IODP Expedition 351: Izu Bonin Mariana Arc Origins

Week 3 Report (8–14 June 2014)

Operations

The week began by conducting a seafloor survey (expanding box pattern out to 50 m) using the dynamic positioning console to inspect the seabed. At the outer area of the survey, an acoustic positioning beacon was deployed and the ship was moved back to the original site coordinates. We observed the bit tag the seafloor at 4700.0 mbsl. Thereafter, the subsea camera system was recovered and preparations for coring were made. Hole U1438A was spudded at 1045 h (8 June) and three advanced piston corer (APC) cores were recovered to 26.5 mbsf before terminating the hole (at 1400 h). This hole was intended only to gain additional material for higher resolution sampling of the upper 20 m. The ship was offset 10 m east of Hole U1438A and Hole U1438B was spudded at 1510 h (8 June). Six successful temperature measurements were taken using the APCT-3 tool on Cores U1438B-3H to 7H and Core U1438B-9H at 26.2, 35.7, 45.2, 54.7, 64.2, and 83.2 mbsf, respectively. Oriented APC coring continued in this hole through Core U1438B-19H to 168.9 mbsf. Incomplete strokes on the last two core barrels and 65,000 lbs of overpull indicated that APC refusal had been reached. The non-oriented half-length APC coring system was then used to recover Cores U1438B-20F to 22F (to 180.6 mbsf) before refusal, after which the Extended Core Barrel (XCB) coring system was used. XCB coring (1800 h on 9 June through 0400 h on 10 June) continued until the decision was made to terminate the hole (0525 h on 10 June) in the interest of time. XCB coring ended with Core U1438B-30X (257.3 mbsf). Throughout Hole U1438B, the core quality was excellent and the overall recovery for the hole was 226.54 m (88.1%). The ship was then offset 20 m west of Hole U1438B (and thus 10 m west of U1483A) for the reentry cone jet-in test (Hole U1438C). The hole was spudded at 0705 h (10 June) where controlled jetting reached a depth of 65.0 mbsf in ~2.5 h with no problems. After successfully completing the jet-in test, the bit was pulled clear of the seafloor (1005 h) and Hole U1438C concluded at 0000 h on 11 June. This also marked the beginning of the rotary core barrel (RCB) pilot hole (Hole U1438D). Preparations included making up the RCB bottom hole assembly (BHA) and coring system. The drill string for this hole consisted of a 3-stand BHA (144.62 m), 104 stands of IODP 5 inch premium drill pipe, and 5.5 inch IODP premium drill pipe. Hole U1438D was spudded at 1330 h on 11 June and drilled without coring to 219 mbsf. Coring began with non-magnetic core barrels at 1915 h until Core U1438D-9R (286.7 mbsf) was recovered. At this point, the weather had deteriorated significantly; a forecasted low-pressure system was upgraded to a full-blown tropical storm (“MITAG”) and, with little warning, passed directly over Site U1438. We experienced sustained winds of 40–45 kt, gusting to 60+ kt, and seas of 12–16 ft over 20 ft swell and >2 m heave. As a result, we stopped coring (0400 h on 12 June), secured the rig floor by placing knobby joints at the top of the drill string through the lower guide horn of the ship, and waited for the storm to pass. Fortunately, the storm moved quickly (20–25 kt) so that by 0930 h on 12 June the sea state rapidly settled. RCB coring

resumed at 1045 h and by midnight on 14 June, a depth of 597.1 mbsf was reached with the recovery of Core U1438D-41R.

Science Results

This week the core description group was fully occupied with describing, imaging and summarizing cores from Holes U1438A, U1438B and U1438D. In all, they examined and described 63 cores ranging in lithology from deep-sea mud to volcaniclastic rock. Following the completion of U1438B, they met with other shipboard scientists to synthesize preliminary findings for all of Hole U1438A (U1438A-1H to 3H) and the upper cores of Hole U1438B (U1438B-1H to 3H), and to initiate sampling of these cores. Throughout the week, the core description team improved their classification methodology and the resulting visual core descriptions (VCDs).

