USING GEOMORPHIC DATA TO MODEL PREHISTORIC ARCHAEOLOGICAL
SITE OCCURRENCES ALONG BLACKWATER RIVER,
SANTA ROSA COUNTY, FLORIDA

by

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ABSTRACT

USING GEOMORPHIC DATA TO MODEL PREHISTORIC ARCHAEOLOGICAL SITE OCCURRENCES ALONG BLACKWATER RIVER, SANTA ROSA COUNTY, FLORIDA

Matthew Alan Newton

Geomorphic investigations were conducted during 2015-2017 at two locations within the Blackwater River-Bay Complex. The project aimed to gain an understanding of Paleoindian archaeological site occurrences in the study area, while placing them within the context of environmental change. The study employed a myriad of marine geophysical surveying techniques, diver investigations, and vibracore extractions from a tripod-mounted vessel. Vibracores were sampled for organic content before being analyzed using a Malvern Mastersizer 3000 particle sizer. Stratigraphic units were coupled with radiocarbon assays, which showed a strong correlation to data collected on prehistoric hurricane landfalls in the northern Gulf. Moreover, the radiocarbon assays relate to pronounced periods of prehistoric occupations along the Blackwater River-Bay complex during the Late Woodland and Mississippian periods. This is perhaps owing to a later development of the estuary system.
CHAPTER I

INTRODUCTION

Does the Blackwater River-Bay complex hold the potential for submerged archaeological sites dating to Paleoindian times? During the early Paleoindian period (14,500–11,050 years before present), the Blackwater Bay–River complex that exists today had not yet developed. Instead, the landscape may have been dotted by perched ponds, or small areas of subaerial groundwater discharge. The availability of freshwater during the Early Paleoindian period limited suitable habitation sites. The drier environmental conditions which persisted during this period reduced rainfall, causing water tables to be much lower. Any surficial water discharge points would have been of value to Paleoindians during this time. Springs during this period were essentially “watering holes,” locales that provided freshwater, food (via the opportunity to hunt animals also seeking freshwater), and high-grade lithic raw materials (Dunbar and Waller 1983). Since freshwater spring locales are known to have been frequented by prehistoric populations, identifying and documenting submarine groundwater discharge locations in brackish waters could add to models of prehistoric settlement patterning.

Previous marine geophysical surveys conducted within the study area serendipitously located anomalous landforms submerged beneath the depths of the river at Peterson Point and Marquis Basin which presented an opportunity to carry out geomorphic investigations into the nature of sedimentological and geological formations within the bay-river complex. The decision to further investigate these features was made in the wake of these findings in an effort to test whether the Blackwater River-Bay complex holds the potential for submerged Paleoindian archaeological sites. If these areas exhibit criteria of submerged spring discharge locations or
submerged paleoriver channels, then the likelihood is high that Paleoindians frequented the exposed freshwater locations.

Research was conducted following amended versions of Anders Fischer’s “Danish Model” (1995), but also was improved by other methodological rubrics and analogs, such as those inherent to the fields of geophysical surveying (geomatics) and hydrogeomorphology. After thorough geophysical surveys, two areas were selected to extract six vibracores from a tripod mounted vessel. The core samples were analyzed for soil particle size distribution, sampled for radiocarbon dating, then placed into a context which discusses the natural development of the Blackwater River-Bay complex and the potential the region holds for the presence of prehistoric archaeological sites dating to the Paleoindian period.

Chapter II provides an environmental overview of the current conditions within the study area. Chapter III discusses the regional archaeological background to which environmental data sets are overlain in an effort to correlate the development of Blackwater Bay to prehistoric archaeological site occurrences. Chapter IV outlines research methodologies and includes a brief description of technologies and techniques employed for the study. Chapter V contains the results of soil particle size distributions and radiocarbon analyses. Chapter VI places the findings within the context of prehistorical archaeological site occurrences along Blackwater River and offers directions for future research. Appendix A contains pertinent information regarding the vibracore extractions. Appendix B displays the results of water chemistry sampling. Appendix C contains histograms showing particle size distribution data. Appendix D contains a report of radiocarbon analysis conducted by International Chemical Analyses, Inc.
CHAPTER II
ENVIRONMENTAL SETTING

An inventory of current natural conditions is necessary to recreate a paleoenvironment. This chapter aims to provide the hydrogeological, hydrologic, climatic and ecological baselines for the project location.

Hydrogeology

The Floridan Aquifer is usually the topic of discussion when referring to groundwater interactions in Florida. However, The Floridan Aquifer is deeply buried by a comparatively thick subterranean confining unit in the Western Panhandle region, encompassing the counties of Walton, Okaloosa, Santa Rosa, and Escambia (Figure 1). The Surficial Aquifer System is the most widely accessible groundwater source within the Panhandle Region, commonly referred to as the Sand and Gravel Aquifer. This confining bed increases in thickness from east to west, with Escambia County exhibiting a maximum thickness of greater than 122 meters (m). This, in addition to the aquifer’s proximity to land surface make it highly susceptible to contamination, since surface water can enter the system in multiple areas due to the lack of a surficial confining unit (Pratt et al. 1996:6). The majority of Santa Rosa County and all of Escambia County withdraw their potable water from the Sand and Gravel Aquifer. Between the Sand and Gravel and The Floridan Aquifers rests the “Intermediate System,” a confining unit stretching into the Western Panhandle, limiting the exchange between waters of the Sand and Gravel Aquifer and the deeply buried Floridan Aquifer System. The Intermediate System is comprised of thick beds of clays and other low-permeability sediments, with a thickness varying between 30m to over 305m, with no water bearing zones known within Western Panhandle Region (Pratt et al. 1996:6).
Figure 1. Stratigraphic units of the Panhandle region of Florida (Pratt et al. 1996:6).

The Sand-and-Gravel Aquifer is informally subdivided into three zones. The upper reaches are composed of predominately fine sands and are referred to as the surficial zone. Underlying this zone is the low permeability zone (LPZ), which contains a higher clay and silt content, resulting in confined or semi-confined conditions. The lowest of the three zones is the main producing zone (MPZ), characterized by highly-permeable coarse sand and gravel beds,
with intermittent zones of sand and clayey sand lenses. The majority of water taken from the portion of the aquifer that rests under Escambia and Santa Rosa Counties is withdrawn from this zone. See Pratt et al. (1996:3) and Katz and Choquette (1991:41) for detailed graphics showing hydrologic and stratigraphic units within the Panhandle region.

Local rainfall inputs recharge the Sand and Gravel Aquifer by way of highly permeable, sandy soils. Groundwater flow directions are variable, since hydraulic head is primarily influenced by elevation of the confining beds, which, in turn, dictates flow directions and locations of subaerial discharge. The Sand-And-Gravel is locally influenced by streams and rivers which dissect the aquifer, serving as boundaries to the separate discharge areas. Throughout the coastal areas, the aquifer discharges into the bays of the Gulf of Mexico (Lewis 2010:3).

Hydrology

Five bodies of water collectively make up the Pensacola Estuarine System—Pensacola Bay, Escambia Bay, Blackwater Bay, East Bay, and Santa Rosa Sound. Combined, these water bodies cover about 18,130 square kilometers (km) (Schwinning et al. 2005:129). Santa Rosa Sound is oriented in a way that parallels the shoreline, a common feature of estuarine environments elsewhere in Florida. Each of the remaining four bodies of water (Escambia Bay, Pensacola Bay, Blackwater Bay, and East Bay) are oriented in an approximate northwest to southeast orientation, extending approximately 32 km inland from the present shoreline of the Gulf of Mexico (Thorpe et al. 1997:5). The East Bay–Blackwater Bay complex is classified as a shallow estuarine embayment, consisting of a shallow shelf on the outside of a relatively deeper mid-bay region. Blackwater Bay, the northern component, has a surface area of approximately 25 square km with a mean depth of approximately 2m. East Bay, the southeastern portion of the
complex, covers approximately 110 square kilometers with a mean depth of 2.5m (Schwinning et al. 2005:130). Approximately 11,265 square km are contained within the Blackwater Bay–River Complex, about one-third of which is within the state of Florida and is overseen by The Northwest Florida Water Management District (NWFWMD) (Schwinning et al. 2005:129). Most of Escambia, Santa Rosa, and Okaloosa Counties, and a portion of Walton County are found within this region. The entirety of the headwaters entering the system originate in southern Alabama as the Escambia, Blackwater, and Yellow Rivers before discharging into the Pensacola Bay complex, providing the majority of the freshwater input into the system. Tides are a major component of circulation in most estuarine systems; however, because of the location of the Pensacola Bay system along the Gulf of Mexico coastline, tidal energy is minimal (Figure 2). Tides within the region are predominantly diurnal, meaning one tidal cycle per day, with a minimal average tidal change of approximately 0.34m (1.1 ft) near the entrance of Pensacola Bay. East Bay has very little transport capability due to tidal forcing alone, indicating that circulation is extremely weak. Most of the freshwater inputs to the Pensacola Bay system are derived from the Blackwater and Yellow Rivers, with a small portion of influx coming from the Escambia River (Lewis 2010:7). Each of the three major inputs vary by basin, type, and size (Thorpe et al. 1997:3). A significant portion of the watershed is in public ownership with large tracts owned and managed by the NWFWMD, the State of Florida (Blackwater State Forest, Escribano Point Wildlife Management Area) and The Federal Government (Gulf Islands National Seashore, Eglin Air Force Base, Hurlburt Field, and Naval Air Station Pensacola NAS) (Thorpe et al. 1997:2-5).
The northwestern extent of the Pensacola Bay Estuarine system is bounded where the Escambia River discharges into Escambia Bay, approximately 5 km north of US Highway 90 (Figure 3). The enclosed bays are protected from the Gulf of Mexico by Santa Rosa Island which takes the blunt of the wave energy from storm surges. Saltwater enters the Pensacola Bay system through a single 800 m wide inlet, Caucus Channel at Ft. Pickens, commonly referred to as Pensacola Pass, Ft. Pickens Pass, or simply by locals as “The Pass” (Schwinning et al. 2005:130). The Yellow River begins in Covington County, Alabama, travelling 177 km before emptying into the northeastern corner of Blackwater Bay. The Yellow River’s drainage basin encompasses 2,197 square km of mostly forested floodplain topography. Average annual discharge is approximately 1,181 cubic feet per second (cfs). The Yellow River is described as a sandy-bottomed river with shallow, tan waters. The primary tributary of the Yellow River is the Shoal River, which originates in northern Walton County. The Shoal River drains approximately
803 square km (Thorpe et al. 1997:5) and has an average annual discharge of about 1,104 cfs and
is gaged at Crestview, Florida, about seven miles above the confluence with the Yellow River
(Lewis 2010:7-9). A gage at the Yellow River (SR87 near Milton) downstream from the
confluence with the Shoal River measured an average flow of 2,289 cfs. The lower reaches of the
Yellow River, and parts of Blackwater and East Bays, are managed as part of the Yellow River
Marsh Aquatic Preserve (NOAA National Weather Service). The headwaters of the Blackwater
River originate in Bradely, Alabama, travelling south approximately 100 km before discharging
into Blackwater Bay. The river drains approximately 1384 square km, of which about 1127
square kilometers are within Florida. The average annual discharge is approximately 342 cfs
(Thorpe et al. 1997:5). Groundwater discharge from the Sand and Gravel Aquifer contributes to
the flow discharge rate, with a smaller contribution coming from surface runoff. Surface waters
drain primarily from acidic pinewoods and other wetlands near to the river, causing the reddish
color due to tannic acid. The Blackwater River is designated an Outstanding Florida Water and is
among the most popular waterbodies in the state for canoeing and other recreational activities
(Thorpe et al. 1997). Major tributaries such as the popular tubing and canoeing destination,
Coldwater Creek are described as swift-moving, shallow and sandy-bottomed (Lewis 2010:8-9).

**Climate**

The climate of northwest Florida is generally humid to sub-tropical, with warm summers
and mild winters. Temperatures average 81°F in the summer and 54°F during the winter (NOAA
National Weather Service). Normal annual rainfall ranges from about 55 to 67 inches per year.
Average annual rainfall is generally highest in the western portion of the NWFWM and lowest
in the eastern portion.
Figure 3. Lower Blackwater River and Blackwater Bay.

Average monthly rainfall ranges between three and eight inches. There are two distinct rainy seasons each year, the first resulting from frontal storm systems during the winter and early spring, and the second occurring during the summer as a result of afternoon and evening thunderstorms. Although the NWFWMD generally has an abundant supply of rainfall, droughts periodically occur. Fall and late spring tend to be drier periods. Annual rainfall may vary as much as 50 percent from the average. Many locations have experienced as little as 40 and as much as 80 inches per year. During the past 100 years, the period of the mid-1950s had the lowest rainfall totals, while the mid-1960s had the highest (NOAA National Weather Service).

The terrestrial environment of Blackwater Bay is characterized by xeric uplands which border a hypoxic aquatic environment. Soil classification data provided by the USDA Web Soil Survey describes the area as predominately Troup Sand. Mean annual precipitation totals 60-68
inches per year with 233-266 frost-free days per year (USDA Web Soil Survey). The parent material is classified as sandy and loamy marine deposits with a typical profile of an A horizon (0cm to 15.24cm deep), E horizon (15.24cm to 116.84cm), and Bt horizon (116.84cm to 203.2cm) (USDA Web Soil Survey). The soils are classified as somewhat poorly-drained (USGS Web Soil Survey).

Flora

Blackwater Bay is only a fragment of the entire Pensacola Bay system; therefore, it is worth mentioning that a complete inventory is not relevant for the purposes of my research. For example, the abundance of certain salt tolerant species will diminish as one travels northward from Pensacola Pass towards the freshwater inputs of the Blackwater, Yellow, and Escambia Rivers. However, the Interstate 10 bridge is a useful marker to delineate between the predominately fresh water north of the bridge and a higher percentage of salt water influx which enters the system from the Gulf of Mexico via Pensacola Pass, rendering Peterson Point a saline environment and Marquis Basin a predominately freshwater environment. Salinity samples taken corroborate this occurrence.

The following inventory will focus on Escribano Point, which is within Blackwater Bay “proper.” The entirety of Escribano Point lies south of the Interstate-10 bridge, making it convenient to refer to the inventory reported here as a “saline” cutout of the entire Pensacola Bay system inventory which would include salt tolerant and upland species which may or may not be found elsewhere within the study area. Many species of fish are tolerant to both freshwater and saltwater environments. For example, Tarpon (Megalops atlanticus) are pelagic (open-sea dwelling), yet they spawn in brackish waters which are protected from wave energy. Many other species of fish are known to travel to estuaries for this specific portion of their lifecycles, and
each spans the spectrum of salt-tolerance. The important idea is that estuarine environments are ideal locales for humans to procure fish.

