Shallow stratigraphy of Great South Bay:
Implications for the evolution of Long Island's South Shore

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In summer 2000, eight students participating in MSRC's Research Experience for Undergraduates conducted a multidisciplinary study in the Patchogue Bay portion of the Great South Bay estuary. As part of this investigation, three 5 m-long vibracores were collected from sites that were selected for their different seafloor morphology, each located about 0.5 km apart (Fig. 1). The bottom-type of the sites included (1) a shelly, moribund oyster reef, (2) a broad sandy mud area, and (3) a slightly deeper (by 0.5 m) muddy low. This pattern of high spatial variability is somewhat unexpected for a shallow, well-mixed lagoon system. Thus, the main objective of the coring study was to determine recent (10^2 yr) and longer-term (10^3 yr) sedimentation patterns for understanding development of the heterogeneous seafloor.

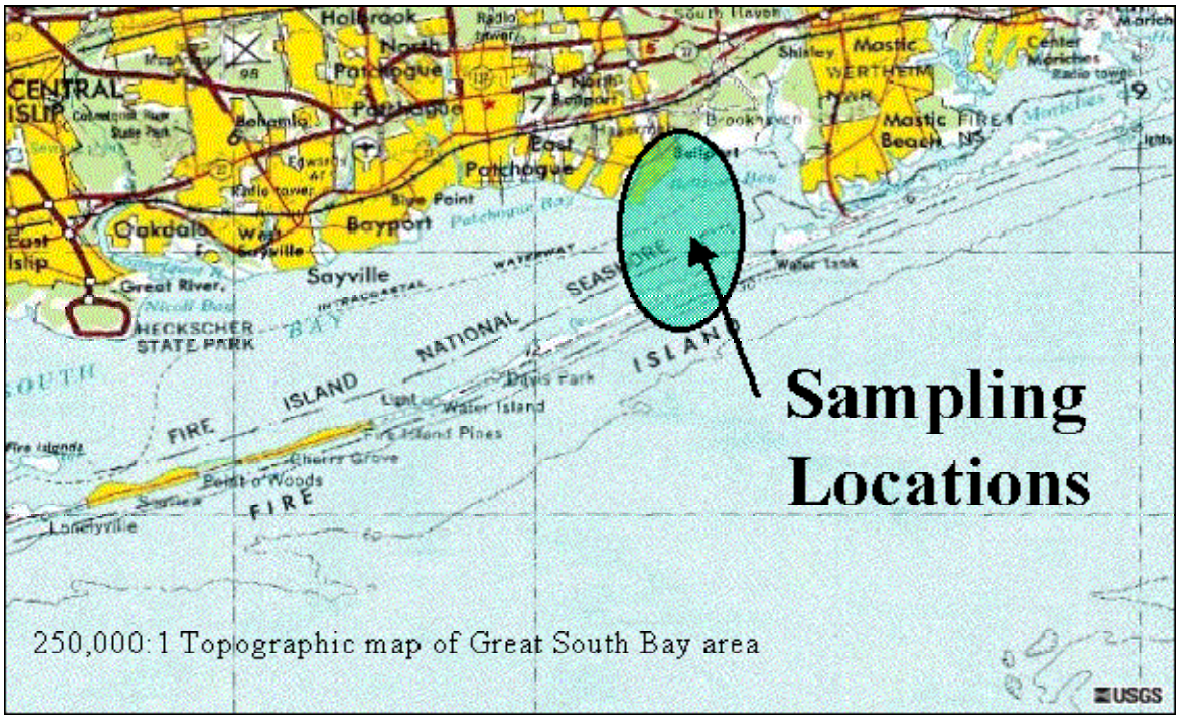
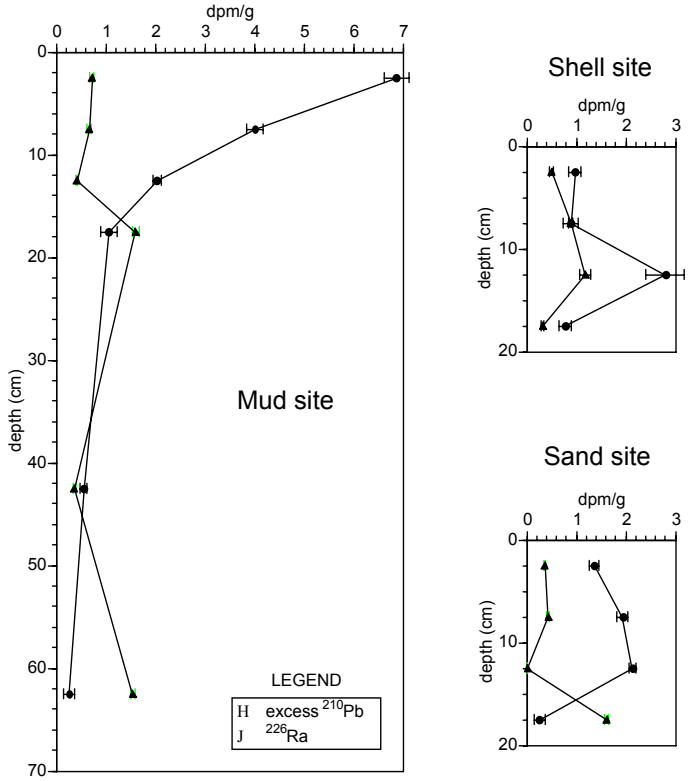


