GEOMORPHOMETRY ALONG WESTERN GREAT BAHAMA BANK - PLUNGE POOLS AND CYCLIC STEPS

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PROJECT OBJECTIVES

- Analyze morphobathymetric dimensions and distribution of plunge pools as well as steepness and orientation of associated cyclic steps on the lower slope.
- Assess influence of plunge pool and sediment ridge geometry on sediment distribution along the slope.
- Perform integrated morphometric analysis (multibeam bathymetry, backscatter data, sediment samples) as proxies for regional currents and resultant sediment distribution.

PROJECT RATIONALE

Facies heterogeneity along the slopes of carbonate platforms is a result of the interplay between platform-derived gravity-driven sediment transport and the sediment distribution parallel and down-slope by benthic and cascading density currents, respectively (Betzler et al., 2014; Wunsch et al., 2016). The interaction of bottom currents and the seafloor sediments result in characteristic bedforms. The morphology and dimensions of these bedforms depend on current velocity and sediment grain size. Plunge pools, associated sediment ridges, and cyclic steps are sediment features that require high-gradient slopes and a down-slope current system to develop. They might also play an important role in the stratigraphic architecture and facies distribution. High-resolution multibeam bathymetry data, backscatter, and sediment samples along the slope of Great Bahama Bank (GBB) provide an ideal dataset to study topography-current interactions and the sediment distribution and assess the dimensions of the various sedimentary features.

PROJECT DESCRIPTION

High-resolution multibeam bathymetry together with sediment samples, collected on several research cruises, provide an opportunity to analyze the heterogeneity of slope facies along GBB. The resolution of the datasets allows the seafloor to be assessed for topographic features and bedforms formed by currents. On the upper slope over 200 plunge pools were identified in the bathymetric data along with hundreds of furrows, funnels, channels, and ridges (Fig. 1). Further downslope sediment wave fields are interpreted as cyclic steps. We plan to assess shape, extent, frequency, and distribution of all these features and their possible role as a sediment sink for material along high-gradient slopes. The aim is to systematically classify and quantify morphologic features indicative of current activity and put them in context with slope inclination and orientation.

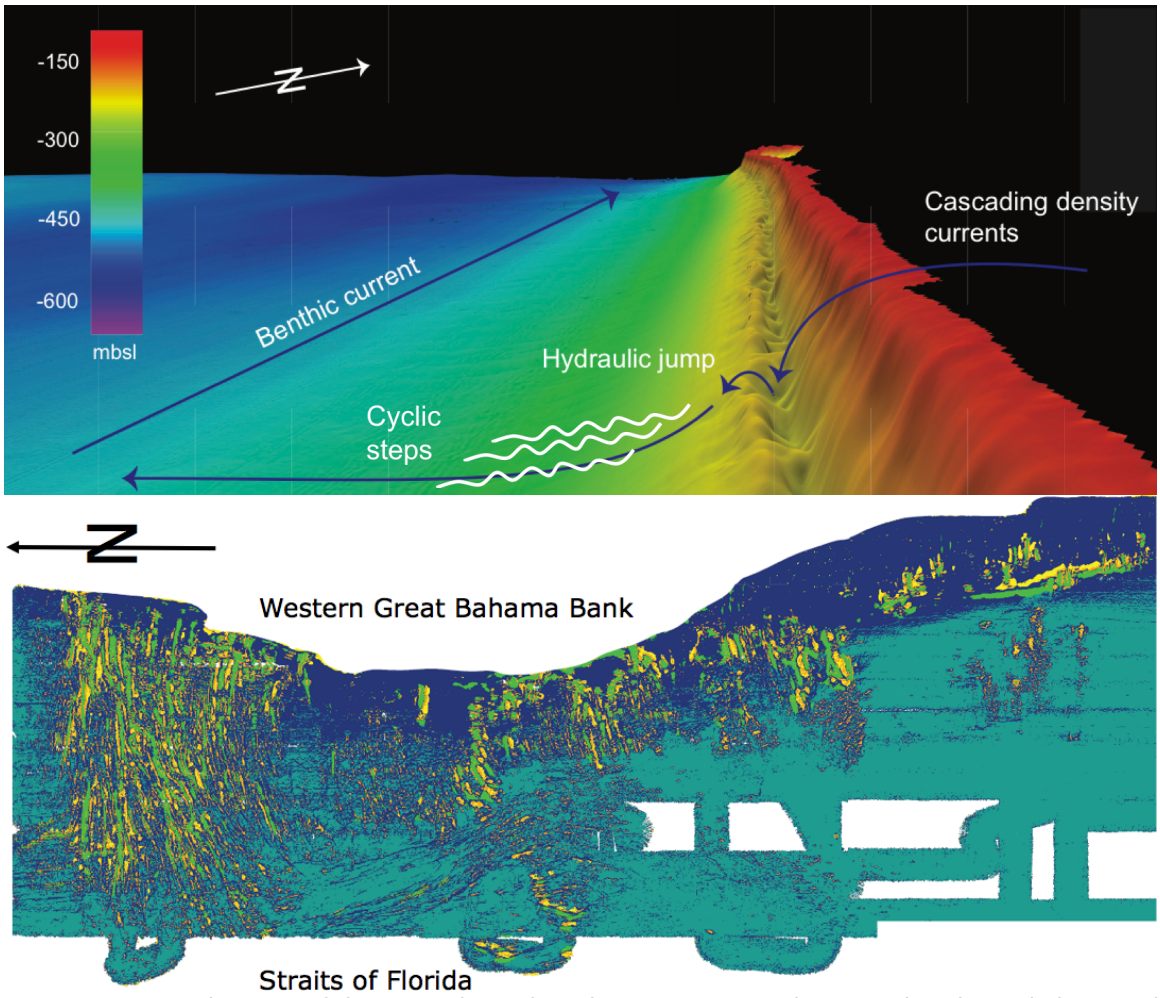

Figure 1. Top: Bathymetry of the steep slope of southwestern Great Bahama Bank with regularly spaced plunge pools and sediment ridges at the base of the escarpment and downslope cyclic steps. Bottom: Example of the use of marine geomorphometry to map and classify topographic features like furrows, ridges, crests, and depressions along the slope and adjacent basin of western Great Bahama Bank.

SIGNIFICANCE

Capturing the dimensions and arrangements of plunge pools and cyclic steps along with other topographic features such as ridges, furrows, and crests will help identify conditions that influence sediment distribution. The aim of this study is to establish a model for slope sediment deposition and distribution along steep-sided carbonate platforms that provides the dimensions of the sedimentary bodies and quantifies the role of cascading density currents and benthic currents.

REFERENCES

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