Plio-Pleistocene Reef Development in the Southern Dominican Republic: Reef Growth and Facies Geometry during High-Frequency Sea-level Cycles

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Project Purpose

The principal factor that appears to determine the growth and facies geometries of fringing reefs is the available accommodation space and changes in relative sea-level. The Pleistocene reefs that developed over the past 1.8 million years provide the best opportunity to study the complex three-dimensional architecture and controlling factors of fringing reef development during high frequency sea level cycles. This project aims to characterize the composition, morphology and distribution of fringing reefs developed along the southern coast of the Dominican Republic. This study will be conducted in conjunction with the petrophysical characterization included in this Prospectus.

Key Deliverables

This project will provide some of the first seismic data of fringing reef development during an extended period of high-frequency sea-level change. By integrating this data with both core and outcrop investigations we will provide an integrated model of reef growth and facies geometries during the Plio-Pleistocene. Results will be presented at the Annual Review and images and data made available to the Industrial Associates.

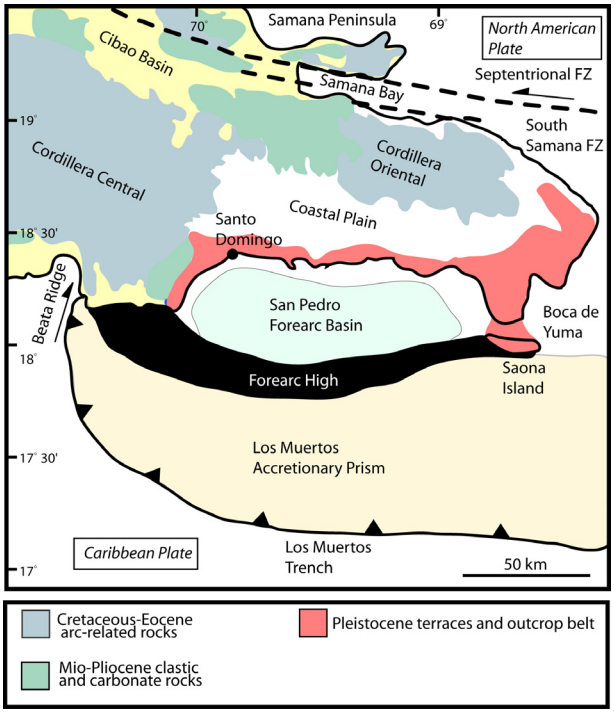

Figure 1. Geologic and tectonic map of southeastern Dominican Republic. The Pleistocene terrace and outcrop belt is shown in red. Modified from Mann et al. (1995).

Scope of Work

The southeastern region of the Dominican Republic is characterized by an approximately 150 mile coastal plain bounded by the Cordillera Central to the west and the Cordillera Oriental to the north (Figure 1). Six to eight fairly continuous terraces are encountered in a belt of coastal reef limestones. An integrated coring, outcrop, and seismic study of the fringing reef deposits on the southern coast of the Dominican Republic has been initiated to determine the morphology and facies geometries of fringing reefs during high-frequency sea-level cycles. Seismic data in the area east of Santo Domingo (Figure 2), acquired by Petroleras las Mercedes in the late 1970's, and some lines are available through the Direccion General de Minera of the Dominican Republic and will be scanned and digitized. This seismic data, in conjunction numerous shallow outcrops and a core transect

perpendicular to the southern coast, will allow us to determine stratigraphic relationships of different reef building events, subsurface facies distributions, and overall reef geometries. Seismic profiles will also be integrated with offshore seismic lines from the San Pedro Basin.

Project Description

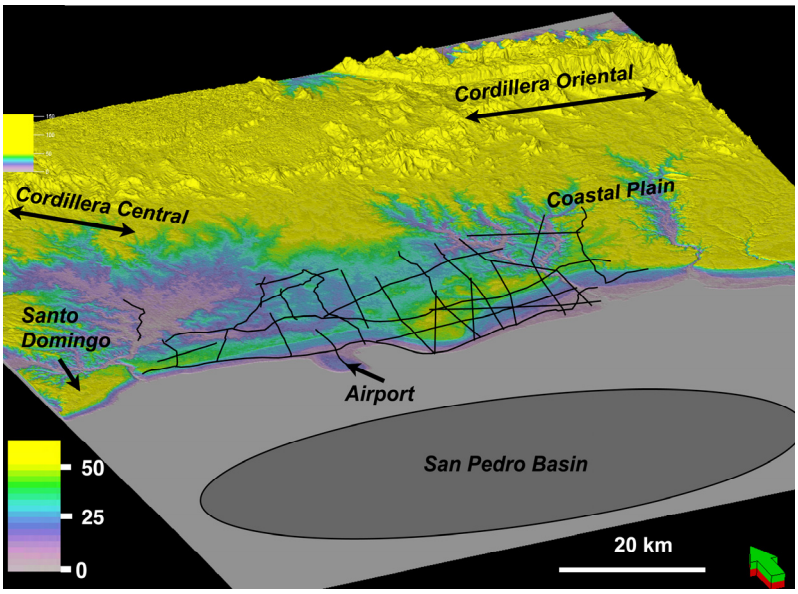

Figure 2. Digital elevation model of the southern coast of Dominican Republic east of the capital city Santo Domingo. The limestone terraces in this area are being extensively quarried which provides numerous outcrop exposures to different reef building events. Black lines indicate the position of seismic lines acquired by Petroleras Las Mercedes.

