

IODP Expedition 327: Juan de Fuca Ridge-Flank Hydrogeology

Week 4 Report (26 July–1 August 2010)

2 August 2010

OPERATIONS

Hole U1362B

At 0730 hr on 26 July 2010 the drill string was tripped back to the surface following the 10-3/4 inch casing installation, ending the second stage of operations in Hole U1362A and starting the second stage of operations in Hole U1362B. The drilling bottom-hole assembly (BHA) was assembled for drilling out the cement inside the 16 inch casing and deepening Hole U1362B for the 10-3/4 inch casing string. The drill string was tripped to the bottom and Hole U1362B was re-entered for the third time at 2030 hr 26 July. The bit tagged the top of the cement plug at a depth of 213 m below seafloor (mbsf). By 0100 hr the following morning the cement was drilled out and by 0600 hr the hole had been cleaned out to the original depth of 250 mbsf. Drilling of the 14-3/4 inch diameter hole was completed at 1645 hr on 27 July to a depth of 282 mbsf. This left a 10 m rat hole below the projected 10-3/4 inch casing shoe depth of 272 mbsf. A significant amount of time was spent on hole conditioning including multiple wiper trips and mud sweeps. By 2130 hr on 27 July the hole was considered to be in acceptable condition and the drill string was recovered back to the surface. The bit cleared the rotary table at 0215 hr on 28 July and preparations began on the 10-3/4 inch casing string. The BHA included a 10-3/4 inch casing hanger with a TAM Freecap 10-3/4 in x 14-3/4 in expandable packer designed to seal the annulus between the 10-3/4 and 16 inch casing. The string was terminated with a conventional Texas pattern casing shoe and contained enough casing to place the casing shoe at a depth of 272 mbsf. It should be noted that all casing collars were welded with four 2 inch long tack welds to ensure that none of the joints backed off during subsequent drilling. A caliper measurement of the swellable packer confirmed a 14-3/4 inch outer diameter and the assembly was ready for deployment by 0830 hr on 28 July. The hole was reentered at 1150 hr. The casing was deployed without incident and at 1330 hr the hanger was landed and latch-in verified with 15,000 lbs of overpull. As before, the bottom of the hole was cemented with 40 barrels of cement pre-blended with Cello Flake and a 1.6% by volume calcium chloride accelerator. Because of an earlier than expected pressure spike, suspicions were that the cement either hardened too quickly while still inside the casing or that the formation was sealed with cement preventing any further flow out into the formation. To verify the location of the top of the cement plug we decided to re-enter Hole U1362B with the tri-cone drilling assembly before offsetting the ship back to Hole U1362A. The drilling assembly was tripped to the seafloor and Hole U1362B was reentered for the fourth time at 0320 hr. The bit tagged cement at 173 mbsf suggesting that ~32 barrels (98 m) of cement were inside the casing and 8 barrels (27 m) had exited the casing shoe. The hope was that this cement had gone up the annulus ~27 m or nearly back to the 16 inch casing shoe at the sediment/basement interface. Since this was a significant amount of cement to drill out inside the casing it was decided to do it before the cement hardened any further. This turned out to be a good decision because another 13.25 hr were required to drill out 89 m of fresh cement at an average rate of penetration (ROP) of 6.7 m/hr. Drilling was halted 10 m above the casing shoe because the science party did not want to open up Hole U1362B to seawater circulation this early in the expedition. The drilling assembly was pulled clear of the seafloor at 1905 hr on 29 July, ending the second stage of operations at Hole U1362B.

Hole U1362A

The third stage of operations started with the ship being offset back to Hole U1362A. The drill crew discovered that the port umbilical messenger guideline was badly frayed and 3 hr were spent

