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Strange bedfellows—a deep-water hermatypic coral reef superimposed on a drowned barrier island; southern Pulley Ridge, SW Florida platform margin

B.D. Jarrett^{a,*}, A.C. Hine^a, R.B. Halley^b, D.F. Naar^a, S.D. Locker^a, A.C. Neumann^c,
D. Twichell^d, C. Hu^a, B.T. Donahue^a, W.C. Jaap^e, D. Palandro^a, K. Ciembronowicz^b

^aCollege of Marine Science, University of South Florida, 140 Seventh Avenue South, St. Petersburg, FL 33701, USA

^bU.S. Geological Survey, Florida Integrated Science Center, Center for Coastal and Watershed Studies, St. Petersburg, FL 33701, USA

^cDepartment of Marine Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA

^dU.S. Geological Survey, Woods Hole Field Center, Woods Hole, MA 02543, USA

^eFlorida Marine Research Institute, St. Petersburg, FL 33701, USA

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Abstract

The southeastern component of a subtle ridge feature extending over 200 km along the western ramped margin of the south Florida platform, known as Pulley Ridge, is composed largely of a non-reefal, coastal marine deposit. Modern biostromal reef growth caps southern Pulley Ridge (SPR), making it the deepest hermatypic reef known in American waters. Subsurface ridge strata are layered, lithified, and display a barrier island geomorphology. The deep-water reef community is dominated by platy scleractinian corals, leafy green algae, and coralline algae. Up to 60% live coral cover is observed in 60–75 m of water, although only 1–2% of surface light is available to the reef community. Vertical reef accumulation is thin and did not accompany initial ridge submergence during the most recent sea-level rise. The delayed onset of reef growth likely resulted from several factors influencing Gulf waters during early stages of the last deglaciation (~14 kyr B.P.) including; cold, low-salinity waters derived from discrete meltwater pulses, high-frequency sea-level fluctuations, and the absence of modern oceanic circulation patterns. Currently, reef growth is supported by the Loop Current, the prevailing western boundary current that impinges upon the southwest Florida platform, providing warm, clear, low-nutrient waters to SPR. The rare discovery of a preserved non-reefal lowstand shoreline capped by rich hermatypic deep-reef growth on a tectonically stable continental shelf is significant for both accurate identification of late Quaternary

* Corresponding author. Tel.: +1 727 553 1183; fax: +1 727 553 1189.

E-mail addresses: bjarrett@marine.usf.edu (B.D. Jarrett), hine@marine.usf.edu (A.C. Hine), rhalley@usgs.gov (R.B. Halley), naar@marine.usf.edu (D.F. Naar), stan@marine.usf.edu (S.D. Locker), aneumann@email.unc.edu (A.C. Neumann), dtwichell@usgs.gov (D. Twichell), hu@carbon.marine.usf.edu (C. Hu), briand@marine.usf.edu (B.T. Donahue), Walt.Jaap@fwc.state.fl.us (W.C. Jaap), palandro@marine.usf.edu (D. Palandro), kciembro@usgs.gov (K. Ciembronowicz).

sea-level position and in better constraining controls on the depth limits of hermatypic reefs and their capacity for adaptation to extremely low light levels.

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1. Introduction

An anomalously deep and healthy hermatypic coral reef extends ~32 km N–S along the outer margin of the southwest Florida platform in 60–75 m of water (Fig. 1A). Displaying maximum local relief up to 10 m, this reef-capped ridge (SPR) forms the southeastern component of a more extensive, ~200-km-long rocky ridge system called Pulley Ridge (Fig. 1B). Pulley Ridge is located seaward of SPR and crests between 80 and 90 m below sea-level (Fig. 1B). Unlike SPR, the southern portion of this

deeper-water ridge system supports a benthic cover consisting primarily of coralline algae (Fig. 2D,E).

Holmes (1985) identified four post-Miocene reef complexes on the southwest Florida platform, including a 10-km-wide zone of reef-like structures and patchy hardgrounds within the geographic confines described herein as SPR (Fig. 1A). Additionally, live corals associated with coralline algal pavements have been described from SPR in a series of U.S. government reports (e.g., Environmental Science and Engineering, et al., 1987); however, no follow-up research was conducted.

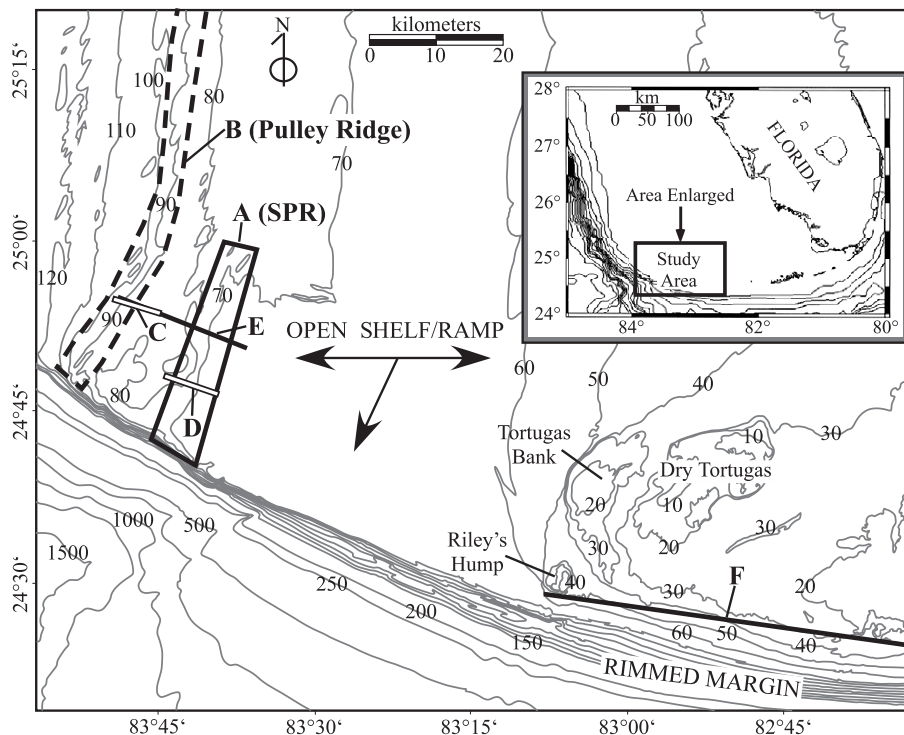


Fig. 1. Location map of southwest Florida margin (contours in meters). A: Boxed area marks location of SPR and 300-kHz multibeam bathymetry coverage. B: Dashed area outlines the southern portion of Pulley Ridge, a feature that extends over 200 km N–S. C and D: Locations of seismic reflection profiles displayed in Figs. 2 and 3, respectively. E and F: Locations of satellite data time-series transects used for comparison of surface waters influencing deep (SPR) (E) and shallow (south of Dry Tortugas) (F) reef environments (results shown in Fig. 5).

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