

IODP Expedition 327: Juan de Fuca Ridge-Flank Hydrogeology

Week 7 Report (16–22 August 2010)

23 August 2010

OPERATIONS

Hole U1362A L-CORK Instrument String Deployment

Following the discovery that the instrument string was protruding by several meters beyond the end of the CORK stinger, it was decided to bring the drill string back to the surface. At 0200 hr on 16 August the L-CORK was hung off in the moon pool. The instrument string was released using the screws built into the system for future removal by a submersible, the string was shortened by 10.17 m, and then it was reinserted into the L-CORK. At 0600 hr the drill string was once again tripped to the seafloor. The trip took longer than usual because the pipe had to be filled from a water hose after assembling each stand. The water was needed to prevent a differential pressure from building up and overloading the latch system on the instrument string. Hole U1362A was reentered for the eleventh time at 1150 hr. The CORK was landed without incident and the inflatable packer assemblies were inflated with 1500 psi pressure over a period of 30 minutes. The Vibration Isolated Television (VIT)/subsea TV was recovered and at 1600 hr preparations began for deploying the CORK platform. The platform halves were maneuvered onto the moon pool doors and bolted together. Another 2 hr were spent assembling the “lunar lander” deployment vehicle with the VIT sleeve and rigging the various required slings. At 1800 hr the platform began its trip to the seafloor but at 2007 hr the subsea TV camera went black. After some initial trouble shooting by the ODL electronic technician, the VIT/subsea TV with the suspended CORK platform was recovered back to the ship. A faulty connector was replaced and the VIT was once again run to bottom. Upon initial landing at 0230 hr on 17 August, the platform reached the CORK running tool but failed to release. After working the platform up and down for ~1 hr the platform eventually released. The VIT was recovered back to the ship and the “lunar lander” was removed along with all platform deployment slings. This was done so they would not become entangled with the L-CORK installation. The VIT/subsea TV was deployed back to bottom, confirming that the platform had not released correctly, and was found to be hanging at an angle off the CORK running tool. The VIT sleeve was set down on the platform multiple times before the platform was jarred off and fell into position on the rim of the reentry cone. The running tool was released from the L-CORK head at 0600 hr on 17 August, successfully completing the installation of the Hole U1362A L-CORK. The drill string was tripped back to the surface and the recovery tool cleared the rig floor at 1045 hr, ending operations at Hole U1362A. Close inspection of the “lunar lander” mechanism and the CORK running tool indicated that one of its arms was bent due to impact with the bolt screwed into the running tool to protect the packer inflation hose fitting. As a result only two of the three arms released initially, causing the platform to hang on the third arm and resulting in the cocked attitude of the platform on the CORK head. A shorter bolt that will not interfere with the “lunar lander” mechanism was installed for the next deployment.

Hole U1301B Instrument String Recovery and Replacement (Expedition 301)

A new bottom-hole assembly (BHA) that included the CORK recovery tool was made up and tripped to the seafloor by 1615 hr on 17 August. At 1730 hr the recovery tool engaged the Hole U1301B CORK head but before the J-tool could be engaged the running tool heaved off. This required a second engagement attempt and by 1815 hr the tool was back on the CORK head. Engagement of the J-slot tool was ineffectual so 10,000 lbs weight was applied to the top of the CORK. The sinker bars were lowered and after multiple attempts the GS overshot engaged the instrument string top plug. Although tension was applied to the instrument string, the instrument

