**IODP Expedition 395: Reykjanes Mantle Convection and Climate**

**Week 7 Report (23–29 July 2023)**

## Operations

Week 7 of IODP Expedition 395 began while attempting to recover the triple combo logging tool string that was stuck at the bottom of Hole U1602E. The drill string, without a bit, was lowered into the hole, and at 0430 h on 23 July, the pipe became stuck at a depth of 742 meters below seafloor (mbsf). After nearly 1.5 h of working the drill string and circulating water, the drill pipe was freed. The hole was cleaned with heavy mud and operations resumed. At 1300 h, the end of the pipe reached the triple combo tool string at a depth of 1079 mbsf. The drill pipe was maneuvered around the tool string, which was then pulled into the pipe. The rig floor crew prepared the rig for pulling up the tools using the core winch line while water continued to be pumped down the pipe using a circulating sub. The tools arrived at the rig floor at 1645 h. The top drive was made up to circulate water and rotate the drill pipe while the triple combo tool string was broken down. After pumping a mud sweep, the drill string was pulled from the hole with the end of the pipe clearing the seafloor at 2135 h. At 0345 h on 24 July the end of the pipe cleared the rig floor. The drill floor was secured for transit and the vessel went into cruise mode at 0409 h, marking the end of operations at Site U1602. At 0423 h the thrusters were secured, and the vessel began the transit to Site U1564.

After completing the 448 nmi transit at 2030 h on 25 July, the thrusters were lowered and the ship was put into dynamic positioning (DP) mode at 2106 h, resuming operations at Site U1564.

The rig crew made up the hydraulic release tool (HRT) casing running stand. The weather was forecasted to deteriorate throughout the day with ~5 m heave, preventing the assembly of the casing and reentry system. The vessel began waiting on weather (WOW) at 0200 h on 26 July.

At 1500 h on 26 July, the Icelandic Coast Guard offshore patrol vessel *Þór* (*Thor*) arrived to deliver severing devices and other supplies. After nearly 2 h, the transfer was postponed due to weather. *Thor* returned the next day at 0823 h for the transfer of severing tools, supplies, and fresh produce. *Thor* pulled alongside the vessel and the portside aft crane was used to transfer six pallets onto the helideck starting at 0902 h. By 0919 h, the transfer was complete, and *Thor* departed at 0925 h.

The rig crew began preparing for the casing installation operations on 27 July immediately following the departure of *Thor*. The mud motor and underreamer assembly were made up and tested. After a successful test, this assembly was racked in the derrick. The rig crew began assembling and welding the casing string to a length of 550 m. The HRT running tool was installed to lower the casing to the mud skirt on the moonpool doors. The running tool was pulled back up to the rig floor. The casing stinger, made up of the drill bit, mud motor,

underreamer, and drill pipe, was run through the casing. The cup packer—a device that prevents cuttings from filling the casing—and the HRT running tool were attached to the stinger and lowered to the moonpool and bolted to the guide base. The reentry cone was then welded to the guide base. At 1200 h on 28 July, the moonpool doors were opened and the guide base with the reentry cone was lowered below the ship. The rig crew began making up the drill string to a depth of 2180 meters below sea level (mbsl). The subsea camera system, along with Niskin water samplers and the Conductivity-Temperature-Depth (CTD) tool, was deployed at 1730 h. At 1800 h the upper guide horn was installed. The top drive was picked up and the bit spaced out to initiate Hole U1564F at 2125 h on 28 July. The casing string was drilled to 550 mbsf and the bit advanced to 553.5 mbsf. The go-devil was pumped down the pipe to release the casing stinger from the reentry system. The drill pipe was pulled up 20 m into the casing to ensure that the underreamer and mud motor entered without issue. The subsea camera system was retrieved, and the drill string was pulled to the surface. The bit cleared the seafloor at 1440 h on 29 July and the rig floor at 2230 h. The week ended while breaking down the reentry installation equipment.

