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Tampa Bay Integrated Science Pilot Study
Historical and prehistorical record of Tampa Bay environments

INTRODUCTION

To analyze the effects of historical alteration to the environment in Tampa Bay, it is important that we understand the prehistorical conditions and natural variations in the environment of the bay. A record of these variations can be found in the sediments that have accumulated in and around the entire bay. One objective of the project demonstration phase was to document the natural variations in Tampa Bay prehistoric environment. This task includes describing wetlands change (evolution) and identifying the anthropogenic effects against natural background conditions. The prehistory record provides a baseline to compare and evaluate the magnitude and effects of sea-level and climate, biological, geochemical, and anthropogenic change. These data are also valuable in planning and executing restoration projects, as they provide a window into the past conditions that restoration projects seek to achieve. In a similar context, the data provide a basis for determining success criteria in restoration and in efforts to improve the bay health.

APPROACH

Coring bay and wetland sediment

- The best method to identify prehistoric environments is to collect and analyze sediment cores. Cores provide samples from the oldest time (at the bottom) to the youngest (at the top).
- Date cores using ^{210}Pb, ^{14}C, and Optical Stimulation Luminescence,
- Determine nature of upland and bay flora using biomarkers and pollen,
- Measure salinity of pore waters,
- Determine change in salinity of bay waters resulting from rising sea level and changes in climate using microfauna,
- Evaluate pollutant content of cores from ICP 40-element analysis and elemental Hg concentration.

Core sites were selected in two general areas: 1) less disturbed natural site, and 2) highly inpacted area. Mariposa Point (Moses Hole) in the Terra Ceia area was chosen for a record of the bay's environment in an area least disturbed by historical activities, and Hillsborough Bay (within Alafia River area on Fig. 1), where the historical effect is expected to be high. Mariposa Point was specifically identified as a focus for combined geological, biological, and geophysical studies. It is largely a mangrove-dominated area of southwestern Tampa Bay that is punctuated with shallow sinkholes created in underlying sandy dolomite and limestone. One of the largest sinkholes, Moses Hole, is located very close to the shore on Mariposa Point, and appears to be free from extensive historical influence. Although isolated from open bay waters, it clearly has been flushed by marine waters through a natural channel and later from two man-made channels dug as part of the state mosquito control effort.

Tampa Bay is thought to have formed as the result of coalescing sinkholes. One core is located in the north central part of Hillsborough Bay (Fig. 1, Alafia River area) and overlies a small sinkhole in about 12 feet of water.

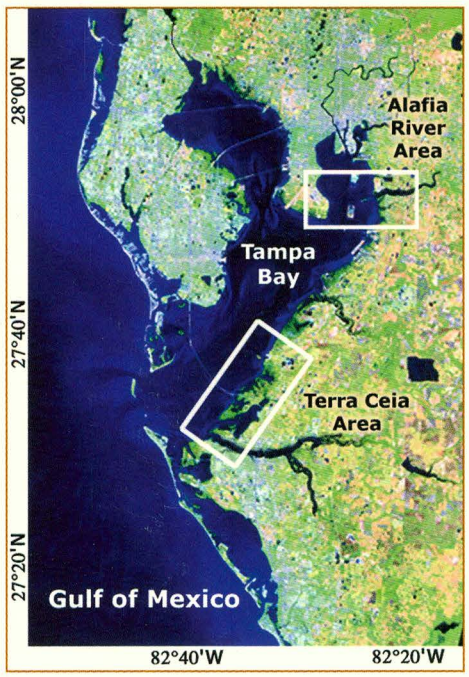

Figure 1. Satellite image of Tampa Bay indicating demonstration study sites near the Alafia River and Terra Ceia area . Colors are near natural; healthy plants are green, agricultural fields are pink or beige.

RESULTS/DISCUSSION

Three vibracores were taken in Moses Hole from which 2.5-3.0 meter long sediment cores were recovered. Gray carbonate clay was recovered in the lowest part of each core and it is overlain by shell hash representing a transgression of the sea over the area, as part of the termination of the last sea-level rise or as a result of a major storm deposit. Overlying the shell hash is a 1.5 meter sand deposit containing minor fragments of shells and evidence of extensive bioturbation or burrowing by organisms living on and below the sea floor. Pollen and microfauna studies indicate that the top meter of sand was deposited in historic times, suggesting that it was deposited rapidly, perhaps as the result of a major storm. Biomarker studies on organic matter

