SCIENTIFIC DIVING AND GEOLOGICAL INVESTIGATIONS OF TORTUGAS BANK, SOUTHWEST FLORIDA MARGIN

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Underwater drilling using a rotary hydraulic drill and NITROX diving techniques was performed during June 1999 on Tortugas Bank, a carbonate bank situated on the southwest Florida shelf margin. Participants included scientists from the University of South Florida Department of Marine Science, the US Geological Survey, the National Marine Fisheries Service, and the National Undersea Research Center. Rock cores that were recovered complement geophysical data acquired within the area and provide ground truth data for interpretations of the overall geologic framework. We anticipate gaining significant insight into the paleoceanographic and paleoclimatic history of the Gulf of Mexico region during the early Holocene using data from this investigation.

Tortugas Bank is a carbonate bank approximately 20 km in length by 10 km wide at depths of 15 to 45 meters below sea level. Three holes were drilled at two separate sites on Tortugas Bank using a diver-deployed rotary hydraulic drill provided by the USGS. Cores were acquired to subsurface depths of 1.52 m, 7.62 m, and 10.67 m. These subsurface depths correspond to absolute depths of 25.3, 31.4, and 29.9 meters below sea level, respectively. Cores from these sites yielded coral reef framework sediments (various genera and species of coral), coralline algae, and carbonate rubble and cements. A paleosol horizon was penetrated at 29 to 31 meters below msl and corresponds to the position of a prominent reflector in seismic data. A radiocarbon date of peat associated with the paleosol provides an age of 10,670 BP. 230Th and radiocarbon dates of the corals indicate initial coral recruitment occurred on the Pleistocene paleosol at ~9,630 BP, making these the oldest Holocene corals found in Florida. Minimum coral ages are 430 BP (at the ~24 m site) and ~4,160 BP (at the ~19 m site). The maximum average growth rate for this relict reef is 1.8 mm/y. It is not clear why Tortugas Bank failed to keep pace with the Holocene sea-level rise, but hypotheses include (1) influence of Mississippi River plume water; (2) greater frequency and severity of cold front passage during the early- to mid-Holocene, or (3) rapid sea-level rise. Further radiocarbon dates and oxygen isotope analyses are pending.

Diving was technically and physically challenging as we were performing strenuous activities associated with drilling at depths up to 80 fsw. To maximize bottom time, we used NITROX and double tanks. A rotating schedule of five dive teams, coordinating with two surface vessels, was needed to accomplish the mission. Funding and NITROX diving support were provided by the National Undersea Research Center-Wilmington.