

Sedimentological Characterization of a Core from the Douglas Manor Marsh Using Laser Diffractometry



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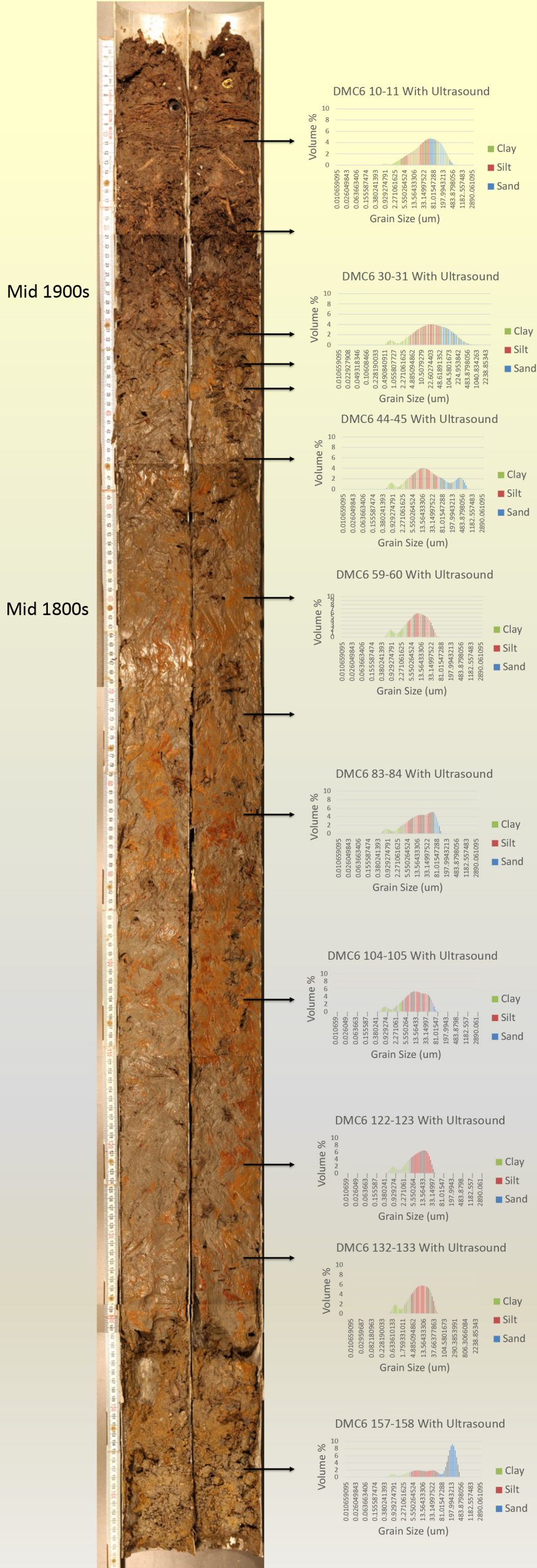


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Abstract

Douglas Manor Marsh in north Queens, NY (Figure 1) is a coastal wetland (Figure 2) invaded by *Phragmites australis* (Common Reed). The Douglas Manor Environmental Association (DMEA) wants to restore the marsh to pre-invasion conditions to improve habitat for native flora and fauna. This research has two main objectives: to determine past environmental conditions in the marsh by looking for distinct changes in sediment particle size over time and to evaluate methods of particle size determination. A previously obtained sediment core (Figure 4) was separated into 1 cm sections and evaluated using the traditional dry sieving method and laser particle analysis with the Malvern Mastersizer 3000 (Figure 3). Lead (Pb) levels in the fine fraction of core samples were measured using benchtop XRF (x-ray fluorescence spectroscopy) and provide a rough chronology of deposition (Figure 5). The results from the Mastersizer were similar to the traditional dry sieved particle size distributions suggesting viability of the more efficient laser diffractometry method. Sediments at the bottom of the core are glacial sands and gravels overlain by fine-grained, organic-rich wetland muds. An increasing component of sand in the makeup of the wetland muds is observed in the upper third of the core, dating to approximately the mid-1800s. The origin of the sandy material could be from runoff associated with anthropogenic modification of the adjacent uplands or from storm or tidal deposition of marine sands associated with sea level rise and increasing marine influence. The analysis will be utilized by the DMEA to inform decision-making for restoration of this region.

