REPORTS

THE UNDERWATER ARCHAEOLOGY OF PALEOLANDSCAPES, APALACHEE BAY, FLORIDA

Michael K. Faught

Submerged prehistoric sites investigated in northwest Florida along the margins of the drowned Aucilla River channel (or PaleoAucilla) extend our understanding of prehistoric settlement patterns and paleolandscape utilization. Bifacial and unifacial tools indicate Late Paleoindian and Early Archaic logistical activities at these sites, as well as later Middle Archaic occupations. Other evidence for terrestrial conditions at these sites include extinct and extant terrestrial faunal remains, in-place tree stumps, and possible eroded middle Holocene shell middens. This report outlines the methodologies used for site investigations, and then discusses the geomorphic setting, character, cultural-historical connections, and timing of full inundation for these offshore sites. During late Pleistocene and early Holocene times, the coastline was much farther out on the continental shelf, and this segment of the PaleoAucilla was forested and well inland. Later, during the middle Holocene stages of transgression, the segment was more of a wide grassy marsh with brackish water tidal creeks and oysters. In this continental shelf setting, submerged archaeological sites remain in clustered arrays accessible by underwater archaeological methods, and the data provide a critical supplement to our present understanding of late Pleistocene and early Holocene settlement patterns and paleolandscape utilization.

Los sitios prehistóricos sumergidos en la placa continental del Golfo de México presentados en este artículo han producido hallazgos de restos liticos que se han diagnosticado como pertenecientes a los tiempos culturales Paleoindio (época geológica tardio Pleistocénica) y Arcaico (época geológica temprana Holocenica). Estos hallazgos confirman y extienden la ocupación y el patron de asentiamento prehistórico del noroeste de la Florida al fin de Pleistocenica, que es ya conocida a través de excavaciones terrestres en esta área. Al alejarse de la costa, estos sitios representan ocupaciones más antiguas y así aumentan nuestro conocimiento de las estrategias de población y organización de los Paleoindios Clovis y sus descendientes. Finalmente, las investigaciones presentadas en este artículo fomentan mayores estudios de la placa continental como sitio potencial de restos prehistóricos. Esta información enfoca en el desarollo de los principios y métodos básicos necesarios para el estudio de los sitios prehistóricos sumergidos en otras areas del mundo.

Our understanding of North American late Pleistocene and early Holocene settlement ranges, coastal occupations, and migration pathways is incomplete because post-glacial sea-level rise submerged paleolandscapes on the continental shelves of both coasts (Dunbar et al. 1992; Emery and Edwards 1966; Erlandson 2001; Faught 1996; Johnson and Stright 1992; Masters and Flemming 1983; Stright 1990, 1995). Underwater archaeology is the only way to investigate these settings, but the underwater archaeology of continental shelf submerged prehistoric sites is a nascent subdiscipline with only a few examples of sustained research projects. In principle, places in North America with concentrations of Paleoindian and Early Archaic sites adjacent to drowned continental shelf paleolandscapes have good potential for early sites offshore (Anderson and Faught 2000; Blanton 1996; Dixon 2001; Easton 1992; Emery and Edwards 1966; Erlandson and Moss 1996; Faught 1996; Fedje and Christensen 1999; Josenhans et al. 1997; Masters and Flemming 1983; Masters and Gallegos 1997;). In the eastern and southeastern United States, Clovis-related Paleoindian and Early Archaic sites are frequent and the adjacent continental shelves are broad and extensive (Anderson and Faught 2000; Bonnichsen and Turnmire 1999; Ellis et al. 1998; Faught 1996; Smith 1986). Northwestern Florida, in particular, has abundant evidence for early population concentrations and the area of adjacent drowned continental shelf is substantial.

Michael K. Faught ■ Department of Anthropology, Florida State University, Tallahassee, Florida 32306 (mfaught@mailer.fsu.edu)

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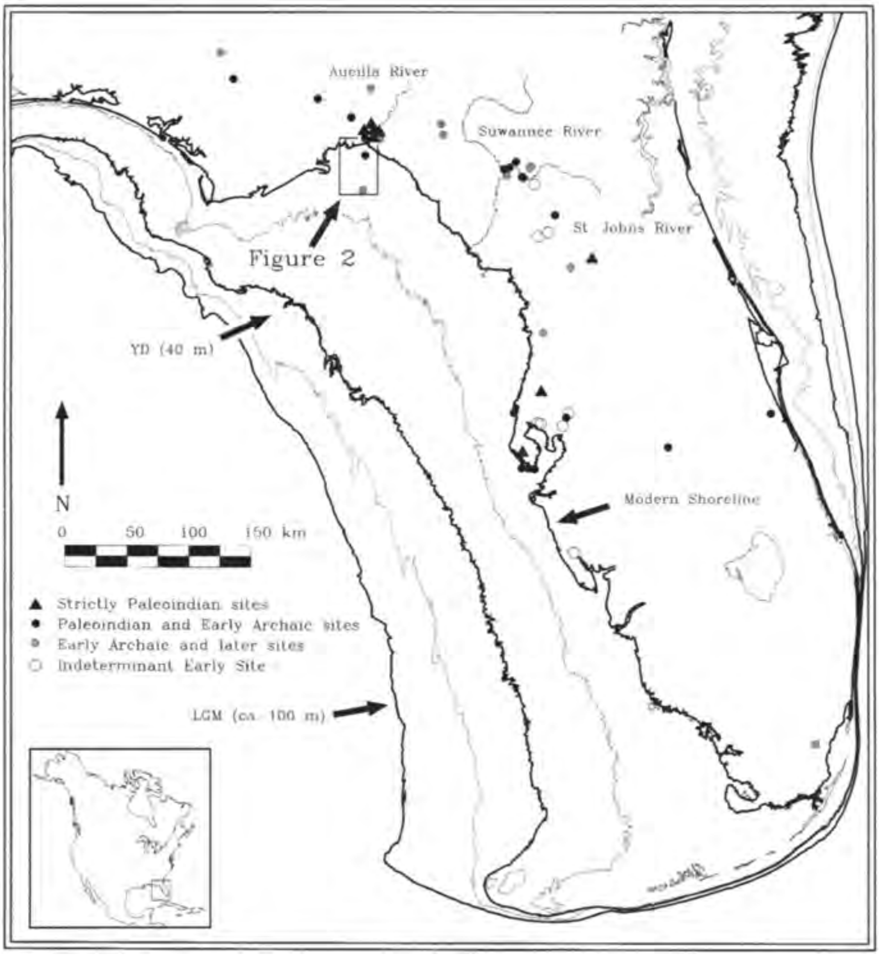

