

### **Capturing Carbonate Heterogeneity in Multiple Dimensions and Scales, Glover's Reef, Belize**

Van Ee, Noelle J.<sup>1</sup>; Eberli, Gregor P.<sup>1</sup>; Anselmetti, Flavio S.<sup>2</sup>; Hudson, James H.<sup>3</sup> (1) Marine Geology and Geophysics, University of Miami, RSMAS, Miami, FL. (2) Aquatic Research, EAWAG, Zurich, Switzerland. (3) Reef Tech Inc, Miami, FL.

Glover's Reef is a 260-km<sup>2</sup> reef-rimmed platform off the coast of Belize. In the modern, the windward-leeward asymmetry and over 800 patch reefs in the lagoon introduce considerable heterogeneity in both facies and morphology. Rotary cores, over 100 km of seismic lines, satellite imagery, petrophysical measurements, and sediment samples from patch reefs and the marginal reef allow rigorous quantitative assessment of carbonate heterogeneity in multiple dimensions and scales for the first time.

A single-channel seismic survey of approximately 111 km of grid lines with 0.5-2 km spacing and six rotary cores is used to determine relationships between antecedent topography and the modern facies. The Pleistocene top is imaged by a transparent to chaotic facies with a set of high amplitude reflections forming an irregular top. In the Holocene section, two seismic facies are identified; high amplitude, continuous reflections in the topographic lows between the patch reefs, and a chaotic to transparent facies that occurs within the Holocene highs. Even when accounting for the pull-up effects caused by the Holocene reefs, Pleistocene topography exists beneath the majority of patch reefs within the lagoon. What is apparent in the cores but lacking from the seismic data; however, is that topography is created by at least two stacked Pleistocene reefs.

Classification of Landsat (30-m resolution) and IKONOS (4-m resolution) satellite imagery compared to ground-truthed bathymetry and sediment samples illustrates facies heterogeneity on different scales. Landsat-based classification images windward-leeward asymmetry on a platform scale, while high-resolution IKONOS imagery is needed to capture asymmetric morphology and facies changes on a patch reef scale (10s to 100s of meters).

Finally, core investigations reveal that vertical variability is dependent on location with respect to the platform. While cores taken from the rim record up to 9 m of Holocene framestone and boundstone, Holocene sections of patch reef cores are comprised almost entirely of loose sand and coral rubble. The Pleistocene and Holocene of patch reefs record an ecological succession of biogenic grainstone and branching corals followed by *Montastraea annularis* coral framestones and finally coral rubble. Higher diversity rim cores illustrate both aggrading and prograding successions. Additionally, the diagenetic overprint differs not only with depth but also between patch reef and reef rim locations.