

IODP Expedition 351: Izu Bonin Mariana Arc Origins

Week 4 Report (15–21 June 2014)

Operations

Rotary core barrel (RCB) coring in Hole U1438D continued to a total depth of 897.8 mbsf. Non-magnetic core barrels were used throughout the coring operation. We drilled the upper 219.0 m without coring as the uppermost section was cored in previous holes at this site. RCB coring then penetrated 678.80 m of section and recovered 523.62 m (77%). Penetration rates for this hole were fast and consistent. The hole was surprisingly stable with no fill on connections, overpull, or drag. As a result, no wiper trips were required and we also decided to use only a single 10.75 inch casing string for the reentry installation at our next hole (U1438E).

After RCB coring in Hole U1438D ended at 1615 h on 17 June the hole was swept and displaced with heavy mud (314 barrels of 10.5 ppg barite) in preparation for wireline logging. The bit was raised to ~304.19 mbsf and we deployed a free fall funnel (FFF) to provide the potential for deeper coring in Hole U1438D if the subsequent reentry of Hole U1438E encountered problems. The subsea camera system was deployed (0120 h on 18 June) to observe the bit being pulled through the FFF and clearing the seafloor. The ship offset 20 m to the north of Hole U1438D and the mechanical bit release (MBR) was activated, dropping the bit onto the seafloor. We moved back to Hole U1438D and started reentry operations (0600 h on 18 June); however, this operation was made more complex because the FFF was obscured by borehole cuttings. After 5 h of attempted reentry, efforts were suspended to pick up the top drive to allow for rotation and circulation. While picking up the top drive, we lost the picture from the black and white long-range camera on the subsea camera system. This camera is critical for reentry so the system was recovered for troubleshooting and the camera was replaced (all of the fiber optic cables were functioning properly). At 1845 h on 18 June, the subsea camera system was deployed again, and at 2130 h the reentry maneuvering began. Within 15 min, the bit reentered Hole U1438D and then the end of the drill string was lowered to 94.87 mbsf.

The camera system was recovered (0245 h on 19 June) and wireline logging preparations began. At 0355 h, the first wireline logging run (triple-combo and the magnetic susceptibility sonde [MSS]) was deployed and it reached ~314 mbsf. The tool string failed to pass this point and the borehole obstruction was attributed to a likely ledge formed during the hours the drill pipe spent heaving in the hole during the FFF and subsea camera system deployments. Logging data was collected from ~314 mbsf up to the end of the drill string, then we recovered the logging tool string. We lowered the end of the drill string down to ~330 mbsf and attempted to log again below the borehole obstruction. This time the logging tool string could not pass below 368 mbsf, so we decided to retrieve the logging tool string and finish Hole U1438D operations. While pulling the drill pipe out of the hole, significant overpull was encountered, but after 2 h (2030–2230 h on 19 June) the pipe was worked free. The drill string was pulled clear of the seafloor at

0040 h on 20 June and Hole U1438D officially ended when the end of the pipe arrived back on the rig floor at 1130 h on 20 June. To achieve our deep-penetration coring objectives, our next operation is to install a reentry cone and casing system in Hole U1438E. The rest of the week consisted of assembling a reentry cone with 16 inch casing and lowering it to the seafloor. Hole U1438E was spudded at 1415 h on 21 June. The reentry cone and casing assembly was jetted in to 60.1 mbsf. The jet-in operation went smoothly and the reentry cone mud skirt was at the mudline by 1800 h on 21 June. As of midnight Saturday (21 June), the drill string was being recovered to change the reentry cone jetting bottom-hole assembly (BHA) to a drilling BHA.

Science Results

At the beginning of the week, the core description group scanned, examined, described, and recorded core characteristics from Cores U1438D-34R through 72R (565–897.8 mbsf). The lower part of Hole U1438D yielded more tuffaceous mudstones, siltstones, sandstones, and volcanic breccia conglomerates, with two intervals having interesting alteration: an alternating dark red-brown and grey-green sequence (700–770 mbsf), possibly reflecting varying oxidizing and reducing conditions within the rocks. A deep green pervasive alteration, affecting the finer-grained lithologies, was found together with increasing deformation features in the lowermost section of Hole U1438D. Late in the week, the team worked on summary reports. Team members interested in volcanic ash were particularly active, identifying, estimating ages, and sampling volcanic ash horizons in Holes U1438A, U1438B, and U1438D. The team also began synthesizing data for the holes, considering potential unit, sub-unit, and facies divisions.

The micropaleontology team has been analyzing the fossil content of core catcher (CC) samples from Hole U1438D. The foraminifer, nannofossil, and radiolarian content has been patchy. Samples U1438D-33R-CC to 72R-CC have been processed for foraminifers and calcareous nannofossils, and all samples to 47R-CC have been analyzed for foraminifer content. The samples are sands and clays with sparse to barren assemblages predominantly composed of broken and abraded larger benthic foraminifers, probably transported from the photic zone. Occasional well-preserved planktonic foraminifers indicate an Oligocene age, and occasional well-preserved benthic foraminifers indicate a bathyal to abyssal water depth. Of the 39 core catcher samples analyzed for calcareous nannofossils, the majority are barren. However, ~25% of the samples yield abundant and well-preserved assemblages. These ranged from Oligocene zones NP23 and NP22 (~29.62–34.44 Ma) to common and moderately well-preserved assemblages indicative of Eocene zone NP20/19 (~34.44–36.97 Ma). Samples U1438D-2R-CC to U1438D-72R-CC were generally barren of radiolarians, or contained very rare and poorly preserved specimens, which have typically been recrystallized and suffered significant dissolution.

