

IODP Expedition 403: Eastern Fram Strait Paleo-Archive

Week 8 Report (21–27 July 2024)

Operations

Coring in Hole U1624C continued with the extended core barrel (XCB) coring system to the approved depth of 258.0 meters below seafloor (mbsf) with Cores U1624C-37X to 43X. The bit was pulled to the surface, clearing the seafloor at 0751 h (UTC + 2 h) and the rig floor at 1110 h on 21 July 2024. The vessel was switched from dynamic positioning (DP) to cruise mode at 1121 h, ending Hole U1624C and Site U1624. A total of 36 cores were taken over a 258.0 m interval, recovering 240.24 m of sediment (93%). The advanced piston corer (APC) was deployed for 10 cores over an 87.7 m interval with 76.05 m of recovery (87%). The half-length APC (HLAPC) was deployed for 11 cores over a 49.9 m interval with 53.06 m of recovery (106%). The XCB was deployed for 22 cores over a 120.4 m interval, recovering 111.13 m of sediment (92%). Nonmagnetic core barrels were used on all APC and HLAPC cores. Total time on Hole U1624C was 30.0 h (1.3 d).

The vessel made the 71.6 nmi transit to Site U1623 (proposed Site BED-02B) in 6.8 h, at an average speed of 10.5 kt. The thrusters were down and secure at 1844 h, and the vessel was in DP mode at 1846 h on 21 July, starting operations at Hole U1623D. The vessel was moved to the target coordinates 20 m at 112° from Hole U1623C and an APC/XCB bottom-hole assembly was assembled and deployed. The bit was lowered to 1703.5 meters below sea level (mbsl), and the core barrel was fired and retrieved empty. The bit was repositioned to 1709.0 mbsl and another APC barrel was deployed. Hole U1623D was spudded at 0108 h on 22 July. Seafloor depth was calculated at 1715.6 mbsl based on recovery in Core U1623D-1H. APC coring continued to a depth of 103.9 mbsf (Cores 1H–13H). The HLAPC was used once in this interval, Core 3F, to offset coring gaps for stratigraphic correlation. There were partial strokes on Cores 6H, 10H, and 13H. The HLAPC was then used to extend the hole to a depth of 156.4 mbsf with Cores 14F–25F. Partial strokes were recorded on Cores 17F, 23F, and 25F. The XCB was then deployed to extend the hole to the total depth of 370.0 mbsf at Core 56X. On 23 July, XCB coring was paused for 1.5 h while the core winch depth indicator was repaired; the downtime occurred between Cores 34X and 35X. After coring was completed on 24 July, the hole was conditioned for logging and the bit was pulled to a depth of 98.4 mbsf. The triple combo logging tool string was rigged up and deployed at 1230 h. The tools reached a depth of 249.8 mbsf and began logging from that point. The triple combo run was completed, and the tools were recovered. The Formation MicroScanner (FMS)-sonic tool string was then rigged up and deployed at 1800 h. The first pass of the FMS-sonic reached a depth of 249.8 mbsf; the second pass was only able to reach 227.8 mbsf before tagging an obstruction. The logging runs were completed, and the tools were recovered at 2200 h. The bit was then pulled out of the hole, clearing the seafloor at 2331 h on 24 July, ending Hole U1623D. A total of 56 cores were taken over a 370.0 m interval,

recovering 351.06 m of sediment (95%). The APC was deployed for 12 cores over a 99.2 m interval with 100.62 m of recovery (101%). The HLAPC was deployed for 13 cores over a 57.2 m interval with 60.94 m of recovery (107%). The XCB was deployed for 31 cores over a 213.6 m interval, recovering 189.50 m of sediment (89%). Nonmagnetic core barrels were used on all APC and HLAPC cores. Total time on Hole U1623D was 76.75 h (3.2 d).

The vessel was offset 10 m at 292° from Hole U1623D, and Hole U1623E was spudded at 0238 h on 25 July with Core U1623E-1H recovering 9.6 m of core. The seafloor was calculated to be 1707.2 mbsl. However, with a full core barrel, it was decided to abandon the hole in favor of obtaining a better mudline core. The hole was ended at 0300 h on 25 July. Total time on Hole U1623E was 3.50 h (0.1 d).

