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Session: CURRENT PREHISTORIC ARCHAEOLOGICAL RESEARCH IN THE COASTAL REGIONS OF FLORIDA

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Current Prehistoric Archaeological Research in the Coastal Regions of Florida: Session Overview

Mr. Richard J. Anuskiewicz
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The MMS of the Department of the Interior is responsible for all OCS minerals activities and their potential for impacting natural and archaeological resources. In order to fulfill its responsibilities for archaeological resources management, MMS has developed a program to inventory, manage, and protect valuable, nonrenewable, prehistoric and historic resources. The MMS meets its goal of archaeological resource protection through a multilevel analysis system. The MMS conducts Regional baseline studies to determine where on the OCS archaeological sites are most likely to occur.

The MMS baseline studies have concentrated on the central and western Gulf of Mexico because most of the oil and gas exploration and production has occurred in this area of the Gulf. However, the recent past has seen the projection of exploration and development of natural resources in the eastern Gulf of Mexico. Regionally-specific archaeological resource management models were originally derived from this baseline data for analysis and management of prehistoric archaeological resources potentially located in the western and central Gulf of Mexico. However, the models are not completely applicable for archaeological analysis in the eastern Gulf of Mexico. In an attempt to resolve this problem, MMS has enlisted the aid of archaeologists conducting current prehistoric research in the coastal regions and offshore Florida. This has been done in order to examine new information from their current research that may be applicable to the MMS cultural resource management program for the eastern Gulf of Mexico.

The focus of this session is to report on the current status of prehistoric archaeological research in the coastal regions of Florida and then to determine if the present analytical models used by MMS, derived from previous baseline studies, are appropriate for performing the requisite MMS cultural resource management analysis.

The first speaker in our session was Ms. Melanie J. Stright of MMS. Ms. Stright began the session by giving an archaeological overview of inundated archaeological sites in the coastal regions of Florida. She reported that 17 inundated archaeological sites have been documented within the coastal area of Florida. These sites became inundated as a result of glacio-eustatic and glacio-isotatic adjustments during the late Wisconsinan glacial epoch and during the Holocene. The distribution of sites should not be considered representative of the true distribution of inundated archaeological sites. There is a strong bias towards shallow water sites since activities such as dredging and sport diving generally concentrate in shallow waters and have led to the discovery of many of the sites.

Diagnostic artifacts recovered include lithics and pottery and span all cultural periods from Paleo-Indian through the Woodland. Human skeletal material from Paleo-Indian and Late Archaic Periods have been recovered, as well as numerous species of late Pleistocene fauna.

The inundated archaeological sites discovered thus far within the coastal areas of Florida suggest that there will be an abundance of archaeological material found off the coast of Florida and that these materials (including organics) will often be well preserved. Sites will probably concentrate in the vicinities of sinkholes, relict fluvial channels, relict estuarine deposits, and outcrops of cryptocrystalline rock. Information contained in these sites may provide important information on prehistoric human migration, settlement patterns, subsistence, and cultural contacts across now submerged landmasses.

The next speaker was Dr. Glen Doran of Florida State University. His paper focused on the preservation potential of organic materials at prehistoric archaeological sites located in wet or saturated environments. He defined these types of archaeological sites, or "wetsites," as locations where remnants of past human activities are preserved in saturated or nearly saturated settings. These types of sites can be found in river channels, coastal marine settings, and within lakes, ponds, and springs. However, there may be some problems in locating wetsites because of their almost invisible nature and the frequent necessity of entering a "hostile" environment to locate them. Wetsites are either underwater, or they are difficult to identify because of water-saturated conditions.

The potential preservation of organic materials is largely due to the presence of moisture, which reduces the physical stress on organic materials by limiting the frequent hydration/dehydration cycle that promotes deterioration of organic remains by expansion and contraction. There are many other factors that contribute to the preservation potential of materials. These factors include the dynamics of water and/or soil chemistry, oxygen levels in the soil and water, temperature, physical stability, and integrity of the soil matrix. When all of the environmental conditions are right, there is also a good potential for preservation of plant material like stems, seeds, leaves, and pollen. Additional soft tissue that can survive includes preserved brain tissue. At the Windover archaeological wetsite, which Dr. Doran has been excavating since 1983, Dr. Doran states that the preliminary analysis of preserved brain tissue indicated a replacement process, that resulted in elevated sulfur levels. Microscopic and macroscopic features of the brains are still preserved, as are some molecular structures. Elemental analysis of bone samples indicates an abnormal absorption of strontium, obviating some studies of dietary composition based on strontium levels. At the same time, some proteins appear well preserved enough for researchers to attempt to develop a biological profile of the 7,000 year old population being studied.

The uniqueness of the preservation of organic materials at wetsites like Windover also presents some unique problems in material preservation. Waterlogged conditions of archaeological material recovered necessitated special conservation techniques. Saturated faunal and human bone was treated with bulking agents which replaced the water. Polyetholglycol (PEG) was initially used, but an acrylic emulsion, Rhoplex, proved more satisfactory. Floral materials (seeds, leaves, wooden artifacts, etc.) involved a variety of conservation procedures including refrigeration, alcohol saturation, treatment with PEG and Damar, and other compounds. Brain tissue was rapidly removed, placed in plastic bags, flooded with nitrogen gas, sealed, refrigerated for transport, and frozen at -70 degrees centigrade within 24 hours to minimize possible degradation and to maximize future analysis possibilities.

Many scientific and archaeological accomplishments were realized at the Windover prehistoric wetsite. The collection, representing a minimum of 155 adults and subadults, is one of the largest samples of human skeletal material and associated cultural materials of this antiquity in the New World. The collection dates between 7,000 and 8,000 years Before the Present (B.P.) and represents an Archaic Period hunting-gathering population. Data on health, diet, disease, demography, etc., in some ways, represent "baseline data," useful in looking not only at human adaptation, but providing an abundance of archaeological, climatological, and environmental data.

Mr. Wilburn A. (Sonny) Cockrell, Director of the Warm Minerals Springs Archaeological Research Project, was the next speaker, and he described his archaeological site as a 70-meter deep spring-fed sinkhole, located 16 kilometers inland from the Gulf of Mexico in Sarasota County, Florida. Saline anaerobic water enters the sinkhole at the 70-meter depth at a temperature of 32-34 degrees centigrade. The source of the springs' water is the Floridian Aquifer some 1,000 meters below the surface. Approximately 19.4 million gallons of natural, hot mineral water flow through the spring each day.

The sinkhole's limestone walls are draped intermittently with dripstone formation zones from 4 to 30 meters below the surface. In addition, some of the underwater sediments are producing a tufa-like formation. This sedimentary rock, composed of calcium carbonate, is formed by evaporation as a thin, surficial, soft, spongy, cellular or porous, semifriable incrustation around the mouth of a hot spring. The limestone matrix of the spring is representative of the Hawthorn Formation, which dates back to the Miocene Period.

Current research is being conducted on a 13-meter ledge, and at the sinkhole's debris cone at a depth of 50 meters. The archaeological diving is being conducted by utilizing both SCUBA and surface supplied air systems. The technology utilized at Warm Mineral Springs reflects both standard underwater excavation methods at the 13-meter ledge and some new and innovative techniques at the 50-meter level where deep diving is required.

There are three archaeological foci at the Warm Mineral Springs archaeological site. They include (1) a terrestrial site located around the rim of the sinkhole, (2) archaeological material at the 13-meter ledge deposited prior to the present level of inundations, and (3) a stratified matrix of undisturbed natural sediments and archaeological materials located in the existing sediment cone at the 50-meter level.

Archaeological material excavated at Warm Mineral Springs ranges from the present to the Formative Period (approximately 2,500 years B.P.), from the Formative to the Archaic Period (approximately 2,500 B.P. to 8,500 B.P.), and from the Archaic Period to the Paleo-Indian Period (approximately 8,500 B.P. to 11,000 B.P.). Archaeological materials excavated from the Paleo-Indian period have been radiocarbon dated to approximately 11,000 B.P. Stratigraphic and chronologic analysis of the archaeological materials excavated indicates that human and other animal faunal remains, such as the ground sloth, saber-tooth tiger, horse and camel, were found to coexist during the same time period. Analysis of preserved botanical remains has provided a continuous paleo-environmental record extending back approximately 30,000 years B.P. In addition, there have been unsubstantiated reports that cave divers in the early 1960's removed a skull from the 13-meter ledge area of the spring and that this skull contained preserved brain material.

Planned future excavations of the anaerobic sediment cone at the 50-meter level may provide a complete time continuum of this archaeological site and, perhaps, provide more preserved faunal material and preserved soft tissue.

The fourth speaker was Mr. Michael Faught, a graduate student from the University of Arizona. His topic involved locating and excavating underwater prehistoric archaeological sites in the Apalachee Bay area of Florida, located in the northeastern area of the Gulf of Mexico. Mr. Faught suggested that anthropologists are somewhat puzzled by the archaeological reconstruction of the cultural transition from the Paleo-Indian Period to the Archaic Period. In the same vein, Quaternary geologists are having similar problems reconstructing the geolomorphical transition from the Pleistocene to the Holocene Period. Both disciplines are acutely aware of the need to study sea level changes and the need to continue to collect paleo-environmental data from the continental shelf. The missing archaeological and geological data includes information about relict geomorphology, prehistoric settlement patterns, and the timing and effects of sea level change on these factors. There has been much written in the archaeological literature about sea level curves; however, very little archaeological research has been conducted on the continental shelf to locate inundated sites to substantiate or dispute existing sea level curves for finding additional prehistoric sites of a terminal Pleistocene age (Paleo-Indian Period).

Mr. Faught further stated that the continental shelves represent a missing and potentially large data set where it is extremely difficult to find either relict topographic and geologic features or submerged archaeological sites. Wave action destruction, subaerial erosion, Holocene alluviation, and neritic sedimentation are significant natural processes that could obscure the Pleistocene geology and continental shelf archaeology.

The search for submerged or drowned prehistoric terrestrial sites by Mr. Faught began after careful examination of onshore settlement pattern models for late Archaic and Paleo-Indian Periods. Research was focused on upland areas of high-density, extinct faunal remains and their associated lithic artifacts and on a potential offshore survey area that exhibited minimal alteration to the natural geology since the Pleistocene. A preliminary predictive model and research design were developed to search for lithic procurement stations, theorizing that lithic cultural material would have the best possibility of surviving natural destructive forces of sea level changes through time. The selected survey area included nearshore regions of the St. Marks, Aucilla, and Econfina Rivers of the Apalachee Bay because the alluvial sedimentation in these rivers is extremely low due to the solutional characteristics of the karst drainage.

The results of the initial survey located four lithic procurement stations in the five areas examined. Three sites were found close to shore in approximately 2 meters of water.

The fourth site was located 4.02 kilometers offshore at a depth of 3.7 meters and produced a large number of modified lithic materials including bifacially trimmed cores and associated flakes. Associated with the lithic debris were pieces of cypress wooden, which radiocarbon dated to 5,160 $\pm$ 100 years B.P.

The preliminary results of offshore archaeological surveys in the Apalachee Bay region indicate that by utilizing the developed predictive model, drowned prehistoric archaeological sites can be located. By examining relict features in the inundated karst region and concentrating on surveying the associated rock outcrops, site location is highly predictable.

