Coarse-grained Sediment Distribution and Transport Processes in western Long Island Sound

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Detailed understanding of benthic habitats is key for identifying areas of special resource concern, and areas suitable for the placement of energy and other infrastructure. The "Long Island Sound Cable Fund Seafloor Habitat Mapping Initiative" is working on detailed habitat maps for different parts of the Long Island Sound (LIS). The information collected as part of the initiative include different acoustic data such as multibeam bathymetry, backscatter, and subbottom profiles as well as sediment grab samples and cores. The geophysical images provided the framework for the sampling but do not provide the sediment composition and its distribution by sediment processes.

The objectives of this study are to give insights into the coarse-grained sediment composition obtained from grabs and of the processes that led to their deposition. This research is based on visual microscope observations of the sediment coarse fraction (>63 microns) and quantitative counts of the grains. Two areas located in western and central LIS were studied. Area 3 in western LIS is bounded to the N and S by the CT and New York shorelines, respectively and between ~73° 30'W to 73°15'W. Area 4 in central LIS extends from the CT shoreline to 41°04'N and from 73°05'W to 72°46'W. We analyzed 60 grabs from Area 3 and 54 in Area 4. The samples were grouped into light (dominated by quartz) and dark minerals (composed mainly of heavy minerals), and calcium carbonate (benthic and planktonic foraminifers) and biosiliceous (diatoms and spicules).

Our observations show that light minerals are scattered throughout both studied areas, in contrast dark minerals are most abundant along a deep channel (~70m) that crosses the study Area 3 from ~NE to SW. This deep channel has been previously associated with paleoshorelines by Gayes and Bokuniewicz (1991) and may be a relic from a paleofluvial system that formed as the ice melted and were reoccupied by estuarine processes during the Holocene transgression. Foraminifers are present throughout, but are common along the CT shoreline, and most abundant along the Milford, CT coastline. Biosiliceous microfossils are found preferentially between 10 - 25 m of water depth.

The observed distribution of minerals, foraminifers, and diatoms is related to currents that rework the sediments. Tidal currents in the studied areas average 15-20 cm/s. They can rework both the minerals and microfossils and are likely an important sediment transport process. Wind driven currents can be from the NE and driven by the Westerly winds (Signell et al., 2000). These currents are strongest along the shore (-5 to -10 m of water depth) reaching 10 m/s and 15 m/s, respectively and provide nutrients for benthic and planktonic foraminifers to thrive. Other process of sediment transport are storms and hurricanes.