# Reconstructing Holocene Shoreline Transgression and Storm History in Horseshoe Cove on the Northern Gulf Coast of Florida


**Paulette S. McFadden[1] and John M. Jaeger[2]**

[1]Laboratory of Southeastern Archaeology, Department of Anthropology, University of Florida

[2]Department of Geological Sciences, University of Florida


## Introduction

The northern Gulf Coast of Florida is a highly dynamic environment that is in constant motion, with many different environmental and social processes playing out on different temporal scales. With a history of at least 4000 years, the people of the Gulf Coast successfully incorporated this changeable environment into their cultural milieu; however periods of rapid environmental change or sudden and unpredictable events may have affected the way that people perceived and acted on the landscape. Much archaeological research in the southeastern United States seeks to explore the role of the environment in social change, but many rely on paleoenvironmental reconstructions that are geographically distant and on non-analogous temporal scales. The eventual goal of this research project is to reconstruct a detailed environmental record of change that is associated with archaeological deposits, with attention toward eventful change, such as high energy storms and periods of rapid sea-level rise. These periods of change would have presented new conditions that must be integrated into existing cultural customs, and in the case of eventful change, may have necessitated interventions, or intentional actions designed to reincorporate new conditions into cultural practices.

## Study Area

Horseshoe Cove is a shallow, relatively protected area near the town of Horseshoe Beach on the northern Gulf Coast of Florida that includes a constellation of islands with archaeological deposits (Figure 1). Evidence of environmental shifts is preserved in sediments that are protected within the center of the parabolic-shaped, drowned paleo-dune, called Butler Island. A significant archaeological site is situated on Bird Island at the tip of the northern arm of Butler Island that preserves evidence of human occupation that dates to over 4,000 years ago.

## Methods

Marine sediment cores were collected at 200 m intervals with a vibracore along a 2 km transect. A second 800 m transect runs perpendicular through the center of Butler Island to the southeast. Archaeological materials were recovered from two test units excavated on Bird Island and sediment samples were collected from the profile of one of the units at 2.5 cm intervals. Sediment cores were split, photographed, and sedimentary facies were described. Samples were collected from each sedimentary facies for analysis of sediment texture, percentage of organic matter, and percentage of carbonate. Smear slides were made for each of these samples to determine presence or absence of microfossils (e.g., sponge spicules). Sediment texture was determined for samples collected from terrestrial excavation units using the same methodology as for the marine sediment cores. To quantify the frequencies of sponge spicules in the terrestrial sediments, five 0.1 gm subsamples were systematically observed by microscope and the number of spicules, diatoms, and forams recorded (see Figure 6). Test units were excavated using standard archaeological methods. Units were excavated in arbitrary 10 cm levels and all materials were passed through a ¼" mesh. Cultural materials recovered from each level were bagged separately. Additional bulk samples and close-interval sediment samples were collected from profiles of each unit.


