

## **IODP Expedition 400: NW Greenland Glaciated Margin**

### **Week 5 Report (10–16 September 2023)**

#### **Operations**

This week we cored three holes with the rotary core barrel (RCB) system.

##### *Hole U1605A*

Week 5 of the expedition began by tripping the RCB bottom-hole assembly (BHA) down to near the seabed. We attempted to spud Hole U1605A based on a water depth of 524.1 meters below sea level (mbsl). Following a 3 m advance, the core barrel returned empty. The pipe was lowered and Hole U1605A was spudded at 0340 h on 10 September 2023 and recovered 3.2 m from an 8.0 m advance. The seafloor was established as 528.66 mbsl. Cores U1605A-1R to 47R advanced from 0 to 282 meters below seafloor (mbsf) and recovered 38.45 m (13.6%). The rate of penetration was highly variable (0.16–28.8 m/h), and averaged 4.56 m/h. The drill string was then tripped up, with the bit at the surface at 1720 h on 13 September. The drill floor was secured for transit and the thrusters were raised and secured for transit at 1748 h, ending Hole U1605A and Site U1605.

##### *Hole U1606A*

The vessel transited 44 nmi from Site U1605 to proposed Site MB-17A (Site U1606). The thrusters were lowered and secured and the ship was fully in dynamic positioning (DP) mode at 2200 h on 13 September. Ice monitoring began and the vessel made the final approach to the site slowly as ice vacated the area. The rig crew made up an RCB BHA in preparation for Hole U1606A, and the drill string was partially lowered while we waited on ice to clear the site. By 0230 h on 14 September we positioned the vessel over the site and Hole U1606A was spudded at 0415 h. Cores U1606A-1R to 20R advanced from 0 to 182.4 mbsf and recovered 30.14 m (16%). At 1030 h on 15 September ice moved within 3 nmi of the vessel and we raised the drill string to 24.6 mbsf by 1215 h. The ice was slow moving (nearly stationary) and was expected to linger over the site for more than a day while moving closer to the vessel. The decision was made to pull out of Hole U1606A and move to proposed Site MB-07B (Site U1607). The drill string was tripped up, with the bit at the surface at 1424 h. The drill floor was secured for transit and the thrusters were raised and secured for transit at 1500 h. We intend to return to Site U1606 later in the expedition.

##### *Hole U1607A*

The vessel transited 17 nmi to proposed Site MB-07B (Site U1607). The thrusters were lowered and secured and the ship was fully in DP mode at 1707 h on 15 September. The rig crew made up an RCB BHA and the drill string was tripped to near the seafloor. Hole U1607A was spudded

at 2225 h, tagging the seafloor at 738.6 mbsl. Cores U1607A-1R to 7R advanced from 0 to 65.0 mbsf and recovered 56.81 m (87%). We ended the week cutting Core 8R.

## Science Results

### *Site U1605, U1606, and U1607*

Science activities during the week included the processing and measurement of core sections and shipboard samples for Sites U1605, U1606, and U1607. The science party also worked on reports and gave site summary presentations for Site U1605.

### *Lithostratigraphy*

Cores from Sites U1605, U1606, and U1607 were split and described. Primary sedimentary lithofacies at Site U1605 are massive diamicton and stratified diamicton. A significant proportion of core recovered contains “washed gravel” (a core disturbance term). Of the 38.45 m recovered (13%), ~23 m is diamicton with the remainder composed of washed gravel. The stratigraphy of Site U1605 is summarized as one lithostratigraphic unit comprising two subunits (lithostratigraphic Subunits IA and IB; youngest to oldest). At Site U1606, the sediments consist of dark gray to dark green diamicton, sand, and mud. Fewer gravel-sized clasts and more macro- and microfossils were observed than at Sites U1603 and U1604. Several short intervals of muddy sand and sand are lithified. At Site U1607, the sediments consist of brown and gray sandy mud and muddy sand, with dispersed clasts, and bioturbation is common.

### *Biostratigraphy*

Core catcher and section half samples from Holes U1605A, U1606A, and U1607A were processed and examined for foraminifera, diatoms, and dinoflagellates. Foraminifera and diatoms were mostly absent from Site U1605. In Hole U1606A some intervals contained trace to rare benthic foraminifera. Rare diatoms were observed in five core catcher samples. Few to common occurrences of the diatom *Thalassionema nitzschioides* (a temperate cosmopolitan species found in the North Atlantic Ocean in modern times) were found in Cores U1606A-6R, 15R, 17R, 18R, and 19R. The richest benthic foraminifera assemblage occurs in Sample U1606A-11R-CC. Foraminifera are barren in Cores U1606A-15R to 19R, where diatoms are present and pyrite and glauconite are abundant. Processing of palynological samples continued. Site U1605 contained few dinoflagellates and acritarchs. Site U1606 palynomorph samples are awaiting examination.

### *Paleomagnetism*

The team finished measuring archive half sections of cores from Hole U1604B on the superconducting rock magnetometer (SRM). Discrete cube samples were collected from Hole U1604B in depth intervals where new material was recovered (deeper than Hole U1604A). All

discrete samples from Site U1604 were measured on either the SRM or the JR-6A spinner magnetometer. We measured archive half sections from Sites U1605 and U1606, collected samples from the least disturbed portions of the recovered material, and measured all discrete samples for anisotropy of magnetic susceptibility (MS) and magnetic remanence, fully demagnetizing the samples to 80 mT.

