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STUDY TITLE: Stability and Change in Gulf of Mexico Chemosynthetic Communities

REPORT TITLE: Stability and Change in Gulf of Mexico Chemosynthetic Communities, Interim Report

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PROJECT MANAGER: Ian R. MacDonald

AFFILIATION: Geochemical and Environmental Research Group (GERG), Texas A&M University

ADDRESS: 833 Graham Road, College Station, TX 77845 (tel: 409-862-2323 / fax: 409-862-1347)

PRINCIPAL INVESTIGATORS*: R.S. Carney, C.R. Fisher, N.L. Guinasso, Jr., S. Joye, M.C. Kennicutt II, I.R. MacDonald, S. Macko , P. Montagna, J.W. Morse, D.C. Nelson, K. Nelson, E.N. Powell, W.W. Sager, R. Sassen, S.W. Schaeffer, and G.A. Wolff.

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BACKGROUND: The discovery of well-developed chemosynthetic communities near petroleum seeps in the Gulf of Mexico led MMS to require that industry protect them from the physical effects of energy exploration and production on the continental slope. While other and concurrent investigations have been conducted in recent years, there are still few data on the ecological interactions in these communities and limited data on temporal stability and change within the communities and the biogeochemical habitat that supports them.

OBJECTIVES: (1) Review existing conceptual models of chemosynthetic communities to refine research plan; (2) Evaluate factors that affect distribution, growth, and abundance of chemosynthetic communities; (3) Investigate nutrient sources for communities and potential effects of petroleum production upon same; (4) Determine

whether chemosynthetic communities are robust or fragile, and (5) Evaluate reliability of acoustic, imaging, and chemical remote sensing of chemosynthetic communities.

DESCRIPTION: This is a research program designed to aid MMS in the scientifically sound management of living resources found at hydrocarbon seeps on the northern Gulf of Mexico continental slope. Communities of tube worms (Vestimentifera), seep mussels (Bathymodiolinae) and clams (Vesicomyidae) colonize active seeps in depths of 500 m and deeper. These communities achieve densities that are much greater than commonly found elsewhere on the continental slope. MMS is concerned to maintain the viability of these communities in the face of increasing energy activities in this region. To do so, it is necessary to distinguish natural cycles in abundance and growth from human-induced changes. Stability and change within these communities can only be understood in the context of their interactions within the geological, chemical, and oceanographic setting. An understanding of the processes that control the distribution, health, and succession of communities in these environments is necessary to forecast and forestall potential impacts derived from exploration and exploitation of fossil energy reserves on the northern Gulf of Mexico continental slope.

SIGNIFICANT CONCLUSIONS: Two mega-sites (shallow and deep) for geophysical remote sensing trials were established. Four primary study sites were established for collection of biological and geochemical samples in lease blocks GB425, GC185, GC233, and GC234,. (See Figure 1.) The program has successfully completed the first half of its field work, including a geophysical survey cruise and a submersible sampling cruise. Study sites, sampling methods, and laboratory analyses have been finalized.

STUDY RESULTS: Because the program is still in progress, results to date are preliminary. Geophysical survey successfully imaged faults, carbonate mounds, mud flows, and other features potentially associated with communities. Successful collections and deployment of marked animals were accomplished for growth studies of tube worms and seep mussels. Collections of sediments for analysis hydrocarbons and pore water chemistry were completed at 15 stations. Collections of ancillary fauna for determination of trophic interaction with chemosynthetic fauna were made. Collections of bacterial mats (*Beggiatoa*) were successful.

STUDY PRODUCT: MacDonald, I.R, ed. 1998. Stability and Change in Gulf of Mexico chemosynthetic Communities, Interim Report. U.S. Dept. of the Interior. OCS Study MMS 98-0034. Prepared by the Geochemical and Environmental Research Group, Texas A&M University.

*P.I.’s affiliation may be different than that listed for Project Manager(s).