IODP Atlantis Massif Oceanic Core Complex APL Expedition (340T)
Week 2 Report (20-26 February 2012)

Operations

The second week of Expedition 340T began while transiting to Site U1309. The vessel made remarkable speed, likely attributable to the recently cleaned hull, newly polished propellers and favourable winds and seas. During the transit, the drilling equipment was inspected and tested to insure performance during Expedition 340T operations. The vessel arrived on site at 2230 hours on 20 February, completing the transit with an average speed of 12.4 knots. Prior to the start of logging operations, a pre-site meeting was held with Siem Offshore, IODP staff, the Chief Scientist, and other science staff.

Drill floor operations began immediately after switching from bridge to DP control at 2257 hours. The drilling string was assembled and run to the sea floor. Despite pre-operational checks, the iron roughneck torqueing system failed during the initial pipe trip, but tripping continued using manual tongs and a rope to spin in the drill pipe. The camera system was run to bottom as the pipe trip continued and at 1015 hours on 21 February we began spacing out the bit for re-entry into Hole U1309D. What appeared to be the re-entry cone was identified almost immediately and a re-entry was attempted, but was unsuccessful, primarily because the assumed re-entry cone was in fact a cone-like seafloor structure. A bottom survey was then conducted to locate the re-entry cone at Hole U1309D. It was located and re-entered at 1320 hours on 21 February. After re-entry the logging bit was positioned at 1711 mbrf, below known problem sections in Hole U1309D.

The triple combination logging tool string was rigged up at 1440 hours on 21 February for the first logging run of the expedition. The tool string was run into the hole, recording standard measurements as well as an in situ temperature from surface to 3060 mbrf. The hole was then logged back to surface. At 0050 hours on 22 February the tool string was completely back in the pipe, but unable to pass through the BHA. After working the logging string for more than 4 hours, the decision was made to use the Kinley Cutter to crimp and cut the logging cable. After deploying two crimping systems and a cutter, the cable was cut and retrieved. The camera system was run to the sea bed before the drill bit cleared the re-entry cone at 1410 hours and the tool string was visually observed hanging out the end of the bit. The drill string was then pulled to surface, a stand of the BHA was set back, and the logging tools were then removed from the last drill collar with care. All tools were successfully recovered and it was apparent that both centralizers had been abraded by the formation, likely breaking during pipe re-entry. After rigging down the logging tools, the drill string was tripped back into the hole. The camera system was then deployed, but had to be retrieved for repairs after a light failed. On re-deployment the lighting system failed again. The camera system was again pulled back and an electronics pod was changed. At 0515 hours on 23 February, the camera system was again run to bottom. The vessel was then positioned for re-entry into Hole U1309D, which

occurred at 0705 hours. The drill string was then run into the hole to 1711 mbrf and the camera system retrieved.

A protected species (PS) watch was initiated at 0630 hours on 23 February and the seismic source (a G-Gun parallel cluster of two 250 in^3 air guns) was deployed 7 meters below sea level, in preparation for a vertical seismic profile (VSP) experiment. After 1.5 hr of PS watch and source ramp-up, the Versatile Seismic Imager (VSI) tool string was rigged up at 0815 hours and run into the hole. The first seismic station was established at 1805 mbrf and the VSP experiment began. After a successful first station, the tool string was run to the bottom of the hole to the deepest station at 3016 mbrf. At 3016 mbrf and four successively shallower stations, data indicated that the VSI was not clamping properly. After a period of trouble-shooting, the tool was pulled back to surface, where it was confirmed that the caliper was broken. A second VSI sonde was substituted into the tool string and it was run back into the hole for one hour of logging before sunset. Three stations were completed and VSP operations ended for the day because of darkness. The VSI tool string was pulled back to surface and rigged down by 1910 hours.

