

IODP Expedition 336: Mid-Atlantic Ridge Microbiology

Week 5 Report (16–22 October 2011)

Science Results

Installing a multi-level CORK observatory deep into oceanic crust at Site U1383 (NP-2) is our primary objective for the remainder of the expedition. This site is ~5.8 km NE of Hole 395A and Site U1382. Following a jet-in test, we started Hole U1383B (22°48.133'N, 46°03.156'W; 4414 m water depth) by installing a reentry cone with 20 inch casing extending to 34.7 mbsf. We then prepared the hole for 16 inch casing by drilling an 18.5 inch hole to 68 mbsf; the sediment/basement interface is at 53 mbsf. After installing and cementing the 16 inch casing to 54 mbsf, we started to prepare the hole for 10.75 inch casing by drilling a hole into basement with a 14.75 inch tricone bit. We decided to abandon Hole U1383B after this tri-cone bit failed at 89.8 mbsf resulting in large parts of the bit being left in the hole. Although we can't deepen this hole, it remains a viable CORK hole as it has a completely functional reentry cone and casing system with ~35 m of accessible basement.

We plan on installing a multi-level CORK observatory at Site U1383 (NP-2) and sufficient time remains in the expedition. We moved back to the site of the original jet-in test and started Hole U1383C (22°48.123'N, 46°03.166'W). We will use two casing strings instead of three. A reentry cone with 16 inch casing to 34.8 mbsf has already been installed. We have just finished drilling a 14.75 inch hole to 69.5 mbsf for the 10.75 inch casing string. The sediment/basement interface was encountered at 38.3 mbsf. The depth of basement penetration that can be achieved in Hole U1383C and the downhole logging results will determine the ultimate configuration of the CORK observatory.

The scientific party is finishing the Hole U1382A reports.

Operations

The 5th week of Expedition 336 began while tripping out of the hole after reaching a total depth of 68 mbsf in Hole U1383B. After clearing the rotary table with the bit at 0450 hours on 16 October, the casing running tool was picked up and made up to the bottom-hole assembly (BHA) and set back in the derrick. A total of 58.82 m of 16 inch casing, including the casing hanger were assembled. The running tool was made up to the casing and the casing was then run to bottom, pausing only to install the camera system. Hole U1383B was re-entered at 1524 hours after approximately 20 minutes of maneuvering. The casing was then lowered into the open hole until the casing shoe contacted the sediment/basement interface. Initially the casing shoe would not pass the interface, but after an hour of attempts, using rotation, vessel offset and repeated attempts, the shoe passed the basement contact. Unfortunately it was unable to advance to successfully land the casing hanger in the re-entry cone. The final position of the casing shoe was approximately 3 m short of landing. At 1945

hours on 16 October, the 16 inch casing was pulled back to surface, clearing the rotary table at 0315 hours on 17 October. The top two joints of casing were removed and the length of the casing shoe joint was shortened by 5 m. A new casing shoe was welded onto the shoe joint and at 0800 hours the casing was started back into the hole. The running tool was reattached and the casing was once again run back to bottom. The camera system was installed 70 stands into the trip to bottom. At 1537 hours, Hole U1383B was re-entered with the 16 inch casing for the second time. The casing was successfully landed at 1630 hours and then cemented into place with 20 barrels of cement with loss circulation material. The casing running tool was released at 1745 hours and the drill string was circulated out to remove any excess cement from the string. At 1845 hours on 17 October, the drill string was pulled back to surface, stopping only to remove the camera system. The running tool cleared the rotary table at 0130 hours on 18 October and then was de-torqued and laid out.

