

IODP Expedition 390: South Atlantic Transect 1

Week 6 Report (15–21 May 2022)

The sixth week of International Ocean Discovery Program (IODP) Expedition 390, South Atlantic Transect 1, was spent rotary core barrel (RCB) coring and wireline logging basement material in Hole U1557D. After completing these operations, the vessel began the transit to Site U1559.

Operations

Week 6 began with waiting on weather, as high heave conditions required us to pull out of Hole U1557D and trip pipe to a depth of 3327 meters below rig floor (mbrf). Weather conditions improved by 1800 h on 15 May 2022 and we began tripping pipe back to the seafloor. The subsea camera system was deployed at 2130 h to guide reentry into Hole U1557D, with a successful reentry accomplished at 0246 h on 16 May. With the top drive in, we tripped pipe inside the casing to 637.1 meters below seafloor (mbsf). The top drive was then set back to replace the wash pipe. After this repair, we continued coring from 637.1 mbsf with Core U1557D-10R. Cores 10R through 14R advanced 47.6 m to a depth of 684.7 mbsf and recovered 34.47 m of material (72%). All cores were full length, with a mud sweep pumped after every core. Penetration rates were <2.5 m/h. Core 14R was the final core for the site; after its recovery, we began tripping pipe out of the hole to drop the bit on the seafloor and reenter for logging. Additional mud (50 barrels) was pumped during the final mud sweep to prepare the hole for logging. In total, coring in Hole U1557D during Expedition 390 advanced 109.1 m and recovered 71.28 m (65%).

The drill pipe cleared the seafloor at 0025 h on 18 May, and the bit was dropped on the seafloor using the mechanical bit release at 0220 h. The subsea camera system was then deployed through the moonpool to guide reentry into Hole U1557D for logging operations. Reentry occurred at 0437 h, the subsea camera system was recovered, and the end of the drill pipe was positioned at 30 mbsf. The triple combo tool string, including tools for measuring formation density, resistivity, magnetic susceptibility (MS), and the borehole caliper, was deployed at 0919 h and lowered to the hole bottom. Two upward passes covering the basement section of the hole were completed, and then the sediment section of the hole was logged through casing as the tools were pulled back to the surface. The tools were back on deck by 1735 h. We tripped pipe out of the hole and performed a cut and slip of the drilling line before tripping back to surface. By 0644 h on 19 May, the bottom-hole assembly (BHA) had been recovered and laid out, and the thrusters raised and secured. The vessel transitioned into cruise mode from dynamic positioning (DP) mode at 0648 h and began the 600 nmi transit to Site U1559 (proposed site SATL-13A).

The approximately 2 d transit was completed at 1818 h on 21 May. We lowered the ship's thrusters and transitioned from cruise to DP mode at 1849 h. At midnight, the BHA for sediment

coring with the advanced piston corer/extended core barrel system had been made up and we were tripping pipe toward the seafloor in preparation for coring Hole U1559C.

Science Results

Week 6 of the expedition entailed coring of basement material in Hole U1557D, logging of the hole, and transiting to our final site, Site U1559. The science party finished processing and describing cores from Hole U1557D. Scientists conducted daily discrete shipboard sampling parties, in addition to one “pooled” sampling party, to generate samples that can form a shared geochemical dataset for postexpedition research. Scientists presented preliminary data and interpretation from sediments at Site U1556 and basement at Site U1557 in science meetings held on 17 May and 21 May respectively.

Site U1557

Cores U1557D-10R to 14R 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 from Hole U1557D consist of clast-supported sedimentary breccia and contain highly or completely altered basalt clasts with cryptocrystalline groundmass. In most cores, alteration made it difficult to evaluate phenocryst abundance. Downhole, some basalt clasts could be identified as sparsely to moderately plagioclase olivine phyric. Chilled margins are present in some clasts. Downhole, the breccia is increasingly compacted and has less cement. Cores near the hole bottom have sharp alteration fronts that result in color alternations between green and orange. The cores from Hole U1557D are considered a single lithological unit.

Paleomagnetism

Basement Cores U1557D-2R through 14R were measured on the superconducting rock magnetometer. Because these sections are composed of breccias, inclination and declination displayed no consistent trends that would permit polarity interpretations. Paleomagnetic investigation at this site instead consisted of characterizing the magnetic mineral assemblage. We collected ~1 discrete sample per section (13 total) from the largest clasts in the breccia. Anisotropy of magnetic susceptibility (AMS) and bulk susceptibility were measured on all discrete cubes. Likewise, all cubes were alternating field (AF) demagnetized, up to 190 mT.

Acquisition of isothermal remanent magnetization (IRM) and backfield IRM experiments were performed on two representative discrete samples. Unlike other sites recovered during the South Atlantic Transect, the inclinations after 20 mT demagnetization measured from Hole U1557D

are not bimodal, instead displaying a “Gaussian-like” distribution, which suggests that the inclinations at Hole U1557D cover the full spectrum of values from -90° to 90° and cluster around 7° . This is much shallower than the inclination expected for this latitude for a geocentric axial dipole (GAD) ($\pm 49.1^{\circ}$ at 30° S). This large departure from that GAD inclination is likely a function of sampling the large clasts from the sedimentary breccia, which should produce randomly oriented directions if the characteristic remanent magnetization (ChRM) was blocked before clast emplacement. AMS data and the results from a basic procedure known as the “conglomerate test” also plot randomly, supporting the previous observations, which confirms the ChRM has indeed been stable since emplacement. IRM and AF demagnetization data suggest that the ChRM is held by low coercivity and highly oxidized magnetite-like grains.