Core DMC-6



Mid 1900s

Mid 1800s

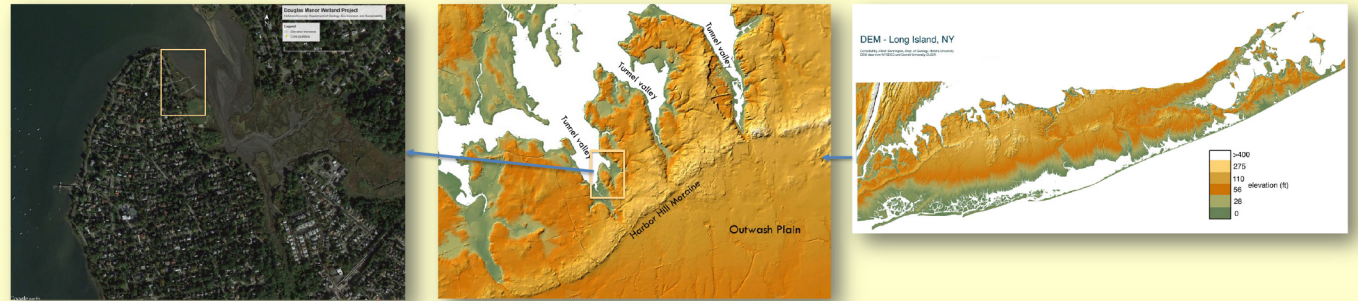


Figure 1: Location of study area along the margin of Udalls Cove in western Long Island, New York

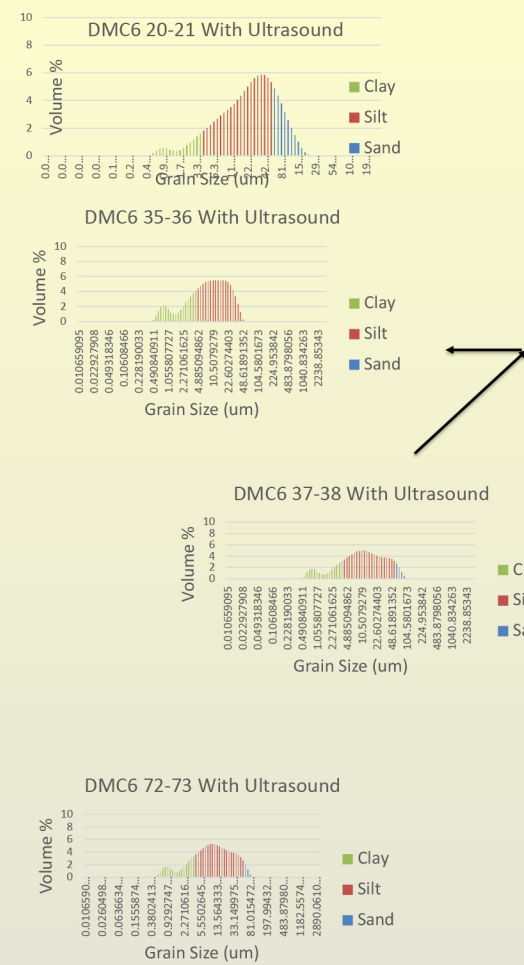


Figure 2: Sediment coring in the Douglas Manor wetland.

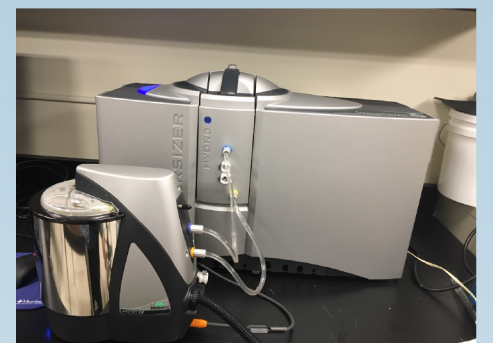


Figure 3: Malvern Mastersizer laser particle analyzer.