The geochemistry team continued extracting interstitial water (IW) from core samples until ~879 mbsf (Core U1438D-71R). All hydrocarbon safety monitoring analyses were completed

with no unusual results. The following IW analyses for Holes U1438B and U1438D are now completed: salinity; pH; alkalinity; oxidation-reduction potential (ORP); ammonium, phosphate, and chloride (via titrations); Ca^{2+} , Cl^- , Mg^{2+} , K^+ , Na^+ and SO_4^{-2} (via ion chromatography); Ca^{2+} , Mg^{2+} , K^+ , Na^+ , Si, Fe^{2+} , Mn, B, Sr (via inductively coupled plasma–atomic emission spectroscopy [ICP-AES]). Solid phase analyses from squeeze cake subsamples of U1438D including carbonate, total and organic carbon, and nitrogen content were also completed. Solid phase analyses on discrete samples taken from the working halves are being processed. IW data were investigated for speciation calculations and the determination of mineral phase saturation indices. During the second half of the week we worked on the summary and report of data collected and analyzed.

The paleomagnetic team completed the analysis of archive half core section data from Hole U1438D, producing a magnetostratigraphy that extends to geomagnetic Chron C12 at the base of the hole. They continued to measure and process SRM data from Hole U1438D, progressively developing a magnetostratigraphy that will hopefully provide additional age control on cores from this hole.

During the week, the physical properties team continued to measure thermal conductivity, P -wave velocity as well as wet and dry masses and volumes of recovered cores from the lower part of the core. P -wave velocity of the cores, as measured with the caliper in the x -direction, ranged widely. With coring completed by the end of the week the team was able to complete all analyses, including the moisture and density (MAD) measurements, for the entirety of Hole U1438D. It also allowed the team to begin looking at the physical property trends as a function of depth as well as the correlation between the physical properties and the core description. The team also consulted with the downhole logging group and assembled a simplified P -wave velocity model for the entirety of Holes U1438B and U1438D for the computation of synthetic seismograms.

Logging operations began on 19 June after coring was completed at Hole U1438D. The plan was to deploy the triple combo (gamma ray, resistivity, porosity, density, magnetic susceptibility), the FMS-sonic (resistivity images and sonic velocity), the Göttigen magnetometer, and the Versatile Seismic Imager (VSI) tool strings. The triple combo was deployed first but could not pass a constriction in the borehole at ~300 mbsf and log data were collected from that depth up to the base of the drill pipe. The triple combo was recovered back on the rig floor and the pipe was lowered to 328 mbsf to help the logging tools pass the borehole obstruction. The triple combo tool string was deployed a second time at 1525 h on 19 June, but the logging tools could not pass another borehole obstruction at ~360 mbsf (i.e., ~40 m below the end of the pipe). We decided to cease logging operations and the logging tool string was recovered. Preliminary assessment of the log data from the first run indicate that the hole diameter varies from 6 inches to greater than 18 inches.

Education and Outreach

Work continued on educational goals for the trip. The first video project installment was completed and science party interviews began. Photographs and video documenting operations of drilling, sampling, and ship life continued to be taken. Broadcasts to outside institutions are ongoing and a request was sent out for additional broadcasts in the upcoming weeks.

Social media engagement continues to stay strong on Facebook (<https://www.facebook.com/joidesresolution>) and Twitter (<https://twitter.com/TheJR>). Page “Likes” increased 0.5% (4,693) while engagement increased 38% over the course of the last week. Level of engagement increased dramatically with over 8,000 page clicks. Post reach has dropped off, but is expected, as initial public excitement appears to be waning. Preparations are underway to begin contests on the JR Facebook page with the drilling of Hole U1438E.

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 from Hole U1438D and the ongoing personal sampling of Hole U1438B. Specific activities of the laboratories and support groups included:

Core laboratory

- The Section Half Multisensor Logger (SHMSL) encountered problems with the lights, which was traced to loose wires. Several core sections had to be rescanned as a result.
- The Section Half Imaging Logger (SHIL) is still occasionally producing 0 kb TIFF files.

Underway geophysics laboratory

- Protected Species training via PowerPoint was given to marine specialists in preparation for seismic source use for conducting a vertical seismic profile.

Application developers

- There was coding for the LIMS On-Line Reporting Environment.
- Build box has been converted to a virtual machine and the physical hardware became a VMware management console.
- Assisted with troubleshooting the SHMSL.
- A functional spare for the SHIL was ensured and swapped in for operational evaluation.
- Continued tracing of DrillReport issues.
- There was another round of data gathering on the servers (Etna/Pico) resource usage.

Miscellaneous

- Several damaged and missing ceiling tiles have been replaced.
- Equipment is being stickered in preparation for export control.

Health and Safety Activities

- Eyewash and safety showers were tested.
- A boat and fire drill is scheduled for June 22.