IODP Expedition 403: Eastern Fram Strait Paleo-Archive

Week 2 Report (9–15 June 2024)

Operations

For large parts of the transit, the vessel's speed was reduced due to high seas and weather. The speed gradually increased as sea conditions and weather eased further to the north. The vessel arrived on site on 14 June with thrusters down and the vessel in dynamic positioning (DP) mode at 0919 h, beginning operations at the site. A positioning beacon was deployed as a backup to GPS. A depth reading was taken using the precision depth recorder (PDR), estimating the seafloor at 1191.8 meters below sea level (mbsl). The crew assembled the advanced piston corer (APC) bottom-hole assembly (BHA).

Prior to beginning coring operations, approximately 1000 m of core winch line was slipped from the drum due to excessive corrosion on the line. The line was reheaded and a core barrel was deployed. The bit was spaced to 1186.8 mbsl—5 m above the PDR seafloor depth—and a mudline core was attempted. When the core barrel was recovered, the barrel was empty. The bit was lowered 5 m to 1207.8 mbsl and a second core barrel was deployed. Hole U1618A was spudded at 2225 h on 14 June and seafloor depth was calculated at 1196.0 mbsl based on the core recovery from Core U1618A-1H. Coring continued with the full-length APC system to a depth of 94.0 meters below seafloor (mbsf). Cores U1618A-7H through 11H were partial strokes and were advanced by recovery. The half-length APC (HLAPC) was then deployed to extend the hole to a depth of 150.8 mbsf (Cores U1618A-12F through 24F) with partial strokes on Cores U1618A-21F, 22F, and 24F. The extended core barrel (XCB) coring system was used from Core U1618A-25X to 32X to a depth of 228.3 mbsf by 0000 h on 16 June.

All APC and HLAPC cores were taken using nonmagnetic core barrels. Temperature measurements were taken on Cores U1618A-4H, 7H, 10H, and 13F using the third-generation advanced piston corer temperature (APCT-3) tool.

Science Results

Lithostratigraphy

The sedimentology group used the transit to create macroscopic and microscopic templates for GEODESC, and they intercalibrated their smear slide descriptions. The group described Cores U1618A-1H to 31X. The lithofacies encountered in Hole U1618A are predominantly silty clays and clayey silts. All cores contain rock fragments in most of the sections, ranging from large sand to gravel, that are interpreted as ice-rafted debris (IRD). Several sections contain layers of

sand and/or gravel, interpreted as paleo-glacial melting events. All cores described were imaged with the Section Half Imaging Logger and scanned with the Section Half Multisensor Logger. In preparation for acquiring X-radiographs on cores from Hole U1618B, the group was trained to use the X-Ray Linescan Logger core scanner.

Biostratigraphy

During the transit, the biostratigraphy group set up a preparation line for foraminiferal samples. The team was introduced to the microscopes and IODP procedures, and they created data for GEODESC. Core catcher (CC) samples from Hole U1618A were qualitatively analyzed for planktic foraminifers. Several samples are barren, but the remaining samples contain relatively well-preserved Pleistocene subpolar to polar fauna. Nannofossils were analyzed from CC samples and are in good agreement with foraminifer results and paleomagnetic stratigraphy. In a few cores, additional toothpick samples were taken from individual sections. Except for Sample U1618A-1H-CC, all samples are barren of diatoms.

Paleomagnetism

The paleomagnestists measured the natural remanent magnetization before and after alternating field demagnetization on all cores from Hole U1618A. Work is ongoing to assess the potential for identifying polarity zones and for establishing a magnetic stratigraphy. The Matuyama–Brunhes boundary at 773 ka is likely present.

Geochemistry

This week, the geochemistry team measured the salinity, alkalinity, pH, ammonium, and phosphate of the interstitial water samples from Hole U1618A. Additionally, the group measured the headspace gas and found that the hydrocarbon concentration showed high values in Core U1618A-36X. One of the main indicators for hydrocarbon safety is the C_1/C_2 ratio, C_1 being methane and C_2 being ethane. The C_1/C_2 ratio dropped throughout the hole, indicative of a relative increase of ethane, and reached the lowest point—highest ethane values relative to methane—in Core U1618A-36X. They also measured the total inorganic carbon and calcium carbonate of sediment from Hole U1618A, and the results are expected to be available soon.

Physical Properties

The physical properties team measured gamma ray attenuation (GRA) bulk density, magnetic susceptibility (MS), *P*-wave velocity (PWV), and natural gamma radiation (NGR) on whole-round core sections from Holes U1618A and U1618B, sampled split sections from Hole U1618A for moisture and density (MAD) analysis, and measured thermal conductivity in one section per core, beginning in Core U1618A-15F. As cores were brought on board, sections were immediately measured for MS and GRA using the fast-track logger to assist in stratigraphic correlation. After sections thermally equilibrated (minimum of 4 h), they were measured for

GRA, MS, and PWV on the Whole-Round Multisensor Logger track and then for NGR using the Natural Gamma Radiation Logger (NGRL). Depending on core length, 1–2 discrete samples were taken for MAD measurements. The presence of IRD and core disturbance from gas expansion made the sediments unsuitable for discrete PWV on the gantry, and instead thermal conductivity was measured on one interval per core starting with Core U1618A-15H.

Microbiology

Most of the week was spent with daily meetings on sampling plans, intervals, and strategies. In addition, the microbiologists trained the geochemistry technicians on the proper workflow for sampling on the core receiving platform (catwalk) and in the splitting room.

Outreach

Once weather and sea state eased, the Outreach Officers (OO) were able to deploy a drone for photos and videos. The OOs released their first Instagram face filter, an Expedition 403 hat. They coordinated an interview with the BBC, presented an overview of our planned film to the technical staff, broadcast the first ship-to-shore event, and finalized the first draft of an article for *Oceanic* magazine. Across all social media platforms, we had 41,804 impressions and increasing engagement rates (intentional interactions with our content). With an increase of 66%, the engagement increase was most pronounced in Instagram. Facebook engagement went up by 31%.

Technical Support and HSE Activities

Laboratory Activities

- Prepared the laboratories for cores and sample analysis.
- Finalized all sampling procedures.
- Prepared for ancient DNA samples to be taken on the catwalk at Hole U1618B.
- Performed iRIS (rig instrumentation) test with the microbiologic tracer pump, and all tests went well.

Application Support Activities

- Helped to fix problems with the correlator software.
- Helping scientists and staff with occasional minor software problems.
- Working on the Hyperscan (hyperspectral camera) project.
- Addressing a few minor issues identified during the iRIS test.

IT Support Activities

- Routine printer and computer maintenance support tasks were completed.
- Helped test the iRIS system before drilling operations began.
- Continued macOS updates for all the Mac visual display units (VDUs) and the Mac workstations.
- Worked with Marine Technicians to install the June Windows updates for the workstations and finished updating all Windows servers.

HSE Activities

- Emergency shower and eye wash stations were tested.
- COVID-19 (COPE) protocols ended on 11 June.
- Lifeboat drill was conducted on 16 June.