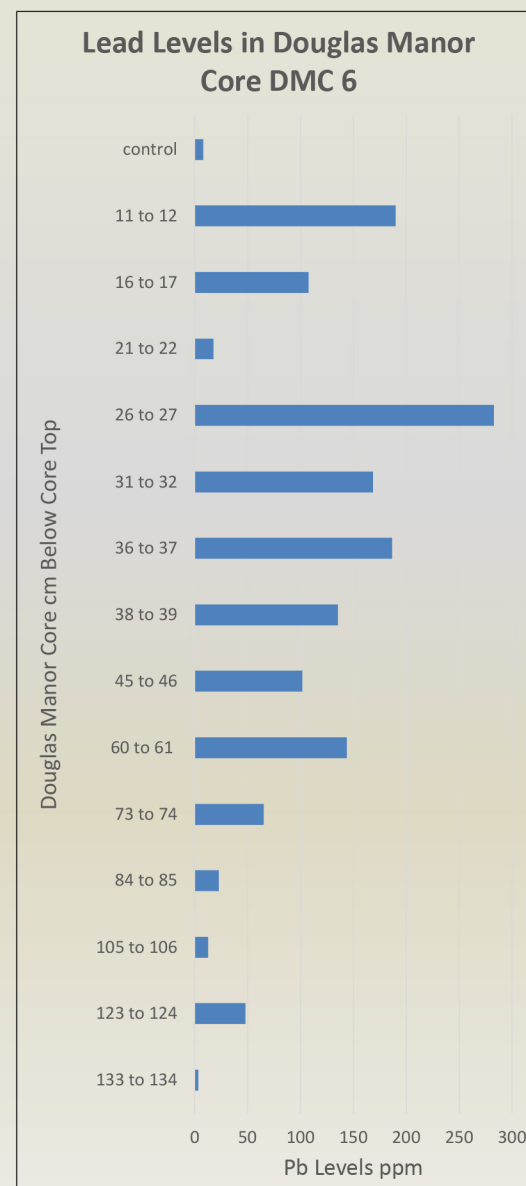


Figure 5: Lead Levels in Douglas Manor Core

Results

Grain Size Distributions in the DMC-6 Core (Figure 4)

- Core sediments from 0 to 30 cm are dominated by organic material, fine sand, and silt. This is the *Phragmites* root mat, with sand likely washed in from the beach.
- From 30 cm to 150 cm the sediments are dominated by silt with lesser amounts of clay-sized particles. Sand is scarce in most samples, although two intervals have significant amounts of sand. There are no obvious differences noted in the sediments deposited throughout this interval, which are characteristic of a terrestrial wetland environment.
- Below 150 cm down core the sediments are dominated by sand and pebbles, with lesser silt and clay, characteristic of glacial deposits.

Lead (Pb) Levels In the DMC (Figure 5)

- Pb levels are low (<50 ppm) relative to control at the bottom of the core, rising to over 150 ppm at level 60-61 cm. Pb levels peak (>250 ppm) at level 26-27 cm and then decline to less than 200 ppm to the top of the core. Preindustrial lead levels recorded in Long Island Sound sediments have been shown to be low in sediments deposited prior to the mid-1800s (McCaffrey and Thomson, 1980) with peak values recorded in sediments deposited in the mid-1900s. Based on Pb measurements, the root mat at the top of the core formed in the 20th Century, while the lower half of the core predates the industrial revolution.
- McCaffrey, R.J., Thomson, J. (1980). A record of the accumulation of sediment and trace metals in a Connecticut Salt marsh. Department of geology and Geophysics, Yale University. *Advances in Geophysics*. Vol. 22.

Figure 4: Core DMC-6 and grain size distribution graphs.