The vessel was offset 1.5 m at 180° from Hole U1623E, and Hole U1623F was spudded at 0323 h. The seafloor was calculated at 1706.8 mbsl, based on recovery from Core U1623F-1H. Coring continued with the APC to Core 13H, at a depth of 120.0 mbsf. There was poor recovery on Cores 11H–13H and it was decided to use the HLAPC to advance the hole in an attempt to increase recovery. The HLAPC was deployed for Cores 14F–22F to a depth of 162.3 mbsf. Cores 11H–22F were very unconsolidated and no weight on the bit was required to drill down after coring. It was determined that the bit sidetracked into an adjacent hole. Coring in Hole U1623F was terminated and the bit was pulled up, clearing the seafloor at 2105 h on 25 July, ending Hole U1623F. A total of 22 cores were taken over a 162.3 m interval, recovering 147.04 m of sediment (86%). The APC was deployed for 13 cores over a 120.0 m interval with 103.47 m of recovery (86%). The HLAPC was deployed for 9 cores over a 42.3 m interval with 43.57 m of recovery (103%). Nonmagnetic core barrels were used on all APC and HLAPC cores. Total time on Hole U1623F was 18.00 h (0.75 d).

It was decided to offset the vessel 20 m at 22° from Hole U1623C. The vessel was in position at 2130 h on 25 July and Hole U1623G was spudded at 2245 h. Seafloor was calculated at 1704.9 mbsl based on recovery from Core U1623G-1H. APC coring continued to a depth of 113.9 mbsf with Core 13H. Partial strokes were recorded on Cores 8H, 10H, and 13H. The HLAPC was deployed for Cores 14F–19F to the total depth of 142.1 mbsf. To the applause of all JRSO staff and scientists, the final *JOIDES Resolution* core of IODP was on deck at 1220 h. The bit was pulled to the surface, clearing the seafloor at 1500 h and the rig floor at 2015 h. The rig floor was secured for transit and the vessel switched from DP to cruise mode at 2036 h, ending Hole U1623G and Site U1623. A total of 19 cores were taken over a 142.1 m interval, recovering 153.5 m of sediment (108%). The APC was deployed for 13 cores over a 113.9 m interval with 123.16 m of recovery (108%). The HLAPC was deployed for 6 cores over a 28.2 m interval with 30.34 m of recovery (108%). Nonmagnetic core barrels were used on all APC and HLAPC cores. Total time on Hole U1623G was 23.50 h (1.0 d).

At 2047 h on 26 July, the thrusters were up and secure, and the vessel was underway at full speed to Amsterdam, Netherlands. The vessel had completed 308 nmi of the 1575 nmi transit by 0000 h on 28 July at an average speed of 11.3 kt.

Science Results

Lithostratigraphy

The sedimentology team finished describing all cores from Sites U1623 and U1624. The primary lithologies encountered at Hole U1624C are silty clays and clayey silts with few layers of sandy mud and sand lenses. Dispersed clasts of varying grain sizes are present in most cores. In Holes U1623D to U1623G, the dominant lithologies are also silty clays with few coarser-grained intervals and few large clasts throughout, with some intervals containing dispersed to abundant clasts and/or interbedded silt/sand layers. Cores U1623F-13H through 22F are highly disturbed, and as such, they were described very superficially.

Biostratigraphy

Biostratigraphic analysis of Site U1624 was finalized. The site is barren of diatoms except for the very top of the hole. Calcareous nannofossils and planktic foraminifers are present in the upper ~180 m. Dinocysts are present throughout, but a few samples are barren. Results from all microfossil groups indicate that site extends to the late Pleistocene, and the environment was Arctic-polar with seasonal sea ice. Dinocysts show the influence of Atlantic water during warm intervals. New holes were drilled at Site U1623 and 17 additional samples for calcareous nannofossils and diatoms were analyzed from Hole U1623D. The additional results confirm existing results from Site U1623, making the age determination and correlation more robust.

