Figure F1. Seismic Line AWI-20050008 showing Site U1581. Preliminary interpretation of seismic units according to the drilled lithologic units is shown. The marked purple reflection corresponds in structure to the top of basement (see Figure F5 in the Expedition 392 summary chapter [Uenzelmann-Neben et al., 2023b]), the brown reflection to the interpreted black shale, the pale green reflection to Reflector O, the red reflection to Reflector M, and the pink reflection to Reflector P. CDP = common depth point.

Figure F2. Lithostratigraphic summary, Site U1581. cps = counts per second.

Figure F3. Major lithologies, Site U1581. A. light yellowish brown and light brown clayey nannofossil ooze with biosilica (392-U1581A-1H-1, 50–60 cm). B. grayish green foraminiferal ooze with medium-grained laminated sand. The foraminiferal ooze is separated by an erosive/scoured boundary from greenish gray nannofossil ooze (1H-3, 115–125 cm). C. Light green nannofossil ooze (6H-6, 65–75 cm). D. Sand with small subangular shell fragments (14H-1, 104–114 cm). E. Silt and nannofossil ooze with sharp contact (392-U1581B-6R-1, 58–68 cm). F. Laminated nannofossil-rich clay with zeolite (12R-1, 67.5–77.5 cm).

Figure F4. Major lithologies, Hole U1581B. A. dark greenish gray sand and silt with weak parallel lamination and normal grading (18R-2, 77.5–87.5 cm). B. very dark greenish gray silt with pyrite (22R-1, 44–54 cm). C. Dark greenish gray siltstone (58R-3, 36.5–46.5 cm). D. Silicified claystone and greenish gray claystone (66R-3, 109–119 cm).

Figure F5. Main sedimentary component abundance compilation, Site U1581. 0 = not present, T = trace (0%–1%), R = rare (1%–10%), C = common (10%–25%), A = abundant (25%–50%), D = dominant (>50%).

Figure F6. Bulk sediment XRD, Site U1581. A. Nannofossil ooze. Dominant minerals are quartz, calcite, and gismondine (zeolite). B. Nannofossil-rich clay with zeolite. Dominant minerals are quartz, glauconite, clinoptilolite, gismondine (zeolite), and sepiolite (possibly from drilling mud). C. Thinly laminated silt. Dominant minerals are quartz, glauconite, illite/montmorillonite, gismondine (zeolite), and sepiolite (possibly from drilling mud). D. Calcareous claystone. Dominant minerals are calcite, quartz, zeolite, and glauconite. E. Black claystone. Dominant components are quartz, muscovite mica, calcium-magnesium-iron carbonate, illite, and glauconite.

Figure F7. Mass movement deposits, Hole U1581B. A. Normal grading and convolute bedding. B. Normal grading, fine lamination, and soft-sediment deformation. Grain size ranges from fine sand to silt. C. Normal grading with interbedded silt and clay. D. Thin lamination and massive beds in a normal graded sequence.

Figure F8. A–J. Major sedimentary lithologies, Site U1581. Left: plane-polarized light (PPL), right: cross-polarized light (XPL). Nanno = nannofossil.

Figure F9. Likely position of the hiatus spanning the K/Pg boundary, 392-U1581B-20R-2. Image enhanced for brightness.

Figure F10. Overview of the preservation and abundance of nannofossils, planktonic foraminifera, siliceous microfossils (excluding pyritized forms), and palynomorphs studied at Site U1581. Preservation: P = poor, M = moderate, G = good, VG = very good, E = excellent. Abundance: B = barren, P = present, Tr = trace, R = rare, F = few, C = common, A = abundant, D = dominant. Nannofossil preservation: tick mark between P and M indicates poor–moderate preservation; tick mark between M and G indicates moderate–good preservation.

Figure F11. Calcareous nannofossil abundance, zones, and distribution of biostratigraphically important taxa, Site U1581. Dashed lines show epoch boundaries. Wavy lines represent inferred unconformities. Taxa distribution shown in red are latest Maastrichtian nannofossils inferred to be reworked into lowermost Paleocene sediment. Abundance: B = barren, R = rare, F = few, C = common, A = abundant, D = dominant.

