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## Exploration of the Deep Gulf of Mexico Slope using *DSV Alvin*: Site Selection and Geologic Character

Harry H. Roberts<sup>1</sup>, Chuck R. Fisher<sup>2</sup>, Jim M. Brooks<sup>3</sup>, Bernie Bernard<sup>3</sup>, Robert S. Carney<sup>4</sup>,  
Erik Cordes<sup>5</sup>, William Shedd<sup>6</sup>, Jesse Hunt, Jr.<sup>6</sup>, Samantha Joye<sup>7</sup>, Ian R. MacDonald<sup>8</sup>,  
and Cheryl Morrison<sup>9</sup>

<sup>1</sup>Coastal Studies Institute, Louisiana State University, Baton Rouge, Louisiana 70803

<sup>2</sup>Department of Biology, Penn State University, University Park, Pennsylvania 16802-5301

<sup>3</sup>TDI Brooks International, Inc., 1902 Pinon Dr., College Station, Texas 77845

<sup>4</sup>Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, Louisiana 70803

<sup>5</sup>Department of Organismic and Evolutionary Biology, Harvard University,  
16 Divinity Ave., Cambridge, Massachusetts 02138

<sup>6</sup>Minerals Management Service, Office of Resource Evaluation, New Orleans, Louisiana 70123-2394

<sup>7</sup>Department of Geology, University of Georgia, Athens, Georgia 30602

<sup>8</sup>Department of Physical and Environmental Sciences, Texas A&M – Corpus Christi, Corpus Christi, Texas 78412

<sup>9</sup>U.S. Geological Survey, 11649 Leetown Rd., Keameysville, West Virginia 25430

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### ABSTRACT

The Gulf of Mexico is well known for its hydrocarbon seeps, associated chemosynthetic communities, and gas hydrates. However, most direct observations and samplings of seep sites have been concentrated above water depths of approximately 3000 ft (1000 m) because of the scarcity of deep diving manned submersibles. In the summer of 2006, Minerals Management Service (MMS) and National Oceanic and Atmospheric Administration (NOAA) supported 24 days of *DSV Alvin* dives on the deep continental slope. Site selection for these dives was accomplished through surface reflectivity analysis of the MMS slope-wide 3D seismic database followed by a photo reconnaissance cruise. From 80 potential sites, 20 were studied by photo reconnaissance from which 10 sites were selected for *Alvin* dives. Four sites, found in Atwater Valley Lease Area, Block 340 (AT 340), Green Canyon Lease Area, Block 852 (GC 852), Alaminos Canyon Lease Area, Block 601 (AC 601), and Alaminos Canyon Lease Area, Block 818 (AC 818) had impressive and diverse chemosynthetic communities as well as well-defined fluid-gas expulsion geology. In addition to chemosynthetic communities, GC 852 had abundant hard and soft corals seated on substrates of exposed authigenic carbonate boulders. During the two dives at this site the water depths (WD) were ~ 4760 ft (1450 m), and the currents were estimated to be 1-1.5 kts (~50-80 cm/s). At AC 601 (WD ~ 7675 ft [2340 m]), a brine lake that was 13 ft (4 m) deep and 590 ft (180 m) wide with a salinity of ~ 90‰ (parts per thousand) was investigated and sampled. White “flocs” floating in the brine and concentrated at the “shoreline” were found to be barite. No visible animal life was observed in the brine, but moribund fauna were found both in the lake and at the shoreline. Isolated living communities of mussels and urchins were found on the lake margins. Geochemically, the concentration of methane in the water column above the lake exceeded all their *Alvin* dive sites by one order of magnitude. Methane was super-saturated all the way to the surface, suggesting the site could be a source of methane to the atmosphere.