

IODP Expedition 361: Southern African Climates

Week 5 Report (22–28 February 2016)

Operations

The vessel arrived at Site U1475 (proposed site APT-01B) at 1500 h on 23 February following a 433 nmi transit from the medical evacuation point. The thrusters were lowered and a positioning beacon was deployed at 1545 h.

The drill string was tripped to 2650.4 mbsl for the first core. The first two coring attempts resulted in water cores and the drill string was lowered a total of 12 m to 2662.4 mbsl. Core U1475A-1H was recovered with 1.48 m of sediment and the seafloor depth was determined to be 2670.4 mbsl. The science party decided that a longer, well-preserved mudline core was necessary and we terminated coring in Hole U1475A.

Hole U1475B was begun at 0330 h on 24 February. The APC was deployed for Cores U1475B-1H to 26H from the seafloor (2669.4 mbsl) to 243.9 mbsf. A total of 250.31 m of sediment was recovered (103%). The drill string was pulled out of the hole and operations in Hole U1475B ended when the bit cleared the seafloor at 0430 h on 25 February.

The vessel was moved 20 m north of Hole U1475B. APC coring in Hole U1475C started at 0625 h on 25 February and penetrated from the seafloor (2669.3 mbsl) to 275.0 mbsf. Cores U1475C-1H to 30H were taken over a 272.0 m cored interval with 280.7 m of sediment recovered (103%). A short interval from 148.5 to 151.5 mbsf was advanced without coring as requested by the Stratigraphic Correlation specialists to cover coring gaps. While taking Cores U1475C-3H and 12H, the shear pins on the core barrel sheared early due to rough sea conditions. After reaching 275.0 mbsf the drill string was pulled out of the hole and operations in Hole U1475C ended when bit cleared the seafloor at 0935 h on 26 February.

The vessel was moved 20 m east of Hole U1475B. The forward core line was reheaded and the seals were replaced on the APC piston prior to initiating Hole U1475D. Coring in Hole U1475D began at 1155 h on 26 February and extended from the seafloor (2668.3 mbsl) to 143.0 mbsf. Cores U1475D-1H to 16H were taken over a 143.0 m interval with 150.86 m of sediment recovered (105%). Interstitial water samples were collected from every core section for postcruise research. While taking Cores U1475D-3H, 6H, and 14H, the shear pins on the core barrel once again sheared early due to rough sea conditions. After concluding coring operations in Hole U1475D, the drill string was pulled out of the hole with the bit clearing the seafloor at 0425 h on 27 February.

The vessel was offset 20 m south of Hole U1475B and Hole U1475E was begun at 0550 h on 27 February. APC coring in Hole U1475E extended from the seafloor (2673.8 mbsf) to 277.0 mbsf. Cores U1475E-1H to 30H were taken over a 270.5 m interval with 277.20 m of sediment

recovered (102%). One interval was advanced without coring from 119.0 to 125.5 mbsf as was requested by the Stratigraphic Correlation specialists to offset coring gaps. While taking Cores U1475E-1H, 5H, 7H, 8H, 12H, 15H, and 18H, the shear pins on the core barrel sheared early due to rough sea conditions. After reaching 277.0 mbsf the drill string was pulled out of the hole and operations in Hole U1475E ended when bit cleared the seafloor at 1335 h on 28 February.

The vessel was moved 20 m west of Hole U1475B and operations in Hole U1475F began at 1450 h on 28 February. The Stratigraphic Correlation specialists devised a spot-coring plan in Hole U1475F to cover gaps in core recovery from the previous holes. The hole was washed down from the seafloor (2669.3 mbsl) to 20 mbsf where spot coring began. Hole U1475F contained four intervals that were advanced without coring (0–20.0 mbsf, 29.5–52.0 mbsf, 71.0–103.0 mbsf, and 112.5–114.5 mbsf). A total of six cores were recovered from selected intervals in Hole U1475F with 97% core recovery. While taking Cores U1475F-4H, 5H, and 9H, the shear pins on the core barrel sheared early due to rough sea conditions.

Science Results

Cores from Holes U1475A, U1475B, and U1475C were described. One major lithological unit was identified, which is composed of alternations of white gray foraminifera-rich nannofossil ooze and light greenish gray nannofossil ooze with foraminifera and quartz. Diatoms are present throughout the cored interval. Two small (<5 mm) quartz clasts were identified in Cores U1475C-1H and 5H, which are interpreted as ice rafted debris. Moderate to strong bioturbation and pyrite is observed in all of the cores.

Whole-Round Multisensor Loggers (WRMSL) were used to measure density, *P*-wave velocity, magnetic susceptibility (MS), and natural gamma radiation (NGR) at 2.5 cm resolution in Holes U1475A, U1475B, U1475C, and U1475E. Cyclic changes in NGR are observed throughout the section. These variations decrease in amplitude below 100 mbsf. At 108 mbsf density and *P*-wave velocity exhibit step increases. Light reflectance and RGB values show characteristic orbital scale variations in sediment color and are useful for stratigraphic correlation. Thermal conductivity measurements were conducted on 15 cores from Holes U1475B and U1475C. Seventy-six samples taken from Holes U1475A and U1475B are being studied for moisture and density.

