

Figure F1. Visual core description, Site U1537. CSF-A = core depth below sea-floor, Method A. Pebble abundance >2 mm is semiquantitative visual assessment of concentration from 1 (no gravel or pebbles) to 5 (many gravel and pebble pieces) per core; pebble abundance >2 cm is semiquantitative count of >2 cm pebbles per core.

Figure F2. Diatom ooze (382-U1537D-7H-4, 26–56 cm).

Figure F3. Silty clay (382-U1537D-12H-5, 3–34 cm).

Figure F4. Color banding (black arrows; incipient glauconite formation?) and burrow-rich layer (red arrow) (382-U1537A-7H-5, 37–60 cm).

Figure F5. Granitic dropstone, pyrite-filled burrow, and pyrite-rich layer (382-U1537A-8H-5, 16–35 cm).

Figure F6. Sharp color boundary between varieties of silty clay (382-U1537A-12H-3, 126–144 cm).

Figure F7. Bioturbated contact (382-U1537D-19H-4, 25–42 cm).

Figure F8. Interbedded silty clay and diatom ooze (382-U1537A-21H-7, 11–27 cm).

Figure F9. Pyrite nodule and pyritized burrows (black spots in the sediment) (382-U1537A-24H-5, 32–50 cm).

Figure F10. Coring-induced soft-sediment fault (382-U1537A-23H-4, 41–60).

Figure F11. Nannofossils (382-U1537D-41F-1).

Figure F12. Turbidite (382-U1537D-49F-3, 101–130 cm).

Figure F13. A–H. Examples of X-ray images showing most characteristic textures, Site U1537D. Dark colors correspond to higher density material.

Figure F14. Biostratigraphic age-depth plot, Holes U1537A and U1537D. FO datums are plotted using the median depth between the upper sample where the fossil was observed and the lower sample where it was not observed (Table T4). LO datums are plotted using the median depth between the upper sample where a species was not seen and the lower sample where it was seen.

Figure F15. Miocene radiolarian species (between 382-U1537D-37F-3, 74–75 cm, and 41F-2, 75–77 cm). A, B. *Acrosphaera australis*. C. *Siphonospaera vesuvius*.

Figure F16. Palynomorphs, Hole U1537A. All scale bars = 20  $\mu$ m. 1. *Lycopodium* spore (25H-CC). 2. Foraminiferal lining (21H-CC). 3. *Nothofagus* pollen (19H-CC). 4. *Tasmanites* (30F-CC). 5. *Brigantedinium* spp. (30F-CC). 6. *Cyathidites* (trilete spore) (50F-CC). 7. *Selenopemphix antarctica* (25H-CC).

Figure F17. Palynomorphs, Hole U1537D. All scale bars = 20  $\mu$ m. 1. Bisaccate pollen (38F-CC). 2. Bisaccate pollen (42F-CC). 3. Bisaccate pollen (44F-CC). 4–6. *Nothofagus* pollen (42F-CC). 7. *Cicatricosisporites australiensis* (reworked cretaceous) (44F-CC). 8. *Cymatiosphaera* sp. (40F-CC). 9. *Brigantedinium* spp. (40F-CC).

Figure F18. Intensity of remanence, declination, and inclination of NRM at 15 mT AF demagnetization level, Hole U1537A. Horizontal dashed lines = section breaks, black dots = original (unedited) data, large cyan dots = edited and adjusted values as described in text, red stars = discrete samples, vertical dashed lines in inclination = GAD predicted values. (Continued on next page.)

Figure F18 (continued).

Figure F19. Intensity of remanence, declination, and inclination of NRM at 15 mT AF demagnetization level, Hole U1537B. Horizontal dashed lines = section breaks, black dots = original (unedited) data, large cyan dots = edited and adjusted values as described in text, vertical dashed lines in inclination = GAD predicted values.

Figure F20. Intensity of remanence, declination, and inclination of NRM at 15 mT AF demagnetization level, Hole U1537C. Horizontal dashed lines = section breaks, black dots = original (unedited) data, large cyan dots = edited and adjusted values as described in text, vertical dashed lines in inclination = GAD predicted values.

Figure F21. Intensity of remanence, declination, and inclination of NRM at 15 mT AF demagnetization level, Hole U1537D. Horizontal dashed lines = section breaks, black dots = original (unedited) data, large cyan dots = edited and adjusted values as described in text, red stars = discrete samples, vertical dashed lines in inclination = GAD predicted values. (Continued on next page.)

Figure F21 (continued).

Figure F22. A–E. X-ray textures from slumped interval, Hole U1537D. Dips of (C) 8°–14°, (D) 20°–30°, and (E) >60°.

Figure F23. Representative vector endpoint diagrams showing progressive AF demagnetization behavior, Hole U1537A. Demagnetization steps: 1 = NRM, 2 = 5 mT, 3 = 10 mT, 4 = 15 mT, 5 = 20 mT, 6 = 30 mT, 7 = 35 mT, 8 = 40 mT, 9 = 50 mT. Drilling overprint is mostly removed by 10 mT. A. Normal specimen. B. Reversed specimen. C. Poorly behaved specimen.

