

Pore Pressure Build-up, Deep-Seated Failure, and Erosion of Levees in Turbidite Channels of the Upper Mississippi Fan, Gulf of Mexico

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ABSTRACT

The levees of Late Pleistocene channels on the Mississippi Fan failed along deep-seated listric faults. The failure planes soled out at the top of an overpressured clay unit tens of meters below the floor. Displacement along the fault was linked to toe thrusts into the channel from *below*. Therefore material was exhumed from depth into the channel. We interpret that this system achieved a delicate dynamic equilibrium wherein further deposition on the levee induced displacement along the fault into the channel that was subsequently eroded down-channel. This study illuminates the linkages between sedimentation, erosion, and the mechanical stability of channel-levee systems on modern and ancient deep-sea fans.

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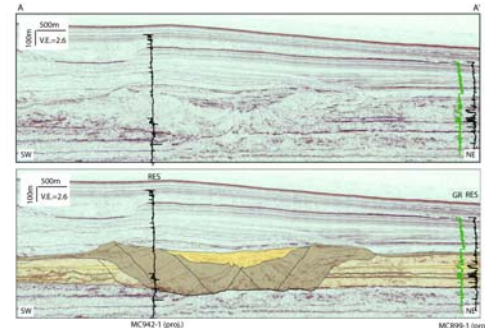


Fig. 1: Deep-seated channel-margin slides of the Ursa Canyon are imaged in seismic data and tied to industry wells. Channel-margin slides are composed of steeply dipping reflectors that are composed of mud. The slides zone thickness is over 200 meters and completely truncates the sandy Blue Unit basin-floor fan.

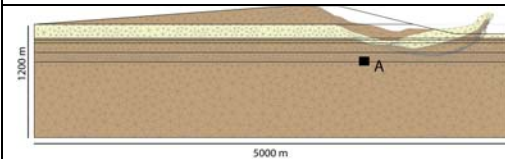


Fig. 2: Deformed finite element mesh (PLAXIS) after deposition of levee (displacements are scaled up). Base failure is predicted as deep-seated failure occurs in the overpressured clay underlying the sand. Vertical displacement into channel is approximately 3 meters.

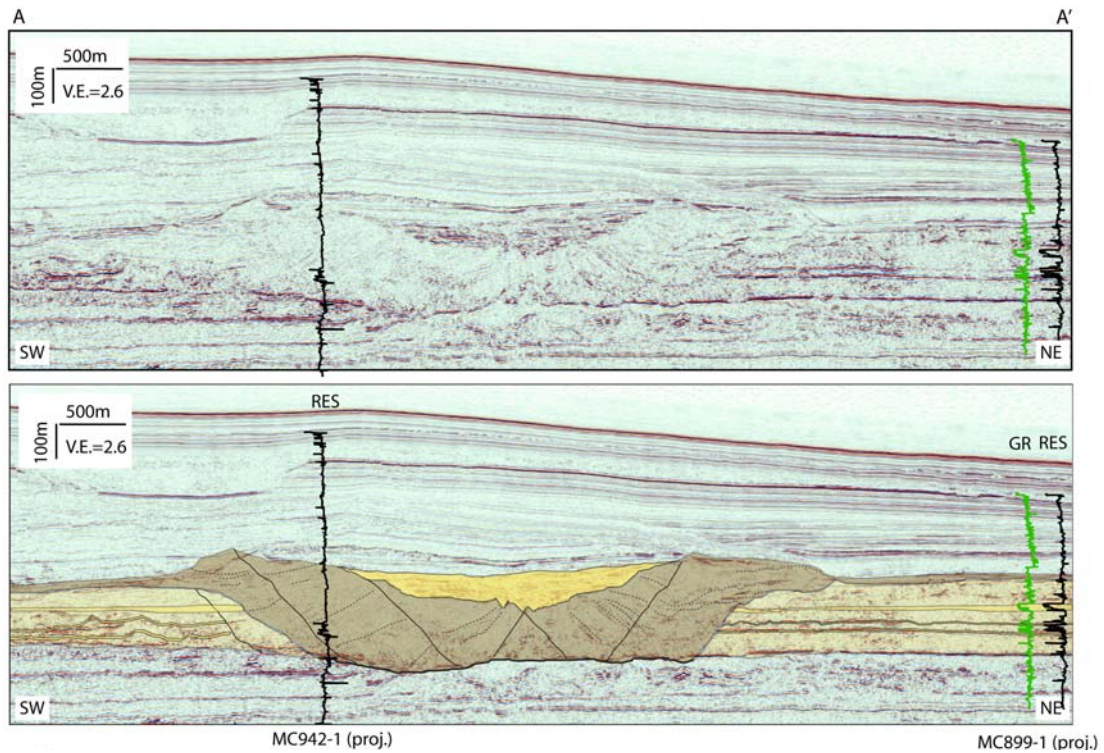


Fig. 1: Deep-seated channel-margin slides of the Ursa Canyon are imaged in seismic cross section A-A' and tied to industry wells. Channel-margin slides are composed of steeply dipping reflectors that are composed of mud, documented by MC 942-1. The slides zone thickness is over 200 meters and completely truncates the sandy Blue Unit basin-floor fan. The channel-levee system and Blue Unit lie above a thick clay deposit.

[Back](#)

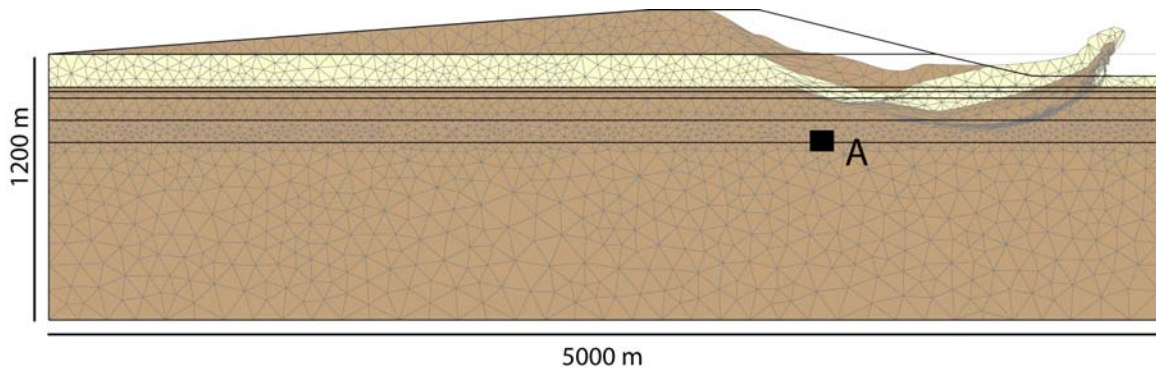


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[Back](#)