Geospatial analyses and habitat characterization of cold-water coral mounds in the Straits of Florida (*final year*)

Thiago B.S. Correa, Klaas Verwer, Gregor P. Eberli, Mark Grasmueck, and Sam Purkis

[1]*Nova Southeastern University, Dania Beach, FL*

Project rationale

High-resolution satellite imageries have been used to quantify the facies patterns of modern carbonate depositional environments (Harris & Kowalik, 1994). Geobodies (e.g., reefs, shoals) are extracted from these images and then analyzed statistically using a suite of geospatial metrics. Data on the size, shape, and frequency-area relationships of geobodies can be used to refine geological models and to assist with interpretations of the subsurface (Rankey, 2002; Purkis et al., 2005). Remotely sensed optical tools, however, cannot penetrate to deep-water environments and therefore, morphometric-based spatial analyses have been restricted to the shallow-water realm. Thus, deep-water reefal depositional environments represent a new frontier in geospatial analyses.

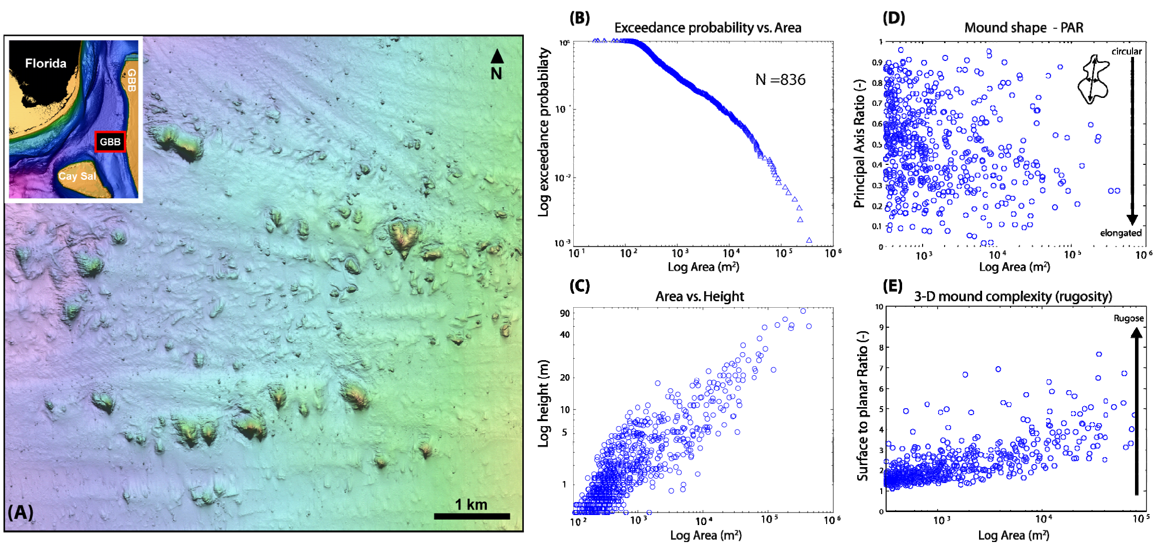

Figure 1. (A) Topographic map of GBB site depicting isolated, individual mounds. Inset, upper left, shows the location of GBB site in the Straits of Florida. (B-E) Graphs report morphometrics for GBB mounds.

Scope of work

Autonomous Underwater Vehicle (AUV) surveys were conducted on cold-water coral mounds in the Straits of Florida from 590 to 860 m water depths. The AUV was equipped with multibeam and side-scan sonar systems that produced a digital elevation model (DEM) and acoustic seabed maps of the seafloor at up to 0.5 m-resolution. Combined with submersible ground-truthing, this unique dataset will allow us to quantify the spatial distribution of coral mounds as well as their facies distribution(s). The AUV also simultaneously collected sub-surface and current regime data over large areas (i.e., tens of km^2). The integrated nature of this combined dataset will undoubtedly provide insights regarding the influence of hydrodynamics and antecedent topography on facies heterogeneity in deep-water environments the Straits of Florida.

Preliminary Results

In 2009 we presented the first results of morphometric analyses for two distinctive sites in the Straits of Florida. For the site characterized by several individual buildups at the slope of Great Bahama Bank (Figure 1), mound perimeter was automatically extracted from the DEM (based on a cutoff of 8°). Subsequently, each mound was statistically analyzed in terms of shape, size-frequency distribution, and complexity (Figure 1). For the site at the base of the Miami Terrace, habitat facies were discriminated from the side-scan sonar and then analyzed in terms of bathymetric variables (e.g., azimuth) using the DEM. Together, analyses for the two sites showed that intrinsic (e.g., antecedent topography) and extrinsic (e.g., current) factors control mound morphology in the Straits of Florida. This coming year, we will complete our analyses for the remaining three sites. These results will broaden our understanding of the forces that control mound distribution, geometry, and development.

Project Objectives

This work aims to: (1) quantitatively discriminate and extract the habitat facies of three cold-water coral field in the Straits of Florida using an integrated dataset; (2) correlate the resulting habitat maps with local topography using spatial statistical analysis; and (3) correlate the observed mound spatial distributions with local current regime in order to gain insights into facies pattern(s) within deep-water carbonate environments.

Key Deliverables

This project will generate high-resolution habitat characterization maps for all surveyed cold-water coral sites in the Straits of Florida. The lateral variability of each habitat facies will be determined. Morphometric parameters will be calculated for each site and statistically correlated with environmental factors, including current regime and antecedent topography.

References

Harris PM, Kowalik WS (1994) Satellite images of carbonate depositional setting: examples of reservoir and exploration scale geologic facies variation, Vol, Tulsa, OK.

Purkis SJ, Riegl BM, Andrefouet S (2005) Remote Sensing of Geomorphology and Facies Patterns on a modern carbonate Ramp (Arabian Gulf, Dubai, U.A.E). Journal of Sedimentary Research 75: 861-876.

Rankey EC (2002) Spatial patterns of sediment accumulation on a Holocene carbonate tidal flat, northwest Andros Island, Bahamas. Journal of Sedimentary Research 72: 591-601.