

IODP Expedition 395C: Reykjanes Mantle Convection and Climate: Crustal Objectives

Week 6 Report (11–17 July 2021)

Operations

During Week 6 of the International Ocean Discovery Program (IODP) Expedition 395C, we continued operations at Site U1562 (proposed Site REYK-3B).

Hole U1562A

The week started with coring operations at Hole U1562A ($60^{\circ}6.3030'N$, $26^{\circ}30.1245'W$; water depth 2003 m below sea level [mbsl]). Cores U1562A-3H to 21H advanced from 11.5 to 192.0 m below seafloor (mbsf) using the advanced piston corer (APC). Core 21H experienced significant overpull and was drilled over with the drill string to release the core barrel. Half-length APC (HLAPC) core barrels were made up and coring continued from Core 22F to 57F (192.0–361.2 mbsf) with 4.7 m long advances. HLAPC refusal was met at Core 57F, which also required the drill string to drill over the core barrel to release it from the sediment. The extended core barrel (XCB) core barrels were made up and coring continued with Cores 58X and 64X (361.2–429.1 mbsf). After coring Core 64X, the XCB cutting shoe was severely damaged and slightly melted, and the base of the core catcher contained basalt. Another core barrel was deployed and Core 65X was advanced to ensure that the bit had reached basement. The bit advanced 0.7 m over an hour and Core 65X contained 0.68 m of basalt, confirming a basement depth of 429.1 mbsf. The final depth of Hole U1562A was 429.8 mbsf. The drill string was pulled from the hole, with the bit reaching the seafloor at 1535 h on 13 July 2021. Hole U1562A ended when the bit reached the rotary table at 1935 h.

All of the full-length APC cores were oriented, and formation temperature measurements using the advanced piston corer temperature tool (APCT-3) were collected for Cores 4H, 7H, 10H, and 13H. Samples for interstitial water (IW), microbiology, micropaleontology, and gas analyses were routinely collected on the catwalk.

A total of 411.04 m of core was recovered over a 429.8 m interval (96%). The average recovery for piston cores was 104% with the APC system and 103% with the HLAPC. The XCB system had an average recovery of 55%.

Hole U1562B

Following the end of Hole U1562A, a rotary core barrel (RCB) bottom-hole assembly (BHA) was made up and the drill string was lowered to the seafloor. The ship was offset 21 m east-southeast of Hole U1562A, and Hole U1562B ($60^{\circ}6.2993'N$, $26^{\circ}30.1026'W$; water depth 2003 mbsl) was spudded at 0320 h on 14 July and advanced without coring to a depth of 408.1 mbsf. The center bit was recovered and an RCB core barrel was deployed. Cores U1562B-

2R to 13R advanced from 408.1 to 474.2 mbsf, recovering 48.65 m of sediment and basalt (55%). The sediment/basement interface was recovered in Core 4R at a depth of 429.0 mbsf. Coring rates drastically sped up from ~2 m/h to over 7 m/h while drilling Core 14R. The driller noted that there was a ~2.5 m long interval that drilled extremely quickly. It was soon revealed that Core 14R recovered 0.6 m of carbonate ooze bracketed by basalt. Coring continued with Cores 15R to 19R advancing from 479.2 to 500.7 mbsf with 47% recovery. While coring Core 19R, the penetration rate dropped to 1 m/h and there was erratic torque on the bit. It was suspected that the drill bit was damaged, and the rig floor crew began pulling the pipe out of the hole. A free-fall funnel (FFF) was deployed at 0220 h on 17 July to allow for the reentry of Hole U1562B. The bit cleared the seafloor at 0312 h and the rotary table at 0708 h. A C-7 RCB coring bit was made up to the BHA and the crew assembled the drill string. The subsea camera was deployed at 1130 h to observe the reentry of Hole U1562B, which occurred at 1450 h. The subsea camera was retrieved and the drill string advanced to 500.7 mbsf. After cleaning the hole with a high-viscosity mud sweep, Core 20R advanced from 500.7 to 503.3 mbsf with 75% core recovery.

Whole-round (WR) samples were routinely collected for postcruise microbiology analysis, and the carbonate ooze in Core 14R was sampled for micropaleontology, microbiology, IW chemistry, and gas analyses.

Science Results

The JRSO technical staff processed the cores and samples in the ship laboratories, following the measurement and sampling plan constructed by the shore-based Expedition 395 Co-Chief Scientists and science party members. Core description, biostratigraphy, and analysis of shipboard data will take place postcruise.

The Science Party held an operations update meeting on 16 July.

Hole U1562A

The sedimentary cores from Hole U1562A were measured using the WR and section half tracks. The WR core measurements included magnetic susceptibility (MS), gamma ray attenuation (GRA) bulk density, *P*-wave velocity, and natural gamma radiation (NGR). The split cores were imaged and measured for thermal conductivity, color reflectance, point magnetic susceptibility, and magnetic properties. Samples for headspace gas, microbiology, IW, and micropaleontology were routinely collected on the catwalk. Carbonate and X-ray diffraction (XRD) samples were subsampled from the IW squeeze cakes. Moisture and density analyses were completed at ~10 m resolution.

