IODP Expedition 327: Juan de Fuca Ridge-Flank Hydrogeology

Week 8 Report (23–29 August 2010)

30 August 2010

OPERATIONS

Hole U1362B Drilling and Tracer Injection Test

The assembly of the injection/flow test bottom-hole assembly (BHA) began at 2200 hr on 22 August. This included a specially made injection sub that had axial circulation slots in the sides and functioned as a carrier for the osmotic samplers, which would be sampling the injectate downhole during the process, and downhole pressure gauges. The BHA length resulted in the bottom of the injection pipe being 13.4 m below the 10-3/4 inch casing shoe into open hole. The drill string was tripped to the seafloor and at 0330 hr on 23 August a pre-injection dry run exercise was conducted to ensure that all parties involved (drill crew, gas injection crew, cementer, and rig floor sampling crew) understood their respective roles and that all equipment was set up properly. Hole U1362B was reentered for the seventh time at 0715 hr. The drill string was run in the hole and began taking weight ~3 m before landing the DQ tool in the 10-3/4 inch casing hanger. The pipe was eventually worked down and the DQ tool was landed. After waiting 1 hr for the hole to equilibrate and establish a baseline starting point, the rig pumps were engaged at a 20 strokes per minute (spm) circulation rate. When pump pressure rose quickly it became apparent that something was not right with the hole or injection system. The drill string was tripped back to the surface clearing the rig floor at 1700 hr. Upon recovery of the injection pipe, a core of drill cuttings, ground up cement, and drilling mud was recovered from the end of the stinger. While this should not have inhibited the injection system it was an indication that the hole was likely packed-off and would have to be opened up before a viable injection test could be conducted. The same bit and drilling BHA used previously was re-assembled and deployed to the seafloor. Hole U1362B was reentered for the eighth time at 0125 hr on 24 August. The drilling assembly was run to bottom without rotation or circulation taking weight at 308 m below seafloor (mbsf). No sign of what may have been plugging the hole was detected. The hole was repeatedly washed, reamed, and swept with high-viscosity mud. Once the hole was felt to be in acceptable condition the drill string was pulled back into the 10-3/4 inch casing string. At 1015 hr on 25 August a 1 hr waiting period commenced to allow the hole to stabilize. This period was followed by another round of wiper trips and hole conditioning because there continued to be spots in the hole that could not be passed without using circulation and/or rotation. The most troublesome spots seemed to be at 353 and 359 mbsf. Ultimately these were cleared and the drilling assembly was recovered back to the surface. At 2100 hr on 25 August the injection BHA was re-assembled. This time the space out was changed to position the lower end of the injection stinger only 3.76 m beyond the 10-3/4 inch casing shoe. The assembly was redeployed to the seafloor and prior to reentry a series of pressure readings were taken at slow circulation rates to provide baseline pressures. Hole U1362B was reentered for the ninth time at 0642 hr on 26 August. This time the injection assembly landed without incident. Once again a 1 hr waiting period started to provide a baseline for the start of the 24 hr injection test. At 0900 hr the injection test started with 20 spm on the rig circulating pumps using sea water as the injected medium. The Vibration Isolated Television (VIT)/subsea TV camera was lowered initially to provide assurance that there was no fluid leaking from the hole. The 24 hr injection test was successfully completed by 1615 hr on 27 August. The injection BHA was recovered back to the ship and the osmotic samplers and downhole pressure data loggers were removed from the injection sub carrier. The 24 hr injection test schedule and tracer types are given below, with SF6 gas injected throughout.

Experiment Hour	Mud Pump (spm)	Cement Pump (spm)	Water Type	Tracer Injected
0:00 – 1:00	20		Salt	
1:00 – 2:00	20		Fresh	
2:00 – 3:00	20		Salt	
3:00 – 3:20	20	30	Salt	Salt (Cs, Er)
3:20 – 19:00	20		Salt	
19:00 – 19:20	20	30	Salt	Salt (Cs, Ho)
19:20 – 20:00	20		Salt	
20:00 – 20:20	20		Fresh	
20:20 – 20:40	20	30	Fresh	Microspheres
20:40 – 21:00	20		Fresh	
21:00 – 21:20	20		Salt	
21:20 – 21:40	20	30	Salt	Bacteria
21:40 – 24:00	20		Salt	

Hole U1362B L-CORK Head Assembly and Deployment

Because having enough open hole was critical to the successful deployment of the L-CORK, a final depth check was conducted using a drilling BHA. At 2130 hr on 27 August Hole U1362B was reentered for the tenth time. The drill string was lowered to a depth of 261 mbsf (inside the 10-3/4 inch casing) and the top drive was picked-up in case it became necessary to wash or ream to bottom. The bit was lowered without rotation or circulation to a depth of 348 mbsf or just 11 m above the total depth of the hole at 359 mbsf. This was below the L-CORK stinger space out depth of 312 mbsf, and the drilling assembly was recovered back to the surface.