The DSI (sonic) tool string was the next planned logging run. Given that it used the same centralizers as the triple combination, a decision was made to only log the deep portion of the hole that had not been logged during Expedition 305. The logging bit was tripped down to 2356 mbrf or 700 mbsf. The pipe trip identified further ledges at 1723 mbrf, 1726 mbrf and 1740 mbrf. The compensator had to be opened up to pass these ledges. At 2200 hours the DSI tool string was rigged up and run into the hole. The tool string started taking weight inside the BHA and could not be run down to the depth of the logging bit. After unsuccessfully working the tool string for an hour to pass the BHA, the tool was pulled back to surface and rigged down at 0330 on 24 February. To address concerns of debris in the pipe, an XCB core barrel was rigged up and run on wireline to verify that the BHA was free and clear to the bit. The DSI tool string was also evaluated and a centralizer was identified as a problem area. The centralizer was modified, allowing the sonic tool to drift the landing seat for the Kinley cutter in the BHA.

While this was going on, the PS watch began again at 0630 hours following the same procedure as on 23 February, and the seismic source was deployed to begin the second day of the VSP experiment. The VSI tool string was rigged up and run into the hole at 0725 hours on 24 February. The VSP experiment continued through the day and was completed prior to sunset. The tool string was then pulled to the surface and rigged down. The logging bit was tripped down to 2356 mbrf or 700 mbsf past the identified ledges at 1723 mbrf, 1726 mbrf and 1740 mbrf. Again, the compensator had to be opened up to pass these ledges.

At 2020 hours, the DSI tool string was rigged up for a second deployment. The tool was successfully run through the BHA, down to 3040 mbrf and back up to the surface with no difficulties. The logging run was concluded at 0435 on 25 February when the tools were rigged down on the drill floor.

The Magnetic Susceptibility Sonde (MSS) tool string was the final logging run in Hole U1309D. The drill pipe was tripped back to 1759 mbrf so that the upper portion of the hole could be logged. The MSS tool is temperature-limited, so the tool string was run into the hole and recorded data from a maximum depth of 2419 mbrf up to the drill pipe. The tool string was run back down and a repeat pass was recorded from 2165 mbrf up to the surface. By 1030 hours, the tools were back on surface and rigged down. The drill string was then pulled clear of the re-entry cone at 1055 hours and spaced out for a bottom survey.

The bottom survey was started from U1309D, moving in an expanding spiral at 5-m increments. It was concluded after 1.5 hours. An attempt was then made to retrieve a sample from a mound-like feature on the sea floor at 30°10.1179′N, 042°07.1118′W. The bit was set down inside the cone-like feature and a modified APC core barrel was lowered by wireline and run into bottom twice to attempt to sample the material inside the feature. Hole U1392A was spudded at 1447 hours, the core barrel was then laid out on the drill floor, and the sample was given to the technicians for processing. The drilling string was then pulled back to the drill floor and the drill collars were secured in the drill collar racks, the upper guide horn was reinstalled and the rig floor was secured for transit at 2030 hours. The thrusters were then raised and a magnetometer survey was started. The week ended with the *JOIDES Resolution* running two crossing magnetometer lines above Site U1309 and preparing to get underway to San Juan, Puerto Rico.

Science Results

During the second week of Expedition 340T, the science party refined the details of the logging program to be carried out at Hole U1309D. Scientists met with ship and IODP staff to discuss the operations plan for Hole U1309D, as well as a short coring program that could follow if time allowed after U1309D logging was completed. The science party also worked to prepare a draft of their methods for the expedition scientific activities.

On 21 February, we arrived at Hole U1309D, a ~1415 m-deep hole into the ocean crust that makes up the domal core of Atlantis Massif. The primary science operation for this expedition is to complete wireline logging of Hole U1309D, in order to document variation in downhole geophysical properties that are hypothesized to reflect zones of lithospheric hydration. Over the course of the week we executed all planned science operations, logging Hole U1309D with four different tool strings.

The first tool string deployed in Hole U1309D was the triple combination, measuring hole size, density, gamma ray, resistivity and borehole fluid temperature. This was the first time this hole had been entered since the conclusion of Expedition 305 operations in February 2005, so the borehole fluid had seven years to reach equilibrium with the surrounding rock formation. The dominant trend in the downhole temperature profile is quasi linear increase with depth, with maximum temperature of ~145°C at 3060

mbrf (1404 mbsf). Gamma ray and resistivity data confirmed repeatability of Expedition 305 data.

