

IODP Expedition 379: Amundsen Sea West Antarctic Ice Sheet History

Week 1 Report (18–20 January 2019)

The first week of the IODP Amundsen Sea West Antarctic Ice Sheet History Expedition (379) consisted entirely of port call activities in Punta Arenas, Chile. All times in this report are in ship local time (UTC – 3 h).

Operations

The Amundsen Sea Expedition was planned to start on 18 January 2019. However, the ship arrived a few days early (15 January) after the long transit from Hong Kong. This time was used to load the special Antarctic fuel required on 15–16 January at the Cabo Negro Oil Terminal. The ship departed Cabo Negro at 1206 h on 16 January and was at anchorage off Punta Arenas at 1438 h on 16 January. The ship left anchorage at 0548 h on 17 January and after a very short transit arrived at the Prat Terminal 2, Punta Arenas, at 0730 h. The rest of the day was spent loading and installing a critical piece of drilling hardware (repaired j-connector) and a few other supplies that were available. The Amundsen Sea Expedition (379) officially started at 0930 h on 18 January with the Co-Chief Scientists and IODP JRSO staff boarding the ship. The JRSO staff conducted their crossover with the departing staff who left later in the afternoon. Other port call activities included a Port State Inspection and loading of 60 tons of drilling mud, a flat of drilling equipment, food and other catering supplies, as well as various IODP JRSO and ship stores. The JRSO technical staff started with preparations to assemble and install the new X-ray system for acquiring images of core sections.

The Amundsen Sea Expedition scientists boarded the ship in the morning of 19 January. After getting settled in their rooms, the scientists were introduced to life on board the *JOIDES Resolution*, general laboratory safety, and information technology resources/services. Other port call activities included loading the final drilling hardware, securing all items for departure, and continued assembly and testing of an alternate satellite communication system since our normal system likely will not work in our area of operations.

On 20 January, the science party met to discuss the primary science objectives of the Amundsen Sea Expedition and participated in the Captain's introduction and safety meeting. The Co-Chief Scientists, Operations Superintendent, Ice Observers, IODP JRSO Assistant Director, IODP JRSO Manager of Information Technology, and Expedition Project Manager met to converge on shipboard procedures for ice and weather data to be used for science operational planning. We also loaded fresh and frozen food and secured equipment for departure. The JRSO technical staff continued with final installation and testing of the new X-ray system for acquiring images of core sections.

Science Results

Expedition 379 will obtain core and log data in the Amundsen Sea Embayment (ASE) to investigate the development and sensitivity of the West Antarctic Ice Sheet (WAIS). The WAIS is largely marine based and thus highly sensitive to both climatic and oceanographic changes. Therefore, the WAIS has likely had a very dynamic history over the last several million years. A complete collapse of the WAIS would result in a global sea level rise of 3.3–4.3 m, yet the world's scientific community has not been able to predict its future behavior. Moreover, knowledge about past behavior of the WAIS is poor, in particular during geological times with climatic conditions similar to those expected for the near and distant future. Reconstructions and quantifications of partial or complete WAIS collapses in the past are urgently needed for constraining and testing ice sheet models that aim to predict future WAIS behavior and the potential contribution of the WAIS to global sea level rise. Large uncertainties exist regarding the chronology, extent, rates, and spatial and temporal variability of past advances and retreats of the WAIS across the continental shelf. These uncertainties largely result from the fundamental lack of data from drill cores recovered proximal to the WAIS. The continental shelf and rise of the Amundsen Sea are prime targets for drilling because the records are expected to yield archives of pure WAIS dynamics unaffected by other ice sheets, and because the WAIS sector draining into the ASE currently experiences the largest ice loss in Antarctica.

We plan to occupy a series of drill sites on the ASE shelf where seismic data reveal seaward-dipping sedimentary sequences that span from the preglacial depositional phase to the most recent glacial periods. Our strategy is to drill a transect from the oldest sequences close to the bedrock/basin boundary at the middle–inner shelf transition to the youngest sequences on the outer shelf in the eastern ASE. If the eastern ASE is inaccessible due to sea ice cover, a similar transect of sites can be drilled on the western ASE. The core transect will provide a detailed history of the glacial cycles in the Amundsen Sea region and allow comparison to the glacial history from the Ross Sea sector. In addition, deep-water sites on the continental rise of the Amundsen Sea have been selected to recover continuous records of glacially transported sediments and detailed archives of climatic and oceanographic changes throughout glacial–interglacial cycles. We will apply a broad suite of analytical techniques, including multiproxy analyses, to address our objectives of reconstructing the onset of glaciation during the greenhouse to icehouse transition, processes of dynamic ice sheet behavior during the Neogene and Quaternary, and ocean conditions associated with the glacial cycles.

Technical Support and HSE Activities

Technical staff moved aboard, completed their crossover with the offgoing staff, and started preparing the laboratories and science party for the upcoming expedition.

Logistics Activities

- Offgoing and oncoming freight activities were completed. Still waiting for the delivery of the two Iridium phones scheduled for delivery on 22 January.
- All supplies have been distributed and the storerooms secured for the expected heavy seas.

Underway Activities

- Waypoints from the bridge have been received and our navigation programs updated accordingly.
- Maintenance is being performed on the towed magnetometer winch before we depart.

Laboratory Activities

- **X-Ray Imaging:** All of the hardware has been installed and fully tested. Need to complete final alignment and secure the system to the countertop. A preliminary survey has been done and confirms that the shielding results in activity values well below those allowed for an uncontrolled space (~22 uR/h). Once we have completed the last modifications, an official radiation survey report will be completed for TAMU HSE. IMS integration will start tomorrow.
- **Superconducting Rock Magnetometer (SRM):** The program is up and running and the issues reported with CryoWATCH have been corrected.
- **Velocity:** A set of new velocity standards carved out of Tenite have been run and show a preliminary value of 2180 m/s. A more thorough test will be completed on the upcoming transit.
- **Microscopes:** The repaired Spot camera is currently being tested,
- **Scanning Electron Microscope (SEM):** We are looking into an issue that prevents the system from starting up.
- **Natural Gamma Radiation (NGR):** Working on minor modifications that resulted from the recent upgrade.

Application Support Activities

- Completed beginning-of-expedition activities and created new user accounts.

IT Support Activities

- Time server's satellite antenna and cabling replaced. System is up and running.

- Resolving numerous Outlook email issues.
- Currently waiting on Iridium phones to arrive and be installed.
- Service call on the forward VSAT near completion.
- All scientists were provided with initial IT information and their computers were connected to the network. Initial training was provided to scientists on how to use network resources.

HSE Activities

- Conducted both the Siem Offshore and IODP safety meeting for the science party and new staff.
- Conducted safety tours for the science party.
- IODP JRSO technical staff completed an audit of the hazardous storage areas and the weekly check of safety showers and eyewash stations.
- Completed Siem Offshore's Cold Weather survival course.
- Distributed cold weather gear to staff.
- Preparing to distribute Cold Weather survival pack to staff and science party.