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KEY WORDS: Central Gulf; Western Gulf; Bouma Bank; Bright Bank; Claypile Bank; Ewing Bank; Parker Bank; Sackett Bank; Sonnier Bank; 18 Fathom Bank; biology; geology; bathymetry; maps; submersible; sediment; hydrocarbons; trace metals; nutrients; water column; tissue; hydrography; time-lapse; photographs; monitoring; nepheloid layer; macrofauna; meiofauna

BACKGROUND: Previous studies provided bathymetric maps, geological data, and biological information concerning 24 topographic features located on the Texas Outer Continental Shelf (OCS) to facilitate judgments concerning regulations for drilling operations. This study involved detailed bathymetric mapping of eight additional banks (Bouma, Bright, Claypile, Ewing, Parker, Sacket, Sonnier, and 18 Fathom) and biological reconnaissance and sampling via submersible for all of the banks except Claypile. Investigations concerning the nepheloid layer at various banks and the brine lake at East Flower Garden Bank were continued. Biological monitoring within the living coral facies of East Flower Garden Bank was initiated.

OBJECTIVES: (1) To produce detailed hydrographic charts for all previously studied banks except East Flower Garden Bank which was mapped earlier; (2) to complete descriptive biological and geological reconnaissance studies from a submersible for Bouma, Bright, Ewing, Parker, Sackett, Sonnier, and 18 Fathom Banks; (3) to study the

following at East Flower Garden, Sonnier, Bright, and Sackett Banks: size distribution and mineralogy of surrounding sediments; hydrography in the vicinity of the banks; chemical analyses of sediments and selected faunal components for trace metals and high molecular weight hydrocarbons; chemical analysis of the water column for nutrients, dissolved oxygen and low molecular weight hydrocarbons; and temperature, salinity, transmissivity, and current velocity profiles of the water column; (4) to initiate a monitoring study within the living coral portion of East Flower Garden Bank through use of long- and short-term time-lapse camera systems; (5) to further observe the brine lake at East Flower Garden Bank discovered in 1976; (6) to study from the submersible the very near-bottom current magnitude and turbulence through use of dye emission; and (7) to continue the distribution study of reworked fossil coccoliths.

DESCRIPTION: Field work was divided into four phases: mapping, sampling, submersible diving, and monitoring. During the mapping cruise, bathymetric surveys were conducted at Bouma, Bright, Claypile, Ewing, Parker, Sackett, Sonnier, and 18 Fathom Banks. Maps were prepared on a scale of 1 cm = 120 m with 2-m depth contour intervals, except where relief required a 5- or 10-m interval. The sampling effort during this study included four sampling cruises. All sediment samples were subsampled for sediment texture, six were sieved for macroinfauna, and the remaining four were sampled for meiofauna, mineralogy, trace metals, high molecular weight hydrocarbons, total carbonate, total organic carbon, and Delta ^{13}C. Transmissometry, salinity, temperature, and depth data were recorded on magnetic tape. A profiling current meter with deck readout was

used to measure water velocity from the sea surface to the bottom, or at a particular depth. Water column samples were taken at surface and mid-depth. Subsamples were taken from all water samples for dissolved oxygen, nutrients, and low molecular weight hydrocarbons. Macronekton samples were obtained with rods and reels for trace metal and high molecular weight hydrocarbon analyses. Biological and geological descriptions were made at Bouma, Bright, Ewing, Parker, Sackett, Sonnier, 18 Fathom, and East Flower Garden Banks during the submersible cruise. Surface geology, epifauna, and groundfishes were assessed visually and recorded on videotape and 35-mm color film. Epifauna sampling was accomplished primarily through use of the submersible's manipulator arm. Bottom water currents around East Flower Garden Bank were observed by recording dye emission patterns. In situ temperature data and water samples were collected at the brine pool. Monitoring of East Flower Garden Bank involved scientific diving and time-lapse photography. Four long-term time-lapse camera systems were used for continuous monitoring of selected locations over a 60-day period. Short-term time-lapse systems were set during afternoon dives and retrieved the following morning. Twenty specific reef stations were selected for repetitive, seasonal photography to generate data on variations in rates of coral tissue regression, mortality, and growth.