### Acknowledgments

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### References


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## Results

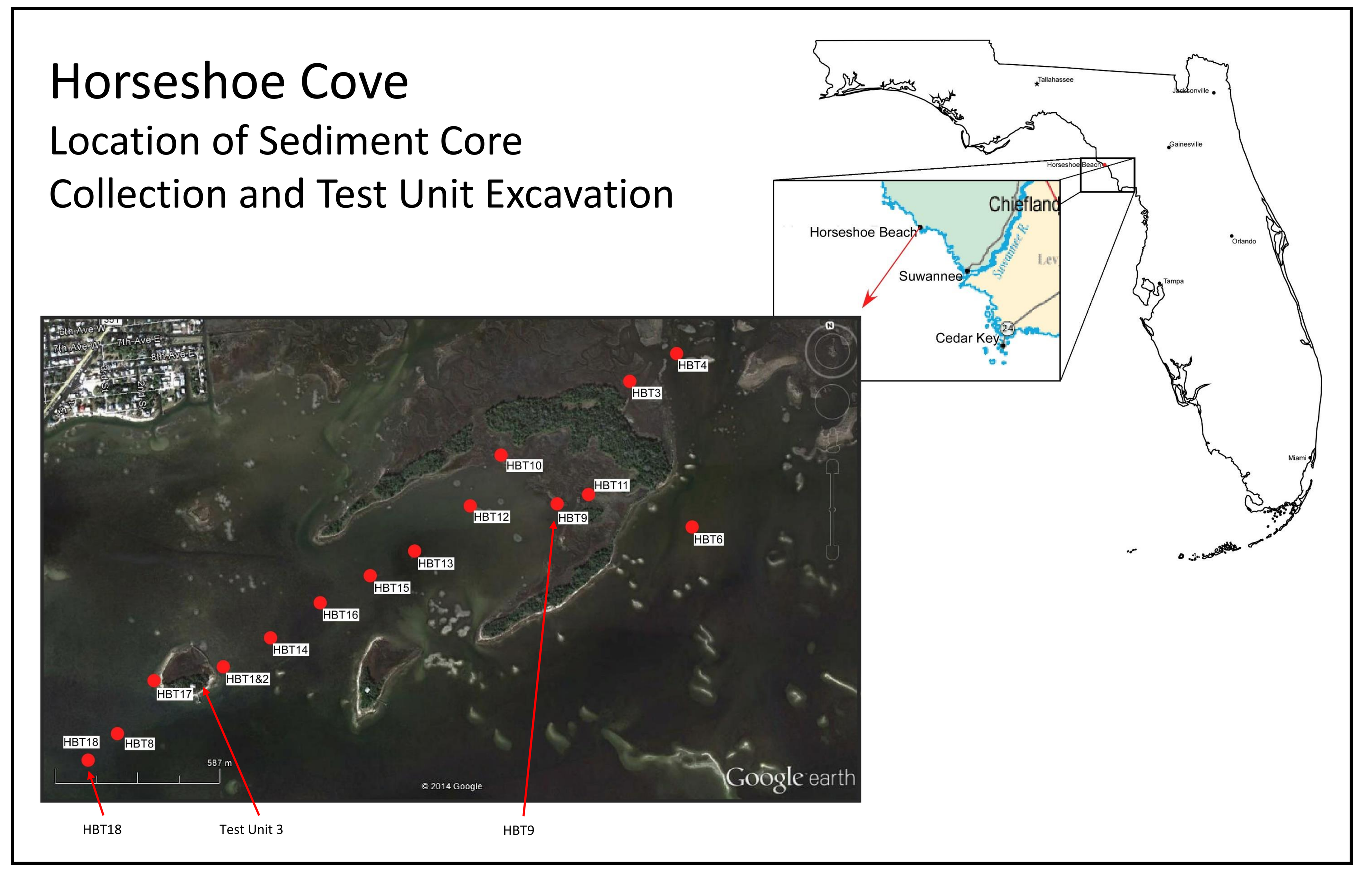


Figure 1. Study area showing locations of marine sediment core collection. HBT9, HBT18, and the location of the Bird Island (8DI52) archaeological site are circled in red.

