Geometry and Initiation of Large Slope Failure along Little and Great Bahama Bank

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Project Objectives

1. Describe the geometry of a large slope failure and associated mass wasting deposits.
2. Examine the modern sea floor morphology and seismic data along strike and dip of these events to determine the depth of the detachment surface.
3. Revisit core and seismic data of ODP Leg 166 to assess the vertical diagenetic and petrophysical changes in the strata to determine the physical conditions of these slope failures.

Project Rationale

Observations from submersible dives (Grammer et al., 1993) have documented scars in the upper slope of Great Bahama Bank. More recent, high-resolution bathymetry maps revealed a slump scar on the magnitude of 100 meters in relief on the toe-of slope of Great Bahama Bank (Grasmueck et al., 2007). This slump scar at very toe-of-slope is imaged in its entirety with multibeam data collected during the CARAMBAR cruise (Figure 1). Other kilometer long scars are visible along the slope of both Little and Great Bahama Bank. Slope failures of this magnitude and at this low of a position on the slope have not been reported and are hard to explain. This study aims to describe the geometries of these slope failures and to give an explanation for why they occur.

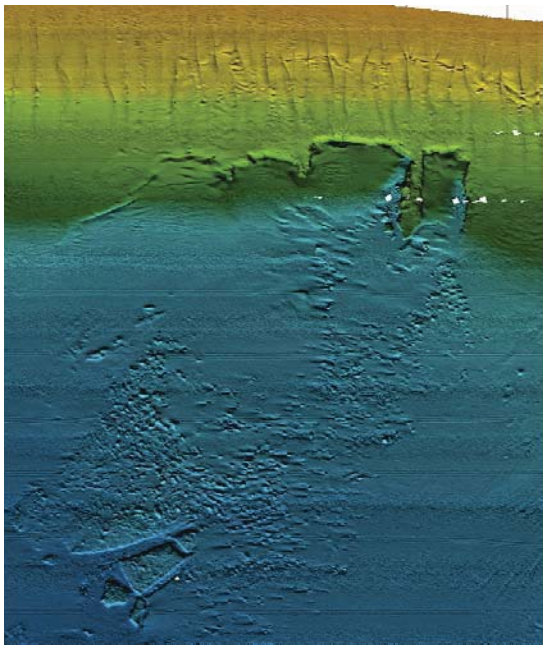

Figure 1: Bathymetry along the western slope of Great Bahama Bank displaying the small gullies in the mid-slope areas and a large, approximately 30km long, slump scar in the ~700 m water depth. Also shown are rafted slope sections kilometers further out into the basin. The slope angle at the location of the scar is less than one degree.

Project description

During Leg 1 of the CARAMBAR cruise, a unique data set was collected that can document, with unprecedented resolution (6m), the geometry of large slope failures on a modern carbonate slope. Multibeam data covering large portions of both Little and Great Bahama Bank display slope failures of various sizes and shapes (Figure 2).

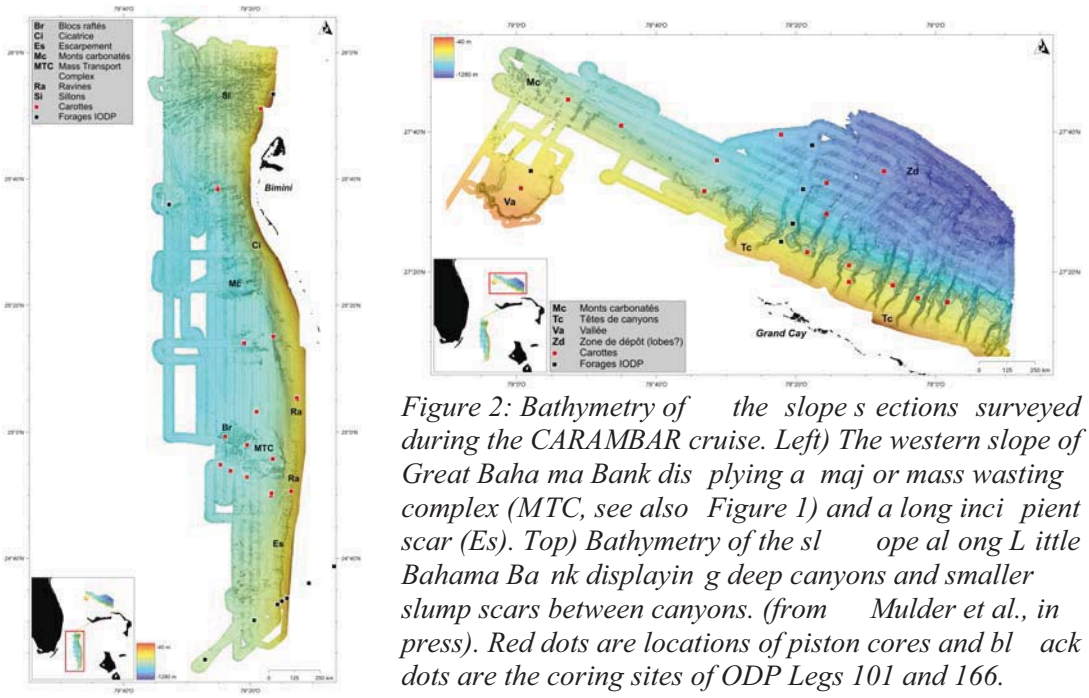

Figure 2: Bathymetry of the slope s ections surveyed during the CARAMBAR cruise. Left) The western slope of Great Baha ma Bank dis plying a maj or mass wasting complex (MTC, see also Figure 1) and a long inci pient scar (Es). Top) Bathymetry of the sl ope al ong L ittle Bahama Ba nk displayin g deep canyons and smaller slump scars between canyons. (from Mulder et al., in press). Red dots are locations of piston cores and bl ack dots are the coring sites of ODP Legs 101 and 166.

The multibeam data will be used to establish the morphometrics of the slope failures. Seismic data across the mass wasting sites will be used to determine the depth of the detachment surface of the slumps and the seismic facies of such mass wasting deposits. A piston core positioned on top of one rafted slab will provide the minimum age of the failure. A large slump mass had been penetrated with a core at ODP Leg 166, Site 1008, providing the opportunity to determine the petrophysical variations across the detachment surface of the slump. This information, together with a petrographic analysis of the diagenetic changes, is expected to provide some clues about the physical conditions that enable slope failure at such low angles.

Key Deliverables

1. Comprehensive description of the dimensions of mass wasting events at the lower slope.
2. Description of the seismic facies of the modern and buried mass wasting deposits.
3. Assessment of petrophysical/diagenetic changes across the detachment surface.

References

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