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

Week 3 Report (20–26 June 2021)

Operations

During Week 3 of the International Ocean Discovery Program (IODP) Expedition 395C, Reykjanes Mantle Convection and Climate: Crustal Objectives, we completed operations at Site U1555 (proposed Site REYK-13A) and began operations at Hole U1554E (proposed Site REYK-6A).

COVID-19 safety protocols were being followed by the shipboard personnel for most of the week. Following 14 d of isolation at sea, these protocols ended at 1000 h on 25 June 2021.

Hole U1555I

After reaching 49 rotating hours on the rotary core barrel (RCB) drill bit, the crew began pulling the drill string out of Hole U1555I (60°13.6897′N, 28°29.9984′W). At 0320 h on 20 June 2021, a free-fall funnel (FFF) was deployed for reentry into the hole. The subsea camera was deployed to observe the placement of the FFF and to ensure that the pipe did not move it out of position when the bit exited the hole. The conductivity, temperature, and depth (CTD) sonde was deployed on the subsea camera frame and collected temperature, pressure, and conductivity measurements of the seawater. The drill bit cleared the seafloor at 0450 h, the subsea camera was retrieved, and the bit cleared the rotary table at 0930 h. After changing the drill bit, the drill string was reassembled and the subsea camera deployed for the reentry of Hole U1555I. The FFF remained in position and the bit reentered Hole U1555I at 1605 h. After recovering the subsea camera, the center bit was dropped and the drill string advanced to 304.8 m below seafloor (mbsf). Mud sweeps were used to clean the hole of debris.

Cores U1555I-27R to 41R were cut from 304.8–376.5 mbsf with 30.9 m of basalt recovered (43%). Core recovery significantly decreased in Cores 38R to 40R with only 10% of the basalt section retrieved. After reaching a depth of 376.5 mbsf, or 200 m into the basement, coring concluded at Hole U1555I on 22 June. A total of 40 RCB cores were recovered from Hole U1555I with 48% core recovery (77% sediment recovery and 45% basalt recovery).

Following coring operations, the borehole was prepared for downhole wireline logging operations. A high-viscosity mud sweep was used to clean the hole of debris. The drill bit was dropped at the bottom of the hole and the drill pipe brought up to 75.6 mbsf. The triple combo logging tool string was assembled and deployed at 1720 h on 22 June. The tool descended to the bottom of the hole and began making its first pass up the hole, but became stuck at 1755 h. After several attempts to pull the tools free using the Schlumberger logging line winch, the decision was made to lower the drill pipe over the tools to clear the obstruction. The drill pipe was lowered and the top of the triple combo was encountered at 183.5 mbsf, ~7 m below the sediment/basement interface. The obstruction was encountered at 225.5 mbsf and the drill pipe

was lowered until the obstruction was pushed past the base of the tool string. At 1015 h on 23 June, the tool string was freed and the rig floor crew began pulling the tools up using the core winch line. At 1400 h, the tools were at the rig floor and were disassembled. The drill pipe was then pulled from the hole, clearing the seafloor at 1700 h and clearing the rotary table at 2015 h. The vessel was secured for transit and the thrusters raised at 2036 h, ending Hole U1555I.

Hole U1554E

Following a 54 nmi transit from Site U1555, the vessel arrived at Site U1554 early on 24 June 2021. Operations at Site U1554 were initially undertaken during Expedition 384 in July 2020. Holes U1554A to U1554D, ranging in depth from 23.5 to 76.0 mbsf, were cored and spliced together. Paleomagnetic data from these cores were used to test and resolve issues with the Icefield MI-5 core orientation tools.

The ship's thrusters were lowered at 0124 h on 24 June and the vessel switched to dynamic positioning mode at 0136 h. The bottom-hole assembly and drill string were made up and run to the seafloor (1870 m below sea level [mbsl]). At 0754 h, Hole U1554E (60°7.5235′N, 26°42.1324′W) was spudded and drilled without recovery to 66.3 mbsf. Coring using the advanced piston corer (APC) progressed from 66.3–218.3 mbsf (Cores U1554E-2H to 17H). The cores expanded upon arrival on the core receiving platform. When taking Core 17H, the core barrel could not be pulled out of the sediment using the core winch line. The barrel was drilled over using the drill string to free the core. Following Core 17H, the extended core barrel (XCB) system was deployed. Cores 18X to 55X were collected to a depth of 586.9 mbsf with 332.65 m of core recovered (90%). The week ended while drilling Core 56X to a depth of 596.6 mbsf.

