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BACKGROUND: In 1974, the U.S. Department of the Interior funded a study to obtain multidisciplinary, short-term, benchmark data on the Mississippi-Alabama-Florida (MAFLA) Outer Continental Shelf (OCS) prior to oil and gas exploration in that region. The project was extended to a long-term, three-year major study in 1975. The results of the 1975-1976 MAFLA investigations are contained in this report.

OBJECTIVES: (1) To conduct seasonal biological, geological, and physical surveys of the water column and seafloor within the MAFLA region; (2) to determine range in concentrations of high molecular weight hydrocarbons and trace metals in sediments, water column, and selected benthic macrofauna; and (3) to conduct histopathological evaluations on selected benthic macrofauna.

DESCRIPTION: The MAFLA/OCS study area was bounded by 81°30' to 89° W long and 25°30' to 30°15' N lat. Depths ranged from 10 to 200 m. Sampling included water column and benthic collections. A box corer (21.3 x 30.5 x 43.2 cm) was used to obtain sediment samples. Forty-five stations were occupied along six transects for box coring. A 9.1-m semi-balloon trawl with 9.5 mm mesh cod-end liner was used to take one sample per station. Two dredge samples were taken at each station using a standard Capetown dredge. Selected biota from trawl and dredge samples were removed for trace metal, hydrocarbon, and histopathological analyses. The Florida Middle Ground area was sampled (photography, observation, and collection) by divers at eight stations during summer and winter.

Temperature and salinity were recorded using salinity-temperature-depth sensors, expendable bathythermographs, water samplers, and reversing thermometers. A transmissometer was used to determine the distribution of light transmission in the water column. Thirty-liter Niskin bottles were used to collect water samples from surface and near bottom. Duplicate zooplankton samples were collected during each of three sampling seasons using 0.5-m Nitex plankton nets with 0.202-mm mesh. Neuston samples were collected using a 1-m floating plankton sampler with 0.202-mm mesh. In the laboratory, sediment samples were analyzed for grain size, percent carbonate, total organic content, benthic clay mineralogy, foraminifera, meiofauna, macrofauna, trace metals, adenosine triphosphate, and hydrocarbons. Macrofauna, macroflora, and demersal fishes were analyzed for hydrocarbons and trace metals. Water samples were analyzed for suspended sediment mineralogy, particulates, primary productivity, chlorophyll a, trace metals, particulate organic carbon, dissolved organic carbon, dissolved hydrocarbons, and salinity following standard methods.

Two ancillary projects were also undertaken. First was the compilation of a lithological map using available geophysical information from the MAFLA area. Second was a pre-, during-, and post-operational monitoring of selected biological, chemical, and geological aspects of the environment surrounding an exploratory drillsite.

SIGNIFICANT CONCLUSIONS: No petrogenic hydrocarbons were found in sediments, water column, benthic organisms, or zooplankton. Abundance and diversity of organisms suggested that the area was essentially a pristine environment. There was no evidence of stress owing to influx of pollutants. Histopathological tests were also negative. Trace metal concentrations in the samples were normal. The Mississippi-Alabama Shelf did show evidence of hydrocarbon contamination due to input from the Mississippi River. Major oceanographic influences were the Mississippi River, Loop Current, and Hurricane "Eloise."

STUDY RESULTS: Sedimentary zones were identified for the MAFLA area using particle size ratios, percent carbonate, and mineralogy. The major influence on sediments of the Mississippi-Alabama Shelf was input from the Mississippi River. Fine sediments, mostly quartz sand and smectite, predominated in this deltaic region. Eastern and western flanks

of De Soto Canyon were comprised of lime muds and carbonate sands, respectively. East of Cape San Blas, a transition to carbonate and kaolinite was evident. The West Florida Shelf was covered by a carbonate sediment sheet; an inshore band of quartz sediment was detected near the coastline.

Infaunal species variability was more closely correlated with depth than grain size. Epifaunal taxa also displayed depth related patterns of abundance and diversity. Four epifaunal assemblages were determined: Middle Shelf, 30 to 60 m; North Middle Shelf, 30 to 60 m and high relief; Deep Middle Shelf, 60 to 140 m; and Deep Shelf, 140 to 200 m. Species abundance, biomass, and diversity for benthic communities were lowest in areas west of Cape San Blas. High microbial biomass and foraminiferans indicated environmental stress. In general, the area east and south of Cape San Blas was considered high in species diversity and relatively stable. The Florida Middle Ground supported diverse communities which exhibited tropical affinities. Epibiota of this area were subjected to natural perturbations (i.e., Hurricane "Eloise") and proved to be resilient. Macroalgae were usually detached by severe storms.

Trace metal concentrations in sediments were variable. Iron used as a mineralogical indicator in predictive plots (iron vs. all other metals) showed no evidence of present-day pollution. Trace metal concentrations were variable within and between epifaunal phyla; corals were the exception, while sponges typified the pattern. Crustaceans and tunicates concentrated copper and vanadium, respectively; both metals are components of respiratory pigments.

Hydrocarbon analysis disclosed that MAFLA area sediments are essentially free of contamination. Exceptions to this were sites south of Mobile, Alabama where stations were characterized by abundant high molecular weight terrigeneous n-alkanes and low molecular weight n-alkanes typical of weathered petroleum. Again riverine input was responsible for these observations. No discernable changes in either the amounts or composition of hydrocarbons in the epifaunal samples were detected between stations or seasons. All hydrocarbons found were biogenic. Some algae did contain hydrocarbons indicative of petrogenic contamination. These findings were seasonal and apparently related to circulation patterns and not petroleum residues in the adjacent sediments.

At the rig-monitoring site, small benthic foraminiferans indicative of rigorous (i.e., stressed) conditions were present before drilling operations began. Foraminiferan populations declined after drilling. Sand, clay, and carbonate levels increased while silt levels decreased during drilling; these trends reversed following drilling operations. Cuttings were found at 100-m and 500-m periphery stations. No significant changes in hydrocarbon content of sediments occurred between the three monitoring phases. Barium was the only trace metal with significantly higher concentrations in sediments during and after drilling.

STUDY PRODUCTS: State University System of Florida, Institute of Oceanography. 1977. Baseline Monitoring Studies, Mississippi, Alabama, Florida, Outer Continental Shelf 1975-1976. A final report for the U.S. Department of the Interior, Bureau of Land

Management Gulf of Mexico OCS Office, New Orleans, LA. Vol. I (Executive Summary) - NTIS No. PB-282-801; Vol. II (Introduction and Methods) - NTIS No. PB-282-802; Vol. III (Results) - NTIS No. PB-282-803; Vol. IV (Discussion) - NTIS No. PB-282-804; Vol. V (Geophysical Investigations for Biolithologic Mapping of the MAFLA-OCS Lease Area) - NTIS No. PB-282-806; Vol. VI (Rig Monitoring) - NTIS No. PB-282-805. Contract No. 08550-CT5-30.

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