### *Geochemistry*

Whole-round core samples were processed for interstitial water (IW), and headspace sampling (HS) void gas samples were measured at Sites U1605, U1606, and U1607, depending on recovery and the availability of soft sediment. Throughout most cores at Sites U1605 and U1606, IW and HS samples were collected at a resolution of one per core, while at Site U1607 two HS samples were collected per core. Measurements of pH, alkalinity, and salinity in IW from Site U1605 and U1606 were performed in near real-time. Major elements, ions and nutrients were analyzed on IW from Sites U1605 and U1606. Additional analyses of IW for Hole U1607A are in progress. Sampling for solid state carbon and carbonate analyses was carried out at a resolution of about one sample per core, depending on the availability of soft sediment material. Analyses of total carbon and nitrogen are ongoing. High-resolution Rhizon sampling for IW was completed for the upper 20 mbsf of Holes U1605A, U1606A, and U1607A.

### *Physical Properties*

Whole-round sections of Holes U1605A and U1606A and the upper cores from Hole U1607A were logged on the Natural Gamma Radiation Logger (NGRL) upon arrival in the laboratory, followed by logging on the Whole-Round Multisensor Logger (WRMSL) once equilibrated to room temperature ( $\sim 20^{\circ}\text{C}$ ). *P*-wave velocity (PWL), MS, and gamma ray attenuation (GRA) bulk density were logged at 2 cm resolution. Thermal conductivity was measured on one section per core. When possible, the data were obtained on the whole-round sections. However, Site U1605 contains abundant igneous rocks and gravel, which were only suitable for thermal conductivity measurements on half sections for a number of cores.

Upon core splitting, X-ray images were obtained for all archive section halves of Sites U1605, U1606, and U1607. Discrete *P*-wave velocity measurements were made using the *P*-wave caliper on the working-half sections. Moisture and density (MAD) samples were taken at a resolution of one per core from these three holes to determine wet and dry bulk density, grain density, water content, and porosity. In general, the variability observed on the measured physical properties of these sites reflects major changes in lithology.

### *Stratigraphic Correlation and Downhole Measurements*

Hole stability and ice prevented downhole logging operations at Site U1605 and U1606. In addition, since only one hole was drilled at Sites U1605, U1606, and U1607, there was no need for stratigraphic correlation. Further efforts to refine the stratigraphic correlation from Sites U1603 and U1604 were made. The downhole logging data from these two sites have now been

processed by Lamont-Doherty Earth Observatory (LDEO) and are being used to refine the stratigraphic correlations.

## Outreach

The following outreach activities took place during Week 5.

There was an increase in the number of live ship-to-shore events this week, likely due to many schools now being back in session. Paul Knutz, Co-Chief Scientist, gave a presentation and led a tour for the European Consortium for Ocean Research Drilling (ECORD) Summer School. A blog series about protected species was posted. Scientists Yuka Yokoyama, Brian Romans, and Sandra Passchier co-led ship-to-shore events for their institutions.

### *Social Media*

<b>Group</b>	<b>No. of posts</b>	<b>Analytics</b>	<b>Notes</b>
<a href="#">Facebook</a>	9	4 new followers Post reactions & likes: 292 Post Impressions: 12,000 Avg Post engagement: 7.22% Post shares: 43	Top post: Repost of ANZIC IODP Coloring Pages (94 reactions and comments)
<a href="#">Instagram</a>	24	12 new followers Post reactions & likes: 526 Post Impressions: 8,800 Avg Post engagement: 9.8%	Top post: What type of samples of Earth's past come up in our cores? (147 likes)
<a href="#">Twitter</a>	11	18 new followers Post reactions & likes: 263 Post impressions: 14,000 Avg Post engagement: 4.74% Re-tweets: 29	Top Post: From sediment samples to yoga mats, scientists work on cores. (8.62%)

## Ship-to-Shore Broadcasts

Group	No. of people	Notes
Lafayette College	10–15	Focus on marine sediments, oceanography, and geology
Penn State Brandywine	20	Introductory-level coastal oceanography course for non-STEM majors, #1
Penn State Brandywine	20	Introductory-level coastal oceanography course for non-STEM majors, #2
Japan High School	~60	Led by Yuka Yokoyama
ECORD Summer School	~100	Led by Paul Knutz
Japan High School	~20	Led by Yuka Yokoyama
Virginia Tech	~45	Led by Brian Romans
Montclair State University	~15	Marine geology course; led by Sandra Passchier

## Technical Support and HSE Activities

The following technical support activities took place during Week 5.

### *Laboratory Activities*

- Technical staff was fully engaged in core processing, sampling, and science support at Holes U1605A, U1606A, and U1607A.
- Continued testing of the latest version of a stand-alone X-ray image processing application.

### *Application Support Activities*

- Worked with the Operations Superintendent to implement changes to iRIS, the new ~~new~~ rig instrumentation software. Investigated separating parts of IMS from iRIS.
- Worked on GEODESC improvements.

- Assisted with various minor data issues related to samples, tests, splices, and drill report errors.
- Provided fixes to Laboratory Information Management System Editor (LIME) so it could update the display flag for whole-round core section images.
- Provided fixes to the Sample and Data Request Management System (SDRM) sample request manager.

#### *IT Support Activities*

- Preconfigured switches for replacement during the upcoming dry dock.
- Continued to troubleshoot network issues causing streaming problems on the Bridge Deck.
- Patched Linux and Windows servers.
- Prepared the Adobe Update Server for updating all Adobe Creative Cloud applications to the 2023 version.
- Worked on updating and reconfiguring the firewall to address some intermittent issues.

#### *HSE Activities*

- Emergency shower and eyewash stations were tested.
- An abandon ship drill was held on 9 September at 1030 h.