Physical Properties and Downhole Measurements

Physical properties measurements were made on the remaining RCB-cored basement cores from Hole U1557D. During Week 6, 31 whole-round sections and core catchers from Hole U1557D were run through the track systems for natural gamma radiation (NGR), gamma ray attenuation bulk density, and MS. Section half track measurements were made after cores were split, with 65 sections from Hole U1557D analyzed during Week 6 for color reflectance and point magnetic susceptibility. 2-D images were generated by the Section Half Multisensor Logger. *P*-wave triaxial velocity and moisture and density data were collected from 31 discrete samples. Thermal conductivity measurements were made on eight representative sections of Hole U1557D cores. Cored material is a sedimentary breccia, containing basalt clasts in a cement matrix. The track data and data generated from discrete samples reflect the variable composition of this material but suggest that analyses produced a representative picture.

Downhole wireline logging data was also collected in Hole U1557D, with the basement section as the primary target, given the casing in the sedimentary section. One logging string was run with the triple combo tool string, which collected borehole diameter, NGR, MS, density, and electrical resistivity data. Wireline logging data correspond well with the whole-round track density and NGR data.

Geochemistry

For Hole U1557D, rock samples representative of the freshest portions in each subunit were chosen for loss on ignition and inductively coupled plasma–atomic emission spectroscopy analyses from Cores U1557D-4R to 14R. Samples were powdered and dissolved for bulk major and minor elemental compositions.

Microbiology

The microbiology team collected basement samples at Hole U1557D in Cores U1557D-10R through 14R. The lithology of all samples collected was sedimentary breccia. Before processing the whole rounds, they were imaged using a Foldio lightbox/turntable system. All sampling was done under the KOACH system, a portable air filtration unit that creates a particle-free area for

low-contamination sampling. Samples were processed for preservation for shore-based analysis and incubation experiments. 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 for potential contamination, drilling fluid was collected at Site U1557D on 12 May and 16–17 May. During postexpedition research, DNA will be extracted from these samples to create a database of potential contaminants for comparison with cored samples. During the transit to Site U1559, the microbiology team initiated the Hole U1557D incubation experiments (sulfate reduction rates, stable isotope probing) and prepared for the final sampling of sediment and basement.

Education and Outreach

The following outreach activities took place during Week 6.

- Posted six new “Expedition Log” (blog) posts, two with video and four with text, including educational resources leveraging shipboard data such as wind, weather, and transit information.
- [Facebook](#): Reached 5,388 people and added 40 new followers.
- [Twitter](#): 16 new tweets posted, 1,285 engagements, and 40 new followers.
- [Instagram](#): seven new posts, including two videos, reaching 1,247 accounts; gained 13 new followers. One Outreach Officer was the #GuestGrammer on the American Geophysical Union’s (AGU) Instagram account on 16 May.
- Completed 11 ship-to-shore broadcasts, reaching an audience of 497 people in three countries (USA, Spain, and United Kingdom).

Technical Support and HSE Activities

The following technical support activities took place during Week 6.

Laboratory Activities

- General
 - Siem Offshore and Entier crew participated in laboratory tours hosted by scientists and technical staff.
 - Operations Superintendent provided rig floor tours to scientists and technical staff.
- Core Laboratory
 - Supported processing and sampling of basement cores from Hole U1557D, including shipboard discrete samples for standard analyses and collection of microbiological samples.

- Siem Offshore crew fixed a leak in the catwalk flush system by replacing the waste/air actuator.
- The vibration isolated television (VIT) and IRIS program were not communicating; cycling power to the VIT restored communication.
- JRNAV and JRDataServer were not communicating at the beginning of transit. All applications were rebooted multiple times in order to reestablish communication.
- Fo'c's'le Deck Laboratories
 - The Aeris X-ray Diffractometer is now operational after the vendor remote-connected to the instrument and cleared instrument errors.
 - The vacuum pump in the Thin Section Laboratory was making excessive noise and was serviced.
 - The towed magnetometer was deployed during transit between Sites U1557 and U1559.

Application Support Activities

- Conducted testing on the modularized version of the MUT system.
- Conducted work on the Sample and Data Request Management (SDRM) and Auther projects.
- Worked on additional ongoing projects, including IMS modularization via LDAQ.

IT Support Activities

- Potential NaviPac replacement Starfix was downloaded and is under review.
- Exchange servers and licenses were updated during transit.
- Acronis server was updated and client licenses reapplied.
- CrowdStrike 6.38 was applied to Windows servers and VDUs with macOS Monterey.
- Room Alert Firmware was updated.
- Confluence update was applied.
- Removal of Adobe Flash and Java 8 from workstations continued.
- A pattern of IRIS communication issues with various instrumentation, including the coreline overlay, VIT, and JRDataServer, was observed and will be investigated.

HSE Activities

- Emergency shower and eye wash stations were tested.
- Conducted a wipe test in the Radiation Van.
- Staff and scientists participated in a fire and lifeboat drill.