At 0530 hr on 28 August preparations started for assembling and deploying the L-CORK in Hole U1362B. The running tool was made up to a 2 m drill collar pup joint and laid out on the rig floor for later use. The bull nose was made up with three 8-1/4 inch perforated and coated drill collars and a single joint of perforated and coated 5-1/2 inch casing along with the required crossover subs. A microbiology miniscreen was installed on the lower end of the 5-1/2 inch casing joint and the umbilical was attached. Three chemistry miniscreens were attached to the upper part of the 5-1/2 inch casing joint along with their respective umbilical lines. This was followed by an inflatable packer, a landing collar (for a future internal instrument string having a bottom plug), and a swellable packer set. The only pressure miniscreen was installed on the 4-1/2 inch casing mandrel below the inflatable packer and was connected to the final umbilical. Nineteen joints of 4-1/2 inch casing were made up and the umbilical lines were strapped and secured to the casing using bands. The CORK running tool was made-up to the L-CORK head, the head was made up to the top 4-1/2 inch casing joint, and the umbilicals were terminated. Only a few casing centralizers were installed on the CORK stinger to minimize the potential for hanging up in open hole during deployment. A single 5-1/2 inch centralizer was used to protect the chemistry miniscreens. A single 4-1/2 inch centralizer was installed near the base of the 4-1/2 inch packer mandrel. Two 4-1/2 inch casing centralizers were installed on each 4-1/2 inch casing joint that would remain inside the 10-3/4 inch casing string. The packer inflation hose was installed between the running tool and the L-CORK head, the valves were opened, and after picking up a single transition stand of drill collars, the L-CORK was lowered into the water. The L-CORK was then pulled back to close the valves and secure the valve handles with rubber bands. The L-CORK assembly trip to the seafloor started at 2315 hr on 28 August.

Hole U1362B L-CORK Instrument String Deployment

At 0200 hr on 29 August the drill string was positioned just above the seafloor and preparations began for deploying the instrument string. A ~200 lb sinker bar (wet weight) was assembled with the osmotic sampler sections, temperature data loggers, Spectra rope, and the landing sub. This process, including the trip to the seafloor, required ~4 hr. The wireline trip was made at a very slow speed (15–20 m/min). To avoid the problem experienced at Hole U1362A where the instrument string extended past the end of the L-CORK stinger, the last 20 m of deployment was made very slowly while monitoring the end of the CORK with the VIT camera. This provided the ability to stop the winch operator quickly should anyone see the string protrude beyond the end of the CORK stinger. In that case, the instrument string could have been recovered before latching-in, thus avoiding a drill pipe trip with the L-CORK. This time the space out on the Spectra rope was fine and the instrument string landed without extending past the bull nose on the L-CORK stinger. The perceived latch-in was verified with several hundred pounds of over pull and the GS overshot, equipped with a weakened shear pin, was jarred off after four attempts. The sinker bar string was recovered back to the surface and at 0648 hr Hole U1362B was reentered for the eleventh time. It was then that water was observed flowing from the drill pipe onto the rig floor. This suggested that the landing sub could have been unseated. The drill string was pulled clear of the reentry cone and the sinker bars were deployed once again to engage the pulling neck on the instrument string to verify latching. Again, after applying several hundred pounds of over pull, it appeared that the string was properly latched-in. However, during the jar-off attempt, the wireline gained the weight of the instrument string. Either the string was latched and the jarring caused the latching mechanism to fail or the string was never fully latched in to begin with. The instrument string was recovered back to the surface and inspected. Nothing was noted that would indicate a problem with the latch or the Spectra rope. The landing/latch assembly was changed out just in case there was a tolerance problem or something wrong with the latch assembly that was not readily apparent. At 1030 hr the string was redeployed. This time, however, it was difficult to achieve any over pull. The GS overshot was jarred off once again and the sinker bars were recovered. Subsequent discussions regarding the water pumping action centered on the possibility that there was enough clearance in the latch down mechanism to allow the sub to lift off the seat due to heave-induced pipe surge, allowing water to flow past the small diameter o-ring seal. In fact, latching the top plug is not required to seal the CORK; the latch is intended mainly as a mean to check that the plug is landed. At 1330 hr Hole U1362B was reentered for the twelfth time. The L-CORK assembly was run in the hole without incident and at 1515 hr the CORK head landed in the 10-3/4 inch casing hanger at the right drill string depth measurement. Visual observation confirmed the CORK head was in the correct position and the VIT/subsea TV was recovered back to the surface. The inflatable packers on the CORK string were then inflated with 1000 psi applied for 30 minutes. The VIT/lunar lander and CORK platform were assembled in the moon pool area and at 1800 hr the platform was deployed through the moon pool. The CORK platform was successfully released at 1930 hr, the VIT was recovered, and the deployment slings and lunar lander were rigged down. The VIT was deployed one last time and at 2200 hr confirmation was achieved that the platform was resting on the re-entry cone as designed. At 2217 hr on 29 August the running tool was released, completing the Hole U1362B CORK installation.

