Peconic Estuary "Oyster Terrain":
Preservation of a Carbonate Mound Trangressive Sequence?

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Multibeam surveys of the Peconic Estuary conducted during the Summer/Fall 2006, and Fall/Winter 2007/2008 have revealed a mounded morphology named the "Oyster Terrain" that may represent a relict transgressive morphology that would not be as well preserved in the open high energy shelf. The mound morphology or "Oyster Terrain" as described in Flood et al. (2006), and Kinney & Flood (2007a,b) is characterized by high backscatter 10-50 m diameter mounds typically ~2 m high in exposed relief and as tall as 4 m. Samples taken from the mounds consisted of stained unarticulated oyster shells. An approximately 22 km^2 subset of the area surveyed had close to 3,000 exposed mounds the tops of which fell between ~6 –18 m depth. Preliminary analysis of other areas seem to show a similar depth distribution of mound tops, with at least 2,000 more exposed in the western portion of Little Peconic Bay. Initial analysis of sub-bottom seismic profiles collected for portions of the bays with a Chirp sub-bottom profiler graciously lent by Liviu Giosan at WHOI during our most recent survey shows a continuation of mounded terrain below the surface, with the tops of buried mounds falling within the same depth range as the exposed mound tops. Profiles of buried and exposed mounds show mound heights extend beyond the typical exposed heights of ~2 m, with some appearing to reach ~6 m in height. Analysis of multibeam coverage along with seismic profiles thus far suggests that mounded morphology or "Oyster Terrain" covers on the order of 100 km^2. Profiles suggest a complicated framework of mound growth and distribution of features in relation to channels and other horizons that are part of the evolution of this system in relation to sea level rise. The Peconic Estuary is located between the two moraines that form the North and South Fork of Long Island and along with the large islands within the estuary, serve to protect seabed features from the higher energy forces such as storm waves that dominate our present post-glacial continental shelf environment. Combined with this protective setting, a relatively small sediment supply is delivered to the estuary via the Peconic River, while high speed tidal currents serve to keep relict morphologies exposed by minimizing burial by fine sediments.

Relatively intact examples of trangressive deposits, such as oyster reefs typically seen only as remnants on the shelf, may be preserved within the Peconic Estuary as "Oyster Terrain". Transgressive deposits are often poorly preserved, especially from the last postglacial sea level rise (MacIntyre et al., 1978, Catteneo & Steel, 2003, Belknap & Kraft, 1981). Relict oyster shells have long been known to have a ubiquitous presence across the U.S. East Coast continental shelf, remnants of the features of the post Wisconsian sea level rise (Merrill et al., 1965). Oysters are commonly used in conjunction with salt marsh peat and terrestrials deposits as indicators of sea level rise due to their limitation to brackish salinities as in Milliman & Emery (1968), Gutierrez et al., (2003). However, the original position and morphology of many of these shell deposits is unknown because of erosion and transport on the present high-energy shelf (MacIntyre et al., 1978, Catteneo & Steel, 2003). High resolution studies of the framework of better preserved examples of such oyster shells deposited during the last trangression to address questions that remain about the environment of deposition of these ubiquitous deposits.

We believe that the "Oyster Terrain" mound morphology we see exposed in the multibeam bathymetry may represent an example of a transgressive sequence of carbonate mounds or reefs that is more common throughout the geological record. The significance of understanding such transgressive deposits as oyster reefs goes beyond understanding the most recent sea level rise or transgression. Carbonate mud mounds or reefs composed of different species are well known to be common throughout the geological record (Henriet et al., 2002). For example the relict morphology of oyster deposits found by Pufahl et al. (2004) from the Pliocene and the Miocene in Murray Basin, Australia. Carbonate mud mounds have long been know to be common in the pre-Cenozoic geological record (Henriet et al., 2002), from brachiopod reefs in trangressive deposits in Carboniferous carbonate platform facies in Kazakstan (Cook et al., 2002) to other carbonate mound deposits often associated with transgressions (Adams et al., 2005, Mel'nikov et al., 2005, Henriet et al., 2002, Huvaz, et al., 2007). Carbonate mound terrain such as these are known to cover extensive areas, such as ~5 km long section of mound terrain of a much larger carbonate unit examined in Adams et al. (2005). Many such carbonate mud mounds or reef types were missing modern analogues until as recently as the 1990’s (Henriet et al., 2002). Extensive mound systems can be found deeper in the geological record on a similar scale to the features seen in the Peconic Estuary with ~50 m diameter mounds such as the terminal Proterozoic stramatolite-thrombolite carbonate mounds from Namibia described by Adams et al. (2005). The high resolution study of such an extensive area of transgressive deposits has potential significance to understanding past mound systems and trangressive sequences elsewhere in the geologic record.

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