

Late Quaternary Fault-Related Folding, Uplifted Paleoshoreline, and Liquefaction Structures: Clues About Transpressional Activity Along the North America - Caribbean Plate Boundary From a Comprehensive Seismic Reflection Survey of Lake Azuei, Haiti

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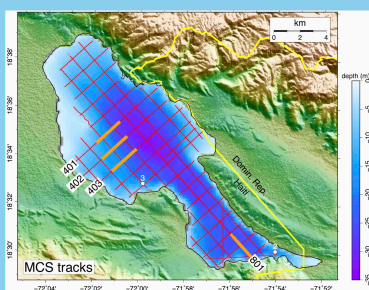
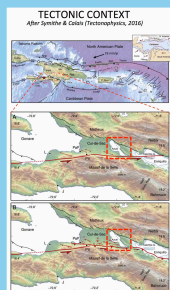
Abstract

The Enriquillo-Plantain Garden Fault (EPGF), one of two left-lateral transforms that define the Caribbean-North American plate boundary in Haiti, plunges beneath Lake Azuei in the eastern part of the country. In 2017, we acquired 220 km of sub-bottom and multichannel seismic reflection profiles (CHIRP and MCS) in a 1.2 km grid pattern across the lake. The two seismic methods achieved subbottom penetration of up to 15 m and 200 m, respectively. CHIRP and MCS data reveal folded turbidites across the expected extension of the EPGF fault zone at the south end of the lake, although direct evidence for faulting is lacking. Along the west side of the lake, however, MCS data image a broad NW-SE monoclinical fold whose geometry is compatible with an underlying SW-dipping blind thrust fault. CHIRP profiles image patches of soft- sediment deformations above the monoclinical fold; they also image a distinctive 11 m-deep paleoshoreline all around the lake that is uplifted by 1-2 m above that fold. These results are compatible with a scenario where some large slip event(s) on the presumed blind thrust occurred after formation of the paleoshoreline, locally uplifting the lakebed and causing liquefaction. Two short sediment cores sampled a layer correlatable to a reflection in the CHIRP profiles. That reflection extends laterally below the 11m shoreline, and thus predates its formation. On-going 14C dating of material from the two cores are expected to provide a maximum age for the shoreline, and thus for some hypothetical slip event(s) on the presumed blind thrust fault. The prominent character of the paleoshoreline suggests that it was stable, something best achieved if the lake level was controlled by the sill depth of an outlet. Presently, no such outlet exists and the lake level fluctuates. Pending results from radiometric dating, we propose that, earlier in the Holocene, the lake overflowed eastward into adjacent Lake Enriquillo along the narrow valley marking the extension of the EPGF fault zone - a valley that is presently blocked by an alluvial fan. Regardless of the relevance of that model, the uplifted shoreline implies a significant uplift rate on a structure extending up to 10 km north of the EPGF fault zone and striking oblique to it, confirming that transpressional tectonics is partitioned over an area at least as broad as Lake Azuei.