A special report compiled by The Fish and Wildlife Commission titled Expansion of The Escribano Point Wildlife Management Area shows a detailed inventory of modern species in the area. Several distinct environments are discussed within their report (bottomland forest, dome swamp, mesic flatwoods, mesic hammock, salt marsh, sandhill, wet flatwoods, wet prairie, xeric hammock, basin swamp, baygall, coastal scrub, lacustrine cultural areas, cypress, dry flatwoods, estuarine, floodplain marsh, freshwater forested wetlands, high pine and scrub, maritime hammock, marshes, and sand beaches) (Hollock- Solomon 2010:2-3). Rating these environments according to importance does not seem plausible in an archaeological research project since these delineations do not depict where prehistoric peoples would have spent their time. In other words, we can assume that all of these zones were exploited, with some areas used more frequently than others. However, the vegetation nearest to the shore of Blackwater Bay and the Blackwater River concerns this research because of proximity to the water bodies under study. Over 180 plant species in total are documented within the Escribano Report.

Close to Peterson Point and Marquis Basin are cedar swamps, which contain species of trees consisting primarily of Atlantic white cedar (Chamaecyparis thyoides), Southern magnolia (Magnolia grandiflora), Swamp bay (Persea palustris), Loblolly pine (Pinus taeda) and Titi (Cyrilla racemiflora) (Hollock-Solomon 2010:2-3). Along the water’s edge are grassy embankments which are prime spawning areas for Redfish (Sciaenops ocellatus) as well as numerous other species. Yellow indiangrass (Sorghastrum nutans), Yellow jessamine (Gelsemium sempervires), and Yellow-eyed grass (Xyris sp.) are found today in the area (Hollock-Solomon 2010:8-13-4).
Fauna


Fishes recorded in Blackwater and Yellow River systems, including Blackwater Bay and East Bay, total over 115 species. An extensive list will not be repeated here yet a few notables include Channel catfish (*Ictalurus punctatus*), Crevalle jack (*Caranx hippos*), Hardhead catfish
(Ariopsis felis), Sheepshead (Archosargus probatocephalus), Tarpon (Megalops atlanticus), and Striped mullet (Mugil cephalus) (Hollock-Solomon 2010).

Over 151 avian species are known to inhabit the area today with some notables including Belted kingfisher (Megaceryle alcyon), Double-crested cormorant (Phalacrocorax auritus), Downy woodpecker (Picoides pubescens), Limpkin (Aramus guarauna), Little blue heron (Egretta caerulea), Mallard (Anas platyrhynchos), Merlin (Falco columbarius), Ring-necked duck (Aythya collaris), Ruddy duck (Oxyura jamaicensis), Snowy egret (Egretta thula), Southeastern American kestrel (Falco sparverius paulus), Swallow-tailed kite (Elanoides forficatus), Tricolored heron (Egretta tricolor), White ibis (Eudocimus albus), White-tailed kite (Elanus leucurus), and Wood duck (Aix sponsa) (Hollock-Solomon 2010).

A total of 33 species of amphibians are documented within the report. A few notable examples include Florida bog frog (Lithobates okaloosae), Fowler’s toad (Anaxyrus fowleri), Gopher frog (Lithobates capito), Gray treefrog (Hyla chrysoscelis), and Green treefrog (Hyla cinerea) (Hollock-Solomon 2010).

Although relatively little archaeological research has been conducted in the project area within the modern era, we can surmise that the dominant geohydrological regimes seen today have been in place since sea level stabilization. In other words, the current environmental setting has prevailed for the last 2,500 years, based on current sea level curves for the Northern Gulf of Mexico. Models have shown that many coastal areas have been relatively stable for the last 6,000 years, although smaller fluctuations in climatic regimes have occurred over millennia (Otvos 2005:159; Donoghue 2011).

The following chapter provides a summary of archaeological investigations conducted within the project area and a general overview of culture periods within the region.
CHAPTER III

HISTORICAL BACKGROUND

These brief summaries are intended to function as contributions to broader discussions of the archaeology of Blackwater Bay and the entire Pensacola Bay system as a whole. This chapter is not meant to be all-inclusive. The tripartite scheme of “Early, Middle, and Late” subperiods is utilized until the beginning of the Mississippian Period. Where warranted, a “classic example” of an archaeological culture, site, or occurrence from outside of northwest Florida is offered to supplement the general discussion. The dominant climatic regimes of the past are also briefly discussed.

The Paleoindian Period (12,850-9,950 BC)

The Paleoindian period is defined by major climatic/environmental oscillations which occurred during the final years of the Pleistocene. Changes in lithic toolkits can be correlated to environmental changes, with Pre-Clovis, Clovis, and Post-Clovis forms corresponding to Early, Middle, and Late Paleoindian periods. Pre-Clovis (as typified by the Page-Ladson site in Florida), Clovis, and Post-Clovis (Dalton style) projectile point/knives (PPK) have been radiocarbon dated within secure contexts, but other forms suspected to correspond to the last expressions of Paleoindian lifeways in Florida, such as Simpson and Suwannee, have not. Page-Ladson, Simpson, Clovis, Dalton and Suwannee PPK have all been recovered from several areas in the state but most frequently from the beds of rivers in karstic Florida, including the Aucilla, Chipola, Ichetucknee, Ocklawaha, Santa Fe, Suwannee, Wakulla, and Withlacoochee river basins (Anderson et al. 2010). However, at least one Simpson PPK was documented near the confluence of Coldwater and Big Juniper creeks, which feed into the Blackwater River (Mackenzie 1988). Clovis PPK have been recovered from the Yellow River drainage on
Eglin Air Force Base, which empties into Blackwater Bay. However, no Simpson PPK have been recovered from Eglin (Campbell 2007:14).

Typical Paleoindian lithic tool kits included an assortment of unifacial and bifacial scrapers (also called expedient tools), gravers, and drills which were made from easily transportable chert cores (Purdy 1981). The expedient toolkit remains a relatively unchanged facet of material culture for several millennia. The presence of these tools, which can be fashioned in little time, helps us understand the mobility of these people.

*Early Paleoindian* (*< 11,050 BC*). Paleoindian origins can be traced to northeastern Siberia, which was much larger during the height of the Last Glacial Maximum (LGM), approximately 20 thousand years ago (kya) due to a larger volume of water trapped within the polar ice caps of the earth (Santos et al. 1999:619). Subsequently, this caused lower water levels in the Bering and Chukchi Seas which allowed for human migrations across the Beringia land bridge. Genetic analyses have hypothesized that the earliest migrations across the bridge could have occurred as early as approximately 43 kya (Volodko et al. 2008:1081), while others propose a period of migration spanning 28 to 19 kya (Fagundes et al. 2008:2). Both scenarios could have provided an opportunity for the original inhabitants of the Western Hemisphere to move across an area that is today beneath the ocean (Erlandson et al. 2008). Several caravans of Pleistocene hunting populations most likely came across at different times, potentially by boat, and possibly along the eastern seaboard (Bradley and Stanford 2004). Recent research has unequivocally shown that there were Paleoindian populations in Northwest Florida by at least 14,550 years ago (Dunbar 2016a; Halligan et al. 2016).

Early Paleoindian populations hunted large mammals, which included the now extinct mammoth, mastodon, horse, camel, bison, giant sloth, and giant beaver (Koch et al. 1998). These
earliest inhabitants of the New World were predominately hunters and gatherers who were nomadic, but perhaps semi-sedentary at times. Although evidence has shown that these people did hunt and butcher megafauna, other evidence shows us that these groups also utilized a wide range of smaller game animals and botanical resources.

The availability of freshwater during the Early Paleoindian period limited suitable habitation sites. The drier environmental conditions which persisted during this period limited rainfall, causing water tables to be much lower. Any surficial water discharge points would have been of value to Paleoindians during this time. Springs during this period were essentially “watering holes,” locales that provided freshwater, food (via the opportunity to hunt animals also seeking freshwater), and high-grade lithic raw materials (Dunbar and Waller 1983).

Little is known about early Paleoindian social organization aside from the notion that these peoples were probably egalitarian. This is based on traditional analogs derived from the behavior of modern hunter-gatherers whose cooperation in hunting strategies is viewed as absolutely necessary to bring down large game animals. Band sizes are also hypothesized to be small in numbers, as is generally the case with highly mobile groups (Laughlin 1968:315). It is presumed that this mode of organization remained relatively unchanged throughout the entire Paleoindian sequence, until populations began to reorganize into primarily sedentary communities during the Middle to Late Archaic.

Middle Paleoindian (12,000-10,500 BC). The Middle Paleoindian Period corresponds to the Allerod Oscillation climatic event, a time of rapidly warming conditions that increased rainfall and temperature to nearly present-day levels, before reversing again towards an overall cooler and drier climate. Clovis PPK of fluted and non-fluted varieties appear in the archaeological record during this era (Dunbar and Hemmings 2004). No other single artifact is
representative of a Clovis assemblage, although the Clovis toolkit in Florida does include large prismatic blades, as well as expedient tools and bone pins (Purdy 1981; Newton et al. 2016:591). It is surmised that the Clovis kit, like other toolkits used throughout the entire Paleoindian sequence, contained perishable items such as baskets, snares, or nets which usually do not withstand thousands of years of degradation after their initial internment, aside from those recovered at the Meadowcroft Rockshelter site in Pennsylvania (Adovasio et al. 1990). Bone tools were also a facet of Clovis culture, including shafts (projectile points and/or foreshafts). It is likely that Clovis peoples relied heavily on bone pins to aid in the butchering process, although bone pins are found in association with other diagnostic lithic artifacts as well (Hemmings 1998:17).

Small seed beads have been recovered at pre-Clovis, Clovis and post-Clovis sites, representing objects of adornment. Red ochre, used as decorative pigment, has also been recovered from Paleoindian sites in Florida (Newton et al. 2016:421), showing that Paleoindian peoples were concerned with bodily appearance. It is possible that other objects used for personal adornment, such as pitch and tattooing implements have gone unnoticed at archaeological sites (Deter-Wolf et al. 2017).

Clovis cultures retained a highly mobile lifeway centered primarily on the hunting of large animals until the beginning of the Late Paleoindian Period. These people represent the largest radiation of Paleoindian material culture, which spread quickly across the entire Continental United States in relatively short time. The disappearance of Clovis from the archaeological record appears to be rather abrupt, no matter the cause. Recent research into the disappearance of Clovis around 10,950 BC is centered on catastrophic environmental changes which may have been sparked by bolide impact (Wittke et al. 2013).
Late Paleoindian (10,950-9,950 BC). Changes in the Paleoindian culture occurred at approximately the same time as the onset of the Younger Dryas (YD), 10,950 BC. During this time, cooler and drier conditions returned to North America, although to a much lesser extent than during the LGM. Surficial water inputs diminished during the YD, but water tables remained much higher than they were during the LGM.

The Late Paleoindian Period subsistence economy is viewed as a time of diversification brought on by yet another change in climate. Most species of Pleistocene megafauna are thought to be largely extinct or near extinction by the YD, although the timing of this phenomenon is not well understood. It could be the case that populations of megafauna were already in decline due to environmental changes, and hunting helped to accelerate the eradications, with individual species going extinct at different times depending on the geographic locale. The appearance of the atlatl, or spear thrower during this time correlates well to the shift away from lancelet sized PPKs to smaller-sized, definitively projectile points. One explanation could be the proliferation of white-tailed deer throughout the southeast (Sherwood et al. 2004:534-551), or another may be viewed as a move towards a more diversified faunal subsistence strategy, such as one centered around the procurement of shore birds (deFrance et al. 2001:235-239).

The Dalton, Beaver Lake, and Long-Eared Suwannee lithic technologies which arose during this period could suggest that multiple groups of geographically separated individuals began to experiment with new lithic technologies. The Dalton type, for instance, is found northward to Illinois, all the way eastward into Pennsylvania, and southward through Alabama into northcentral Florida, with the highest concentration of known Dalton sites along the Central Mississippi Valley (Anderson et al. 2010; Anderson and Sassaman 2012:61). Radiocarbon dates associated with the Dalton horizon were obtained from cave and rockshelter sites (Goodyear
Although woodworking tools such as adzes do occur in pre-Dalton context (Bradley et al. 2010), they do not appear as a common implement until the latter part of Paleoindian times (Morse and Goodyear 1973). It is highly possible that some woodworking tools have gone unnoticed among pre-Dalton stone toolkits. The potential that canoes were used during this time is high, considering that Dalton peoples were highly mobile and were spread along the edges of the newly formed major river drainages throughout the Southeast.

Significant overlap may exist between Clovis and Suwannee/Simpson, since both elements have been recovered from similar contexts, yet the opportunity to date the two types has been elusive (Dunbar and Waller 1983; Jones and Tesar 2000). The extent of the relationships between the different technologies and, perhaps, the different peoples who made them are still up for debate. Furthermore, it is now surmised that the Simpson PPK was probably used as a knife, since the morphology and thin width of the specimens suggests that the item would not have functioned very well as a projectile. Instead, the distinct curvature midway through the blade functions well as a macerating device. Some researchers now believe that the Simpson form is a part of the Suwannee toolkit (Dunbar and Hemmings 2004:68).

Evidence for Paleoindian treatment of the dead has been documented at the Sloan site, a late Paleoindian cemetery in Arkansas, which produced a ceremonial cache of tools, including hypertrophic bifaces, referred to as “Sloans” (Morse 1997). This site stands as an isolated example of burial practices from the late Paleoindian period. At this time there have been no credible examples of artwork in the Southeast that dates to the Paleoindian period.

What we see today as Blackwater Bay once consisted of braided stream complexes meandering through a sand scrub forest, disconnected from the Gulf of Mexico until approximately 2,500 years ago. While freshwater discharge points are known to locals who have
spent considerable time on the Blackwater River, none are formally documented. Freshwater discharge sites are now potentially submerged as a result of sea level rise. The geomorphological features under investigation at Peterson Point show an extinct course of the Yellow River, now subsumed by Blackwater Bay. A freshwater discharge point at Marquis Basin, now beneath the Blackwater River, represents an area of high archaeological probability, owing to the fact that freshwater spring locales, few in number, were frequented by prehistoric peoples during Paleoindian times (Dunbar and Waller 1983). Dalton and Clovis PPK’s recovered from the nearby Yellow River drainage system (Penton 1991; Prentice and Campbell 1993), and at least one Simpson PPK documented at Blackwater River (Mckenzie 1988) stand as examples of a Paleoindian presence along the river drainage system.

*The Archaic Period (9,550-1,800BC)*

The Paleoindian-like lifestyle continued into the Archaic Period, while environmental conditions changed towards the modern patterns and cycles which persist today. New strategies for land use developed during this transition (Anderson and Sassaman 2012:71), including the increased exploitation of coastal and riverine habitats (Saunders and Russo 2010:40). The timing of the appearances of these changes occurred differentially throughout the Southeast, and it is important to note that more sites dating to this period have been discovered further inland rather than on the coast. Inundated coastal sites dating to the Archaic are undoubtedly offshore, although the oldest are within depths accessible to divers (Faught 2004).

Population increase during the Archaic is thought to be due, in part, to the success of food capture methods and increased access to potable water sources. Archaeological data show that the first evidence of the use of cultigens occurred during the Early Archaic, although the
systematic use of seed bearing plants is not considered as a full regional trait until the latter end of the sequence (Anderson and Sassaman 2012:69-70).