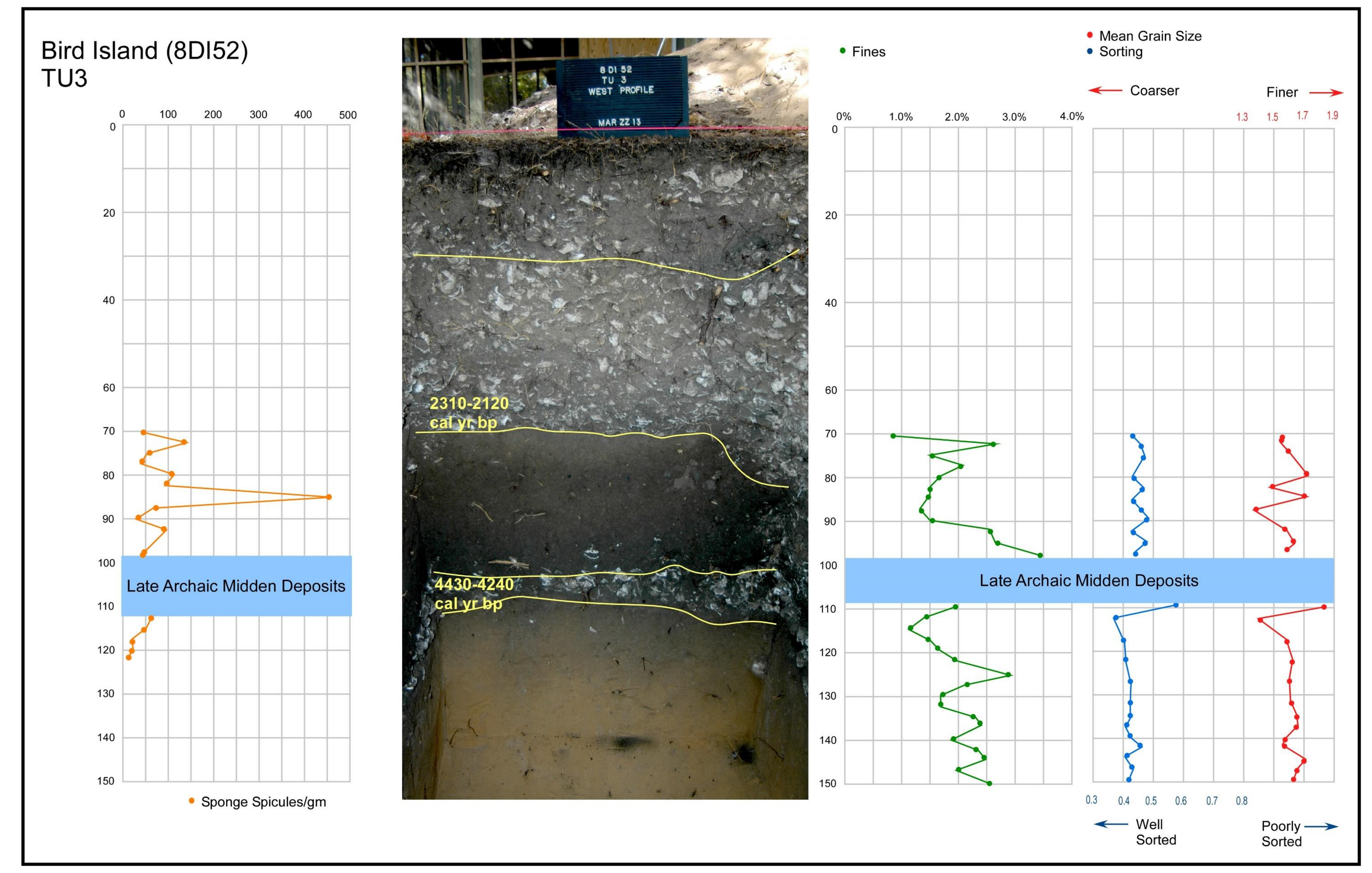


Figure 2. Profile of TU3 at Bird Island (8DI52) showing radiocarbon dates, percent fines, grain size and sorting statistics, and sponge spicule frequencies by depth.