string appeared to be stuck in place. After working the sandline with various degrees of overpull the instrument string started creeping slowly upward. At 0920 hr on 17 August the instrument string parted. The CORK recovery tool was disengaged and a portion of the instrument string was recovered back to the surface. Upon recovery it was found that a splice in the Spectra rope had failed directly above the middle plug of the installed instrument string. Five temperature data loggers and 377 m of Spectra rope were recovered. After laying out the recovered portion of the instrument string the CORK head was re-engaged at 2225 hr. Another sandline run was made to deploy temperature data loggers to obtain a temperature profile of the remaining portion of the hole as well as determine the depth of the available open hole. This allowed proper configuration of the replacement instrument string. The bottom of the open hole was ultimately tagged at 3037 m (370 m below seafloor). The recovery tool was disengaged once again at 0130 hr on 18 August. Make-up of the replacement instrument string began at 0145 hr. This included the rigging of the Schlumberger electric logging line. The new Electronic Release System (ERS), under development by Stress Engineering for use with the developmental SCIMPI CORK system, was used for this deployment since the Hole U1301B CORK system was not configured with an instrument string latch-down system. Historically there have been a lot of problems jarring off the instrument string without dislodging the upper landing/seal sub. Therefore it was hoped that the ERS system would work. The replacement instrument string was ready for deployment at 0330 hr and the CORK running tool was engaged once again at 0435 hr. The instrument string was successfully landed and released using the ERS without incident and the Schlumberger logging line was recovered and rigged down. At 0530 hr on 18 August the CORK recovery tool was disengaged for the final time and the ship began offsetting in dynamic positioning (DP) mode to Hole 1027C.

Hole 1027C CORK Recovery and Replacement (Leg 168)

At 1000 hr on 18 August the CORK recovery tool was slipped onto the Hole 1027C CORK head and by 1015 hr engagement of the J-slots with the CORK lugs was verified. Another 3-1/2 hr were spent attempting to recover the CORK without success. Ultimately it was realized that to release this type of CORK another set of lugs further down on the CORK head (below the CORK platform) had to be engaged. The recovery tool deployed was not long enough to reach these latches so the drill string was recovered to the surface while a discussion of options took place. Finally, it was decided that the crew could fabricate the required recovery tool using the existing tool as a starting point, which took 36 hr to complete. A test-fitting jig was built to emulate the 1027C CORK head to be recovered, a section of 20 inch casing was used to extend the length of the tool so it could reach deep enough to engage the lower set of CORK latches, the lower section of the tool was enlarged to the correct inside diameter, and the small reverse cone used to enhance the ability to get over the CORK head was cut down to a 32 inch diameter. Everything had to be welded back together, doubler plates were added for extra strength, and then the tool was fit over the test jig for the final time. The drill string was tripped to the seafloor and at 1200 hr on 20 August the new recovery tool was slipped over the Hole 1027C CORK head. The tool was lowered down through the 48 inch hole in the center of the CORK platform and by 1245 hr the lower latches on the CORK head were engaged with the “modified” recovery tool J-slots. The next 3-1/2 hr were spent trying to pull the CORK but the latching mechanism would not release. Attempts were cycled between allowing the recovery tool to hammer down on the CORK head with 10,000 lbs to exerting an overpull of up to 100,000 lbs, again without success. At 1615 hr the recovery tool was disengaged from the CORK head and the drill string was recovered back to the surface. The VIT/subsea TV was recovered and at 2130 hr on the recovery tool cleared the rotary table, ending operations at Hole 1027C and beginning operations at Hole U1362B. The failed recovery operation changed the direction of shipboard operations as it became clear we could not replace the Hole 1027C CORK. This meant we would likely have time for coring at one or more of the Grizzly Bare alternate sites.

Hole U1362B Drilling and Tracer Injection Test

Once the drill string was recovered, the BHA was changed to a drilling BHA and a new 9-7/8 inch tri-cone drill bit was deployed. Hole U1362B was re-entered for the sixth time at 0423 hr on 21 August. The bit was advanced to bottom taking weight at 172 mbsf. The top drive was picked up at that point and the hole was washed/reamed to a depth of 262 mbsf where the top of the major concentration of cement was contacted. The cement was drilled out and the hole cleaned to the bottom of the 14-3/4 inch hole at 282 mbsf. The hole was then deepened another 57 m to 339 mbsf, 3 m short of the original target depth of 342 mbsf. A 50-barrel sweep of high-viscosity mud was circulated and two successive wiper trips were conducted from the 10-3/4 inch casing shoe to total depth. On the last wiper trip the driller noted some resistance at 310 mbsf but this was easily passed and 6 m of hard fill was noted on bottom. Another 50-barrel mud sweep was circulated and at 1630 hr on 22 August the drill string trip back to the surface began. The seafloor was cleared at 1745 hr and assembly of the injection test BHA began at 2200 hr on 22 August.

