

IODP Expedition 390C: South Atlantic Transect Reentry Systems

Week 8 Report (22–28 November 2020)

Operations

During Week 8 of the International Ocean Discovery Program (IODP) Expedition 390C, South Atlantic Transect Reentry Systems, we successfully installed a reentry system and 146.1 m of 13³/₈ inch casing to ~10 m above basement in Hole U1558D, after two previous failed attempts. We then transited to Site U1559 (proposed Site SATL-13A), cored to basement, and installed 55.3 m of 13³/₈ inch casing and a reentry system to ~9 m above basement. That installation marks the end of operations for Expedition 390C.

Site U1558

Hole U1558D

After two failed attempts to install casing and a reentry system at Holes U1558B and U1558C, we determined that our inability to disengage the Dril-Quip running tool from the reentry system once the casing had been drilled into hard rock was the result of the hard rock inhibiting the complete transfer of weight off the tool. As such, the only option for installing a reentry system at Site U1558 was to remove a joint of casing so that the casing shoe landed in sediment above the hard rock contact. By the end of the previous week, one joint had been removed, the casing had been latched into the reentry system, the stinger assembly had been made up and lowered through the casing, and the running tool had engaged with the reentry cone. The length of the shortened casing string is 146.1 m. At ~0245 h on 22 November 2020, we opened the moonpool doors and started to lower the reentry cone through the splash zone. On the first attempt, the reentry cone and base slipped out of the bottom snap ring groove, catching on the upper one. We recovered the system, reset the casing hanger snap ring, and attempted a second deployment with the same result. After recovering the system and resetting the snap ring again, we decided to proceed with the deployment because changing out the reentry system at this stage would require breaking down and then remaking all of the casing, using up the remainder of our operational time. The reentry cone was lowered through the splash zone at 0335 h and we began the process of tripping drill pipe toward the seafloor. Drill pipe was filled with water every ten stands to equalize the pressure. We closely monitored the weight of the drill string as an indicator of whether the reentry cone was still attached. However, ship heave generated noisy hook load data that made it difficult to track weight changes on the order of the reentry cone (8,800 lb). At 0600 h, the vessel was moved into position over our proposed location for Hole U1558D (30 m east of Hole U1558A, near U1558B). Prior to the move, the vessel was located in an offset position 40 m west and 20 m south of Hole U1558A.

The subsea camera system was deployed at 1200 h and lowered towards the seafloor. When the camera caught up with the running tool at 3957.6 m below sea level (mbsl), we observed that the reentry cone had slipped and fallen off of the casing, which was still attached to the drill string

via the running tool. We then initiated a search for the reentry cone on the seafloor. If it could be located and had landed in proper orientation, we would be able to reenter and drill-in the casing as planned. We pulled the subsea camera system back to the surface so that we could remove the drill pipe insert and install a door that enlarges the opening of the camera frame. The camera was redeployed at 1545 h and lowered over the running tool to the bottom of the casing string, just above seafloor. Visibility was good despite the fact that the repaired camera system only has one functional camera and light. We searched for the reentry cone by moving the ship in dynamic positioning (DP) mode in an expanding grid pattern, starting at the offset position 40 m west and 20 m south of Hole U1558A. Our best estimate from the hook load data was that the reentry cone had fallen off early in the tripping process, before the ship was positioned over the intended location of Hole U1558D. Ultimately, however, we located the reentry cone and mudskirt at 2223 h, sitting upright on the seafloor in the vicinity of Holes U1558A–U1558C and close to its intended position. This location implies that the reentry cone fell off later, after the ship had moved. We picked up the top drive and prepared to spud Hole U1558D.

