-effective, however, to concentrate on a smaller area and obtain a more intense data yield. A sampling fraction of the entire shelf, stratified or

not, sufficient to reveal meaningful patterns of either archeological site distributions or the distributions of paleoenvironmental variables (or both), would have to be so large as to be prohibitively expensive.

While this (or other) pilot study may be regarded as "pure" research by contrast to the other data collection activities described above, every opportunity to gather information on prehistoric environments and settlement patterns should be taken.

7.2.2 Future Studies in Shipwreck Archeology

There is a need to acquire baseline data from historic shipwrecks in order to develop a comprehensive resource management plan which will establish archeological priorities and effective mitigation options for preserving sites that might be threatened in the future. Site specific information should be gathered in an attempt to address the following:

1. Determine the nature of the interrelationship between underwater cultural resources and the surrounding natural environment. Investigate the extent to which natural benthic phenomena can be used as biological indicators in helping to detect the presence of cultural material.
2. Determine how bio-cultural interrelationships can be used to help archeologists formulate predictive models and determine sensitivity zones relative to the discoverability and recoverability of cultural material.
3. Determine the distribution of shipwreck material and how the artifact scatter patterns are affected by varying depositional environments such as hermatypic coral, patch reefs, coral rubble, clastic overburden and Thalassia beds.
4. Determine to what extent environmental variables such as water depth, bathymetry, currents and tidal action affect the archeological data base.
5. Determine the present physical integrity and archeological potential of individual wreck sites in terms of structures, artifacts, and contextual data.
6. Determine the extent to which already disturbed sites can be used to generate cultural and/or historical hypotheses which might be used in future testing at other sites.

7. Determine to what extent previously disturbed shipwreck sites can be used as recreational resources by the public and as educational resources to train students in underwater archeology and cultural resource management.
8. Determine how disturbed sites can be used to evaluate cost-effective data recovery methodologies and remote-sensing techniques.

Pilot studies would best be carried out in shallow riverine environments and inshore coastal waters where shipwrecks are best preserved, and where cost-effective survey operations would maximize data recovery within tight budgetary constraints. Though deep-water environmental conditions generally favor shipwreck preservation, present economic realities make such offshore archeological work difficult to fund. Areas for future pilot studies are suggested below:

North Carolina - A good area seems to be on the inside of Ocracoke Island in the vicinity of Portsmouth and Ocracoke. The old inlet at the mouth of the Cape Fear River also presents a good opportunity to conduct depositional studies of shipwrecks being uncovered from time to time by storm surges. The results from the archeological survey of Bath Harbor suggests that inland waterways and anchorages are ideal areas for pilot studies (Gordon P. Watts, personal communication, October 1979).

South Carolina - The on-going archeological work being carried out in the rivers by the Institute of Archaeology and Anthropology represents the best opportunity to acquire a better understanding of the nature of shipwreck contextual data. Over the last few years six historic shipwrecks dating from 1750 to 1850 and 15 wooden canoes of the historic period have been located in South Carolina waters (Alan Albright, personal communication, February 1979). Some work might also be carried out in harbor areas in Charleston, and on the bar in the vicinity of Sullivan's Island.

Georgia: There are a number of locations along the Intracoastal Waterway in the general Brunswick-Darien area which might be considered for future pilot studies. The navigable channels in the vicinity of Cumberland Island and St. Simons Island are particular areas which might yield interesting results. The North channel of the Savannah River and the nearshore bar are two other

possible pilot study areas. The continuing work by the Savannah District, Army Corps of Engineers, is demonstrating the feasibility of conducting evaluation studies on shipwrecks in the Savannah River (Anuskiewicz et al., 1979; E. G. Garrison, personal communication, March 1979). The major drawback with conducting such studies off the Georgia coast is the bad visibility and high tidal range which can be almost 3 metres during spring tides. This tidal action creates strong currents which makes any type of underwater work off the Georgia coast difficult.

Florida - This part of the Study Area offers the best conditions for future pilot studies. The wide range of archeological material from different periods and the relatively clear visibility present an excellent opportunity to conduct more intensive evaluation studies on shipwreck sites within varying depositional environments. The type of survey work carried out by the State (Cockrell and Murphy, 1978) in the Fort Pierce area should be expanded to other wreck sites along different parts of the coast. A number of potential pilot study areas include:

1. St. Augustine Harbor
2. New Smyrna Beach
3. Fort Pierce
4. Biscayne National Monument
5. John Pennekamp State Park
6. Key Largo Coral Reef Marine Sanctuary
7. Crocker Reef - Coffins Patch
8. Lignum Vitae State Park
9. Looe Key Marine Sanctuary - American Shoals
10. Sand Key - Samboe Key
11. Key West Harbor.

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