The micropaleontology team analyzed the fossil content of core catcher (CC) samples from Holes U1438A, U1438B and U1438D. The foraminiferal, nannofossil and radiolarian content has been patchy. The mudline samples from Holes U1438A and U1438B were barren of planktonic foraminifers, but contained agglutinated foraminifers, diatoms, and a relatively abundant radiolarian assemblage consistent with a water depth below the calcium carbonate compensation depth (CCD).

Core catcher samples from Cores U1438A-1H to 3H were barren of radiolarians and nannofossils, and contained only occasional planktonic foraminifers characteristic of the Pliocene–Pleistocene. Toothpick samples of nannofossils and foraminifers from fossil-rich horizons gave an age of Pliocene–Pleistocene.

In Hole U1438B, core catcher samples were analyzed down to Sample U1438B-30X-CC. Foraminifers and nannofossils were absent through Sample U1438B-17H-CC. From Samples U1438B-18H-CC to 30X-CC, calcareous nannofossil assemblages are persistently present, and can be assigned to Oligocene zones NP25–NP23 (~32–24 Ma). Foraminiferal abundance was patchy and generally low, and some samples resistant to sieving are currently still being processed with kerosene. Both benthic and planktonic species were present in several samples in this interval. The majority of planktonic foraminifers are not age-diagnostic, but some give an age consistent with the Oligocene. Benthic foraminifers are generally typical of bathyal open ocean faunas, and may or may not be transported. From Sample U1438B-2H-CC to about 11H-CC, radiolarians were generally barren with only very rare and poorly preserved specimens observed. They became slightly more abundant and better preserved in Samples U1438B-12H-CC to 15H-CC. The only dated radiolarian record from this interval is a 17.6–15 Ma (Burdigalian-Langhian) radiolarian datum in Sample U1438B-14H-CC. From about sample U1438B-16H-CC to 30X-CC, radiolarians are absent.

In Hole U1438D, radiolarians are generally barren down to Sample U1438D-13R-CC. Calcareous nannofossils are present in approximately half of the samples down to Sample U1438D-33R-CC, and are within Zone NP23 (~32–29 Ma). The majority of foraminifer core catcher samples are still being processed, and some heavily lithified conglomerates cannot be passed through a sieve. However, the sand horizons commonly contain poorly-preserved benthic foraminifers that include shallow water forms presumably transported with the sands. One toothpick sample of sand contained several well-preserved planktonic foraminifers that are long-ranging but consistent with an Oligocene age.

The geochemistry team adjusted to their specific tasks during catwalk sampling, which included samples taken for onboard analysis (headspace gas analysis for hydrocarbon safety monitoring, whole round samples for interstitial water [IW] analysis) and personal samples of ephemeral properties (i.e., microbiology and redox-sensitive metals). Geochemical analyses for Hole U1438A were restricted to hydrocarbon gas safety monitoring from headspace vials. The following geochemical analyses for Holes U1438B were completed: Hydrocarbon gas for safety monitoring, IW, salinity, pH, alkalinity, oxidation-reduction potential (ORP), ammonium, phosphate and chloride titrations as well as Ca, Cl, Mg, K, Na, and S via ion chromatography. Solid phase analyses on squeeze cake aliquots from U1438B were also completed and provided carbonate ($CaCO_3$), total carbon (TC), and total nitrogen (TN) content. Solid phase analyses from routine shipboard samples taken on the working halves are still being processed. Hole U1438D has presented some challenges with extracting IW from well-lithified volcaniclastic sediments; however, IW whole rounds (15 cm) are still being taken and a sizeable quantity of IW has been extracted from Core U1438D-41R (592 mbsf).