Figure F12. Selected Quaternary and Neogene calcareous nannofossils, Hole U1581A. Scale bar = 10 μm. A. *Gephyrocapsa oceanica* (1H-1, 110 cm). B. *Pseudoemiliania lacunosa* (1H-CC). C. *Calcidiscus tropicus* (4H-CC). D. *Helicosphaera*

sellii (1H-1, 110 cm). E. *Ceratolithus cristatus* (3H-CC). F. *Nicklithus amplificus* (21H-CC). G. *Sphenolithus capricornutus* (29H-CC). H. *Sphenolithus heteromorphus* (24H-CC). I. *Discoaster tamalis* (15H-1, 53 cm). J. *Discoaster quinqueramus* (21H-CC). K. *Discoaster brouweri* (6H-CC). L. *Discoaster asymmetricus* (18H-CC). M. *Discoaster surculus* (32R-6, 65 cm). N. *Discoaster variabilis* (19H-CC). O. *Discoaster berggrenii* (23H-CC). P. *Discoaster deflandrei* (3H-CC). Q. *Umbilicosphaera rotula* (31R-2, 95 cm). R. *Calcidiscus premacintyrei* (24H-CC). S. *Orthorhabdus rugosus* (21H-CC). T. *Coccolithus miopelagicus* (29H-CC).

Figure F13. Selected Paleogene calcareous nannofossils. Scale bar = 10 μm. (Parts G, H, K, P: Hole U1581A; others: Hole U1581B.) A. *Reticulofenestra umbilicus* >14 μm (2R-3, 66 cm). B. *Reticulofenestra bisecta* >10 μm (2R-3, 66 cm). C. *Coccolithus pelagicus* (6R-7, 59 cm). D. *Coccolithus formosus* (5R-6, 70 cm). E. *Pletolithus mutatus* (5R-6, 70 cm). F. *Pletolithus gigas* (7R-4, 91 cm). G. *Chiasmolithus altus* (36F-CC). H. *Clausicoccus fenestratus* (36F-CC). I. *Sphenolithus pseudoradians* (2R-3, 66 cm). J. *Sphenolithus furcatolithoides* (5R-6, 70 cm). K. *Furcatolithus avis* (40X-2, 87 cm). L *Furcatolithus cuniculus* (6R-7, 59 cm). M. *Furcatolithus akropodus* (3R-3, 77 cm). N. *Sphenolithus orphanknollensis* (5R-3, 23 cm). O. *Furcatolithus obtusus* (5R-2, 142 cm). P. *Furcatolithus predistentus* (36F-CC). Q. *Discoaster sublodoensis* (8R-CC). R. *Discoaster saipanensis* (6R-CC). S. *Discoaster barbadiensis* (6R-CC). T. *Gomphiolithus magnus* (14R-1, 106 cm).

Figure F14. Selected Cretaceous calcareous nannofossils, Hole U1581B. Scale bar = 10 μm. A. *Prediscosphaera arkhangelskyi* (30R-CC). B. *Gartnerago segmentatum* (26R-7, 79-80 cm). C. *Eiffellithus parallelus* (26R-7, 79-80 cm). D. *Ahmuellerella octoradiata* (29R-CC). E. *Zeugrhabdotus xenotus* (49R-CC). F. *Tranolithus orionatus* (21H-CC). G. *Tetrapodorhabdus decorus* (39R-CC). H. *Rhagodiscus splendens* (48R-CC). I. *Monomarginatus quaternarius* (32R-CC). J. *Retecapsa angustiforata* (31H-CC). K. *Broinsonia parca constricta* (30R-CC). L. *Reinhardtites anthophorus* (26R-7, 79-80 cm). M. *Biscutum magnum* (46R-6, 21 cm). N. *Lucianorhabdus maleformis* (24R-CC). O. *Micula murus* (18R-1, 8 cm). P. *Uniplanarius trifidus* (36R-CC). Q. *Arkhangelskiella cymbiformis* (24R-CC). R. *Misceomarginatus pleniporus* (24R-CC). S. *Zeugrhabdotus embergeri* (17R-4, 67 cm). T. *Braarudosphaera bigelowii* (17R-4, 67 cm).

