

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

## Week 7 Report (18–24 July 2021)

### Operations

During Week 7 of the International Ocean Discovery Program (IODP) Expedition 395C, Reykjanes Mantle Convection and Climate: Crustal Objectives, we continued operations at Hole U1562B (proposed Site REYK-3B) and Hole U1554F (proposed Site REYK-6A), and began coring at Site U1563 (proposed Site REYK-11A).

#### *Hole U1562B*

The week began with operations at Hole U1562B (60°6.2993'N, 26°30.1026'W). Coring continued with Cores U1562B-21R to 28R advancing from 503.3 to 561.5 m below seafloor (mbsf) at a rate of ~2.5 m/h. Coring operations concluded at Hole U1562B after coring ~132.5 m into the basement section. The final depth of Hole U1562B was 561.5 mbsf. A total of 73.08 m of core was recovered over a 153.4 m cored interval at Hole U1562B (48% recovery). In all, 31 rotary core barrel (RCB) cores were collected from this hole. The average rate of penetration while coring basalt was 2.1 m/h.

Following coring, the rotary shifting tool was run to release the bit into the bottom of the hole in preparation for logging. The drill string was pulled up and the end of the pipe was set at a depth of 89 mbsf. The triple combo logging tool string was made up and deployed at 1755 h on 19 July 2021. After completing two successful passes of the entire hole, the tools were retrieved and reached the rig floor at 2310 h. After the triple combo tool string was laid out, the Formation MicroScanner (FMS)-sonic tool was made up and deployed at 0100 h on 20 July. Following two passes that extended to the base of the hole, the FMS-sonic tool was pulled from the hole and reached the rig floor at 0645 h. The next logging run used the Versatile Seismic Imager (VSI) tool. Protected species observation protocols began at 0730 h and the JRSO technical staff ramped up the air guns starting at 0834 h. The VSI tool was lowered to the base of the hole and a total of four depth stations (420.5, 426, 459.9, and 556.6 mbsf) were completed: two within the basement section, one at the sediment/basement interface, and one in the lowermost sediment. The VSI tool could not be successfully run throughout the sedimentary section due to the wide diameter (>16 inch) of the borehole. Following the VSI run, the air guns were put away and the tool reached the rig floor at 1320 h. The final logging run, using the Ultrasonic Borehole Imager (UBI) tool, began at 1445 h. The UBI made two passes of the basement section, acquiring 360° borehole images. The UBI was recovered at the rig floor at 2130 h. The drill string was pulled out of the hole to a depth of ~1489 m below sea level (mbsl) and the ship began the transit in dynamic positioning (DP) mode to Hole U1554F at 2355 h on 20 July, ending Site U1562.

### *Hole U1554F*

The vessel returned to Hole U1554F (60°7.5136'N, 26°42.1140'W) on 21 July to attempt the completion of VSI logging operations. The ship completed the 6.1 nmi transit in DP mode from Site U1562 to Hole U1554F at 0730 h. The subsea camera was deployed and the drill pipe was lowered to 1836 mbsl. The drill pipe was positioned over the reentry cone and reentered Hole U1554F at 0930 h. The subsea camera was retrieved and the pipe was run to a depth of 68.5 mbsf, within the casing string, in preparation for downhole logging with the VSI tool. At ~1030 h, fog had formed around the vessel and reduced visibility. The vessel waited on the fog to clear and at 1250 h the VSI tool was deployed to the base of the casing string (602 mbsf), the air guns were set in the water, and the protected species observation protocols were initiated. Almost immediately whales were spotted within the exclusion zone, which delayed the start of VSI operations. After two hours of tracking whales in the vicinity of the vessel, foggy conditions reduced visibility, prohibiting the continuation of the protected species observation watch. With the fog forecasted to worsen throughout the evening and into the next day, the planned VSI operations were cancelled at 1600 h in favor of coring at the next site. The VSI tool was pulled from the drill pipe, reaching the rig floor at 1700 h. While retrieving the tool string, visibility briefly improved only to reveal that the whales had come closer to the ship. The drill pipe was pulled out of the hole and the end of the pipe cleared the seafloor at 1840 h and the rig floor at 2210 h. The rig floor was secured for transit and the thrusters were raised. The vessel began the 39 nmi transit to Site U1563 at 2236 h, ending Hole U1554F.

### *Hole U1563A*

The vessel completed the transit to Site U1563 on 22 July. The thrusters were lowered at 0212 h and the ship entered DP mode at 0235 h, marking the start of Site U1563. The advanced piston corer/extended core barrel (APC/XCB) bottom-hole assembly (BHA) was made up and the drill string deployed to 1415.7 mbsl. Hole U1563A (60°11.9985'N, 28°00.0209'W) was spudded at 0800 h. Core U1563A-1H recovered 7.4 m of sediment, placing the seafloor at 1417.8 mbsl. Cores 2H to 16H advanced to 149.9 mbsf, with 105% core recovery. During the collection of Core 16H, the core barrel became detached from the sinker bars and GS overshot tool when the shear pin in the GS overshot tool evidently failed. The sinker bars and GS overshot tool were recovered, the GS overshot tool replaced, and the core barrel retrieved. However, the APC piston rods had twisted while the core barrel was in the BHA and the rods required replacement. Coring continued with Cores 17H to 21H advancing from 149.4 to 197.4 mbsf. APC refusal was reached at Core 21H when, after the core barrel became stuck in the sediment, it required 130,000 lb of overpull to release the barrel from the formation. The half-length APC (HLAPC) was deployed for Cores 22F to 47F (197.4–319.6 mbsf) and was switched out for the XCB coring system as the bit neared the estimated depth of the basement. Core 48X (319.6–326.6 mbsf) recovered the sediment/basement interface and the depth of basement at Hole U1563A was encountered at 326.4 mbsf. Core 49X was deployed to ensure that basement had in fact been reached. The core advanced 1 m, to a final hole depth of 327.6 mbsf, and recovered 0.42 m of basalt. Following Core 49X, the drill string was pulled out of the hole. The bit cleared the seafloor at 0400 h and

the rotary table at 0715 h on 24 July, ending Hole U1563A. A total of 334.98 m of core was recovered from Hole U1563A (102% core recovery).

