IODP Expedition 393: South Atlantic Transect 2

Week 2 Report (12–18 June 2022)

Operations

Transit Activities

Week 2 of Expedition 393 began and ended with *JOIDES Resolution* underway to Site U1559 (proposed Site SATL-13A). At the start of 12 June 2022, the ship had completed 96 nmi of the voyage, and by the end of the week it had completed 1578 nmi. Most of the transit was completed at reduced speed due to rough seas and high winds, and at times the heading had to be adjusted. Sea conditions began to improve on 18 June, allowing the ship to increase to full speed for the final two days of the transit. Week 2 ended with the ship traveling at 11.9 kt,135 nmi from Site U1559.

There were two time changes during the transit, with the clocks going back one hour on 14 June and 16 June, placing the vessel in the UTC time zone. During the transit, the rig crew tested the drilling equipment and prepared for coring operations.

Science Results

The science party spent this week preparing procedures and instruments in the laboratories. They also measured and described cores from Holes U1558A and U1560A that had been drilled during Expeditions 390C and 395E, respectively. These included whole-round basement sections of Core U1558A-19X and Cores U1560A-15X and 16X, and archive half sediment Cores U1558A-1H to 18X and U1560A-1H to 14X. The laboratory groups updated and submitted their methods sections for the expedition *Proceedings* volume, based on the methods written by the Expedition 390 science party.

Lithostratigraphy

In Week 2, the sedimentology team made visual core descriptions (VCD) and smear slides for the sediment cores from Holes U1558A and U1560A. Cores U1558A-1H and 2H (0–12.9 meters below sea floor [mbsf]) are dominated by brown to light brown nannofossil-rich clays with occasional common foraminifers. Cores 3H to 13X are rather homogeneous, consisting of pinkish white to light reddish-brown nannofossil ooze with variable quantities of clay. The ooze-to-chalk transition appears at the top of Core 14X (113.5 mbsf), with the sediments below the transition being represented by nannofossil chalk with clay down to Section 18X-5 (157.9 mbsf), where a few thin lenses of volcanic material are observed. The sediment/basement transition occurs in the core catcher of Core 18X at 158.4 msbf. Bioturbation occurs sporadically throughout the core and is predominantly manifested by biogenic mottling. In rare cases,

individual trace fossils could be identified, such as *Zoophycos, Planolites, Thalassinoides, Chondrites,* and *Phycosiphon*. In general, foraminiferal content is <10%, with the exception of the top 50 cm of Core 1H.

Cores U1560A-1H to 5H (0–43.8 mbsf) consist of interbedded pinkish-white to pink nannofossil ooze that has variable amounts of clays and foraminifers. Cores 6H to 11H (43.8–97.5 mbsf) consist of pink nannofossil ooze with clay, interbedded with light brown to brown clayey nannofossil ooze. Cores 11X to 14X (97.5–119.23 mbsf) consist of pink nannofossil ooze with foraminifers interbedded with light brown to brown nannofossil ooze with clay and foraminifers. In the lowermost 20 cm of Section 14X-1, below 119.23 mbsf, just above basement, clay content increases and the sediment is brown clayey nannofossil ooze with foraminifers. Biogenic mottling and individual ichnofossils appear sporadically throughout the hole.

Petrology

The uppermost basement core sections from Holes U1558A and U1560A were imaged, split, and described. Core U1558A-19X (161.5–164.2 mbsf) and Cores U1560A-15X and 16X (120.1–121.4 mbsf) were first scanned on the Deutsche Montan Technologie (DMT) 360° core scanner. These cores consist of basaltic pillow lavas with glassy margins that are macro- and microscopically consistent with mid-ocean ridge basalt, as expected in this setting. All the cores have undergone seawater-rock reaction and this manifests as a range of background and halo alteration. The cores were sampled for inductively coupled plasma–atomic emission spectroscopy (ICP-AES)/X-ray diffraction (XRD) and thin section shipboard analyses. The DMT 360° core scanner and scanning workflow has been optimized and is ready to receive the first basement cores of this expedition.

Geochemistry

The geochemistry team spent the transit week preparing for the sampling of fluids and sediment headspace, in situ pore water oxygen measurements, and igneous rock analyses. The workflow was defined for interstitial water (IW) sample collection (by squeezing and Rhizon syringe sampling), headspace gas analysis (sampling on catwalk and gas collection), and oxygen measurements. The team consulted with the Expedition 390 geochemists to confirm their procedures for some specialized analyses (specifically sulfide analyses and oxygen measurements) and their protocols for the plate reader instrument brought aboard for the two expeditions. Solution standards for shipboard IW analyses were completed, gas chromatographers and the ion chromatography (IC) instrument were calibrated, and containers were cleaned for postcruise sample splits. Standard reference materials for ICP-AES analysis of basalts were selected, and the process of weighing and fusing standards for ICP work has begun. The new Bruker portable X-ray fluorescence spectrometer (pXRF) instrument was unboxed, and two scientists received training as the authorized users on their respective shifts. A preliminary pXRF run of mafic standard reference materials yielded very positive results, with multiple elements showing linear correlations with accepted values. Excel workflows are now being

developed for downloading data from the instrument and conducting external calibrations, for use in both powder and rock surface analyses.