Figure 1. Map of Great South Bay lagoon showing Patchogue Bay study site and area of sample collection.

Geochronology results (Fig. 2) show that only the mud site is receiving significant sediment input, with a mean accretion rate of 2.5 mm/yr (not believed to be a mixing signal). The shelly mud and sandy mud bottoms reveal very low excess ^{210}Pb activities with vertically mixed profiles, indicating little or no accretion in these areas. These differences appear to be related to environmental changes within the past few hundred years, because the underlying strata (> 2m



depth) reveal a similar depositional history among the sites. This similarity in stratigraphy suggests that *modern* seafloor morphology is not directly influenced by antecedent topography. However, none of the cores penetrated the total thickness of lagoonal muds, indicating that the estuarine stratigraphic sequence is > 5 m thick. Given the generally flat topography of the south-shore outwash plane, the great thickness of these lagoonal deposits suggests that portions of Great South Bay have developed in glacial or outwash features (e.g., paleochannels).

Figure 2. Radioisotope geochronology results from vibracores collected at three sites in Patchogue Bay. Excess ^{210}Pb values show that only the muddy-bottom site has received active sediment accretion in the past century (~ 2.5 mm/yr). The other sites comprising slightly shallower (~ 0.5 m) shelly and sandy mud bottoms appear to be largely moribund in terms of sediment accumulation.

Furthermore, the thickness of fine-grained lagoon deposits in Great South Bay implies that the system has either: (1) infilled very rapidly since its formation (~ 5 mm/yr), or (2) that it is significantly older than might be expected, based on a presumed 2000-3000 year age for the coastal plain. The generally low input of fine-grained sediment to the modern system suggests that rapid infilling is less likely. Another possible interpretation is that the Great South Bay lagoon formed very early, perhaps 4000-5000 years ago when sea level was ~ 5 m below present. At that time, any barrier island located along the South Shore would have been located many kilometers seaward of their current position. If true, Great South Bay might have been a much

broader system, perhaps similar to Pamlico Sound in North Carolina. Given recent evidence that a moraine extended offshore of the Montauk Peninsula, such a feature could been a major sediment source that allowed for early, seaward development of the barriers islands and Great South Bay. Thus, the thick fine-grained deposits found there today would have accumulated as the barriers retreated landward and fine-grained sediments were reworked into the increasingly smaller lagoon system. Although these ideas are speculative given available data, findings from Patchogue Bay suggest an intriguing geologic history for the Great South Bay estuary, and the South Shore in general, which could be better understood with additional investigations.