

## **IODP Expedition 383: Dynamics of Pacific Antarctic Circumpolar Current (DYNAPACC)**

### **Week 7 Report (1–6 July 2019)**

Week 7 of the International Ocean Discovery Program (IODP) Expedition 383, Dynamics of the Pacific Antarctic Circumpolar Current (DYNAPACC), was spent transiting to our operational area at the southwest Chilean margin, and coring at Site U1542. At Site U1542, we cored Holes U1542A (0–169.5 m below seafloor [mbsf]; 181.74 m recovered [107%]), U1542B (0–1.4 mbsf; 1.46 m recovered [104%]), and U1542C (0–234 mbsf; 225 m cored and 236.9 m recovered [105%]). All times in this report are in ship local time (UTC – 3 h).

### **Operations**

At 1300 h on 1 July 2019, the seas and weather subsided enough over the operational area in the Chilean margin to get underway again from our waiting-on-weather location at 48°44.0'S, 89°24.7'W. The thrusters were raised and the vessel was underway at 1330 h. A course was set for proposed Site CHI-1C, giving us the best ability to change course for either proposed Sites CHI-4B or ESP-1B, if the weather improved over those sites first. At 1345 h on 2 July, we decided to adjust the course for Site CHI-4B.

The vessel arrived at Site U1542 at 1948 h on 3 July. After the thrusters were lowered, the vessel switched into dynamic positioning mode by 2030 h. An advanced piston corer/extended core barrel (APC/XCB) bottom-hole assembly was made up and lowered to the seafloor. Based on a precision depth recorder (PDR) reading of 1111.4 m below rigfloor (mbrf), an APC shooting depth of 1108.4 mbrf was chosen and Hole U1542A was spudded at 0215 h on 4 July. Core U1542A-1H retrieved 7.1 m of sediment, determining the seafloor depth at 1110.8 mbrf (or 1099.8 m below sea level [mbsl]).

APC coring continued until 165.6 mbsf (Cores U1542A-1H to 19H), when the core barrel became detached from the sinker bars during retrieval. The core barrel fell ~50 m back to the landing seat. Three attempts were needed to retrieve the barrel finally. Once at the surface, we found that only 1.05 m of core was recovered, and we decided to switch to the half-length APC (HLAPC) to deepen the hole. The HLAPC was used for one core, recording a partial stroke and recovering 3.91 m before the hole was abandoned due to high seas and winds. The bit was pulled to 1033 mbrf, clearing the seafloor at 2359 h on 4 July, and ending Hole U1542A. A total of 20 APC and HLAPC cores were taken over a 169.5 m interval, recovering 181.74 m (107.2%).

Nonmagnetic core barrels and the orientation tool were used on all cores. The advanced piston corer temperature tool (APCT-3) was used to measure formation temperature on Cores U1542A-4H, 7H, 10H, 13H, and 16H. Partial strokes were recorded on Cores 10H through 13H and 16H through 21F. The total time spent on Hole U1542A was 27.5 h (1.1 d).

The vessel waited on the seas and winds to calm from 0030 h to 1545 h on 5 July with the bit set at 1033 mbrf. Then, the vessel was offset 20 m to the east of Hole U1542A, the bit was lowered to 1104.0 mbrf, and Hole U1542B was spudded at 1745 h on 5 July 2019. Core U1542B-1H recovered only 1.46 m of sediment, and because of the low recovery and quality of the core, we decided to obtain a better mudline core, so Hole U1542B was abandoned.

The vessel stayed at the same coordinates and the bit was moved to 1105 mbrf. Hole U1542C was spudded at 1830 h on 5 July. Based on the recovery from Core U1542C-1H (3.3 m), the seafloor was calculated at 1111.2 mbrf (1100.2 mbsl). APC coring continued in Hole U1542C to 169.3 mbsf with Core 20H. While running in with the core barrel for Core 21H, the Captain terminated operations due to high currents and winds. When the core barrel was retrieved, it was found that the pins had sheared and 3.57 m of core had been retrieved for an advance of 3.0 m.