Figure 1. Peninsular Florida, showing the distribution of terrestrial Paleoindian and Early Archaic archaeological sites adapted from Dunbar (1991) and Faught (1996, 2004a). The image also includes bathymetric contours (isobaths) of the continental shelf offshore at selected 20-m intervals. The 100-m isobath represents the probable extent of the late glacial maximum (LGM) paleolandscape, the 40-m isobath the possible Younger Dryas (YD) shoreline, and the 20-m isobath the possible shoreline at 8000 B.P. The boundary of Figure 2 (Apalachee Bay) is also shown.

This report focuses on the distribution of a sample of nine submerged prehistoric sites located around one segment, or reach of the drowned Aucilla (or *PaleoAucilla)* river channel in northwest Florida.[1] These sites currently lie 6–9 km from the modern coastline, in 4–6 m of seawater. The methodologies used and integrity of sites found are discussed, but the intent is to portray the distribution of sites from a submerged paleolandscape setting. In Figure 1 the locations of late Pleistocene and early Holocene archaeological sites known in Florida terrestrially are shown, as are selected bathymetric contours on the continental shelf offshore (Dunbar 1991; Dunbar et al. 1988; Faught 2004a; Faught and Carter 1998; Faught and Donoghue 1997). Early sites in Florida are usually associated with rivers, springs, and other karst geologic formations (Dunbar 1991). In Table 1 I organize the age and sequence of regional diagnostic artifact styles, the stages of transgression, and the probable paleoshoreline depths expected offshore.

It is clear that global sea-level rise occurred in two major melt-water pulses interrupted by the Younger Dryas (YD) climatic interval (Fairbanks 1989; Ruddiman and Duplessy 1985; Waelbroeck et al. 2001). At the late glacial maximum (LGM) the western Floridian continental shelf extended 185 km or more from the modern Aucilla at depths somewhere between 60 and 100 m below present sea level (Ballard and Uchupi 1970; Faught and

Table 1. Culture Historical Sequence Based on Diagnostic Projectile Points and Expected Sea Levels in Northwestern Florida.

Projectile Point Type Names and Estimated Ages	Stage of Transgression	Probable Maximum Depth of Occurrences
Archaic Stemmed Several varieties 8000 to 5000 B.P.	Last Phases of Submergence	5 to 10 m
	Possible Lacuna of Occupation, change of settlement pattern	
Later Corner Notched Bolen, Palmer, Kirk Up to 9000 B.P.	Second Melt-Water Pulse L/MWP 1b	20 m +
Early Notched Points Bolen, Big Sandy, Taylor 10,000 B.P.	End of Younger Dryas	40 m
Unfluted lanceolates Suwannee, Simpson, Quad, Greenbriar 10,500 B.P. estimate	Younger Dryas	40 m
Fluted lanceolates Clovis 11,000 B.P. estimate	Last of First Melt-Water Pulse MWP 1a	40 m +

Note: Refer to Anderson and Sassaman (1996); Faught and Carter 1998; and Faught and Donoghue (1997) for additional details.

Donoghue 1997). The first major pulse of glacial melt-water causing sea-level rise (known as MWP 1a) began after 14,000 B.P. and continued until the beginning of the YD at about 11,000 B.P., resulting in a probable shoreline about 140 km (and ca. 40-m depth) from the mouth of the modern Aucilla. The rapid expansion of Clovis technology across North America is coincident with the beginning of the YD (Bonnichsen et al. 1987; Faught 2001; Haynes 1991). Coastal margins stabilized (or possibly receded) during this climatic interval due to the reduction of melt-water flow as a result of re-advancing glacial margins (Faught 1996:166–168, 469). After 10,000 B.P. the second pulse of glacial melting (MWP 1b) commenced, forcing additional reductions of the paleolandscape and readjustments of human settlements and foraging ranges. This took place over the next 5,000 to 6,000 radiocarbon years (Faught and Donoghue 1997; Frazier 1974).

Numerous fluted points, large biface preforms, and carved ivory fore-shafts indicate a Clovis presence in and around the Aucilla drainage basin (Dunbar 1991; Faught 2004a; Haynes 1980; Hemmings 1998, 2000). There are, however, no radiocarbon ages associated with these earliest artifacts in Florida or the greater Southeast (Ellis et al. 1998; Goodyear 1999). On the other hand, there is plenty of evidence indicating that Clovis-related populations settled into the region after 11,000 B.P. and survived for several millennia (Faught 2004a). These data include abundant isolated finds of diagnostically early artifacts, as well as stratigraphic sequences that include technological changes from lanceolate to notched points associated with very early Holocene radiocarbon ages (Anderson and Sassaman 1996; Bullen 1958; Cambron and Hulse 1964; Coe 1964; Daniel and Wisenbaker 1987; Driskell 1996; Faught 2004a; Goodyear 1999). In order to complete and refine Southeastern culture history and understand the extent of early settlement patterns, it is necessary to understand the entire paleolandscape setting by finding and investigating prehistoric sites underwater on the continental shelves.

Methods

The basic approach to investigating submerged prehistoric sites on the continental shelf of northwest Florida is to reconstruct the pre-inundation paleolandscape, inventory and analyze archaeological sites, and determine the effects of sea-level transgression upon them (Easton and Moore 1991; Faught 1996:216–219, 2004b). The research program for the *PaleoAucilla* includes both survey and testing operations to find and investigate sites. Research vessels for working offshore have ranged in size from 6–21 m and both SCUBA and surface-supplied air are used for working underwater. Side-scan sonar and subbottom-profiling remote-sensing devices are used to reconstruct bottom morphology, locate paleochannels, identify sediment beds, and select targets for diver survey. Segments of river channels and other karst void features have also been found by studying bathymetric maps and aerial photographs, conducting offshore survey with fathometers and by towing divers behind small boats. Most survey targets have been located near paleochannel margins and around rocky outcrops. Target locations are recorded using GPS and initial sampling is by diver swim survey and hand fanning. Targets producing any artifacts are known as "encounters." If 10 or more artifacts are encountered upon initial inspection the targets are given Florida Master Site File numbers.[2] Diagnostic artifacts found at these sites are the best means of controlling for time and culture (Faught 2004b).