Paleomagnetism

Paleomagnetic and rock magnetic investigations of archive half and discrete cube samples were completed for Site U1624, and archive half measurements were made on cores recovered in Holes U1623D through U1623G. While diamicton sediments were challenging for paleomagnetic measurements in XCB coring at Site U1624, discrete successive cube samples from one of the few intervals with intact biscuits had reverse polarity. This places some constraint on the depth range of the Matuyama/Brunhes boundary and constrains the base of recovery to be greater than 773 ka. The additional holes at Site U1623 provide new material to help identify reproducible features in the upper 100 m of the site versus paleomagnetic features that are related to coring deformation. Overall, favorable magnetic mineralogy and reproducibility between Site U1623 and Sites U1621 and U1624 indicate good potential for higher resolution paleomagnetic reconstructions in the upper 100 m of sediment in this region.

Geochemistry

This week the geochemistry group finished high-resolution sampling of headspace and interstitial water (IW) samples. In total, the group collected eight samples each from the uppermost part (0–25 mbsf) of Hole U1623F. The analyzed data show a more detailed profile of methane and IW geochemistry in the sampled sections of Hole U1623F than in the upper part of Hole U1623A, but the overall patterns remained unchanged.

Physical Properties

Physical properties data for Holes U1623D and U1623G are similar to those observed in Holes U1623A and U1623C. Magnetic susceptibility (MS) maxima are overall lower in the Bellsund Drift sites compared to the northern sites of Expedition 403, suggesting less postdepositional alteration. The group finished all data acquisition for moisture and density, thermal conductivity, MS, gamma ray attenuation bulk density, and natural gamma radiation (NGR) for all Expedition 403 cores. Anelastic strain recovery measurements are ongoing.

Downhole logging was conducted for Hole U1623D using the triple combo and FMS-sonic tool strings. Due to swelling of the formation narrowing the borehole, the hole could only be logged to a depth of about 249 mbsf. The logging results from two successful passes are still being processed at the Lamont-Doherty Earth Observatory (LDEO). Preliminary results show that the calipers on the FMS-sonic tool string recorded several washouts and swelling formations, similar to the observations in Hole U1620D. Logs of NGR, density, electrical resistivity, acoustic velocity, and borehole images were acquired, but some of them seem to be noisy due to washouts and swelling. Due to some technical issues, the Magnetic Susceptibility Sonde (MSS) could not acquire a log of MS.

Stratigraphic Correlation

At Site U1624, the correlators constructed a single spliced interval from 0 to 270.167 m core composite depth below seafloor (CCSF) based on correlations among Holes U1624B and U1624C. The splice is generally defined down to ~210 m CCSF; however, below this depth there are a few relatively large gaps due to poor core recovery in both holes. After reoccupation of Site U1623, seven holes with variable depths became available for correlation, allowing us to generate a primary and alternate splice. The primary splice comprises a single interval from 0 to 404.18 m CCSF based on correlations between Holes U1623A, U1623C, and U1623D, except for the top 3 m CCSF where the first core of Hole U1623F was used. For the alternate splice, a single spliced interval from 0 to 174.5 m CCSF was constructed using cores that were not included in the primary splice. This splice is based primarily on correlations between Holes U1623F and U1623G, with additional sections from Holes U1623A, U1623C, and U1623D used in the interval from 73.7 to 174.5 m CCSF. The alternate splice is secured between 0 and

145.1 m CCSF and is extended by appending cores between 145.1–174.5 m CCSF based on the growth rate.

Outreach

As the final week of onsite operations came to an end, most of the focus was placed on filming necessary footage of people working in the laboratories, as well as conducting interviews for the documentary. Social media accounts featured more profiles on the science party, a blog post showcasing the work of the Marine Computers Specialists, and a post using a very high frame rate on our cinema camera to capture the spray of water on the rig floor. Due to the focus on filming, social media activity has been reduced, but there are a few prepared posts that will be published in the next day. Across all social media platforms, we had 21,200 impressions.

Technical Support and HSE Activities

Laboratory Activities

- Staff continued to handle cores with high gas content that resulted in expansion and shattered liners.
- Chemistry Laboratory technicians helped the chemists weigh all headspace samples for postcruise study.
- Staff continue to inventory chemicals and to dispose of nonhazardous material properly.
- Began laboratory cleaning.

Application Support Activities

- Worked on the Hyperscan project.

IT Support Activities

- Continued preparing for end-of-expedition data backups and any special requests for data to be brought back to shore before the start of demobilization.
- Worked with TAMU IT server administrators on shore to fix the final Windows server affected by the CrowdStrike outage.

HSE Activities

- Emergency shower and eye wash stations were tested.