The paleomagnetism team has demagnetized and measured the remanent magnetization of samples from Holes U1438A and U1438B, and Hole U1438D through to Section U1438D-17R-6. They performed both continuous measurements with the cryogenic magnetometer and analyses on discrete samples obtained from the working half of the cores. One discrete sample was collected from each section when lithology was represented by fine-grained material (mudstones and siltstones). Mudstone intervals sampled with plastic cubes have been subject to alternating field demagnetization using the D-2000 demagnetizer instrument, and remanent magnetizations measured with the JR6 spinner magnetometer. There is an equipment fault with the D-2000 demagnetizer, however, which is drastically increasing the processing time for discrete samples. Remanence data from Hole U1438B have been processed and filtered up to a depth of ~200 mbsf (Core U1438B-20H) and a magnetostratigraphy has been constructed for the first 50 m of Hole U1438B.

The physical properties group worked on data from Holes U1438A, U1438B, and U1438D, provided input on the APCT-3 acquisition and analyzed the resulting data, and integrated some physical properties with the downhole logging team. The downhole logging team also assisted in running the whole-round track systems as well as measuring *P*-wave velocity (V_P) on split cores. In Hole U1438A, whole-round V_P, magnetic susceptibility, and gamma ray attenuation (GRA), as

well as thermal conductivity were measured. For Hole U1438B, only some physical properties were measured on the whole-round track system. Within the visible mud layers, all physical properties were measured, including V_P when the mud made good contact with the plastic casing. Shear strength was measured through to Section U1438B-20F-1. Below Core U1438B-20F (174 mbsf), the shear vane did not easily penetrate into the sediment. *P*-wave velocity and moisture and density (MAD) were measured in nearly every section of each core from Hole U1438B. However, the V_P *y*-component was not measured, as this part of the tool remained inoperative. Additionally, six temperature measurements within the sediment and one seafloor temperature were made with the APCT-3 temperature tool in Hole U1438B. The data are deemed to be of very high quality. Extensive physical property measurements were made from Cores U1438D-2R to 28R. The V_P data were compared to the pre-existing seismic model and multichannel seismic (MCS) data with the downhole logging team. In preparation for logging, the logging group successfully tested the different tools that will be run in Hole U1438D.

Education and Outreach

This week the education officers have diverged into respective tasks, overlapping on the social media and website duties. We have continued to grow the Facebook (https://www.facebook.com/joidesresolution) audience, with an increase of 88 persons and a 2% increase in "Likes" over the past week. Scientist participation in blogs on the *JOIDES Resolution* outreach website has increased with more interest developing.

The day shift is focused on various video projects (core workflow video and staff interviews) and working with the technical and science staff to more accurately depict the process. Much work was done to obtain updated crew profiles and images to send shoreward and be uploaded via faster internet connection.

There has been an average of one video broadcast per day during the nightshift. Broadcast audiences vary in age levels from middle childhood to adult, while education levels varied from 7th grade to undergraduate/graduate students. Response to the broadcasts has been positive, adjustments have been made based on age level and previous knowledge of the audience. Members of the science party have reached out to shore-based groups and there has been an additional influx of broadcasts.

Technical Support and HSE Activities

The technical group was mainly involved in core handling and flow during the week. The core laboratory was particularly occupied with processing cores and sampling of Hole U1438A and U1438B-1H to 3H. Specific activities of the laboratories and support groups included:

Underway Geophysics laboratory

- In preparation for running the versatile seismic imager (VSI) in Hole U1438D, the acoustic guns were set up.

Thin section laboratory

- The first requests from the science party (~10) were received and the thin sections made. The work is ongoing.

Marine Computer Specialists (MCS)

- The server (ETNA) is now back online and functioning properly.
- There is ongoing troubleshooting with the Section Half Imaging Logger (SHIL).

Application developers

- Assisted with the recovery of the after-effects generated by malfunctioning of the servers ETNA, which went down, and PICO not picking up properly.
- Performed daily Drill Report repairs.
- Participated in the design and implementation of LIMS on-line reporting environment (LORE), which is a framework for making report writing easier.
- Redistributed LIMS data editor (LIME), a browser-based editing tool, so that the application is consistent between the ship and on shore.
- Assisting in the ongoing troubleshooting of the SHIL.

Health and Safety Activities

- A boat and fire drill took place at 1030 h on June 14.