Paleomagnetism

During the transit, the paleomagnetism team was trained in laboratory procedures and they set up the instruments for new core measurements. The natural remanent magnetization (NRM) of archive half Sections U1558A-19X-1 and 19X-2 was measured on the superconducting rock magnetometer (SRM) after alternating field (AF) demagnetization at steps of 0, 5, 10, and 20 mT. To monitor the noise level of the SRM, background and blank measurements were also performed. One oriented discrete cube sample was taken from the working half for the following sequence of paleo- and rock-magnetic measurements: anisotropy of magnetic susceptibility (AMS), NRM (before and after alternating field (AF) demagnetization), saturation of isothermal remanent magnetization (IRM), and backfield IRM. This sample was shared with the physical properties team for moisture and density (MAD) measurements, and the two laboratories will continue to share such cube samples during the expedition. These samples are dried in an oven at 105°C as part of the MAD procedure, but the heat may cause magnetic overprinting or mineral changes in the sample. To assess these possible effects, old sediment samples were tested in different heating environments (ovens in the Paleomagnetism and Physical Properties Laboratories, and in a mu-metal shielded canister in the Physical Properties Laboratory oven). First results were inconclusive and testing of the shielded cannister will continue.

Physical Properties and Stratigraphic Correlation

The physical properties specialists were trained on laboratory instruments. The team measured whole-round basement Cores U1558A-19X and U1560A-15X and 16X on the Natural Gamma Radiation Logger (NGRL) and the Whole-Round Multisensor Logger (WRMSL). Thermal conductivity was measured after the cores were split, and the oriented paleomagnetic cube sample was measured for MAD and *P*-wave velocity. The sediment cores from Holes U1558A and U1560A had previously been measured on the suite of physical properties instruments during Expeditions 390C and 395E, apart from the X-ray Imager (XRI), so the team took X-ray images of all the sediment cores. One section of a basement core was scanned to compare X-ray images taken on whole-round and section half pieces. The stratigraphic correlators were trained on the Correlator software.

Microbiology

The microbiology team prepared sampling procedures and workflow. Artificial seawater media and an anaerobic chamber were prepared for incubation experiments. Protocols were prepared for the oxygen/temperature probe measurements and for using the plate reader for nutrient measurements (ammonium, phosphate, and sulfite). The team tested the Foldio turntable and camera to take pictures of the microbiology whole-round core samples prior to processing.

Education and Outreach

This week, the Onboard Outreach Officer posted on social media, followed up with educational organizations and programs to confirm interest for ship-to-shore broadcasts, and wrote a post for the expedition log.

- Twitter has an average 74 engagements (min is 28 and max is 170) per post, and an engagement rate of 3%, with an at least 32 additional followers.
- Facebook has reached 7,058 people, with 380 page views, and added 24 followers.
- Instagram has 23 new posts, reached 2427 accounts, engaged 363 accounts, and has 21 new followers, 6 unfollows.
- On 13 June, an adult education center was given a ship-to-shore video tour.
- Five new blogs were posted on the *JOIDES Resolution* website, four of which are by expedition scientists.

Technical Support and HSE Activities

The following technical support activities took place during the Week 2 transit.

Technical and Analytical Support

- Conducted daily COVID-19 antigen testing until 17 June, then testing will occur every second day until the end of the mitigation period on 24 June.
- Split and recurated the remaining whole-round cores from Holes U1558A and U1560A, which contain the sediment/basement transition at these sites.
- Set up the new Bruker pXRF instrument and started to train scientists on its use.
- Reran XRD samples from Expedition 390 on the AERIS instrument because the previous runs had a spurious peak due to the material of the sample holders also being measured.
- Integrated heave, pitch, and roll data from the motion reference unit (MRU) into the NaviPac navigation software.
- Gave introductory training in core sampling to the scientists.
- Started to set up the COY softshell anaerobic chamber on the Upper 'Tween Deck. It will be used for microbiological incubation work at room temperature.
- Cleaned the laboratory after water came back up from a drain in the Chemistry Laboratory. This mishap was most likely related to the heavy rolls the ship took during transit. Engineers will reexamine it once on site.
- Core describers were trained to use the DESClogik core description software.
- Scientists were trained on the parallel saw to cut paleomagnetic cube samples.
- Magnetometer *x*-, *y*-, and *z*-axis degaussing coils were tested and are all performing within acceptable limits.
- Held training classes for new technical staff.

IT Support

- Patched and remediated Linux, Windows, and ESXi servers.
- Building instrument host images for new computers and testing deployment scripts.
- Set up a laptop for scientists to use to run Python/Anaconda scripts.
- Preparing to patch Windows and software on all ship workstations and instrument hosts.

Application Developer Support

- Launched and tested VirtualCorePhoto in the Publications Office.
- Researched the import and export function between Angular and Excel for GEODESC Project.

HSE Activities

- Checked safety showers and eyewash stations.
- A boat drill was held on 12 June.