Jumbo Piston Coring at MC118, site of the Gulf of Mexico Hydrates Research Consortium's Seafloor Observatory

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Goals

Collection of 5 Jumbo Piston cores to supplement existing geological, geophysical and geochemical information from gravity, box and push-cores. This information will help researchers determine conditions under which hydrates form and dissociate

CORING EFFORT

A research cruise to Mississippi Canyon 118 (MC118), site of the Hydrates Research Consortium's Seafloor Observatory, was executed aboard the R/V *Brooks McCall* with the Mississippi Mineral Resources Institute (University of Mississippi), University of South Carolina and Florida State University participants aboard.

The research objective was the collection of 5 Jumbo Piston cores to support the further geological, geophysical and geochemical characterization of the shallow subseafloor at Woolsey Mound, a carbonate-hydrate mound complex and the primary bathymetric/morphological feature on the seafloor at MC118, site of the Hydrates Research Consortium's seafloor observatory.

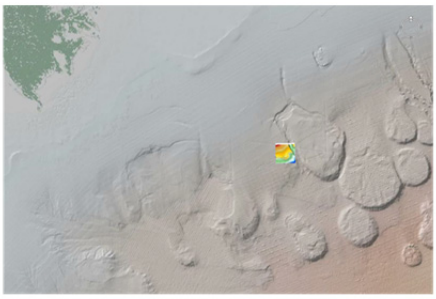

Figure 1. Woolsey Mound, MC118, is located on the continental slope in ~900m of water, on the edge of a slump block in the northern Gulf of Mexico.

Although work at the site has been ongoing since early 2005, important gaps remain in our understanding of the complex geomorphological and geochemical forces driving the tectonics, seep development and resultant chemosynthetic communities at the site. No deep cores (>10m) had yet been recovered. For several months prior to the cruise, Consortium members were asked to nominate sites for these cores and justify their nominees. In general, sites were targeted because they showed promise of providing tie-in to geophysical datasets, could reveal the geologic section to greater depths than has been possible with MMRI's 10m capability, showed potential to provide information regarding geophysical/seismic anomalies (high frequency scatter, blanking, hot spots, pockmarks), provide information regarding faulting noted in seismic data, or confirm presence of resistivity anomalies found in a survey conducted in June, 2009.

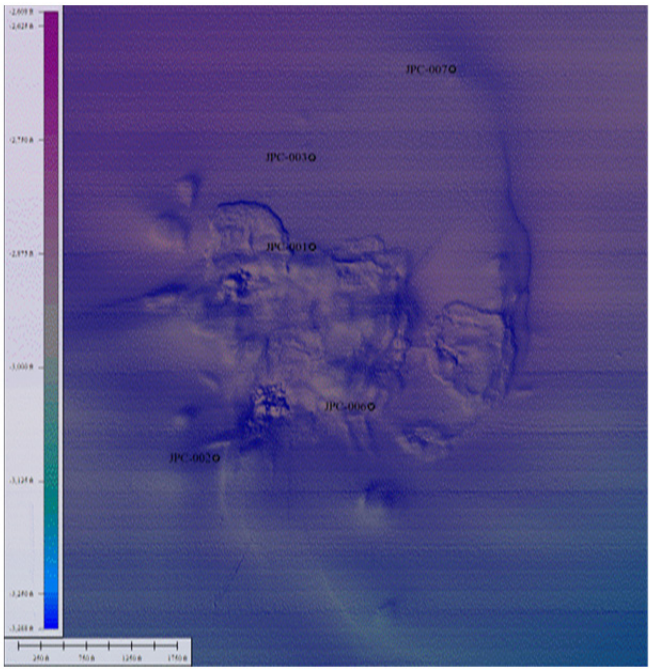

Figure 2. Locations and justifications for the selection of the 5 Jumbo Piston Cores recovered from Woolsey Mound, January, 2011.

JPC-001 Justification: growth section along the "Blue Fault", ground-truth on SSDR data; about 100 m west from high resistivity anomaly A.

JPC-002 Justification: south-west of the SW Crater Complex, in a compressed stratigraphic section, close to the "Pink Fault".

JPC-003 Justification: calibration JPC-001, penetrate complete marker unit (age constraint for blue fault movement).

JPC-006 Justification: between SW and SE Crater Complexes, close to the Pink Fault, acoustic blanking on CHIRP data.