Mr. Rik Anuskiewicz of MMS was the next speaker, and he reported preliminary archaeological investigations at Ray Hole Spring, a submerged karst feature located on the OCS. The MMS, in cooperation with the Florida Bureau of Archaeological Research, conducted preliminary underwater archaeological investigations at Ray Hole Spring. This submerged karst feature is located approximately 88.5 kilometers southeast of Tallahassee, Florida, and about 38.6 kilometers from the nearest Florida landfall. The Spring is a typical karst feature probably formed during the Pleistocene as a result of the surface limestone collapsing because of either solutional or mechanical action caused by underground drainage.

A 1976 Florida Bureau of Geology bulletin, titled "Springs of Florida," describes Ray Hole Spring as an occasional flowing spring lying in 11.6 meters of water, measuring 7.6 meters in diameter. The north side of the sink slopes southeast with the southeast side of the sink having a nearly vertical limestone wall to a depth of 18 meters. A cave strikes down and southeast from the 18-meter depth to approximately 30 meters.

The October 1986 investigation of the spring revealed a completely different environmental setting at the site. The diving reconnaissance indicated that the spring had almost completely filled in with recent (since 1976) marine shell detritus. Only about 3 meters of relief existed in the southeastern end of the sink. The archaeological investigation of the site included diver swimming reconnaissance, mapping, attempts at coring, and waterjet excavation of selected test units. Coring was discontinued because the coring tool made very little penetration in the shell matrix as a result of the small core diameter and the large size matrix of the marine shell detritus. After negative results from Test Units 1 and 2, and Core Tests 1 and 2, testing was moved to the outer rim of sink. One dive team began excavating with the waterjet at a large crevice. It was theorized that if this were an archaeological site, cultural material may have fallen or have been washed into a crevice and become trapped. The crevice was approximately 15 cms in width and ran in a southwesterly direction towards the rim of the sinkhole. Waterjet excavation approximately 15 to 20 cms into the crevice recovered several poor quality limestone or chert flakes. This material was immediately returned to the surface for examination. Continued waterjet excavation of the crevice yielded a lens of articulated whole oyster shell at the 75 cm level; at the one-meter depth, waterlogged wood was encountered. Samples of the shell and wood were collected, returned to the surface, and stabilized for future analysis. Below where the wood samples were recovered, the crevice narrowed and bottomed out. Excavation was terminated as was the initial archaeological testing.

In April 1987, analysis was conducted on the oyster and wood samples to identify the species and to obtain a radiocarbon date of this organic material. The wood species was identified as live oak, and radiocarbon dates for the oyster shell and wood dated 7,390 ± 60 years B.P. and 8,220 ± 80 years B.P., respectively. The wood sample, dating approximately 800 years older than the oyster shell and being recovered in a lower stratigraphic level than the oyster shell, suggests that these materials were deposited in situ.

Preliminary analysis of the data collected at Ray Hole Spring suggests that this sinkhole may be a prehistoric archaeological site. Several factors (environmental and possibly cultural) tend to support this initial contention. The radiocarbon dates obtained at Ray Hole Spring in combination with the regional sea level curve indicate that for approximately 8,200 years B.P. the sinkhole was a freshwater site supporting freshwater flora. Some time after 8,200 B.P., sea level began to rise, and by 7,400 B.P., the Ray Hole Spring area was supporting a shellfish population in a brackish water environment.

In addition, a cultural manifestation may exist at Ray Hole Spring. The two large limestone/chert flakes collected were examined by five archaeologists. They all seem to agree that the way the flakes were removed from the lithic core suggests that they could have been made by prehistoric man. However, they also agree that two flakes usually do not make an archaeological site.

Obviously, there is more work to be done to fully verify if Ray Hole Spring is an authentic archaeological site. An intensive testing program includes remote sensing studies to determine the true depth and profile of the sink hole, coring of the sediment cone to gather paleo-environmental data, more organic sample collecting for radiocarbon analysis, and the recovery of diagnostic lithic artifacts.

The final speaker of our session was Mr. James Dunbar, archaeological field supervisor with the Florida Bureau of Archaeological Research, Department of State. Mr. Dunbar began his comments by stating that prehistoric archaeological sites inundated by the sea are the most elusive sites to locate. The sites may be deeply buried and inaccessible in some regions of the continental shelf and shallow, but difficult to identify in other areas. The karstic area of the Florida Gulf Coast represents a unique archaeological area where Paleo-Indian remains are highly concentrated and sedimentation has been minimal.

Given the difficulties associated with locating offshore sites, a model based on the type and distribution of sites on the adjacent coast was developed for the Apalachee Bay region of the Gulf of Mexico. Offshore survey work (report by Faught and Anuskiewicz this session) incorporated the assistance of fisherman and sport divers familiar with the project areas. In three days, Mike Faught's survey located four archaeological sites from one to four miles offshore. Rik Anuskiewicz and others surveyed Ray Hole Spring some 24 miles offshore and discovered evidence of what may prove to be a drowned archaeological site.

Mr. Dunbar found from his research that prehistoric site distributions in Florida occurred in changing patterns not only linked to evolving technologies but to fluctuations in the regional surface water systems. The availability of potable water in relation to other needed resources helped dictate possible site locations through time. Ninety percent of the Paleo-Indian sites containing Clovis, Suwannee, or Simpson projectiles are located near karst depressions that penetrate the Tertiary limestones of Florida. Some sites are located around isolated sinkholes and solution depressions, but most occur in areas where multiple karst features occur together and dominate the topography. The largest site clusters are located in and around mature karst river channels with smaller but significant clusters centered around karstified lakes, bays, and prairies.

1. At given points in time, from 15,000 to 5,000 years B.P., can absolute sea level stands be identified to allow chronologically evolving site predictive models?

2. Do archaeological sites exist in the eastern Gulf of Mexico that have stratigraphic integrity despite Holocene sea level transgression and marine erosive conditions?

3. What is the functional variety of archaeological sites encountered?

4. Once prehistoric offshore sites are located, can remote sensing instruments provide diagnostic signatures of the known sites?

Mr. Richard J. Anuskiewicz obtained his B.A. in 1972 and his M.A. in 1974 from California State University at Hayward. He was employed with the U.S. Army Corps of Engineers from 1974 to 1984 as a terrestrial and underwater archaeologist. In 1982 Mr. Anuskiewicz completed all requirements for his Ph.D., except for his dissertation, at the University of Tennessee at Knoxville. In 1984, he accepted a his current position at MMS, Gulf of Mexico OCS Region.

Inundated Archaeological Sites of the Florida Coastal Region: A Regional Overview

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At least seventeen archaeological sites, inundated as a result of late Wisconsinan and early Holocene glacio-eustatic and glacio-isostatic adjustments, have been documented within the coastal area of Florida (Figure 12.1). The distribution of reported sites is more reflective of shallow-water activities, such as dredging and sport diving, which have resulted in the discovery of the sites, rather than the true distribution of sites.

Three of the reported sites--the Saxon-Holland Site, Warm Mineral Springs and Little Salt Springs--lie inland of the present coastline within the karst area of central Florida. During periods of lower sea level, the karstic topography was better drained, resulting in lower water levels at these inland lake and sinkhole sites.

SAXON-HOLLAND SITE (SITE NO. 1)

The Saxon-Holland Site is located in Blue Cypress Lake in Indian River County, Florida (see Figure 12.1). Archaeological materials and human remains ranging in age from 11,000 to 500 B.P. occur between 2 and 3 meters below present lake level (W.A. Cockrell, personal communication 1987). There is a direct relationship between the depth of the material and its age, with the oldest material being found in the deeper portions of the lake.

WARM MINERAL SPRINGS
(SITE NO. 2)

Warm Mineral Springs is a sinkhole approximately 19.3 kilometers southeast of Venice, Florida, in Sarasota County. Paleoenvironmental data indicate that the spring would have been an important fresh water source during the late Pleistocene and early Holocene when the climate was more arid and local water tables were lower. The excellent preservation of organic materials in the anaerobic waters of the spring offer a unique opportunity to study the late Pleistocene environment and, also, early man. A detailed discussion of this site is provided in Mr. Wilburn A. Cockrell's paper, included in these proceedings.

LITTLE SALT SPRINGS
(SITE NO. 3)

Little Salt Springs, a water-filled collapse limestone sinkhole, lies 4.8 kilometers northeast of Warm Mineral Springs in Sarasota County, Florida. The site is an Archaic village and cemetery (ca. 7,000 to 5,000 B.P.) which extends into the sinkhole to a depth of 10 meters below the present water level (Cockrell, 1980).

A wooden mortar, two firepits (one near the mortar), food remains, and unidentified carved wooden implements were discovered within the sinkhole at a depth of about 10 meters below present water level. At a depth of 27 meters, the shell of a giant land tortoise with two wooden stakes stuck between the plates of the shell was found. A radiocarbon date of 13,000 B.P. was obtained from one of the stakes (C. Clausen, unpublished report, 1979).

Human remains from a total of 50 individuals, dating approximately 7,000 to 5,000 B.P., have been recovered from the site. Pleistocene faunal remains recovered from the sinkhole include giant ground sloth, giant land tortoise, and bison (C. Clausen, unpublished report, 1979).

A burned log dating 10,000 ± 200 B.P. was located in a cave at the springhead, 24 meters below the present surface of the sinkhole (Lazarus 1965). Although the remains of seven humans also have been found in the cave, direct association with the burned log has not been demonstrated. No artifacts have been removed from the cave.

Like Warm Mineral Springs, Little Salt Springs would have provided an important fresh water source during the late Pleistocene and early Holocene when the climate was more arid and local water tables were lower.

THE DOUGLAS BEACH SITE
(SITE NO. 4)

The Douglas Beach Site extends from the beach to approximately 600 meters offshore in the vicinity of Ft. Pierce, Florida in water depths of 3 to 12 meters. The base of the site is formed by coquina of the Anastasia Formation. Sediment-filled depressions occur within the coquina. Sand forms the lowest sediment layer within these depressions across part of the site. The sand layer, or where it is absent, the coquina rock, is overlain by a dark gray-green clay, which is capped by a dark gray peat. Organics within this peat layer gave an average radiocarbon date of 5,000 B.P. (J. Dunbar, personal communication 1987).

In 1979, a human maxilla with six teeth, a portion of the palate, and part of the sinus cavity was recovered from a pocket of shell hash in the coquina. The find had no provenience. Newnan age projectile points were found out of context, but, due to their known time range, probably came from the clay layer which lies beneath the 5,000 year-old peat layer. Wooden stakes, possibly sharpened at one end, were found within the peat layer. Glades Plain ceramics have been found at the surface of the site. This material is apparently eroding from a nearby land site and being redeposited offshore (J. Dunbar, personal communication 1987).

Although remains of extinct Pleistocene fauna have been found at the site, and artifacts of stone, shell, and bone (bone pins) and human remains have been recovered, direct association between the two components presently cannot be demonstrated. This site is important in demonstrating that intact Pleistocene deposits and associated archaeological deposits can be preserved offshore of high-energy coastline.

THE VENICE BEACH SITE (SITE NO. 5)

This site extends from the present beach at Venice, Florida, out into the Gulf of Mexico. The site consists of a complex of shell middens, with at least two on the beach and one offshore. The top of the offshore midden lies at 2.23 meters below present mean sea level. The offshore midden produced large quantities of shell, Perico Islands Period potsherds, burned and unburned fishbones, land mammal bones, and charcoal. The matrix of the midden was clayey sand. An <u>in-situ</u> sample of charcoal from 20 to 31 cm below the top of the midden gave a radiocarbon date of 1981 ± 85 B.P. (Ruppe', 1980). Approximately 100 meters seaward of the offshore midden, in 5.5m of water, a number of Middle Archaic stone tools have been found lying on the seafloor.

