

Thickest recorded Holocene reef section, Isla Pérez core hole, Alacran Reef, Mexico

Ian G. Macintyre

Department of Paleobiology

Smithsonian Institution

Washington, D.C. 20560

Randolph B. Burke

Marine Sciences Institute

University of South Florida

St. Petersburg, Florida 33701

Robert Stuckenrath

Radiation Biology Laboratory

Smithsonian Institution

Washington, D.C. 20560

ABSTRACT

The Isla Pérez core hole (Alacran Reef, Mexico) records the thickest Holocene section (33.5 m) known from either Atlantic or Indo-Pacific reefs. The high rate of deposition of reef material—a maximum of 12m/1,000 yr—is attributed to accumulation of the open framework constructed by the rapidly growing coral *Acropora cervicornis*. Mineralogic and radiocarbon analyses indicate that in areas protected from frequent high-energy agitation, this fragile branching coral, which thrives in moderate to shallow water depths, is capable of constructing extensive Holocene biohermal structures having more than 15 m relief.

INTRODUCTION

Interest in the history of Caribbean Holocene reefs and their accumulation rates (for example, Purdy, 1974a; Adey and Burke, 1976; Macintyre and Glynn, 1976) prompted us to examine material in the Isla Pérez core previously collected from Campeche Bank (Bonet, 1967) and to obtain radiocarbon dates from some core samples. Bonet's core provides the only Holocene reef section from an area where the development of Holocene reefs has been the subject of considerable speculation (see Hoskin, 1963; Logan, 1969). Our radiocarbon dates confirm that Bonet's Isla Pérez core penetrates the thickest Holocene reef section reported to date (33.5 m) from either the Atlantic or Indo-Pacific.

Bonet's core hole is 55 m southeast of the old lighthouse and 250 m behind a hanging reef that borders Isla Pérez from northeast to southwest (Fig. 1). In order to retain unconsolidated sediments, he relied mainly on manual rotation drilling without water circulation, and the resulting short core intervals allowed excellent control of depth of recovery. Bonet provided us with eight samples from this core hole; five were from the Holocene section,

of which three contained material suitable for radiocarbon dating (clean, unaltered cores of *Montastrea annularis*).

REGIONAL SETTING

Campeche Bank is the submerged extension of a low-lying limestone plateau that forms the Yucatan Peninsula. It is composed of middle Miocene to Pliocene Carillo Puerto limestone, with a thin cover of Pleistocene and Holocene material (Bonet, 1967). Alacran is the largest and easternmost reef complex on Campeche Bank, rising above the bank from depths of 50 m to form a shallow-water platform (250 km²) that has been termed a shelf atoll (Kornicker and Boyd, 1962). Alacran's suboval outline—approximately 22 km long and 11 km wide—encloses a shallow lagoon, which has a maximum depth of 15 m and contains numerous small patch reefs.

Alacran winds are either from the northeast or southeast with the easterly component dominating at 8 to 12 knots (15 to 20 km/h). Surface currents set west, averaging 0.5 knots (0.9 km/h; U.S. Hydrographic Office Pub. 106, 1969). Evaluation of oceanographic data indicates that waves from the south or east

prevail in duration, although waves associated with "northers" (which traverse the deeper water over the greater fetch to the north and northeast) dominate in terms of energy (Logan, 1969, p. 14).

Isla Pérez (870 m long, 150 to 180 m wide) is the largest of five sand cay islands of Alacran, all located on the northwest-trending bank-barrier reef leeward of the main reef complex (Fig. 1). The average elevation of the island is 1.2 m above mean sea level, and it consists of uncemented sand and gravel (Folk and Robles, 1964).

PRESENT DAY REEFS OF ISLA PEREZ

Isla Pérez is oriented north-northeast on the south leeward margin of the Alacran Reef complex. The open Alacran lagoon (as much as 15 m deep) lies beyond a deep embayment (as much as 31 m deep) to the north and east of Isla Pérez, with shallow sand flats to the west and open gulf waters to the south (Folk and Robles, 1964). Isla Pérez is therefore exposed to a variety of predominantly moderate-energy wave and current conditions, which have influenced the development of its coral-reef communities (Fig. 1).