JPC-007 Justification: in the northern portion of the parabola, NE of Woolsey Mound, exhibits high-frequency scatter in SSDR data, it is in a pock mark and the surface expression of the "Yellow Fault".

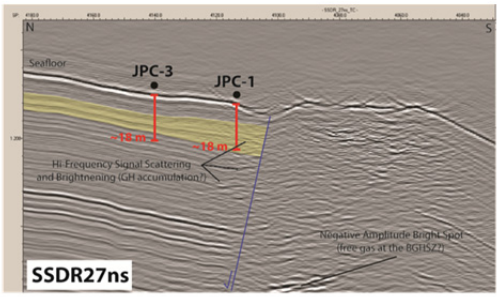

Figure 3. Surface-source deep-receiver (SSDR) profile shows seismic justification for JPC-001, including imaging of the fault and the growth sequence.

Five cores were recovered from the area of the mound and its periphery. Recovery of the TDI-Brooks Jumbo Piston coring rig ranged from 12.5-15.5m. Cores were sectioned, tops photographed and sampled for geochemical parameters, closed, and scanned for temperature anomalies using infrared imagery. A subset of these sections was tested for shear strength using minivane techniques. Top sections were windowed and sampled for sulfate and methane. In one case a core section was opened and examined for hydrate occurrence based on the IR readings. This section was found to contain hydrates in a variety of occurrences: massive chunks, blades, nodules and disseminated grains/granules. Some of the hydrate was collected for chemical analyses.

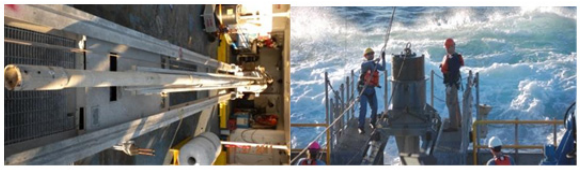

Figure 4. (left) Jumbo Piston coring rig, onboard the R/V *Brooks McCall* (right) Jumbo Piston coring rig in receiver, ready for deployment.

Figure 5. (left) Undisturbed section of core 3. (middle) Section of JPC-006 showing sampled section. Note blisters of gas appearing on exposed surface. (right) Hydrate comprises a significant fraction of this section of JPC-001, opened nearly 2 hours after retrieval. Note large chunks of hydrate.

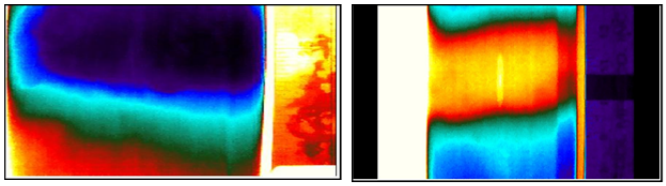

Figure 6. (left) Blue indicates a cold section, the case we expect if hydrates are in the core. (right) Warm colors indicate a warm section or, as is the case here, a void.

Figure 7. (left) Hydrate blades, chunks abound in the lower sections of JPC-001. (right) The JPC cut a 2cm thick wafer of hydrate.

WHAT COMES NEXT?

The cores have been transported to the Navy Research Laboratory at Stennis Research Facility where they will be analyzed with a Geotek logger for resistivity, compressional strength, density, and magnetic susceptibility. They will then be opened, examined visually, photographed, logged and subsampled for additional geochemical analyses and bio- and lithostratigraphy. The FSU participants are performing chemical analyses of samples collected onboard prior to the opening of the cores. These results will be used to determine sites for extensive coring in April to extend the range of geologic and geophysical characterization of Woolsey Mound and to aid in determining target sites from which to recover heat-flow data later in 2011.

PROJECT FUNDING

The seafloor observatory at MC118 was established by the Consortium to enable researchers to study gas hydrates in situ. Originally funded by Minerals Management Services (now the Bureau of Ocean Energy, Management, Regulation and Enforcement, BOEMRE), to establish the role of hydrates in seafloor stability/instability on the continental slope, other federal agencies became involved for different reasons. The Department of Energy's National Energy Technology Laboratory (DOE-NETL) is interested in hydrates as a potential energy resource while NOAA is concerned about their possible role in climate change and marine ecology.

Collaborators

University of South Carolina
University of Southern Mississippi
Florida State University
Baylor University
Naval Research Laboratory - Stennis Space Center
TDI-Brooks. International

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