

**Figure F1.** Bathymetric map showing the location of Site U1624 on the Isfjorden sediment drift along the western margin of Svalbard between the Bellsund TMF to the south and the Isfjorden TMF to the north. Glacial troughs: IF = Isfjorden, BS = Bellsund, SF = Storfjorden. Inset: close-up view of Holes U1624A–U1624C. Hole U1624A is located on Seismic Line CAGE20-5HH-13 along the margin of Svalbard. Hole U1624B is located 5 m east of Hole U1624A, and Hole U1624C is 20 m southwest of Hole U1624B; these two holes align parallel to Seismic Line EG-01A.

**Figure F2.** A. Seismic profile along the northwest–southeast Seismic Line CAGE20-5HH-13 showing the location of Site U1624. Interpreted Reflectors R1–R4A and the maximum penetration depth of 258 mbsf are shown. B. Seismic Line EG-01A shows evident mass gravity deposits associated with past shelf-edge glaciations. Holes U1624B and U1624C are located parallel to this line. Time = two-way traveltimes, CDP = common depth point.

**Figure F3.** Paired core photographs (left) and X-radiographs (right; black = high density) showing typical lithologies and lower contact boundaries, Hole U1624B. A. Gray (7.5YR 5/1) clay/silty clay with greenish gray (5GY 5/1) laminations. B. Reddish gray (10R 5/1) sandy mud transitioning to light greenish gray (10GY 7/1) silty clay. C. Dark reddish gray (10R 3/1) diamicton.

**Figure F4.** Paired core photographs (left) and X-radiographs (right; black = high density) showing common structural features, Hole U1624B. A. Dark patches and bioturbation. B. Interbedded silty clay with silt layers. C. Sand patches in silty clay.

**Figure F5.** Physical properties, Hole U1624B. Density and CIELAB L\*, a\*, and b\* are displayed as dots superimposed with an 11-point running mean. Unit and subunit boundaries are displayed in relation to their location at section breaks and within core sections rather than at the corresponding depth because overlapping sections occurred due to gas expansion and are not correctly displayed on the CSF-A depth scale. cps = counts per second.

**Figure F6.** Physical properties, Hole U1624C. Density and CIELAB L\*, a\*, and b\* are displayed as dots superimposed with an 11-point running mean. Unit and subunit boundaries are displayed in relation to their location at section breaks and within core sections rather than at the corresponding depth because overlapping sections occurred due to gas expansion and are not correctly displayed on the CSF-A depth scale. cps = counts per second. See legend for lithology in Figure F5.

**Figure F7.** Lithologic correlation, Holes U1624B and U1624C. Unit and subunit boundaries are displayed in relation to their location at section breaks and within core sections rather than at the corresponding depth because overlapping sections occurred due to gas expansion and are not correctly displayed on the mbsf depth scale. Core lithology is simplified by grouping (silty/sandy) clay and clay; sandy mud and (clayey) silt; and (muddy/sandy) diamicton. Clast abundance, laminations, degree of bioturbation, and degree of drilling disturbance are all color coded and shown as histograms. See legend for lithology in Figure F5.

**Figure F8.** Downhole mineralogy from smear slide analysis, Hole U1624B.

**Figure F9.** Downhole mineralogy from smear slide analysis, Hole U1624C.

**Figure F10.** Ternary diagram of sand, silt, and clay percentages of sediment as inferred from smear slides, Holes U1624B and U1624C.

**Figure F11.** XRD results for clay analysis, Hole U1624B.

**Figure F12.** Biostratigraphic summary, Site U1624. Letters in parentheses refer to the hole(s) where the event is observed.

**Figure F13.** Age–depth model, Site U1624. Calcareous nannofossils: Ehux = LO *E. huxleyi*, HOGcar = HO acme *G. caribbeanica*, LOGcar = LO acme *G. caribbeanica*, Rasa = HO *R. asanoi*. Foraminifers: Npach = LO *N. pachyderma*. Paleomagnetic boundaries: B/M = Brunhes/Matuyama boundary (see Paleomagnetism).

