

**Figure F1.** Bathymetric map showing the locations of Sites U1619 and U1618 on the western and eastern terminations of the Vestnesa Ridge sediment drift, respectively. Site U1619 is located ~66 km from Site U1618. The Molloy Transform Fault (MTF) is parallel to and south of the Vestnesa Ridge and connects the actively spreading Knipovich and Molloy Ridge segments. ODP Site 909 is located on an abyssal hill south of the MTF. KF = Kongsfjorden glacial trough. MD = Molloy Deep.

**Figure F2.** Seismic profile along northwest–southeast Seismic Line CAGE20-5-HH-11-2D showing the location of Site U1619. Interpreted Reflectors R1–R8 and the maximum penetration are shown. Time is two-way traveltime.

**Figure F3.** Paired core photographs (left) and X-radiographs (right; black = high-density) showing typical lithologies and associated split core colors, Site U1619. A. Dark greenish gray (10GY 4/1) calcareous rich silty clay. B. Greenish gray (5GY 5/1) clay with dark patches. C. Black (2.5Y 2.5/1) silty clay. D. Very dark grayish brown (10YR 3/2) silty clay. Core photographs have not been altered from their original format to show the true color of the sediments.

**Figure F4.** Paired core photographs (left) and X-radiographs (right; black = high-density) showing authigenic minerals, Site U1619. A. Iron sulfide nodules in dark gray (5Y 4/1) silty clay. B. Yellowish orange sand-sized carbonate grains concentrated in lenses within gray (5Y 5/1) silty clay. C. Light brownish gray (2.5Y 6/2) carbonate-rich clayey-silt interval (70–74 cm) that is denser than apparent on the X-radiograph between very dark gray (5Y 3/1) silty clay.

**Figure F5.** Paired core photographs (left) and X-radiographs (right; black = high-density) showing sedimentologic features used to define lithostratigraphic units, Site U1619. A. Clasts >4 cm between the transition from very dark greenish gray (5GY 3/1) silty clay to very dark gray (10YR 3/1) silty clay at 77 cm in which the sediments are exhibiting uparching. B. Thin laminations within biscuit-colored very dark gray (5Y 3/1) silty clay. C. Bioturbated sediments in black (2.5Y 2.5/1) silty clay. D. Dark patches in black (5Y 2.5/1) silty clay as apparent on the core surface and even more apparent in the X-radiograph image. Brightness increased by 20% and contrast lowered by 20% in core photographs in B–D to enhance the features.

**Figure F6.** Physical properties, Site U1619. Density and CIELAB L\*, a\*, and b\* are displayed as dots superimposed with an 11-point running mean. Color reflectance data are not shown for intervals in which the SHMSL did not contact the split core surface during measurement and were therefore not considered when determining lithostratigraphic unit boundaries. cps = counts per second.

**Figure F7.** Ternary diagram of sand, silt, and clay percentages of sediment as inferred from smear slides, Hole U1619A.

**Figure F8.** Downhole mineralogy from smear slide analysis, Site U1619.

**Figure F9.** XRD results for clay analysis, Site U1619. Visual core descriptions show lithologic changes downhole.

**Figure F10.** Biostratigraphy and paleoenvironment, Hole U1619A.

**Figure F11.** Age-depth model, Site U1619. All encountered biostratigraphic and paleomagnetic datums are shown. Calcareous nannofossils: Ehux = LO *E. huxleyi*, Gcar = acme *G. caribbeanica*, Hsel = HO *H. sellii*, Ramp = HO *R. amplia*, Rpseu = HO *R. pseudoumbilicus* (>7 µm). Foraminifers: Cter = HO *C. teretis*, Npac = LO *N. pachyderma*, Natl.sin = HO *N. atlantica* (sin), Cgro = HO *C. grossa*. Diatoms: Tjous = HO *T. jouseae*, Fjous = HO *F. jouseae*. Dinocysts: Pstel = acme *P. stellatum*, Ffil = HO *F. filifera*, Htec = HO *H. tectata*, O?eir = HO *O. ? eirikianum*, Bgra = HO *B. graminosum*, Bmin = HO *B. minuta* in the Norwegian Sea (dotted line = range in wider North Atlantic), Sbrev = HO *S. brevispinosa* in Norwegian Sea (dotted line = range in wider North Atlantic). Acritarchs: C?aeg = HO *C. ? aegirii*, Lcri = HPO *L. cristata*, Lcan = HO *L. canalis*, Lluc = HO *L. lucifer* in Norwegian Sea (dotted line = range in wider North Atlantic). For paleomagnetic datums, see Paleomagnetism.

**Figure F12.** Two iron sulfides (millimeter to centimeter scale) visible from the split core surface, Site U1619. A, B. Left: reflected light image of a polished thin section. Right: EDS mapping of iron, sulfur, and silicon from (A) a low-MS interval showing an iron sulfide infilling a burrow with inclusions of sand-sized silicate minerals (403-U1619A-32X) and (B) a high-MS interval showing a more massive iron sulfide nodule, which XRD confirmed was greigite (33X). C. Abundant greigite nodules associated with some of the highest MS values observed at this site (33X). D. Intensity of NRM, ARM, and 300 mT IRM during AF demagnetization. E, F. Demagnetization behavior of (E) NRM and (F) ARM. Blue = vertical plane, red = horizontal plane. Behavior associated with GRM acquisition is highlighted with lighter colors.