SCIENCE RESULTS

Core description, shipboard sampling, and laboratory measurements continued throughout the week. Early in the week a science meeting was held to discuss operations at Hole 1027C. Later in the week, following the failed recovery of the Hole 1027C CORK, a meeting was held to discuss operations at Hole U1362B and possibly the alternate Grizzly Bare sites if time allows. CORK specialists, engineers, and technical staff formulated a plan for the upcoming 24-hr tracer injection experiment, followed by an operations review with ODL staff.

Core description of Hole U1362A cores is now almost complete. A detailed vein log for all cores has been made to document changes in secondary mineral occurrence with depth. Structural measurements are currently being processed to correct relative dips to absolute dips. The dominant structures within this hole are veins and joints. Thin section observations of igneous and metamorphic properties are almost complete. Currently all observations are being summarized and interpreted for the site report.

No new physical properties samples were obtained. As track and thermal conductivity measurements were completed in previous weeks, we have only the finalized *P*-wave and moisture and density (MAD) results to report. *P*-wave velocities were measured on 71 discrete samples, yielding values of 4.3–6.0 km/s, with an average of ~5.4 km/s. This average value is greater than the values obtained during Expedition 301. The lowest velocity was measured on a heavily altered sample. A test of nearby unaltered material yielded much higher velocity, which demonstrates the influence of alteration on *P*-wave velocity. There is no statistically significant velocity trend with depth or velocity anisotropy depending on sample direction.

Moisture and density properties were determined on 73 discrete samples from Hole U1362A. Bulk density ranges from 2.58 to 2.89 g/cm³ with an average of ~2.74 g/cm³. Grain density exhibits a range of 2.66–3.16 g/cm³ with a mean of ~2.88 g/cm³. Porosity values range from 2.76% to 14.2% with a mean of 7.9%. The highest value of porosity was made in a highly altered sample, which also has the lowest velocity. Overall, the data clearly show *P*-wave velocity and porosity to be inversely correlated.

CORK specialists analyzed the temperature data recovered from the loggers recovered with the Hole U1301B CORK instrument string. The data are excellent and provide confirmation that the remedial cementing operation conducted in June–July 2009 during Expedition 321T was successful in sealing the hole. New temperature loggers were deployed in Hole 1027C to obtain a

temperature profile. Geochemists prepared and deployed Osmosamplers on the replacement CORK instrument string.

Remanent magnetization measurements were made on 79 discrete pieces and on portions of 23 core sections. Remanent magnetization measurements were completed for Hole U1362A and the data are being analyzed. Most samples display simple magnetization behavior and the majority have positive inclinations, indicating the magnetization was acquired during a normal polarity period. A few samples display a reverse magnetization, most likely a result of alteration and remagnetization.

OUTREACH

Outreach Officer Jackie Kane led a videoconference with the Toledo (Ohio) Imagination Station, followed by a videoconference with her students at St. Ursula's Academy. A videoconference was also held with a University of Southern California Wrigley Institute science camp and the R/V *Thompson* as it was returning from Juan de Fuca Ridge. ROV activities concluded with morning and night ROV challenges. The outreach team and several scientists participated in a scientific-costume making workshop led by Katie Inderbitzen. The week concluded with the Post-2013 Drilling Program Naming Workshop that was attended by several scientists, outreach officers, technical staff, and ship's crew.

TECHNICAL SUPPORT AND HSE ACTIVITIES

HSE activities: The weekly fire and boat drill were held as scheduled.

Laboratory activities:

Processing of hard rock cores continued. All Hole U1362A sections were measured with the section half multisensor logger. Staff continues to provide support for various science, education and engineering projects. Laboratory projects in progress include the following: section half multisensor logger calibration, whole core multisensor logger software upgrade in user testing, moisture and density/pycnometer software upgrade, and laboratory documentation updates. Minor updates were released for several LIMS applications.