Monitoring Seafloor Morpho-Geological Evolution of the MC118 Hydrate/Carbonate Mound via Multiple AUV Missions

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A one-kilometer-diameter carbonate/hydrate mound dominates seafloor morphology at Mississippi Canyon Block 118, site of a multi-sensor, multi-disciplinary, sea-floor observatory (SFO) managed by the Gulf of Mexico Hydrates Research Consortium, University of Mississippi. The SFO will, upon completion, employ a variety of multi-sensor arrays and provide more-or-less continuous monitoring of hydrographic, geophysical, geological and biogeochemical processes in the proximity of the mound. Objectives include investigations of spatial and temporal variability of processes influencing mound evolution: fluids venting from the seafloor, formation and dissociation of hydrates. Seafloor morphology and geology have been characterized integrating Autonomous Underwater Vehicle (AUV) high resolution swath bathymetry, acoustic imagery, sea-floor video and sediment, water column, and pore-water samples. An initial bathymetry survey was made in 2005; video images, photographs, and core samples have been collected 2005 - 2009. A new bathymetric survey was acquired in June, 2009, using the Consortium's access to the National Institute for Undersea Science and Technology (NIUST) AUV, Eagle Ray. Using 2005 bathymetry and related video surveys as the morphological baseline, changes in mound morphology over time, can be tracked, having AUVs visit the site at least annually.

The 2005 survey revealed craters with 2-6m relief, individual craters 5-60m in diameter, large hydrate outcrops, carbonate/hydrate pavements, bacterial mats, and bubble plumes. The craters cluster into three complexes each with distinct relief and relative venting activity: a SE complex has low relief and no observable venting activity, the NW complex has moderate-to-low relief and venting, and the SW complex exhibits moderate-to-high relief and venting activity. By comparing 2009 with 2005 bathymetry, changes in morphology can be identified, i.e. the NW crater complex appears to have eroded and two distinct pockmarks have coalesced. Video images acquired in 2006-7 show significant change in a particular hydrate outcrop. 2009 backscatter analyses depict a possible new vent between the SE and SW complexes.

Changes observed to date reveal a mound extremely dynamic in spatial and temporal scale, confirming the appropriateness of continuous monitoring over the five-to-ten years of anticipated observatory operational life.