IODP Expedition 366: Mariana Convergent Margin

Site 1200 Summary

Background and Objectives

Ocean Drilling Program (ODP) Site 1200 (MAF-4B) is located on the summit of South Chamorro Seamount at 13°47.07′N, 146°0.17′E, in 2932 m water depth. In March 2001 during ODP Leg 195, six holes were drilled at this site and a borehole observatory Circulation Obviation Retrofit Kit (CORK) was installed in one of them, Hole 1200C. The objective of revisiting Hole 1200C during IODP Expedition 366 was to remove the CORK body and leave the casing ready for a future expedition to install more modern CORK infrastructure and instruments, termed CORK-Lite.

South Chamorro Seamount is one of 14 large (up to 50 km in diameter and 2 km high) active serpentine and blueschist mud volcanoes on the Mariana Forearc (Fryer, 1996 and 2012), located about 78 km from the trench. It is primarily composed of unconsolidated flows of serpentine mud with clasts consisting dominantly of serpentinized mantle peridotite, but also includes clasts that contain blueschist fragments (Shipboard Scientific Party, 2002). The summit of the seamount shows active fluid seepage of slab-derived fluids and hosts subsurface Archaea (Mottl et al. 2003; Curtis and Moyer, 2005) and Bacteria (Takai et al., 2005).

An original-style CORK (Davis et al., 1992) was installed in Hole 1200C, with casing set to 202.8 mbsf and the screened section extending from 148.8 to 202.3 mbsf. This screened section allows formation pore fluids to enter the borehole and be sampled within the protective environment of the casing/CORK. The CORK was instrumented with a thermistor string with pressure cells, and two osmotic water samplers, together with a data logger to collect data for assessing temporal processes associated with active serpentinite mud volcanism.

In March 2003 the ROV *Jason II* recovered the borehole instruments deployed during ODP Expedition 195. The discharged fluids and data were collected to assess fluid flow rates from the borehole, among other applications (Wheat et al., 2008). Additional sampling of the fluids at Hole 1200C was conducted in 2009 by a Japanese-led expedition. However, the small diameter (about 9 cm) of the hole within the CORK body and protruding latches within the CORK body limit the size and shape of potential experiments and sensors that can currently be placed within the borehole.

Given these limitations to the original-style CORK at Hole 1200C, the plan for IODP Expedition 366 was to remove the CORK body and leave the hole open for a future ROV deployment of a CORK-Lite (Wheat et al., 2012). A CORK-Lite allows for a modular design including multiple ports for experiments and sensors outside of the CORK body. These can access fluid from the formation and allow for large diameter (25 cm) experiments and sensors to be deployed within

the borehole, which can be sealed or allowed to discharge. Such capabilities would serve a range of scientific interests for future deployments of sensors, samplers, and experiments. After recovering the old CORK body, a new ROV landing platform was to be deployed. Finally, it was planned to use the WSTP tool to measure an equilibrated temperature profile and collect borehole (formation) fluids, including a dissolved gas sample. These samples would be unaffected by contamination from drilling fluid as would be the case in a freshly drilled borehole.

Operations

After an 11 h transit from Guam, the vessel arrived at Site 1200 (MAF-4B) at 1624 h on 13 December 2016. Planned operations at Hole 1200C were to remove the currently installed CORK and ROV platform, install a new ROV platform, and deploy the WSTP beyond the drill string to the depth of the screened portion of the cased hole to collect pristine formation fluid and measure a temperature profile for calculating the natural rate of fluid discharge from the borehole.

The recovery attempt began at 0500 h on 14 December, and several near misses occurred when the tool appeared to go over the top of the CORK head but the pipe heaved off before the J-slots were fully engaged. After 5.25 h, the CORK head was engaged and the recovery tool J-slots were fully engaged. However, the CORK head parted while attempting to pull it free of the reentry structure. Less than 10 klb of overpull was being applied to get the CORK latch to shift; however, it failed at the latch assembly. Video of the reentry cone after removal showed a small diameter tube protruding from the center of the reentry cone. This was interpreted to be a piece of PVC tubing that had been previously installed in the CORK via ROV in 2009 after the original thermistor string was recovered in 2003. The high-resolution camera with the new upgraded pan, tilt, and zoom capability proved to be quite effective during the CORK recovery and assessment.

At 1615 h, the recovery tool with the recovered portion of the CORK returned to the rig floor. Science party microbiologists and geochemists sampled macrofauna and precipitates from the CORK head. Since the original CORK platform was not recovered and because the lower portion of the CORK remained in the hole, replacement of the ROV landing platform replacement and the WSTP water sampling run could not take place and preparations were made to transit to Site U1492 (proposed Site MAF-16A).

Principal Results

Removal of the original-style CORK from Hole 1200C succeeded in recovering only part of the CORK body, leaving the remainder in place. While attempting to remove the CORK, the latch

rods failed to remove the portion of the CORK that latches into the casing hanger, forming a seal and focusing discharge up a steel pipe that contains the seal sleeve (5.24 inch outer diameter and 3.5 inch inner diameter). This steel pipe parted above the seal sleeve where it was tack welded to an identical sized pipe that extended to the top of the CORK. On the basis of visual observations of the reentry cone and dissection of the lower potion of the CORK body that was recovered, the CORK is likely sealed with access to the casing via a portion of a PVC insert that was deployed in 2009.

White and reddish material on the outside of the CORK body was collected for microbial and mineralogical analyses. About seven limpet-like shells were recovered from the CORK body and preserved for shore-based identification.

References

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