Methods for testing prehistoric sites underwater include hand fanning, vibra-coring, and induction dredge test pit excavations (Faught 2003, 2004b). Most of the artifacts recovered offshore have been found by hand fanning, a technique analogous to shovel testing and effective to about 50 cm depths. Vibra-coring is of limited success for probing sediment in this particular geologic environment because the rocky substrate frequently hampers penetration, but the technique remains valuable for situations with sandier sediments. In this karst setting the best method of exposing sufficient area to find artifacts, work around large rocks, and to make detailed observations of sediment beds is by 10-cm and 15-cm-diameter induction dredges (these devices are also known as hydraulic or water dredges; air lift dredges would also be effective). The sediment spoil is expelled onto floating platforms with 635-cm hardware cloth installed into the bottoms. Tough fabric "funnels" are connected to the bottom of these floating screen decks to decrease water turbidity and control the location of the "back-dirt" (i.e., dredge spoil).

Geomorphic Setting

The western continental shelf of Florida is a low-relief, low-slope drowned karst plain. It is riddled with karst depressions and channel segments and "protruded" by weather-resistant limestone and chert outcrops. Karst is the result of chemical erosion of limestone by acidic conditions in water and soils and karst depressions and combinations of chemical erosion and structural collapse create voids of diverse sizes. Chemical erosion is pronounced in the river channels, along the flood plains, and at the interface between river and ocean at the coast. Fluvial processes and sediment transport are minimal in this karst environment, allowing for little destruction of artifact arrays in freshwater settings and little production of sediment offshore (Dunbar et al. 1988; Faught and Carter 1998). We have evidence that lower-order, discontinuous segments of karst river systems, like the Aucilla is today, occur in the northern, nearer shore, portion of the *PaleoAucilla* research area, and that these first-order drainages combine into an alluvially controlled, continuous second-order paleoriver channel offshore (Figure 2; Faught and Donoghue 1997). This second-order paleochannel system has been designated as the *PaleoOchlockonee* and it combines with the first-order *PaleoApalachicola* farther offshore. It is the *PaleoApalachicola* that would have drained to the paleocoastline at about the 40-m, Younger Dryas, isobath (Figure 1).

The local marine environment is low energy and the low slope of the continental shelf promoted rapid lateral flooding and, theoretically, reduced alteration of archaeological sites. The geomorphology of the *PaleoAucilla* includes exposures of rocky outcrops with pockets of deeper sediments interspersed along the margins, and within the channel itself (Figure 3). There are seven major and several minor depressions known along the thalweg of this paleochannel segment as indicated by subbottom profiler remote sensing, bathymetric analysis, and coring operations. These are discussed in detail elsewhere (Faught 1996:365–400, 2004b; Faught and Donoghue 1997). The northernmost major sinkhole depression was designated as "Locus L1" in 1991 (Figures 3 and 4). The pre-inundation "pediment" away from the channel margins was a cover of sandy soils and muds that

