

IODP Expedition 390: South Atlantic Transect 1

Week 3 Report (24–30 April 2022)

The third week of International Ocean Discovery Program (IODP) Expedition 390, South Atlantic Transect 1, was spent rotary core barrel (RCB) coring basement material in Hole U1556B.

Operations

From 24 to 27 April 2022, coring continued smoothly in Hole U1556B, from Core U1556B-11R through 28R and a depth of 475.6 meters below seafloor (mbsf). At this point, the RCB bit had 61.0 h of drill time on it, and the decision was made to pull out of the hole, change the bit, and reenter. The bottom-hole assembly and bit cleared the seafloor at 0420 h on 27 April and reached the rig floor at 1335 h. A new C-4 bit with a mechanical bit release was installed on the outer core barrel and all parts were inspected. Pipe was tripped to 4952 meters below rig floor (mbrf), stopping twice to fill stands with seawater and microbial contamination tracer. The subsea camera system was deployed at 0500 h on 28 April to guide reentry into Hole U1556B. We achieved reentry at 0625 h and recovered the subsea camera system through the moonpool.

RCB coring in Hole U1556B resumed at 1130 h on 28 April with Core U1556B-29R, which advanced 8.6 m and recovered 5.61 m (65%). Due to low penetration rates (<3 m/h), the decision was made to take half-length cores through Core 33R. Core 34R advanced a full 9.7 m after penetration rates increased and recovered 6.82 m of material (70%). However, the core catchers were missing teeth and there were gaps in the core liner. During coring of Core 35R, we experienced high pump pressures (>2400 psi) and the core barrel was retrieved so that we could attempt to restore circulation. The deplugger tool was deployed and several mud sweeps were run, which successfully returned circulating pressure to normal coring values. The decision was made to make only half-length advances for the rest of the hole, both to improve recovery and to prevent further damage to the RCB coring system. Overall, Cores U1556B-11R to 41R advanced 208.1 m, from 339.3 to 547.4 mbsf, and recovered 109.47 m of material (53%). Recovery per core varied widely, from 15%–100%.

On 25 April, all shipboard personnel took their final rapid antigen tests for COVID-19, according to the COVID mitigation protocols. All tests were negative. After 14 d since last contact with shore, the COVID mitigation period officially ended at 1135 h on 26 April.

Science Results

The Expedition 390 science party spent Week 3 processing and describing cores from Hole U1556B. During the coring of basalt, scientists conducted a daily discrete shipboard sampling

party in addition to an occasional “pooled” sampling party, to select and generate samples that can form a shared geochemical dataset for representative basalts. Additionally, the Expedition 390 science party held its first science meeting to present results from Holes U1557A and U1557B, the sediment and sediment/basement interface cored during Expedition 390C and described during Expedition 390. Preliminary sedimentary unit boundaries and age models were discussed.

Site U1556

During Week 3 of Expedition 390, we continued RCB drilling in Hole U1556B. Cores U1556B-11R to 41R were recovered, sampled for microbiology, and curated. Whole rounds were analyzed on whole-round track systems, and larger pieces were imaged with the DMT core scanner. After imaging, cores were split into archive and working halves for description, section half track scanning, and collection of discrete shipboard samples.

Petrology

Cores U1556B-8R to 34R were described for igneous and alteration petrology. Core 8R contains sedimentary breccia and hyaloclastite in a limestone matrix. The predominant lithology of Cores 9R to 34R is moderately or sparsely olivine phyric basalt with cryptocrystalline groundmass, emplaced as pillow lava flows. Some intervals, including Cores 26R to 28R, consist of aphyric basalt. Interpillow hyaloclastite is common and contains palagonite, basaltic glass, and calcite precipitated in the void spaces. Veins are the most common fill type, with vesicles and breccia less common. Fresh glass is present in the interiors of large clasts in the hyaloclastite and along chilled margins. Downhole, glass in chilled margins is moderately to highly altered.

Paleomagnetism

Standard cube samples for paleomagnetic analysis were collected from representative basalts recovered from Hole U1556B. Sampling targeted different grades of alteration. Both alternating field demagnetization of the natural remanent magnetization (NRM) and acquisition of isothermal remanent magnetization (IRM) indicate a variety of coercivities for the ferromagnetic phases present in samples, requiring fields up to 190 mT to fully demagnetize NRM. The identity of the contributing ferromagnetic minerals cannot be identified without additional shore-based work. Most samples carry a well-defined single component remanence with normal inclinations (reverse polarity) compatible with the rock age. An additional component of negative inclination was observed in brecciated orange-colored rocks and some apparent oxidized basalt samples that likely represents a component acquired upon alteration. As analyzed samples are saturated or close to saturation at the maximum field applied during IRM acquisition (1.2 T), magnetization of original magnetite-titanomagnetite minerals is suspected. Suitable half-core pieces (greater than ~15–20 cm in length) from the archive halves also have been measured on the superconducting rock magnetometer.

