

IODP Expedition 336: Mid-Atlantic Ridge Microbiology

Week 6 Report (23–29 October 2011)

Science Results

After cementing the 10.75 inch casing in at 60.4 m below seafloor (mbsf), drilling in Hole U1383C proceeded with an RCB bit from 69.5 to 211.6 mbsf. From this 142.1 m long interval, 28.55 m of core was recovered (20.1%). Rocks are glassy to fine-grained basalts with variable phenocryst (plagioclase and olivine) contents. Down to 127 mbsf, core consists of microcrystalline to fine-grained, sparsely plagioclase phyric basalt with abundant glassy margins and numerous intervals of hard interflow limestone. From 127 to 164 mbsf, massive, plagioclase-olivine phyric basalts are developed, which occasionally host limestone (with and without basalt clasts) as fracture fill. Below 164 mbsf, glassy to variolitic to cryptocrystalline basalts (most likely pillow flows) predominate and limestone is largely missing. Each of these three main lithologic units is divided into numerous (between 22 and 48) subunits based on the occurrence of glassy margins. The overall abundance of glass is noticeably greater than in Hole U1382A, and the extent of palagonitization ranges from weak to moderate. Basalts are avescicular to sparsely vesicular and show vesicle fills of clay, carbonate, and Fe-oxyhydroxide. Brownish alteration halos commonly track veins filled with clay and/or carbonate and zeolite. After changing the RCB bit and repairing the heave compensation system, coring resumed in the evening hours of the 29th.

We collected 51 hard rock whole rounds for microbiological analysis. Samples were selected in the core splitting room as quickly as possible after core recovery, following initial discussion with petrologists on sample representation and photographic documentation of the sample before removal from the core liner. When sample volume permitted, samples were preserved for shipboard deep UV scanning, shore-based DNA and RNA analysis, shore-based fluorescence in situ hybridization and cell counting analysis, shipboard culturing and enrichment, shore-based isotopic analysis, and shipboard fluorescent microsphere analysis. At least one, and usually several, microbiological hard rock samples were collected from every core section. Hard rock samples span a range of lithological units, alteration states, presence of chilled margins, and some contain at least one vein/fracture. Additionally, a few recovered plastic bags that held the fluorescent microsphere solutions in the core catcher have been collected as a contamination check in DNA analysis. Examination of the microsphere abundance in/on the recovered samples is ongoing.

Operations

Hole U1383C was initiated last week by (1) installing a re-entry cone and 34.7 m of 16-inch casing and (2) preparing a hole to install 10.75 inch casing by drilling a 14.75-inch hole to 69.5 mbsf (31.2 m below the sediment-basement interface).

This week we continued with operations in Hole U1383C. After completing the drilling and hole conditioning, we retrieve the drill string and the bit was back on board at 0702 hours on 23 October. We assembled 60.41 m of 10.75-inch casing and lowered it to just above the seafloor, pausing about halfway to deploy the camera system. After ~30 minutes of maneuvering, we reentered Hole U1383C at 1626 hours on 23 October. The casing string was landed at 1720 hours and we confirmed it was

latched in with a 20,000 lb overpull. The casing was secured in place by pumping 25 barrels of cement with lost circulation material (Cello-Flake). The casing running tool was released at 1940 hours, the drill string flushed clear of any remaining cement, and we started pulling out of the hole. With the casing running tool at 2336 mbrf, the trip was halted so we could slip and cut 115' of drill line. We also spent two hours replacing a spool valve and repairing a hydraulic line on the 5 inch pipe racker. We then continued retrieving the casing running tool, which was back on board at 0825 hours on 24 October.

