HIGH-RESOLUTION SEISMIC EVIDENCE FOR CHANGING SEDIMENTARY CONDITIONS IN THE HUDSON RIVER ESTUARY, PIERMONT, NY

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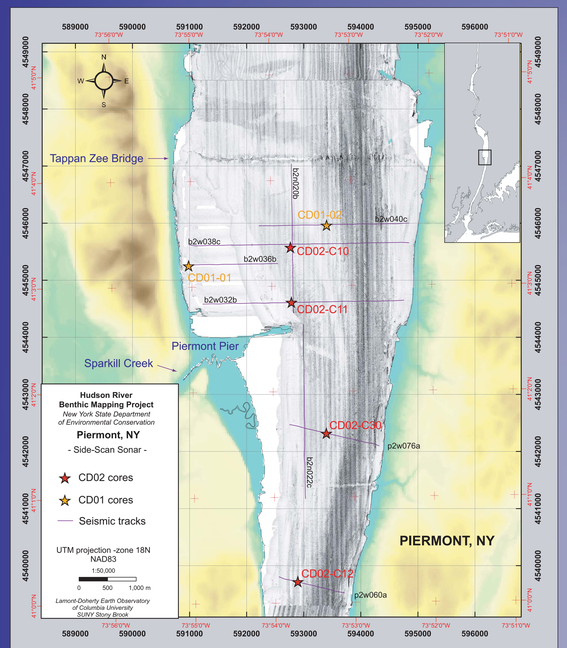

Fig. 1 - Basemap of Piermont, NY, showing 100 kHz sidescan sonar data, key seismic lines and sediment core sites. Details of seismic lines and cores shown in Fig. 2 - 8.

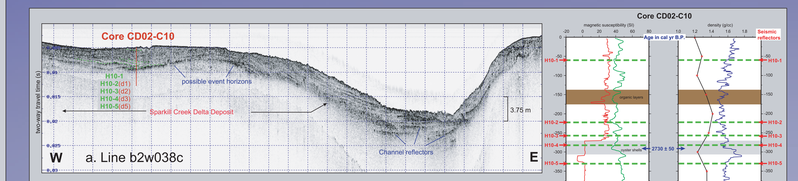

Fig. 2a - East-west seismic profile b2w038c showing location of core CDO2-C10. Prominent reflectors in CD02-C10 are H10-1 through H10-5, the youngest reflectors in the Sparkill Creek deltaic sequence.

Fig. 2b - Summary diagram for CD02-C10, including bulk density, magnetic susceptibility, p-wave velocity and LOI. Calendar ages are shown in blue and prominent seismic reflectors are indicated in red.

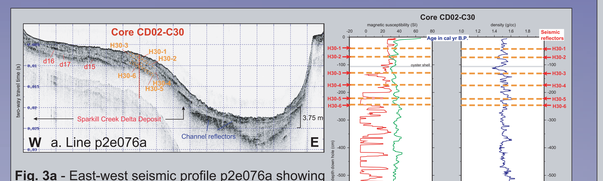

Fig. 3a - East-west seismic profile p2e076a showing location of core CDO2-C30. Prominent reflectors are H30-1 through H30-6.

Fig. 3b - Summary diagram for CD02-C30, including bulk density, magnetic susceptibility and p-wave velocity. Prominent seismic reflectors are indicated in red. Dating is in progress.

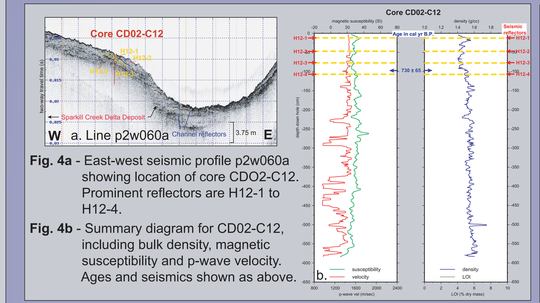

Fig. 4a - East-west seismic profile p2w060a showing location of core CDO2-C12. Prominent reflectors are H12-1 to H12-4.

