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STUDY TITLE: Northern Gulf of Mexico Continental Slope Study

REPORT TITLE: Northern Gulf of Mexico Continental Slope Study, Annual Report and Executive Summary

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BACKGROUND: Little information is available concerning the biology, geology, and chemistry of continental slope environments in the Gulf of Mexico. With the growing potential of oil and gas exploration on the slope, additional environmental data will be required by resource managers faced with leasing decisions. The U.S. Department of the Interior has sought to further the understanding of slope habitats by funding a four-year investigation of the continental slope environments of the northern Gulf of Mexico.

OBJECTIVES: (1) To determine the abundance, structure, and distribution of animal communities in the deep sea in the Gulf of Mexico; (2) to determine the hydrographic structure of the water column and bottom conditions; (3) to determine and compare sedimentary characteristics; (4) to relate differences in biological communities to hydrographic, sedimentary, and geographic variables; (5) to assess seasonal changes in biological communities in terms of abundance, structure, animal size, and reproductive state; and (6) to measure present levels of hydrocarbon contamination in

sediments and selected animals prior to, and in anticipation of, petroleum resource development beyond the shelf-slope break.

DESCRIPTION: All sampling efforts were confined to the northern Gulf of Mexico, north of 27°N Lat, where physical, chemical, and biological characteristics of the water column and seafloor were obtained. Three transects were established perpendicular to the slope, each comprised of five stations. One transect was located in each of the three Gulf of Mexico Planning Areas (Eastern, Central, and Western). Average sample depths along each transect were 348, 657, 839, 1,341, and 2,530 m which correspond to previously proposed faunal zones: Shelf/Slope Transition (150-450 m); Archibenthal, Horizon A (475-750 m); Archibenthal, Horizon B (775-950 m); Upper Abyssal (975-2,250 m); and Mesoabyssal, Horizon C (2,275-2,700 m). In November 1983, only the Central Transect was sampled. During April 1984, all three transects were sampled.

Field sampling consisted of taking water column measurements, sampling bottom sediments for physical/chemical characteristics and meiofauna and macroinfauna, and collecting and photographing demersal fishes, epifauna, and macroinvertebrates and their habitats. Hydrographic measurements included continuous and discrete samples. Discrete sampling employed a 12-bottle rosette sampler which provided water samples for temperature, salinity, dissolved oxygen, and particulate organic carbon (POC) determinations. For sediment sampling, six replicate box cores (24.5 x 24.5 x 44 cm) were taken at each of the Central Transect stations during both cruises; three replicates were taken at each of the Eastern and Western transect stations. Undisturbed and uncontaminated sediment samples for analysis of hydrocarbons, grain size, carbonate, total organic carbon, meiofauna, and infauna were subsampled from each box core. In the laboratory, sediments were analyzed for grain size, organic carbon, and carbonate carbon content. Epifauna, macroinvertebrates, and demersal fishes were collected using using a 9-m, semi-ballon trawl with 3.8 cm stretch mesh and 1.3 cm cod end mesh. A single haul was taken at each station. Benthic photography used a Benthic Underwater Camera System (a Benthos 35 mm camera mounted on a sled equipped with a pinger operated altimeter). Carbon isotopic analyses were performed on sediments and selected organisms to determine carbon source. High molecular weight hydrocarbons in macroepifauna, infauna, fishes, and sediments were determined using total scanning fluorescence followed by gas chromatography/mass spectroscopy.

SIGNIFICANT CONCLUSIONS: After one sampling year, analyses were incomplete and no definite conclusions could be reached. Biological and physical parameters exhibited some spatial and temporal variability among transects. Evidence of anthropogenic hydrocarbon contamination was not found in the slope environment or biota thus far examined. Natural hydrocarbon seeps were prevalent in the vicinity of the Central Transect and may, in fact, provide an additional source of energy to newly discovered chemosynthetic communities in this region.

STUDY RESULTS: Environmental parameters of the water column follow the layers of Gulf of Mexico, Tropical Atlantic Central, Antarctic Intermediate, and Gulf Deep Waters. Water mass characteristics were uniform across the Gulf as observed by temperature,

salinity, and transmissometry profiles. Water temperature decreased with depth, ranging from 10.8°C in 346 m to 4.3°C in 2,567 m. Sediment data from the Central Transect revealed clay sized particles from the three shallow stations grading into sandy or silty clays at the deepest stations. The western transect stations graded from sand-silt-clay mixtures to silty clays at the deeper stations. The Eastern Transect contained mostly sandy clay. Eastern and Western Transect sediments contained a higher proportion of sand-sized particles than the Central Transect. Organic carbon levels in bottom sediments were generally higher for the shoreward stations; highest on the Central Transect at all sampling depths, and lowest on the Eastern Transect. The Eastern Transect contained the highest calcium carbonate levels of the three transects. Carbon isotope analyses from Central Transect stations indicated organic carbon derived from planktonic algae with no trends related to depth or distance offshore. Sediments in all three transects contained a mixture of thermogenic, terrigenous, and planktonic hydrocarbons. The influence of riverborne hydrocarbons was greatest at the Central Transect. Hydrocarbon distributions at the Central Transect were consistent with mixed biogenic and thermogenic sources. In general, hydrocarbons were only present in low concentrations, especially at the Eastern Transect. Aliphatic hydrocarbon levels ranged from 10 to 50 ppm.

Meiofaunal samples consisted mostly of nematodes, harpacticoid copepods, polychaetes, ostracods, and kinorynchs. All groups were most abundant on the Central Transect. Nematodes and harpacticoids were the most abundant groups from a total of 36 groups. Meiofaunal densities along the Central Transect ranged from 1,139 to 274 organisms cm^{-2}. The most abundant macroinfaunal groups were polychaetes and nematodes, followed by harpacticoids, isopods, bivalves, ostracods, and tanaidaceans. Most macroinfaunal densities ranged from 2,435 to 8,628 organisms m^{-2}. Macroinfaunal densities from the Eastern and Central Transects were greater than the Western Transect. Megafaunal invertebrates collected by trawling included 78 decapod (mostly galatheids and anomurans) species and 33 echinoderm species (not including brittle stars). A total of 94 species of demersal or benthopelagic fishes in 42 families was collected on the three transects. Species from the families Macrouridae, Rajidae, Ophidiidae, Synaphobranchidae, and Halosauridae accounted for 38% of the total collected.

Benthic photography was refined and developed during this study phase. Preliminary results of photographic analysis, conducted at one station of each transect, indicates that the Central Transect station was characterized by a greater density of both biota and lebensspuren than the other two stations.

STUDY PRODUCTS: LGL Ecological Research Associates, Inc. and Texas A&M University. 1985. Annual Report for Northern Gulf of Mexico Continental Slope Study. Annual Report. A final report for the U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Region, Metairie, LA. NTIS No. PB86-246352. Contract No. 14-12-0001-30046. 311 pp.

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LGL Ecological Research Associates, Inc. and Texas A&M University. 1985. Annual Report for Northern Gulf of Mexico Continental Slope Study. Vol. I, Executive Summary. A final report for the U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Region, Metairie, LA. NTIS No. PB86-246345. MMS Report 85-0058. Contract No. 14-12-0001-30046. 23 pp.

*P.I.'s affiliation may be different than that listed for Project Manager.