The next stage of operations involved drilling out approximately 100 m of basement to install 10.75 inch casing. A new bit was made up to the BHA and the drill string was tripped to bottom. At 90 stands into the trip the camera system was installed and run to bottom behind the bit. Just above the seafloor, the trip was suspended to slip and cut 115' of drilling line from the draw works winch. After 15 minutes of maneuvering, Hole U1383B was re-entered at 1210 hours on 18 October. The bit was tripped to near bottom, the top drive picked up and cement was tagged at 49 mbsf which was 5 m above the casing shoe. After 45 minutes of drilling the bit broke free of the cement at 57 mbsf – 3 m below the casing shoe. From 1500 hours on 18 October, through 0515 hours on 19 October drilling proceeded to 89.8 mbsf. At this depth torque increased, RPM became erratic, and penetration rates dropped to zero. A wiper trip was performed from 89.8 mbsf to the 16" casing shoe at 54 mbsf and back to bottom. Attempts to resume drilling were unsuccessful. At 1000 hours, we decided to pull the bit and inspect it at surface. The top drive was set back and the drill string was pulled from the hole. The bit cleared the rotary table at 1750 hours on 19 October and it became immediately apparent why drilling had stalled. Inspection revealed that 2 of the 3 rotary cones and both shanks including bearings and nozzles had broken off the body of the bit. Only one cone remained on the bit – and it too had all the inserts broken off. After discussions with all operations staff on board, it was decided that there was a greater chance of achieving the expedition objectives if a new hole was started rather than trying to salvage Hole U1383B. At 1830 hours construction began on a re-entry cone for Hole U1383C. Because of several factors, we decided to start the new reentry system with 16 inch casing jetted in to a depth of 34.58 m at the same location as the original jet-in test at Hole U1383A.

Assembly of the Hole U1383C reentry cone was completed at 0630 hours on 20 October. It was moved to the moon pool and positioned on the moon pool doors. Thirty-five meters of 16 inch casing was then picked up, landed and latched into the reentry cone. The running tool was then released and the stand set back in the derrick. The stand with the 14.75 inch drill bit was then picked up, followed by another 5 m of

8.25 inch drill collar pup joints to space the bit out to the 16 inch casing shoe. The drill collar stand with the casing running tool was picked up and made up to the BHA and lowered and latched into the 16 inch casing hanger. The remainder of the BHA was assembled and the re-entry system and casing were lowered to just above the seafloor, stopping every thirty stands to fill the drill string. The camera system was installed 90 stands in and run to just above the reentry system. Hole U1383C was spudded at 1900 hours on 20 October. The reentry system was jettied in ~35 m and the casing running tool was released at 2130 hours. The camera system and drill string were then pulled back to surface; the 14.75 inch bit cleared the rotary table at 0545 hours on 21 October. After changing the nozzles on the bit, the drilling BHA was assembled and run back to bottom. The camera system was installed at stand 70 and run to bottom following the bit to the seafloor. At 1130 hours, the vessel began maneuvering and reentered Hole U1383C at 1444 hours. After the top drive was picked up, drilling began at 1635 hours on 21 October. Only 10 minutes after starting to drill, contact was made with basement at 38 mbsf – just 3 m below the 16 inch casing shoe. Basement drilling then commenced at slow penetration rates (0.5 to 2.5 m/hr) and reached a total depth of 69.5 mbsf at 1840 hours on 22 October.

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 and educator ideas) and staff scientist Adam Klaus (operations). Heath Mills is writing about Mid-Atlantic Ridge microbiology on Texas A&M's georesearch page: <http://georesearch.tamu.edu/blogs/microbiology/>. 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: Eight live ship-to-shore interactive programs were conducted with the following audiences: university students from Colorado, Form 8 boys from London, UK, 8th grade students from New Jersey, and 4th and 5th graders from California. Six conferences 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. A video was produced explaining the process of hard rock coring and microbiology sampling.

Adopt-A-Microbe: Week 5 activities (classes explored microbial habitats such as sediment and rock) were submitted and Week 6 activities (creating fabric microbes) were assigned.

Classroom Connection: This week's theme was "Data Collection," and students participated in a variety of related activities. These included creating and administering a survey of the JR scientists and crew, an activity on deep-sea diving vessels, and an interview with and atmospheric microbiologist, Dale Griffin.

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

Technical support and HSE activities

Science Mission Support: Technical staff continue to provide analytical support for materials recovered from Hole U1382A and worked on various projects and maintenance issues around the labs.

Other Technical Activities:

- Completed Hole U1382A hard rock sampling.
- Continued to assist scientists with DESCLogik.
- Issues with consistent velocity calibrations are still unresolved – started looking at source code.
- Developers worked with staff to correct and test Sample Master upgrades.
- Work continued on the 3D camera project, installing encoder repeater to trigger camera.
- Installed new laser engraver software; upgraded workstation to Win7.

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