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STUDY TITLE: Historical Reconstruction of Contaminant Loading and Biological Responses in the Central Gulf of Mexico Shelf Sediments

REPORT TITLE: Historical Reconstruction of the Contaminant Loading and Biological Responses in the Central Gulf of Mexico Shelf Sediments

CONTRACT NUMBER(S): 14-35-0001-30660-19930

SPONSORING OCS REGION: Gulf of Mexico OCS Region

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KEY WORDS: OCS environmental contaminants, trace metals, organics, pesticides, foraminifer, pigments

BACKGROUND: A pervasive, continuing, and confounding feature of the OCS Program and continental shelf investigations involves evaluation of the relative influences of these oil and gas recovery efforts against a background of regional forcing functions, such as riverine sources, climate, and estuarine exchanges that vary ‘naturally’ and have also changed over decades from landscape-scale influences. The question is whether *in situ* release of contaminants are as significant as the changes occurring from landuse changes in the Mississippi River watershed, and can they be detected against a background that includes a substantial natural variability. These influences complicate estimations of the more localized releases of oil and gas drilling and production operations. Whether contaminant releases are significant in terms of background or ‘natural’ amounts is an issue complicated by transport and degradation processes.

OBJECTIVES: Changes in chemical contaminants were documented in the Central Gulf of Mexico continental shelf sediments, the biogeochemical signature of ecosystem changes found within them and the biological response by the foraminiferal community. Changes are placed within the framework of the regional influence of the Mississippi River, oil and gas recovery efforts, and the natural variability of the ecosystem. The approach was to analyze constituents in dated sediment cores.

DESCRIPTION: The report is divided into four (4) chapters addressing aspects of these questions on this shelf. Our primary analyses are of the constituents in dated sediments before mineral recovery activity began up to the mid-1990s. Chapter 2 examines three main categories of pollutants or bio-indicators: total polycyclic aromatic hydrocarbons, or PAHs, (indicative of pyrogenic PAHs), total hopanes (indicative of petrogenic PAHs) and total organochlorine pesticides. Chapter 3 documents the regional changes in trace metals and in biological materials (carbon, nitrogen, biogenic silica) in time and space. Chapter 4 and Chapter 5 examine two different aspects of the planktonic record.

SIGNIFICANT CONCLUSIONS: The distribution of the selected trace metals and organic compounds suggests a chronic contaminant loading from the river itself, from oil and gas exploration in the Gulf of Mexico, perhaps from natural seeps in the area, and the chronological usage of chlorinated agricultural pesticides. The temporal patterns in phytoplankton are consistent with the increased accumulation of diatom remnants in sediments. The increasing pigments and greater concentrations in areas where hypoxia is more likely to occur indicate an increase in eutrophication or a worsening of hypoxia or both. No definite relationship could be established between the contaminant concentration in sediments and the composition of foraminiferal assemblage. Deformed foraminifera, one indicator of extreme chemical pollution, are not present in either of the cores. On the other hand, the diversity and relative-abundance changes of foraminiferal species fit the model of progressively worsening seasonal hypoxia in the area.

STUDY RESULTS: Analysis indicate that both OCS development and riverine sources exert strong influences on the sediment constituents offshore, and that these influences may be independent of one another.

STUDY PRODUCT(S): Turner, R.E., E.B. Overton, N.N. Rabalais, and B.K. Sen Gupta (eds.). 2003. Historical reconstruction of the contaminant loading and biological responses in the Central Gulf of Mexico shelf sediments. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2003-063. 131 pp.