Expedition 321T: Juan de Fuca Hydrogeology: Cementing Operations at the Hole U1301A and Hole U1301B Borehole Observatories (CORKS)

3 July 2009

SITE U1301 SUMMARY

IODP Expedition 301 was part of a series of expeditions and experiments to quantify hydrogeologic, lithologic, biogeochemical, and microbiological properties, processes, and linkages on the eastern flank of the Juan de Fuca Ridge. Borehole observatories installed during IODP Expedition 301 were designed to seal open holes so that thermal, pressure, chemical conditions could equilibrate following the dissipation of the drilling disturbance; to facilitate collection of fluid and microbiological samples and temperature and pressure data and to serve as long-term monitoring points for large-scale crustal testing (Fisher et al., 2005b). Unfortunately, the CORKs installed in Holes U1301A and U1301B were not sealed as intended (Fisher et al., 2005a), and data and samples collected during subsequent ROV and submersible servicing operations have shown that both observatory systems are leaking. The main objective of IODP Expedition 321T is to pump cement into re-entry cones around subseafloor borehole observatories in Holes U1301A and U1301B, in order to seal the systems and permit later completion of long-term hydrogeologic monitoring, sampling, and experiments. Expedition 321T was not intended to collect any data or samples. Only observatory sealing operations were conducted.

CEMENTING OPERATIONS

Cementing operations began with Hole U1301B as re-entry at this hole was somewhat less challenging through the open slot on the platform compared to re-entry through a screened 12" diameter opening at Hole U1301A.

Hole U1301B (47° 45.229' N, 127° 45.826' W; Seafloor depth 2667.8 m DRF)

After lowering thrusters and stabilizing the ship over the location coordinates, the cementing Bottom Hole Assembly (BHA) was picked up. This consisted of the cementing stinger (made from a joint of 5-1/2" drill pipe cut in half at a 60° angle and with four staggered 3" diameter holes drilled in the lower 9", 1 joint of 5-1/2" transition drill pipe, X/O, two 8-1/4" diameter control length drill collars (CLDC), tapered drill collar (TDC), and another joint of 5-1/2" transition drill pipe. The drill string was run to a depth of 1376.2 m below rig floor (DRF) and the VIT/subsea TV was deployed. The drill string trip was then completed to a depth of 2664.3 m DRF (4.4 m above reentry cone rim) and spaced out for reentry. A drill string wiper "pig" was pumped down to clean any remnant mud from the pipe. Pump strokes were monitored and timed as a crosscheck on the calculated displacement of the drill string. The exit of the "pig" was marked by a large cloud of mud that billowed out of the end of the drill pipe upon its arrival. The lo-torque valve and cementing system integrity was then pressure tested and at 1030 hr 30 June 2009 vessel maneuvering for the first reentry attempt began. The reentry target was a single (1 of 12) pie shaped window in the Hole U1301B CORK platform. The platform was reentered at 1215 hr that same day after 2 hours and 15 minutes of maneuvering. The driller's task was made more complicated by the fact that the top of the

cone rim was 1.1 m below seafloor depth (DSF), which meant drill string activity around the cone/platform vicinity stirred up the mud and obscured visibility for several minutes.

At 1245 hr, after observing the drill string and seafloor installation for stability and heave-out potential, the decision was made to move forward with the cementing operation. Preparations began for mixing the first batch of cement. At 1300 hr the actual cementing mixing operation was initiated and by 1350 hr a total of 60 barrels (bbls) of 15.8 pound per gallon (ppg) class G neat cement blended with Cello-flake lost circulation material (LCM) was mixed up with fresh water and displaced into the pipe. This was chased with 20 barrels of fresh water using the Halliburton cementing pump followed by 120 barrels of sea water displaced with the Triplex rig pumps. The drill string was pulled clear of the top of the reentry cone (TOC) at 1420 hr 30 June with ~10 barrels of cement still falling from the drill string. This was done to avoid the potential of pumping water into the reentry cone and diluting the cement slurry.

Hole U1301A (47° 45.210' N, 127° 45.833' W; Sea floor depth: 2667.3 m DRF)

The cementing unit was cleaned and the tanks flushed while offsetting the ship the 35 m to Hole U1301A. The drill pipe was also flushed and a drill string pig was pumped to wipe away any remnant cement. Maneuvering for reentry at Hole U1301A began at 1530 hr. This time the reentry target was more challenging: one of eight 12 inch diameter holes in the old style "solid" CORK platform. Reentering through one of these holes required using the cement stinger to push through the steel grating that had been tack-welded in place below the platform on Expedition 301, requiring careful timing and control of weight on bit. The Hole U1301A platform was reentered at 1815 hr after only 2-3/4 hr of maneuvering time. The cone rim at this site was 1.4 m DSF and covered with a layer of fine sediment. Whenever the bit would drag on the platform surface it would stirred up a cloud of sediment obscuring visibility for several minutes.

For this hole, a total of 114 bbls of 15.8 ppg "blended" cement was mixed up and displaced in the same manner as in Hole U1301B. Mixing ended at 2000 hr, the batch was chased with 20 bbls of fresh water using the Halliburton cementing pump followed by an additional 120 bbls of sea water using the rig pumps. The pipe was pulled clear of the TOC at 2020 hr 30 June with another ~10 barrels of cement still falling from the drill string.

Return to Hole U1301B and Hole U1301B

Hole U1301B platform was reentered for the second time at 2250 hr requiring only 65 minutes. Preparations for mixing the second batch of cement for the hole started immediately. 70 bbls of 15.8 ppg "blended" cement was displaced into pipe, chased with 20 bbls of fresh water using Halliburton cementing pump, and an additional 120 bbls of sea water using the rig pumps. The pipe was pulled clear of the TOC at 2355 hr 30 June again with ~10 barrels of cement still falling from the drill string. After the second cement job, visual observations at Hole U1301B indicated that the reentry cone appeared to be full of cement as well as the surrounding area outside of cone**.** The cementing unit was cleaned and the tanks flushed while offsetting the ship 35 m back again to Hole U1301A. Visual

observations at Hole U1301A indicated that the reentry cone was full of cement as well as the surrounding area outside of cone. The cementing equipment was rigged down, the subsea TV/VIT was recovered back aboard, and the drill pipe was tripped back to the surface ending cementing operations at Site U1301 at 0900 hr 1 July.

REFERENCES

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