Analysis of calcareous nannofossils, planktonic foraminifera, and diatoms reveals that Site U1475 spans the Late Pleistocene to the late Miocene. Calcareous fossils are moderately to well-preserved and diatoms are poorly to moderately preserved. The assemblages of all three fossil groups include a mix of temperate to subpolar species and subtropical forms, the latter of which are more common in Pliocene age sediment. Several biozones are identified and provide good chronologic control. Preliminary estimates of sedimentation rates in the Pleistocene and uppermost Pliocene are nearly linear at ~3 cm/k.y. A notable increase in sedimentation rates to

~7 cm/k.y. is found in the lower Pliocene. The oldest sediment recovered in Hole U1475B is ~7.5 Ma based on the biostratigraphy of all three fossil groups.

Holes U1475B and U1475C were run in the superconducting rock magnetometer (SRM). The measured natural remanent magnetization (NRM) intensities after 25 mT demagnetization are on the order of 10^{-5} to 10^{-4} A/m. In some rare intervals, which were disturbed during drilling, NRM intensities increase up to 0.5 A/m. Downcore inclination data from Hole U1475B are noisy and distinct polarity zones cannot be identified. Inclination data obtained from stepwise NRM demagnetization (15, 25, 40, 60, and 80 mT) of discrete samples from Hole U1475B are consistent with the high-resolution SRM records. In contrast, the uppermost ~100 m of sediment recovered from Hole U1475C provides a downcore inclination record displaying clear intervals of normal and reversed polarity. These polarity zones can be tentatively linked to the Brunhes, Matuyama, and Gauss chrons as well as the Jaramillo and Olduvai subchrons.

Interstitial water (IW) samples from Holes U1475B and U1475D and discrete samples from Hole U1475B were processed. High-resolution IW samples in Hole U1475D were collected for shore-based research. All of the IW samples were squeezed and the pore waters were collected and split. IW samples from Hole U1475B were analyzed for alkalinity, pH, and chlorinity. They are awaiting analysis of cations by ion chromatography, major and minor elements by ICP-AES, and phosphate by spectrophotometry. Rhizon samples were collected from Core U1475D-1H for shipboard nitrate analysis and shore-based work. Preliminary shipboard nitrate measurements suggest that little to no nitrate persists beyond Section U1475D-1H-1. Sediment samples collected from Hole U1475B were prepared for total carbon and nitrogen analysis. Carbonate content varies between 75% and 90% in Hole U1475B, with lower values found between 36 and 122 mbsf.

Correlation between Holes U1475B and U1475C were accomplished using NGR and color core imaging (RGB and light reflectance); however, several disturbed core sections and multiple coring gaps are present. Cores from Hole U1475E are being scanned and tied to Holes U1475B and U1475C. A targeted spot-coring plan was developed for Hole U1475F to cover the major stratigraphic gaps.

Education and Outreach

Ship to Shore Events

- Seven live broadcasts to US schools; 590 students reached (480 elementary, 110 high school, plus well over a dozen teachers).

Social Media

- *JOIDES Resolution* blog (<http://joidesresolution.org/>): seven posts, 1,035 reads so far.

- Facebook (<https://www.facebook.com/joidesresolution>): seven posts, 3,830 people reached.
- Twitter (<https://twitter.com/TheJR>): seven tweets, ~35–40 retweets, 2,700 followers, 3,340 impressions.
- Instagram (http://instagram.com/joides_resolution): seven posts, hundreds of likes.

Media

- Press releases were sent to:
 - The Rhode Island Science Teachers Association (RISTA) listserv (reaches ~1,000 members)
 - The Science Supervisor of the Rhode Island Department of Education (published for 300 schools, potentially reaching 15,000 teachers)
 - Governor Gina Raimondo’s office (Rhode Island)
 - The Yale School of Forestry and Environmental Sciences Alumni Office
- Published a video of shipboard paleontologist Richard Norris introducing Expedition 361.
- Filmed footage for two more videos with Richard Norris that will focus on Expedition 361 and the Agulhas Current.

Technical Support and HSE Activities

Technical Activities

- Caver Presses: We are continuing to have issues with the pump disengaging while pressing very soft sediment.
- Zebra Printers: Adhesive build-up inside the print head continues to be an issue. The staff are cleaning the printers every ~6 h. Additionally, the label darkness must continually be adjusted.
- Coulometer: The applications developers worked with chemistry technicians to write requirements and specifications for an upgrade to the coulometer application. This was submitted to shore personnel for additional comments.
- Stratigraphic Correlation: The applications developers wrote a new web service to extract drilling disturbance information from the LIMS database and began to work on a method to import drilling-disturbance data into *Correlator* v2.1.
- Cyromagnetometer: The applications developers are working on the new Integrated Measurement System (IMS) software.

HSE Activities

- The weekly fire and boat drill was held on 28 February.