The cone was reentered at 0056 h on 23 November and Hole U1558D was spudded at 0059 h. The drill-in process proceeded smoothly, with the bit achieving a maximum depth of 150.0 m below seafloor (mbsf) at 0745 h. Basement is estimated to be at ~155.9 mbsf in Hole U1558D. With the reentry cone on the seafloor, the Dril-Quip running tool rotated easily and disengaged from the casing and reentry cone at 0750 h. We began pulling the subsea camera and drill string back to the surface and recovered the camera at 0945 h. For the next ~8 h, we pulled the remaining drill pipe to the surface. The running tool was recovered at 1800 h and the rest of the bottom-hole assembly (BHA) was pulled up to the rig floor and laid out. The upper guide horn (UGH) was reinstalled and the rig floor secured for transit to Site U1559 (proposed Site SATL-13A) at 2356 h, ending Hole U1558D. The vessel switched out of DP mode at 0003 h and was underway at full speed by 0018 h.

Site U1559

Hole U1559A

We completed the 508 nmi transit to Site U1559 at an average speed of 12.3 kt. We arrived on site at 1715 h on 25 November, lowered the thrusters, and were in DP mode ready to begin operations by 1740 h. The advanced piston corer/extended core barrel (APC/XCB) BHA was made up and deployed, and we began tripping pipe towards the seafloor. Hole U1559A was spudded at 0140 h on 26 November with the bit positioned at 3049.7 mbsl, and recovered 3.54 m of sediment. The mudline core established the water depth as 3055.7 m. APC coring continued through Core 4H, advancing to 32 mbsf and recovering 32.9 m of sediment (103%). After Core 4H, we transitioned to the XCB coring system as basement was estimated to be at 50 mbsf. No magnetic orientation or temperature measurements were conducted with the APC cores due both to time constraints and to not wanting to damage tools if we encountered basement sooner than expected. XCB Cores 5X to 8X advanced from 32 to 64.7 mbsf. We encountered a hard layer at 64.0 mbsf that dramatically decreased the rate of penetration to <1 m/h. Recovery of this layer

was poor: ~11% of the 0.7 m advance and ~8 cm of small, rubbly pieces of basalt. Core 9X was drilled by time in hard rock material, advancing 1.5 m at a rate of 0.64 m/h. Only 0.39 m of material was recovered (26%), appearing to consist of indurated sediment and altered glass. Excluding hard rock material, Cores 5X to 8X advanced 32 m and recovered 24.64 m (77%). In total, Hole U1559A penetrated to 66.2 mbsf with a recovery of 58.01 m (88%). We began pulling out of the hole after Core 9X to have time to install a reentry system with casing. The bit cleared the rig floor at 2200 h, ending Hole U1559A.

Hole U1559B

To prepare for installation of the reentry system at Hole U1559B, the UGH was removed and the reentry cone was positioned above the moonpool doors underneath the rig floor. The casing shoe was found to be damaged and a new one was prepared. Four joints of 13 $\frac{3}{8}$ inch casing were made up followed by a crossover and the 16 inch casing hanger needed to latch into the reentry cone. One joint of casing was found to have a bent coupling and was replaced. Once the casing string was made up, the Dril-Quip running tool was used to lower it through the reentry cone and latch it into place. Next, the BHA with the bit, underreamer, and mud motor was made up and lowered through the casing, and the running tool engaged with the reentry system. The moonpool doors were opened and the reentry system was lowered through the splash zone at 1645 h on 27 November. The reentry system was lowered at a controlled rate of descent, pausing to fill the drill pipe with water every 10 stands to ensure equalized pressure. The subsea camera was deployed at 2345 h to observe the casing drill-in and release. The conductivity-temperature-depth (CTD) sensor was attached to the frame of the subsea camera system and logged water column data during the camera deployment.

Once the bit was spaced out to 3022.7 mbsl, we picked up the top drive and spudded Hole U1559B at 0130 h on 28 November, establishing seafloor depth as 3055.0 mbsl. The bit reached its maximum depth of 58.9 mbsf by 0315 h with the casing shoe at 55.3 mbsf. Basement is expected to be at 64.0 mbsf. With the reentry system on the seafloor, the driller then applied torque to rotate the running tool 3.5 times, releasing it from the reentry system and casing. We pulled out of the hole, with the bit clearing the reentry cone at 0358 h. The subsea camera was pulled back to the surface and recovered at 0415 h. The top drive was set back, and fluid was circulated through the drill string, displacing seawater with freshwater in the drill pipe. We tripped the rest of the drill pipe back to surface, recovered and laid out the BHA, and detorqued the running tool. The UGH was reinstalled and the moonpool secured. The rig was secured for transit at 1815 h, ending Hole U1559B as well as operations for Expedition 390C. The ship then transitioned out of DP mode and got underway. The 1723 nmi transit to Cape Town, South Africa, is anticipated to take ~6.5 d with an estimated arrival on 5 December.