A test pit in one of the beach middens revealed the same types and frequencies of materials as those recovered from the underwater midden; however, the pollen from the beach midden indicated a marsh environment, while the pollen from the offshore midden reflected a predominance of arboreal species such as pine and oak (Ruppe', 1980). It is assumed that some change in eustatic sea level within the last 2,000 years has caused inundation of this site.

TERRA CEIA BAY SITE (SITE NO. 6)

Clay dredge material from Terra Ceia bay in Manatee County, Florida, was used to build a beach on the northeastern side of the bay. Subsequently, archaeological material and Pleistocene faunal material was discovered eroding from the clay beach.

The archaeological material includes projectile points; plano-convex turtle back scrapers; a hammerstone; chert flakes; and plain, sand-tempered, black pot shreds. Six of the ten projectile points recovered represent types similar to an Alabama Dalton Complex dating approximately 9,300 B.P. (Warren and Bullen, 1965). Three of the points are Greenbrier points, a Florida variation of the Dalton point.

The projectile points recovered from this site suggest a late Paleo-Indian to early Archaic site; while the pottery suggests a Woodland component.

Well-mineralized Pleistocene faunal remains recovered from the site include bison horn cores, fragments of mammoth teeth, turtle shell, manatee rigs, fragments of mastadon teeth, and shark teeth (Warren and Bullen, 1965).

No information on the paleogeography or stratigraphy of the bay at the dredge site was provided in the literature.

APOLLO BEACH SITE
(SITE NO. 7)

Dredge material from Tampa Bay, Florida, used as fill for a real estate development at Apollo Beach on the east side of the bay, has produced artifactual and some Pleistocene faunal materials. The dredge material came from a zone ranging between 1 meter below mean high tide (bay bottom), to 5.5 meters below mean high tide (the maximum depth of dredging).

Lithic material recovered from the dredge fill site includes projectile points, scrapers, knives, bifacial core choppers, unifacial core planes, one drill, flakes, worked flakes, and cores. Thirty-four of the 37 projectile points recovered were angle-notched and bifacially worked with little secondary retouching. Pot sherds representing the Orange (fiber-tempered), Transitional, Deptford and Perico Island Periods were also found at the Site (Warren, 1968 (a)). The artifactual material suggests that the original archaeological deposits in the bay is late Archaic to Woodland.

TURTLECRAWL POINT SITE
(SITE NO. 8)

Channel dredging to a depth of approximately 3 meters in Boca Ciega Bay, near St. Petersburg, Florida, produced Early Archaic and Middle to Late Archaic artifacts from apparently <u>in-site</u> archaeological deposits within the bay (Goodyear, et. al., 1980).

The base of the site, at approximately 3 meters below present mean sea level, is marked by the middle Miocene Hawthorn Formation, which locally contains abundant chert. A blue-green clay overlies the Hawthorn Formation and contains residual chert from that formation. Quartz sand overlies the clay layer. The stratigraphy of the dredge spoil pile matches the original geologic stratigraphy, indicating that the dredge first encountered the clay, then the overlying sand. This was explained by the fact that the dredge had intersected the clay deposit in the sloping valley wall of an ancient river channel, then, moving laterally and upward, had contacted the overlying sand deposit.

The Early Archaic material included four Bolen Beveled Point, Two Clear-Fork Gouges, a hafted spokeshave with graver spurs, flake scrapers, and three denticulates. A bifacially flaked adze was found that is similar to Early Archaic Dalton adzes.

The Middle to Late Archaic material included one Marrow Mountain Point, one Newnan Point, and two Florida stemmed Archaic points. Two columella shell gouges and the distal portion of a dagger-shaped tool made from a deer metapodial were also assigned to this late Archaic occupation. The shell gouges were radiocarbon dated to approximately 4,400 B.P. (A.C. Goodyear, personal communication, 1987).

Most of the lithic material is not of the local Hawthorn chert but of a chert foreign to the site. None of the lithics were water-worn, indicating that they had been dredged from <u>in-situ</u> archaeological deposits.

Shell material, mainly <u>mercenaria</u>, was present in the spoil pile. A subbottom profiler run just offshore of the point produced a low-amplitude, domed reflector immediately above the clay reflectors (S.B. Upchurch, personal communication, 1987). This was interpreted as a possible midden deposit and the probable source of the <u>mercenaria</u> found in the spoil pile.

Regional sea level curves indicate that sea level was 12 to 22 meters lower than present during the Early Archaic occupation, making this component an inland site approximately 13 to 28 km east of the coastline. The Early Archaic site is interpreted to have been a lithic procurement and tool manufacture area.

The Middle to Late Archaic component (ca. 7,000 to 4,000 B.P.) was probably coastal. If the domed reflector, observed on the subbottom profiler data, does represent a shell midden, the site function may have been shellfish procurement and processing.

TAMPA BAY SHELL DEPOSITS (SITE NO. 9)

Shell dredging in Tampa Bay has produced Pleistocene vertebrate fossils, artifacts, and one well-mineralized midsection of a human femur (Warren, 1972(b)). A survey of public and private roads constructed from the Tampa Bay shell resulted in an inventory of artifacts including flakes, scrapers, knives, and projectile points. Two of the projectile points, a side-notched Bolen point and a Beveled Bolen point are diagnostic of the Paleo-Indian Period in Florida. The shell itself is probably derived from prehistory shell middens in the bay.

CALADESI CAUSEWAY SITE (SITE NO. 10)

Draglines, dredging to a depth of 5.5 meters below mean high tide in St. Joseph's Sound near Clearwater, Florida, brought up artifactual material suggestive of a Paleo-Indian of Early Archaic lithic workshop. The dredge material was used to construct a causeway.

The ground surface of the causeway was covered with flakes and cores of silicified limestone, and three test pits dug into the fill material showed the lithic debitage to be extremely dense. Artifacts included hammerstones and crude, percussion-flaked knives (Warren 1968(b)). The only diagnostic artifact was the base of a crude, percussion-flaked Suwannee Point. Two other projectile points could not be precisely identified. One was made of mineralized bone, and the other resembled a Bolen Beveled Point, but also had characteristics of a stemmed Archaic point.

The crude percussion flaking of the artifacts and the base of the Suwannee Point suggest that the site represents a Paleo-Indian to Early Archaic Workshop. Like the Turtlecrawl Point Site, with sea level at 12 to 22 meters lower than present, this site would have been well inland of the coast at the time of occupation.

STORM HARBOR MARINA SITE (SITE NO. 11)

Just north of the Caladesi Causeway Site, and approximately 3 miles south of Tarpon Springs, Florida, another channel dredging operation produced artifactual material. The channel was dredged to a depth of 5.5 meters, and the fill was used as land fill adjacent to the dredge site. The surface of the fill material was littered with flakes and artifacts.

Artifacts recovered from the site include small bifacially worked tools (probable scrapers), a small drill, a thin, plano-convex knife or scraper, a high-crowned plano-convex scraper, two non-diagnostic stemmed points, and two small hammerstones. Diagnostic artifacts include Hernando Points, a Clear Fork Gouge, and two non-beveled Bolen Points, or Greenbrier Points (Warren, 1972(a)).

The original stratigraphy of this site has not been studied; therefore, the elevation of the stratum from which the artifactual material was derived is uncertain. The few diagnostic artifacts found in the dredge fill material range from Paleo-Indian to Late Archaic; therefore, the original archaeological deposit may be multicomponent. The debitage suggests a workshop area; however, a broader function of the site is not precluded.

ONE FATHOM SITE
(SITE NO. 12)

The One Fathom Site is a shell midden that lies approximately 0.5 miles seaward of the present beach near New Port Richey, Florida.

Archaic lithic material and Deptform Period shreds have been recovered from the midden deposit. This midden would have been subaerial until approximately 2,600 B.P. A minor sea level reversal would have re-exposed the midden deposit between 2,050 B.P. and 1,650 B.P. (Lazarus, 1965). The dates derived from the sea level curve are completely compatible with the diagnostic artifacts recovered from the midden deposit, and indicate that the site was probably abandoned due to rising sea level at approximately 2,600 B.P.

CHASSAHOWITZKA RIVER SITE
(SITE NO. 13)

This site is situated on the drowned bank of the Chassahowitzka River, Citrus County, Florida, at its confluence with a former tributary. The site has been severely deflated by tidal currents. All that remains are concentrations of archaeological material within pockets in the limestone bedrock at elevations of 0.5 meters to 2.5 meters below present mean sea level (R.J. Ruppe', personal communication, 1987).

Artifacts recovered from the site include Middle Archaic through Late Archaic projectile points, and ceramics dating approximately 1,400 to 1,100 B.P. (R.J. Ruppe', personal communication, 1987)

Results of the research on this site will be published in an upcoming issue of the Florida Anthropologist.

OFFSHORE CHERT OUTCROPS
(SITE NO. 14-17)

Archaeological investigations of chert rock outcrops within the coastal marsh and shallow offshore areas of the Apalachee Bay Region, Florida, identified ten prehistoric quarry sites. Six of the sites occur on the edge of the coastal marsh, but extend below the low tide line. Of the four offshore sites, three are partially exposed at low tide, and the fourth, the Econfina Channel Site (8TA531), occurs 5.5 kilometers offshore in the relict channel of the Econfina River. A detailed discussion of this site is provided in Mr. Michael Faught's paper, included in this proceedings.

Numerous coastal rivers in Florida have produced Pleistocene faunal material and Paleo-Indian artifacts. The best documented of these drowned river sites are the Page-Ladson Site in the Aucilla River whose basal levels are at 8.5 meters below present river level (J. Dunbar, personal communication, 1987); the Piney-Island Site in the Oklawaha River at 0.5 to 1 meter below present river level; and the Tarpon Point Site in the Mayakka River reported to lie at mean sea level, but which is inundated at high tide (L. Murphy, personal communication, 1987).

Like Warm Mineral Springs and Little Salt Springs, many other inundated Florida sinkholes have produced Pleistocene faunal material and archaeological material. Among these are Wakulla Springs, Silver Springs, Hornsby Springs, Devils Den, and Jughole Springs of the Ichetucknee River. With the possible exception of the Silver Springs Site (Hoffman, 1983), the association of faunal and archaeological material has not been demonstrated (Cockrell and Murphy, 1978(b)).

The sites discovered thus far suggest that there will be an abundance of archaeological material found off the coast of Florida and that these materials (including organics) will often be well preserved. The sites will probably concentrate in the vicinities of sinkholes, relict fluvial channels, relict estuarine deposits, and outcrops of cryptocrystalline rock. Information contained in these sites may provide important information on prehistoric human migrations, settlements patterns, subsistence strategies, and cultural contacts across now-submerged landmasses.

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A Consideration of Archaeological Wetsites

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INTRODUCTION

Archaeological "wetsites" are by definition locations where remnants of past human activities are preserved in saturated or nearly saturated settings. The biggest contrast to the typical terrestrial site is in the often excellent preservation of organic materials, difference in excavation techniques, and the necessity of careful conservation (chemical treatment) of virtually all recovered materials.