Formation temperature measurements using the advanced piston corer temperature (APCT-3) tool were collected on Cores 2H, 5H, 8H, and 11H. All APC cores were oriented and collected using nonmagnetic core barrels.

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 Co-Chief Scientists and Expedition Project Manager held a summary meeting for Site U1555 with the Expedition 395 science party on 26 June. We reviewed the site operations, coring results, and some of the datasets collected on board the vessel.

Hole U1555I

With the exception of the uppermost two cores, the Hole U1555I cores consisted of basalt. The cores were run through the whole-round (WR) track systems and the split section half track

systems. The WR core measurements included magnetic susceptibility, gamma ray attenuation bulk density, and natural gamma radiation. The split cores were imaged and measured for *P*-wave velocity, thermal conductivity, color reflectance, point magnetic susceptibility, magnetic properties, and X-ray fluorescence using a portable X-ray fluorescence spectrometer (pXRF). WR rock pieces were routinely collected for postcruise microbiology studies. Select core pieces were scanned using the superconducting rock magnetometer.

The split core images and pXRF data were sent to science party members on shore. Using the images, they selected sampling intervals for thin sections and shipboard inductively coupled plasma–atomic emission spectroscopy measurements. Postcruise analysis of samples obtained from Expedition 384 Hole U1555G showed a downhole trend in the chemical composition of the basalts. The Expedition 395 shipboard pXRF data were compared to the shore-based inductively coupled plasma–mass spectroscopy (ICP-MS) data (1) to see if the trend could be reproduced on board, and (2) to determine if the basement coring depth needed to be extended. The pXRF data did show the same trends as the ICP-MS data and allowed the science party to determine that it is unnecessary to increase the depth of coring.

The basalts display varying degrees of alteration including veins, infilled vesicles, and staining. Glass rinds are observed on some of the core pieces. The formation changes at the very base of the hole to vesicular basalt.

Despite the difficulties with the downhole logging, the triple combo collected data on the way downhole and over the lowermost ~180 m on its first and only pass uphole prior to getting stuck.

Hole U1554E

The sedimentary cores from Hole U1554E were measured using the WR and section half tracks. Additionally, shipboard samples were collected. Headspace gas samples were collected across the entire cored interval to monitor for safety and for postcruise research. Samples for postcruise biostratigraphy were collected from each core catcher. Catwalk sampling for interstitial pore waters and microbiology began at Core 31X (~350 mbsf). The overlying sedimentary section will be sampled for these analyses during Expedition 395 when the section is recored and a sailing science party is available to assist with the measurements. Carbonate and X-ray diffraction samples will be collected from the interstitial water squeeze cakes.

Cores U1554E-2H to 14H contain clay and silt that alternate between dark gray, light gray, and light greenish gray intervals. Cores 15H to 43X are dark gray and do not display the color changes observed in the upper section of the hole. The APC cores display mottling and bioturbation. Dropstones of varying composition are occasionally observed. Foraminifers and biogenic silica can be seen in the split core sections using a hand lens. The cores contain gastropod shells, some of which are pyritized. The XCB cores have prevalent biscuiting from the coring process.

Education and Outreach

This week the Education and Outreach effort spanned multiple media types.

Shore-based education officer, Jose Cuevas, held a shore-to-shore event with the Mote Marine Laboratory in Sarasota, Florida.

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 includes 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	15	35,474	2,493
Twitter	27	101,356	4,036
Instagram	5		354

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 U1555I and U1554E.
- All sampling and measurements were taken by the technical staff.
- The CTD sonde was deployed during Hole U1555I.
- The acid neutralization tank was filled with limestone rock.

IT Support Activities

- The Marine Computer Specialists (MCS) worked on the downhole logging winch feed to RigWatch. Connectivity was established for both the IODP network and the winch controller private subnet for the Schlumberger logging winch management system.
- The MCSs installed computer updates and continued researching replacements for the Mac minis.

Developer Support Activities

- The developer continued to work on the QCViewer project and a new version of the program was deployed for testing.
- An issue was encountered in Sample Master when creating a new site, which was resolved.
- The developer is working with the Imaging Specialist on ideas to update the Image Capture software.

Health and Safety Activities

- The safety shower and eye wash stations were tested.
- A life boat drill was held on Sunday 20 June.