IODP Expedition 390C: South Atlantic Transect Reentry Systems

Week 6 Report (8–14 November 2020)

Operations

During Week 6 of the International Ocean Discovery Program (IODP) Expedition 390C, South Atlantic Transect Reentry Systems, we reached basement and completed coring in Hole U1557B, installed 60 m of 16 inch casing and a reentry system at Site U1557, and began coring at Site U1558. Installation of 10¾ inch casing to basement at Site U1557 and the casing and reentry system at Site U1556 were made impossible by the pressure-related failure of the subsea camera.

Site U1557

Hole U1557B

We completed coring in Hole U1557B on 8 November 2020. Cores U1557B-61X to 66X advanced 27.3 m from 546.7 to 574.0 m below seafloor (mbsf) and recovered 17.4 m (64%). We began conducting mud sweeps during Core 61X and continued mud sweeps on every core thereafter. Basement was encountered at 564.0 mbsf in Core 63X. Three additional cores were taken with the extended core barrel (XCB) coring system to achieve 10 m penetration into basement. Cores 64X and 65X had low recovery (<50%), and Core 64X consisted of small rubbly pieces that appeared to jam in the core liner and core catcher. Core 66X had 100% recovery on a 2.1 m advance (drilled by time) and returned cohesive pieces of basalt/breccia. Overall, coring in Hole U1557B advanced to 574.0 mbsf and recovered 414.94 m (72%). The bit cleared the seafloor at 0210 h on November 9, ending Hole U1557B.

Hole U1557C

After coring ended, we began preparation for a jet-in test to determine whether sediment at Site U1557 was appropriate for the installation of a reentry cone and five joints of 16 inch casing (~64 m) prior to installation of 10¾ inch casing to basement. The drill string was raised to ~30 m above seafloor and the ship was repositioned 20 m south. Hole U1557C was spudded at 0345 h on 9 November using the advanced piston corer/extended core barrel (APC/XCB) bit. The jet-in test advanced to 3 mbsf before contacting a hard layer. The ship was repositioned 20 m west for a second jet-in test that was unable to penetrate the seafloor. Because the jet-in tests were unsuccessful, the top drive was set back and the drill string was pulled back to the surface. The bit cleared the rig floor at 1930 h on 9 November, ending Hole U1557C.

Hole U1557D

A revised plan was made to drill in the reentry cone with five joints of 16 inch casing (~60 m) using a stinger with a mud motor and underreamer. In preparation for assembling the casing string, the mouse hole and upper guide horn (UGH) were removed and the reentry cone was moved under the rotary table on top of the moonpool doors. The casing was made up, lowered

through the reentry cone, and latched into the hanger. The first three joints were locked and welded. Then, we tested the mud motor and underreamer to determine the pump rate required to open up the arms of the underreamer (50 strokes/min, 350 psi). The full casing stinger was assembled and lowered through the reentry cone, and the Dril-Quip running tool at the top of the stinger was latched into the reentry cone. The driller lifted the assembly, measuring the weight of the system and checking the engagement of the running tool. The moonpool doors were opened and the reentry cone, casing, and stinger assembly were lowered through the splash zone at 1045 h on 10 November. The reentry system was lowered using a controlled descent to 729.0 m below rig floor (mbrf) while filling the drill pipe with water every 10 stands. The UGH was then reinstalled.

When the reentry cone reached ~4020 mbsl, the subsea camera system was deployed and lowered quickly until it caught up with the cone. The camera then began following the cone down. At 0615 h on 11 November and at ~4900 mbsl, video feed and communication from the subsea camera system was lost, and the system was pulled back to the surface to diagnose and repair the issue. The telemetry pod was swapped out for a spare and the system was redeployed. At the same depth (~4900 mbsl) video and communication were again lost and the system was pulled back to the surface. In the meantime, Hole U1557D was spudded at 1050 h on 11 November, and the reentry cone and five joints of 16 inch casing were successfully drilled into the sediment to a depth of 64.2 mbsf. The driller lost the weight of the reentry system with casing at 5010.7 mbsl, establishing that as the seafloor depth for Hole U1557D. The Dril-Quip running tool was disconnected from the reentry cone at 1400 h, without the ability to observe this operation on the subsea camera.

We determined that the problem with the subsea camera system is pressure related. Consequently, we will not be able to complete the installation of 10¾ inch casing to basement in Hole U1557D, nor the installation of 13⅜ inch casing into basement at Site U1556. Instead, we decided to transit to Site U1558 (proposed Site SATL-43A) and continue coring and reentry system installations at the other planned sites, where the water depth is shallower and pressure will not limit use of the subsea camera. Ship and shore staff are working on solutions that will allow operation in deep water (>4900 mbsl) so that casing and reentry system installations at Sites U1557 and U1556 can be completed in the future.

The drill string was pulled back to the surface and the running tool was detorqued. The UGH was removed in order to recover the Dril-Quip running tool, and then was reinstalled after recovery of the running tool and the bottom-hole assembly (BHA). The rig floor was secured at 0908 h on 12 November for the transit to Site U1558 (proposed Site SATL-43A).

