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KEY WORDS: Eastern Gulf; Central Gulf; Western Gulf; Alderdice Bank; Coffee Lump Bank; Diaphus Bank; Elvers Bank; Fishnet Bank; Geyer Bank; Jakkula Bank; Rezak-Sidner Bank; Applebaum Bank; 32 Fathom Bank; East Flower Garden Banks; West Flower Garden Banks; geology; biology; hydrography; Florida Middle Ground; maps; bathymetry; submersible; trace metals; hydrocarbons; sediment; water column; nutrients; fish; monitoring; nepheloid layer; tissue

BACKGROUND: The geology and biology of 28 banks in the northwestern Gulf of Mexico were characterized by studies that began in 1974. This study concerned eight additional banks (i.e., Alderdice, Coffee Lump, Diaphus, Elvers, Fishnet, Geyer, Jakkula, and Rezak-Sidner) and provided additional information on four banks previously studied [i.e., Applebaum (previously called Little Sister), 32 Fathom, and East and West Flower Garden Banks]. Florida Middle Ground, a unique biotope off Florida's western coast, was also included in this investigation.

OBJECTIVES: (1) To gather biological, chemical, geological, geophysical, and physical oceanographic data to characterize selected topographic features and the Florida

Middle Ground; (2) to perform descriptive reconnaissance studies to assess the biology and geology of the features; (3) to conduct chemical analyses for trace metals, high molecular weight hydrocarbons (HMWHC), Delta ^{13}C and total organic carbon in Coffee Lump and East and West Flower Garden Banks sediments; (4) to analyze *Spondylus* and certain fish species collected at the Flower Garden Banks for trace metals and HMWHC, and to analyze water samples for nutrients and dissolved oxygen; (5) to study the size distribution and mineralogy of sediments at select banks; (6) to continue study of reworked fossil coccolith distributions; (7) to continue the East Flower Garden Bank coral, coralline algae, zooplankton, algae, and brine seep monitoring study; and (8) to perform mapping, hydrocarbon analysis, and monitoring studies at West Flower Garden Bank.

DESCRIPTION: Approximately 2,110 statute miles of survey data from eight northern Gulf of Mexico banks and the Florida Middle Ground were obtained during the first mapping cruise. The second mapping cruise was limited to West Flower Garden Bank. Two submersible cruises were conducted for biological and geological reconnaissance and sampling to characterize biotic communities and surficial geology; the submersible was equipped with a manipulator arm, a wire mesh collection basket, and a scoop sediment sampler. For dives at the brine pool, a temperature probe and vacuum collection hose were added to the arm for collection of in situ data and water samples. Data collection associated with sedimentary processes in the bottom boundary layer at East Flower Garden Bank was accomplished through attachment of a transmissometer, salinity/temperature/depth (STD) system, and profiling current meter to the submersible. The coral and coralline algal population phase of the East Flower Garden Bank monitoring study included dive teams that photographed random 10-m line transects; photographic mosaics were used in species identification and transect analyses. The study of recruitment and early growth of corals and coralline algae was conducted using a stereo dissecting microscope and counting grid. Coelenterate larvae and other zooplankton were collected with 0.333-mm mesh nets fitted on a buoy array; nets fished at depths measured in 10-m increments from the surface to 40 m for 1 h of sampling. Water column measurements were taken with a transmissometer, Niskin bottles, STD system, and profiling current meter. For long-term current measurements, current meter arrays were set near East and West Flower Garden Banks. All *Spondylus* samples for trace metal and HMWHC analyses were collected by the submersible. Sediments for similar analyses, Delta ^{13}C, fossil coccoliths, and total organic carbon were taken with a Smith-McIntyre grab.

SIGNIFICANT CONCLUSIONS: Significant correlation was found between biotic zonation, substrate nature, and top depth of the nepheloid layer. There was no indication of significant change in benthic community condition at East Flower Garden Bank. Biological zonations at West Flower Garden, Alderdice, Elvers, Geyer, Jakkula, and Rezak-Sidner Banks were similar to those at East Flower Garden Bank and therefore warrant a protective classification. The Florida Middle Ground was of particular concern because of its unique fragile biota.