Sea level has risen quite substantially since the end of the Pleistocene (Donoghue 2011:18). However, this may have only caused subtle changes to the landscape within a human lifespan, which may not have been clear to prehistoric populations (O’Donoghue et al. 2011:3). Our understanding of the phenomenon resulting from sea level rise suggests that many sites should be found in the areas between the lower extreme of the flooding, the early Pleistocene, and the highest extreme, the present day Holocene (Donoghue 2011; Hameed et al. 2006; Herget et al. 2013; Macdonald and Herget 2013). Many inundated sites could be as far as 120 kilometers from the current coastlines (Donoghue 2011:17). As noted in professional literature, a general understanding of the coastal adaptations of early Holocene peoples has remained elusive as a result of sea level rise (Thompson and Worth 2011:55).

The Archaic period has been formally divided into three divisions—Early, Middle, and Late—based largely on lithic point typologies which correlate to larger climate trends at the onset of the Holocene. Research orientations focusing on the Archaic period tend to follow along the themes of importance of mound construction, alliance and exchange networks, mortuary practices, subsistence ecologies, and the Paleoindian-Archaic transition (Anderson and Sassaman 2012:69).

*Early Archaic (9,550-6,900BC)*. The end of the Paleoindian and beginning of the Archaic is marked by a worldwide climatic change brought about by the end of the YD, also referred to as the beginning of the Preboreal period. The Preboreal marks the end of the Pleistocene and beginning of the Holocene by ushering in a warming period which resulted in the spread of oak and hickory forests throughout the Southeast.
While large mammalian protein sources were dying out at the end of the Pleistocene, simultaneous decreases in salinity levels in estuarine environments began to allow for the proliferation of shellfish species, although this development probably took place over several hundred years or more (Brech 2004; Braje et al. 2012). Freshwater inputs from newly developed river drainages increased the amount of freshwater discharge into conduits along the coast. These freshwater inputs remained near the shoreline, slowly moving through spring conduits before ultimately discharging into the Gulf of Mexico. This process created episodes of burgeoning freshwater levels near the coasts. Springs, perched ponds, and rivers would spill over until the burgeoning freshwater inputs discharged into the Gulf of Mexico, subsequently re-lowering freshwater tables.

Like Paleoindians, Archaic period peoples favored spring locales, which had overflowed during times of increased freshwater input before “levelling off” as groundwater discharged through the conduits. The newly increased surface water volumes created more numbers of habitable sites, allowing for more potable water sources than were available during the Paleoindian periods (Milanich 1980:63). Significant overlap of Paleoindian and Archaic cultural materials are found at wet sites which were already frequented during the Paleoindian periods, such as Little Salt Springs and Page-Ladson (Clausen et al. 1977; Dunbar 2004).

As the environment changed in response to a warmer, wetter climate, prehistoric populations did also. As is the case throughout the entire Southeastern US, Bolen points and temporally related Bolen-like points (early side notched varieties) and Tallahassee points serve as temporal markers for Early Archaic material culture in northwest Florida (Anderson et al. 1996; Driskell 1994, 1996; Ellis et al. 1998). The occurrence of several Bolen and early notched
sites that are virtually the same age corroborate this several times over. A few of these include Page-Ladson and Warm Mineral Springs in Florida, and Dust Cave in Alabama.

The Windover site in Brevard County, Florida is an Early Archaic wet cemetery that has produced a wealth of data spanning several topics, including burial practices, anthropometrics, epidemiology, and material culture (Doran and Dickel 1988). These analyses were made possible because peat deposits had preserved the burials and other usually perishable materials, such as wood, textiles, cordage, brain matter, mtDNA, and bone tools. The unique example at Windover helps us to understand the behavior of Early Archaic peoples. Multiple generations visited the site periodically over hundreds of years to formally inter their dead relatives before the water table eventually became too high to stake down new burials on the peaty bottom of the pond. Isotopic studies have shown that the interred individuals travelled long distances, probably along seasonal subsistence rounds (Stojanowski et al. 2002; Tomczak and Powell 2003). Treatment for ailing group members is witnessed in at least one of the Windover specimens. The skeleton of one individual shows lesions which would have rendered the individual unable to walk at all, let alone long distances. Therefore it can be presumed that the individual was carried somehow by other group members. There doesn’t appear to be evidence of status distinctions amongst the interred in the form of exotic grave goods, and curiously, few lithic artifacts were present in comparison to the amounts of wooden and bone tools recovered (Doran and Dickel 1988).

Sites in Northwest Florida dating to the Early Archaic are usually represented by evidence of small, short-term hunting parties. Several of these ephemeral encampments were documented by the Blackwater Bay Drainage Archaeological Potential Project in the 1980s. These sites consist primarily of small lithic scatters of Tallahatta Quartzite materials. Hence, many are designated as “Indeterminate Archaic Sites.” The major goal of the project was to
inventory existing data gathered through surface collections and collector repositories; therefore, subsurface testing was not a component of the project (Curren et al 1988:25; Phillips1989:95; Penton 1991:18). Further evidence of more sizable settlements may be present on higher bluffs or beneath the river.

\textit{Middle Archaic (6,900-3,800BC).} The Middle Archaic Period correlates to the Hypsithermal, also referred to as the Altithermal, Atlantic, or Climatic Optimum. The Hypsithermal is recognized as a global phenomenon, yet geographic regions experienced different climatic conditions. For example, the lower Southeast experienced increased occurrences of flooding during this time, which aided the development of cypress swamps and the expansion of pine forests. The onset of considerably warmer and wetter global temperatures increased fresh water inputs which resulted in ever expanding fish and shellfish populations (Russo 2002:57). This also created even more wetland and inland water-resource based habitats that were frequented by permanent and semi-permanent settlements beginning in the latter Early Archaic, reaching maximum expansion potential by the Middle Archaic, and remaining so through the end of the Late Archaic. Southeastern groups increased their exploitation of coastal environments since these habitats now provided ample protein sources such as fish, reptiles, rodents, deer, waterfowl, cultigens, and fresh drinking water sources (Sassaman et al. 2011). Population sizes in the Southeast increased during this time, and cultural practices become more complex. It is during this time that shell mounding increases in magnitude (Russo 2002; Sassaman et al. 2011).

Stemmed biface technology developed during the Middle Archaic, with newer, distinct forms radiating throughout the Southeast. However, many of the forms do not persist into the Late Archaic. Also, the Stemmed Archaic Cluster, a grouping of robust, crudely-flaked bifaces,
is not well-represented in extreme northwestern Florida, although Hamilton Points have been recovered further east along the Panhandle (Bense 1983; Farr 2006; Newton et al. 2016).

Elsewhere in the Southeast, archaeologists have collected data which suggest participation in long-distance trade networks, as well as interpersonal violence and warfare (Quinn et al. 2008). Bannerstone objects were used in ritual performances during the Middle Archaic, although little is known about the practitioners who used them. Southeastern groups continued seasonal rounds and remained largely nomadic, although they did so within an increasingly smaller geographic area, which may also imply that independent local cultures began to develop during this time (Anderson and Sassaman 2012:74).

Multidisciplinary research at the Mitchell River site cluster at Choctawhatchee Bay has determined that the estuary was originally inhabited near the latter end of the Middle Archaic (Saunders et al. 2009). Oyster and shellfish resources began to attract seasonal residents beginning approximately 5,300 BC, although the sites were periodically abandoned and reoccupied several times over the next three millennia, before catastrophic hurricanes probably caused the outright abandonment of the Mitchell River sites (Saunders et al. 2009:135). The Meig’s Pasture site, also within Choctawhatchee Bay, is an exceptionally large, mostly undisturbed site that was first occupied beginning in the latter end of the Middle Archaic. The inhabitants of Meig’s Pasture harvested oyster and marsh clams and utilized other small game animals, as well as several shallow water fish species, birds, and turtles (Curren 1987:55). These two examples highlight the coastal dwelling preferences of peoples along the Gulf Coast of Florida during the Middle Archaic, correlating well to the prevailing weather patterns which persisted during this time. Smaller, ephemeral occupations should be found near a centrally-
located site, which is perhaps why evidence of Archaic hunting camps is so abundant in northwest Florida (Curren et al 1988; Phillips 1989; Penton 1991; Taylor 2015).

*Late Archaic (3,800-1,800 BC).* The Late Archaic Period is marked by the end of the Hypsithermal and beginning of the Subboreal climatic episode, which ushered a trend towards modern climatic conditions. The Subboreal Period correlates to a time of cooler and drier conditions than in the preceding Middle Archaic Period (Hypsithermal), although the climate during the Late Archaic was warmer than present-day conditions. Sea-level rise is thought to slow during this time to modern rates, suggesting that sites dating to this era and onward are in the same environmental (climatic) zones as today. River channel gradients slowed due to increased fresh water inputs which allowed for the development of wetlands across the Southeast. This is especially the case in Florida where freshwater snails begin to flourish along the plethora of newly-formed river drainages. It is also during this time that modern estuaries began to form in coastal zones (Otvos 2005; Brech 2004).

A clear marker for the onset of the Late Archaic in northwest Florida is the appearance of fiber-tempered Norwood ceramics, found mostly at sites situated within riverine and estuarine environments in the Florida Panhandle (Sears 1977). However, the timing of the adoption of ceramic traditions in the Gulf Coast occurred later than in other southeastern loci (Saunders and Hayes 2004). Steatite, or soapstone, vessels begin to be utilized by Gulf Coast peoples at approximately the same time that ceramic vessel technologies were spreading throughout the Southeast, although some Gulf Coast peoples adopted ceramic vessel technology slightly later than other locales. Further convoluting the identification of definitively Late Archaic sites in Florida is the fact that Archaic Stemmed Biface technology spans a very large time frame,
beginning sometime near the beginning of the Middle Archaic and persisting through to Woodland times (Bullen 1975; Farr 2006).

Terrestrial excavations at Late Archaic sites have determined that inhabitants lived close to their food and water sources (Day et al. 2012; Sassaman 2004; Mikell and Saunders 2007). Some sites dating to the Late Archaic are now submerged off the Gulf Coast of Florida, although likely fewer in number than sites from the preceding periods. Notably, far fewer sites of considerable size are in the interior of northwestern Florida, which may suggest that areas farther away from wetlands were not favorable for larger scale settlements, although smaller hunting parties would frequent the interiors (Milanich 1994:87). Sites along Choctawhatchee Bay, Mitchell River, and Meig’s Pasture help to paint a picture of increasing sedentism at coastal sites during the Archaic, fitting well within the circumscribed resource array theory proposed by Kelly (2000). In any case, significant population booms occurred during the Middle to Late Archaic which archaeologists correlate to sound subsistence strategies (Milanich 1994:87; Anderson and Sassaman 2012:74).

The cultural developments of the Lower St. Johns River Valley, Poverty Point, and Savannah River Valley begin to take hold during this time, each perhaps a catalyst for widespread practices such as large gatherings and ceremonial treatment for the dead. The construction of monumental shell mound structures begins during this time in Florida, with mounds representing congregational meeting places to further cosmological ideologies and places to hold ritual feasts (Sassaman et al. 2011). In some cases, burials were interred within the existing mound structures, and others show mound construction occurring after the deposition of human remains (White 2011; Sassaman et al. 2011; Russo 2002).
Baked clay objects found at the Meig’s Pasture, as well as the presence of steatite vessels at Meig’s Pasture and Mitchell River sites, relates the Poverty Point culture to Choctawhatchee Bay in the expression referred to as the Elliot’s Point Complex (approximately 1,500–450 BC) (Curren 1987; Thomas and Campbell 1993; Mikell 2017). Further evidence of Elliot’s Point is possibly submerged in shallow depths within the Blackwater Bay drainage.

The Woodland Period (1,200BC–AD 1,000)

The entirety of the Woodland Period correlates to the Subatlantic Climatic Episode, the climatic regime of today. The Subatlantic has undergone several oscillations of hotter and colder than present weather, but none of which were as drastic as the preceding climatic episodes. Sea level rise was very gradual at the onset of the Subatlantic but has accelerated since the beginning of the nineteenth century.

The use of ceramic technology was widespread throughout the northern Gulf coast near the beginning of the Woodland, with unique styles distributed across the region (Willey and Woodbury 1942; Willey 1949). Use of Early, Middle, and Late Woodland temporal markers takes into account the frequency of finding more than one pottery type at a site including what might be considered as stylistic transitions between the Late Archaic and Early Woodland and Late Woodland to the beginning of the Mississippian period (White 2011:227). Much detail could be given to the individuals of the Woodland period by focusing on Deptford, Santa Rosa-Swift Creek, and Weeden Island traditions rather than broad-scale trends. I have chosen to focus on site locations along the Blackwater Bay drainage in relation to the environmental changes which occurred in the area. Archaeologists agree that great overlap exists between the different ceramic styles present at sites, and the timing and magnitude of these relationships are varied. Here, I refer to the classic expressions present in northwest Florida, without focusing on the
overlaps. The reader is encouraged to think of Early, Middle, and Late Woodland in northwest Florida as correlates to Deptford, Swift Creek, and Weeden Island, although ambiguity will be present in either scheme since there is overlap in temporal and spatial occurrences of Deptford to Santa Rosa-Swift Creek, of Santa Rosa-Swift Creek to Santa Rosa, and Santa Rosa to Weeden Island (Willey 1949; Milanich 1994:144; White 2011:225).

Most groups throughout the Southeast lived in mostly permanent communities by the onset of the Woodland although archaeological evidence for smaller hunting sites is abundant in northwest Florida. Successful food capturing strategies allowed new cultural practices to flourish during the Woodland Period. Groups navigated water routes throughout much of the Southeast, forging trade routes along waterways while simultaneously exchanging ideas and technologies. Major trends of the Woodland include the increased importance of seed bearing plants, increased use of permanent village areas, elaborate mortuary practices (including mound construction), and the widespread adoption of ceramic technology (Anderson and Sassaman 2012:114; Jefferies 2004).

*Early Woodland (1,200-100 BC).* Early Woodland society in northwest Florida is most associated with Deptford groups, known for their proximity to coastal resources and their use of easily recognizable plain or paddle-stamped designs on sand-tempered ceramics. Deptford style ceramics spread from the Atlantic Coast of Georgia westward through the Big Bend and Panhandle portions of Florida, all the way to the Perdido drainage in extreme western Florida (Willey 1949:265). The most common expression of Deptford groups in Florida are found along the Gulf Coast; and inland, along major rivers. This inland riverine expression of the culture is best recognized along the river basins of North Florida, where their sites remain above the water line (Milanich and Fairbanks 1980:66; Tesar 1980). Many Gulf Coast sites dating to the early
Deptford Period (onset of the Subatlantic) are now submerged in shallow water or are in immediate danger of erosion and sea level encroachment (Sassaman et al. 2015:17).

Fishing, oyster harvesting, and inland hunting were facets of Deptford economies (Bense 1985; Sassaman et al. 2016). Deptford peoples harvested shellfish and oyster resources as well as reptile, bird, deer, and other inland dwelling animals. Seeds (wild and cultivated) and acorns made up a large part of the Deptford diet (Milanich 1994). The Deptford tool kit was comprised of a diversified assortment, including nets, snares, cordage, fish hooks, and bone and wooden tools, which reflects the myriad of food capture techniques that Deptford people employed. Weirs were used to corral fish in areas where they could be taken easily in great numbers, as was the case at the Hawkshaw site on Escambia Bay (Bense 1985). Currently, little is known of Deptford social organization. The movement of Deptford peoples to the interior of northcentral Florida resulted in villages that produced mound sites, while Gulf Coast Deptford peoples are thought to have retained their subsistence strategy (Milanich 1994:134).