Site U1558

Hole U1558A

The ship arrived at Site U1558 after a 92 nmi transit at an average speed of 11.7 kt and switched into dynamic positioning mode at 1724 h on 12 November 2020. The drill string with the

APC/XCB BHA and a nonmagnetic drill collar was lowered and the bit spaced out to 4326.7 mbsl based on the precision depth recorder (PDR) seafloor depth of 4331.6 mbsl. The first mudline core attempted came back empty. The bit was lowered 4 m and the core was reshot. Hole U1558A was spudded at 0700 h on 13 November and recovered 3.46 m, which established a water depth of 4336.8 mbsl. APC Cores U1558A-1H through 11H advanced to 94.9 mbsf and recovered 87.87 m (92%). Core 9H was a partial stroke, advancing only 6 m. Core 10H experienced a strong overpull (70 klb) and was drilled over in order to release it from the formation. However, as Core 10H was a full stroke, the decision was made to attempt another APC core. Core 11H was a full stroke, but also experienced a strong overpull and had to be drilled over. The decision was made to switch to the XCB system with the polycrystalline diamond compact (PDC) cutting shoe. Cores 1H to 11H were oriented with the Icefield MI-5 core orientation tool. Measurements of formation temperature were taken using the advanced piston corer temperature (APCT-3) tool on Cores 4H, 7H, and 10H.

XCB Cores 12X to 19X advanced from 94.9 to 163.9 mbsf and recovered 50.82 m (74%). Core 12X had a broken liner and was pumped out of the core barrel. A hard layer was encountered at 158.9 mbsf in Core 18X. Core 18X advanced 2.6 m into the hard layer but recovered none of it, aside from some small crushed rocks in the core catcher. Core 19X advanced an additional 2.4 m into basement and recovered 2.62 m of basalt (109%), making total recovery of hard rock material 52%. After Core 19X, we began the process of pulling the drill string back to the surface in order to prepare for casing and reentry system installation at this site. Overall, coring in Hole U1558A recovered 138.69 m out of the 163.9 m advance (85%).

Science Results

Hole U1557B

Basement cores will not be split during Expedition 390C and are being preserved in nitrogen gas-flushed bags for description and analysis during Expeditions 390 and 393. All other cores from Hole U1557B were split and measured on the track systems. Sediment lithology oscillates between layers of clay and carbonate ooze with sharp contacts in between. After Core 32X (bottom depth 296.1 mbsf), lithology transitioned toward predominantly carbonate ooze with less frequent and thinner clay layers. Physical properties such as magnetic susceptibility and natural gamma radiation generally correlate with lithology. No core description will occur during Expedition 390C.

Hole U1557D

The first deployment of the subsea camera system was also the inaugural deployment of the newly acquired conductivity, temperature, and depth (CTD) sensor, which was attached to the subsea camera frame. The deployment was successful and produced quality water column data.

Hole U1558A

Similar to Hole U1557B, the basement cores from Hole U1558A will not be split and will instead be preserved in nitrogen gas-flushed bags. All other cores were split and measured on the track systems. Sediment lithology is primarily carbonate ooze. APCT-3 measurements did not produce good quality data.

Outreach

No onboard Outreach Officer is sailing during Expedition 390C. Limited social media posts were made via the JR Facebook and Twitter accounts.

Platform	# of posts	Analytics	Notes
Facebook	11	1099 engagements (comments, shares, likes, or clicks on parts of the post)	
Twitter	11	1466 engagements (including 28 retweets, 4 comments, 247 likes), 8 new followers	Does not include retweets of other accounts.

Technical Support and HSE Activities

Laboratory Activities

- Processed cores from Holes U1557B and U1558A.
- The newly acquired CTD sensor was successfully deployed and tested during the first subsea camera frame run at Hole U1557D.
- X-ray diffraction (XRD) samples from shore were analyzed manually on the Aeris instrument.
- Testing of a new grain mount method for thin sections continued.
- A series of tests on the Section Half Imaging Logger (SHIL) using cores with either homogeneous or diverse colors were conducted and the results sent to shore for review.
- Small pucks for thermal conductivity measurements that can fit inside a core liner were cut and tested successfully.
- Check sheets for all Physical Properties Laboratory instruments were finalized.
- Quick user guides for various instruments were finalized and uploaded to Confluence.
- Preparation of shipping documents for offgoing equipment and samples began.
- Comments on the COVID-19 protocol (COPE) document and guidelines were compiled.
- The document addressing sonar dome repairs was organized in Confluence. Supplies needed for the removal project were identified.

- The standard operating procedure for the magnetic orientation tool alignment jig was revised.
- Staff contributed to the GEODESC, Catwalk sampling module, and diversity, equity, and inclusion DEI projects.

Application Support Activities

- Deployed new versions of Catwalk sampling module and LIMSW, in order to improve interactions with the Catwalk sampling module.
- Worked to resolve sample label printing errors caused by the new firewall on the Matterhorn server.

IT Support Activities

- Upgrading to macOS 10.15.7 Catalina was tested. Adobe products were found to be incompatible, so a solution will need to be found before Catalina can be rolled out.
- The Data AUX A/C system has been tripping often. The temperature settings were changed slightly at the request of the Siem Offshore electricians in order to decrease the number of cycles and determine if that influences frequency of tripping.
- Started building replacement servers for some of the Linux virtual servers.
- Addressed an issue with the subsea camera frame depth not displaying on the SubCDVR overlay. Hung software on Krakatoa and SubCDVR was determined to be the cause.

HSE Activities

- Tested emergency shower and eye wash stations.