

IODP Expedition 340: Lesser Antilles Volcanism and Landslides

Week 5 Report (2-8 April 2012)

OPERATIONS

Week 5 began while drilling a dedicated logging hole, Hole U1399C, at 222 mbsf with a target depth of 240 mbsf. Drilling continued to 240 mbsf and the hole was completed at 0045 hours (UTC-4h) on 2 April. After the completion of the drilling, a 35-barrel mud sweep was pumped and the XCB core barrel was recovered. The XCB core barrel was twisted off at ~2 m above the cutting shoe. Circulation parameters confirmed that the missing section of core barrel was not still in the bit, but had fallen to the bottom of Hole U1399C. The hole was then displaced with 104 barrels of 10.5 ppg mud. The drill string was pulled back to 81 mbsf and knobbies were installed and hung from the blocks. Because of numerous indications of poor drilling conditions, a modified triple combo logging string was assembled and lowered into the hole. The triple combo tool string tagged the bottom of the hole at 235 mbsf. Two successful passes were made with the triple combo before it was pulled from the hole and rigged down. Next the Vertical Seismic Imager (VSI) tool string was assembled and began running in the hole at 1200 hours on 2 April. The required protective species watch was started and following seismic source use protocols, the seismic sources were soft-started and the experiment was begun. The VSI tool string was run to 232 mbsf and the seismic experiment continued from the bottom of the hole to just below the end of the pipe. The VSI tools were then pulled to surface and rigged down around 1930 h. The FMS-sonic tool string was then rigged up, run into the hole to 208 mbsf, and two successful passes were made before it was pulled from the hole. After having some trouble entering the pipe, the tools were at the surface and rigged down at 0600 h on 3 April. We started to retrieve the drill string and with 40 stands of drill pipe remaining, at 0930 h on 3 April, polypropylene line was found wrapped around the drill pipe. The rest of the day was spent removing large amounts of the polypropylene line from the drill string as the pipe was slowly raised. At 1415 h on 4 April, the bottom hole assembly (BHA) was finally secured on the rig floor ending Hole U1399C and Site U1399.

After a 17 nautical mile transit from Site U1399 (CARI-08B) in cruise mode, the vessel arrived at Site U1400 (CARI-07C). The vessel stabilized over Site U1400 (CARI-07C) at 1630 h on 4 April. A seafloor positioning beacon was deployed at 1650 h on 4 April. Hole U1400A was spudded at 0030 h on 5 April. The seafloor depth was calculated from the length of the first core (3.5 m) to be 2756 mbrf (2744 mbsl). We attempted to shoot Core U1400A-2H but it failed to penetrate the formation. After retrieving the core barrel, the piston head was found to be sanded off and stuck. Core orientation was only on the first core and non-magnetic core barrels were used up to Core U1400A-9H. The APC

system was advanced to 51 mbsf (Core U1400A-9H). Except for the first core, all APC piston strokes were partial strokes and the hole was advanced by recovery. At 51 mbsf, the drill string became stuck without circulation and rotation. Keeping within the overpull limits, the string was worked and was eventually freed from the formation and we decided to abandon Hole U1400A. Nine piston cores were taken from 0 to 51 mbsf and recovered 51.80 m (101%). The drill string was then pulled out of the hole and the bit cleared the seafloor at 1445 h on 5 April ending Hole U1400A.

Based on the challenging hole conditions, we decided to move Hole U1400B as far away from Hole U1400A as possible. A new beacon was deployed 250 meters on a heading of 160° from Hole U1400A. However, we decided to maximize beacon-offset capabilities, and the final distance between Holes U1400A and U1400B was 750 meters at a heading of 160°. Hole U1400B was spudded at 1605 h on 5 April. The seafloor depth was calculated from the length of the first core (6.8 m) to be 2758 mbrf (2743 mbsl). APC coring advanced to Core U1400B-28H at 213 mbsf. Twelve partial APC strokes were recorded – most near the top section of the hole. The hole was advanced by recovery. After shooting Core U1400B-28H, we were unable to pull the core barrel to surface. Two wireline runs were made to attempt to free the core barrel. After the second attempt, we abandoned Hole U1400B and retrieved the BHA to free the stuck core barrel. Twenty-eight APC cores were taken from 0 to 213 mbsf and recovered 215.19 m (101%). The drill string was pulled back to the rig floor and the core barrel was extricated from the BHA. A shear pin had managed to become lodged between the landing seat and the core barrel assembly. The landing seat had to be removed from the landing sub and cut off with an acetylene torch. After removing all the coring equipment from the BHA, Hole U1400B ended at 1030 h on 7 April.