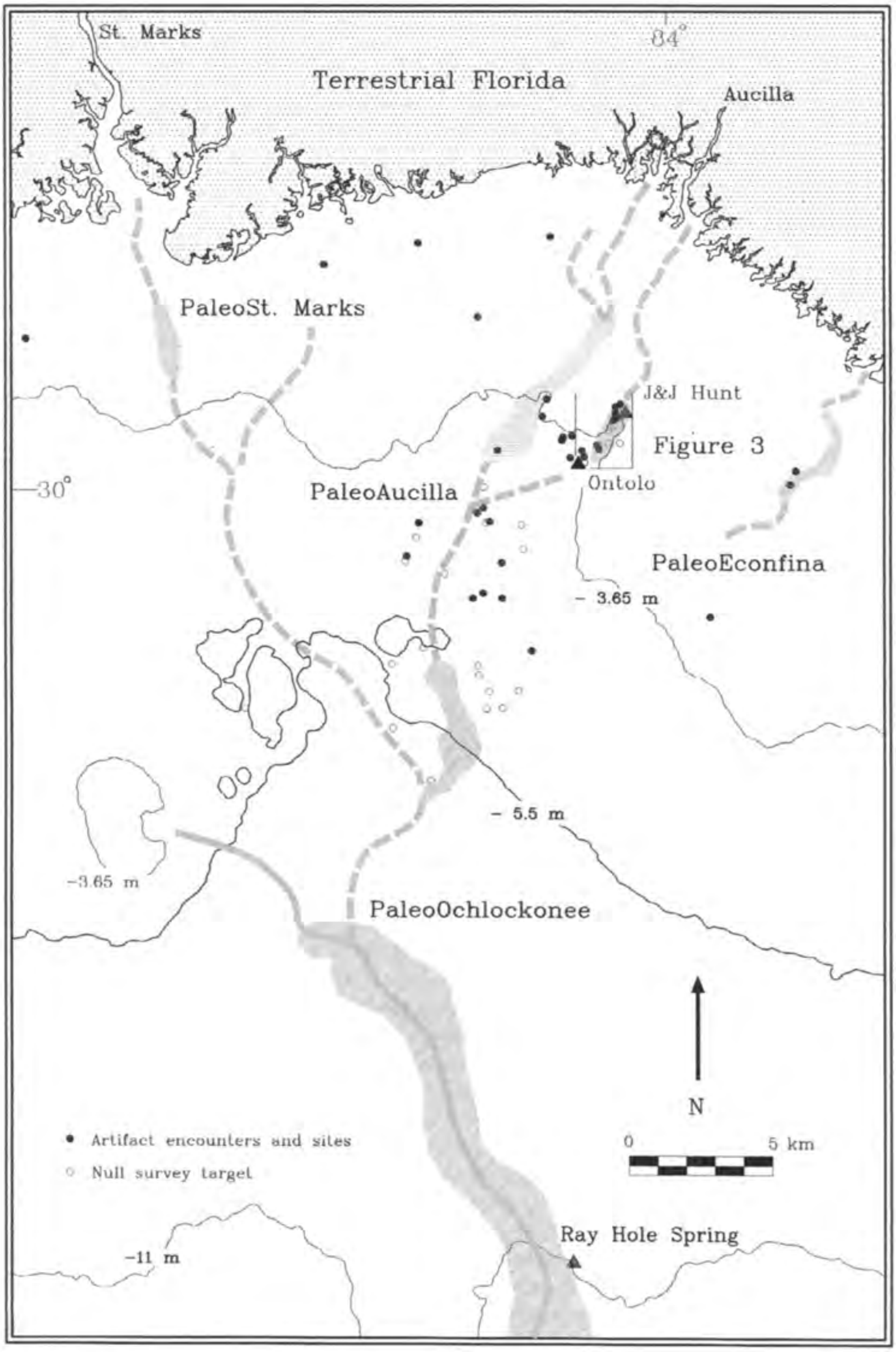

Figure 2. Map of the research area enlarged from Figure 1, including probable trends of paleochannels, the locations of sites and artifact encounters (filled circles), and survey locations without artifacts (open circles). J&J Hunt (8JE740) and Ontolo (8JE1577) are indicated as triangles around the segment of the *PaleoAucilla* discussed in this report. The boundary of Figure 3 is also indicated. This map was made from bathymetric data published on the NOAA navigational chart of Apalachee Bay, Florida (Chart number 11405).

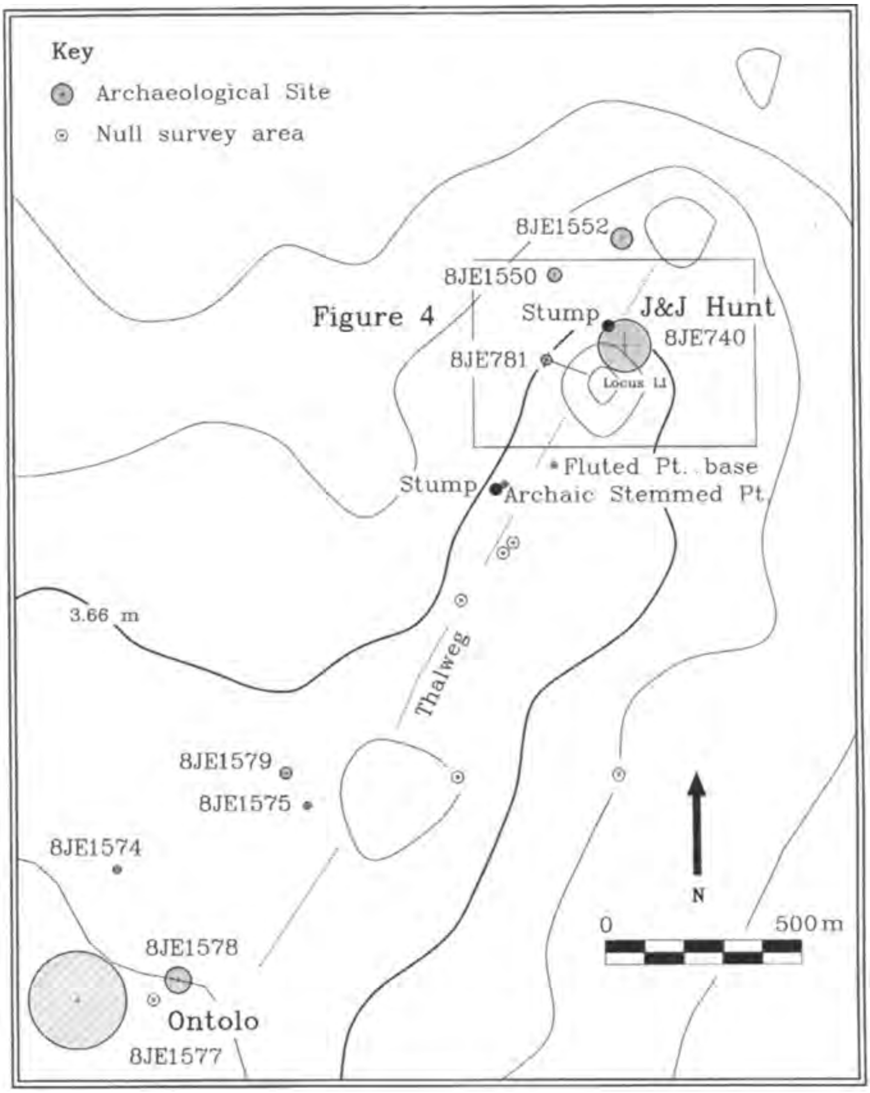

Figure 3. A segment of the *PaleoAucilla* channel identified offshore, the approximate trend of the thalweg, and the locations of sites discussed in the text and summarized in Table 2. The locations of two in-place tree stumps and the boundary of Figure 4 are also indicated.

blanketed the limestone bedrock and included both sandy beds in upland settings and hydric soils in the lowland floodplains. These sediments were truncated and reworked by transgressing seas to varying degrees. Marine sediments are ubiquitous now, except where bedrock protrudes, and these are dominated by quartz sand with fluctuating frequencies of whole and broken scallop (*Pecten*) and other shellfish species depending on local conditions and water depth. Below the marine sands, in protected voids and basins, there are dark organic-rich horizons that represent the transition between the marine sediments above and terrestrially derived mud beds below. These horizons often include whole and fragmented oyster (*Crassostrea*) shells and waterlogged arboreal debris indicating freshwater flotsam and brackish water conditions.

The mud beds are probably residuum from chemical weathering processes. Some are calcitic (from limestone) and some are dolomitic (the area is rich in dolomite). Some of the gray mud beds encountered in the sediment columns are soft (and possibly reworked), some are firm (probably freshwater deposits), and some are quite hard (indicat-

Table 2. Sample Attributes of Nine Sites Located Along the *PaleoAucilla* (Figure 3).