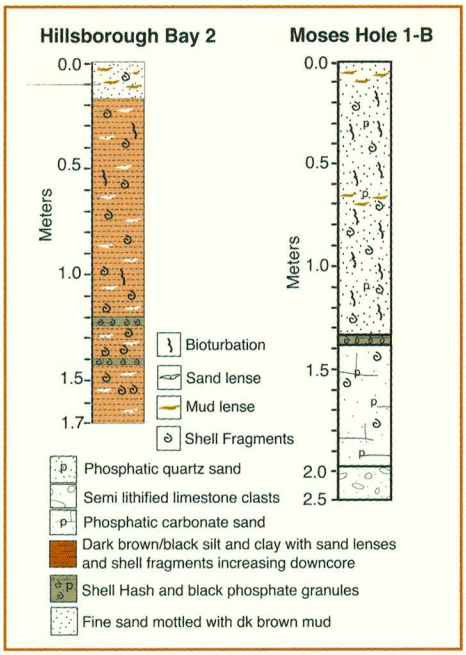

Figure 2. Graphic of key sediment cores from Hillsborough Bay and Moses Hole.

demonstrate that submergent vascular plants dominate the organic matter, but contributions from upland terrestrial plants were observed in the upper part of the core. Salinity values of pore water throughout the core were at open marine levels, but on land, away from the bay salinities of pore water in the sediment is over twice marine levels. These results agree with geophysical measurements of more deeply buried groundwater salinities from depths of 10-40 meters conducted in the same area. Pore-water measurements taken from onshore cores in the Mariposa Point area provide valuable information for biologists studying flora.

The Hillsborough Bay core contained more organic material than the core taken from Moses Hole and yielded lead and carbon isotopes suitable for dating. Biomarker studies on organic matter in the core documented the transition from prehistorical, dominantly submergent vascular plants to upland species. This information suggests changes in river flow and groundwater input to the bay. In addition, recent conditions in the bay changed from aerobic to anaerobic, which is coincident with enhanced input of algal, zooplankton and sewage sources.

SUMMARY

The summary presented here is based on preliminary results derived from a few months of study during the demonstration project and serves as a guide for future, more comprehensive studies in the bay.

- An area of minimal historical influence in wetlands (Moses Hole) signals increased input of organic material derived from upland regions during population growth around Tampa Bay.
- Pollen and microfaunal analyses of sediment from Moses Hole indicate that a large influx of sand occurred in the Mariposa Point area during the last century, possibly recording a major storm event.
- Increased algal, zooplankton, and sewer input in Hillsborough Bay coincides with the development of anaerobic water conditions in youngest sediment.
- Changes in sources of ground water and surface water supply to Tampa Bay are evident from prehistorical to historical times (Links to other Tampa Bay Research).

The prehistoric environment of Tampa Bay is of value to those projects analyzing modern and historic levels of contaminants in sediments and in the water column. In addition, the data are valuable in determining the age of the ponds (sinkholes) being studied by the biologists. In some cases, the salinity of pore water in sediment cores are used to ground truth resistivity studies conducted on land.

LINKS TO OTHER TAMPA BAY RESEARCH

Cores from Tampa Bay will assist in defining the historic trends and current status of the health of Tampa Bay by establishing a preanthropogenic baseline with which to compare historic and current levels of contaminants in sediments and in the water column. The results of sediment studies in the bay will identify suitable techniques to be applied to the sediments to render the most useful results that can be applied to crafting a template for integrated research in other Gulf of Mexico estuaries. In addition to these activities related to the evaluation of the health of the bay, the results also provide a better understanding of events leading to the formation of the bay during the last post-glacial sea level rise, and in particular monitoring the transition from a fresh-water environment to that of an estuary.

For more information, please contact:

Terry Edgar, Task Leader, Email: *tedgar@usgs.gov*
U.S. Geological Survey, Geological Discipline
600 Fourth Street South, St. Petersburg, Florida 33701
Phone: 727-803-8747

Kimberly Yates, Scientific Project Leader, Email: *kyates@usgs.gov*
U.S. Geological Survey, Geological Discipline

Contributing Scientists:

Gregg Brooks, Eckerd College
Tom Cronin, USGS/Geological Discipline
David Hollander, University of South Florida
Randy Runnels, Florida Dept. of Environmental Protection
Pam Sutton, University of South Florida
Yvonne Werzinsky, Florida Dept. of Environmental Protection
Deb Willard, USGS/Geological Discipline