STUDY RESULTS: Crests of Alderdice, Elvers, Geyer, Jakkula, and Rezak-Sidner Banks were above the normal depth of the nepheloid layer and had reef-building

populations of coralline algae within well developed Algal-Sponge Zones. These banks also displayed normal carbonate sands associated with biogenic reefs. Diaphus Bank might also have an Algal-Sponge Zone, but its crest was near the lower depth limit of this zone at the Flower Garden Banks. Applebaum, Coffee Lump, Fishnet, and 32 Fathom Banks had less diverse benthic assemblages adapted to chronic turbid water conditions. Strong correlation was found between biotic zonation, substrate nature, and top depth of the nepheloid layer. Currents at the Flower Garden Banks were steered by topography. Water from the base of East Flower Garden Bank cannot flow up to the level of the living reef. Silt and clay were nearly absent from the bank above 80 m, an approximate depth of biotic change; a clear-water fauna existed above that depth but was missing below it.

The crestal graben typical of most banks investigated has not developed at East Flower Garden Bank; significant normal faulting has not yet occurred. A crestal graben has developed at West Flower Garden Bank; continued movement along the faults is expected. Applebaum, Coffee Lump, and 32 Fathom Banks were similar in structure and sediments and considered relatively inactive banks underlain by salt diapirs that have not moved appreciably upward since late Pleistocene times. The remaining banks were described as tectonically active with geologically recent faulting common in their immediate vicinity. No significant changes in benthic community structure or condition at East Flower Garden Bank were noted. There were no changes in rate of accretionary growth of dominant corals over the last decade. Rates of encrusting coral growth and coral mortality were highly variable; there was no indication that encrusting growth had been impaired or that mortality had increased. Larval coral settlement, early growth, and development occurred at normal rates. Leafy algal populations appeared normal and were largest in spring. There was no obvious change in health of benthic communities southeast of the main coral reef at East Flower Garden Bank. The condition of corals and coralline algae within the Algal-Sponge Zone appeared similar to that of previous years. There were no signs of mass mortalities for any conspicuous community component. Natural brine seep effects on benthic biota at East Flower Garden Bank were restricted to an area within a few meters of the seep and recognizable brine-seawater mixture. West Flower Garden Bank had biological zonation similar to that of East Flower Garden Bank (i.e., classified as a sensitive environment). Other banks classified as sensitive included Alderdice, Elvers, Geyer, Jakkula, and Rezak-Sidner Banks. The presence of larger areas of clear-water reefal communities in the upper portion of these banks warrants protection. Remaining banks were classified as being of low priority. Overall, diversity and abundance of benthic biota were low compared to those of other shelf-edge banks in the northwestern Gulf. Applebaum, Coffee Lump, and 32 Fanthom Banks were compared to south Texas fishing banks with respect to the hard-bottom assemblage (Antipatharian Zone) of organisms. Low diversity and abundance of benthic biota on Diaphus and Fishnet Banks were attributed to chronic turbidity and sedimentation. Nevertheless, snapper and other game fishes were numerous in the vicinity of these banks. Mapping, geological sampling, and physical and chemical studies established a background for biological studies at the Florida Middle Ground. A unique biotope and a habitat of particular concern because of the extremely fragile biota, it supports both a Caribbean eurythermal species complex and a Caribbean restricted species complex of algae,

invertebrates, and fishes. This study explored the possibility of using selected cryptofaunal hosts as quantitative sampling units, and elucidated which faunal groups would yield the most useful results. It was speculated that during extremely cold winters, a combination of storm surge and cold water (12 to 13°C) remaining in the area for several days could bring about depauperation of the more tropical species that inhabit the Florida Middle Ground.

STUDY PRODUCTS: Rezak, R. and T. J. Bright. 1981. Northern Gulf of Mexico Topographic Features Study. A final report by Texas A&M University Department of Oceanography for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. Vol. I (Introduction, Geology, Biotic Zones and Banks, Water and Sediment Dynamics, Summary and Recommendations) - NTIS No. PB81-248650 (PC/A07); Vol. II (Methods, Sediment Dispersal, Chemical Analyses) - NTIS No. PB81-248668 (PC/A08); Vol. III (Flower Garden Banks) - NTIS No. PB81-248676 (PC/A09); Vol. IV (Coffee Lump Bank, Fishnet Bank, Diaphus Bank, Jakkula Bank, Elvers Bank, Rezak-Sidner Bank, Alderdice Bank, 32 Fathom Bank, Applebaum Bank) - NTIS No. PB81-248684 (PC/A09); Vol. V (Florida Middle Ground) - NTIS No. PB81-248692 (PC/A12); Vol. VI (Executive Summary) - NTIS No. PB81-248643 (PC/A07); Set (6 Vol.) - NTIS No. PB81-248635 (PC/E99). Contract No. AA551-CT8-35. Tech. Rept. No. 81-2-T.

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