## Science Results

### *Sedimentology*

Core description for Site U1602 was completed the previous week. This week was spent writing and revising reports, preparing presentations, and entering and updating data in GEODESC. Thin sections taken from Site U1602 were described.

### *Petrology*

The alteration team worked on including shipboard energy dispersive X-ray analysis methods and results on Expedition 395C basalt thin sections into the site reports, as well as uploading the data and images associated with these analyses to the LIMS database. The alteration team found having the ability to perform such analyses on board very helpful in better understanding often complicated alteration mineralogy, particularly when identification of these assemblages is limited via observation through transmitted light microscopy.

### *Micropaleonology*

As drilling terminated at Site U1602 and the ship transited back to Site U1564, the micropaleontologists were largely occupied with refining age models, writing up results, and data curation. Samples from Hole U1602E continued to be returned from the freeze-dryer to be washed and readied for study of foraminifers and bolboforms. Calcareous nannofossils constrained the Oligocene/Miocene boundary, but below this only one Oligocene biohorizon, Top *Reticulofenestra umbilicus* (32.02 Ma) at the top of Core U1602E-88R, could be identified due to the absence of *Furcatolithus* species. The bottom of the hole was found to contain a very poorly preserved planktonic foraminifer assemblage of probable late Eocene age. Bolboforms in

Hole U1602E occur mostly in a relatively restricted stratigraphic interval in which one upper Miocene biohorizon was identified.

*Physical Properties*

With all shipboard physical properties measurements completed for Hole U1602E, the physical properties team focused on data cleaning and report writing for Sites U1602 and U1564. The datasets of natural gamma radiation (NGR) and magnetic susceptibility (MS) collected on cores correspond well with the datasets collected from the downhole wireline logging measurements.

*Stratigraphic Correlation*

The stratigraphic correlation team focused on making the splice for Site U1602. They constructed a full splice for the first 170 m core composite depth below seafloor, method A (CCSF-A) using Holes U1602B and U1602D. The splice is further extended with the presence of a few small gaps (estimated to be <1–2 m) until reliable correlation becomes difficult at ~270 m CCSF-A, which is near the base of Hole U1602B.

*Paleomagnetism*

Paleomagnetists remeasured the natural remanent magnetization (NRM) of archive half-core Sections U1564D-51X-3A to 55X-7A. Demagnetization steps of 25 and 30 mT were added, which helped to further remove any drilling overprint and resolve the clarity of inclinations observed in those sections. Overall, about 45 m of core was remeasured on the superconducting rock magnetometer (SRM).

All the discrete samples from Holes U1564D, U1602C, U1602D, and U1602E were run for anhysteretic remanent magnetization (ARM). An ARM field was applied to samples using the D-2000 demagnetizer. Then samples were measured for their intensity in the SRM. After this step, the samples were then demagnetized with an alternating field (AF) using the same steps (0, 5, 10, 15, 20, 25, 30, 40, 50, 60, 80, and 100 mT) as the demagnetization of their NRM. Overall, about 238 discrete cubes were measured for ARM.

Further, isothermal remanent magnetization (IRM) measurements began on discrete samples. Samples were run through the ASC Scientific Impulse Magnetometer (IM-10) at 100, 300, 500, and 1000 mT steps. Samples were measured with the SRM after each applied field. After the 1000 mT step, samples were AF demagnetized and measured at the same steps as the NRM and ARM demagnetizations. Finally, samples had a field of –100 mT applied to them and they were then measured. Overall, IRM measurement have been completed for 44 cubes.

*Geochemistry*

Shipboard sediment analyses continued for samples collected at Site U1602, including inductively coupled plasma–atomic emission spectrometry (ICP-AES). Sediment samples from squeeze cake residue and discrete intervals from the working half of split cores were collected

and measured for wt% total carbon, organic carbon, nitrogen, sulfur, and $CaCO_3$. Discrete samples were also selected from the squeeze cakes for X-ray diffraction analyses of bulk elemental and mineralogical composition.