For the past two years we have been investigating the composition and stratigraphic relationships of the highstand reef deposits on the southern coast of the Dominican Republic. Like Barbados and the coast of Huon Peninsula, New Guinea, the reef terraces are preserved by long-term tectonic uplift, such that the youngest formations are located at the lowest elevations close to the present coast, and older reef terraces at higher elevations and further inland. Based on our early outcrop studies we have developed a preliminary model of the ages and stratigraphic relationships of the reef terraces (Figure 3). This model is based on confirmed radiometric ages of the youngest (6 m) terraces that date to ~125 Ka, estimated rates of tectonic uplift (Mann et al., 1995), and changes in the reef faunal composition. Reefs of the younger terraces are dominated by modern reef coral *Acropora palmata*. Reefs of the higher terraces and subsurface quarry exposures are often dominated by the extinct reef coral *Stylophora*. One aspect of this study will be to confirm this proposed age model through strontium isotope, radiometric, and paleomagnetic age dating.

Seismic analyses and coring studies will allow us to further refine the stratigraphic relationships and geometries of each of the highstand reef building events. Furthermore, these studies will allow us to integrate the surface geology into a broader temporal and geographic context. The seismic profiles will allow us to examine changes in fringing reef morphology underlying the surface terraces and determine how fringing reef development was influenced by Pleistocene climatic fluctuations and dramatic changes in the reef building fauna (Huebeck et al., 1991). We will also correlate the onshore seismic data with offshore data collected in the San Pedro Basin (Ladd et al., 1981). This should provide a complete onshore-offshore record of deposition during the Plio-Pleistocene climatic transition (Figure 3).

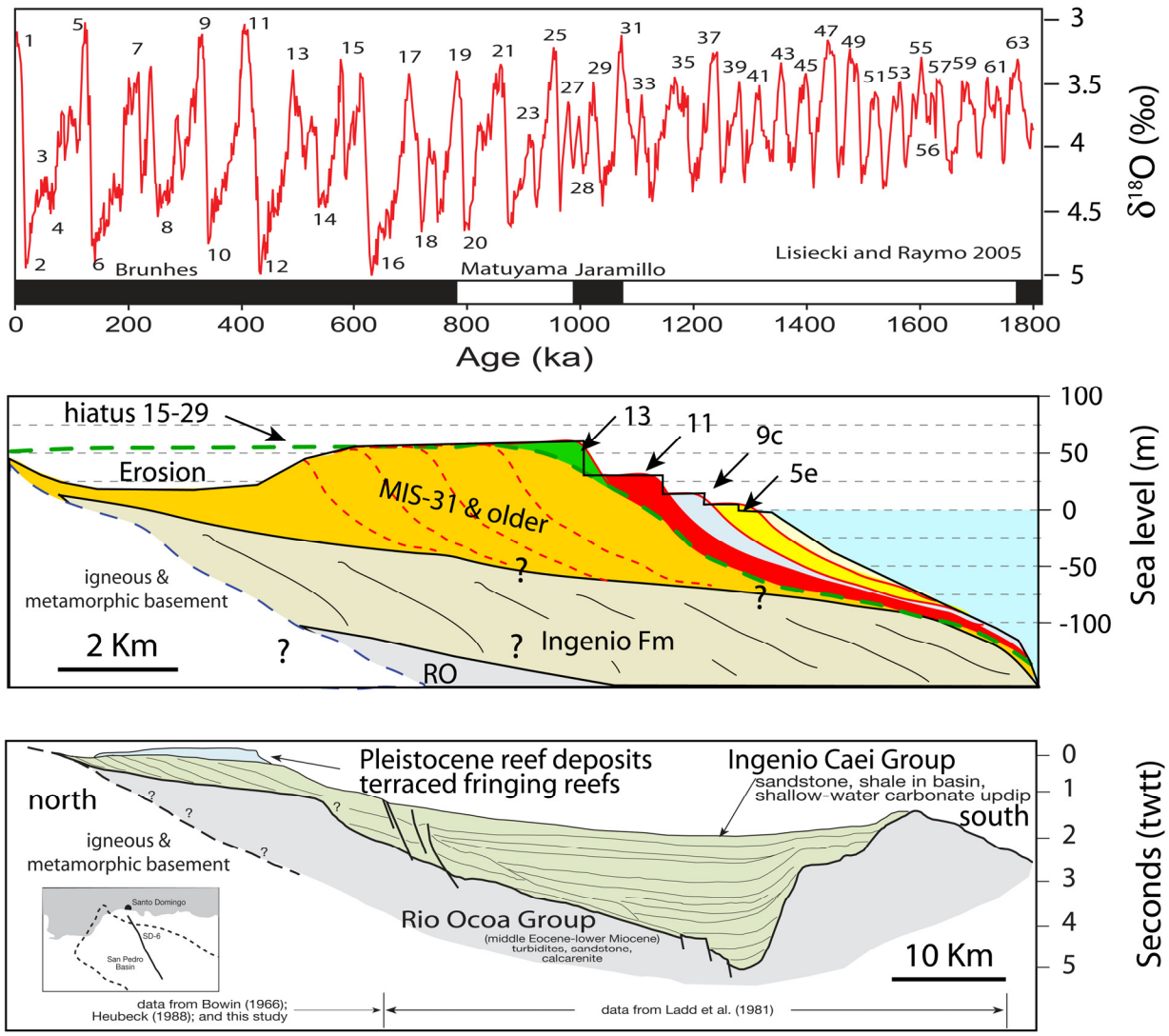

Figure 3. (Top) Pleistocene oxygen isotope record showing the timing and intensity of high-frequency sea level events. (middle) Cross-sectional model of Plio-Pleistocene reef development on the southern coast of the Dominican Republic. Reef building events are labeled according to the marine isotope stages above. (Bottom) Cross-sectional model showing the relationship of the Pleistocene reef terraces and both the onshore and offshore Ingenio Caei Group.

References

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