At 0900 h on 6 July, the bit was pulled to 71.8 mbsf and the top drive set back to wait on weather with the bit in the hole. The crew continued to wait on weather until the seas subsided at 1630 h. The top drive was picked up, the hole was washed to the bottom by 1815 h, and coring continued with Cores U1542C-22H through 28H to 226.0 mbsf at midnight on 6 July.

A total of 26 cores were taken over a 217.0 m interval with two 4.5 m drilled intervals (9 m total drilled). A total of 228.91 m was recovered (106% recovery).

Nonmagnetic core barrels were used with all cores and the orientation tool was removed after Core U1542C-20H. A misfire was recorded on Core 8H and partial strokes were recorded on Cores 10H, 12H, 13H, 16H, 17H, and 20H–28H.

## **Science Results**

This week we processed and measured cores and samples from Site U1542, completed the reports from Site U1541, and discussed postexpedition research plans and activities. We also discussed and summarized the results of the three central South Pacific sites (U1539–U1541).

### *Sedimentology*

Sediment cores from Holes U1542A–U1542C were split into archive and working halves, described lithologically, and X-ray imaged. The upper 200 m of the sedimentary sequence consists of siliciclastic sediments with infrequent thin beds of calcareous ooze. Dark gray clayey silt dominates the sedimentary record at Site U1542. Thin light gray calcareous beds of foraminifer- and clay-bearing silty nannofossil ooze or foraminifer-rich nannofossil ooze are observed below 95 mbsf.

### *Biostratigraphy*

All core catcher (CC) samples from Hole U1542A and selected CC samples from Hole U1542C have been analyzed for the presence of biostratigraphic markers. Our preliminary results based primarily on diatom, radiolarian, and planktonic foraminifer biostratigraphy provide an age estimate of >0.7 Ma for the base of Hole U1542C.

### *Paleomagnetism*

Natural remanent magnetization (NRM) measurements of cores at Site U1542 are ongoing. Demagnetization steps are reduced to only one step at a peak alternating field of 15 mT in order to keep up with the fast workflow at this site. Both initial NRM and NRM after demagnetization are strong, with the demagnetized NRM varying in the range between  $10^{-6}$  and  $10^{-1}$  A/m. A few geomagnetic excursion events are inferred from the downhole variation of NRM intensities, but no magnetic reversal has been found in Hole U1542A. Measurements are ongoing for Hole U1542C.

### *Geochemistry*

Fifty-eight whole-round samples from Holes U1542A and U1542C have been squeezed to obtain interstitial water (IW) samples for salinity, alkalinity, pH, chlorinity, ammonium, and silica analyses, as well as for major and minor cations and anions. Fifty-seven samples have been collected for solid phase analysis of inorganic carbon (IC), total organic carbon (TOC), and total nitrogen (TN) content. Of the homogenized samples, 19 have been analyzed for total carbon (TC) and TN concentrations spanning the depth interval from 1.4 to 78.7 mbsf in Hole U1542A. TC occurs in relatively low concentrations, with an average of 0.65 wt%. TN has an average concentration of 0.039 wt%.

### *Physical Properties*

All core sections from Hole U1542A were measured for physical properties, including Whole-round Multisensor Logger (WRMSL) gamma ray attenuation (GRA) density, *P*-wave velocity, and magnetic susceptibility (MS); natural gamma radiation (NGR); thermal conductivity (one sample per core); discrete *P*-wave velocity (two samples per core); and discrete moisture and density (54 samples) measurements. Initial processing of data from Hole U1542A shows that due to the hemipelagic facies and many core sections expanding substantially due to outgassing, the data quality of most physical properties has been compromised by numerous cracks and gaps that appear during the temperature equilibration process. This pervasive expansion of the sediment due to high gas content affected the integrity and quality of the cores to an extent that some shipboard measurements (e.g., *P*-wave velocity) were impacted. We abandoned discrete caliper *P*-wave velocity measurements below Section U1542A-13H-4 (116.61 mbsf), since no reasonable readings could be obtained. We measured the upper part of Hole U1542A, until Section U1542-5H-1 (37.07 mbsf), through the Special Task Multisensor Logger (STMSL) for

an initial assessment of downhole physical properties variations. When compared to the WRMSL MS and GRA density data obtained after temperature equilibration and core expansion, the STMSL data were found to be less affected by postrecovery alterations and therefore are more reliable for interpretation.