Archaeological materials can enter saturated settings in several ways. Materials can be intentionally placed in saturated settings such as apparently occurred at Windover, a burial area in east central Florida. Materials can be accidentally discarded or lost in wet settings. In some cases, originally dry sites can be covered with water or organic or other soils that effectively seal the moisture in and limit decay.

PRESERVATION IN WETSITES

Preservation of organic materials, in particular, is what provides much of the scientific potential of many wetsites. The nature of materials recovered in wetsites is dependent upon both what materials are deposited and what materials survive. In many terrestrial sites, organic materials do not survive unless they are carbonized.

Wooden artifacts, stakes, grinding tools, awls, canoes, nets, carvings, baskets, fabrics, etc., appear to be preserved in acidic, basic, and chemically neutral saturated soils (Cushing, 1987; Gilliland, 1975; Beriault et al., 1981; Sears, 1982; Purdy, 1979,1981,1987; MacDonald and Purdy, 1982).

Preservation of soft tissue, in the form of the bog bodies of Europe, is characteristic of acidic bogs where a natural tanning process takes place. Stomach contents, leather, fabric, and other materials may survive (Fischer, 1980; Glob, 1969). Although such acidic bogs exist in the New World, chemical differences, perhaps related to the plants comprising the bog habitat itself, have not produced tanned bodies. Efforts to extract DNA from an English bog body failed and indicate acid bog settings are not conducive to some of the kinds of research that are possible with New World materials (Hughs et al., 1986).

Virtually the only New World parallels in the preservation of soft tissue in wetsites are in the preservation of brain tissue in a number of Florida locations--Windover, with over 90 individuals; Warm Mineral Springs (Royal and Clark, 1960); Bay West (Beriault et al., 1981); Republic Groves (Wharton et al., 1981); and the historic St. Marks Cemetery (Dailey et al., 1972.)

Plant materials (stems, seeds, leaves, pollen, etc.) are common in wetsites and can provide excellent archaeological, climatological, and environmental data (Alexander, 1986; Brooks et al., 1979; DePratter and Howard, 1981; Levathes, 1987; Watts, 1971,1975,1986; Spackman, 1987; Stout, 1986). Preservation of bone, antler, and shell generally requires pH conditions approximating neutrality (Nabergall, 1987).

Stone and ceramic artifacts survive in most wet or dry settings with very little if any deterioration.

WHERE ARE WETSITES FOUND?

Wetsites are more abundant in areas where human activity concentrated, and they can be found in river channels, particularly large, relatively slow moving streams with sand or muddy bottoms that may provide some physical protection to any deposited materials (Cockrell, 1980; Dunbar and Waller, 1983; Waller, 1969). Within the floodplain of water courses, the lower levels of some terrestrial sites may be saturated and can also be classified as wetsites (Purdy, 1987; Jahn and Bullen, 1978).

Some coastal sites are saturated as a result of inundation after deposition (Ruppe', 1980) while others represent events and activities that took place in coastal waters (Cockrell and Murphy, 1978). Shipwrecks are clearly not the only type of coastal wetsites, though they have received the bulk of the attention (Marmelstein, 1975; Marx, 1969).

Wetsites can also be found within lakes, ponds, and springs (Cockrell, 1973; Clausen et al., 1975; Clausen et al., 1979). The Windover materials were approximately 10 ft. below pond bottom in a small 1/4 acre freshwater pond on the east central coast of Florida (Brevard County-Doran, 1986; Doran and Dickel, 1986).

Saturated, but not necessarily submerged, organic soils (peats in particular) are characteristic of wetlands, and the past bogs of Europe are also well known for their archaeological productivity.

At the simplest level, the presence of moisture reduces the physical stress on materials (particularly organic materials) by limiting the frequent hydration/dehydration cycle, which promotes deterioration by expansion and contraction (Stone et al., 1986).

The dynamics of water and/or soil chemistry are also critical in preservation. At Windover and Warm Mineral Springs, Florida, very hard, highly mineralized waters promote preservation. Highly acidic saturated peats have already been mentioned with respect to soft tissue preservation, but at the same time, very acidic conditions can "dissolve" the underlying bone as well as the molecular integrity of some molecules such as DNA (Hughs et al., 1986).

Low oxygen levels (reducing environments) also enhance preservation by limiting the biological activity of decomposing bacterial and fungal organisms.

The physical stability and integrity of the matrix (soil) in which such materials are deposited is also important. Increased movement of materials downslope or across coarse surfaces increases destruction, as will water movement and wave action. At Windover, no fabrics and relatively few articulated skeletal segments were recovered from sloping pond areas. In these locations materials were slowly but inexorably sliding downslope. Where the pond bottom was flatter, approximately 100 articulated burials were recovered, and 37 burials contained had woven fabrics.

Other factors, such as temperature, may also be important. Decay processes of fungi and microbes are reduced at lower temperatures, and this may partially explain the preservation of bog bodies in Europe. Some materials, such as stone artifacts and pottery, are relatively stable, but organic materials are subject to the interplay of changes in moisture levels, temperature, water, and soil chemistry.

Some chemical changes, referred to as digenetic changes, can be precursors to fossilization and involve absorption or depletion of compounds and elements from the soil matrix (Walker and DeNiro, 1986). If the mineralogical component is depleted (demineralization), rapid deterioration can occur. Mineral compounds can also replace organic compounds, and this mineralization, while promoting physical survival, may preclude some chemical and elemental analysis (Buikstra and Mielke, 1985).

At Windover, preliminary analysis of preserved brain tissue indicates a replacement process elevated sulphur levels. Microscopic and macroscopic features are still preserved, as is some molecular structure (Doran et al., 1986). Elemental analysis of bone samples (Hancock, 1987) indicates an abnormal absorption of strontium, obviating some dietary inferences based on trace element analysis (element reference). At the same time, some bone proteins appear well preserved enough for researchers to attempt to develop a biological profile of this 7,000 year old population (Tuross, 1987).

In some wooden artifacts the long fibers providing structural integrity breakdown and conservation becomes difficult. Warping, splitting, checking, and deterioration became problematic. Materials less than 2,000 years old seem to exhibit relative stability while the materials from Windover are more difficult to preserve (Gardner, 1986).

WETSITE DISCOVERY

Archaeological sites (both wet and dry) are often accidentally discovered as a result of construction or other ground disturbing activities. It could be argued that proportionately greater numbers of wetsites escape the attention of archaeologists than dry sites, simply because they are less visible and less accessible.

In addition to accidental discovery, many dry sites are found during archaeological surveys that are designed to identify sites prior to construction or development, as part of cultural resource management programs. Archaeological assessments or surveys are legally required in cases where state or federal property is involved (Tesar, 1986). Survey programs are less effective in wetland and underwater settings.

A large problem in locating wetsites lies in their almost invisible nature and the frequent necessity of entering a "hostile" environment to locate them. Wetsites are either underwater, thus creating problems of simple access, or they are difficult to identify because of the water saturated conditions existing in bog, marsh and lake settings. Literally millions of dryland acres have been surveyed by archaeologists, but only a fraction of the areas with potential wetsites have been effectively studied.

CONSERVATION NECESSITIES OF WETSITE INVESTIGATION

Wetsite investigation is often more difficult and involved than the investigation of a typical terrestrial site. Different excavation strategies may be needed, and the waterlogged condition that preserves materials necessitates special conservation techniques. Some of the Windover procedures will be presented as examples of the conservation requirements necessitated by analytical goals as well as the nature of the materials.

Saturated faunal and human bone was removed from the field in plastic bags and, as rapidly as possible, treated with bulking agents that replaced the water. Initially, polyethylene glycol (PEG) was utilized, but an acrylic emulsion, Rhoplex AC-33 (Conservation Materials, Sparks, Nev.), proved more satisfactory. Small samples of human bone were also removed and frozen for specialized chemical and protein analysis. Concern that molecular changes were continuing to take place even after conservation prompted removal of larger bone samples, which were frozen at -70 centigrade (Tuross, 1987).

Floral materials (seeds, leaves, wooden artifacts, etc.) involved a variety of conservation procedures including refrigeration; alcohol saturation; and treatments with PEG, Damar, and other compounds (Stone et al., 1986). Refrigeration (in sealed containers) reduces the possibility of bacterial or fungi decay and minimizes dehydration. Woven fabrics (made from plant materials) and wooden artifacts undergo a multistep procedure similar to that applied to wooden artifacts. This procedure involves refrigeration, removal of mineral salts by soakings in deionized water, and replacement of water with alcohol/ethulose/PEG solutions. None of the fabric materials has completely passed through the conservation sequence as of December 1987, even though some began treatment over a year ago (Adovasio, 1986).

Brain tissue was rapidly removed, placed in plastic bags, flooded with nitrogen gas, sealed, refrigerated for transport and frozen at -70 centigrade within 24 hours to minimize possible degradation and maximize future analysis possibilities.

Clearly, one of the most profound obligations wetsite investigation entails is a willingness to ensure that the materials recovered are conserved properly, not only for current research needs, but also for future research (Purdy, 1974; Stone et al., 1986).

ACCOMPLISHMENTS OF WET SITE INVESTIGATION--WINDOVER AS AN EXAMPLE

Some have estimated that over 80 percent of most societies' "artifacts" are organic and may not survive in normal archaeological settings. The opportunity to study materials from wetsite settings can provide a much greater understanding of earlier populations and are illustrated by the multidisciplinary research efforts of the Windover Archaeological Research Project.

Excavation at Windover required installation of an extensive wellpoint system (approximately 160 wellpoints between 11-21 ft. in length) which pumped 700 gallons of water per minute 24 hours a day for the first several months of excavation. This demonstrates that dewatering of some wetsites is possible and practical.

The collection, representing a minimum of 155 adults and subadults, is one of the largest samples of human skeletal material of this antiquity in the New World (Taylor et al., 1985; Smith, 1976; Protsch, 1978). The collection dates from between 7,000 and 8,000 years B.P. (before present - A.D. 1950) and represents an Archaic hunting-gathering population (Milanich and Fairbanks, 1980; Smith, 1986; Steponaitis, 1986; Ford, 1985). Data on health, diet, disease, demography, etc., in some ways, represents "base line data" useful in looking not only at human adaptation in this early time, but also as a valuable comparative reference point for understanding later populations' adaptation (Dickel, 1987).

The fabrics from Windover, exhibiting seven different twining and manufacturing techniques, are the oldest fabrics in the southeastern United States and are regarded by some as the largest, most complex set of fabrics of this time period in the New World (Adovasio, 1986). Analysis of the fabrics, bone, antler, stone and wooden artifacts will provide new insights to early craft sophistication.

Plant remains identified as the semidomesticated bottle gourd (Lagenaria siceraria; Newsom, 1987) are the oldest known bottle gourd materials in North America (Smith, 1986; Conrad et al., 1984; Richardson, 1972; Kay et al., 1980). These findings support the proposition that the earliest North American domesticates are tropical plants, and, even at this early date, relations between populations may have been more complex than realized (Ford, 1985).

Identification of preserved human mitochondrial DNA from Windover brain tissue yielded the oldest identified human genetic materials indicating that in some situations molecular analysis of archaeological materials may be possible (Doran et al., 1986).