Name FMSF	N	Debitage to Tool Ratio	Cortex-Free Debitage (%)	Mean Weight (g)	Median Weight (g)	Standard Deviation of Weight
Upper Portion of the PaleoAucilla						
J&J Hunt 8JE740	1740	14.4	82	11.6	2.19	42.9
Area 91-B 8JE781	165	22.57	74	7.2	2.1	21
8JE1550	18	18	83	11.01	25.5	14.88
8JE1552	45	44	77	96.33	3.7	145.12
Lower Portion of the PaleoAucilla						
8JE1575	19	No tools	42	14.34	6.4	21.02
8JE1574	31	6.75	52	15.14	5.05	55.98
Ontolo 8JE1577	621	5.03	72	16.80	4.30	44.43
8JE1578	94	17.80	80	8.20	2.65	16.27
8JE1579	51	24.5	65	6.61	3.05	9.41

ing desiccation by subaerial exposure). Evidence for bioturbation by bivalves, fish, and other marine fauna occurs in the softer beds in the form of "krotovina-like" holes and tunnels. Tree stumps, roots, and root casts are frequent in the harder beds, supporting an interpretation of terrestrial conditions and indicating the preservation of at least some of the past sedimentary profile. The outer growth rings of two preserved oak tree stumps, both growing in hard mud beds (locations indicated on Figure 3), have returned ages of 7240 ± 100 B.P. (A-6714; wood; $\delta^{13}C$ = -26.6 ‰) and 7080 ± 70 B.P. (Beta-169503; wood; $\delta^{13}C$ = -26.4 ‰). Dolomite cobbles and boulders are found with depth in virtually all sediment exposures investigated so far.

Site Integrity

Artifacts are found on the surface of rocky sea-floor bottoms and reworked into marine and brackish sediment beds by the processes of transgression and sustained submergence (Faught 1988, 1996, 2004b). Artifacts remain clustered but stratigraphic relations are conflated. Reworking to some extent occurs at virtually all marine submerged prehistoric sites known around the world so far (Andersen 1987; Easton and Moore 1991; Flemming 1983; Galili and Weinstein-Evron 1985; Waters 1992). Nevertheless, the contiguity of large and small chipped stone items preserved in clustered associations in this offshore setting suggests limited sorting and lateral movement. Comparison of mean, median, and standard deviations of weight in Table 2 shows that there is an unsorted diversity of sizes at the sites discussed in this report.

There is no rounding of the artifacts by fluvial action, rolling in surf, or by sustained wave action. The edges of the majority of artifacts are well preserved and sharp. On the other hand, a thin black (sulfur?) stain completely, or partially, covers half or more of the artifacts found at all sites in the *PaleoAucilla* sample. This black staining enables discovery in the tan-colored sandy marine deposits, but inhibits adequate study of chert sources. A small percentage of the artifacts are corroded. Corrosion here indicates a condition that probably originates from subaerial exposure to ultraviolet rays, causing "chalking," and then aerobic marine submergence, causing ferrous staining and corrosion of the edges (Faught 1996:373–375, 2004b; Faught and Latvis 2000:49–50). Analysis to identify and understand these conditions is underway to best determine the formation processes involved and to develop appropriate conservation techniques for them, but the point is that the nature, condition, and extent of artifacts can be ascertained.

Archaeological Sites Distributed Along the *PaleoAucilla*

Figure 3 is an isometric outline of the *PaleoAucilla* channel segment boundaries. The locations of nine prehistoric archaeological sites, two encounters of isolated artifacts, and six nonproductive survey locations are plotted. Table 2 lists these sites, the numbers of artifacts found at each, the debitage to tool ratios, the percentage of items without cortex, and the average, median, and standard deviation of weight of each collection. The sizes of circles in Figure 3 are relative to the numbers of artifacts found per diver hour of initial survey, an index that acts as a rough proxy for artifact density. Four sites

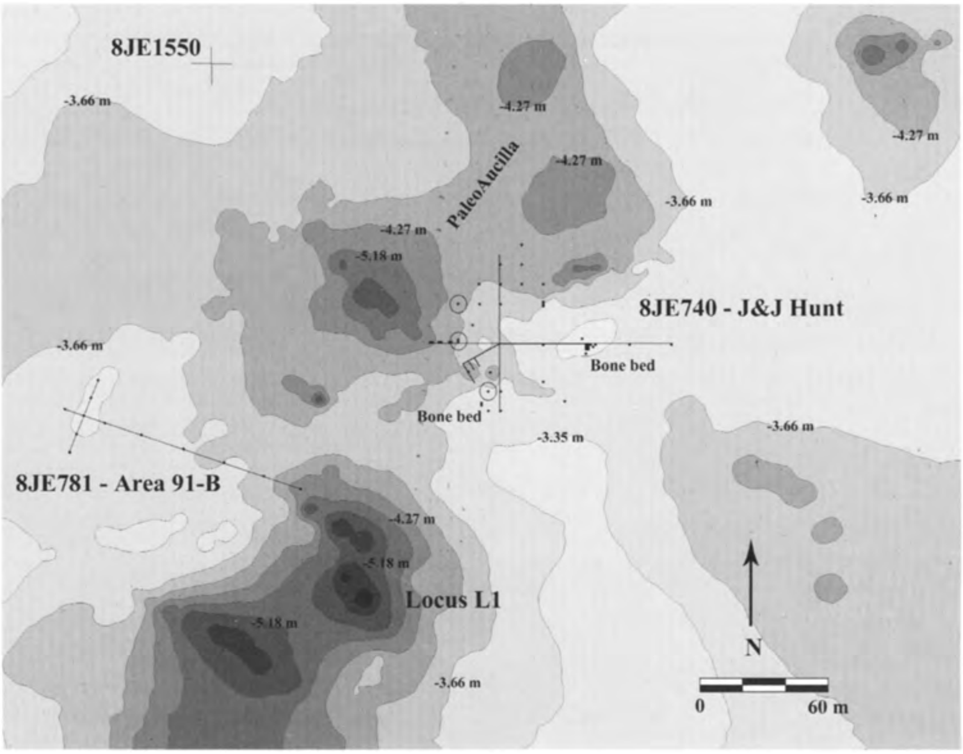

Figure 4. Detailed bathymetric reconstruction of the upper portion of the *PaleoAucilla*. The base lines set up for study and sampling are indicated at each site.

