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Fluid and Gas Expulsion: Impacts on Seafloor Geology and Biology

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Abstract

The northern Gulf of Mexico continental slope is the most thoroughly imaged and studies continental slope in today's oceans. The entire slope is covered with 3D-seismic and much of the area has been imaged with higher resolution acoustic systems. These data describe a complex seafloor impacted by fluid-gas expulsion. *Alvin* dives in 2006 and ROV *Jason* dives in 2007 have produced seabed observations and samples that have greatly improved our understanding of cross-slope and along-slope distribution and variability in biologic communities and their hydrocarbon seep related habitats. Site selection for the 2006 *Alvin* dives was accomplished though surface reflectivity analysis of the MMS slope-wide 3-D seismic database followed by photo reconnaissance. From 80 potential sites, 20 were subjected to photo reconnaissance from which 10 sites were selected for *Alvin* dives. Four sites, found in AC 818, AC 601, GC 852 and AT 340 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 authigenic carbonate boulders. At AC 601 (WD ~ 2340 m) a brine lake (4 m deep and 180 m wide, salinity ~ 90 ‰) 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. Isolated living communities of mussels and urchins were found on the lake margins. Geochemically, the water column methane concentration above the lake exceeded all other *Alvin* dive sites by an order of magnitude. Methane was supersaturated all the way to the surface, suggesting the site could be a source of methane to the atmosphere. At the four key sample locations Autonomous Ultrawater Vehicle (AUV) data were acquired prior to the 2007 ROV *Jason* cruise. Multibeam bathymetry from the AUV was used as a navigation underlay for detailed sampling by *Jason*. Depth and geographic ranges for key components of chemosynthetic communities were improved and our understanding of the geologic aspects of hydrocarbon seep habitats was significantly advanced by data from the 2006 and 2007 dives.