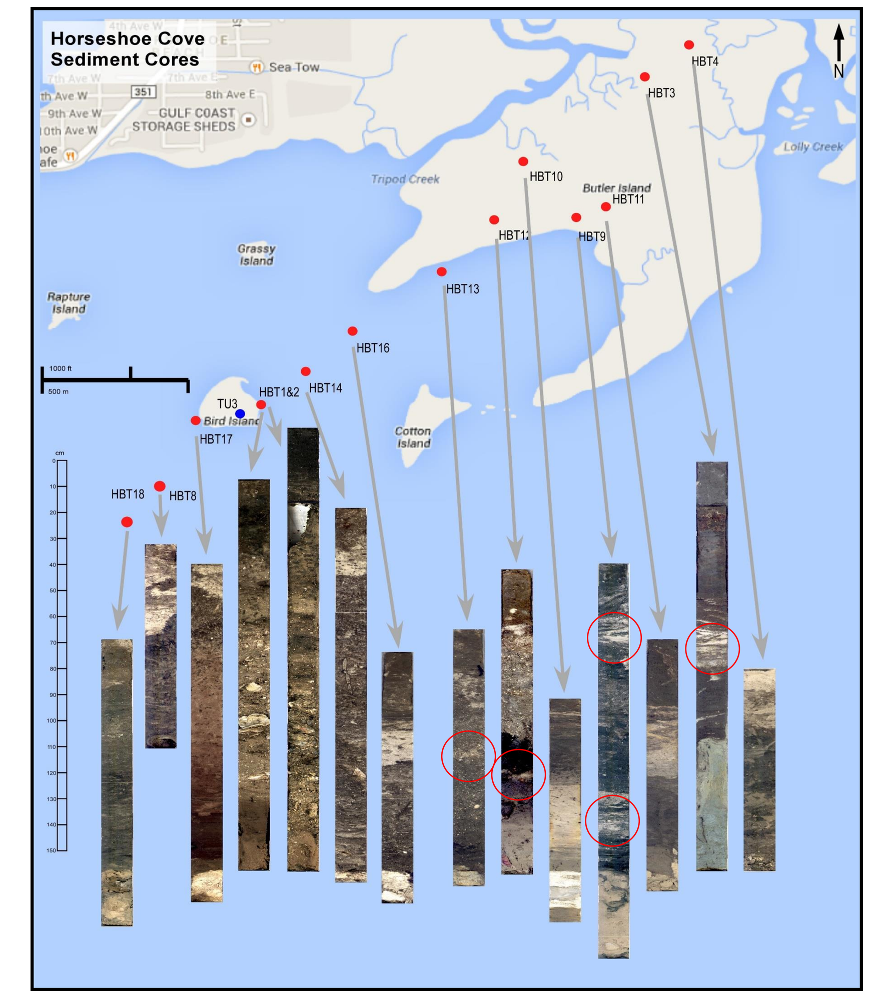


Figure 3. Sediment cores arranged in relative geographic position with storm beds circled in red.