are located near the north portion, or "head," of the paleochannel, including J&J Hunt, which has been studied more than any other site in this research area. Five sites are located near the southern portion of the channel segment. The five sites in the southern group were discovered in 2001, and one of them, Ontolo (8JE1577), was surface collected in 2002 (Marks 2002). Two isolated finds between the northern and southern clusters of sites include a probable fluted biface base (Figure 5a) and an Archaic stemmed point (Faught 1996:433–434, Figure 8.09a and b). Most sites have been found on the western margin of the paleochannel because there is less sediment cover there and there are more exposed rocky areas making artifacts more visible. The eastern margin consists of finer organic marine sediment beds, which promote the development of sea-grass beds but which inhibit artifact discovery (Arbuthnot 2002).[3]

Figure 4 is a detailed bathymetric reconstruction of the northern portion of the *PaleoAucilla* segment, with J&J Hunt and two other sites (8JE1550 and 8JE781) indicated. This reconstruction was made from subbottom-profiler remote-sensing data contoured using Surfer. J&J Hunt is located on the northeastern margins of the northernmost deep depression at the head of the *PaleoAucilla* segment (Locus L1) on a peninsular-shaped rocky outcrop. J&J Hunt was discovered in 1989, tested by controlled hand-fanned collections in 1992, and excavated every year between 1998 and 2002 (Faught 1996; Faught and Latvis 2000; Latvis and Faught 2001; Tobon and Pendleton 2002). This testing includes 34 induction dredge test pits positioned to determine site limits and to discover any preserved presubmergence sediment beds, of which there are some examples (Faught 2004b). The small black squares arrayed in N-S, E-W orientation in Figure 4 are the locations of the 1-x-1-m (and larger) induction dredge test pits. The group of tests at a bearing of 240 degrees in the southwestern quadrant of the site is the area of hand-fanned collections in 1992. Two test pits are indicated as having fauna ("bone beds," Test Pits 99-01 [east] and 02-01 [south]). Test pits with whole shell beds possibly indicating middle Holocene shell midden deposits have circles around them. Test pits to the north, west, and south encountered deeper marine sediments.

Most chipped stone artifacts have been found on the surface and within the first 20 cm of the marine beds. Artifacts have been recovered from deeper contexts in both marine- and brackish-derived sediment beds along the northern and southern margins of the site. On the other hand, no artifacts have been found in terrestrially derived sediments, even though Pleistocene and Holocene fauna have. One mud bed excavated at J&J Hunt (Test Pit 99-01; bone bed to the east of the main datum on Figure 4) indicated especially prolonged desiccation by its hard consistency, blocky to prismatic structure, and organic (pedogenic) staining (Faught and Latvis 2000). Broken teeth and fragments of the mandible and maxilla of a juvenile mastodon were found in the upper portions of this hard bed and in the eroded contact above it (Faught and Latvis 2000). Root casts (filled with marine sediments) indicated the locations of now-degraded trees in the hard mud bed. No artifacts were found with the mastodon teeth embedded in the hard mud bed, although great effort was made to discover such an association, but artifacts were found in the eroded contact above. These artifacts included a unifacial end scraper and a side-notched Bolen point diagnostic of ca. 10,000 B.P. (Figure 5f). The mastodon dentition and bone were submitted for radiocarbon dating but they were too depleted of collagen for reliable results. Nevertheless, this bed demonstrates the likelihood that preserved primary deposits remain to be found offshore. A second deposit with abundant bone fragments (almost 5 kg in weight and including Pleistocene and Holocene faunal elements) was excavated on the southern margin of the site in 2002 (Test Pit 02-01). Analysis of this material is ongoing, but preliminary observations of the condition of the bones suggest predator "chew," rather than food processing debris or midden trash.

Artifacts are most frequent along the northern margins of the site, but tools (of which there are 121 in the sample) are most frequent in the southwestern quadrant, nearest to the paleochannel margins. Tools consist of unifacial scrapers (22 percent), whole and broken bifacial items (42 percent), and utilized flakes (21 percent). Cores (mostly without much cortex) combine for a total of 18 percent of the tools, and hammer stones make up an additional 4 percent. The variety of tools indicates biface production and other possible retooling at J&J Hunt during its use-history. The chipping debris is mostly cortex free, indicating transport of the raw material from elsewhere; but no outcropping chert has been found in the exposed bedrock of the site. There is limited evidence for tool-edge maintenance activities (Faught 1996:455).

The artifact assemblage at J&J Hunt (8JE740) includes several temporally diagnostic bifacial and unifacial tools (Figures 5, 6, and 7). Sixteen, possibly 17, projectile points and projectile point fragments have been recovered from J&J Hunt, including one late Paleoindian Suwannee projectile point base (Figure 5b) and one possible Suwannee preform (not illustrated because it is severely corroded; hence the difficulty in counting total numbers). Five side-notched Bolen projectile points have been recovered in surface and excavated contexts (Figure 5e-h and Figure 6a); one of these is unifacial (Figure 5g), three have beveled blade edges (Figure 5e, f, and h), and one is known locally as a "high-notched" Bolen (Figure 6a; Bullen 1975:52). Other tools found at J&J Hunt diagnostic of early Holocene age and activity include one broken adze bit and two formal unifacial side scrapers known locally as Hendrix scrapers (Daniel and Wisenbaker 1987:70–74). Hendrix scrapers are associated with Bolen points at site 8LE2105 in northwestern Florida in strata with multiple radiocarbon ages averaging ca. 10,000 B.P. (Faught 2004a; Goodwin et al. 1996). The site would have been located well inland during these late Pleistocene–early Holocene occupations as the paleoshoreline was much farther out on the continental shelf (Table 1). Two shouldered, straight-stemmed projectile points have been recovered from J&J Hunt (Figure 6b and c) which may indicate later early Holocene age, Early Archaic activities, perhaps around 9,000 radiocarbon years ago, but this is speculative and they could also be designated as Savannah River or Hamilton projectile points that would be later, middle Holocene-aged artifacts (Bullen 1975:35, 38).

