TESTING CURRENT CONTROL ON SLOPE CURVATURE

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PROJECT OBJECTIVES

- Test the hypothesis that contour currents influence carbonate slope curvature.
- Propose evolutionary trends of carbonate slope morphology with increasing and decreasing current strength.
- Investigate the role of bottom currents on the distribution of carbonate slope facies.

PROJECT RATIONALE

Carbonate slopes display a variety of curvatures (Adams and Schlager, 2000). Analyses of the morphology of the East Florida Shelf, the Northern Marion Platform, the Kardiva Platform, the Maiella Platform, and the Wolcampian Platform of the Delaware Basin give evidence that contour currents strongly influence carbonate slope curvature. In particular, contrary to the model proposed by Schlager and Ginsburg (1981), we found that currents influenced both the accretionary and escarpment margins and that neither age nor height of the slope is directly related to the slope morphology. Likewise, incorporating currents into slope models will require refining and altering existing carbonate slope models compiled by Playton et al., 2011.

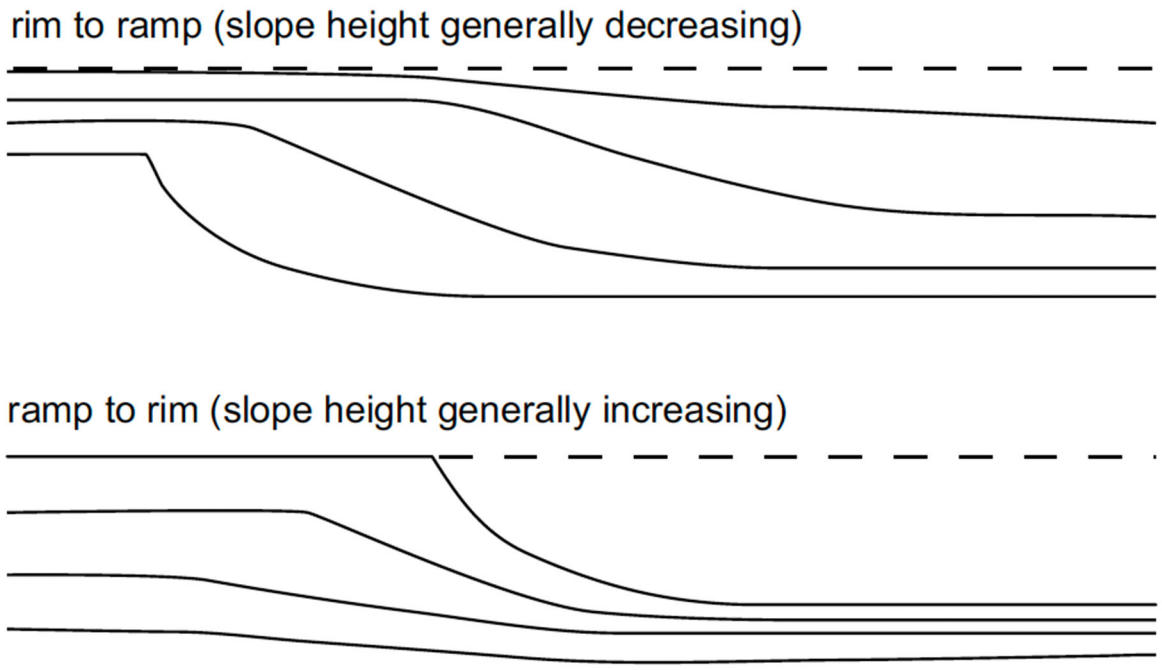

Figure 1: Slope profile evolution explained with slope height (Schlager, 2005). This project tests whether increased sedimentation to the slope by currents or decreased sedimentation can produce these two differing slope profiles.

Consequently, the role of currents in slope evolution needs to be investigated. This project tests the hypothesis that slope curvature is controlled by the slope's sedimentation, which is strongly controlled by contour currents.

WORKING HYPOTHESIS

This project tests the following hypothesis:

a) Erosion and nondeposition by currents form escarpment margins, while current-derived contribution to the slopes produces the accretionary slope.
b) Plastered and periplatform drifts decrease slope angles and might transform steep margins to more ramp-like margins, enabling the platform to change from aggradation to progradation.
c) The morphology changes from the ramp to the rimmed shelf are related to the onset of currents.

APPROACH AND DATA SETS

Investigate carbonate slope profiles that are exposed to currents with variable strength. An ideal place to pursue such an investigation is the Bahamian archipelago, as all the platforms are of the same age and composition but have different exposure to currents. In the Straits of Florida, slopes experience the strong Florida Current, the northern slope of Little Bahama Bank is exposed to the less vigorous Antilles Current, and in Exuma Sound, ocean currents are absent. Seismic, core, and log data that can be investigated exist for all three locations from ODP Leg 101. In addition, seismic and core data from ODP Leg 194 and IODP Expedition 359 will be revisited to investigate the carbonate slope facies and their associated drift deposits. Investigations into ancient carbonate slopes will concentrate on 1) the Cretaceous platforms in Abruzzi, Italy, that were exposed to currents flowing from east to west in the Tethys Ocean, and 2) the Permian platform system of West Texas, where current influence has been documented (Price et al., 2022).

SIGNIFICANCE

Contour currents have proven to be important agents in slope sedimentation but, hitherto, current influence has not been incorporated in slope models. Incorporating these processes into the models will provide a new outlook to characterize the carbonate slopes.

REFERENCES

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