SCIENCE RESULTS

Meetings were held to discuss the end-of-cruise schedule, postcruise activities, publication obligations, and the sampling plan for the Grizzly Bare sites.

The final descriptions of shipboard thin sections were completed and were used to verify hand specimen observations. Saponite was confirmed as the most abundant hydrothermal mineral with iron oxyhydroxides and celadonite also present throughout the background alteration and within

veins. These results were combined with visual core descriptions to produce the site report. Results from the shipboard ICP-AES geochemistry data indicate that all the basalts from Hole U1362A are normal depleted MORB and have a similar or the same magmatic source. Analysis of structural measurements indicates that fracture intensity is much greater in the pillow lava units than the sheet flow units.

The Physical Properties and Paleomagnetism site reports were finalized.

Microbiologists collected fluid samples during the 24-hour tracer injection experiment at Hole U1362B and prepared microbial colonization experiments for deployment on the CORK instrument string.

The first 24-hr tracer injection experiment in the history of ocean drilling was conducted prior to the CORK deployment. Fast-sampling reverse osmosis pumps and pressure gauges were run to just below the casing show in the open hole. During the 24-hour pumping and tracer injection test scientists and technicians collected samples of the injectate every 15 min, 30 min, or 1 hr depending on sample type. The schedule and tracer types are given in "Operations" above. The composition of the injected fluid will be analyzed postcruise but the recovered pressure data provide an excellent record of hole conditions during the experiment.

CORK specialists assisted in the assembly and deployment of the CORK stinger and instrument string. The CORK monitors a single basement interval extending from a single set of swellable and inflatable packers positioned just inside the base of the 10-3/4 inch casing to the bottom of the hole (272 to 359 mbsf). Pressure in this interval is monitored via a 1/4 inch stainless steel tubing connected to a miniscreen installed just below the inflatable packers. The intakes of the three 1/2 inch stainless steel fluid sampling lines are all installed in the center of the perforated and coated 5-1/2 inch casing, ~3 m below the packers, providing sampling redundancy. A single 1/2 inch PTFE microbiology sampling line ends in a titanium miniscreen that rests on perforated and coated 5-1/2 inch casing, 7 m below the base of the deepest inflatable packer, just above the perforated collars. The downhole instrument string is comprised of six separate osmosamplers, eight autonomous temperature probes, including two installed in osmosamplers suspended inside the perforated and coated drill collars, and a 200 lb sinker bar.

OUTREACH

The outreach team taped their end-of-cruise interviews for evaluation purposes. Outreach officers and scientists participated in a videoconference with the Harte Research Institute for Gulf of Mexico Studies at Texas A&M, Corpus Christi. Outreach officer Stephanie Keske gave a presentation on computer graphics animation and showed her CORK animation and the entire team presented all the projects they have been working on.

TECHNICAL SUPPORT AND HSE ACTIVITIES

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

Laboratory activities:

Staff continued to provide support for 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. An end-of-cruise schedule was circulated and storage spaces were cleaned.