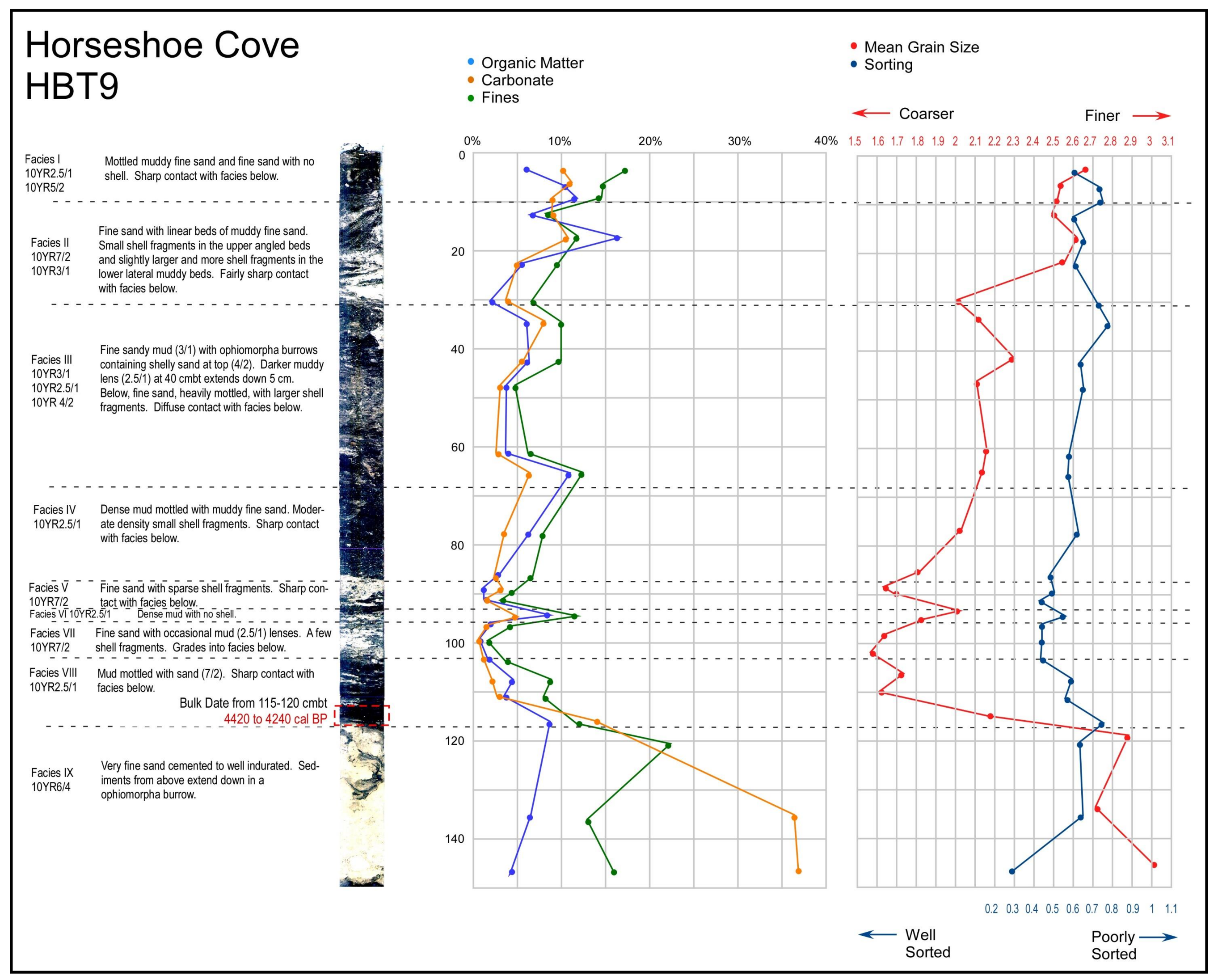


Figure 4. Image of marine sediment core HBT9 with facies description, location of dated sample, percentage of fines, carbonate, and OM, and grain size and sorting statistics.

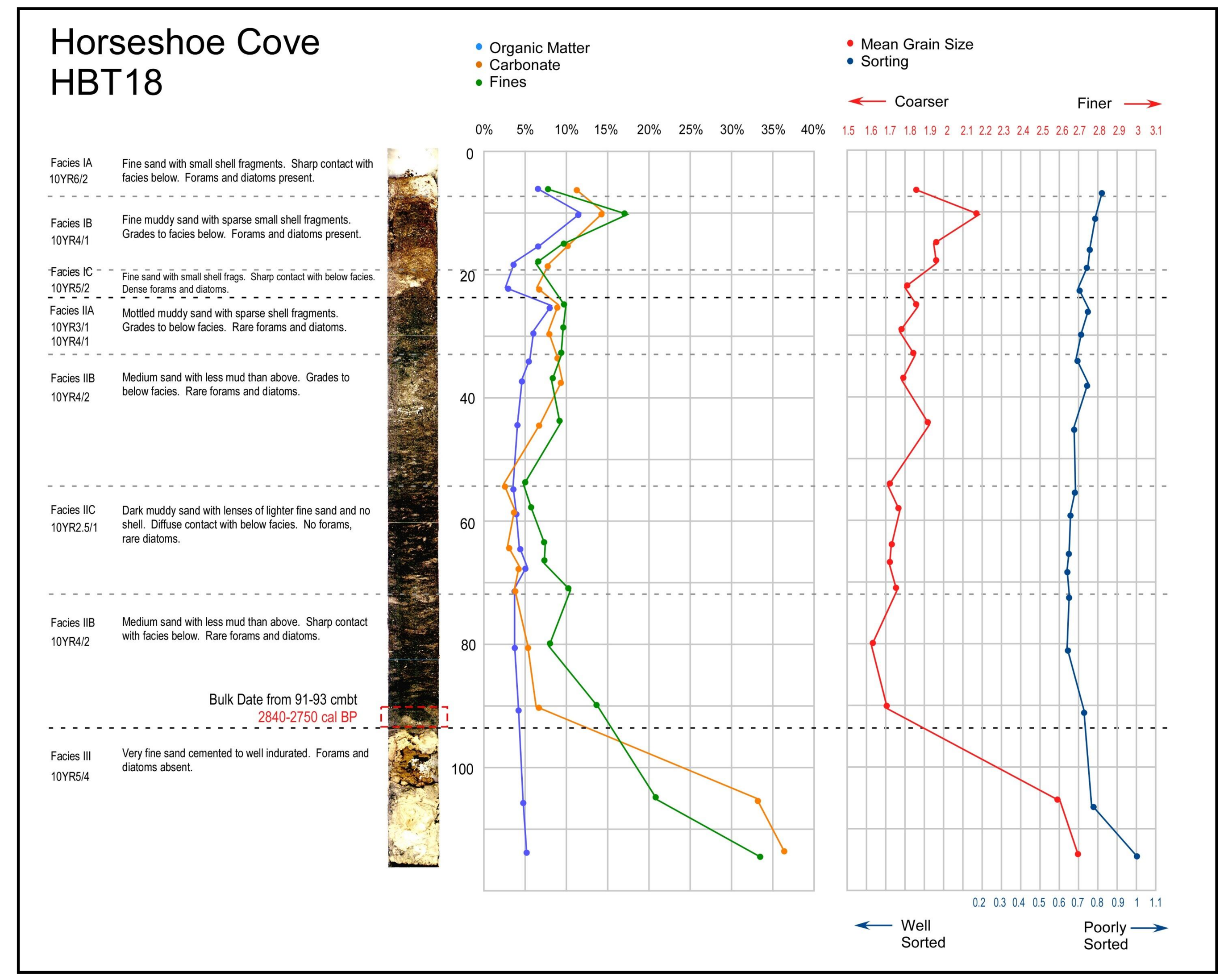


Figure 5. Image of marine sediment core HBT18 with facies description, location of dated sample, percentage of fines, carbonate, and OM, and grain size and sorting statistics.