Figure F15. Selected planktonic foraminifera. A (1,2). *Globorotalia plesiotumida* (SEM S9: 392-U1581A-1H-CC). B (1,2). *Trilobatus trilobus* (SEM T1: 392-U1581A-5H-CC). C. *Globoconella inflata* (SEM S21: 392-U1581A-2H-CC). D. *Sphaeroidinella dehiscens* (SEM S32: 392-U1581A-3H-CC). E (1, 2). *Neogloboquadrina acostaensis* (SEM T15: 392-U1581A-11H-CC). F. *Globigerinoides ruber* (SEM T16: 392-U1581A-11H-CC). G. *Globigerinoides extremus* (SEM T21: 392-U1581A-11H-CC). H (1,2). *Globigerinella siphonifera* (SEM T27: 392-U1581A-20H-CC; 4–5 Ma). I. *Orbulina bilobata* (SEM U18: 392-U1581A-23H-CC). J (1,2). *Planoheterohelix globulosa* (SEM V1: 392-U1581B-20R-CC). K, L. *Trilobatus immaturus*; (K) SEM U1: 392-U1581A-21H-CC; (L) SEM U3: 392-U1581A-21H-CC. M. *Sphaeroidinella dehiscens* (SEM T2: 392-U1581A-5H-CC). N (1,2). *Trilobatus sacculifer* (SEM U6: 392-U1581A-21H-CC). O. *Candeina nitida* (SEM T34: 392-U1581A-20H-CC). P. *Globorotalia pseudomiocenica* (SEM U7: 392-U1581A-21H-CC).

Figure F16. Selected benthic foraminifera. A (1,2). *Cibicidoides* spp. (SEM S22: 392-U1581A-2H-CC). B (1,2). *Melonis affinis* (SEM S29: 392-U1581A-2H-CC). C, E. *Plectofrondicularia pellucida*; (C) SEM U10: 392-U1581A-21H-CC; (E) SEM U12: 392-U1581A-21H-CC. D (1,2). *Proxifrons inaequalis* (SEM U9: 392-U1581A-21H-CC). F. *Spiroloculina* sp. (SEM T22: 392-U1581A-11H-CC). G. *Bolivina affiliata* (SEM U20: 392-U1581A-23H-CC). H. *Bolivina reticulata* (SEM U35: 392-U1581A-30H-CC). I. *Siphonodosaria ketienziensis* (SEM T33: 392-U1581A-20H-CC).

Figure F17. Selected siliceous microfossils. Colors indicate species general environments (blue = Southern Ocean or cooler waters, red = subtropical warm water, green = coastal and freshwater, black = pyritized forms). (Part T: Hole U1581B; others: Hole U1581A.) A, B. *Fragilariopsis kerguelensis* (1H-CC; 63× objective). C. *Actinocyclus ingens* (5H-CC; 63×). D. *Thalassiosira elliptipora* (2H-CC; 63×). E. *Eucampia antarctica* (1H-CC; 63×). F. *Thalassiosira lentiginosa* (1H-CC; 63×). G, H. *Fragilariopsis barronii*; (100×); (G) 10H-CC, (H) 5H-CC. I. *Actinocyclus actinochilus* (2H-CC; 63×). J. *Hemidiscus karstenii* (4H-CC; 63×). K. *Azpeitia tabularis* (2H-CC; 100×). L. Chain of *Paralia sulcata* (1H-CC; 100×). M. *Trachyneis* spp. (3H-CC; 63×). N. Large benthic diatom fragment (9H-CC; 63×). O. *Azpeitia nodulifera* (3H-CC; 63×). P. *Hemidiscus cuneiformis* (5H-CC; 63×). Q. *Trigonium alternans* (5H-CC; 63×).

R. *Cocconeis* spp. (3H-CC; 63×). S. Pyritized diatoms post-HF treatment and sieving (16H-CC; 63×). T. *Hemiaulus* spp. (23R-CC; 63×). U. *Trinacria* spp. (23R-CC; 63×). V. *Stephanopyxis* spp. (23R-CC; 63×).