Physical Properties and Downhole Measurements

Physical property measurements were made on basement cores collected during Expedition 390 from Hole U1556B, including natural gamma radiation, gamma ray attenuation bulk density, and magnetic susceptibility (MS). MS typically ranged between 0 to 200 IU but a transient increase to very high values (>250 IU) was observed at ~447.3–447.4 mbsf. 3-D imaging with the DMT core scanner system was conducted on 99 whole-round sections. Color reflectance and point magnetic susceptibility measurements, as well as 2-D images from the Section Half Imaging Logger, were collected from 30 split half-core sections. Discrete measurements allow us not only to characterize the properties of representative altered basalts within the basement interval at this hole, but also to capture targeted information about hyaloclastite- and breccia-dominated units. We collected moisture and density data on 23 discrete samples, triaxial *P*-wave measurements on 26 discrete samples, and made 25 thermal-conductivity measurements. Physical properties of discrete samples vary with lithology. Early analysis indicates that the hyaloclastite samples feature porosities that are a factor of 2×–4× higher than the basalts. *P*-wave velocities correspond to the trends in porosity variation, with fresh basalt having higher values than altered basalt, and hyaloclastites having even lower values.

Geochemistry

Twenty-two discrete quarter-round samples were cut from Cores U1556B-2R to 31R for analysis via X-ray diffraction (XRD), X-ray fluorescence, inductively coupled plasma–atomic emission spectroscopy, and loss on ignition. Sampled intervals included sediments at the sediment/basement interface as well as representative fresh and altered basalts.

Microbiology

During Week 3, the microbiology team collected approximately one sample per 10 m advance (Cores U1556B-11R, 13R, 16R to 25R, 27R to 30R, 32R, 34R, 35R, 37R, 39R, and 41R) for preservation for shore-based analysis. Before processing the whole rounds, they were imaged using the Foldio lightbox/turntable system. All sampling was done within the KOACH system, a portable air filtration unit that creates a particle-free area for low-contamination sampling. Sample handling was conducted using an ethanol-washed steel rock box and chisels. Subsamples from the microbiology whole rounds from these cores were preserved for cell counts and analysis of community DNA, RNA, and lipids during postexpedition research. To test the contamination of drilling fluid, we collected the inner and outer rock chips containing perfluorocarbon tracer (perfluoromethyldecalin [PFMD]) from each whole round. PFMD samples from Core U1556B-2R through 25R were analyzed via gas chromatography/electron capture detection (GC/ECD) and indicated no intrusion of drilling fluid in the majority of samples. Furthermore, we collected drilling fluid at Site U1556B on 24 and 30 April. During postexpedition research, DNA will be extracted from these samples to create a database of potential contaminants for comparison with cored samples.

Education and Outreach

The following outreach activities took place during Week 3.

- Posted two new “Expedition Log” (blog) posts, one video and one text. All blog posts contain an audio reading of each post’s text to increase accessibility. Blog posts are available on the [JOIDES Resolution expedition website](#).
- [Facebook](#): Reached 603 people and added 11 followers.
- [Twitter](#): 15 new tweets posted, 2002 engagements, and 45 new followers.
- [Instagram](#): Nine new posts, reaching 1791 accounts.
- Completed 10 ship-to-shore broadcasts, reaching an audience of ~285 people in two countries (USA and Spain).
- Laura Guertin served as #Guestgrammer on the American Geophysical Union [Instagram](#) account, posting about the expedition. The post reached 2316 additional accounts.

Technical Support and HSE Activities

The following technical support activities took place during Week 3.

Laboratory Activities

- Core Laboratory
 - An acid leak was detected, neutralized, and cleaned up in the cabinet under hood #C8 in the Paleontology Preparation Laboratory. The likeliest source was the spigot on one of the HCl storage carboys; carboys should not be stored with spigots attached.
 - Air flow in all chemical hoods in the Paleontology Preparation and Chemistry Laboratories was verified using smoke candles.
- X-Ray Laboratory
 - The Bruker XRD is operational but needs to be shut down between uses.
 - The Aries XRD is not operational and the vendor is unresponsive.
 - The portable X-ray fluorescence spectrometer (pXRF) issue of failing to recognize and scan discrete powder samples was diagnosed by the vendor as being related to the dimming of the X-ray tube. Samples containing a high proportion of lighter elements are not recognized. The new pXRF will be sent to the ship for Expedition 393.
- Chemistry Laboratory
 - Calibration of the GC/ECD was successful; analysis of the perfluorocarbon microbial contamination tracers is underway.

- Microbiology
 - The pump for the microbial contamination tracer system is being run continuously during drilling at Hole U1556B. Tracer usage rate is approximately 800 mL/d, or ~35 mL/h.

Application Support Activities

- A new version of IODP Launcher was installed on the Thermcon computer, resolving an issue with data uploading.
- The MADMax program was changed to allow multiple measurements of a single sample. This feature should be considered on an expedition-by-expedition basis.
- Issues with the scanning electron microscope workstation were resolved.
- Progress was made on the MUT modularization project, including fixes to MUT on the Paleomagnetism Laboratory KappaBridge.
- Work was conducted on the Sample and Data Request Management (SDRM) and Auther projects.

IT Support Activities

- Supported a remote connection in order to fix ongoing issues with the subsea camera system program.
- Restored the computer host used for the fluorescent plate reader and dissolved oxygen measurements to service.
- Microscopy workstations were given access to Mikrotax.org, and full Internet access was given on two workstations for the duration of this expedition only.
- Distributed DriveMapper for macOS v1.1 to ship network.
- Updated Thunderbird on ship network; documentation updates are ongoing.
- Installed Anaconda 3 2021-11 at the Stratigraphic Correlation workstation.
- Updated SonicWall Firewall application.

HSE Activities

- Emergency shower and eye wash stations were tested.
- Personnel participated in the weekly fire and boat drill on 24 April.
- SIEM Offshore conducted a security drill, including a bomb search exercise, involving JRSO staff.
- The COVID-19 mitigation period ended at 1135 h on 26 April.