The Yent Complex, named after a Deptford mound site in the eastern Panhandle, could be thought of as a representation of “Terminal Gulf Deptford Period.” The Yent Complex lasted from approximately 100 BC–500 AD in the eastern Panhandle and northern Peninsular Gulf coast (Sears 1977). Archaeologists believe that the Yent Complex is associated with the Hopewell Interaction Sphere due to the presence of non-local items such as stone, copper ear spools, metals, ornaments, and worked bone items such as carnivore teeth and mandibles (Milanich 1994:135). Yent complex burials include flexed, bundled, extended, and single-skull burials, which may imply differential treatment for the dead based on social status. Elaborate pottery is present within the ceremonial mound structures but not within individual burial contexts, although shell (*Buscyon*) cups are found with elaborate pottery in Yent burials. These
patterns of ritual internment point to the existence of a sacred set of rules governing the use and discard of ceremonial objects (Sears 1977).

*Middle Woodland (100 BC–AD 500).* In the western Panhandle, Santa Rosa-Swift Creek refers to a variant of Swift Creek ceramic types found between Pensacola Bay and St. Andrew’s Bay (Willey 1949). Swift Creek groups participated within a larger exchange system that spanned much of the southeastern United States, encompassing the entirety of Georgia, the entire Florida Panhandle from Jacksonville westward, portions of South Carolina, North Carolina, and Tennessee, much of Alabama, and a small portion of southeastern Mississippi (Wallis 2011:7–31). Participation in a Southeastern Interaction Sphere likely reached its apex during the Middle Woodland (Caldwell 1964; Wallis 2011).

Complicated stamped ceramics demarcate the beginnings of Swift Creek culture in northwest Florida (Willey 1949:349–350; Wallis 2011:7–31). Intricate surface designs were created on clay vessels by impressing a carved wooden paddle, although a single two-sided baked clay stamp has been recovered (Milanich 1994:146). Judy Bense’s (1992) research determined that Santa Rosa-Swift Creek represents an earlier regional manifestation of Swift Creek ceramic style. In the Pensacola Bay area, Santa Rosa-Swift Creek is found in strata underlying definitive Swift Creek ceramics (Bense 1992). Santa Rosa-Swift Creek is not found east of Panama City, and Swift Creek is not found east of the Apalachicola in peninsular Florida, although Swift Creek extends a considerable distance northward into Georgia. Excavations in Okaloosa County at the Fort Walton Mound site produced Deptford Plain and Simple stamped ceramics in the lowest strata below Santa Rosa-Swift Creek ceramics, suggesting that the Deptford ceramic tradition predated Swift Creek in the Pensacola Bay area (Willey 1949:86).
Swift Creek peoples used a large toolkit that included pins, flakers, scrapers, and bone awls. Shell tools are rare at Swift Creek sites. The Swift Creek lithic complex, identified by Phelps (1969), contained a diagnostic point that is very similar to the Columbia type, also described as a Weeden Island typological indicator by Bullen (1975). Bifacial knives, spokeshaves, hammer stones, and nutting stones are other non-perishable artifacts recovered from Swift Creek sites.

Evidence of economic interactions in the Swift Creek Period is determined by the high quantities of exotic goods such as precious metals, stones, and sheets of mica. Baked-clay figurines depicting a woman, or perhaps a mother-goddess, have been recovered at inland village sites and are believed to be objects obtained through participation in an interaction sphere. Polished carnivore mandibles and drilled carnivore teeth have been recovered at inland sites, perhaps representing ritual items (Wallis et al. 2015).

The Green Point complex, originally identified by Sears (1977), was defined by four Swift-Creek mounds dating to the Early Woodland. Swift Creek burials are most often flexed and were partially cremated in the earlier years before transitioning to single context internments within conical mounds. Ritual ceramics were interred along with the deceased, although there is no known difference between utilitarian and ritual wares based on analyses of surface designs alone (Milanich 1994).

Settlement patterns of the Middle Woodland vary by environment and region, but were usually centered around a small village with dispersed satellite hamlets which served as resource extraction sites (Anderson and Sassaman 2012:124-125). The Byrd Hammock site in Wakulla County has produced data on Swift Creek village life (Bense 1969; Penton 1969), as have other representative sites in Escambia County such as the Bernath and Hawkshaw Sites, which both
contain Deptford through Santa Rosa-Swift Creek components. Other sites connected to the Pensacola Bay watershed are the Gulf Breeze sites in Santa Rosa County, which were, at one time, middens of considerable size. The Gulf Breeze site cluster contained Santa Rosa-Swift Creek ceramic deposits in the lower strata beneath later Weeden Island and Fort Walton deposits (Willey 1949:95).

In the late nineteenth century, S.T. Walker excavated several graves at Maester Creek, near Escribano Point, approximately two miles south of Peterson Point. Walker described the slab burials as covered with shell and lime before being wood fired, which created a solid covering over the extended bodies. Walker believed that there was an extensive village site at this location, although he provides few notes relating to the village. Each of the burials contained fragments of Santa Rosa-Swift Creek and Fort Walton ceramics (Walker 1885:857-858). C.B. Moore excavated 16 burials at Maester Creek approximately 15 years after Walker, noting the presence of hematite and restricted neck vessels that accompanied the burials. Moore also documented looter holes within the three-foot high mound (Brose and White 1999:59). Willey revisited Maester Creek to excavate a large mound on the south side of Pensacola Sound approximately two miles west of Navarre which produced large amounts of oysters and other refuse. Sherds recovered from this site span the Deptford, Santa Rosa-Swift Creek, and Swift Creek occupations (Willey 1949). Other Woodland Period sites of a more ephemeral nature have been documented along the Blackwater and Yellow River drainages (Little et al. 1988; Phillips 1989; Penton 1991; Phillips and McKenzie 1993).

**Late Woodland (AD 200–900).** The Weeden Island cultures of Florida first appear in the archaeological record near Late Woodland times. Distinctive changes in ceramic styles arose during this period, including new surface decorative styles and the use of elaborate mortuary
vessels distinct in form, style, and composition from utilitarian vessels. Willey (1949) originally noted the similarities in motifs to the Coles Creek complex found along the Mississippi River Valley. The Yent and Green Point complexes do not carry on into Weeden Island times, which may suggest that outside influences from the Lower Mississippi valley brought about change. Elaborate ceramic styles of the Late Woodland originally described by Willey (1949) include Carrabelle Incised, Carrabelle Punctated, Keith Incised, Weeden Island Incised, and Wakulla Check Stamped. Weeden Island Pottery is considered to be the most elaborate and decorative type produced by Florida’s prehistoric groups, with many regional manifestations abound. Effigy vessels have been recovered almost exclusively in association with burial contexts. The Northwest Florida Weeden Island manifestations are centered on the early (Carrabelle) and late (Wakulla) phases, named for sites in the Panhandle. Networks of exchange continued throughout the Late Woodland, as galena, mica, and copper from the Midwest, and marine shell from coastal areas moved about the Southeast and Midwest. Anthropomorphic and zoomorphic imagery also appear on ritual vessels for the first time (Milanich 1994).

Mound-village complexes are characteristic of this era, although the practice of maize horticulture is evidenced only at a limited number of inland sites in the region. Archaeologists note the apparent differences in subsistence strategies between coastal and inland sites, such as the presence of nets, hooks, and snares at coastal sites, in contrast to the recoveries of grinding stones, used to process maize, at inland sites (Milanich 1994). Similar to the preceding Woodland Periods, coastal village life was centered on salt marshes adjacent to brackish estuaries situated along the Gulf near fish, shellfish, and other resource niches such as seeds and acorns. This way of life, which began during Deptford times, proved to be successful because coastal Weeden Island peoples could capitalize on the numerous resources available, depending
on the season (Sassaman et al. 2016). Inland expressions of Late Weeden Island culture in the Northwest region of Florida are typified by the work at Bird Hammock (Bense 1969; Penton 1969; Nanfro 2004). Notably, Greg Mikell’s zooarchaeological analysis from Mack Bayou identified over 19 species of vertebrates, many of which are present today in Blackwater Bay, such as sheepshead and redfish (Mikell 2012:24, table 3).

Other Late Woodland sites excavated by Willey include Hickory Shores, Graveyard Point, Woodlawn, and Fundy Bayou, which is adjacent to Maester Creek (Willey 1949). The East Pensacola Heights site, originally described by S.T. Walker (1885), also contained Weeden Island ceramics. Recent surveys documented several new Late Woodland and Mississippian Period sites within the Escribano Point Wildlife Management area, approximately six km south of Peterson Point (Mikell 2016).

*Mississippian Period (AD 1,000–1,500)*

In Pensacola Bay, the Mississippian Period is represented by the sand-tempered Fort Walton (1,200–1,500 AD) and shell tempered Pensacola (1,000–1,500 AD) ceramic traditions originally defined by Willey (1949:452), although the quintessential expressions of either type do not match their namesakes. For instance, more recent evidence has shown that the Pensacola ceramic tradition spread eastward in the Pensacola Bay area from Bottle Creek, Alabama, with the type diminishing in frequency east of Choctawhatchee Bay (Brown 2003; Harris 2012). Fort Walton sites are distributed from the Aucilla River westward to Mobile Bay, and northward into the Chattahoochee River drainage in Alabama and Georgia, similar to Wakulla period sites (Tesar 1980; Marrinan 2012). However, the inland expressions of these ceramic traditions do not correlate to known sites in the Pensacola Bay area since both Fort Walton and Pensacola type sites lack large platform mounds and ceremonial centers (Harris 2012). Large Mississippian sites
within northwest Florida occur exclusively in the eastern Panhandle inside the bounds of the Fort Walton ceramic tradition with the largest known being the Lake Jackson Mound site, a large village containing a series of large platform mounds surrounded by smaller mounds (Scarry 1980). The Fort Walton Temple Mound, located on Choctawhatchee Bay, is also a platform mound of considerable size that produced Pensacola and Fort Walton ceramic types, although much of the mound remains unexcavated (Jones 1982). Other Fort Walton sites within Choctawhatchee Bay are typically situated around a burial mound or cemetery, although platform mounds appear to be present in only in the Fort Walton heartland to the east (Mikell 1992:51-54; Ashley and White 2012:18-25). Similarly, sites containing Pensacola ceramics also tend to cluster near smaller mounds or cemeteries (Phillips 1995; Harris 2012).

Typical Mississippian Period sites of either the Fort Walton or Pensacola traditions do not occur within the interior of Eglin Air Force Base, which Blackwater Bay borders on the base’s western margin (Thomas and Campbell 1993). This might imply participation within a smaller regional exchange network that is situated along the bays and estuaries of the north Gulf Coast region of the panhandle, Bottle Creek perhaps being one such center of exchange (Brown 2003; Harris 2012). At least one Fort Walton period site further inland, Waddells Mill Pond, was surrounded by a palisade structure, suggesting that warfare and conflict may have occupied a part of life at this location. However, palisades or other fortification structures have not been identified at other Mississippian Period sites in the Pensacola Bay area (Gardner 1966). Pensacola ceramics found above Fort Walton ceramics, as well as in contemporaneous levels, suggests that either Pensacola Bay area was a ceramic “transition zone,” an area of exchange
between two neighboring groups, or yet a separate culture distinct from inland Mississippian chiefdoms (Harris 2012). The relationships between and amongst Mississippian groups within the Panhandle region remains unclear.

The use of shell tempering agents in Pensacola ceramics may have increased in a westward direction through time (Weinstein and Dumas 2008:204) while sand tempering may have spread from an area northeast of Pensacola Bay along the Chattahoochee drainage (White et al. 2012). Mississippian societies were practicing maize agriculture at interior locations along major river drainages. There is no evidence of this in the coastal lowlands surrounding Pensacola, Choctawhatchee, and St. Andrew Bays, where the middens do not contain maize and oysters and fishes made up the bulk of foodstuffs. Any agricultural items were likely acquired by trade, owing to poor soils (Sears 1977; Milanich 1980; Mikell 1992; White 2011; Marrinan and White 2007). Approximately 160 Mississippian Period sites have been recorded within the Pensacola Bay watershed, exclusively near the shores of bays or estuaries (Harris 2012:280).

Lithic and perishable toolkits include an assortment of gravers, drills, shell hoes, triangular projectile points, fish hooks, snares, and weirs (Milanich 1994). Globular bowls, gourd effigies, and collared bowls recovered from Pensacola and Fort Walton sites evidence a connection to the Mississippian iconography and burial practices of the greater Southeast. One such site, Hickory Ridge Cemetery, is located on a narrow peninsula separating Perdido and Pensacola Bays, approximately 50 meters from an unnamed Mississippian Period village site (8ES1052).

Excavations at Hickory Ridge by UWF (Phillips 1989, 1995) produced Bottle Creek ceramics and other Mississippian cultural materials, suggesting a connection to a larger Mississippian center and perhaps other burial sites located along the Pensacola Bay drainage. Along Blackwater Bay, Maester Creek and Fundy Bayou (Walker 1883; Sheldon 2001; Willey
1949), and the newly recorded Escribano Point sites (Mikell 2016) evidence Mississippian influences. Within Pensacola Sound, the Navarre sites, Butcherpen Mound, and the Naval Live Oaks cluster show resemblance to Mississippian Period settlements along to the Pensacola Bay drainage. Finally, the Bear Point site at nearby Perdido Bay resembles other Mississippian Period burial sites in the area (Sternberg 1875; Lazarus 1961).

Many of the archaeological sites listed above are connected to each other by way of the Pensacola Bay system although their temporal span and relationships to one another remains unclear at this time. An understanding of the natural processes which caused the watershed to form could help to inform research on prehistoric archaeological site occurrences by determining the temporal relationship between the formation of the bay system and periods of prehistoric occupations. Does Blackwater Bay hold the potential for submerged Paleoindian sites? The geomorphic and remote sensing data collection methods presented in the following chapter are used to form a narrative which relates the development of the Blackwater River-Bay estuary to prehistoric archaeological site occurrences within the system.
CHAPTER IV

METHODS

The opportunity to investigate submerged geomorphic features presented itself during Dr. Gregory Cook’s 2013 Maritime Survey Methods course, when student teams collecting sidescan survey data identified anomalous submerged features at two different areas within the river-bay complex. Models or analogs were then consulted accordingly and selected on the basis for their potential to evaluate and contextualize submerged terrestrial landscapes. Currently, there exists no comprehensive rubric for this project, therefore the investigation of the geomorphic features required the use of multiple methodologies derived from previous geoarchaeological research conducted within the Gulf of Mexico (Coastal Environments Incorporated 1977; Gagliano et al. 1982; Dunbar et al. 1988; Faught 2004). While each of these studies are thorough, none are as inclusive as the methodology outlined in Anders Fischer’s (1995) “Danish Model.” Fischer’s model laid the foreground for investigating submerged landscapes within Doggerland before being expanded on by Benjamin (2010), Ford and Halligan (2010), and Faught (2010). This research loosely follows the Danish Model in a six-fold manner, and for the purposes of this research, is amended where necessary to accommodate other modes of archaeological site prospection. The Danish Model includes the following: Phase I. Regional Familiarization; Phase II. Ethnographic Component; Phase III. Map, Chart, Aerial Analysis, and Location Plotting; Phase IV. Observation of Potential Survey Locations; Phase V. Diver Investigations; and Phase VI. Post-Fieldwork Analysis, Interpretation, and Dissemination.