to replace it. Hole U1362A was reentered for the sixth time at 0050 hr 30 July. The drill bit was lowered to a depth of 282 mbsf before contacting cement. This was within 2 m of the calculated displacement depth placing the cement exactly where desired. Drilling of the cement plug started at 0230 hr on 30 July and 5 hr later, at 0730 hr, the bit broke through the last of the cement at a depth of 309 mbsf or ~1 m below the 10-3/4 inch casing shoe. Cleaning up the rat hole below the casing shoe to 346 mbsf proved to be a more daunting task. Once again, a significant amount of time was required for hole cleaning and conditioning. This included multiple wiper trips, mud sweeps, and aggressive reaming of several trouble spots. The hole was believed to be in good enough condition for coring by 0200 hr on 31 July, after 18.5 hr of struggling through the same 38 m section. The drilling BHA cleared the rig floor by 0900 hr and preparations began for Rotary Core Barrel (RCB) coring. An RCB roller cone bit with a C-7 cutting structure was made up to a standard bit sub. Three additional drill collars were picked up allowing a 5-stand BHA to be assembled. This placed the top of the 8-1/4 inch control length drill collars at 158.7 m or ~21 m inside the 10-3/4 inch casing at total depth. Thus only slick pipe was in the borehole with the only upset located right at the bit. This technique was successfully used in the past during Expedition 301 to minimize the potential for a stuck drill string. Hole U1362A was re-entered for the seventh time at 1715 hr on 31 July and the first RCB core barrel was deployed at 2215 hr. The preliminary drilling needed to install the casing was designated as a drilled interval, dictating the first RCB core to be identified as Core 2R. This core advanced 6.6 m to a depth of 352.6 mbsf per drill pipe measurements and was on deck at 0535 hr on 1 August. Recovery was 1.99 m for an official recovery percentage of 30.2%. Because of tidal influences the actual advance was closer to 5.5 m, which would yield an unofficial recovery percentage of 36.2%. The ROP was a very slow 1.3 m/hr through this highly altered and minimally fractured basalt. It was anticipated that there would likely be other alternating zones of less altered and more highly fractured rock as the hole progressed deeper. By the end of this week coring had progressed to a depth of 370.2 mbsf with the cutting of Core 5R still underway. Continuous challenges have been encountered throughout the coring process. Effective hole cleaning was a constant problem with successively larger and more frequent high viscosity mud sweeps being employed as well as the use of higher pump strokes while cutting the core. Penetration rates have been variable ranging from <2 m/hr in the more massive altered rock to >4 m/hr in the more friable material. Recovery has been quite variable as well with an overall average of 27.1%.

SCIENCE RESULTS

The petrologists continued their review of legacy cores from Leg 168 and Expedition 301. The physical properties team continued working on instrument calibration. A core flow and sampling meeting was held with the science party, Curator, and Staff Scientist. The CORK specialists continued with their preparations. Cores U1362A-2R to 4R were received on the last day of the week. A preliminary examination of Core 2R suggests it consists of sparsely clinopyroxene or plagioclase-clinopyroxene phyric basalt that is slightly to highly altered with clay and iron oxide veins. Several chilled margins were observed in the core suggesting these are pillow basalts.

The engineering staff completed the plumbing and pressure testing for all CORKs, and pressure tested the straddle packer. Modifications to the L-CORK bulkheads were also completed. A CORK space-out scenario was developed using variable casing lengths to meet the science objectives. Signs indicating valve direction were fabricated on board for all valves and were mounted on the instrument bays. The Logging Staff Scientist and Schlumberger Engineer continued testing and troubleshooting the electronic RS (ERS) tool.

OUTREACH

Outreach activities included a presentation on logging tools and data, lectures on ocean crust formation, petrology, and alteration followed by core descriptions in the lab, a presentation on

recovering CORK data with submersibles, a talk on structural geology, an exercise on sediments and microfossils followed by making smear slides, a talk on heat flow, and a multi-day project on assembling ROVs for use in schools. In addition, all outreach officers are working on individual projects involving curriculum materials and experiments to be used in schools, art, and computer animation.

TECHNICAL SUPPORT AND HSE ACTIVITIES

HSE activities: A helicopter and fire alarm drill was held as scheduled. A safety plan was set up for flame sterilization procedures in the microbiology laboratory. Safety spill gear was sorted and inventoried.

Laboratory activities:

Technical staff continued to provide support for various science, education and engineering projects. Laboratories were prepared for the start of coring operations. Laboratory projects in progress include the following: section half multisensor logger software upgrade, whole core multisensor logger software upgrade in user testing, moisture and density/pycnometer software upgrade, refurbishment of interstitial water squeezers, installation of fiber optic cable to microbiology van, and lab documentation updates. Installation of copier table and thin section/smear slide photography stand and training of staff and scientists were completed.