

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

Week 6 Report (24–30 June 2019)

Week 6 of the International Ocean Discovery Program (IODP) Expedition 383, Dynamics of the Pacific Antarctic Circumpolar Current (DYNAPACC), was spent transiting across the South Pacific on a bad weather avoidance course. All times in this report are in ship local time (UTC – 3 h).

Operations

At 0236 h on 20 June 2019, the vessel got underway at full speed to the northeast of Site U1541 to avoid heavy weather headed towards the operational area. Taking advantage of the transit, we deployed the towed magnetometer. The vessel continued transiting for 1109 nmi over 112.2 h on a northeasterly course until 1845 h on 24 June, when sea conditions allowed us to turn around and start heading to our operational area at the southwest Chilean margin. During the transit, on 21 June we passed just 120 nmi east of Point Nemo, the most remote location on our planet.

The vessel set a course for proposed Site CHI-1C, located at the southernmost Chilean margin close to the Pacific entrance of the Drake Passage, providing the best ability to change course for proposed Sites CHI-4B or ESP-1B if the weather improved over those sites first. The vessel continued on this course until 1230 h on 28 June, covering 873 nmi. Then, a strong system of high winds and seas was predicted to begin moving across the transit path and into the Chilean Margin operational area, forcing us to stop at 48°44.0'S, 89°24.7'W. The thrusters were lowered to wait for the system to pass.

Science Results

This week was spent finishing analyses of discrete samples for geochemical and paleomagnetic measurements, writing and reviewing the shipboard reports for Sites U1540 and U1541, and discussing postexpedition research plans and postcruise activities.

Sedimentology

Handheld X-ray fluorescence (XRF) measurements were performed on Cores U1541B-10H to 15H ($n = 46$ measurements; 85–135 mbsf) and Cores U1541C-1H to 3H and 10H to 13H ($n = 160$ measurements; 0–15 and 80–118 mbsf). The main purpose for the XRF measurements was to compare potassium (K) content between natural gamma radiation (NGR) and XRF data, and to detect elemental concentration changes across lithostratigraphic Subunits IIIA and IIIB.

Biostratigraphy

We continued to collect surface water samples four times per day to study the modern distribution of coccolithophores, diatoms, and radiolarians, and we started to analyze the stained mudline samples from the first three sites for living benthic organisms.

Paleomagnetism

We finished measuring and processing the paleomagnetic data from Site U1541. It is an outstanding site with more than 25 different reversals recognized between Holes U1541B and U1541C. The record can be clearly correlated to the geomagnetic polarity timescale (GPTS) with an almost continuous stratigraphic record that extends back more than 8 Ma. The opportunities that this provides for future research are being explored.

Geochemistry

All remaining carbonate samples from Site U1541 have been analyzed for total organic carbon (TOC) and total nitrogen (TN) content. TOC comprises a small portion of the carbon pool relative to total inorganic carbon (TIC), with an average of 0.41 wt% and a maximum value of 0.82 wt% at 70.5 mbsf. TN occurs in very low concentrations, often falling below the instrumental detection limit, with an average value of 0.015 wt% and values never exceeding 0.057 wt%. The ratio of TOC to TN is relatively high, reaching a maximum of 0.82 at 70.5 mbsf, corresponding to maximum TOC and minimum TN values at Site U1541. Interestingly, the high mean TOC:TN ratio suggests a significant source of terrestrial organic material reaching Site U1541.

Physical properties

We compared the handheld XRF potassium (K) results with the NGR derived K data, and a good correlation ($r^2 = 0.758$) is observed from 7.5 mbsf to the bottom of the record. In the upper 7.5 m, the NGR derived K data show significantly higher K concentrations than the XRF data.

Inductively coupled plasma–atomic emission spectroscopy (ICP-AES) measurements of K from discrete samples from Sites U1539 and U1540 were also compared with the NGR K data. For the comparison, the water component of the K% data (measured in wet samples) was removed using the water content from moisture and density (MAD) discrete measurements and the whole-round gamma ray attenuation (GRA) measurements. The ICP-AES data were normalized by the total percent of the ten major oxide elements to remove the effect of volatiles. A good correlation ($r^2 = 0.766$) is seen in Site U1539 from samples from 20 mbsf to the bottom and in Site U1540 ($r^2 = 0.922$) from below 5 mbsf.

Outreach

This week we reached ~2,141 individuals through live broadcasts, website blog posts, and all social media. We made four blog posts on joidesresolution.org, and multiple posts on Facebook (<https://www.facebook.com/joidesresolution>), Twitter (<https://twitter.com/TheJR>), and Instagram (http://instagram.com/joides_resolution). We did five live broadcasts (Japan, California, Arizona, Chile, Florida) with 88 participants.

Technical Support and HSE Activities

Laboratory Activities

- We held knowledge exchange sessions among the IODP technical staff; presentations included the database structure and software architecture, experience on other research vessels, and research projects.
- The troubleshooting of the 3D printer found that the heating wire had a loose connection due to the movement with the print head. This caused the printer nozzle temperature to fluctuate during the printing process, resulting in failed output. We resolved the issue by allowing more slack and securing the cable to the print head.
- Reevaluated the core logistics spreadsheet.
- Continued to update and create user guides for various instruments.
- Conducted chemicals inventory in BFLM, BHAZ, FCL, and MPIO areas.
- Conducted inventory of hotplates and ultrasonic bath.

Application Support Activities

- Continued Catwalk sampling application development, including demos for the Curator and others.
- Continued to resolve the problem with missing uploaded files.

I.T. Support Activities

- Experienced intermittent loss of the satellite data feed, even though the bow dome was tracking the satellite. Further investigation found a loose connection to the arbitrator. We reseated the connector, which restored the operational functions of the bow dome.
- Per email traffic from shore, licensed Confluence software current. License is good through September 2020.

HSE Activities

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