Phase I: Regional Familiarization

Information on the geography, geology, geomorphology, hydrography, and hydrology of the Blackwater Bay-River complex was acquired from documents published by the United States

Phase II: Ethnographic Component (Literature Reviews)

Archaeological site reports acquired from the Florida Bureau of Archaeological Research (BAR) and the University of West Florida Archaeology Institute provided preliminary background information on archaeological resources in the area.

Phase III: Map, Chart, Aerial Analysis, and Location Plotting

Spatial analysis provided an opportunity to model the terrain of the present-day Blackwater Bay-River complex. Nautical charts, historical aerial photos, and local maps were acquired from a variety of sources, including the University of Florida Digital Collections Library, Google Earth Imagery, USGS Quadrangle maps, bathymetric maps, and ArcGIS maps generated by the author. The earliest large scale historical imagery was captured during flyovers beginning in 1946 were georeferenced and used for comparison.

Phase IV: Observation of Potential Survey Locations

Since 2010, UWF has been actively surveying the Blackwater Bay-River complex. The primary goal of this ongoing survey is to identify and document shipwrecks along the river. Surveys typically include standalone or tandem sidescan sonar and towed magnetometer surveys. While magnetometer surveys are largely ineffective in locating prehistoric archaeological sites due to the absence of ferrous metals in the western hemisphere prior to European conquest, sidescan surveys can effectively detect anomalous geomorphic features such as submerged river channels and springs (Atherton 2001; Quinn et al. 2002; Faught 2004). Two different data series were collected in an effort to corroborate the anomalies. A suite of remote sensing techniques were
used to observe the features at Marquis Basin and Peterson Point. The following subsections briefly discuss each method.

*Sidescan Sonar.* Sidescan sonar uses acoustic waves to map submerged features. A transducer projects sound waves from the center of the device while a receiver calculates return rates of the sound waves, which are then used to create a detailed picture of bottom features (Atherton 2011:1.8).

*Subbottom Profiling.* Subbottom profilers emit a pulse of sound towards the bottom of a water body and calculate the return rates and refractions of the pulses from the seafloor (Singh et al. 2000). The amount of refraction of the sound pulses can then be used as data to characterize substrates. In this case study, hardpan, or confining layers, were indicative of potential spring conduits and were noted as targets in Hypack software.

*Multibeam Echosounding.* Multibeam echosounders use an array of sonic pulses transmitted towards the seafloor. A receiver captures the return rates of the sonic pulses, or “pings,” which are used to generate precisely time-stamped bathymetric images. A model of the bowl-shaped depression near Marquis Basin was generated using an Edgetech 6205 Combination Sidescan and Multibeam Echosounding unit as part of UWF graduate student research (Marionneaux 2018).

**Phase V: Diver Investigations**

Anomalous changes in bottom types were recorded as detailed targets within Hypack while conducting subbottom surveys during the summer of 2016. All spatial data were referenced using a Trimble moving-base real-time kinematic GPS unit, which carries an accuracy to <1 centimeters (cm). Student dive teams then investigated the targets (see Figure 4).
Blackwater River, true to its name, is a very low visibility environment in which to conduct diver investigations. The tannic acid from upland pine forests stains the water year-round, making it an ideal place to teach “blackout diving.” Baseline measurements collected near Peterson Point by student dive teams were used to generate a rough outline of the feature. Graphite “push-rods” were used to differentiate between loosely compacted silty sediments and sandy compact sediment.

*Temperature and Salinity Measurements.* Water chemistry samples were collected from different heights within the water column using a Van Dorn water sampling unit. Next, a YSI meter was used to measure temperature and salinity. A significant change in temperature gradients between ambient water (river) and subterranean water (spring) discharge would provide ancillary data which could then be used to explain the nature of the submerged geomorphic features.
Vibracoring Operations. Vibracoring operations were made possible by the personnel at UWF’s Marine Services Center, Steve Melin, Fritz Sharer, and Robert “Del” Delasantos. The 28ft pontoon boat used to conduct the vibracoring operations was equipped with spud anchors at the port side of the bow and starboard side of the stern to keep the vessel steady as the concrete vibrating block drove the five-inch diameter aluminum cores into the substrate. The length of the spud anchors limits the water depth at which a vessel may obtain the core to approximately six feet. A winch-pulley system extracted each core, while a team member capped the bottom of the core tube as it left the river bottom, thus minimizing sample loss (Figure 5). The length of each core tube was measured prior to obtaining a sample to account for the length of water present within each core tube sample. Water length was subtracted from the total core length, leaving a calculated value for the total depth of penetration. Core samples were transported in an upright position to a climate-controlled storage space at UWF’s Collections.
Facility where they remained fastened upright until analysis. Coring locations were selected along shallow banks adjacent to Marquis Basin and Peterson Point. See Appendix A for spatial coordinates.

Sediment Sampling. An aluminum circular saw blade was used to cut open the core tubes before each was photographed and sampled (Figure 6). Munsell designations and preliminary textural characterizations were given to each stratigraphic unit (Appendix A). Sample intervals were selected near stratigraphic breaks when available. Each sediment grab was collected while wearing sterile latex examination gloves and using a ceramic knife systematically cleaned with deionized water before each sample extraction. Sediment samples were mostly collected from the same half of each splayed core, allowing for correlation to radiocarbon sample intervals except where noted (Figure 7). Radiocarbon samples were stored in aluminum foil packets. A single wood fragment was sampled and the other seven radiocarbon assays were obtained from soil organics. The remaining materials not selected for sedimentary or radiocarbon analysis were...
wet-screened through 1/16” hardware cloth. No cultural materials were recovered from any of the core samples.

Figure 7. Sampling splayed vibracore.

Phase VI: Post-Fieldwork Analysis, Interpretation, and Dissemination

Soil particle size distribution analysis (PSA) was conducted at the UWF Soils Laboratory in the Department of Earth and Environmental Sciences during the months of April–June 2017. Analysis of soil, or sediment, matrix is a proven method for classification of composition by particle fractions.Geomorphologists and geoarchaeologists seeking to minimize subjective errors in soil classifications have incorporated PSA into their research (Baver et al. 1972; Langhor et al. 1976; Catt 1985; Holliday 1985; Ferring 1992; Waters 1992).

Simple methods for determining particle fractions exist, such as the pippette method or fractionation by mechanical seiving. However, although accurate, the pippette method is very time consuming and mechanical seiving, albeit a quick method, is less reliable when fractioning
fine-grained sediments. Therefore both of these methods were jettisoned once access to a Malvern Mastersizer 3000 was granted, thereby increasing sample processing speed, accuracy, and data output capacity (Figure 8).

Approximately 50 grams of each sediment sample was air dried for one week before being mechanically separated with a pestle and mortar. The samples were then sifted through a two millimeter (mm) sieve to remove any fractions larger than very coarse sand, using the Wentworth Scale. Eight grams of sediment from each sample interval was placed into a 1000 mL laboratory beaker filled with 800 mL of deionized water. The machine then calculated sediment grain sorting from laser refractions before outputting the values as tabular data as a Microsoft Excell spreadsheet according to the size classes, in micrometers (µm). Each sample was conducted for three cycles per batch. A duplicate sample batch was then analyzed, bringing the total number of sample runs to six. The six samples were then averaged together to achieve a higher level of precision.
Summary of Methods

Additional sidescan data were collected and analyzed on two different occasions. The anomalous features were present in each data set. Subbottom data were collected on two different occasions. UWF Underwater Archaeology personnel were deployed to visually investigate the features, which were confirmed to be depressions. Temperature and salinity were measured using an YSI instrument. A bathymetric image depicting the entrance to Marquis Basin was generated using an Edgetech 6205 multibeam and sidescan sonar combo unit. Vibracores were extracted from select locations using a tripod mounted vessel. Vibracores were splayed, photographed, characterized, and sampled for soil particle size analysis. Particle size analysis was conducted using a Malvern Mastersizer 3000. Radiocarbon assays were obtained from selected core sample intervals. The following chapter discusses the results of the remote sensing surveys, as well as the results of the radiocarbon and particle size distribution analyses.
CHAPTER V

RESULTS

The following pages present the results of remote sensing surveys and the radiocarbon and sediment particle size distribution analyses of sediments collected in vibracores from Peterson Point and Marquis Basin. Coring locations were selected adjacent to each of the anomalous depressions and were extracted in three to six feet of water depth. UTM coordinates for each core extraction are presented in Appendix A. Sediment samples were collected from stratigraphic breaks present within the core tubes. In most cases, organic-rich sediments were collected for radiocarbon analysis although a single wood fragment was analyzed from Core Six.

The first anomalous feature recorded near Marquis Basin is located approximately 6 km upriver, north of Peterson Point (Figure 9). The Marquis Basin data reveal a drastic change in depth spanning between approximately one to 15 meters at its deepest point along the western bank. At first glance, the Marquis Basin feature resembled a bowl-shaped spring depression, perhaps now a submerged sinkhole, much like those found exclusively within karstic environments. The second anomalous sidescan sonar image collected near Peterson Point (Figure 10) depicts an irregular change in depth from approximately 1.5 meters at its shallowest to 5.5 meters at its deepest point, paralleling the present shoreline.
During the summer of 2015, Dr. Cook and the author deployed a Stratabox subbottom profiler at Marquis Basin and Peterson Point. An additional subbottom survey was conducted at
both locations by UWF alumni Eric Swanson and Will Wilson during the summer of 2016. Each of the subbottom datasets show the same differences in substrate at approximately 8–12 meters beneath the river bottom, potentially representing a consolidated “hardpan” layer at Marquis Basin which acts as a confining unit that reroutes groundwater and determines the location at which surface water is discharged.

At Marquis Basin, salinity levels remained low, less than one percent for both discharging water points and the ambient water. As Marquis Basin is located further upriver, it is not surprising that salinity concentrations are very low and evenly distributed throughout the water column. At Peterson Point, salinity concentrations measured approximately 28 percent throughout the entire water column, a result of the influx of salt water entering Pensacola Pass. The image depicting the depression at Marquis Basin (Figure 11) suggests that the feature may be a submerged spring which was once exposed. However, the data do not show any significant changes in the temperature of water column sample intervals at either Marquis Basin or Peterson Point (Appendix B).

At Peterson Point, the image profiles show that the first surface encountered by the sonic pulses are those containing softer, finer, silts and clays, which typically represents an infilling of sediments during a time of low energy gradients. In other words, a low energy environment is conducive to the accumulation of finer grained sediments. The subbottom data might suggest that the Peterson Point location is an in-filled paleoriver channel.
Figure 11. Bathymetric image of Marquis Basin. Data collection, processing, and post processing by Arlice Marionneaux.

All radiocarbon analyses were conducted by International Chemical Analyses, Inc. (ICA) of Miami, Florida. Calibrated ages were attained using INTCAL13 software. A two-sigma calibration (95 percent probability) was used. Conventional ages are presented in BP and have been corrected for fractionation using the delta C13 isotopic signature. Organic sediments were pretreated with the hot HCL method (AO) to remove carbonates and acid-soluble compounds before being heated to 80°C for one hour. Next, each sample was centrifuged then decanted. Finally, the sample was rinsed in deionized water and dried at 60°C. The wood fragment was pretreated using the acid-alkaline-acid method (AAA) which is an industry standard for pretreating plant material, charcoal, wood, and peat. The process involved three steps. First, an acid treatment was applied to remove secondary carbonates and acid-soluble compounds; next, an alkali treatment was used to separate out humic acids; and lastly, a second acid treatment was applied to remove atmospheric CO2. The sample was then placed HCL and heated to 80°C for one hour before being centrifuged and decanted. The sample was then washed with NaOH to
remove possible contamination by humic acids, treated with dilute HCl and washed with
deionized water, and dried at 60ºC. Each sample is presented below (Table 1 and Table 2), then
discussed in detail within the following section (see Appendix D for the complete report of the
radiocarbon analysis authored by ICA).

Table 2. Radiocarbon Assays from Marquis Basin (C4-1, C4-2, C4-3) and Peterson Point
(C2-1).

<table>
<thead>
<tr>
<th>ICA ID</th>
<th>Submitter ID</th>
<th>Material Type</th>
<th>Pretreatment</th>
<th>Conventional Age</th>
<th>Calibrated Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>17OS/0301</td>
<td>C4-1</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>1360 +/- 30 BP</td>
<td>Cal 620 - 660 AD (92.2%) Cal 750 – 780 AD (3.2%)</td>
</tr>
<tr>
<td>17OS/0302</td>
<td>C4-2</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>1230 +/- 30 BP</td>
<td>Cal 660 - 750 AD (32.7%) Cal 760 – 860 AD (82.7%)</td>
</tr>
<tr>
<td>17OS/0303</td>
<td>C4-3</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>100 +/- 40 BP</td>
<td>Cal 1600 – 1780 AD (30.8%) Cal 1900 – 1940 AD (64.6%)</td>
</tr>
<tr>
<td>17OS/0304</td>
<td>C2-1</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>60 +/- 30 BP</td>
<td>Cal 1600 - 1730 AD (23.1%) Cal 1610 – 1820 AD (72.3%)</td>
</tr>
</tbody>
</table>

Table 1. Radiocarbon Assays from Marquis Basin.

<table>
<thead>
<tr>
<th>ICA ID</th>
<th>Submitter ID</th>
<th>Material Type</th>
<th>Pretreatment</th>
<th>Conventional Age</th>
<th>Calibrated Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>17OS/0806</td>
<td>C1L-144-150</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>1310 +/- 30 BP</td>
<td>Cal 660 – 730 AD (65.0%) Cal 740 – 770 AD (27.4%)</td>
</tr>
<tr>
<td>17OS/0807</td>
<td>C3L-115-119</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>1240 +/- 30 BP</td>
<td>Cal 680 – 760 AD (61.3%) Cal 790 – 860 AD (34.1%)</td>
</tr>
<tr>
<td>17OS/0808</td>
<td>C3L-B-74-78</td>
<td>Organic Sediment</td>
<td>AO</td>
<td>1500 +/- 30 BP</td>
<td>Cal 410 – 550 AD</td>
</tr>
<tr>
<td>17W0889</td>
<td>C3L-126-127</td>
<td>WOOD</td>
<td>AAA</td>
<td>2000 +/- 30 BP</td>
<td>Cal 190 – 40 BC (64.5%) Cal 10 – 9 BC (0.9%)</td>
</tr>
</tbody>
</table>
Core One

Organic sediment taken from a depth range of approximately 144–150 cm returned a conventional radiocarbon date of 1,310 +/- 30 BP, two-sigma calibrated date range of 660–770 AD (Figure 12). Corresponding PSA samples show particle size ranges clustering between very coarse sand (1.0–2.0 mm) and very fine pebble (2.0–4.0 mm) classes.