These results led us to change part of the core flow in order to minimize the time between core arrival and splitting by measuring the whole-round sections of Hole U1542C immediately after catwalk processing through the STMSL (for GRA and MS data) and then through the NGR at a coarser, 20 cm resolution. This allowed the core sections to be split into working and archive halves faster to allow for more uniform degassing across the entire surface of the split core. The core section halves then were processed following normal core flow procedures. The scientists and technicians kept up with the faster pace and the core quality seems to have significantly improved.

In general, GRA densities yield significantly higher values (1.7–2.1 g/cm<sup>3</sup>) than at the central South Pacific (CSP) Sites U1539 to U1541, indicating a different lithology, with higher amounts of terrigenous components. Likewise, MS and NGR values in Hole U1542A are also much higher than at the CSP sites, with values ranging from 50 to 500 IU for MS, and from 32 to 48 counts/s for NGR.

### *Stratigraphic Correlation*

We used Correlator v3.0, WRMSL and STMSL MS data, NGR data, and Section Half Multisensor Logger (SHMSL) color reflectance b\* data to identify stratigraphic markers and correlate Holes U1542A and U1542C. We have constructed a preliminary splice for the site that is continuous from 0 to 114 m core composite depth below seafloor (CCSF-A). From this point to the bottom of U1542C (at 234 mbsf), there are currently several stratigraphic gaps due to incomplete core recovery and the extension of Hole U1542C beyond the lowermost depth of Hole U1542A (169 mbsf). We aim to cover many of these gaps with cores from Hole U1542D. We continue to examine the results of ongoing measurements at this site and have begun to identify the best data sets with which to generate a finalized spliced record for Site U1542 following completion of drilling.

### **Outreach**

This week we reached a total of ~2,843 individuals through live broadcasts, website blog posts, and all social media.

## **Technical Support and HSE Activities**

### *Laboratory Activities*

- Because of core expansion due to high gas content in the cores, we taped core extenders at the ends of sections to allow expansion, and updated the curated length prior to splitting the cores.
- For Holes U1542C and U1542D, the Co-Chief Scientists requested shortening the WRMSL and NGR measuring time, so the cores were split sooner to reduce core deformation due to expansion. Cores were split based on track pace, instead of description pace. All IODP JRSO technical staff and scientists worked hard to keep up with the faster pace.
- Produced load out plan for bulk material shipments.
- Cleaned up Rad Van and confirmed scintillation counter is working.
- Conducted Rad Van wipe test training for Assistant Laboratory Officers.
- Staff continued to update instrument manuals in Confluence.
- The Electronics Technician rebuilt the sonic plastic welder gun.

### *Application Support Activities*

- Continued development of Catwalk sampling application.
- Fixed test records in the database that assigned the wrong instrument value.
- Removed unused “original\_asman\_id” and “original\_filename” columns from the expanded NGR report.
- Assisted technicians with various minor issues.

### *I.T. Support Activities*

- Held multiple remote sessions with Micro Focus about errors with iPrint appliance displaying printers. Troubleshooting is ongoing.
- Siem Offshore performed routine preventative maintenance on LTDAT AUX AC unit. All checked OK, and the belt was not replaced.
- Setup print services on Rad Van laptop using TCP/IP setup method. WinSpectral Counter software on laptop did not recognize iPrint printer setup. Printer setup method was documented in Tech SOP for future reference.
- Multiple issues with the Bow dome temporarily losing or not tracking the satellite. A ticket was opened with Rignet to investigate, but they did not discover any issues. The Bow dome had clear line-of-sight to the satellite, with no obstructions during these outages. The Bow dome is currently operational.
- Created Expedition 385T email accounts.

### *HSE Activities*

- Conducted weekly test of safety showers and eyewash stations.
- The abandon ship drill was performed on Sunday.