We assembled an RCB and bottom-hole assembly, verified the core barrel space out, and lowered this to the seafloor. About halfway down, we paused to deploy the camera system. This reentry only took us ~10 minutes of maneuvering. After we retrieved the camera system, installed the top drive, and spaced out for drilling, we tagged the top of the cement at 43.8 mbsf (~16.6 m above the casing shoe). Once we drilled out the cement and cleaned out the rat hole, we recovered the center bit. We dropped an RCB core barrel and started coring at 0000 hours on 25 October. We cut Cores U1383C-2R through -18R from 69.5 to 211.6 mbsf. After Core 15R, we performed a wiper trip back up to the casing shoe and encountered 20 m of fill getting back to the bottom of the hole. Hole cleaning remained a priority with mud sweeps being performed on average twice during each cored interval. A total of 142.1 m were cored and 28.55 m recovered (20%). Just after starting to cut Core 18R and with 45.8 hours on the bit, the vessel began experiencing high heave. This heave made it almost impossible to keep sufficient weight on bit to keep the bit on bottom, so we circulated cuttings out of the hole with a final mud sweep and pulled the bit out of the hole. This first RCB bit was back on board at 1720 hours on 28 October. It was fortunate that we did not continue coring with this bit as it had experienced bearing failures on all four roller cones.

While we assembled a new RCB bit (C-7) bit and inspected the float valve and support bearing assemblies, we conducted routine rig maintenance. This identified a faulty air cylinder for the locking pin on the motion compensator that had to be repaired. This resulted in 9.25 hours of rig down time. During the repair, we assembled the previous bottom-hole assembly and added 3 more drill collars. We installed a center bit so that the float valve would remain open during the trip allowing the drill string to fill with seawater. At 0630 on 29 October, we started tripping the BHA to the seafloor. The reentry cone was visible as soon as the camera system reached the seafloor and the bit was almost directly over the cone. We reentered Hole U1383C at 1231 on 29 October. We retrieved the camera system and the center bit and lowered the bit to the bottom of the hole while carefully checking the hole for tight spots and fill.

Education and Outreach

Outreach efforts for this expedition have continued through a variety of programs.

Blogs: Current bloggers this week include our onboard education officer Jennifer Magnusson (personal, educator ideas, and a blog for kids) and staff scientist Adam Klaus (operations). Heath Mills continues writing about Mid-Atlantic Ridge microbiology on Texas A&M's georesearch page. Katrina Edwards continues her blog on the Scientific American Expeditions page and the C-DEBI site. Beth Orcutt continues to blog about microbiology on the Adopt-a-Microbe website and Amanda

Haddad continues to provide science content and connect with a special needs audience on the Classroom Connections website.

Videoconferences: Six live ship-to-shore interactive programs were conducted with the following audiences:

- 7th/8th graders in California
- 6th – 8th graders in Illinois
- 7- and 8-year-olds in Spain
- 11th/12th graders in Pennsylvania
- Texas A&M University weekly Geology and Geophysics seminar

Ten interactive events are scheduled for next week.

Social Media: The education officer continues to post daily updates on the JR Facebook page and Twitter account. Updates include links to the blog or other pages on the JR website, photos, videos, operational updates, and classroom activities. Daily math questions continued to be posted. An activity was posted that encourages students to combine math and art to create a model of a re-entry cone and calculate drilling distances to scale.

Adopt-A-Microbe: Week 6 activities (classes created fabric microbe models) were submitted and Week 7 activities (culturing microbes) were assigned. Microbiologist Steffen Leth Jorgensen provided an introduction to *Methanopyrus kandleri*.

Classroom Connection: This week's theme was "Life on board the JR," and students participated in a variety of related activities. These included designing and building a kite, watching videos from the JR website, and an interview with the image specialist, Bill Crawford.

Documentary: The videographers have continued full-time filming and interviewing for their documentary.

Technical support and HSE activities

Science Mission Support: Technical staff provided analytical support for coring operations at Hole U1383C and worked on various maintenance issues around the labs.

Other Technical Activities:

- Continued to assist scientists with DESCLogik;
- Issues with consistent velocity calibrations were finally resolved by changing parameters in the software code;
- Developers continued to work with staff to correct and test upgrades to Sample Master;
- Work continued on 3D camera project: (a) temporary mounting hardware installed for testing system on the section half multisensory logger, (b) coding and testing of software modules in progress

The weekly fire and abandon ship drill was held as scheduled.