**Figure F13.** Comparison of magnetic parameters along the Vestnesa Ridge east (Site U1618) and west (Site U1619) sites. Values for Vestnesa Ridge greigite nodules and the average for near-surface samples are plotted in the upper six graphs for comparison.

**Figure F14.** Inclinations, Site U1619. Red dashed lines = inclination values expected for a GAD at this latitude.

**Figure F15.** MS and paleomagnetic data for APC/HLAPC-cored interval, Hole U1619A. Inclination, intensity, and MS: black lines = core section measurements with inclinations from disturbed intervals in gray, squares = discrete cube samples. ChRM inclination (from cube samples): gray squares = samples with poorly defined magnetizations (maximum angular deviation > 20°), blue squares = data on which we base our interpretation. GPTS 2020: polarity interpretation and correlation to geomagnetic polarity timescale of Gradstein et al. (2020) (black = normal; white = reverse; gray = undetermined).

**Figure F16.** MS and paleomagnetic data for XCB-cored interval, Hole U1619A. Inclination, intensity, and MS: lines = core section measurements, squares = discrete cube samples. ChRM inclination (from cube samples): gray squares = samples with poorly defined magnetizations (maximum angular deviation > 20°), red squares = high-MS intervals (>5 × 10<sup>-4</sup> SI), blue squares = data on which we base our interpretation. GPTS 2020: polarity interpretation and correlation to geomagnetic polarity timescale of Gradstein et al. (2020) (black = normal; white = reverse; gray = undetermined).

**Figure F17.** Age-depth plot, Site U1619. Squares = upper and lower bounds for reversal depths. Black lines = linear segments at constant sedimentation rate (0.0–1.0, 1.0–2.0, 2.0–3.8, and 3.8–5.9 Ma). Dashed lines = major reflectors. Left: interpreted polarity column (black = normal, white = reverse, gray = uncertain). Top: geologic timescale (Gradstein et al., 2020).

**Figure F18.** Physical properties, Site U1619. Lines = five-point running averages. cps = counts per second.

**Figure F19.** MS, Site U1619. Measurements were taken on whole rounds using a pass-through loop sensor (WRMSL) and split archive-half sections using a point-source sensor (SHMSL).

**Figure F20.** NGR, GRA bulk density, and MS, Site U1619. cps = counts per second.

**Figure F21.** MAD parameters, Hole U1619A.

**Figure F22.** GRA bulk density and MAD, Site U1619. Measurements were made on the WRMSL (GRA) and discrete samples (MAD).

**Figure F23.** Thermal conductivity, Site U1619. Orange = individual measurements, orange lines = standard deviation, purple = averages.

**Figure F24.** ASR initial results, Sample 403-U1619-82X-6, 66–76 cm. Top: temperature monitoring data used to ensure water bath temperatures were stable. Middle: results from a dummy channel used to ensure that the data logger was

operating correctly. Bottom: average values of the 11 ASR measurements collected from the 18 strain gauges every 10 min for ~15 days.

**Figure F25.** Violin plots summarizing physical property associations with preliminary lithostratigraphic units/subunits, Hole U1619A. cps = counts per second.

**Figure F26.** Reflectance spectroscopy and colorimetry (RSC)  $L^*$ ,  $M_S$ ,  $N_{GR}$ , and density, Site U1619. cps = counts per second.

**Figure F27.** Depth scale offset, Hole U1619A. A. Comparison of CSF-A and CCSF-A scales and equation to convert between them. B. Growth of cumulative depth offset.

**Figure F28.** IW chloride, sodium, and salinity, Site U1619. Black arrows = average seawater values.

**Figure F29.** IW sulfate, alkalinity, iron, and manganese, Site U1619. Black arrows = average seawater values.

**Figure F30.** IW calcium, magnesium, strontium, silicon, barium, and lithium, Site U1619. Black arrows = average seawater values.

**Figure F31.** IW potassium and boron, Site U1619. Black arrows = average seawater values.

**Figure F32.** IW ammonium and phosphate, Site U1619. Black arrows = average seawater values.

**Figure F33.** Bulk sediment concentration records with smoothed lines for TC,  $CaCO_3$ , TOC, and TN, and the C/N ratio, Site U1619.

**Figure F34.** Bulk sediment contents of TS, Site U1619.

**Figure F35.** Concentrations of methane ( $CH_4$ ), ethane ( $C_2H_6$ ), heavier hydrocarbons ( $C_2-C_6$ ), and methane/ethane ratios ( $C_1/C_2$ ) measured on headspace gas samples from ~5 cm<sup>3</sup> of sediment, Hole U1619A.

**Figure F36.** Formation temperature, Hole U1619A. Dashed line = linear regression results.