**Figure F14.** Biostratigraphy and paleoenvironment, Hole U1624B.

**Figure F15.** Biostratigraphy and paleoenvironment, Hole U1624C.

**Figure F16.** MS and paleomagnetic data, Holes U1624B and U1624C. NRM intensity and inclination from archive half data are after the final AF demagnetization step. Data were collected on archive halves (purple/black = APC/HLAPC-cored sections; pink/red = XCB-cored sections). For discrete cube data, MS is scaled to the WRMSL IU by a factor of  $7.0 \times 10^{-6}$  (e.g., Thomas et al., 2003). Inclinations with well-defined magnetizations (maximum angular deviation  $<20^\circ$ ) are plotted as ChRM identified using principal component analysis (yellow squares). Rock magnetic parameters  $ARM_{30mT}/ARM$  and  $ARM/MS$  are plotted for comparison. Light red shading = intervals described as diamicton, sandy mud, and/or having common or abundant clasts (did not appear to preserve a primary sedimentary fabric in XCB cores). Orange squares = discrete cube samples from intervals for which intact biscuits could not be confidently identified in split core and X-ray images. Dashed line = expected inclination value for this latitude. GPTS 2020: polarity interpretation and correlation to the geomagnetic polarity timescale (Gradstein and Ogg, 2020). Black = normal, white = reverse.

**Figure F17.** Inclination, Holes U1624B and U1624C. Blue shading = peak AF demagnetization. Orange lines = Hole U1624B ChRM inclination from discrete cube samples. Vertical dashed lines = expected value for this latitude based on a GAD.

**Figure F18.** Split core and X-ray images of example paleomagnetic sample locations and ChRM inclinations (403-U1624B-29X). Intervals where intact biscuits could and could not be identified are shown. Squares = cube sample locations. Samples with inclination within  $20^\circ$  of expected values for this latitude for a GAD are shaded black (normal) and white (reverse), and samples with ChRM inclinations greater than  $20^\circ$  from expected values for this latitude are shaded gray. IW = interstitial water sample.

**Figure F19.** Physical properties, Holes U1624B and U1624C. Lines = running five-point averages. cps = counts per second.

**Figure F20.** MS, Holes U1624B and U1624C. Measurements were taken on whole rounds using a pass-through loop sensor (WRMSL).

**Figure F21.** NGR, GRA bulk density, and MS, Holes U1624B and U1624C. Triangles = Hole U1624B, Xs = Hole U1624C. cps = counts per second.

**Figure F22.** MAD parameters, Hole U1624B.

**Figure F23.** GRA bulk density and MAD, Hole U1624B. Measurements were made on the WRMSL (GRA) and discrete samples (MAD).

**Figure F24.** Thermal conductivity, Hole U1624B. Orange diamonds = individual measurements, orange lines = standard deviation, purple diamonds = averages.

**Figure F25.** Violin plots summarizing physical property associations with lithostratigraphic units/subunits, Hole U1624C. cps = counts per second.

**Figure F26.** MS data, Holes U1624B and U1624C. Top: MS splice constructed by combining data from all holes. Break in scale is due to high values at some depths with high concentration of authigenic greigite minerals.

**Figure F27.** Reflectance spectroscopy and colorimetry (RSC) L\* and a\*, MS, and NGR, Site U1624. cps = counts per second.

**Figure F28.** Depth scale offset, Site U1624. A. Comparison of mbsf and CCSF scales in the splice and equations to convert between them. B. Growth of cumulative depth offset.

**Figure F29.** IW chloride, sodium, and salinity, Hole U1624B. Black arrows = average seawater values.

**Figure F30.** Sulfate, alkalinity, iron, and manganese of the IW composite record, Hole U1624B. Black arrows = average seawater values.

**Figure F31.** IW calcium, magnesium, strontium, silicon, barium, and lithium, Hole U1624B. Black arrows = average seawater values.

**Figure F32.** IW potassium and boron, Hole U1624B. Black arrows = average seawater values.

**Figure F33.** IW ammonium and phosphate, Hole U1624B. Black arrows = average seawater values.

**Figure F34.** Bulk sediment concentration records with smoothed lines for TC,  $\text{CaCO}_3$ , TOC, TN, and C/N ratio, Hole U1624B.

**Figure F35.** Bulk sediment contents of TS, Hole U1624B.

**Figure F36.** Concentrations of methane ( $\text{CH}_4$ ), ethane ( $\text{C}_2\text{H}_6$ ), propane ( $\text{C}_3\text{H}_8$ ), and methane/ethane ratios ( $C_1/C_2$ ) measured on headspace gas samples from  $\sim 5 \text{ cm}^3$  of sediment, Hole U1624B.

**Figure F37.** Formation temperature, Hole U1624B. Dashed line = linear regression results.