### *Hole U1563B*

The ship was offset 21 m east of Hole U1563A and the RCB BHA was made up with a C-7 RCB drill bit. The drill string was made up and deployed to 1403 mbsl. Prior to initiating Hole U1563B, 115 ft of drill line was removed as part of regular maintenance. The center bit was lowered into the RCB bit and Hole U1563B (60°11.9946'N, 27°59.9996'W) was spudded at 1605 h on 24 July. By midnight the bit had completed 279 m of the ~300 m drilling advance without core recovery.

## **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 a science summary meeting for Site U1562 on 23 July.

### *Hole U1562B*

Cores were run through the whole-round (WR) and the section half track systems. The WR core measurements included magnetic susceptibility (MS), gamma ray attenuation (GRA) bulk density, and natural gamma radiation (NGR). The split cores were imaged and measured for *P*-wave velocity, thermal conductivity, color reflectance, point MS, 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 superconducting rock magnetometer (SRM). The shore-based petrology group provided intervals for inductively coupled plasma–atomic emission spectroscopy (ICP-AES) and thin section samples.

Cores U1562B-20R to 32R (500.7–559.6 mbsf) are 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 several of the core pieces.

The MS of the uppermost basalt cores (Cores 4R and 5R) is higher than the rest of the cored section. The average MS values of basalts in these two cores are ~400 instrument units (IU) with a maximum value of 1535 IU. The average MS value for Cores 6R to 32R is 124 IU. The average *P*-wave velocity of the basalts is 5400 m/s and the magnetic inclination shows normal polarity.

The downhole logging measurements and borehole images are being processed by the Borehole Group at Lamont-Doherty Earth Observatory.

### *Hole U1563A*

Cores were run through the WR and the section half track systems. The WR core measurements included MS, GRA bulk density, *P*-wave velocity, and NGR. The split cores were imaged and measured for thermal conductivity, color reflectance, point MS, and magnetic properties. Samples were collected on the catwalk for interstitial water (IW) measurements, gas analysis, and postcruise paleontology and microbiology studies. Samples for carbonate and X-ray diffraction (XRD) analyses were collected from the IW squeeze cakes, and samples for moisture and density (MAD) measurements were collected at ~10 m resolution.

The primary lithologies in Hole U1563A are clay and silt with occasional fine sand beds and dropstones. Core U1563A-1H alternates between brown and gray layers and Cores 2H to 44F (7.2–305.5 mbsf) show light gray to dark gray banding. Cores 13H, 17H, and 19H each contain a ~20 cm thick coarse sand bed. Core 40F and the tops of Cores 41F and 43F contain brown, unconsolidated fine sand. Within Core 45F, the lithology transitions to a light gray silt and clay with gray and green mottling. This extends down to Core 47F where there is a sharp transition to yellow to white calcareous ooze. Core 47F contains three large (~3 cm) basalt clasts. The calcareous ooze extends to the basalt basement found in Section 48X-CC. Core 49X is dark gray basalt with intercalated carbonate beds.

The physical properties of the cores reflect changes in their composition. NGR values range from 5 to 32 counts/s from 0 to 212 mbsf, with the exception of a maximum peak of 46 counts/s at 136.7 mbsf. Below 212 mbsf, NGR values decline from ~10 to 5 counts/s as the base of the hole. MS ranges between 15 and 541 IU in the uppermost 280 m of the section. Below 280 mbsf, values are consistently below 100 IU.

Cores 1H to 33F were run through the SRM. The inclination displays clear intervals of normal and reversed polarity, which will allow for the construction of a magnetostratigraphy.

Most of the chemistry measurements are still ongoing, but initial pore water measurements and gas measurements were completed. Methane values in Hole U1563A range from 0 to 2.15 ppmv. Pore water alkalinity increases from ~3 mM at the top of Hole U1563A to a maximum value of 5.8 mM at 210 mbsf, and then decreases to ~2 mM at the base of the hole.

### **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. Jose also hosted a Facebook Live event for the friends and family of the

Filipino crew members. This video provided information on the purpose of the *JOIDES Resolution* and celebrated the role of Filipinos in the maritime industry.

### *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	16	32,213	1,971
Twitter	27	96,857	3,695
Instagram	4		171 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 U1562B and U1563A.
- All sampling and measurements were taken by the technical staff.
- Protected species observation protocols took place during VSI operations at Holes U1554F and U1562B. All whale sightings were documented.
- The G Gun Parallel Cluster was deployed for VSI operations at Holes U1554F and U1562B.
- Preparations are underway for the end-of-expedition shipments.

#### *IT Support Activities*

- The telemetry from the Schlumberger logging winch is now displaying on RigWatch.
- 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.

- The Expedition 396 email and server accounts were created.

*Developer Support Activities*

- The QCViewer program development continued along with bug fixes.

*Health and Safety Activities*

- The safety shower and eye wash stations were tested.
- A life boat drill was held on Sunday 18 July.