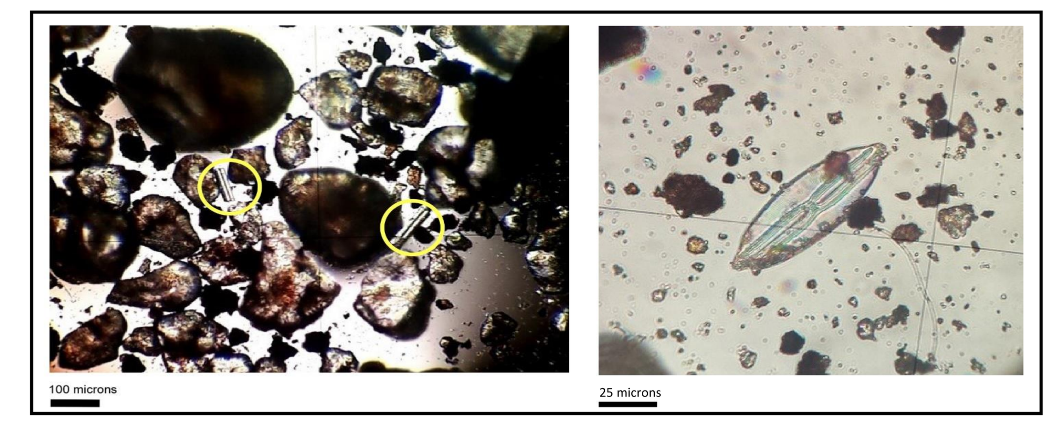


Figure 6. Left: sponge spicules in sediments from Stratum IV, Bird Island (8DI52). Right: Diatom in sediments from Stratum IV, Bird Island (8DI52).

Figure 7. Collection of sediment samples from the west profile of TU3, Bird Island (8DI52).

## Conclusion

Evidence from two marine cores (Figures 4 and 5), along with analysis of terrestrial sediment samples, archaeological data, and radiocarbon dates (see Figure 2) can provide a preliminary chronology of shoreline transgression, evidence of at least one high energy storm event that significantly reworked the sedimentary environment, and may explain the culturally sterile stratum on Bird Island. Fresh to brackish water marsh developed landward of Bird Island sometime after about 4400 yr bp. At the same time, midden materials began to be deposited on the island. A high frequency of periwinkle (*Littoraria irrorata*) shells in the midden suggests the marsh was in very close proximity to the site. Sometime after 2700-2100 yr bp, evidence suggests that at least one high energy storm may have scoured marsh deposits from the seaward area of Bird Island, resulting in the later radiocarbon date at the transition to marsh in the seaward core. Storm beds observed in at least 4 cores (see Figure 3) may be evidence of this type of event. During this time, the northern Gulf Coast of Florida was experiencing an increase in landfalls of catastrophic high energy storms, a cycle that lasted from 3643-1022 cal yr bp (Lui and Fern 2000). Scoured marsh sediments may have been deposited atop midden material on the highest elevation of the island. The upper portion of the midden was likely disturbed and some materials possibly removed during the event, which could account for some of the missing time in the archaeological deposits. Soon after the event, deposition of midden materials resumed on Bird Island. The preservation of microfossils (see figure 6), particularly sponge spicules, in the sediments suggest that Stratum IV was rapidly buried by the upper midden deposits since microfossils are likely removed from exposed terrestrial sediments by post-depositional processes (Hadden and Stapleton 2013). Additionally, the increase and variability of spicule frequency with depth in the stratum suggests the spicules were deposited with the sediments rather than being the result of bioturbation, since the expected exponential decrease in frequency with depth does not occur in this stratum (Guinasso and Schink 1975). Spicules were also found in sediments below the Late Archaic midden deposits and in these deposits the expected decrease with depth is observed.