Fig. 4b - Summary diagram for CD02-C12, including bulk density, magnetic susceptibility and p-wave velocity. Ages and seismics shown as above.

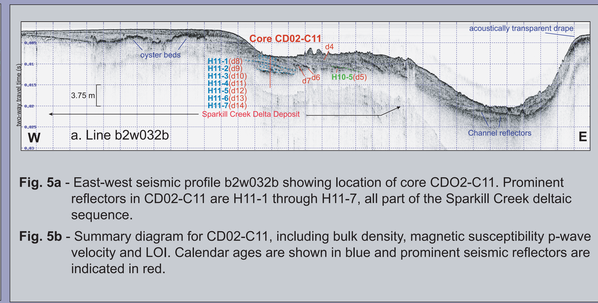

Fig. 5a - East-west seismic profile b2w032b showing location of core CDO2-C11. Prominent reflectors in CD02-C11 are H11-1 through H11-7, all part of the Sparkill Creek deltaic sequence.

Fig. 5b - Summary diagram for CD02-C11, including bulk density, magnetic susceptibility p-wave velocity and LOI. Calendar ages are shown in blue and prominent seismic reflectors are indicated in red.

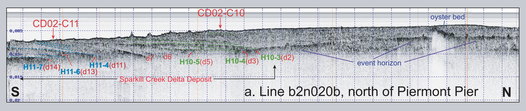

Fig. 6 - Seismic profiles describing the Sparkill Creek deltaic sequence. Deltaic sequence is numbered from youngest to oldest reflection, d1-d21.

a: North-south line b2n020b, located north of Piermont Pier; locations of CD02-C10 and CD02-C11 are projected onto profile, illustrating their position in delta stratigraphy.

b: North-south line b2n022c, located south of Piermont Pier; prominent reflectors are d14-d21; note inflection point of deltaic sequence.

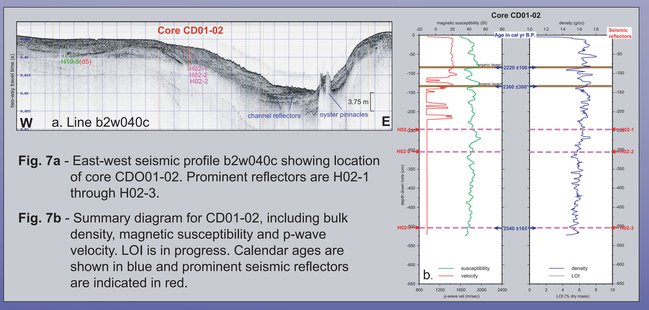

Fig. 7a - East-west seismic profile b2w040c showing location of core CDO01-02. Prominent reflectors are H02-1 through H02-3.

Fig. 7b - Summary diagram for CD01-02, including bulk density, magnetic susceptibility and p-wave velocity. LOI is in progress. Calendar ages are shown in blue and prominent seismic reflectors are indicated in red.

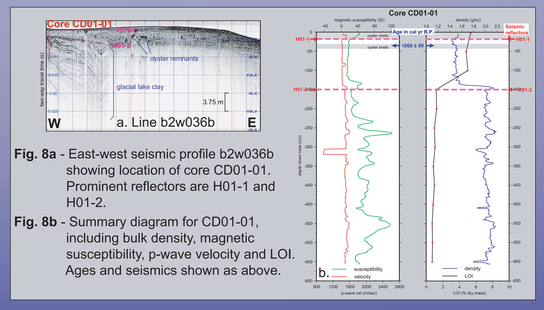

Fig. 8a - East-west seismic profile b2w036b showing location of core CD01-01. Prominent reflectors are H01-1 and H01-2.

Fig. 8b - Summary diagram for CD01-01, including bulk density, magnetic susceptibility, p-wave velocity and LOI. Ages and seismics shown as above.

