

Sedimentological Processes and the Evolution of Waquoit Bay

This is a long-term, multi-phase project (really more of a research program wish list) whose primary purpose is to better understand the geological evolution of Waquoit Bay. Central to that goal is investigating the processes: oceanic, estuarine, terrestrial, climatic and biological that have operated in the past and currently operate that affect the bay's sediment system. Despite a wealth of current ecological and hydrological data on Waquoit Bay, designated as one NOAA's National Estuarine Research Reserves in 1988, little is known about its evolution or that of many similar embayments in the region -- particularly, how fast they respond to changing environmental conditions. Donnelly, et al., 2001 have documented changes in the frequency and intensity of storminess over the last 2000 years in the Northeast, which likely has had considerable influence on the nature of these estuaries, as most are fronted by extensive barrier beaches. Variations in sea level, no doubt, has had profound impacts on the evolution of these coastal embayments. Radiocarbon-dated sediment records indicate a deceleration in the rate of relative sea-level rise (RSLR) over the last 6,000 years in southern New England, from approximately 3 mm/year to less than 1 mm/year (Donnelly and Bertness, 2001). Tide gauge measurements from the last 60 to 140 years, however, indicate rates of RSLR between 2 and 3 mm/year (Emery and Aubrey, 1991). Recent studies have shown that this apparent two- or three-fold increase in the rate of sea-level rise occurred in the late 19th century (Donnelly and Bertness, 2001), and there is evidence that links this RSLR acceleration to a narrowing of some barrier systems over the past 150 years (Leatherman, 1983), making them more susceptible to overwash and breaching. Inlet dynamics have been shown to have significant ecological consequences by altering the hydrodynamics of backbarrier environments (Orson and Howes, 1992; Roman et al., 1997; Warren and Niering, 1993).

Current work and research plans includes: 1) monitoring shoreline change and morphology along the entire 3-miles of south-facing barrier beach fronting Waquoit Bay, 2) sediment core analysis including down-core radiocarbon-dating, radiometric dating and sediment-size, 3) wave and current analysis, and 4) sub-surface geophysical imaging. Partnerships or collaborations are actively welcomed to broaden and deepen these studies.

Below is a graph of radiocarbon-dates on fossil material vs. core depth from a 9 meter sediment core taken in 2002 in the north basin of Waquoit Bay (about 200 m south of the northern shoreline). Our analysis indicates that the sediment were marine in origin (mostly muds), except perhaps for the last few centimeters at the base (glacial or beach sands?).

Waquoit Core-north basin