Larger grain sizes are indicative of a high energy fluvial environment. In other words, larger grain sizes require higher flow velocities to be transported (Macdonald and Herget 2013). The presence of large grain sizes in the bottom reaches of Core One also indicates that the coring unit penetrated to a depth nearing bedrock, although the exact depth of the bedrock is unknown. However, the presence of large grains in the lowest depths of the sediment core suggests that the
radiocarbon date obtained from the core can be used as a temporal marker; the date obtained from Core One suggests that the area adjacent to Marquis Basin was within a moderate-to-high energy fluvial environment before approximately 660 AD.

Core Two

Organic sediment from a depth range of 34–39 cm returned a conventional radiocarbon date of 60 +/- 30 BP, two-sigma calibrated date range of 1,690–1,920 AD (Figure 13). Corresponding PSA samples show a clustering of sediment grain sizes clustering within the very fine pebbles size class (2–4mm). The apparent homogeneous mixture of sediment throughout the core sample suggests the overlying sediments have been removed by erosional processes. As previously mentioned, the coring unit could not reach the suspected paleoriver channel at Peterson Point. Core Two was taken between the submerged channel and present-day shoreline, an area highly susceptible to erosional processes. The results of the radiocarbon analysis suggests

Figure 13. Photograph of Core Two. Note: small arrow points towards surface.
that the area is either an actively eroding landform, newer organic materials have pervaded the sediment, or significant mixing has occurred since the removal of overlaying sediments. The radiocarbon date of 60 calendar years before the present obtained from Core Two should be taken in lieu of these considerations (Matthews 1985).

Core Three

Organic sediment from a depth range of 116–119 cm returned a conventional radiocarbon date of 1,240 +/- 30 BP, two-sigma calibrated date range of 680–880 AD (Figure 14).

Figure 14. Photograph showing Core Three. Note: overwash event present between 110–112 cm.

PSA samples taken from corresponding depths of 113-116 cm show a clustering of sediment grain sizes around a mean of approximately 0.07 mm which, using the Wentworth Scale, is within the boundary between coarse silt (0.031-0.062 mm) and very fine sand (0.062-0.125 mm). This suggests that the finer-sized sediment particles were transported in a low energy fluvial environment at approximately 680–780 AD.
Sediment taken from a depth range of 199–203 cm returned a conventional radiocarbon date of 1,580 +/- 30 BP, two-sigma calibrated date range of 410–550 AD (Figure 15).

Figure 15. Photograph showing bottom of Core Three.

PSA samples taken from 194–198 cm bracket the Core Three 199-203 cm range, showing a clustering around the coarse sand (0.5–1.0 mm) to very coarse sand (1.0–2.0 mm) categories. The bottom bracket taken from range 204–208 cm shows a clustering that is skewed towards very coarse sized particles. At approximately 410–550 AD, this part of Marquis Basin was either a very active fluvial environment or may have been impacted by a hurricane or storm over wash events, although details cannot be ascertained without analyzing comparative samples from nearby locations (Liu and Fearn 2000).
Core Four

Core Four contained the most well-stratified sedimentary deposits in the study. Organic sediment from a depth range of 19–25 cm returned a radiocarbon date of 100 +/- 30BP, two-sigma calibrated date range of 1,680–1,940 AD (Figure 16). PSA data bracketing the radiocarbon date show, on the more recent end (12–18 cm), a sediment size clustering around very coarse sand particles. Within the depth range beneath the radiocarbon sample (27–32 cm) particle sorting clustered around the same size classes. An additional sample taken from the opposite half of Core Four at the same depth as the radiocarbon sample showed a nearly identical sorting of sediment grain sizes throughout. This could imply that the range of samples were deposited within a single event, perhaps a hurricane or storm overwash event at approximately 1,680–1,760 AD. However, additional sampling is necessary to explore this proposition.

Figure 16. Photograph showing upper portion of Core Four.
Organic sediment from a depth range of 46–50 cm returned a conventional radiocarbon date of 1,230 +/- 30 BP, two-sigma calibrated date range of 690–880 AD (Figure 17). Samples taken from above the radiocarbon sampling depth range (43–46 cm), those taken from beneath the radiocarbon date range (50–53 cm), and a corresponding sample from the corresponding half of the core tube at the same depth of the radiocarbon sample (46–50 cm) all show vastly similar sediment grain sorting which clusters around the very coarse sand (1.0–2.0 mm) category. Similarly, the depth range of these samples might also imply that there was a single depositional event around 690–750 AD, although additional testing would be necessary to corroborate these claims.

Figure 17. Photograph showing Core Four.
Organic sediment taken from depth range 72–77 cm returned a conventional radiocarbon date of 1,360 +/-30 BP, two-sigma calibrated date range of 620–760 AD (Figure 18).

Figure 18. Photograph showing Core Four.

PSA samples taken from 68–72 cm, 72–77 cm, and 77–80 cm show a vastly similar sediment sorting which clusters around the very coarse sand (1.0–2.0 cm) category. Again, the similarity in particle sizes within proceeding, contemporaneous, and deeper depth ranges also suggests continuity within the stratigraphic layers deposited during approximately 620–690 AD. Additional data could help to solidify these claims.
Core Five

No radiocarbon assays were attempted from Core Five samples, although a definitive band of organic sediment was present at a depth range of 23–25 cm (Figure 19).

Figure 19. Photograph showing Core Five. Note: band of organic sediment present at 23-25 cm.

Core Six

A fragment of wood taken from a depth range of 120–127 cm returned a conventional radiocarbon date of 2,080 +/- 30 BP, two-sigma calibrated date range of 190–0 BC (Figure 20). PSA shows considerable differences in sorting throughout the samples taken from Core Six. However, it is important to note that Core Six contained a mostly homogenous layer of organic sediment throughout the entire core, aside from a single, diffused band of sand at approximately 100–110 cm (see figure 22). The radiocarbon assay was taken from a wood fragment rather than organic sediment, as in the previous seven radiocarbon samples. This was done for two reasons: first, because the homogenous mixture of organic sediments presented difficulty, since intrusive and recent materials are likely mixed throughout the entire core sample and determining where one layer ends and another begins was not possible with available methods; and second, the
radiocarbon assay taken from the wood sample is used to determine the utility of dating soil organics for this project.

The age of the wood fragment dates to approximately 190–0 BC, yet this indicates that the wood, and not the sediment, is the oldest sampled in this study. The problem of “old wood” may have a role in this analysis, since radiocarbon assays taken from wooden materials may vary according to plant species. See Figures 21–22 for summary of core sample locations and radiocarbon sample extraction locations within the vibracores.

Figure 20. Photograph showing Core Six.
Figure 21. Cores extracted from Peterson Point, showing radiocarbon sample extraction location from Core Two.
Figure 22. Cores extracted from Marquis Basin showing radiocarbon sample extraction locations with side scan sonar data.
CHAPTER VI

DISCUSSION

Sediment cores taken at two locations between the submerged river channel and Peterson Point produced particle size distribution data which show that the larger, coarse sand- and cobble-sized grain sizes were deposited within a high energy fluvial environment (Figure 23). The conformity of the sediments present in the core samples suggests a homogenous mixture of large-grained particles throughout. The radiocarbon date obtained from the core is much more recent than expected, given the large size of the sediments. This is perhaps owing to removal of overlying sediments during private dredging projects which may have been undertaken in efforts to deepen residential boat launches. The relationship of Peterson Point to other archaeological sites in the vicinity remains unknown. However, further testing of the river channel and adjacent landforms could provide evidence to support a paleoenvironmental model.

The submerged depression at Marquis Basin is potentially a remnant of a freshwater discharge point. Sedimentary data collected from the four vibracores taken at Marquis Basin

Figure 23. Histogram showing particle size in micrometers for 82-85 cm range in Core Three. Note: clustering around large grain sizes (larger than sand-sized particles).

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suggest that the surrounding landforms are actively eroding. Stratigraphic sequences present in the cores show a fluctuating environment alternating between organic muck- and sand-sized particle sizes. In some cases, stratigraphy shows definitive overwash deposition, such as that in Core Three (Figure 24), likely transported during single events such as prehistoric hurricane landfalls. This is evidenced by Liu and Fearn (2000), who found that a climatic shift resulted from changes in the prevailing Jet Stream current and Bermuda High pressure areas, thereby increasing the frequency of hurricane landfalls on the northern Gulf Coast during the temporal span of 1,000–3,400 radiocarbon years BP, with many occurring during the first millennium AD. Several radiocarbon dates obtained from sedimentary units within the cores taken from Marquis Basin are situated precisely within Liu and Fearn’s (2000) temporal span. If humans were living within the study area during a temporal window of 0–1,000 AD, it is likely that they experienced one or more category four or category five hurricanes. Figure 24 shows a clustering of fine-grained (silt and clay) particles nearest the surface in Core Six, which is indicative of a low-energy environment.

Figure 24. Histogram showing particle size distribution of Core Six. Note: clustering around small grain size classes.
As is the case in all cores sampled in this study, particle sizes increase near the bottom of the profile. The wooden fragment was collected within a layer of heterogenous sediments, with small-grained sediments above (Figure 24), and large-grained, coarse sediments below the radiocarbon sample location (Figure 25).

Figure 25. Histogram showing particle size distribution in lowest portion of soil profile. Note: clustering around large grain size classes.
CHAPTER VII

CONCLUSION

Do geomorphic data collected from anomalous landforms within the Blackwater Bay-River complex suggest that the area holds potential for submerged archaeological sites dating to the Paleoindian period? After employing a suite of remote sensing techniques and sedimentological and radiocarbon analyses, the answer is, at this time, no. It is possible that the submerged landforms, or bathymetric anomalies, are relic landforms, although they may have developed more recently than expected. The data collected from the six vibracores do not suggest that the landforms were present until at least 2,000 years ago, well beyond Paleoindian times.

Instead, the data coincide with studies conducted elsewhere along the northern Gulf Coast which show that the modern conditions of the bay and river developed after approximately 2,500 calendar years ago (Liu and Fearn 2000; Otvos 2005). Prior to this, the Escambia, Blackwater, and Yellow rivers were disconnected from the saline waters of the Gulf of Mexico. The Pensacola Bay watershed began to take form over the following millennium, slowly encroaching northward towards the Escambia, Yellow, and Blackwater Rivers (Otvos 2005). During a period of approximately 1,000–2,000 years ago, several category four and five hurricanes made landfall along the northern Gulf Coast, potentially reworking river embankments and widening Pensacola Pass. It can be surmised that the current natural environment of Blackwater Bay came into being sometime after approximately 1,000 AD, which produced newfound spawning habitats for several fish species.

The analysis of additional sedimentary, radiocarbon, and palynological data could help to further bolster the hypothesis that the Blackwater Bay-River complex formed after
approximately 2,500 years ago. Furthermore, diver-driven sediment cores taken from the depths of Blackwater River would help to develop a stratigraphic model showing erosional and depositional sequences.

At Peterson Point, a more detailed image of the submerged river channel could be produced with rudimentary mapping techniques. Furthermore, investigations of the nearby shell middens deposited along the northern coast of Blackwater Bay could help add to an understanding of prehistoric occupations along the watershed. At this time, the nature of the anomalous feature remains unclear, although it still retains the potential to be an extinct course of the Yellow River. Future investigations could shed light on this question.

At Marquis Basin, the extraction of diver-driven cores could help to correlate the stratigraphy of the river to the surrounding landforms in an effort to show continuity in sediment deposition. It is recommended that coring strategies follow a cruciform pattern to accomplish this since the cores collected in this study do not correlate well to one another. An additional battery of tests might better reveal continuities, breaks in same strata, and anomalies across the bottom of the basin related to its formation. Finally, radon testing for subaerial spring discharge at the submerged depression could identify the presence of groundwater discharge, proving that the area contains a submerged spring that was, prior to approximately 500 BC, likely outside of the modern-day river channel. The implications of a submerged spring could still hold potential for further models of archaeological site occurrences within the study area, especially during the Early and Middle Paleoindian periods (12,850–10,050 BC), yet only if benthic sediments coincide with this era. If the submerged feature is not a spring, then the question remains, what is it?
Evidence in the forms of Paleoindian and Archaic lithics and Deptford pottery shows that prehistoric inhabitants lived along the Blackwater River between the Paleoindian to Early Woodland Periods (12,500–1,000 BC), yet it is likely they negotiated a purely riverine environment. Beginning at approximately 500 BC, the study area began to transform to an estuarine environment that would eventually resemble modern-day conditions, near the beginning of the first millennium. Limited archaeological investigations within the study area have produced data which highlight a period of sedentary, prehistoric occupations beginning in the Middle to Late Woodland periods (100 BC–1,000 AD) and persisting through the Mississippian Period (1,000–1,500 AD). It is likely that nearby sites, such as Escribano Point and Fundy Bayou, for example, would produce radiocarbon date ranges which fall within this temporal span.

In many ways, life on the Blackwater has changed considerably over the course of several millennia, yet it has remained the same in several regards. During the early years of human occupations in the area, there was no Blackwater Bay. Furthermore, the Blackwater, Yellow, and Escambia rivers were likely quite diminutive in comparison to today. And yet, evidence of human lifeways, however scant for the earliest periods, are present from the Paleoindian era. The relationship that exists between people and their environment has always hinged on the ability to acquire the necessary resources to make a living, be it by the procurement of large or small game animals, fish, shellfish, wild cultigens, or other edible items. The natural environment that hosts any variety of taxa is dependent on many factors, some of which were explored in this study, although more research is warranted.

Any models of Paleoindian habitations in the region should consider the fact that the present landforms may have developed more recently than expected. The possibility remains that
the landforms investigated may be recent deposits overlain above earlier strata which date to the Paleoindian periods, although these deposits may not be attainable with available technologies and methods, given their formidable depth.

Finally, evidence from the vibracore samples may support recent scholarship on increased hurricane cycles during the Woodland period. The prehistoric inhabitants of the Blackwater Bay-River complex were negotiating the effects of hurricanes for thousands of years, without knowing exactly when or where the next would occur. One can only ponder the thought that the development of the estuary, which began a trend towards modern-day conditions, was perhaps created during a period of intensified hurricane activity spanning over one thousand years, something that the current residents of the area can relate to.
REFERENCES

Adovasio, J. M., J. Donahue, and R. Stuckenrath

Anderson, David G.


Anderson, David G. and Kenneth E. Sassaman

Anderson, David G., Lisa O'Steen and Kenneth E. Sassaman

Anderson, David G., D. Shane Miller, Stephen J. Yerka, J. Christopher Gillam, Erik N. Johanson, Derek T. Anderson, Albert C. Goodyear, and Ashley M. Smallwood

Ashley, Keith and Nancy Marie White

Atherton, Mark W.


Bense, Judith A.
1969 Excavations at the Bird Hammock Site (8WA30), Wakulla County, Florida. Master’s Thesis, Department of Anthropology, Florida State University, Tallahassee.


Bradley, Bruce, Michael B. Collins and C. Andrew Hemmings 2010  Clovis Technology. 1st ed. Archaeological Series 17. International Monographs in Prehistory, Ann Arbor, MI.


Brech, Alan 2004  Neither Ocean nor Continent: Correlating the Archaeology and Geomorphology of the Barrier Islands of East Central Florida. Master’s Thesis Presented to the Graduate School of the University of Florida, Gainesville.


Bourgeois, Philip D. and L. Janice Campbell

Bullen, Ripley P.


Burt, R.

Burt, Timothy and Stephen T. Trudgill

Caldwell, Joseph R.

