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STUDY TITLE: South Texas Topographic Features Study, FY 1975

REPORT TITLE: A Biological and Geological Reconnaissance of Selected Topographical Features on the Texas Continental Shelf

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KEY WORDS: Western Gulf; Baker Bank; South Baker Bank; North Hospital Rock; Southern Bank; Dream Bank; Adam Bank; East Flower Garden Banks; geology; biology; grain size; macrofauna; meiofauna; photographs; videotapes; coral reef; fish; submersible; faunal zones; nepheloid layer; maps; hydrography

BACKGROUND: The geology and biota associated with south Texas Outer Continental Shelf (OCS) banks in or adjacent to blocks under consideration for oil and gas lease sales were not well documented prior to 1975. The U.S. Department of the Interior contracted for biological and geological studies to facilitate judgment concerning restrictive regulations on drilling near these banks. This study was conducted to assess groundfish populations, reefal and epifaunal communities, meiofaunal and infaunal populations, unique biological and geological features, substratum type and distribution, and the biotic and geologic relationships between these and those banks farther north in the Gulf of Mexico.

OBJECTIVES: (1) To provide precision positioning, detailed bathymetric maps, and side-scan sonar coverage of a number (ultimately 15) of specified sites; (2) to provide enough descriptive information concerning selected banks (i.e., Baker, South Baker, North Hospital, Southern, Dream, and Big Adam) to allow determination of their aesthetic and/or commercial value; and (3) to document current biological and

geological conditions at the banks to serve as a basis of comparison for later environmental monitoring programs that might be warranted.

DESCRIPTION: Field work was comprised of two phases. Phase I (winter of 1974) was devoted to mapping the banks. Phase II (spring of 1975) involved photographic and visual reconnaissance of selected south Texas banks and East Flower Garden Bank, biological and geological sampling, subbottom profiling, and supplemental mapping. Geological analyses consisted of: (1) grain size analyses, (2) carbonate analyses, (3) x-ray radiography, (4) core descriptions, (5) particle type identification, (6) x-ray diffraction (mineralogy), and (7) bedrock analysis. Biological observations and analyses were to: (1) characterize benthic communities in terms of dominant macrobenthic organisms; (2) plot distribution of these communities on bathymetric charts; (3) provide information on distribution and abundance of key species (particularly groundfishes), potential "environmental indicator" organisms, and other commercially important organisms; (4) assess condition or "health" of the communities; (5) photographically document observations; and (6) identify and quantify the meiofauna surrounding the banks. A bathymetric and side-scan sonar survey was accomplished during Phase I over 14 of the 17 selected topographic highs. Bathymetric charts, presented in 2-m contour intervals, were prepared from depth records. Side-scan records were used to locate the tops of prominences. Biological/geological sampling and photographic/visual reconnaissance were accomplished at the selected banks and visual assessment, documented by videotape and color photography, of portions of East Flower Garden Bank was performed during Phase II. Devices used for obtaining geologic and biologic samples included the following: (1) piston corer, gravity corer, and box corer for sediments; (2) pipe dredge and rock dredge for rocks and epifauna; (3) box corer for meiofauna; and (4) hook-and-line for fishes. The submersible DRV DIAPHUS was used in visual observations and also for epifaunal collections; observations were documented by color transparency photographs, videotapes, and audiotapes. Additional videotapes were obtained by means of an underwater TV system lowered from the deck of the ship. Chemical analyses were performed on two species of snapper (*Rhomboplites aurorubens* and *Lutjanus campechanus*) and on groupers of the genus *Mycteroperca*.

SIGNIFICANT CONCLUSIONS: Banks on the Texas OCS were divided into two groups; the northern group showed a distribution associated with subsurface salt domes whereas the southern group was controlled by a Pleistocene shoreline. It was speculated that the banks were never exposed. A thick nepheloid layer allowed only the top 10 m of the banks to be in relatively clear water. Two meiofaunal ratios were proposed as being responsive to environmental modification.

STUDY RESULTS: Banks of the Texas OCS were divided into two main groups with the division line being generally along 27°45'N lat. The northern banks associated with subsurface salt domes had greater relief than the southern banks. The southern banks were not associated with subsurface structures and their distribution was controlled by a Pleistocene shoreline. Except for two banks capped by outcrops of Tertiary bedrock, all banks were covered by a heavy growth of coral and coralline algae that lived at times of lower sea level. West and East Flower Garden Banks had living coral reefs with

drowned reefs at greater depth levels. Sediments that surrounded actively growing reefs were coarse sands and gravels that graded into finer sediments with increasing water depth. Sediments adjacent to drowned reefs consisted of about 30 cm of sandy and silty clays over coarse sediment. Muddy sands were found only near the immediate perimeter of the banks; these sediments were derived from the Rio Grande River with perhaps some input from the Colorado River. Heavy mineral assemblages consisted solely of Rio Grande and weathered Rio Grande material. Little variation of clay mineral distribution was noted for the southern banks; montmorillonite was predominant (59 to 66%) on all banks with illite being the second most prominant (22 to 30%). Total carbonate in the sediments ranged from 2.3 to 78.4%; however, of the 95 samples analyzed, only 8 contained more than 10% carbonate. Absence of low-magnesium calcite in most samples indicated that the banks were never exposed at any time after their growth. The deepwater macrobenthic biota of the South Texas banks (53 to 78 m) was characterized by the presence of antipatharian sea whips (*Cirripathes* sp.), deepwater alcyonarian fans, comatulid crinoids, certain species of deep-dwelling fishes, and sparse populations of encrusting coralline algae. The highly diverse and abundant Flower Garden Banks biota with coral reefs (22 to 49 m), algal nodule and sand-covered platforms (45 to 76 m), and drown reefs (76 to 100+ m) had an assemblage of organisms directly comparable to the south Texas banks. Commercial snappers and groupers frequented all of the banks, but this study indicated a smaller serranid population on southern banks. The most conspicuous fish on the banks, excluding the coral reefs at the Flower Garden Banks, was the small yellowtail reeffish, *Chromis enchrysurus*. Biotic assemblages of the South Texas banks have adapted to turbid water conditions as these banks are subject to nearly total inundation by thick nepheloid layers which overlie the predominantly soft bottom. It is probable that most of the time only the top 10 m of the banks were in relatively clear water. This study demonstrated that natural variation in the populations of permanent meiofauna was large on a spatial, and probably temporal, basis. Sediment granulometry and associated factors were most influential in determining spatial variations. Coarse and medium silt had the highest correlation to the number of individuals. Fine and very fine clay had the second highest correlation, but it was negative; the small amount of interstitial space within such sediments, and the resultant lack of available oxygen and pore water, limit meiofaunal habitat. A nematode/harpacticoid copepod ratio (i.e., high correlation/low correlation with sediment fractions, respectively) was proposed as being responsive to both sediment and chemical change. A second ratio, macroinfaunal/meiofaunal, was considered as definitive for a given type of sediment and also changed in response to environmental modifications. Substantial numbers of meiofauna were found living as deep as 10 to 15 cm in deepwater sediments, often without the sharp reduction of individuals below the 5-cm level shown in data reported by others. It was speculated that other investigators could have lost the upper 5 to 10 cm of their sample because of pressure wave and/or winnowing effects on a collection device. An adequate number of replicates collected with a reliable sampler (e.g., grab-type box corer) must be taken for making estimates of meiofaunal populations.

STUDY PRODUCT: Bright, J. T. and R. Rezak. 1976. A Biological and Geological Reconnaissance of Selected Topographical Features on the Texas Continental Shelf. A final report by Texas A&M Research Foundation and Texas A&M University Department

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