Figure F18. Selected dinocysts. Scale bar = 50 µm. (Parts J, O: Hole U1581A; others: Hole U1581B.) A. *Achomosphaera* sp. (45R-CC). B. *Alisocysta circumtabulata* (17R-CC). C. *Areoligera senonensis* (14R-CC). D, E. *Batiacasphaera reticulata*, (D) 34R-3, 114–116 cm; (E) 57R-CC. F. *Batiacasphaera*? (74R-CC). G. *Cannosphaeropsis* sp. (17R-CC). H. *Cerodinium* sp. A. "small" Bijl et al., 2021 (21R-CC). I. *Chatangiella ditissima* (34R-3, 114–116 cm). J. *Chiropteridium galea* (32F-CC). K. *Circulodinium distinctum* (55R-CC). L. *Coronifera oceanica* (74R-CC). M. *Cribroperidinium tenuitabulatum* (17R-CC). N. *Danea californica* (19R-CC). O. *Deflandrea phosphoritica* (40X-CC).

Figure F19. Selected dinocysts. Scale bar = 50 µm. (Parts D, G, H, L: Hole U1581A; others: Hole U1581B.) A. *Diconodinium psilatum* (18R-CC). B. *Dinogymnium euclaense* (25R-CC). C. *Disphaerogena carposphaeropsis* (17R-CC). D. *Distatodinium biffi* (32F-CC). E. *Eisenackia reticulata* (14R-1, 106–108 cm). F. *Glaphyrocysta divaricata* (14R-1, 106–108 cm). G. *Homotryblium plectilum* (32F-CC). H. *Hystrichokolpoma cinctum* (32F-CC). I. *Isabelidinium magnum* (63R-CC). J. *Isabelidinium pellucidum* (25R-CC). K. *Leberidocysta chlamydata* (28R-CC). L. *Lejeunecysta* sp. (9H-CC). M. *Nelsoniella aceras* (73R-CC). N. *Nematosphaeropsis* sp. (57R-CC). O. *Odontochitina costata* (36R-CC).

Figure F20. Selected dinocysts. Scale bar = 50 µm. (Parts J, O: Hole U1581A; others: Hole U1581B.) A. *Odontochitina cribropoda* (74R-CC). B C. *Odontochitina porifera*; (B) 28R-CC; (C) 29R-CC. D. *Odontochitina*? sp. (52R-CC). E–G. *Oligosphaeridium* sp.; (E) 61R-CC; (F) 73R-CC; (G) 73R-CC. H. *Palaeocystodinium golzowense* (25R-CC). I. *Satyrodinium haumuriense* (55R-CC). J. *Selenopemphix selenoides* (9H-CC). K. *Senoniasphaera*? (17R-CC). L. *Spinidinium densispinatum* (31R-CC). M. *Spiniferella cornuta* (14R-CC). N. *Spongodinium delitiense* (73R-CC). O. *Stelladinium stellatum* (9H-CC).

Figure F21. Selected dinocysts. Scale bar = 50 µm. (Part A: Hole U1581A; others: Hole U1581B.) A. *Stoveracysta inornata* (32F-CC). B. *Subtilisphaera* sp. (21R-CC). C, D. *Trichodinium castanea*; (C) 52R-CC; (D) 74R-CC. E, F. *Trithyrodinium evittii*; (E) 16R-CC; (F) 20R-2, 53–54 cm. G. *Xenikoon* aff. *australis* (39R-CC).

Figure F22. Selected miospores. (Parts A–C: Hole U1581A; D–L: Hole U1581B.) A. Miospore indet. (9H-CC). B. *Laevigatisporites* (9H-CC). C, D. *Cicatricosisporites*; (C) 40X-CC; (D) 18R-1, 4–5 cm. E. Trilete miospore (18R-1, 4–5 cm). F, G. *Ephedripites jansonii*; (F) 25R-CC; (G) 20R-2, 53–54 cm. H. *Nothofagidites* (36R-CC). I. *Ischiosporites*? (36R-CC). J. Trilete miospore (34R-3, 114–116 cm). K. *Cyathidites*? (20R-3, 56–57 cm). L. *Densoisporites* (25R-CC).

