

Oligocene Reef Tract Development, Southwestern Puerto Rico*

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Abstract

Oligocene Reef Development

As noted by various authors, the Oligocene marked the zenith of worldwide Tertiary reef-building, and fossil reefs have been reported extensively from the Caribbean-Western Atlantic, Mediterranean, Middle East and Near Eastern regions (e.g., Frost, 1977A). Their occurrence is in part due to the “middle” and late Oligocene eustatic rise which flooded shelf margins (Vail and Hardenbol, 1979). It is due in most part, however, to the diversity, abundance, and growth luxuriance of the cosmopolitan reef-building coral fauna. In the Caribbean-Western Atlantic region, Oligocene reefs flourished from the northern rim of the marine tropics, southern Georgia to southeast Texas, southward well into the interior of Venezuela and Colombia. Although Eocene tropical shelf facies are thicker and cover larger belts of outcrop in the region than do corresponding Oligocene facies, there is a striking disparity in the abundance and diversity of reef deposits (Frost, 1972). This is due primarily to the evolutionary radiation in the latest Eocene-earliest Oligocene of a pan-tropical reef coral assemblage which can be traced from southern India westward through the Tethys and the Americas around to the Philippines (Frost, 1977A). Early to early middle Miocene Caribbean-Western Atlantic reef coral assemblages are transitional between the cosmopolitan Oligocene and endemic mid-Miocene-Holocene faunas (Frost, 1977B). In the Caribbean-Western Atlantic biogeographic region, only the Pliocene-Pleistocene rivals the Oligocene in reef development.

Oligocene of Puerto Rico

In Puerto Rico, Oligocene marine deposits are extensively exposed in the southwestern and northern-northwestern parts of the island (Fig. 1). In the southwest, these include: (a) a late Oligocene narrow, reef-rimmed shelf which is exposed for more than 27 km (17 mi) from near Peñuelas southeast to Guánica, and (b) an embayment of deeper shelf to island-slope sediments extending north and northeast of Ponce (Fig. 2). All of these different facies have been mapped as the Juana Diaz Formation (Kruschensky and Monroe, 1975, 1978, 1979; Monroe, 1980).

Figure 1. Surface and estimated subsurface distribution of Oligocene strata, Puerto Rico.

On the northern slope of the island, Oligocene rocks are preserved in a broad crescentic embayment which extends from south of San Juan nearly to Moca. These comprise the non-marine and marine San Sebastian Formation which grades upward into a carbonate platform sequence, the Lares Formation (Fig. 1). At either end of the embayment the Lares platform carbonates grade into the Mucarabones terrigenous clastic facies (Monroe, 1989, Fig. 8). A reference stratigraphic section of the Lares Formation at its type area is included herein (Fig. 39) to compare and contrast with the southwestern Puerto Rico reef sequence.

Figure 2. Facies and locality map, Oligocene rocks of southwestern Puerto Rico (after Monroe, 1980, and Moussa and Seiglie, 1970).

Objectives

As a result of the study of intensively sampled outcrop stratigraphic sections, this report presents our interpretation of the development, depositional history, paleoecology, and diagenetic sequence of an extensive and well exposed carbonate shelf and reef tract in southwestern Puerto Rico.

We conclude that the initiation, development, areal distribution and eventual demise of the carbonate shelf reefs, fringing reefs and deeper water communities resulted from the complex interaction between:

- (1) tectonic subsidence and upward;
- (2) eustatic change;
- (3) water mass movement and temperatures; and
- (4) the relative constructional and sedimentational potential of the various Oligocene carbonate shelf and reef communities.

The rock and fossils records of these interactions have been slightly modified by early and late-stage diagenesis as well as by uplift and subaerial weathering.

Our objectives, based on data derived from study of the outcrops, are to show how the processes listed above combined in the development of the Peñuelas-Guánica carbonate

shelf, fringing reefal complex and shallow island slope, and its subsequent stratigraphic record. We hope that the conclusions about paleoecological, sedimentological and diagenetic processes presented herein will contribute to the interpretation of similar fossil reefs elsewhere in the surface and subsurface.

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