The VSI, essentially a downhole three-axis geophone accelerometer, was deployed three times as part of the VSP experiment. One good station was recorded at ~1805 mbrf (149 mbsf), but poor quality (noisy) data at subsequent stations suggested that there was a problem with the VSI caliper arm. The VSI tool string was brought back to the rig floor, where it was confirmed that the caliper had broken. The VSI sonde was replaced, the tool string was run back into the hole, and three good stations were recorded between 1773 and 1742 mbrf (117 and 86 mbsf) before the end of daylight hours on 23 February (a limiting factor for VSP operations). During the final VSI run the following day, stations were recorded with 20-30-m spacing between 3016 and 1832 mbrf (1360 and 176 mbsf). Recorded waveforms are noisy; the exact cause is unknown but likely is due to a combination of factors such as sea conditions, wireline tension, and possibly ship-generated noise.

The sonic tool string, including the Dipole Sonic Imager (DSI) and General Purpose Inclinometer Tool (GPIT), was deployed twice in Hole U1309D. The first deployment was unsuccessful because the tool string could not pass below the BHA. One of the centralizers that keep the tool oriented in the center of the borehole was not able to close completely to pass through the landing seat in the BHA. Debris from working the pipe through tight spots as it tripped down to logging depth may also have contributed to the clearance problem. The second deployment, carried out after modifying the centralizer, was successful. A full set of sonic data was obtained, including borehole compressional, shear, and Stoneley wave slowness (the reciprocal of velocity) from 2356 to 3040 mbrf (700 to 1384 mbsf).

The final tool string run in Hole U1309D included the deep-reading sensor of the MSS. The MSS provides a measure of the magnetic susceptibility of the borehole, which depends on the concentration and composition of magnetic minerals in the wallrock. This tool string is temperature-limited, so the logging run sampled only the cooler, upper interval of the hole down to 2419 mbrf (763 mbsf). A 200-m repeat pass was also run, to check repeatability in the measurements. Magnetic susceptibility was measured on core recovered from Site U1309 during Expeditions 304/305; the MSS log shows similar features, suggesting the measurement is a reliable one.

Following the successful conclusion of logging operations, a short camera survey was carried out in the vicinity of Hole U1309D. The survey was designed as a 5-m expanding spiral centered at Hole U1309D, in order to document the local seafloor environment. Following the survey, the ship navigated back to a distinctive mound-like feature that was imaged a few meters from Hole U1309D during re-entry and again in the camera survey. Using a modified Advanced Piston Core (APC) core barrel, a sample composed mainly of rock chips was collected near the edge of this mound-like feature, designated Site U1392. Prior to concluding operations and departing for San Juan, a short magnetometer survey, consisting of two lines crossing directly over Hole U1309D, was completed.

Education and Outreach

This week's education and outreach activities included six live broadcasts with classrooms ranging from 4th grade to high school. The Education Officer continued to work with the Imaging Specialist and other staff to film and edit a video documenting the "J/aRt – Art Under Pressure" styrofoam sculptures submerged to ~1650 mbsf during the re-entry of Hole U1309D. The JR Web Portal page and social networks, including Twitter and Facebook, were updated on a daily basis with blog entries, updated ship position, and "Ask A Scientist" Q&A.

Technical Support and HSE Activities

Science Mission Support: The technical staff rigged and deployed the GI cluster seismic source and maintained a Protected Species watch throughout two days of Vertical Seismic Profile (VSP) operations. During the VSP experiment, no protected species were sighted and the seismic source operated without problems. In the labs, staff continued with upgrades, equipment maintenance and verification that analytical systems will be ready for Expedition 340.

Other Technical Activities:

LabView 2011 upgrades continue. Most system have been vetted and found operational.

Issues were found with the power supply to the natural gamma radiation (NGR) multisensor logger's shield detector. Spares have been ordered.

Work continues on the Cold Lab repairs. Installation of furniture continues.

Conference room lights have been removed for repairing paint damage on the interior bezels;

The Bathy 2010 system troubleshooting continues. A power supply was installed but problems continue. Additional memory has been ordered.

Work in the Underway Lab:

- Lights were rewired and problems with extension cables fixed by Siem crew.
- Electrical and data cables were arranged and labeled as necessary.
- A new Trimble GPS was installed and integrated with WinFrog

Work continues on 3D camera project:

- Operational parameters have been established
- Work has begun on laser mounting hardware

Core Storage: installation of the fan coil foundations is complete.

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