STRATIGRAPHY AND DIAGENESIS OF THE EXUMAS WINDWARD MARGIN AT BELL ISLAND, BAHAMAS

Brandon Navarro, Gregor P. Eberli, Donald F. McNeil, and Kelly L. Jackson[1]
1) Ransom Everglades School

PROJECT OBJECTIVES

- To decipher the stratigraphy of the windward margin along the Exuma Sound from cuttings of two disposal wells.
- Determine the facies and the ages of the sediments deposited during the last interglacial (MIS 5e; 128 – 115 kyrs).
- Investigate diagenetic and mineralogical changes of dolomite-limestone alternations observed in the deep wells.

PROJECT RATIONALE

Windward platform margins are often excellent reservoirs of grainy, high energy facies successions. This complex transition zone from the platform to the slope is built by stacked successions of highstand deposits that are typically very heterogenous alternating between marine and eolian deposits (McNeill et al., 2013). In addition to the vertical complexity, lateral heterogeneity is produced by the antecedent topography that focuses tidal energy, resulting in a complex shoal and channel morphology. The modern Bell Island (Fig. 1) is situated on the windward

Figure 1: Bell Island with the location of the two disposal wells that were drilled down to 183 m (600') thereby providing the deepest record of the Exumas windward margin. Inset: Drill rig used to drill the disposal wells.

margin along Exuma Sound and consists mostly of eolianites from the last interglacial (MIS 5e). Cores drilled to various depths and at various locations allow us to investigate the vertical and lateral heterogeneity of the bank-margin succession and small-scale features. The deepest cores reach 183 m (not dated yet) and might penetrate the entire Pleistocene succession. Preliminary XRD analyses document the transition from aragonite to calcite with dolomite appearing at about -40 m, subsequently alternating with limestone, illustrating a complex diagenetic overprint on the heterogeneous facies succession.

DATA SETS

Bell Island and its surrounding area was mapped by Jackson (2017), illustrating the influence of the Pleistocene aeolian topography on the modern marine facies distribution. In the course of planning the construction of a yacht harbor the owner asked the CSL to drill several short cores (1m) together with a longer 11 m core on the island. In addition, two disposal wells (Fig. 1) to 183 m were drilled. The CSL collected the cuttings that now provide the deepest record of the windward margin in the Exumas chain.

WORKPLAN

The planned work consists of a detailed analysis of the core and cutting material, starting with description, thin section analysis and facies reconstruction. The preliminary XRD measurements will be complemented with additional data points. Other geochemical analyses will include stable isotope measurements. Porosity measurements will be performed on the shorter cores where core plugs can be cut.

The results will subsequently be compared to the results of two cores drilled to -36 m on Normans Cay and Lee Stocking, situated about 80 km further south on the Exuma margin (McNeill and Hearty, 2008, 2009).

SIGNIFICANCE

Grainy platform margins in the transition between platform interior and platform flank is a complex zone where correlation of sequences and facies connectivity is hard to establish. The results of this study will provide an example of the potential scale of heterogeneity both in facies and diagenesis. Such data is important as input in modeling but also in training of AI guided models.

REFERENCES

Jackson, K.L., 2017. Sedimentary record of Holocene and Pleistocene sea-level oscillations in the Exuma Cays and New Providence, Bahamas. Ph.D. dissertation University of Miami, pp.560.

McNeill, D.F., Eberli, G.P. and Harris, M., 2013. Heterogeneity of bank margin ooid sands: Depositional models and reservoir analogs. CSL Guidebook to the Exumas: pp131.

McNeill, D.F. and Hearty, P., 2008. Progradation and Aggradation of a Windward Platform Margin, Exuma Islands, Bahamas. Abstract CSL annual review meeting: 47-52.

McNeill, D.F. and Hearty, P., 2009. Windward Carbonate Margin Parasequence Geometry Linked to Precursor Topography, Exuma Cays, Bahamas. Abstract AAPG annual meeting.