Study of the preserved bone proteins and amino acids, including (but not limited to), osteonection, transferrin, albumin, IGG, IGN, IGA, methionine, and cystine, provide a unique opportunity to develop a new type of biological profile of an archaeological population. Further studies of these materials should expand our understanding of prehistoric human biology and population relationships (Tuross, 1987).

Detailed analysis of faunal and floral materials are providing data critical to understanding hydrological, climatological, and environmental changes in east central Florida for the last 11,000 years (Newsom, 1987; Nabergall, 1987; Holloway, 1985a, 1985b; Stout, 1986; Spackman, 1987; Flowers, 1985; Frazee, 1986).

THREATS TO WETSITE SURVIVAL

Wetsites, like all archaeological sites, are consistently being destroyed by both natural and human agencies. Natural changes in hydrology and water and matrix chemistry, as well as natural exposure of wetsites by wave action, erosion, etc., can destroy archaeological sites. Some of these destructive agents are beyond normal human control. Some destruction is, however, avoidable, if the importance of the unwritten saga of human experience is recognized, and steps to protect and study such sites are taken.

Urbanization, pipeline construction, dredging, and other coastal and wetland modification are increasingly involving areas containing archaeological materials. If sites can be recognized and activities shifted to avoid sites, such construction may be beneficial in that wetsite locations may be better understood. Furthermore, if such accidentally discovered sites can be investigated, we all benefit.

An invisible threat exists when large scale hydrological patterns are changed for farming, ranching, and other land use needs, and previously saturated areas are dehydrated (Coles, 1984). Archaeological materials below the surface begin to undergo an inexorable dehydration that can eventually lead to total destruction. The loss of these invisible resources is in some ways the most frightening prospect of all. In some areas of the world, such land use changes are associated with peat mining for electrical energy production. Coles has noted that most of the archaeological materials in the Irish National Museum were recovered from wetsite settings (Coles, 1986). As peat is mined without a consideration of the archaeological loss the prospects for understanding many aspects of Ireland's past become increasingly difficult. Coles fears that by the turn of the century the wetsites heritage of Ireland will be irrevocably lost.

Regrettably, intentional relic collecting, without a consideration of the archaeological significance, site integrity, or the potential contribution to our body of knowledge, continues in many areas. In some states, legally sanctioned salvage of archaeologically significant coastal wrecks amounts to little more than pot hunting when insufficient consideration of the scientific importance of the materials exists. This is especially graphic when materials are auctioned off to the highest bidder or the "booty" divided up among investors. Some states, such as Florida, have virtually assured continued pillage by treasure hunters. Other states, like Texas, deem the scientific value of coastal materials sufficiently important to restrict such activities within their coastal waters.

Archaeological sites on state and federal property are protected by state and federal antiquity statutes. Literally millions of dollars are annually spent on seeing that this priceless heritage is not wantonly destroyed. By and large, sites on private property are afforded virtually no protection. Regrettably, even when owners are cooperative, investigations are severely impeded by the lack of funds for proper scientific treatment of these important legacies of human experience.

ARE SOME AREAS MORE LIKELY TO PRODUCE WETSITES THAN OTHERS?

While reliable models capable of predicting wetsite locations are relatively crude, some generalizations about possible locations of wetsites may be helpful.

In North America, wetsites discovery would seem most likely in areas that have been submerged in the last 12,000 years and are, or were, in relatively low energy settings where conditions for preservation may be better. Areas that are rich in organic soils (peats and related soils) may contain significant archaeological materials. When such areas were frequently inhabited or visited by prehistoric and historic peoples, the possibility of wetsite occurrence increases. Submerged peatlands, stream channels, estuary and bay margins would be likely to contain saturated archaeological materials.

During the course of construction, dredging, etc., the following kinds of materials might be discovered:

- o large wooden artifacts (stakes, canoes, etc.)
- o human skeletal material (bones of the leg and skull are the largest and probably the most noticeable)
- o pot sherds, charred bone, fabrics, and small wooden artifacts (these would be very difficult to casually identify in dark peaty soils)
- o stone artifacts (although small, if they are a light color they could be distinct against a dark peaty soil)

Any observed materials should be collected and resubmerged in water; further impact to the site should be minimized if at all possible; the location or general area they came from recorded, and an archaeologist contacted as rapidly as possible.

Pragmatic observers have shrewdly noted the media attention that can result from such discoveries and subsequent investigations can create a very positive public image for a company or industry. Local business may also benefit from the increased tourism such sites may generate. Careful planning can also incorporate tours of the site by local dignitaries, school groups, civic organizations enhancing education about archaeological resources. We estimate in the three years of excavation (August - Jan.) between 10,000 and 15,000 people visited Windover. On the Open House Weekend at Windover over 4,000 people visited the site. Needless to say, such public interest requires forethought and planning.

This is almost the exact scenario that began in 1982 when the Windover site was discovered. The accidental discovery, shifts in construction routes, involvement of archaeologists, and the discoveries of the last three years have been reported worldwide. As a result, thousands of central Florida citizens are better informed and more aware of the rich Florida archaeological heritage.

Recognition of the significance of archaeological resources is no guarantee that they will be safe, but it is the first step. Only through enlightened management and understanding of the potential of wetsites to vividly and uniquely reveal the saga of human existence will our prehistoric heritage be safe.

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Results and Implications of the Multidisciplinary Archaeological Research Project at Warm Mineral Springs, Florida

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Warm Mineral Springs is a 70-meter-deep, spring-fed sinkhole 16 kilometers inland from the Gulf of Mexico in Sarasota County, Florida. Saline, anerobic water, originating in the Floridian Aquifer some 1,000 meters below surface, enters the cenote at a depth of 70 meters below water surface at a temperature of 32-34 degrees C. The principal hot water spring provides some 19.4 million gallons per day.

The cenote's limestone walls are draped intermittently with dripstone formation zones from 4 to 30 meters below surface; additionally, the underwater sediments have been producing exotic tufa specimens. The limestone matrix is of the Hawthorne Formation of the Miocene.

There are three archaeological components: 1) the remains located on land, 2) dry-laid deposits on the 13-meter-below surface ledge, and 3) deposits in the debris cone on the bottom below 40 meters.

Recovered archaeological deposits range from Formative Stage artifacts (ethnographic present back to approximately 2,500 B.P.) artifacts from the Archaic Stage (2,500 B.P. to approximately 8-9,000 B.P.), and Paleo-Indian Stage materials dating back thus far to 11,000 radiocarbon-years B.P.. The oldest human remains stratigraphically and chronologically coexist with ground sloth, saber cat, horse, camel, and extant species. Well-preserved botanical remains provide a continuous record extending back an estimated 30,000 years from the initial opening of the cavity during a time of lowered sea level.

Current research is principally conducted on the 13-meter ledge and on the debris cone 50 meters below surface. Both SCUBA and surface-supplied air have been used. Technology consists of time-honored archaeological techniques coupled with innovations, when need dictates. Mixed gas diving with surface decompression on oxygen is planned for the upcoming dive season in order to increase bottom time and diver safety.

Warm Mineral Springs and related sites have long been seen by the principal investigator as furnishing primary critical data for predictive modelling for site location on the Outer Continental Shelf. 1 In 1973 the Bureau of Land Management was first informed of the research value of this type site, and subsequent papers have continued to emphasize the technical and scientific applications of the Warm Mineral Springs research.

Phase I of the writer's research as principal investigator was conducted as Florida State Underwater Archaeologist from 1972-1983; Phase II began in 1983 and continues, funded by the Florida State Legislature currently through Florida State University's Department of Anthropology.

Mr. Wilburn A. Cockrell is the Director of the Warm Mineral Springs Archaeological Research Project, Florida State University. He holds a B.A. in anthropology (University of Alabama, 1963), an M.A. in anthropology (Florida State University, 1970) and has completed all but dissertation for his Ph.D. in anthropology at Arizona State University. He began Phase I research at the 12,000-year-old prehistoric site at Warm Mineral Springs as Florida State Underwater Archaeologist in 1972; Phase II of his research began in 1983 and continues, funded by the Florida State Legislature. He has published extensively on early man studies and submerged terrestrial sites, as well as shipwreck archaeology and related legal issues.

Some Archaeological Sites in the Apalachee Bay of Florida

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The results of our survey showed relevant lithic artifactual materials in 4 of 5 outcrops located. Of these, 3 are found close to shore, in more than 6 feet of water (WA 275, 267, JE654). More significantly, a relict channel of the Econfina River was identified in 12 feet of water 2.5 miles offshore, and significant numbers of artifacts, including bifacially trimmed cores and numerous flakes were found at its margins. In no cases were overlying neritic sediments more than 15 cm, and the relict channel was easily identified by its depression and the lack of plant material in it. Associated with the lithic debris were pieces of cypress wood which dated to 5,160 $\pm$ 100 bp (A-4696 University of Arizona and NSF grant BNS 8505083).

The results of this survey have substantiated our ideas of the ease of identity of relict features in inundated karst geomorphology, the technique of finding outcrops as lithic procurement areas, and the potential of finding other kinds of prehistoric settlements. The goals of our next season are to continue identification of relict channels, search for sea level standstills, and obtain core samples of river stratigraphies. Two other sites (JE 652, 653) have been added since our initial survey, and we expect to find many more.

Many anthropologists who are concerned with reconstructing the transition from Paleo - Indian to Archaic adaptations are in the same boat with Quaternary geologists who are interested in the transition from Pleistocene to Holocene time: both are acutely aware of the reality of sea level rise and the need for more data from now inundated continental shelves. Missing data include information about relict geomorphology, past human settlement patterns, and the timing and effects of sea level rise on them. While much work has been published about the extent, character, and timing of sea level change (Bloom, 1977, 1983; Morner, 1971; Ruddiman and Duplessey, 1985, for samplers), the archaeological literature is virtually empty of reports of the inundated shelf sites, particularly from late Pleistocene early Holocene context (see Flemming, 1983 for survey). This paper reports the findings of mid-Holocene relict geomorphology and archaeological sites in the Apalachee Bay of Florida, and suggests the high potential of finding many more, including terminal Pleistocene ones.

To suggest that continental shelves represent a missing and potential data set is not to understress the difficulty of finding either relict topographic, geologic features, or archaeological sites. Wave destruction, and Holocene alluvial, and nertic sedimentation are significant processes in the obscuring of Pleistocene details (Flemming, 1983; Emery and Edwards, 1966; Coastal Environments, 1977). These facts, in combination with the logistics of working underwater, can be offset by locating research in areas with minimal alteration since the Pleistocene, by relevant stratigraphic data, and by adequate archaeologic potential (i.e. high density sites of relevant time periods), thus ensuring cost-effective, multidisciplinary research activities. The Apalachee Bay of northwestern Florida is just such an area (Figure 12.2).

A pilot survey by J.S. Dunbar (Florida Department of State), M.K. Faught (University of Arizona), and PART of Florida (a competent amateur organization) was undertaken in July of 1986 to assess the potential of finding offshore archaeology and geomorphology. Our survey area included the nearshore regions of the St. Marks, Aucilla, and Econfina Rivers of the Apalachee Bay. The associated onshore region, the Ocala Uplift, is a raised karst feature with the Floridian aquifer at the surface. High density extinct faunal remains and Paleolithic to Archaic lithic artifacts are well known in the region (Neil, 1964; Dunbar and Waller, 1983), and are currently under professional underwater excavation (Dunbar, et al., In Press). Alluvial sedimentation in these rivers is rare because of the solution characteristics of karst drainage, and sinkholes within the onshore rivers collect quiet water peat and marl sediments, with a high degree of organic preservation. Most terrestrial rock outcrops are the loci of dense chert, and are likely spots for prehistoric lithic procurement. Our survey procedure was to locate inundated wreck outcrops and hand fan the neritic sediments while looking for artifacts. This kind of research was predicted, if not actuated, by the work of Ruppe' (1980), farther south in Venice, Florida.

