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Gulf of Mexico Integrated Science - Tampa Bay Study
Historical and Prehistorical Record of Tampa Bay Environments

Introduction

To study how Tampa Bay, Florida, has changed over time, the prehistorical conditions and natural variations in the bay environment are being evaluated. These variations can be tracked by examining the sediments that have accumulated in and around the bay. The prehistorical record, which pre-dates settlers' arrival in the Tampa Bay area around 1850, provides a baseline with which to compare and evaluate the magnitude and effects of sea-level, climate, biological, geochemical, and man-made changes. These data also are valuable for planning and conducting projects aimed at restoring wetlands and other estuarine habitats to their original state. In addition, the data provide a basis for judging efforts to improve the health of the bay.

Approach

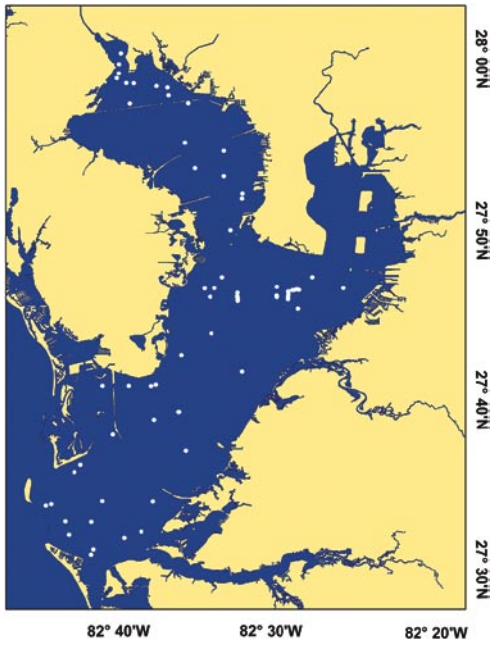
Sediment record

The primary technique for identifying man-made and natural variations in the bay environment is to examine sediment that has been collected from beneath the bottom of the bay. Scientists push core barrels into the sea floor and recover the sediment trapped inside. Research partners from the U.S. Geological Survey (USGS), University of South Florida (USF), Eckerd College, and Florida Department of Environmental Protection (FDEP) have collected 74 cores throughout Tampa Bay. Six have been selected for detailed examination, which includes analyzing the sediment and fossils contained in the cores. Geochemical analyses reveal the chemical elements and isotopes characteristic of the environment in which the organisms lived, such as water salinity and temperature. Climate variations affect the bay-water components and are determined by analyzing pollen from ancient vegetation and from geochemistry of the sediments in the bottom of the cores. The results of the detailed analyses on these six cores will be correlated with similar data from cores located throughout the rest of the bay to trace layers of different sediment types among the cores.

Indian midden (see text) inland from the water's edge in Terra Ceia where sea level is thought to have encroached inland, resulting from a vertical rise in sea level of approximately 76 cm about 1500 years ago.

Contaminants in clams

A short-term record of contaminants in Tampa Bay can be determined from a recently developed chemical analysis that measures trace metals in clam shells from season to season. Large southern quahog clams, or *Mercenaria campechiensis,* live up to 30 years and form growth increments similar to annual growth rings in trees. When alive, it is possible to determine how old they are by counting the growth increments, and variations in trace metal concentrations found in the shell can be dated.



Locations of 74 sediment cores taken for the Tampa Bay Study. All the cores show the nature of the sediment accumulation in the bay, but only six will be analyzed in detail to evaluate effects of anthropogenic change.

Local historic climate change

Mangroves are very sensitive to weather and cannot tolerate freezing temperatures for very long. Sediment cores taken from coastal lakes located near mangrove trees contain their pollen. Mangrove pollen does not travel far, indicating that the trees have been located next to the lakes for a long time. Initial results show that temperature in the Tampa Bay area has not changed significantly in the past 2,000 years.

Sea-level change

During the last ice age, water that formed the glaciers was drawn from

Retrieving a sediment core from Tampa Bay.

the oceans, which lowered sea-level about 125 m. During the time of lower sea level, the west coast of Florida would have been about 200 km west of Tampa Bay, and the bay at that time would have been dry land and located in central Florida. At the end of the last glacial period 21,000 years ago, the ice began to melt rapidly and sea level rose swiftly. During the last 5,000 years, sea level has remained fairly constant with only minor fluctuations.

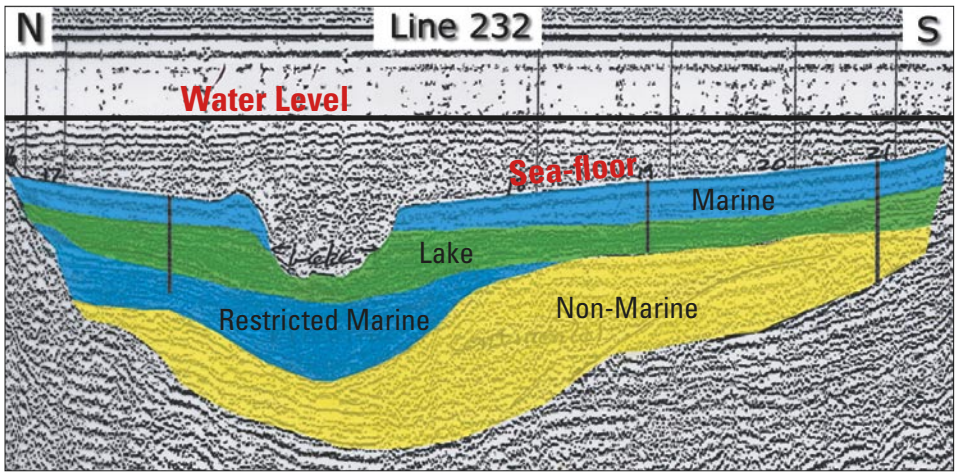
A preliminary review of Indian middens (trash piles of shells that we believe were deposited near old shorelines) in southwestern Florida and Tampa Bay indicates that sea level rose about 76 cm approximately 1,500 years ago. A sea-level rise in Tampa Bay has been identified by the presence of middens inland from the present coast. As the water later retreated, it left a "bathtub ring" of these middens around the bay marking the ancient coastline. The ring has disappeared in places due to urbanization, but scientists continue to map the "bathtub ring," using the middens as a guide.

Links to other project research

Sediment cores will assist in defining the historic trends and current status of the health of Tampa Bay by establishing a baseline that dates back to before human times in the bay area. This baseline can be used to compare prehistoric and current levels of contaminants in sediment and water. In addition to helping evaluate the health of the bay, the prehistoric data also provide a better understanding of how the bay was formed during the last sea-level rise, and how it changed from a freshwater environment to that of an estuary.

Variations in porewater salinity (water trapped in the spaces between sediment particles) have been recorded in some of the cores. These variations may indicate fossil waters trapped during sedimentation or waters from different sources entering the sediment after the layers were deposited (such as seepage of fresh water from aquifers into the overlying sediment).

Geologists are conducting seismic studies of the bay. Seismic profiles record different sediment layers below the bay floor. Seismic data are used to identify suitable locations to take cores and to correlate sediment layers found in the various cores. Meanwhile, the core and seismic data are correlated to identify the types of sediment in the layers beneath the bay floor.



Seismic lines showing layers of sediment beneath the bay floor, and locations of cores that penetrated and recovered sediment from these layers. The blue layer near the surface and at depth is marine sediment, the green layer is sediment deposited at the bottom of an ancient lake, and the yellow layer is sediment derived from streams and rivers when sea level was low.

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