*Downhole Logging*

The downhole logging team received the Hole U1602E processed datasets from the Borehole Research Group, Lamont-Doherty Earth Observatory. The single downhole logging pass of the triple combo tool string successfully collected a NGR log, spectral gamma logs for uranium, thorium, and potassium, a set of formation resistivity logs, and a MS log. Logging data show seven clear logging units through the sedimentary sequence of Hole U1602E.

## Outreach

The Outreach Officer (OO) focused outreach content on the ship and the technology that supports the science. The OO toured the mudroom and observed the process of a drill line cut and slip. This was turned into an educational video and posted on YouTube. Other processes that were filmed include the making up and testing of the underreamer assembly, as well as the deployment of the reentry cone and the vibration isolated television (VIT) subsea camera system.

*Social Media*

- Facebook: There were 12 posts with 11,000 impressions and four new followers.
- Twitter: There were 32 posts with 61,000 impressions and 45 new followers.
- Instagram: There were nine posts, including five stories, with 3,300 impressions and 16 new followers.
- YouTube: One new video was posted: “Slip and Cut” with 123 views.

*Ship-to-Shore Broadcasts*

- Kochi Core Center, Japan: 30 students participated.

*Expedition Log (blog posts)*

- “The Core Story.”
- “My Journey to the Mudroom.”

*Feedback*

- KCC Tour: “Thank you for your live tour. We enjoyed the tour with detailed explains and relaxed atmosphere. The tour was organized very well. The answers for student’s question were also critical. Thank you very much.”
- About “A Brand-New Mystery” Blog: “Thank you for sharing. Excellent resource of my Physical Geology with Lab students.”

**Technical Support and HSE Activities**

*Laboratory Activities*

- The technical staff finished processing cores and samples from Hole U1602E.
- The end-of-expedition schedule was distributed.
- The SRM temperature alarm went off. The chilled water filter was cleaned, fixing the issue.
- SRM discrete sample offset reporting was different from the actual depth recorded in LIMS. Data files were manually corrected and reuploaded.
- Niskin bottles and the CTD were deployed on two VIT runs. During the first run, one of the weights interfered with the bottom closure of the 5 L Niskin bottle, resulting in no water being collected. The second run was successful. The water was filtered, acidified, and stored according to the sample request.
- The transformer for the muffle furnace and carbon-hydrogen-nitrogen-sulfur analyzer (CHNS) was not working. A burned wire was located and replaced by the Siem Offshore electronics technicians.
- The mixer mill was not working. The motor was taken apart and cleaned; it is now functional.

*Developer/IT Activities*

- Windows updates were installed on all workstations.
- Worked on the code for the iRIS operations module, specifically for hole entry and hole updates. This section was rebuilt, distributed, and tested.
- IODP Launcher applications:
    - About a dozen updated applications were rolled out to shipboard production for broader review and testing. This includes Catwalk Sampling, SampleMaster, MUT, Spreadsheet Uploader, ImageCapture, and MADMax.
    - The application updates were approved for use in the laboratories after testing.
    - The updated SEM Uploader is not working correctly. Until the code is fixed, the application has been rolled back to a previous version.
    - The computer in the Downhole Tools Laboratory will continue to run an older, local copy of the TPfit Loader until the workstation station is free for further evaluation and testing.
    - The Cahn balance is in use again in both the Chemistry Laboratory and in the RadVan. The application no longer crashes.
- GEODESC
    - Thin section descriptions were failing the section offset validation. This was resolved by revising sample records so that the curated length and section offsets agree. This validation issue within DataCapture briefly prevented the publishing of description data for thin section slides.

    - Hole summaries have yet to be generated in GEODESC. The production version of GEODESC presently cannot save entries into the template. Code revisions are in progress and being tested.
- LORE
    - Revisions for the correct sorting of the SRM section, discrete, and JR-6 spinner magnetometer reports were placed on production on the ship.
- IMS
    - Updates were made to the SRM and XSCAN IMS applications.

*HSE Activities*

- The eye wash stations and safety showers were tested.