SIGNIFICANT CONCLUSIONS: Coral reefs and clear-water epifauna occupied the crest of 18 Fathom Bank, a Category 1 bank. Bright, Bouma, Ewing, and Parker Banks were also Category 1 banks but without coral reefs. Sonnier and Sackett Banks were characterized as Category 2 and 3 banks, respectively. Data indicated that a nepheloid

layer was part of the bottom boundary layer in the study area. Infauna of the hard bank flanks formed stable communities and were more numerous than in adjacent level bottoms. No undue changes related to coral health were noted at East Flower Garden Bank since the 1976 study. No indication of substantial pollution was observed at any of the topographic highs studied. No evidence of serious effects due to drilling of nearby wells was found at Sonnier Bank.

STUDY RESULTS: Seven topographic features in the northwestern Gulf of Mexico were characterized through biologic and geologic reconnaissance efforts. 18 Fathom Bank was a shelf-edge carbonate bank bearing clear-water epibenthic communities with depauperate coral reefs on the crest of the bank. An Algal-Sponge Zone extended downward with healthy populations of coralline algae forming algal nodules and algal reefs. 18 Fathom Bank was classified as a Category 1 bank with living coral reefs (highest environmental priority). Bouma, Bright, Ewing, and Parker Banks were all carbonate banks with biotic communities and zonation similar to 18 Fathom Bank except that they lacked living coral reefs. They were considered Category 1 banks without coral reefs. Sonnier Bank was a mid-shelf feature comprised of eight separate peaks that consisted of Tertiary sandstones, siltstones, or claystones. The crest of the largest peak was nearly totally covered by hydrozoan corals and sponges. It was classified as a Category 2 bank.

No evidence of serious environmental effects was found due to drilling of nearby wells during the mid 1960s. Sackett Bank had a crest of carbonate reef rock that was probably produced during the late Pleistocene. Only limited amounts of live coralline algae were present on the bank as crusts and nodules. Most of the carbonate substrate was covered by a thin veneer of sediment, and benthic communities were not as well developed on Sackett Bank as on other shelf-edge banks at comparable depths. In terms of environmental priority, it was classified as a Category 3 bank.

Three biological monitoring sites were established on the coral reef at East Flower Garden Bank. Substantial mechanical destruction of coral tissue by coral eating reef animals was documented. Passage of two hurricanes probably accounted for the dislodging of coral heads and disruption of leafy algae. Neither the studies related to coral health nor submersible reconnaissance revealed undue changes in rates of coral growth and death or in the apparent condition of benthic communities since 1976. Data collected from hydrographic cruises clearly indicated that the nepheloid layer was an integral part of the bottom boundary layer. The amount of suspended sediment and its penetration height above bottom was a function of the local sediment type and intensity of the turbulence present. Stratification in the water column precluded transport of sediment above the top of the mixed layer. Mapping the distribution of redeposited Cretaceous coccoliths in surface sediments provided an overview of the dispersal pattern of fine silt and clay sized particles introduced along the shoreline; in general, the proportion of redeposited coccoliths decreased with distance from shore. Meiofauna of the hard bank flanks formed a stable community and were more numerous than in adjacent level bottoms; the community varied with regard to depth, orientation downcurrent of the bank, and sediment grain size. Macroinfauna also formed a stable community that was more abundant downstream of the bank and significantly more

abundant on the flanks than on level bottoms. Both meiofauna and macrofauna responded to sediment bed characteristics. Levels and variability of trace metals and hydrocarbons were generally similar to previous investigations; although significant differences in levels between bank stations were observed, there was no indication of substantial pollution at any of the topographic highs sampled.

STUDY PRODUCTS: Bright, T. J. and R. Rezak. 1978. Northwestern Gulf of Mexico Topographic Features Study. A final report by Texas A&M Research Foundation and 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 - PB294-769/AS (667 pp.); Vol. II - PB81-106205(PC/AOS) (80 pp.). Contract No. AA550-CT7-15.

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