Figure F23. Magnetostratigraphic results, Hole U1581A. Dark blue dots = NRM intensity and inclination before AF demagnetization. Cyan dots = NRM intensity and inclination after 15 mT AF cleaning of the archive halves. Black line in inclination column = 15 point moving average, red dots = discrete samples. The magnetic polarity plot is generated from the moving average: negative (up-pointing) inclination indicates deposition during a normal geomagnetic polarity field (black bands). Gray bands = intervals without paleomagnetic measurement (e.g., core gaps) or intervals where polarity could not be confidently constrained. The magnetic polarity is correlated with the GPTS (Ogg, 2020) (blue bands). Biostratigraphic data suggest there is a condensed interval in Cores 17H–26H, and an Oligocene age is assigned from Core 28H downcore. Correlation with the GPTS in this interval is hampered by poor quality data.

Figure F24. Magnetostratigraphic results, Hole U1581B. Dark blue dots = NRM intensity and inclination before AF demagnetization. Cyan dots = NRM intensity and inclination after 20 mT AF cleaning of the archive halves. Black line in inclination column = 15 point moving average, red dots = discrete samples. The magnetic polarity plot is generated from the moving average: negative (up-pointing) inclination indicates deposition during a normal geomagnetic polarity field (black bands). Gray bands = intervals without paleomagnetic measurement (e.g., core gaps) or intervals where polarity could not be confidently constrained. Magnetic polarity is correlated with the GPTS (Ogg, 2020) (blue bands).

Figure F25. Discrete sample demagnetization results, Holes U1581A and U1581B. Vector endpoint diagrams (left-hand panels) are shown with the equal area projection of the vector endpoints (round panels) and a graph showing natural magnetization (M) decay during demagnetization (top right panels). White symbols = projections onto the vertical plane, black symbols = projections onto the horizontal plane, X and Y = axes of the working halves, and Up = vertical up-pointing (−Z-) axis of the core. Equal-area projections: open symbols = negative (up-pointing) directions, black symbols = positive (down-pointing) directions. All plots: red symbols = steps used to determine the characteristic remanent directions.

Figure F26. Equal-area projections, Holes U1581A and U1581B. All down-pointing (reversed; solid symbols) and up-pointing (normal; open symbols) paleomagnetic directions are shown. Directions are shown with average inclination and 95% confidence boundaries as indicated in the inset (N + R = combined normal and reversed directions). A. Hole U1581A results. Square symbols = oriented cores (Cores 392-U1581A-1H through 29H, except Cores 22H and 26H that were not oriented), and circles = unoriented cores (Cores 30F–41X). B. Hole U1581B results. All cores were unoriented. Results are shown with quantile-quantile analysis used to attest the uniformity of measured declinations; if μ > 1.207, the null hypothesis of a uniform distribution of declination can be excluded at a 95% certainty (Fisher et al., 1987; Tauxe, 1992); the uniformly distributed declination values support the lack of pervasive drilling-induced magnetic overprints.

Figure F27. (A) SIRM, (B) HIRM, (C) *S*-ratio, and (D) MS (*k*), Site U1581.

Figure F28. AMS analysis of discrete samples, Site U1581. A, C. Equal-area projection of all samples from (A) Hole U1581A and (C) Hole U1581B. Red squares = k1 axis, green triangles = k2 axis, black dots = k3 axis. Results are shown with AMS tensors calculated from 1000 bootstrapped data sets and cumulative distribution of the eigenvalues V_1 (black circles), V_2 (green triangles), and V_3 (red squares) associated to the three eigenvectors of the AMS tensor, calculated from the bootstrapped data set. B, E. Stratigraphic variations of P' and T parameters in sedimentary units. D. Diagram of P' and T parameters; blue dots = Hole U1581A, red dots = Hole U1581B, yellow dots = anisotropy parameters of samples from Cores 392-U1581B-69R through 71R.

Figure F29. Histogram of all magnetic inclination data for Holes (A) U1581A and (B) U1581B.

Figure F30. Age-depth model and average sedimentation rates, Site U1581. Numbers for bioevents correspond to those in Table T3. Numbers for magnetic reversals correspond to those in Table T11.

Figure F31. Age-depth model for the uppermost 200 m of sediment recovered at Site U1581. Numbers for bioevents correspond to those in Table T3. Numbers for magnetic reversals correspond to those in Table T11.