SUMMARY of KEY DATA

1. Sparkill Creek Delta Deposit
- * Sedimentation rate of 3-4 mm/yr, compared to 1-2 mm/yr average rate for the estuary.
- * Youngest deltaic sediments deposited 2520 yr B.P.
- * Oldest dated horizon (H11-14) deposited 3370 yr B.P.
- * 41 x 10^6 m^3 sediment deposited in ~850 yr; this would require 1.5 m of erosion from entire watershed in that time.
- * Preliminary data indicate higher organic carbon content in deltaic sediments (see Fig. 2b, 4b, 8b).

2. Sedimentary Environment
- * During deltaic interval, Piermont area is actively depositional; delta deposit is pushing channel eastward, and loading the flats west of the channel.
- * In modern environment, only localized regions of erosion and deposition are found (associated with anthropogenic structures, i.e. Piermont Pier, Tappan Zee Bridge).

3. Evidence of other Events
- * Glacio-lacustrine clays sitting below estuarine sediments record differential flooding of the shoreline by marine waters (see Fig. 8a-b).
- * Relic oyster beds (exposed, buried and eroded) show changes in morphology and sedimentary conditions in the river (see Fig. 9).

ABSTRACT

A detailed analysis of high-resolution seismic reflection data from the Piermont area of the Hudson River Estuary indicates major changes in sedimentation during the Holocene. The dominant depositional feature is a delta deposit sourced from Sparkill Creek, which enters the river from the west through the Piermont Marsh. Integration of seismic data with sediment cores provides spatial and temporal boundaries for the delta. Preliminary analysis of 14C data indicate that the most recent period of deposition occurred between 3370 and 2520 cal yr B.P. Truncated reflections at the exposed surface of the delta demonstrate that the deposit is no longer actively accreting and that the interval of delta deposition was followed by a period of erosion. However, the reasons for the onset and termination of this deposit are not yet clear. These dramatic changes in sedimentary environment may be related to variations in sediment supply from the Sparkill Creek, modification of its watershed, or changes in estuary morphology.

Additional evidence of major change has been preserved and identified in other areas of the Hudson River Estuary. Examples of two such events found in Piermont and other areas are the presence of relic oyster beds that have changed in depth and morphology, and evidence of glacio-lacustrine clay layers underlying estuarine sediments, indicating that parts of the area were subaerially exposed while other had already been flooded. Further investigation of these events will lead to better distinction between local events that affect only part of the estuary, and regional or global events that affect the entire estuarine system.

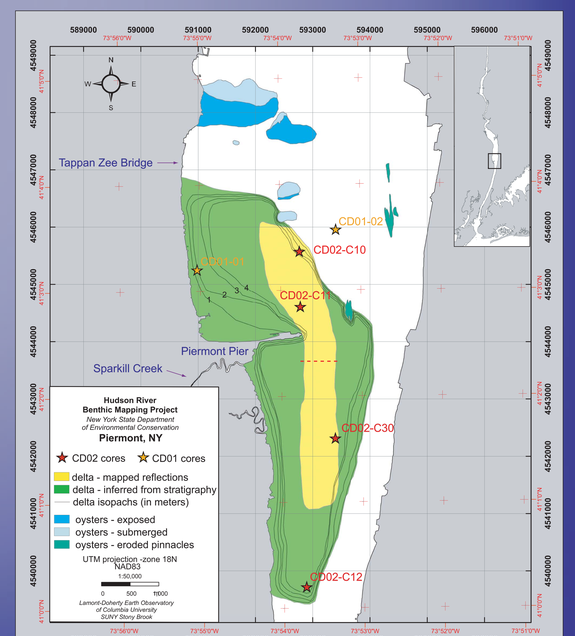

Fig. 9 - Map view of Sparkill Creek delta deposit (in yellow and green). The inflection point in mapped deltaic reflections is indicated by dashed red line. Sediment isopachs are at 1-meter intervals. Oyster beds in Piermont area are also shown.

ACKNOWLEDGEMENTS

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