The sediments in the uppermost ~250 m (Cores U1562A-1H to 34F) are primarily composed of clay and silt with fine sand beds and dropstones interspersed through the section. The cores are

mostly gray to dark gray, but contain brown and greenish gray intervals as well. Within Core 35F (253.1–257.9 mbsf) is a transition from the overlying gray clay and silt to a lighter gray clay. This core contains notable soft sediment deformation. Cores 36F to 54F (257.8–347.2 mbsf) range from light gray to dark gray clay with bioturbation and discrete intervals of soft sediment deformation. Core 55F (347.1–356.06 mbsf) captures a transition between the overlying clays and silts to a finer grained, carbonate-rich greenish gray sediment with abundant bioturbation that continues to Core 64X. Cores 58X and 60X contain large (~5 cm) basalt clasts. The lithology in Core 64X (419.4–427.82 mbsf) transitions from the greenish gray, bioturbated, fine-grained sediment to a white carbonate ooze. Section 64X-CC and Core 65X (427.4–429.8 mbsf) are composed of dark gray, vesicular to avesicular basalt that contains white to green veins and infilled vesicles. The XCB cores are fractured and disturbed.

Porosity linearly decreases downhole from values ~80% at the top of the section to 63% above the sediment/basement interface. MS and color reflectance records align with color changes in the cores, potentially indicating changes in carbonate content.

Cores were scanned at 2.5 cm resolution using the superconducting rock magnetometer (SRM). The magnetic inclination shows clear intervals of normal and reversed polarity, which will be used to establish the magnetostratigraphy for the site.

Chemistry measurements were made on gas, pore water, and sediment samples. Hydrocarbon gases in Hole U1562A are present in very low concentrations. Methane peaks at 2.61 ppmv at ~223 mbsf. The sediments of the uppermost 150 m of Hole U1562A contain little carbonate, with values ranging from 0.04 to 33 wt%. Within the interval of 150–300 mbsf, carbonate values range from 4 to 65 wt%; below 300 mbsf, values are consistently elevated with a maximum of 78 wt%. Total organic carbon has an average value of 0.59 wt% with a maximum concentration of 5.23 wt% at 413 mbsf. Pore water alkalinity increases downhole from ~2.5 mM at the top of the hole to a maximum value of 7.5 mM at 223 mbsf. Below 223 mbsf, alkalinity decreases to ~3.5 mM above the sediment/basement interface (~427 mbsf).

Hole U1562B

Cores were run through the WR track systems and the section half track systems. The WR core measurements included MS, GRA bulk density, and NGR. The split cores were imaged and measured for *P*-wave velocity, thermal conductivity, color reflectance, point magnetic susceptibility, magnetic properties, and X-ray fluorescence (XRF) using a portable X-ray fluorescence spectrometer (pXRF). WR rock pieces were routinely collected for postcruise microbiology studies and select core pieces were measured using the SRM.

Core U1562B-2R through Section 4R-1 (408.1–428.57 mbsf) contains greenish gray, fine-grained, carbonate-rich, bioturbated sediment. Section 4R-2 through Core 19R (428.57–499.82 mbsf) is composed of dark gray to brown basalt. The basalt displays varying degrees of alteration with infilled vesicles, calcite veins, and staining. Glass rinds are observed on many of

the core pieces. Section 14R-2 (475.54–476.2 mbsf) contains a 0.6 m long interval of nannofossil ooze bracketed by basalt flows, and intercalated carbonate beds are found in Cores 5R, 6R, and 15R to 19R.

The shore-based petrology group provided intervals for inductively coupled plasma–atomic emission spectroscopy (ICP-AES) and thin section samples.

Education and Outreach

This week the Education and Outreach effort spanned several platforms. Shore-based Outreach Officer Jose Cuevas held a shore-to-shore event with Junior Paleo Scholars at the Alf Museum in Claremont, California. A new blog post, written in French and English by Co-Chief Scientist Anne Briais, details what it is like to be a shore-based scientist while their cruise is happening.

Social Media Posts

Social media is spread across three platforms: [Facebook](#), [Twitter](#), and [Instagram](#). The table below summarizes the metrics and impacts of original posts (retweets not included). This includes impressions, which are the number of times a post has been displayed, and engagements, which include likes, shares, and comments.

Social media is a collaborative effort, with many of the Expedition 395 science party and Expedition 395C technical staff engaged in posting original content and sharing posts from the *JOIDES Resolution* accounts.

| Platform | Number of Posts | Impressions | Engagements |
|-----------|-----------------|-------------|-------------|
| Facebook | 24 | 39,163 | 2,141 |
| Twitter | 30 | 119,035 | 3,966 |
| Instagram | 15 | | 900 likes |

Technical Support and HSE Activities

The JRSO technical staff were engaged in laboratory and project activities.

Laboratory Activities

- The technical staff received and processed core from Holes U1562A and U1562B.
- All sampling and measurements were taken by the technical staff.

- The Conductivity-Temperature-Depth (CTD) sonde was deployed at Hole U1562B.
- The configuration and testing of the NaviPac navigation and location software continued.
- Preparations are underway for the end-of-expedition shipments.

IT Support Activities

- The center light of the subsea camera currently is not working. The cables and fibers connecting the light are in good condition, but a communications error is still appearing. We will continue to troubleshoot the issue.
- Windows updates and required patches were deployed to all computers.
- Software updates were deployed to ship computers.
- A local server was established for shipboard updates to Adobe Creative Suite software.

Developer Support Activities

- The QCViewer program has been deployed for viewing and testing.

Health and Safety Activities

- The safety shower and eye wash stations were tested.
- A life boat drill was held on Sunday 11 July.