Middle Archaic activities are also indicated at J&J Hunt by diagnostic artifacts (Figure 7a–d). Three Florida Archaic straight-stemmed points (Figure 7a, b, and c) and one contracting-stemmed

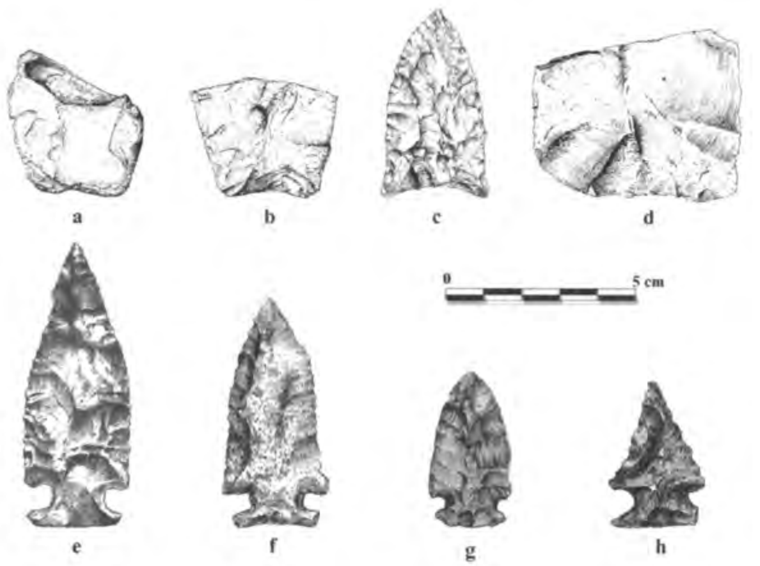

Figure 5. Diagnostic projectile points found offshore indicating late Paleoindian and Early Archaic occupations, including a possible fluted point base (a, location of discovery shown on Figure 3), late Paleoindian (Suwannee) lanceolate base (b) found at J&J Hunt (8JE740), Suwannee lanceolate projectile point (c) found at Ontolo (8JE1577), late Paleoindian (Suwannee) preform (d) is from Area 91-B (8JE781). Early Archaic notched Bolen points (e, f, g, and h) are from J&J Hunt (8JE740). Specimen (e) is unifacial.

Figure 6. Diagnostic projectile points found offshore indicating possible later Early Archaic (a), or early Middle Archaic (middle Holocene) occupations (b and c). These examples are less reliable for age and culture group affiliation.

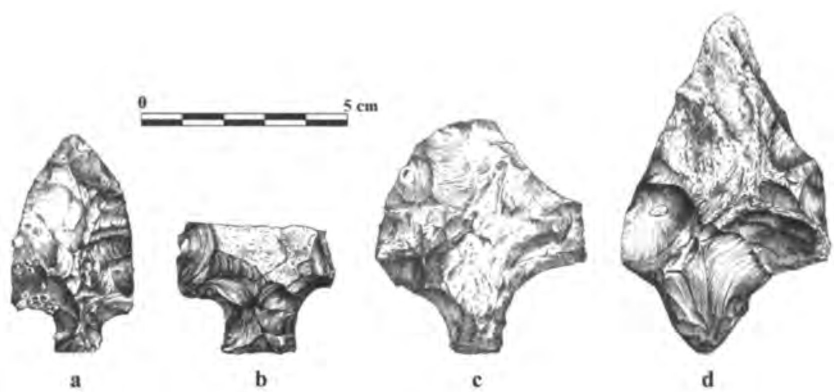

Figure 7. Middle Archaic stemmed points from J&J Hunt 8JE740 indicating middle Holocene age occupations.

point (Figure 7d) represent evidence for middle Holocene age, Middle Archaic activities between 7500 and 5000 B.P., at which time the site was fully inundated (Bullen 1975:32; Faught and Donoghue 1997). Beds of whole but disarticulated oyster shell in some test pits indicate possible eroded oyster shell refuse deposits (shown on Figure 4 as circles around test pit symbols) that are inferred to be representatives of this middle Holocene occupation (Faught 2004b; Faught and Latvis 2000; Latvis and Faught 2001; Tobon and Pendleton 2002). One of these beds produced a radiocarbon age of 5970 ±40 B.P. (BETA-169504; on charcoal; $\delta^{13}C = -26.7$ ‰).

Two other sites in the northern group also indicate Late Paleoindian and Early Archaic presence. Area 91-B (8JE781) was found in 1991 and sampled in 1992 (Faught 1996:433–438). At Area 91-B, also located near the head of the *PaleoAucilla* segment, additional evidence for late Paleoindian occupation was indicated by small bifacial flaking debris, a unifacial scraper, and a Suwannee preform (Figure 5d). Another Hendrix side scraper was collected with chipped stone debris at 8JE1552. No tools were collected from 8JE1550.

Of the sites found in the southern portion of the paleochannel segment, the Ontolo site (8JE1577) is by far the largest lithic scatter (Figure 3). Ontolo was found in 2001 by side-scan sonar remote sensing for outcropping rock and then diver reconnaissance to test for artifacts (Latvis and Faught 2001; Marks 2002; Tobon and Pendleton 2002). While the research is just beginning at Ontolo, the site has a high artifact density and lower debitage-to-tool ratio than any other site found offshore so far (Table 2). Artifacts without cortex make up the majority of debitage. Tools consist of unifaces (35 percent) and bifaces and biface fragments (37 percent). Expedient tools have been identified from the debitage, including simple edge-damaged flakes, a few with notches, and some lightly shaped spurs. These items make up 20 percent of the tools inventoried. Cores make up eight percent of the tools, but no hammer stones have been identified yet. These data contrast with J&J Hunt, which has more evidence for bifacial tool production, and more cores and hammer stones, but less evidence for utilization of the artifacts. The diversity and frequency of tools at Ontolo suggest a wider range of logistical activities taking place at the location than at J&J Hunt (Marks 2002).

