THE DEEP FORE REEF AND ISLAND SLOPE, DISCOVERY BAY, JAMAICA, WEST INDIES

Clyde H. Moore, Jr.[1]
Lynton S. Land[2]

ABSTRACT

The understanding of the morphology, biological zonation and sedimentology of the Discovery Bay fringing reef has been dramatically extended by submersible operations allowing direct observations of the hitherto inaccessible zones of the Deep Fore Reef (-250′) and Island Slope (-400′ to -1000′).

The Fore Reef Slope (-70′ to -180′), as described by Goreau and Land in 1974, is terminated at 180′ by a near vertical to overhanging wall extending to approximately -400′ and termed the Deep Fore Reef (Goreau and Land, 1974). The Deep Fore Reef is constructional with a scleractinian frame in the upper part (down to approximately -210′) and a sclerosponge frame in the lower sector down to approximately -340′, with the remaining 60 feet probably accreting by lithification of coarse detrital reef debris. The Deep Fore Reef is broken by a series of barren reentrants and biologically lush promontories with major framework construction confined to the promontories and sediment dispersal to the barren reentrants. Halimeda was observed to form an important constituent of the promontory cover down to -300 feet.

The base of the Deep Fore Reef is marked by a steeply dipping slope (45°), termed the Island Slope. The upper Island Slope, where it intersects the Deep Fore Reef, is marked by a series of steep, very coarse sediment cones originating within the rather regularly spaced reentrants of the Deep Fore Reef. These cones merge onto the general slope, forming a hummocky topography dipping steeply toward the Cayman Trench at an average slope of 35° (to -1010′). The Island Slope is cut by a gentle but distinct channel-like feature oriented normal to the reef crest, and termed the Discovery Bay Canyon. The axis of the Canyon is characterized by the occurrence of numerous very large (up to 90′ high) limestone blocks of unknown origin and age, resembling in form haystacks, and extending in a veritable "haystack field" between the depths of -600′ to -1010′

A series of sediment samples were recovered from the Island Slope along a traverse generally parallel to the axis of the Discovery Bay Canyon covering the depth range from -400′ to -1010′. These samples were compared with a larger suite of samples collected from the shallower portions of the Discovery Bay Reef by William Meaney in 1971-72 (from -10′ to -180′) in order to assess shallow reef sediment contribution to the Island Slope. As expected, the sediment grain size and degree of sorting decreased with depth, while percentages of silt and clay increased. However, the percentage of gravel-sized material increased from the Fore Reef Slope to the Island Slope because of extensive rock falls of reef frame from the Deep Fore Reef as a consequence of the boring activity of the clionid sponge. A comparison of sediment composition between the Island Slope and Fore Reef Slope may indicate that significant sediment contribution from the Fore Reef Slope above is episodic with significant pelagic dilution presently occurring very close to the base of the Deep Fore Reef. It should be noted that unlithified sediment is presently concentrated in the axis of the Discovery Bay Canyon, while the adjacent slopes are composed of lithified, Holocene lime grainstones - packstones, with at most a thin veneer of uncemented sediment streaming across the steep slopes. A significant percentage of the silt-sized sediment owe their origin to the boring activity of the clionid sponge as predicted by Goreau and Hartman in 1963.

Rock samples were recovered by submersible from the Deep Fore Reef after blasting and from the Island Slope by breaking exposed ledges with the submersible itself. Scleractinian and sclerosponge framework from the Deep Fore Reef exhibits extensive biodegradation by clionid sponges, cavity infill by fine pelagic suspended material, clionid debris and relatively coarse reef derived material from above. Extensive lithification of internal sediment and precipitative internal pore fill by fine to coarse crystalline magnesium calcite is common and extensive. The resultant rock can truly be termed a biolithite. Successive generations of boring, infill and lithification can completely destroy the original rock, creating a truly complex secondary fabric.

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[1]Louisiana State University, Baton Rouge, La. 70803
[2]The University of Texas at Austin, Austin, Texas 78712