Catt, John A.

Coastal Environments, Inc.
1977 Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf. Multiple Contributing Authors. Prepared for the United States National Park Service, Department of the Interior.

Cook-Hale, Jessica W., Nathan L. Hale, Ervan G. Garrison
nd The Tempest. In Press

Curren, Caleb

Day, John W., Joel D. Gunn, William J. Folan, Alejandro Yáñez-Arancibia, and Benjamin P. Horton
deFrance, Susan D., David K. Keefer, James B. Richardson, and Adan Umire.  

Deter-Wolf, Aaron, Benoît Robitaille, and Isaac Walters  

Donoghue, Joseph F.  

Doran Glen H. and David N. Dickel  

Driskell, Boyce N.  


Dunbar, James S.  

Dunbar, James S. and C. Andrew Hemmings  

Dunbar, James S. and B.I. Waller  

Dunbar, James S., C. Andrew Hemmings, Pamela K. Vojnovski, S. David Webb and William Stanton  
Ellis, Christopher, Albert C. Goodyear, Dan F. Morse and Kenneth B. Tankersley
*Quaternary International* 49-50:151-166.

Erlandson, Jon M., Todd J. Braje, and Michael H. Graham


Farr, Grayal Earle

Faught, Michael K.


Ferring, C. Reid

Franks, B.J.

Ford, Ben and Jessi Halligan


Hollock-Solomon, Michael

Holliday, Vance T.

Jefferies, Richard J.

Jones, Calvin B.

Jones, B. Calvin and Louis D. Tesar

Kelly, Robert L.

Koch, Paul L., Kathryn A. Hoppe, and S. David Webb

Langohr, R., C.O. Scoppa, and A. Van Wambeke

Laughlin, William S.

Lazarus, William C.
Lewis, F. Graham

Little, Keith J., Caleb Curren, and Lee McKenzie

McKenzie, Lee

Macdonald, Neil, and Jürgen Herget

Matthews, J.A.

Marrinan, Rochelle A.

Marrinan, Rochelle A. and Nancy Marie White

Marionneaux, Rachel Arlice

McCaig, M.

Mikell, Gregory A.


Mikell, Gregory A. and Rebecca Saunders.
2007 Terminal Middle to Late Archaic Settlement in Coastal Northwest Florida: Early Estuarine Exploitation on the Northern Gulf Coast. *Southeastern Archaeology* 26(2).

Milanich, Jerald T.

Milanich, Jerald T. and Charles H. Fairbanks

Morse, Dan F.

Morse, Dan F. and Albert C. Goodyear

Newton, Matthew A., James S. Dunbar and Madeleine Carr

Nanfro, Claire Elizabeth

O’Donoghue, Jason M., Kenneth E. Sassaman, Meggan E. Blessing, Johanna B. Talcott, and Julie C. Byrd

Otvos, Ervin G.
Penton, Daniel T.
1969 *Excavations in the Early Swift Creek Component at Bird Hammock (8WA30).* Master’s Thesis, Florida State University, Tallahassee.


Phillips, John C.


Phillips, John C. and C. Lee McKenzie
1993 Archaeological Assessment of the Yellow River Marsh Aquatic Preserve. Report of Investigations Number 54. Archaeology Institute, University of West Florida.

Pratt, Thomas R., Christopher J. Richards, Katherine A. Milla, Jeffrey R. Wagner, Jay L. Johnson and Ross J. Curry

Purdy, Barbara A.

Quinn, Rory, Wes Forsythe, and Colin Breen

Quinn, Rhonda L., Bryan D. Tucker, and John Krigbaum
2008 Diet and Mobility in Middle Archaic Florida; Stable Isotope and Faunal Data from the Harris Creek Archaeological Site, Tick Island. *Journal of Archaeological Science* 35:2346-2356.

Russo, Michael
Santos, Fabricio R., Arpita Pandya, and Chris Tyler-Smith

Sassaman, Kenneth E.

Sassaman, Kenneth E., Zackary I. Gilmore and Asa R. Randall

Sassaman, Kenneth E., Ginessa J. Mahar, Mark C. Donop, Jessica A. Jenkins, Anthony Boucher, Cristina I. Oliveira, Joshua M. Goodwin.

Sassaman, Kenneth E., Neill J. Wallis, Paulette S. McFadden, Ginessa J. Mahar, Jessica A. Jenkins, Mark C. Donop, Micah P. Mones, Andrea Palmiotto, Anthony Boucher, Joshua M. Goodwin, and Cristina I. Oliveira

Saunders, Rebecca, John H. Wrenn, Willian Krebs, and Vaughan M. Bryant

Saunders, Rebecca and Michael Russo

Scarry, John F.

Schwenning, Lisa, Traci Bruce, and Lawrence R. Handley

Sears, William H.
Sheldon, Jr. Craig T.  

Sherwood, Sarah C., Boyce N. Driskell, Asa R. Randall, and Scott C. Meeks  

Sternberg, G.M.  

Stojanowski, Christopher, Ryan M. Seidemann, and Glen H. Doran  

Stuckenrath, R., J. M. Adovasio, J. Donahue, and R. C. Carlisle  

Taylor, Robert  

Tesar, Louis D.  


Thomas, Prentice M., and L. Janice Campbell  

Thompson, Victor D., and John E. Worth  
Thorpe, P., R. Bartel, P. Ryan, K. Albertson, T. Pratt, and D. Cairns

Thulman, David K.

Tomczak, Paula D. and Joseph F. Powell

USDA Soil Survey Laboratory Methods Manual

USDA Field Book for Describing and Sampling Soils.

Volodko, Natalia V., Elena B. Starikovskaya, Ilya O. Mazunin, Nikolai P. Eltsov, Polina V. Naidenko, Douglas C. Wallace, Rem I. Sukernik

Wallis, Neil J.


Wallis, Neill J., Paulette S. McFadden, Hayley M. Singleton.

Walker, S.T.


APPENDICES
Appendix A: Core Sample Logs
### CORE 1

<table>
<thead>
<tr>
<th>Column</th>
<th>Depth Range of Sample</th>
<th>Sample Type</th>
<th>(ICA) Radiocarbon Sample ID</th>
<th>Munsell</th>
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<td>N/A</td>
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<td>N/A</td>
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<td>Pollen</td>
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<td>N/A</td>
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<td>80-100cm</td>
<td>Screen</td>
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<tr>
<td>R</td>
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<td>Pollen</td>
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<td>138-142cm</td>
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**Location**: Marquis Basin  
**Max Depth of Core**: 169cm  
**Weather**: (90F)  
**UTM**: 16R 0497198-3387297  
**Date of Sampling**: 2/10/2017

### CORE 2

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<td>Radiocarbon</td>
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**Date of Core**: 9/16/2016  
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**UTM**: 16R 0500104-3382705  
**Date of Sample**: 2/8/2017
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</tr>
<tr>
<td>R-B</td>
<td>116-119cm(241-244)</td>
<td>Pollen</td>
<td>10YR2/1 black muck</td>
<td></td>
</tr>
</tbody>
</table>

**Date of Core 9/23/2016**
**Location: Marquis Basin**
**Max Depth of Core 172cm**
**Weather (92F)**
**UTM 16R 0497212-3387272**
**Date of Sample 2/9/2017**

<table>
<thead>
<tr>
<th>Column</th>
<th>Depth Range of Sample(cm)</th>
<th>Sample Type</th>
<th>(ICA)Radiocarbon Sample ID</th>
<th>Munsell</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>19-25cm</td>
<td>Pollen</td>
<td>10YR 2/1 Black Saturated</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>46-50cm</td>
<td>Pollen</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>72-77cm</td>
<td>Pollen</td>
<td>10YR 2/1 Black Saturated</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>150-170cm</td>
<td>Spill</td>
<td>10YR 2/1 Black Saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>0-25cm</td>
<td>Spill</td>
<td>10YR 2/1 Black Saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>12-18cm</td>
<td>Sediment</td>
<td>10YR 2/1 Black Saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>19-25cm</td>
<td>Radiocarbon</td>
<td>17OS/0303</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>27-32cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>43-46cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>46-50cm</td>
<td>Radiocarbon</td>
<td>17OS/0302</td>
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<tr>
<td>L</td>
<td>50-53cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>61-67cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>68-72cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>72-77cm</td>
<td>Radiocarbon</td>
<td>17OS/0301</td>
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<tr>
<td>L</td>
<td>77-80cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>85-87cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray saturated</td>
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</tr>
<tr>
<td>L</td>
<td>123-125cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray mottled with 10YR 2/2 very dark brown saturated</td>
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<tr>
<td>L</td>
<td>130-134cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>136-140cm</td>
<td>Sediment</td>
<td>10YR 2/2 very dark brown saturated</td>
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<tr>
<td>L</td>
<td>145-149cm</td>
<td>Sediment</td>
<td>10YR 7/1 light gray saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>153-155cm</td>
<td>Sediment</td>
<td>10YR 2/1 Black Saturated</td>
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</tr>
<tr>
<td>L</td>
<td>160-165cm</td>
<td>Sediment</td>
<td>10YR 2/2 very dark brown saturated</td>
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</tr>
</tbody>
</table>

**Date of Core 9/23/2016**
**Location: Marquis Basin**
**Max Depth of Core 172cm**
**Weather (92F)**
**UTM 16R 0497210-3387206**
**Date of Sample 2/9/2017**
### CORE 5

<table>
<thead>
<tr>
<th>Column</th>
<th>Depth Range of Sample (cm)</th>
<th>Sample Type</th>
<th>(ICA) Radiocarbon Sample ID</th>
<th>Munsell</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>0-10cm</td>
<td>Spoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>10-20cm</td>
<td>Spoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>20-30cm</td>
<td>Spoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>23-24cm</td>
<td>Radiocarbon</td>
<td>10YR 2/1 Black saturated soil matrix</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>0-10cm</td>
<td>Spoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>5-8cm</td>
<td>Sediment</td>
<td>10YR 3/6 Dark Yellowish Brown Saturated Sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>15-18cm</td>
<td>Sediment</td>
<td>10YR 3/6 Dark Yellowish Brown Saturated Sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>18-22cm</td>
<td>Sediment</td>
<td>10YR 3/6 Dark Yellowish Brown Saturated Sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>23-24cm</td>
<td>Radiocarbon</td>
<td>10YR 2/2 Black saturated soil matrix</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>25-28cm</td>
<td>Sediment</td>
<td>10YR 2/2 Very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>28-31cm</td>
<td>Sediment</td>
<td>10YR 2/2 Very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>30-40cm</td>
<td>Spoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>40-43cm</td>
<td>Sediment</td>
<td>10YR 2/2 Very dark brown saturated</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>55-60cm</td>
<td>Sediment</td>
<td>10YR 2/2 Very dark brown saturated</td>
<td></td>
</tr>
</tbody>
</table>

Date of Core: 10/7/2016  
Location: Peterson Point  
Max Depth of Core: 63cm  
Weather: (80F)  
UTM: 16R 0500500-3382764

Date of Sample: 2/8/2017

### CORE 6

<table>
<thead>
<tr>
<th>Column</th>
<th>Depth Range of Sample (cm)</th>
<th>Sample Type</th>
<th>(ICA) Radiocarbon Sample ID</th>
<th>Munsell</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>0-20cm</td>
<td>Wood</td>
<td>10YR Black Muck</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>20-26cm</td>
<td>Pollen</td>
<td>10YR 1/4 Yellowish brown fine sand mottled with 10YR 2/1 Black Muck and Sand</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>10-12cm</td>
<td>Wood</td>
<td>10YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray muck and sand</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>25-28cm</td>
<td>Pollen</td>
<td>10YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray muck and sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>15-20cm</td>
<td>Sediment</td>
<td>10YR 2/2 Black Mottled with 10YR 2/1 Black Muck</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>20-26cm</td>
<td>Radiocarbon</td>
<td>10YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray muck and sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>30-45cm</td>
<td>Wood</td>
<td>10YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray muck and sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>70-80cm</td>
<td>Sediment</td>
<td>10YR 6/2 Light Brownish gray fine sand mottled with 10YR 2/1 Black Muck</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>80-100cm</td>
<td>Wood</td>
<td>10YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray muck and sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>101-106cm</td>
<td>Sediment</td>
<td>10YR 5/4 Yellowish brown fine sand mottled with 10YR 2/1 Black Muck</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>120-127cm</td>
<td>Radiocarbon</td>
<td>charred wood surrounding matrix is 10YR 5/4 Yellowish brown fine grain sand mottled with 10YR 2/1 Black Muck</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>120-150cm</td>
<td>Carbonized wood</td>
<td>17W/0809 carbonized wood 10 YR 2/1 Black Mottled with 10YR 6/2 Light Brownish gray</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>150-160cm</td>
<td>wood</td>
<td>10YR 2/1 Black Mottled with 10YR 3/1 Very dark gray course sand</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>180-200cm</td>
<td>Sediment</td>
<td>10YR 3/1 Very Dark Gray Coarse sand mottled with some 10YR 2/1 Black muck</td>
<td></td>
</tr>
</tbody>
</table>

Date of Core: 10/7/2016  
Location: Marquis Basin  
Max Depth of Core: 216cm  
Weather: (80F)  
UTM: 16R 0500497-3382764

Date of Sample: 2/10/2017

---

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Appendix B: Water Chemistry Sample Log
## Peterson Point (UTM 16R 0500174-3382663)

<table>
<thead>
<tr>
<th>Drop Sample</th>
<th>Time</th>
<th>Temp</th>
<th>Salinity (parts per thousand)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Conductivity (microseimens)</th>
<th>Oxygen (%)</th>
<th>Specific Conductivity (microseimens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr1-Sample1</td>
<td>10:35</td>
<td>31</td>
<td>0.3</td>
<td>5.45</td>
<td>732</td>
<td>73.5</td>
<td>658</td>
</tr>
<tr>
<td>Dr1-Sample2</td>
<td>10:35</td>
<td>31</td>
<td>0.3</td>
<td>5.46</td>
<td>794</td>
<td>73.4</td>
<td>714</td>
</tr>
<tr>
<td><strong>8 Feet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr1-Sample1</td>
<td>10:10</td>
<td>28.8</td>
<td>1.4</td>
<td>4.12</td>
<td>16.6</td>
<td>53.4</td>
<td>15.2</td>
</tr>
<tr>
<td>Dr1-Sample2</td>
<td>10:10</td>
<td>29.3</td>
<td>1.8</td>
<td>3.73</td>
<td>37.96</td>
<td>49.2</td>
<td>34.45</td>
</tr>
<tr>
<td>Dr2-Sample1</td>
<td>10:20</td>
<td>29.3</td>
<td>1.6</td>
<td>3.46</td>
<td>33.14</td>
<td>45.6</td>
<td>30.67</td>
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<tr>
<td>Dr2-Sample2</td>
<td>10:20</td>
<td>29.9</td>
<td>1.4</td>
<td>3.71</td>
<td>30.34</td>
<td>49.5</td>
<td>27.56</td>
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<tr>
<td><strong>16 Feet</strong></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Dr1-Sample1</td>
<td>9:45</td>
<td>28.5</td>
<td>6.5</td>
<td>1.88</td>
<td>12.26</td>
<td>24</td>
<td>11.44</td>
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<tr>
<td>Dr1-Sample2</td>
<td>9:50</td>
<td>28.6</td>
<td>5.7</td>
<td>1.79</td>
<td>10.79</td>
<td>20.9</td>
<td>10.16</td>
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<tr>
<td>Dr2-Sample1</td>
<td>9:55</td>
<td>27.4</td>
<td>6.9</td>
<td>0.92</td>
<td>12.69</td>
<td>12.2</td>
<td>12.08</td>
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<td>Dr2-Sample2</td>
<td>9:57</td>
<td>27.8</td>
<td>6</td>
<td>0.69</td>
<td>11.13</td>
<td>8.9</td>
<td>10.59</td>
</tr>
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## Marquis Basin (UTM 16R 0497223-3387364)