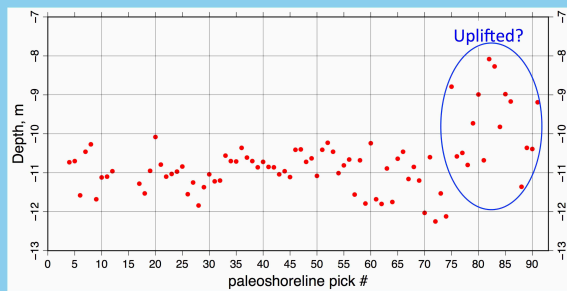
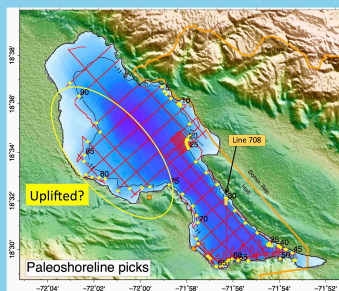
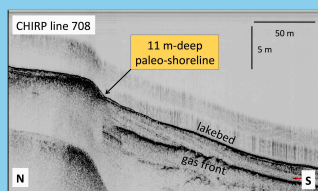
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SUMMARY. The Enriquillo-Plantain Garden Fault (EPGF), one of two left-lateral transforms that define the Caribbean-North American plate boundary in Haiti, plunges beneath Lake Azuei in the eastern part of the country. In 2017, we acquired 220 km of CHIRP and multichannel seismic reflection profiles (MCS) across the lake. **(RIGHT)** Major seismogenic structures we imaged include: (1) A NW-SE monoclinical fold whose geometry is compatible with an underlying SW-dipping blind thrust fault. Liquefaction structures are imaged across its top; (2) An E-W fault zone and small EW folds along the south shore. **(BELOW)** CHIRP profiles image an 11 m-deep paleoshoreline all around the lake that is uplifted by 1-2 m above the monocline. **(LOWER RIGHT)** The paleo-shoreline is younger than 3,000 yr; we suggest it formed at ~1,000 yr BP, ~during the "Terminal Classic Drought".

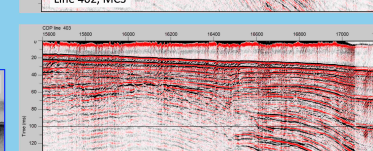
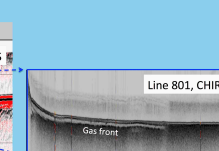
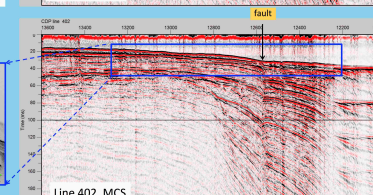
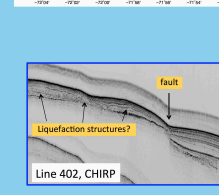
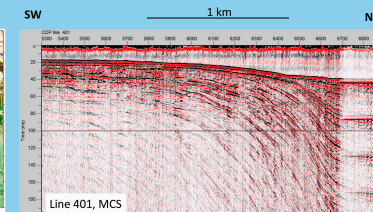
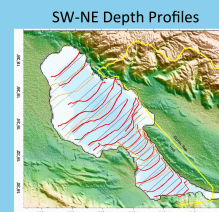
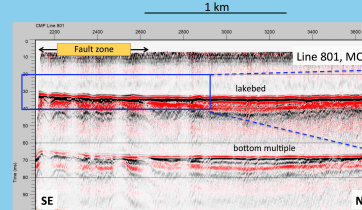


(RIGHT) CHIRP profiles image a distinctive paleo-shoreline (example from Line 708, located below with orange segment). **(BELOW)** The paleo-shoreline is mapped all around the lake (yellow dots). Picks are numbered 1 through 91 clockwise from north). **(LOWER RIGHT)** The paleo-shoreline appears uplifted by 1 - 2 m along the west side of the lake (picks 75 to 91). This is compatible with a scenario where some large slip event(s) on a presumed NW-SE blind thrust occurred after formation of the paleoshoreline.



(RIGHT) MCS profiles (located at left with yellow segments) that image the NW-SE monoclinical fold; inset shows CHIRP profile with liquefaction structures.

(NEAR RIGHT) Depth profiles derived from the CHIRP data and from a 2013 echosounder survey (courtesy of M. Piasecki, CUNY) highlight the map-view continuity of some of the structures **(BELOW)** MCS profiles at south end of lake image a ~ 500m-wide E-W corridor of faulted and folded sediments. However, CHIRP profiles do not provide any penetration below a shallow gas front.



Bottom of core is ~2,000 yr-old, suggesting that a seismic horizon extending below the paleo-shoreline may be about 3,000 yr-old. The paleo-shoreline may be from the *Terminal Classic Drought*, ~1,000 yr BP.