The diagnostic artifacts found at Ontolo include one Suwannee lanceolate point (Figure 5c) that is unquestionably of late Paleoindian age, three straight-stem projectile points, arguably classifiable as Wacissas (Early Archaic?; Neill 1963), and another Hendrix side scraper (not illustrated, but see Marks and Faught 2003). A Kirk-like stemmed projectile point is the youngest of the points of presumed early Holocene age (Bullen 1975; Coe 1964). Additional research is being conducted at Ontolo to identify more about the distribution of artifacts and site formation processes represented by this large chipped stone array, as well as to ascertain the specific activities taking place there. Other sites in the southern portion of the *PaleoAucilla* appear to be dense clusters of artifacts, possibly indicating one large area of settlement at the southern end of this discontinuous karst segment. The age, function, and affinity of these sites will be the focus of additional research in the future.

Table 3 presents radiocarbon ages of floral and faunal specimens found in different geomorphic contexts that inform on the chronology of the submergence process. These specimens come from the northern portion of the *PaleoAucilla* and include in-place tree stumps and wood from gray mud beds, flotsam wood from brackish sediments, oyster shell, and charcoal from possible coastal resource procurement activities at the end of the submergence process. These data indicate fully terrestrial conditions until after 7000 B.P., near coastal conditions after 6000 B.P., and full submergence of the paleochannel segment after 5000 B.P.

Conclusion

This research demonstrates that evidence for past settlement and resource-procurement systems can be located in continental shelf settings and that underwater archaeological techniques can be used to study them. The intent is to understand the past landscape setting, the extent and character of settlement, and the site formation processes that affect sites offshore. These data contribute to understanding of how to find and investigate submerged prehistoric sites and supplement terrestrial settlement pattern data.

Bathymetric enhancement, subbottom-profiling, and side-scan sonar remote sensing are effective tools for reconstructing the courses of

Table 3. Radiocarbon Ages for In-Place Tree Stumps, Flotsam Wood, Charcoal, and Oyster Shell, from Sediments Sampled at the Upper End of the Paleoaucilla Segment that Indicate Past Environmental Conditions.

Interpretation	Radiocarbon Age	Lab Number	Comments
Near coastal human activities	5,970 ± 40	BETA 169504	Charcoal in possible shell midden
Brackish water	6,135 ± 80	AA-10508	*Crassostrea* around in-place oak stump at 4.5-m depth
Brackish water	6,375 ± 80	AA-11045	*Crassostrea* around in-place oak stump at 4.5-m depth
Freshwater conditions	6,785 ± 80	AA-8859	Flotsam wood
Freshwater conditions	6,825 ± 120	AA-10510	Flotsam wood
Freshwater conditions	6,755 ± 60	AA-10513	Wood from gray mud
Freshwater conditions	7,010 ± 80	AA-11047	Wood from gray mud
Freshwater conditions	7,160 ± 95	AA-10511	Wood from gray mud
Freshwater conditions	7,130 ± 75	AA-8872	Wood from gray mud
Terrestrial conditions	7,080± 70	BETA 169503	In place tree stump at 4.2-m depth
Terrestrial conditions	7,240 ± 100	A-6714	In place tree stump at 4.5-m depth

Note: Data from this report and Faught and Donoghue 1997.

paleoriver channels, studying bottom types, and generating locations for diver survey. Use of regional prehistoric culture histories and terrestrial analogs of settlement patterns known locally increase the potentials for artifact recovery. While this geomorphic situation (a drowned karst plain) is conducive to site discovery, research projects to find sites in different geomorphic environments in the Gulf of Mexico or along the Eastern Seaboard are more than warranted. The growth in knowledge of submerged prehistoric continental shelf archaeology will come from sustained investigations—either by divers or by remotely operated devices

Overall, five of the diagnostic artifacts from the *PaleoAucilla* indicate late Paleoindian (Suwannee) presence, 13 indicate Early Archaic (Bolen) presence, and six indicate Middle Archaic presence. This is not an unexpected ratio of evidence for early prehistoric occupations in Florida, even though extrapolating from this data is questionable because the sample is small and biased relative to the amount of time spent at each site, and to materials exposed on the sea floor bottom or to within about a meter of deposition. Nevertheless, these late Pleistocene and early Holocene sites are older, more abundant, and larger in size than other submerged prehistoric sites known elsewhere in North America, including those along the West Coast where early coastal migration pathways have been demonstrated (Dixon 2001; Erlandson 2001; Fedje and Christensen 1999; Josenhans et al. 1997; Stright 1995). Because Clovis ancestry can be tracked for several millennia through stylistic evolutionary sequences in the Southeast, it follows that these submerged paleolandscapes are important sources of data about the prehistory of this enigmatic culture. Whether submerged prehistoric sites will present evidence for early Clovis activities in coastal settings, or whether later Paleoindian and Early Archaic sites are all that are to be found, remains to be seen by research in deeper water, farther out on the continental shelf.

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Notes

1. Several other submerged prehistoric sites have been found out to a distance of 21 km during research operations I have organized (Faught 1996; Faught 2004b; Faught and Latvis 2000; Latvis and Faught 2001; Tobon and Pendleton 2002). Remote sensing operations have logged more than 500 linear km of track lines within the research area described in Figure 2 and Figure 3. Survey operations have occurred at 57 targets. The resultant sample from all survey and testing operations is 30 locations of artifact encounters producing over 4,500 pieces of chipped stone, including diagnostic projectile points, formal chipped stone tools, and debitage. Ancillary geoarchaeological data include faunal bone, wood, mollusks, and sediment samples. Seven other sites are recorded in the Florida Master Site File (FMSF) for Apalachee Bay, and prior research by Anuskiewicz and colleagues found chipped stone debitage at Ray Hole Spring, a sinkhole about 38.5 km south of the mouth of the Aucilla, at a depth of 11 m, and near the *PaleoOchlockonee* (shown in Figure 2) (Anuskiewicz 1988; Dunbar et al. 1992:131–132). This brings the combined number of artifact encounters and sites to 37 in the Big Bend .

2. The farthest encounter out on the shelf is 15 km from the mouth of the modern Aucilla. There are 18 designated sites and 12 encounters recorded.

3. The Florida Department of Environmental Protection prohibits dredging in sea-grass beds.

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