Science Results

Hole U1559A

Cores U1559A-1H through 7X have been split and measured on the track systems. In addition, we took 1–2 whole-round (WR) samples per core for chemical analysis of interstitial water. Lithology consists of carbonate ooze. Sediment color is slightly darker in the first core and then transitions to pale beige-white. Physical properties generally correlate with lithology. Counts of natural gamma radiation peak in the first section of the first core, decline rapidly through the first core, and then continue to slowly decrease throughout the hole. No systematic core description will occur during Expedition 390C. Cores 8X and 9X, containing hard rock material, were analyzed on the WR track systems but were not split during Expedition 390C and are preserved in nitrogen-gas flushed bags for description and analysis during Expeditions 390 and 393.

The newly acquired CTD sensor was deployed with the subsea camera system at Hole U1559B. It successfully logged water column data. The towed magnetometer was deployed during the transit between Sites U1558 and U1559.

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	12	1246 engagements (comments, shares, likes, or clicks on parts of the post)	
Twitter	12	1811 engagements (including 57 retweets, 17 comments, 335 likes), 6 new followers	Does not include retweets of other accounts.

Technical Support and HSE Activities

Laboratory Activities

- Processed all cores from Hole U1559A. Some additional chemical analyses still need to be conducted on samples from Holes U1558A and U1559A.
- Moved cores onto pallets and rearranged the gas bottle rack for outgoing shipments.
- Stored the Expedition 390C sediment/basement interface cores that will remain on board.

- The gas line manifold on the gas chromatograph (GC) was repaired using stainless steel tubing and Swagelok fittings. Test runs of the GC were conducted using nitrogen gas (N₂) from either the N₂ generator or an O₂-free bottle as the makeup gas.
- Test calibrations were conducted on the QE Pro spectrophotometer detector of the Section-Half Multisensor Logger (SHMSL).
- A series of test runs of the X-ray imager helped to optimize parameters for light-colored, foraminifer-rich sediment cores.
- Repairs and maintenance of general laboratory fixtures were conducted.
- The supply checkout sheets were updated.
- Laboratory cleaning began.
- Staff worked on technical reports for the expedition.
- Staff contributed to the GEODESC, Catwalk sampling module, and diversity, equity, and inclusion (DEI) projects.

Application Support Activities

- Addressed a minor issue with the Drill Report.
- Tested replacement web servers set up by the Marine Computer Specialists.
- Deployed a new version of the Catwalk module to fix bugs, but had to revert back to the previous version after the program began crashing on startup.
- Reverted to a previous version of LIMSW to address an issue with uploading in SampleMaster. The uploading issue was fixed but SampleMaster is still not parsing the information correctly.

IT Support Activities

- Made upgrades to several servers and changed security configurations.
- Upgraded Confluence to version 7.7.4 and updated relevant plugins.
- Further replacement servers were built and tested and are now in production.
- Finished upgrading VDU Mac Minis to O/S 10.15.7 Catalina.
- Continued upgrading workstation Mac Minis and Mac Pros to O/S 10.14.6 Mojave.
- Continued testing of CrowdStrike antivirus software.
- Upgraded iPrint appliance.
- Began upgrades of the vRealize Log Insight server but could not download necessary patches. The IT software administrator is working on a solution with VMware support.

HSE Activities

- The Ship's Doctor conducted a weekly temperature check.
- Tested emergency shower and eye wash stations.
- Conducted a fire and lifeboat muster drill.