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Preliminary Archaeological Investigations at Ray Hole Spring

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In early October 1986, the Minerals Management Service (MMS), in cooperation with the Florida Bureau of Archaeological Research (FBAR), conducted a preliminary underwater archaeological investigation and testing program at Ray Hole Spring. FBAR first became interested in Ray Hole Spring through interactions with the sport diving community from the Tallahassee area. Several sport divers contacted Mr. James Dunbar of FBAR, suggested that the spring may be an archaeological site, and offered to take him to the spring. The MMS was working with the State of Florida and FBAR with mutual research interests in locating the prehistoric archaeological potential of Ray Hole Spring. The two agencies put together a low-budget, cooperative research effort to conduct a preliminary archaeological investigation.

Ray Hole Spring is a submerged karst feature located on the OCS approximately 88.5 kilometers southeast of Tallahassee, Florida, and about 38.6 kilometers from the nearest Florida landfall. The spring is a typical karst feature probably formed during the Pleistocene as a result of the surface limestone collapsing or solutional or mechanical action caused by underground drainage (Glossary of Geology, 1974).

A 1976 Florida Bureau of Geology bulletin titled "Springs of Florida" describes Ray Hole Spring as an occasionally flowing spring lying in 11.6 meters of water and measuring 7.6 meters in diameter. The north side of the sink slopes southeast and the southeast side of the sink has a nearly vertical limestone wall to a depth of 18 meters. A cave strikes down and southeast from the 18 meter depth to approximately 30 meters (Figure 12.3).

The October 1986 investigation of the spring by MMS and FBAR revealed a totally different environmental setting at the site. The diving reconnaissance indicated that the spring has almost completely filled in with recent (since 1976) marine shell detritus. Only about 3 meters of relief exist in the southeastern end of the sink. The archaeological investigation of the site included diver swimming reconnaissance, mapping, attempts at coring, and waterjet excavation of selected test units. Coring was discontinued because the coring tool made very little penetration in the shell matrix as a result of the small core diameter and the large size matrix of the marine shell detritus.

After negative results from Test Units 1 and 2 and Core Tests 1 and 2, testing was moved to the outer rim of the sink. The rim of the sink has a thin layer of carbonate sand underlain by limestone rock. The MMS and FBAR dive team began excavating with the waterjet at a large crevice. Our initial theory was that if this was an archaeological site that some cultural material may have fallen or may have been washed into one of the many crevices around the edge of the sink and become trapped. The crevice we selected measured approximately 15 centimeters in width and was oriented in a southwesterly direction towards the rim of the sinkhole. Waterjet excavation, approximately 15-20 centimeters into the crevice, recovered several probable, culturally-modified limestone or chert flakes. This material was returned to the surface for examination. Continued waterjet excavation of the crevice yielded a lens of articulated whole oyster shell at the 75 centimeters level; at 1-meter depth, waterlogged wood was encountered. Samples of the shell and wood were collected, returned to the surface, and stabilized for future analysis. Below the point where the wood samples were recovered, the crevice narrowed and bottomed out. Excavation was terminated as was the initial archaeological testing.

In April 1987, analysis was conducted on the oyster and wood samples to identify the species and to obtain a radiocarbon date of this organic material. The wood species was identified as live oak, and radiocarbon dates for the oyster shell and wood were dated 7,390 $\pm$ 60 years B.P. and 8,220 $\pm$ 80 years B.P., respectively. The wood sample dated approximately 1,000 years older than the oyster shell and was recovered in a lower stratigraphic level than the oyster shell, which suggests that these organic materials were deposited in situ.

Preliminary analysis of the data collected at Ray Hole Spring suggests that this sinkhole may be a prehistoric archaeological site. Several factors (environmental and possibly cultural) tend to support this initial contention. The radiocarbon dates obtained at Ray Hole Spring in combination with the regional sea level curve (Figure 12.4, CEI, 1983 and 1986) indicate that approximately 8,200 years ago B.P. the sinkhole was a freshwater site supporting freshwater flora. Some time after 8,200 B.P., the sea level began to rise, and by approximately 7,400 B.P., the Ray Hole Spring area was supporting a shellfish population in a brackish water environment.

In addition, a cultural manifestation may exist at Ray Hole Spring. The two large limestone/chert flakes that were collected were examined by five archaeologists. They all seem to agree that the way the flakes were removed from the lithic core suggests that these flakes could have been produced by prehistoric man. However, they also agree that just two flakes alone usually do not constitute an archaeological site (Figure 12.5, depicts one of the potential decortication flakes).

Obviously, there is more work to be done to verify Ray Hole Spring as an authentic archaeological site. This includes a proper level of funding to conduct an intensive testing program, remote sensing studies to determine the true depth and profile of the sinkhole, coring of the sediment cone to gather paleoenvironmental data, more organic sample collecting for radiocarbon analysis, and, hopefully, the recovery of diagnostic lithic artifacts.

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Archaeological Sites in the Drowned Tertiary Karst Regions of the Eastern Gulf of Mexico

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INTRODUCTION

Prehistoric archaeological sites inundated by the sea are the most elusive sites to locate. They may be deeply buried and inaccessible in some regions of the continental shelf and may be shallow but difficult to identify in others. The karstic area of the Florida Gulf Coast represents a unique archaeological area where Paleo Indian remains are highly concentrated and sedimentation has been minimal. The number of Paleo Indian sites located in inland freshwater and terrestrial locations is substantial, but few offshore sites have been located because marine growth and weathering have tended to conceal site locations.

Given the difficulties associated with locating offshore sites, a model based on the type and distribution of sites on the adjacent coast was employed in the Apalachee Bay region of the Gulf of Mexico offshore survey work (reports by Faught and Anuskiewicz this session), incorporating the assistance of fishermen and sport divers familiar with the project area. In three days, Mike Faught's survey located four archaeological sites from one to four miles offshore. Rik Anuskiewicz and Melanie Stright surveyed Ray Hole Spring some 20 miles offshore and discovered evidence of what may prove to be a drowned archaeological site.

ARCHAEOLOGICAL AND GEOHYDROLOGICAL BACKGROUND

As early as the late 1930s, unusual underwater discoveries, including partially articulated mastodon remains associated with stone tools, were being investigated in Florida (Jenks and Simpson, 1941). Almost thirty years later, Wilfred Neill (1964) introduced the "Oasis Hypothesis," proposing that some underwater artifact concentrations represented drowned terrestrial sites. Geologist Kelly Brooks (1973a & b) believed that the availability of surface water for drinking fluctuated so radically over the last 15,000 years that it impacted prehistoric populations. He proposed that potable water existed as climate-dependent, parched systems (intermittent ponds, lakes, etc.) or as exposures of the drought-tolerant Tertiary limestone aquifer system--the Floridian aquifer.

Perched water tables occur as localized systems in some areas of Florida, but quickly shrink if extended droughts starve modern water budgets. In geologic time, long term trends have shifted from arid to wet, and vice versa; thus perched systems have been intermittently turned on and off. When perched water systems existed, the abundance of surface water increased; therefore, settlement options and site distributions became more widespread (Dunbar and Waller, 1983).

Even though the massive Floridian Aquifer is drought tolerant, it has fluctuated with sea level, having low stands during glacial phases and near present or higher stands during the interglacial phases of the Pleistocene (Webb, 1974). Glacial stage water tables as low as 48 meters below present occurred prior to the human habitation of Florida (Brooks, 1967). Investigations of the inundated Devils Den and Little Salt Springs sites revealed that the aquifer was greater than 25 meters below present water level, when human activity was taking place (Webb, 1974 and Clausen et.al., 1979). Parched water systems were greatly reduced during dry climatic phases, and as a result, site distributions were restricted to areas with persistent supplies--mainly aquifer locations (Dunbar and Waller, 1983).

Prehistoric site distributions in Florida occurred in changing patterns not only linked to evolving technologies but to fluctuations in regional surface water systems. The availability of potable water in relation to other needed resources helped dictate possible site locations through time (Dunbar and Waller, 1983). There are three major geohydraulic regions in Florida (Bush, 1982) where potable water supplies varied with climatic changes:

1. The OUTLYING REGION, where the Tertiary limestones are buried by more than 35 meters of younger sediment. A region rarely breached by sinkholes, potable surface water occurs in local, climate dependent, perched systems. Lithic resources for tool production are rare to non-existent.
2. The MARGINAL REGION, where the Tertiary limestones are buried up to 35 meters deep. This region is breached by open sinkholes that penetrate the overlying sediment to expose the limestone. Limestone exposures may occur above but more often below present water tables. Lithic resources

include chert bearing Tertiary limestones and opalized inclusions in the Hawthorne Formation. Lithic resources are not abundant.

3. The TERTIARY KARST REGION, where the limestone occurs near or at the ground surface. The Tertiary limestones of Florida hold one of the nation's largest grown water systems—the Floridian Aquifer. The Tertiary limestones also contain the best and only major chert rock resource in Florida.

Ninety percent of the Paleo Indian sites containing Clovis, Suwannee or Simpson projectiles are located near karst depressions that penetrate the Tertiary limestones of Florida (155 of a total of 172 sites). The Tertiary Karst Region has 71 percent of the sites, the Marginal Region 17 percent of the sites, and the Outlying Region 12 percent of the sites (Figure 12.6). Some sites are located around isolated sinkholes and solution depressions (9 percent), but most occur in areas where multiple karst features occur together and dominate the topography (81 percent). The largest site clusters are located n and around mature karst river channels (60 percent) with smaller but significant clusters centered around karstified lakes, bays, and prairies (23 percent). In Florida, the distribution of Clovis/Suwannee sites indicates settlement patterns were centered where natural resources were most abundant, particularly drinking water and lithic supplies (Dunbar, 1987). For example, natural resource availability in karst river systems has been expressed as a hypothesis for archaeological testing:

> "The river basins in the (two) Tertiary karst regions of Florida have the greatest concentration of Clovis/Suwannee Paleo Indian sites because unique environmental conditions created natural resource accumulations that complemented technology and subsistence behavior. Stable habitats in the karst regions supported grazing animals but drought intervals confined game herds to oasis locals. During droughts, oases in the karst river bottoms offered water, food, bone, and lithic resources for Paleo Indian exploitation. As a result, major site clusters in Florida became centered around rivers like the Santa Fe and Aucilla because multiple resources were available, and repeated exploitation could be supported. During wet periods when intermittent water sources existed above the river valleys, game herds dispersed, and with them mobile hunting groups. Thus a semi-sedentary Paleo Indian life way may have existed with prolonged river camp occupations and less frequent periods of high hunter/gatherer mobility" (Dunbar, 1987).

The geohydraulic history of the Tertiary Karst Region has been dynamic, including the Holocene (ca. 10,000 years ago to present) inundation of many former land areas by transgressing seas or inland water table rises. The Inundation of sites in karstic terrain has promoted good organic preservation and, as a result, promises to yield some of the most informative archaeological remains in the eastern United States. The potential for major archaeological discoveries seems as great offshore as those that have been made inland in sinkholes, springs, and in karst rivers like the Aucilla.