We decided a third hole was necessary to fully achieve the science objectives of Site U1400. The vessel was offset another 20 meters at 160° from Hole U1400B. After tripping to bottom, the bit was set at 2751 mbrf. A mud line core was attempted but the bottom section of the non-magnetic core barrel broke off. Since the uppermost 20-25 meters of Hole U1400B had been hard sand, we switched to steel core barrels to make another attempt at a mud line core. Despite our successfully coring the mud line on Hole U1400B, it was a surprise when this second mud line core attempt resulted in a bent core barrel. Since we could not pull the core barrel out of the BHA, the entire drill string had to be tripped back to surface. After the BHA reached the rig floor, it was necessary to remove the bit and bit sub, to cut the steel barrel so that it could be pulled back through the bottom of the BHA.

The BHA was re-assembled, tripped back to just above the seafloor, and we picked up the top drive to spud Hole U1400C at 0950 h on 8 April. The seafloor depth of Hole U1400C was assumed to be the same as at Hole U1400B of 2758 mbrf (2743 mbsl). To penetrate through the problematic seafloor surface, we drilled without coring from 0 to 15

mbsf. APC coring started with Core U1400C-2H at 15 mbsf. APCT-3 temperature measurements were taken on Cores U1400C-5H, -8H and -12H. Core orientation started on Core U1400C-5H and non-magnetic core barrels were used starting with Core U1400C-2H. Due to poor hole conditions, the core orientation tool and the non-magnetic core barrels were not used after Core U1400C-10H. At week's end, APC coring continued with Core U1400C-14H from 112 mbsf.

SCIENCE RESULTS

Week 5 started in the middle of our logging operations on Hole U1399C (CARI-08B), a dedicated logging hole, and ended in the middle of our coring operations on Site U1400 (CARI-07C) west of Martinique.

Logging of Hole U1399C was conducted quite successfully. Not only were we able to run the triple combo and the FMS-sonic tool strings, but we were also able to run the VSP for the planned seismic experiment. The quality of the obtained in situ physical property data (magnetic susceptibility, natural gamma radiation, resistivity, seismic velocity) is generally high. These downhole data will, after a calibration of these data with the material cored, allow us to interpret the parts of the different holes where core recovery was low and derive a more complete lithostratigraphy.

Site U1400 was chosen to characterize debris avalanche emplacement and associated erosional processes. The evolution of the active Montagne Pelée volcano on Martinique is characterized by three major flank collapse events (~ 0.1 Ma, $\sim 25,000$ y, $\sim 9,000$ y), which systematically destroyed the western flank of the volcano. The volume of material displaced by these collapses varies from 2 to 25 km³. The produced debris avalanches traveled into the Grenada Basin. In addition, at 0.3 Ma the Pitons du Carbet volcano experienced a sector-collapse. As interpreted from the seismic profiles obtained during several pre-expedition surveys, this site will penetrate through volcanic and biogenic sediments with thick intercalated chaotic units.

Due to challenging hole conditions, we were not able to reach our depth objective of 510 mbsf at any of the holes at this site. Hole U1400A was abandoned after the drill string became stuck at 51 mbsf. We abandoned Hole U1400B at 213 mbsf after the core barrel became stuck in the BHA. Nonetheless, the core material recovered so far from 0 to 213 mbsf in Holes U1400A and U1400B will allow us to address the main scientific objectives of this site. Generally, this hole is composed of alternating sequences of thick, hemipelagic sediment units and thinner, volcanoclastic sand layers, with interbedded multiple tephra layers. The consolidation stage of the retrieved sediments is much higher than observed at the other sites and the proportion of volcanoclastic sand is much lower. The sediments retrieved at this site show signs of intense deformation throughout the entire cored interval and steeply inclined bedding of the sedimentary layers. This clearly

indicates that we achieved the main coring objective of this site – to retrieve sequences of the chaotic deposit.

In the middle of the week we also held a meeting, during which each of the scientists had the chance to present a refined version of their research plans.

EDUCATION AND OUTREACH

Our education and outreach activities during the fifth week continued with eight live videoconferences, blogging, and daily postings on Facebook and Twitter. Videoconferences were held with schools and colleges in Marseille (France), San Juan (Puerto Rico), Martinique, Florida and Iowa. Besides our Education officer Teresa Greely, a number of expedition scientists participated in the videoconferences, including our Co-Chief Scientist Anne Le Friant as well as Michael Martinez and Nicole Stroncik.

TECHNICAL SUPPORT AND HSE ACTIVITIES

Science Mission Support:

Technical staff remains fully engaged in providing support for coring operations. In addition, staff rigged and deployed the GI cluster seismic source and maintained a Protected Species watch during an entire Vertical Seismic Profile experiment. We had two sightings of protected species (whales) within the exclusion zone. Per protocol, the VSP seismic source operations were suspended and the restart procedures followed after the exclusion zone was cleared.

Other Technical Activities:

- NGR data reduction: As coring permits different experiments were run to refine our edge correction procedure. Preliminary results indicate that the correction coefficient is not only volume dependent but also energy and matrix dependent.
- Technical staff assisted the drill floor crew with the removal of debris entangled on the drill string.

HSE Activities:

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