<table>
<thead>
<tr>
<th>Drop Sample</th>
<th>Time</th>
<th>Temp</th>
<th>Salinity (parts per thousand)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Conductivity (microseimens)</th>
<th>Oxygen (%)</th>
<th>Specific Conductivity (microseimens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr1-Sample1</td>
<td>12:03</td>
<td>30.9</td>
<td>0</td>
<td>6.5</td>
<td>20.7</td>
<td>86.9</td>
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<td>Dr1-Sample2</td>
<td>12:03</td>
<td>30.2</td>
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<td>5.35</td>
<td>7.7</td>
<td>70.7</td>
<td>7.1</td>
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<td><strong>15 Feet</strong></td>
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</tr>
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<td>Dr1-Sample1</td>
<td>11:37</td>
<td>28.8</td>
<td>0</td>
<td>1.74</td>
<td>3.6</td>
<td>22.2</td>
<td>3.3</td>
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<td>Dr1-Sample2</td>
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<td>28.2</td>
<td>0</td>
<td>2.23</td>
<td>3.5</td>
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<td>3.6</td>
</tr>
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<td>28.3</td>
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<td>76.5</td>
<td>14.9</td>
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<td>28.3</td>
<td>0</td>
<td>1.16</td>
<td>1.5</td>
<td>14.9</td>
<td>14.6</td>
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<td><strong>28 Feet</strong></td>
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<td>Dr1-Sample1</td>
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<td>29</td>
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<td>0</td>
<td>1.24</td>
<td>7.6</td>
<td>16.2</td>
<td>7</td>
</tr>
<tr>
<td>Dr2-Sample1</td>
<td>11:27</td>
<td>29.1</td>
<td>0</td>
<td>1.46</td>
<td>5.6</td>
<td>18.7</td>
<td>5</td>
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<tr>
<td>Dr2-Sample2</td>
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<td>29.1</td>
<td>0</td>
<td>1.23</td>
<td>22.7</td>
<td>16</td>
<td>20.9</td>
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## Oyster Pile Boat Ramp

<table>
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<th>Time</th>
<th>Temp</th>
<th>Salinity (parts per thousand)</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Conductivity (microseimens)</th>
<th>Oxygen (%)</th>
<th>Specific Conductivity (microseimens)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr1-Sample1</td>
<td>12:25pm</td>
<td>29.2</td>
<td>0.1</td>
<td>5.1</td>
<td>155.4</td>
<td>66.8</td>
<td>144.5</td>
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APPENDIX C: Histograms Showing Results of Particle Size Distribution Analysis
Core One

% Sand

Core One Sample Interval (CMBS)

% Silt and Clay

Core One Sample Interval (CMBS)
Soil Particle Size Distribution
Core One
125-130 CMBS

Soil Particle Size Distribution
Core One
138-142 CMBS

Soil Particle Size Distribution
Core One
150-155 CMBS
Core Two

### %Sand

```
Core Two Sample Interval (CMBS)
```

#### Percent of Sample

- 0
- 20
- 40
- 60
- 80
- 100

#### Core Two Sample Interval (CMBS)

- 5-9
- 10-13
- 22-27
- 48-55
- 71-76
- 82-85

### % Silt and Clay

```
Core Two Sample Interval (CMBS)
```

#### Percent of Sample

- 0
- 20
- 40
- 60
- 80
- 100

#### Core Two Sample Interval (CMBS)

- 5-9
- 10-13
- 22-27
- 48-55
- 71-76
- 82-85
Soil Particle Size Distribution
Core Two
5-9 CMBS

Soil Particle Size Distribution
Core Two
10-13 CMBS

Soil Particle Size Distribution
Core Two
22-27 CMBS
Soil Particle Size Distribution
Core Two
48-55 CMBS

Soil Particle Size Distribution
Core Two
71-76 CMBS

Soil Particle Size Distribution
Core Two
82-85 CMBS
Core Three

% Sand

Core Three Sample Interval (CMBS)

% Silt and Clay

Core Three Sample Interval (CMBS)
Soil Particle Size Distribution
Core Three
12-17 CMBS

Soil Particle Size Distribution
Core Three
40-43 CMBS

Soil Particle Size Distribution
Core Three
47-51 CMBS
Soil Particle Size Distribution
Core Three
111-113 CMBS

Soil Particle Size Distribution
Core Three
113-116 CMBS

Soil Particle Size Distribution
Core Three
119-123 CMBS
Soil Particle Size Distribution
Core Three
135-139 CMBS

Soil Particle Size Distribution
Core Three
143-145 CMBS

Soil Particle Size Distribution
Core Three
149-153 CMBS
Soil Particle Size Distribution
Core Three
216-220 CMBS

Soil Particle Size Distribution
Core Three
238-241 CMBS
Core Four

% Sand

Core Four Sample Interval (CMBS)

% Silt and Clay

Core Four Sample Interval (CMBS)
Soil Particle Size Distribution
Core Four
43-46 CMBS
Soil Particle Size Distribution
Core Four(R)
46-50 CMBS

Soil Particle Size Distribution
Core Four
50-53 CMBS

Soil Particle Size Distribution
Core Four
61-67 CMBS
Soil Particle Size Distribution
Core Four
136-140 CMBS

Soil Particle Size Distribution
Core Four
145-149 CMBS
Core Five

% Sand

Core Five Sample Interval (CMBS)

Percent of Total

% Silt and Clay

Core Five Sample Interval (CMBS)

Percent of Total
Core Six

% Sand

Core Six Sample Interval (CMBS)

% Silt and Clay

Core Six Sample Interval (CMBS)
### Summary of Ages

**Submitter Name:** Matthew Newton  
**Company Name:** University of West Florida  
**Address:** 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
<th>ICA ID</th>
<th>Submitter ID</th>
<th>Material Type</th>
<th>Pretreatment</th>
<th>Conventional Age</th>
<th>Calibrated Age</th>
</tr>
</thead>
</table>
| 17OS/0301 | C4-1         | Organic Sediment | AO           | 1360 +/- 30 BP      | Cal 620 - 690 AD (92.2%)  
|           |              |                 |              |                    | Cal 750 - 760 AD (3.2%)  |
| 17OS/0302 | C4-2         | Organic Sediment | AO           | 1230 +/- 30 BP      | Cal 690 - 750 AD (32.7%)  
|           |              |                 |              |                    | Cal 760 - 880 AD (62.7%)  |
| 17OS/0303 | C4-3         | Organic Sediment | AO           | 100 +/- 40 BP       | Cal 1680 - 1760 AD (30.8%)  
|           |              |                 |              |                    | Cal 1800 - 1940 AD (64.6%)  |
| 17OS/0304 | C2-1         | Organic Sediment | AO           | 60 +/- 30 BP        | Cal 1690 - 1730 AD (23.1%)  
|           |              |                 |              |                    | Cal 1810 - 1920 AD (72.3%)  |

* Unless otherwise stated, 2 sigma calibration (95% probability) is used.
* Conventional ages are given in BP (BP=Before Present, 1950 AD), and have been corrected for fractionation using the delta C13.
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
<th>Date Received</th>
<th>March 02, 2017</th>
<th>Material Type</th>
<th>Organic Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Reported</td>
<td>April 05, 2017</td>
<td>Pre-treatment</td>
<td>AO</td>
</tr>
<tr>
<td>ICA ID</td>
<td>17OS/0301</td>
<td>Conventional Age</td>
<td>1360 +/- 30 BP</td>
</tr>
<tr>
<td>Submitter ID</td>
<td>C4-1</td>
<td>Calibrated Age</td>
<td>Cal 620 - 690 AD (92.2%) Cal 750 - 760 AD (3.2%)</td>
</tr>
</tbody>
</table>

![Graph showing radiocarbon age and calendar years](image)
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

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<td>AO</td>
</tr>
<tr>
<td>ICA ID</td>
<td>17OS/0302</td>
<td>Conventional Age</td>
<td>1230 +/- 30 BP</td>
</tr>
</tbody>
</table>
| Submitter ID  | C4-2           | Calibrated Age | Cal 690 - 750 AD (32.7%)
                                |                |                  | Cal 760 - 880 AD (62.7%) |

![Graph showing Radiocarbon Age (BP) vs Calendar Years (AD)]
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
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<tbody>
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<td>Date Reported</td>
<td>April 05, 2017</td>
<td>Pre-treatment</td>
<td>AO</td>
</tr>
<tr>
<td>ICA ID</td>
<td>17OS/0303</td>
<td>Conventional Age</td>
<td>100 +/- 40 BP</td>
</tr>
</tbody>
</table>
| Submitter ID        | C4-3           | Calibrated Age    | Cal 1660 - 1760 AD (30.8%)
|                     |                |                   | Cal 1800 - 1940 AD (64.6%) |

Radiocarbon Age (BP)

Calendar Years (AD)
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
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<tr>
<td>ICA ID</td>
<td>17OS/0304</td>
<td>Conventional Age</td>
<td>60 +/- 30 BP</td>
</tr>
<tr>
<td>Submitter ID</td>
<td>C2-1</td>
<td>Calibrated Age</td>
<td>Cal 1690 - 1730 AD (23.1%) Cal 1810 - 1920 AD (72.3%)</td>
</tr>
</tbody>
</table>
**QC Report**

**Submitter Name:** Matthew Newton  
**Company Name:** University of West Florida  
**Address:** 11000 University Pkwy  Pensacola, FL 32514

<table>
<thead>
<tr>
<th>Date Submitted</th>
<th>QC 1 Sample ID</th>
<th>QC Expected Value</th>
<th>QC Measured Value</th>
<th>Pass?</th>
<th>Date Reported</th>
<th>QC 2 Sample ID</th>
<th>QC Expected Value</th>
<th>QC Measured Value</th>
<th>Pass?</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 02, 2017</td>
<td>IAEA C7</td>
<td>49.53 +/- 0.50 pMC</td>
<td>50.01 +/- 0.10 pMC</td>
<td>YES</td>
<td>April 04, 2017</td>
<td>NIST OXII</td>
<td>134.09 +/- 0.70 pMC</td>
<td>133.81 +/- 0.15 pMC</td>
<td>YES</td>
</tr>
</tbody>
</table>

- pMC = Percent Modern Carbon.  
- IAEA = International Atomic Energy Agency.
## Summary of Ages

**Submitter Name:** Matthew Newton  
**Company Name:** University of West Florida  
**Address:** 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
<th>ICA ID</th>
<th>Submitter ID</th>
<th>Material Type</th>
<th>Pretreatment</th>
<th>Conventional Age</th>
<th>Calibrated Age</th>
</tr>
</thead>
</table>
| 17OS/0806| C1L-144-150  | Organic Sediment | AO           | 1310 +/- 30 BP   | Cal 660 - 730 AD (68.0%)  
Cal 740 - 770 AD (27.4%)       |
| 17OS/0807| C3L-116-119  | Organic Sediment | AO           | 1240 +/- 30 BP   | Cal 680 - 780 AD (61.3%)  
Cal 790 - 880 AD (34.1%)       |
| 17OS/0808| C3L-874-78   | Organic Sediment | AO           | 1580 +/- 30 BP   | Cal 410 - 550 AD              |
| 17W/0809 | C5L-120-127  | WOOD          | AAA          | 2080 +/- 30 BP   | Cal 190 - 40 BC (94.5%)  
Cal 10 - 0 BC (0.9%)            |

* Unless otherwise stated, 2 sigma calibration (95% probability) is used.
* Conventional ages are given in BP (BP=Before Present, 1950 AD), and have been corrected for fractionation using the delta C13.
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

Date Received: August 02, 2017
Material Type: Organic Sediment

Date Reported: August 31, 2017
Pre-treatment: AO

ICA ID: 17OS/0806
Conventional Age: 1310 +/- 30 BP

Submitter ID: C1L-144-150
Calibrated Age: Cal 660 - 730 AD (68.0%)
Cal 740 - 770 AD (27.4%)

![Radiocarbon Age (BP) vs Calendar Years (AD) graph]
Sample Report

Submitter Name: Matthew Newton  
Company Name: University of West Florida  
Address: 11000 University Pkwy Pensacola, FL 32514

<table>
<thead>
<tr>
<th>Date Received</th>
<th>August 02, 2017</th>
<th>Material Type</th>
<th>Organic Sediment</th>
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<tbody>
<tr>
<td>Date Reported</td>
<td>August 31, 2017</td>
<td>Pre-treatment</td>
<td>AO</td>
</tr>
<tr>
<td>ICA ID</td>
<td>17OS/0807</td>
<td>Conventional Age</td>
<td>1240 +/- 30 BP</td>
</tr>
</tbody>
</table>
| Submitter ID   | C3L-116-119     | Calibrated Age | Cal 680 - 780 AD (61.3%)  
                             |                 |                  | Cal 790 - 880 AD (34.1%)  |

Radiocarbon Age (BP)

Calendar Years (AD)
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

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<td>AO</td>
</tr>
<tr>
<td>ICA ID</td>
<td>17OS/0808</td>
<td>Conventional Age</td>
<td>1580 +/- 30 BP</td>
</tr>
<tr>
<td>Submitter ID</td>
<td>C3L-B-74-78</td>
<td>Calibrated Age</td>
<td>Cal 410 - 550 AD</td>
</tr>
</tbody>
</table>

![Graph showing radiocarbon age vs calendar years](image)

Calendar Years (AD)

Radiocarbon Age (BP)
Sample Report

Submitter Name: Matthew Newton
Company Name: University of West Florida
Address: 11000 University Pkwy Pensacola, FL 32514

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<tbody>
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<td>Date Reported</td>
<td>August 31, 2017</td>
</tr>
<tr>
<td>Material Type</td>
<td>Wood</td>
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<tr>
<td>Pre-treatment</td>
<td>AAA</td>
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<tr>
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<td>17W/0809</td>
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<tr>
<td>Conventional Age</td>
<td>2080 +/- 30 BP</td>
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<tr>
<td>Submitter ID</td>
<td>C6L-120-127</td>
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</tbody>
</table>
| Calibrated Age | Cal 190 - 40 BC (94.5%)
                    Cal 10 - 0 BC (0.9%) |

![Radiocarbon Age (BP) vs Calendar Years (AD) graph]

5 of 6
**QC Report**

**Submitter Name:** Matthew Newton  
**Company Name:** University of West Florida  
**Address:** 11000 University Pkwy, Pensacola, FL 32514

<table>
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- pMC = Percent Modern Carbon.  
- IAEA = International Atomic Energy Agency.