THE AUCILLA RIVER AREA AS A MODEL TO LOCATE OFFSHORE SITES

The Aucilla River is a limestone entrenched river system that flows into the central area of Apalachee Bay. The mouth of the river is located about 50 miles southeast of Tallahassee, Florida. Since 1983, several research expeditions have been conducted in the Aucilla River, including its tributary, the Wacissa River. Numerous land and underwater sites have been recorded. Major research has been conducted on the Page/Ladson site (8Je591) located in the Half Mile Rise section of the Aucilla River. The underwater component of the Page/Ladson site has reveled a stratified sequence some 4 meters thick with in-situ cultural levels 9,500 to 12,000 years old (Dunbar, et.al., In Press).

In the Aucilla River area, Paleo Indian site locations occur in predictable patterns. Large sites are located adjacent to and in river channel segments that are breached by sinkholes. Small or infrequently used sites occur in, around, and away from the river, sometimes around isolated sinkholes. Flint (chert) quarry areas are located in a number of locations, including in the river channel, around sinkholes, and in the surrounding karstic terrain, where erosion resistant chert boulders protrude above the flat coastal terrain.

Prehistoric sites in the flat terrain near the Aucilla River are difficult to locate. Fortunately, any of the most interesting sites are located around obvious features such as chert rock outcrops, sinkholes, and in the river basin.

THE PREDICTABILITY OF OFFSHORE SITES IN APALACHEE BAY

The search for offshore sites becomes much easier if one can locate inundated sinkholes, river channels, and chert rock outcrops as convenient guide posts. The irregular topography associated with these features attracts fish and other marine life which, in turn, attract fishermen and sport divers. Many potential site locations have already been pinpointed. In Apalachee Bay and along the Gulf Coast to Tampa Bay, there are hundreds, probably thousands, of topographic targets to inspect.

The need to conduct offshore archaeological research is overdue. Other than our cursory survey (which did demonstrate numerous sites exist), no meaningful work has been attempted in the Tertiary Karst Region of the Florida shelf. Much of the karst area is environmentally sensitive with numerous sea grass beds and rock outcrops representing breeding areas for marine life. The knowledge we have gained about the marine environment, in all its subtle detail, has been gathered by extensive scientific investigation. Conversely, the archaeological resource has been ignored and is rarely acknowledged and almost never studied.

If we are to fully understand the archaeological potential in the Tertiary Karst Region of the eastern Gulf of Mexico, basic archaeological research questions must be answered. Not only are these research questions important to archaeology in general but also to resource managers who need information to properly manage offshore resources. Therefore, future research on the karstic Florida shelf should consider the following questions:

1. At given points in time from 15,000 to 5,000 years before present, can absolute sea level stands be identified to allow chronologically evolving site predictive models? Coring sinkholes to obtain dateable freshwater and saltwater sediments should provide an absolute sea level curve and

paleo-environmental data to answer this research question.

2. Do archaeological sites exist in the eastern Gulf of Mexico that have stratigraphic integrity despite Holocene sea level transgressions and marine erosive conditions? This question is of particular importance to the limestone sediment starved study area. Conducting limited test excavations to determine site integrity should answer this research question.
3. What is the variety of archaeological sites encountered?--For example, resource procurement vs. habitation sites, coastal oriented vs. inland, major base camp vs. small habitation areas? This questions may also be answered by limited test excavation.
4. Once prehistoric offshore sites are located, can remote sensing instruments provide diagnostic signatures of the known sites? Can prehistoric sites be located with remote sensing equipment once known sites have been scanned? Can it locate several sites in a variety of marine settings and conduct remote sensing surveys to determine if diagnostic signatures are obtainable? If so utilize, this data in an attempt to locate sites with remote sensing equipment.

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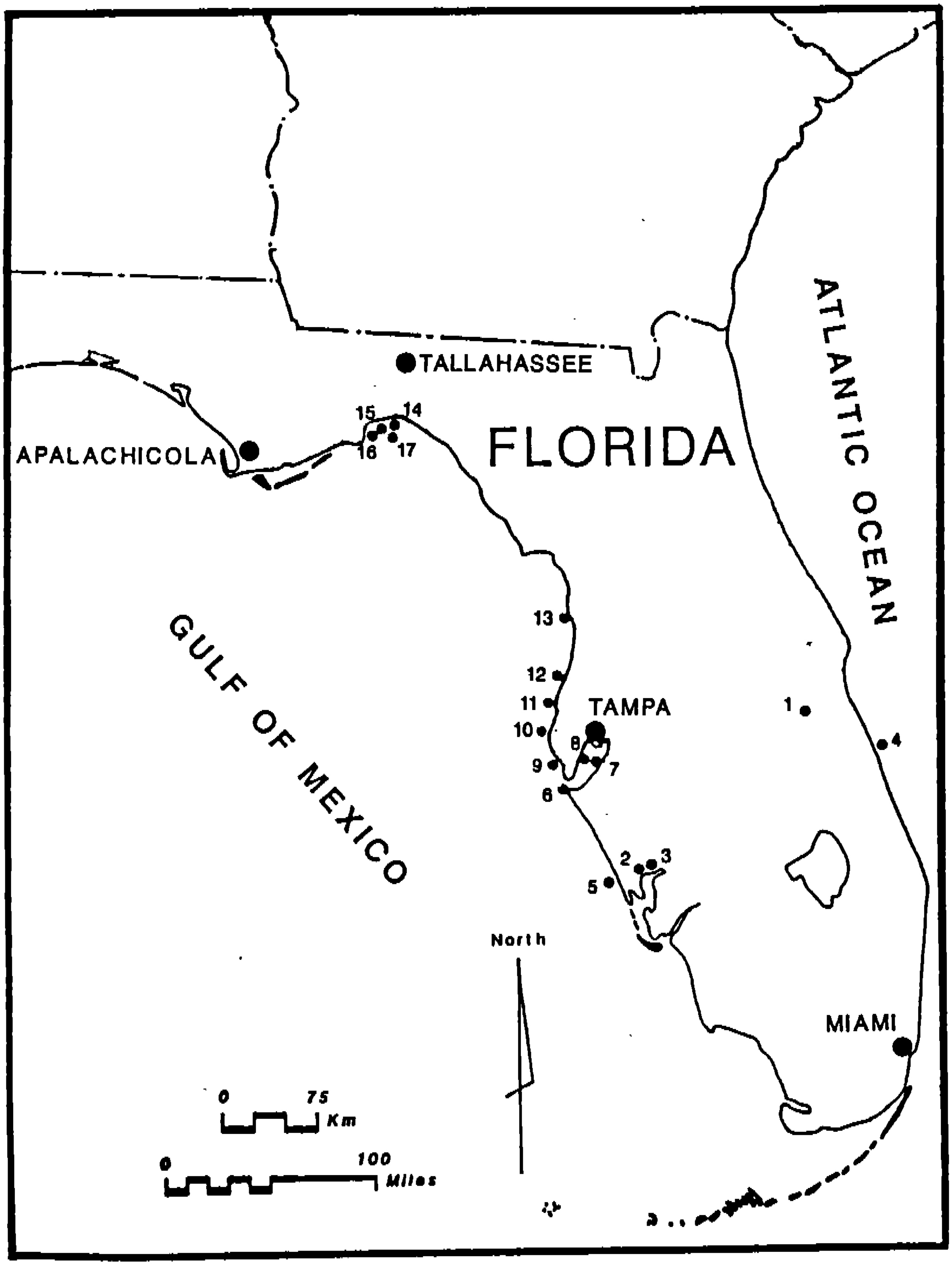

Figure 12.1.--Inundated archaeological sites of coastal Florida.

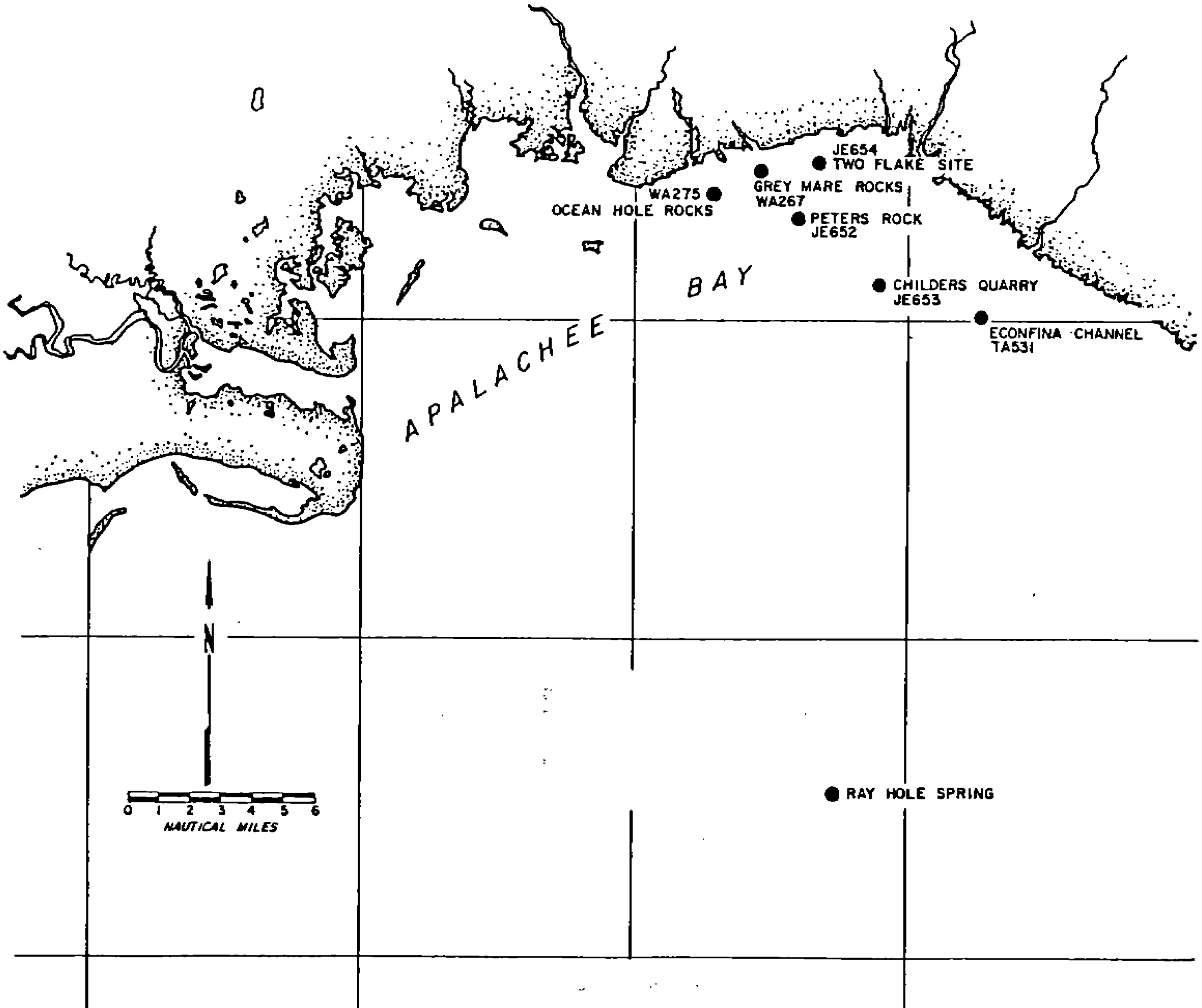

Figure 12.2.--Archaeological sites in Apalachee Bay.

