

IODP Expedition 374: Ross Sea West Antarctic Ice Sheet History

Week 7 Report (11–18 February 2018)

Operations

Week 7 of Expedition 374 (Ross Sea West Antarctic Ice Sheet History) began while cutting Core U1524C-15R from a depth of 384.3 m. Rotary core barrel (RCB) coring continued through Core 20R to a final depth of 441.9 m. At 0915 h on 11 February, coring operations for the remainder of the expedition had to be terminated due to a mechanical breakdown of the port stern tube and shaft arrangement. After recovering the last core, 50 barrels of high-viscosity mud were circulated to improve hole conditions for the trip out of the hole. The drill string was pulled out of the hole with the bit clearing the seafloor at 1150 h and arriving on the rig floor at 1820 h on 11 February. The rig floor was secured for transit at 1835 h, ending Hole U1524C and Expedition 374 science operations. The time spent on Hole U1524C was 7.75 h (0.3 d). The thrusters were raised and the vessel was underway at 1900 h on 11 February. The sea passage to Lyttelton, New Zealand, continued throughout the rest of the week with a total of 1604 nmi of the 1906 nmi transit completed at an average speed of 10.8 kt.

Science Results

The sedimentologists described cores from Cores U1524C-2R through 20R using a combination of visual core description, microscopic inspection of smear slides, core imaging, spectral color scanning, and point magnetic susceptibility measurements. Hole U1524C was cored from 260.5 to 437.03 m and recovered only 19.20 m (11%). The recovered sediments between ~260.5 and 315 m consist of massive to laminated greenish gray diatom ooze with sharp lower contacts interbedded at centimeter-scale with light greenish gray diatom ooze with burrows, pyrite stained laminae, and gradational contacts. A few cores in this interval recovered only washed cobbles. Below ~317 m, the sediment consists of massive to laminated greenish gray diatom-rich mud/sandy mud interbedded at decimeter- to meter-scale with bioturbated greenish gray diatom-rich sandy mud with dispersed clasts to muddy diamict. Intervals of poor recovery are inferred to represent unconsolidated diamict and gravel layers. The greenish gray intervals are heavily bioturbated and bioturbation with burrows extending centimeters or decimeters below their lower contacts.

The paleontologists examined the remainder of the core catcher samples from Hole U1524C. The lower part of the recovered succession is late Miocene in age, and is separated from overlying Pliocene sediment by an unconformity. The paleomagnetists measured the natural remanent magnetization of all archive-half core sections from Hole U1524C that consisted of more than only a core catcher. The alternating field (AF) demagnetization and measurement sequence

included a 5 mT step in addition to the 0, 10, and 20 mT peak AF demagnetization that was used during Hole U1524A. Oriented discrete samples (up to 3–4 samples/core) were collected to test the fidelity of the magnetostratigraphy and to determine the magnetic fabric. The magnetostratigraphy of Hole U1524C primarily consists of normal polarity intervals, which could not be tied confidently to a geomagnetic polarity timescale due to spotty recovery. Combined paleontological and paleomagnetic data provide a preliminary age-depth model for Site U1524 which includes upper Miocene to Pleistocene/recent sediments. Concurrences of multiple biostratigraphic events identify three hiatuses within the section.

The physical properties team finished measuring Hole U1524C whole-round sections for bulk density and magnetic susceptibility (MS) on the Whole-Round Multisensor Logger, as well as natural gamma radiation (NGR). They also collected and analyzed discrete samples for moisture and density (MAD) measurement of bulk density, grain density, and porosity, as well as measuring *P*-wave velocity with the *P*-wave caliper on the Section Half Measurement Gantry. Poor recovery made interpretation difficult, but *P*-wave velocity generally increases with depth in Hole U1524C. MS is generally low, with a few high peaks coinciding with large clasts. NGR data in Hole U1524C is generally higher than the more biogenic-rich sediment cored at the bottom of Hole U1524A.

The geochemists finished interstitial water (IW) and organic geochemical bulk sediment analyses of samples collected from Hole U1524C. Only one IW sample was taken at ~396 m CSF-A. Due to the low amount of extractable IW, only pH (7.8), salinity (32.5), and alkalinity (16.1 mM) could be determined for this sample. Bulk total organic carbon (TOC), carbonate (CaCO₃) and total nitrogen (TN) contents are variable but generally low (<0.9, <1.4, and <0.06 wt%, respectively) in Hole U1524C, with the exception of one sample collected from a carbonate-cemented mudstone that has much higher CaCO₃ content (64 wt%). Overall, the mean TOC/TN ratio of sediments at Site U1524 is low, suggesting dominance of marine-derived organic matter deposited at this site.

Education and Outreach

This week, the Education and Outreach team conducted 19 live broadcasts with schools in the USA (6), New Zealand (7), France (2), Thailand (1), Sweden (1), Australia (1), and the United Kingdom (1). We also posted seven blogs, including:

- Do you want to be part of the Physical Properties team on the *JOIDES Resolution*?
- An introduction to a short illustrated book and activity to help students understand Physical Properties.
- How do we know that the world was once covered by a thick ice cap?
- Simple science—snippets explaining our science using the 1000 most commonly used words in the English language.

- Expedition 374 and ice sheet modelling: a conversation with Benjamin Keisling, scientist onboard the *JOIDES Resolution* during Expedition 374.
- A hole in the ship? An explanation of what a moonpool is.
- Paleomagnetism for rookies, part 2.

The videographer continued to work on videos and posted several to the JOIDES Resolution website (<http://joidesresolution.org/>), including Episode 2: The birth of the West Antarctic Ice Sheet, a tour of the *JOIDES Resolution* (in French), and finding radiolarians in the core catcher.

All Education and Outreach team members made posts to social media (Facebook [<https://www.facebook.com/joidesresolution>], Twitter [<https://twitter.com/TheJR>], and Instagram [http://instagram.com/joides_resolution]). They also continued working on collaborative projects to create blogs, activities, and videos to introduce the various geological disciplines to classrooms.

Technical Support and HSE Activities

The following technical support activities took place during Week 7.

Laboratory Activities

- Laboratories received cores from Hole U1524C.
- X-ray diffraction (XRD) software was installed on an additional computer in the Core Description area.
- Staff reviewed *P*-wave velocity logger calibration and calculation.
- Staff began to review standard operating procedures and Quick Start Guides and User Guides.
- Cold weather PVC curtain on catwalk was removed and cleaned.

HSE Activities

- Tested safety showers and eye wash stations.
- An abandon ship, fire drill, and security drill were conducted on 18 February.