Figure F32. Age-depth model for the Maastrichtian–Paleocene interval, Site U1581. Numbers for bioevents correspond to those in Table T3. Numbers for magnetic reversals correspond to those in Table T11.

Figure F33. Headspace gas measurements, Site U1581.

Figure F34. IW sulfate, chloride, sodium, magnesium, calcium, and potassium, Site U1581.

Figure F35. Alkalinity, pH, ammonium, and IW silicon, Site U1581.

Figure F36. IW lithium, strontium, boron, iron, and manganese, Site U1581.

Figure F37. Total carbon, calcium carbonate, organic carbon, and the organic carbon to nitrogen weight ratio, Site U1581. Organic carbon is calculated as the difference between total and inorganic carbon.

Figure F38. Sediment aluminum, calcium, iron, potassium, sulfur, and silicon, Site U1581.

Figure F39. Physical properties, Site U1581. All plotted data sets omit data points of poor quality such as from section ends and cracks in the cores. Dotted lines = lithostratigraphic boundaries. cps = counts per second.

Figure F40. NGR and K, Th, and U abundances from deconvolution of the total NGR energy spectra, Holes U1581A and U1581B. Red lines = 25 point moving averages, dotted lines = lithostratigraphic boundaries. cps = counts per second.

Figure F41. Th vs. K contents derived from the gamma energy spectra of NGRL measurements, Site U1581. 2D probability density function (PDF) contour plots for Th-K data are shown for each lithostratigraphic unit: A. Lithostratigraphic Subunit Ia. B. Lithostratigraphic Subunit Ib. C. Lithostratigraphic Subunit IIa. D. Lithostratigraphic Subunit IIb. Th/K ratios correspond to boundaries in the spectral classification of radioactive mineral by Quirein et al. (1982).

Figure F42. MAD and thermal conductivity results, Site U1581. Dotted lines = lithostratigraphic boundaries.

Figure F43. MAD results, Site U1581. A. MAD bulk density vs. thermal conductivity. B. MAD porosity vs. thermal conductivity. C. MAD porosity vs. MAD bulk density. D. MAD bulk density vs. MAD grain density. Thermal conductivity data were paired with the closest MAD measurement with a maximum depth offset of 3.27 m.

Figure F44. WRMSL density and *P*-wave velocity, Site U1581. A 100 point median filter was applied to PWL data for smoothing. WRMSL data omit data points of poor quality such as from section ends, cracks in the cores, or poor contact between the core and core liner. Dotted lines = lithostratigraphic boundaries.

Figure F45. Bulk density, Site U1581. A. MAD wet bulk density vs. GRA bulk density. B. MAD wet bulk density vs. GRA bulk density corrected for core volume in Hole U1581B, which was drilled using the RCB system. MAD data were paired with the nearest GRA bulk density measurement. The plotted GRA bulk density data omit data points of poor quality such as from section ends and cracks in the cores. Correlation coefficients between GRA bulk density and MAD density are shown for Holes U1581A and U1581B.

Figure F46. Comparison of whole-round core NGR data from the NGRL in Hole U1581A with downhole log data from the EDTC in Hole U1581B. Core recovery = Hole U1581A. cps = counts per second, gAPI = American Petroleum Institute gamma radiation units.

Figure F47. Downhole temperature data processing results, Hole U1581A. The measured temperature with time after the penetration of the thermal probe is fitted with theoretical decay curves (left panels). The equilibrium temperature is estimated by interpolation and decay model tie-point symbols correspond to points on the left panel temperature profile (middle panels). The best-fit time delay parameter is found at the minimum of root mean square (RMS) values (right panels). Figures were made using TP-Fit software (Heesemann et al. 2006).

Figure F48. Heat flow estimation results, Hole U1581A. A. Measured thermal conductivity on core sections using puck probe. B. Downhole temperatures estimated using TP-Fit software and geothermal gradient of 37.0°C/km based on linear regression of the data. C. Thermal resistance with depth based on the linear conductivity-depth relation. D. Thermal resistance vs. temperature and estimated surface heat flow (SHF) of 47.3 mW/m^2.