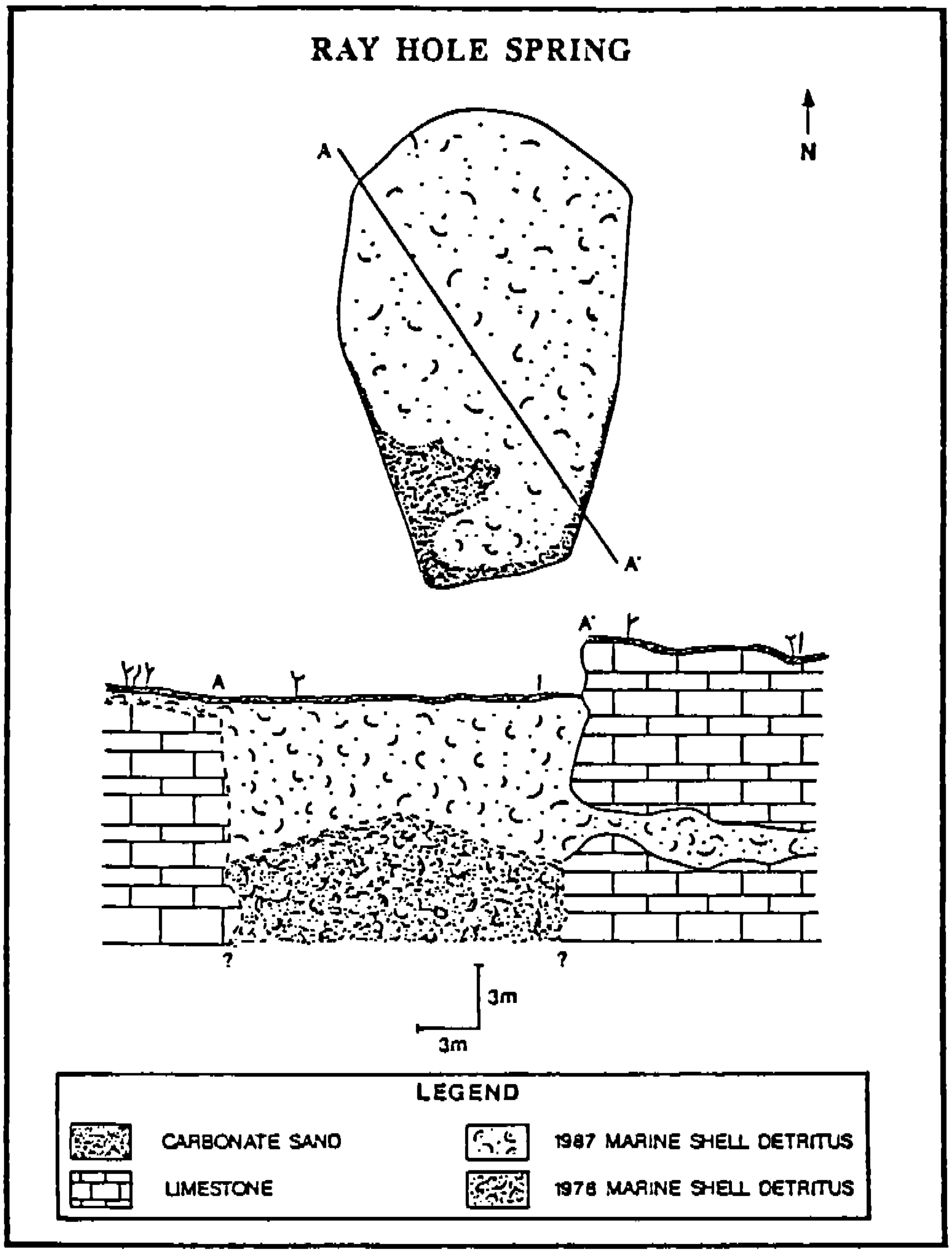

Figure 12.3.--Cross-section drawing of Ray Hole Spring.

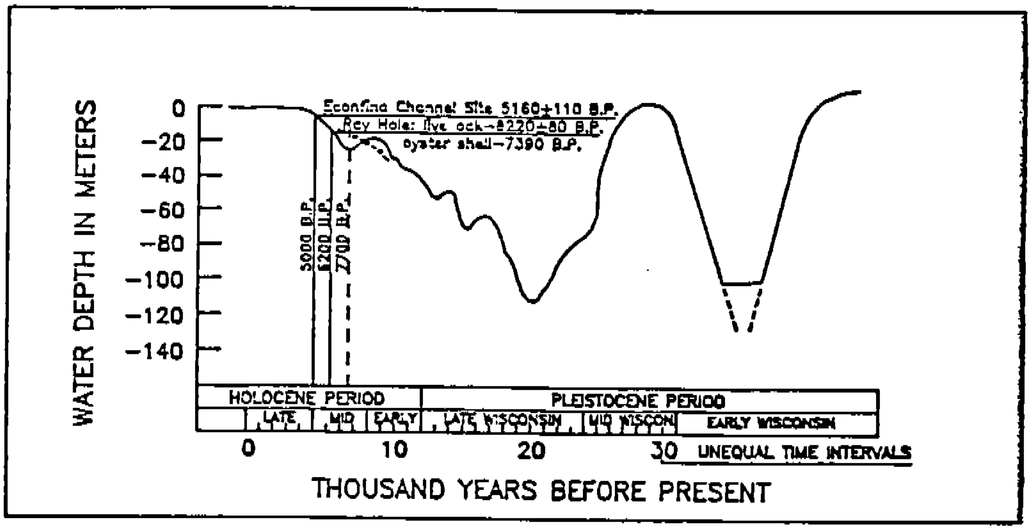

Figure 12.4.--Sea level curve for the Gulf of Mexico.

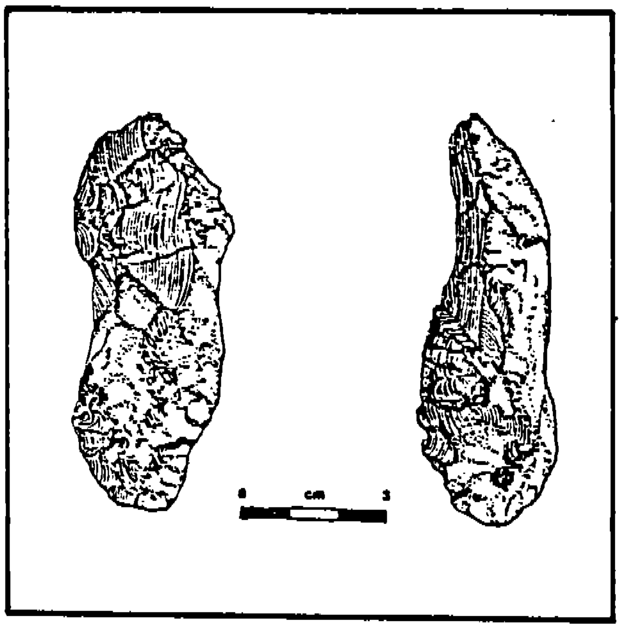

Figure 12.5.--Possible decortication flake associated with Ray Hole Spring.

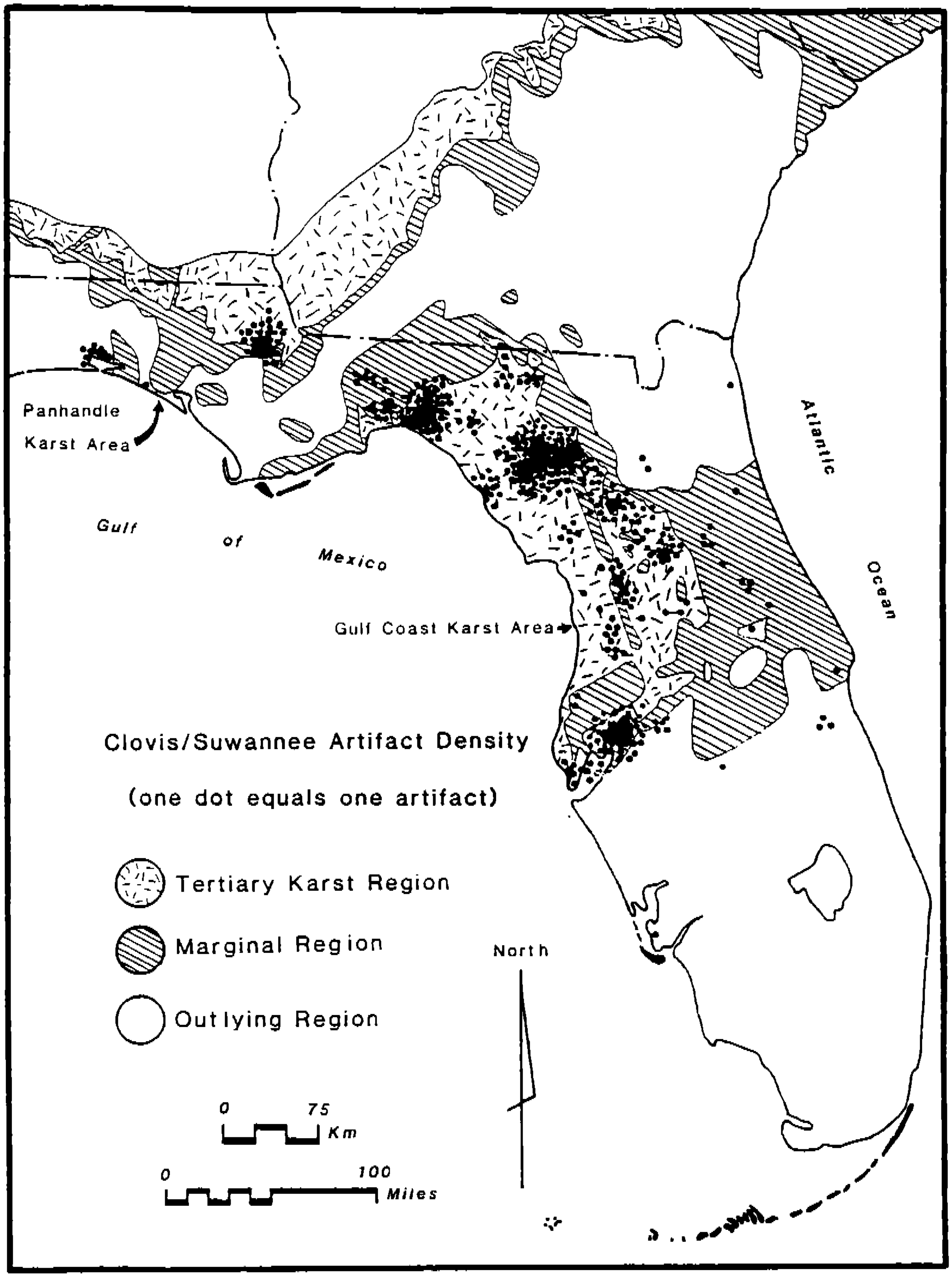

Figure 12.6.--Distribution pattern of diagnostic Clovis, Suwannee, and Simpson artifacts in the Outlying, Marginal, and Tertiary Karst Regions of Florida.