IODP Expedition 395E: Complete South Atlantic Transect Reentry Systems

Site U1556 Summary

Background and Objectives

Operations at International Ocean Discovery Program (IODP) Site U1556 (proposed Site SATL-53B) started during South Atlantic Transect (SAT) Expedition 390C in October 2020, when Hole U1556A was cored to basement (Estes et al., 2021). The objective for Expedition 395E was to drill and install a 10¾ inch reentry system with casing to basement in Hole U1556B. These operations will expedite basement drilling during SAT Expeditions 390 and 393.

Site U1556 is located in the central South Atlantic Ocean at 30.6°S, ~1250 km west of the Mid-Atlantic Ridge, in 5006 m water depth. It lies on seismic line CREST1A/B at CDP 3410 near the CREST05 crossing line (Coggon et al., 2020). A reflector at ~6.9 s two-way traveltime (TWT) was interpreted as the top of basement and was found at 278 m below seafloor (mbsf) in Hole U1556A. This site is located 6.7 km west of Site U1557 (proposed Site SATL-56A), and the basement at both sites is predicted to have formed at ~61.2 Ma at a half spreading rate of ~13.5 mm/y. Oceanic crust at these sites is the oldest that will be drilled on the South Atlantic Transect expeditions. The mineralogy and extent of alteration of the basement rocks at Site U1556, changes in physical properties such as porosity, and the composition of the microbial communities will be compared to the same characteristics at the other sites along the transect to investigate the development of hydrothermal circulation and crustal aging. The sedimentary succession at Site U1556 is about half as thick as at Site U1557, and contrasts between these closely spaced sites will allow exploration of the blanketing effect of sediment thickness on hydrothermal circulation. Sediment in Hole U1556A alternates between 1–10 m thick layers of red-brown clay and carbonate ooze with sharp contacts between these lithologies (Estes et al., 2021), and will be used in palaeoceanographic and microbiological studies.

Operations

Hole U1556B

We arrived at Site U1556 at 0715 h on 5 May 2021 after moving from Site U1557 in dynamic positioning (DP) mode. In preparation for installing casing in Hole U1556B, we made up the hydraulic release tool (HRT) and set it aside in the derrick. We then assembled 284.2 m of 10¾ inch casing and landed it on the base of the reentry cone in the moonpool. From 1700 to 2215 h, we assembled the stinger (comprising a 9⅞ inch bit, underreamer, and mud motor), tested it in the moonpool, and lowered it down through the casing. The same assembly had been used to drill Hole U1560B earlier in the expedition. The HRT running tool was attached and bolted to the base of the reentry cone, and the reentry cone was welded to the base. At 0230 h on 6 May, we lowered the assembly through the moonpool and started the pipe trip to 4994 m below sea level (mbsl). At 1300 h, we started to lower the subsea camera.

We started Hole U1556B (30°56.5244′S, 26°41.9472′W) at 1655 h on 6 May, and by 2000 h we had drilled-in the casing to 75.5 mbsf. During this operation, the cable to the subsea camera had wrapped around the drill pipe eight times, which is more than usual, so we paused drilling and slowly raised the subsea camera to the ship. It was back on board at 2245 h. We resumed drilling and at 1530 h on 7 May, at an apparent depth of 282.3 mbsf, the weight of the casing was no longer held by the drill string, indicating that the reentry cone had landed on the seafloor, at a shallower depth than the expected 286.2 mbsf. At 1630 h we released the casing from the HRT. We filled the hole with 75 bbl of heavy mud and raised the drill bit, clearing the seafloor at 1920 h. From 0245 to 1200 h on 8 May we disassembled the bit, underreamer, and mud motor, and then assembled the bottom-hole assembly (BHA) for cementing.

After stowing the casing deployment equipment, we lowered the cementing BHA to 4922 mbsl. The next operation was to deploy the subsea camera to guide reentry into Hole U1556B. However, rough weather with ~4 m heave made it unsafe to launch the camera (at a water depth of 5000 m the camera's umbilical cable has a fatigue operating limit of ~2.5 m of heave), so we waited for the seas to subside. At 0945 h on 10 May, the seas had calmed enough to deploy the subsea camera. We observed that the top of the reentry cone was level with the seafloor, and tagged it to determine a water depth of 5001.8 mbsl for Hole U1556B. This depth is 4.6 m shallower than the mudline depth at Hole U1556A, which explains why the casing in Hole U1556B landed at a shallower depth than expected. Based on the water depth, the depth of Hole U1556B was revised to 286.2 mbsf, with the 10¾ inch casing shoe at 284.2 mbsf. As a result of the shallower-than-expected seafloor, Hole U1556B came close to but did not reach the sediment/basement contact.

At 1225 h on 10 May we reentered Hole U1556B with the cementing BHA. A circulation test showed that the formation had sealed around the casing, so there was no need to cement the base of the hole. We raised the BHA, which cleared the seafloor at 1240 h and reached the rig floor at 2359 h, ending operations at Hole U1556B.

Principal Results

Expedition 395E did not retrieve core material from Hole U1556B, but a description of the principal results from Hole U1556A, cored during Expedition 390C, are described in the *Expedition 390C Preliminary Report* (Estes et al., 2021). Additional analyses and data interpretation will take place during Expeditions 390 and 393, which are scheduled to take place in 2022.

References

Coggon, R.M., Christeson, G.L., Sylvan, J.B., Teagle, D.A.H., Estes, E., Williams, T., and Alvarez Zarikian, C.A., 2020. *Expedition 390/393 Scientific Prospectus: The South Atlantic Transect*. International Ocean Discovery Program. https://doi.org/10.14379/iodp.sp.390393.2020

Estes, E.R., Williams, T., Midgley, S., Coggon, R.M., Sylvan, J.B., Christeson, G.L., Teagle, D.A.H., and the Expedition 390C Scientists, 2021. *Expedition 390C Preliminary Report: South Atlantic Transect Reentry Systems*. International Ocean Discovery Program. https://doi.org/10.14379/iodp.pr.390C.2021