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PUBLIC ABSTRACT
GULF OF MEXICO SEA FLOOR STABILITY AND GAS HYDRATES MONITORING STATION PROJECT

The Center for Marine Resources and Environmental Technology (CMRET) of the University of Mississippi, Oxford campus, has initiated a project to study gas hydrate mounds and hydrocarbon vents in the Gulf of Mexico for the purpose of understanding the relationships between these features and the episodes of sediment instability that threaten the petroleum industry's infrastructure and cost many millions of dollars each year.

Gas hydrate mounds form along the intersections of faults with the sea floor. They are edifices constructed largely of water from the sea and hydrocarbon gases that have migrated up the faults from buried reservoirs. It is not uncommon for them to be located near vents from which hydrocarbons, both gaseous and liquid, are expelled into the water column. In addition to gas hydrates, the mounds contain various minerals deposited by bacteria feeding on the hydrocarbons.

The mounds and vents are capable of changing greatly within a matter of days. Many scientists familiar with geologic processes in the Gulf of Mexico think that events which produce the changes can also trigger episodes of sediment instability at and below the sea floor. There have been problems obtaining direct evidence of this, however. Due to the difficulty and expense of research vessels remaining on station for extended periods of time, observations of hydrate mounds and hydrocarbon vents tend to be "snapshots" taken rather infrequently. It is not uncommon for features of interest to change greatly between "snapshots", but rarely is the process of change observed in its entirety. This makes it difficult to obtain a good understanding of the mechanisms involved. That will require much more frequent "snapshots" or, better yet, the means to make more-or-less continuous observations over a significant period of time.

It is feasible to make almost continuous sea-floor observations over a long period of time by employing a technology developed for military purposes. It has been used for years by various navies to monitor activity on the surface and in the water column but only recently has it become available for civilian purposes.

The principal sensors are hydrophones to detect pressure waves in the water and seismometers or accelerometers to detect seismic waves in the sediment. A number of sensors are assembled into a network that continuously records sound in the water and movement in the sediment. Signals from the network are digitized and transmitted to a computer facility where they are processed to form images. The images can include tracks of vessels transiting the area, tomography within the volume of water encompassed by the network and the configuration and physical properties of geologic units within the sediment.

After a computer model of the acoustic/seismic environment has been determined using known sound sources in the water and shear-wave sources on the sea floor, such a network relies on the sound of

passing ships either to verify that the model has not changed significantly or to signal that a specified degree of change has been exceeded.

If the network is augmented with other types of sensors, changes to the model can be correlated to changes in heat flow, sediment permeability, rate of fluid flow from vents and the thermal, electrical and chemical properties of vented fluid. The inclusion of biological sensors would allow the effects of change on chemosynthetic communities to be assessed.

CMRET proposes to install a multisensor, remotely controlled station that will provide the means to monitor sea floor stability in the vicinity of a gas hydrate mound or hydrocarbon vent in the northern Gulf of Mexico. Details of how such a monitoring station should be designed, constructed and deployed has been discussed on several occasions by representatives of academia, government and industry. Project activities, begun in 1998, are being expanded in 2000 under the direction of an international Board of Scientific Supervisors. Development work is expected to be completed in 2003 with an operational station being deployed during 2004.

CMRET has requested the U. S. Department of Energy to provide funds for some portions of the development and associated laboratory work, beginning in the year 2000.

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A REMOTELY OPERATED STATION TO MONITOR SEA FLOOR STABILITY AND GAS HYDRATE OUTCROPS IN THE GULF OF MEXICO

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