Figure F24. A–L. Comparison of stepwise AF demagnetization of NRM and ARM for 12 discrete cube samples chosen to be representative of observed lithologies, Site U1537. All demagnetization curves are normalized by their value at 20 mT. Samples are arranged from (A) weakest ARM intensity to (L) strongest.

Figure F25. Frequency of inclination values (after editing) at 15 mT AF demagnetization step measured for (A) APC and (B) HLAPC cores, Site U1537. Blue curves = kernel density estimates (KDEs).

Figure F26. Declination values (after editing) at 15 mT AF demagnetization step measured for (A) APC and (B) HLAPC cores, Site U1537. C, D. Quantile-quantile plots of declinations (after editing; red) with Kolmogorov-Smirnov test results showing that a uniform distribution cannot be rejected at 95% level of confidence (Tauxe, 2010). Blue curve in D = declination data before editing that have a slightly different distribution showing that a uniform distribution can be rejected at 99% level of confidence.

Figure F27. Test of hypothesis that uparching of sediments in archive halves leads to bias in declinations toward double line, Site U1537. A. Set of 100 directions drawn from Fisher distribution with declination of 45° and inclination of –75°. B. Set of poles to planes modeling upward bowing of sedimentary layers in archive half. C. Resulting directions after bowing.

Figure F28. A, B. Equal-area projections of normal core mean directions before (red) and after (blue) adjustment using Icefield MI-5 tools as described in text, Holes U1537A and U1537D. All directions are in upper hemisphere.

Figure F29. Magnetostratigraphic correlation. A, B. Holes U1537A and U1537D (mbsf). C. Inclination converted to CCSF-A depth using affine in Table T20. D. Data grouped in 5 m bins and plotted as KDEs. E. GPTS2012. Red lines = our ties to GPTS. Polarity: black = normal, white = reversed.

Figure F30. Age-depth plot for data in Table T15, Site U1537. RAD = radiolarian, PMAG = paleomagnetism.

Figure F31. Methane concentrations, Site U1537.

Figure F32. IW properties ( $\text{SO}_4$ ,  $\text{PO}_4$ , Ca, Ba, carbonate, methane, ammonium, alkalinity, salinity, pH, Na, Cl, K, Br, Na/K, and Br/Cl), Site U1537. Blue squares = seawater concentrations or elemental ratios for reference (where applicable).

Figure F33. IW properties (Ca, Si, B, Sr, Mg, Fe, Mn, B/Ca, Mg/Ca, Si/Ca, Ba/Ca, Sr/Ca, Mg/Si, Mg/K, K/Ca, and Na/Cl), Site U1537. Blue squares = seawater concentrations or elemental ratios for reference (where applicable).

Figure F34. Bulk sediment TOC, TOC/TN ratio, and  $\text{CaCO}_3$ , Site U1537.

Figure F35. Bulk sediment major element compositions, Site U1537.

Figure F36. Selected trace element compositions and elemental ratios, Site U1537. La is a rare earth element, and Zr is a high field strength element. Note that elemental ratios shown here are weight ratios.

Figure F37. Physical property data, Hole U1537A. MS: red = WRMSL, gray = SHMSL (MSP). *P*-wave velocity: dots = WRMSL, squares = PWC. Wet bulk density: line = WRMSL, diamonds = discrete. cps = counts per second.

Figure F38. Physical property data, Hole U1537D. MS: red = WRMSL, gray = SHMSL (MSP). *P*-wave velocity: dots = WRMSL, squares = PWC. Wet bulk density: line = WRMSL, diamonds = discrete.

Figure F39. Crossplots and linear relationships of NGR, GRA, and MS, Holes U1537A and U1537D.

Figure F40. MAD results, Hole U1537A. *P*-wave velocity = caliper velocity measurements with automatic and manually picked first arrival times.

Figure F41. MAD results, Hole U1537D. *P*-wave velocity = caliper velocity measurements with automatic and manually picked first arrival times.

Figure F42. SHMSL color reflectance  $L^*$ ,  $a^*$ , and  $b^*$  and color component R, Hole U1537A.

Figure F43. SHMSL color reflectance  $L^*$ ,  $a^*$ , and  $b^*$  and color component R, Hole U1537D.

Figure F44. MS data, Site U1537.

Figure F45. Spliced record of color  $b^*$ , GRA density, NGR intensity, and MS, Site U1537. Sections used to construct spliced records are shown at base of figure (see Table T21).

Figure F46. Comparison of spliced stratigraphies, Sites U1537 and U1536. NGR intensity data shown on Site U1537 CCSF-D scale after manual graphic correlation of the two records (see Table T22). Site U1536 data are offset vertically from y-axis values. Gray bars = two slumped intervals in Site U1536 stratigraphy. Based on correlation shown, we infer that the lower slump adds an erroneous physical property cycle to Site U1536, whereas the upper slump appears to obstruct one physical property cycle preserved in Site U1537 stratigraphy. Black and white horizontal bars at base of figure denote GPTS2012 interpretation of Site U1537 magnetochronostratigraphy (see Paleomagnetism). B/M = Brunhes/Matuyama boundary (0.781 Ma), J = Jaramillo (0.99–10.7 Ma), O = Olduvai (1.78–1.95 Ma), R = Reunion (2.13–2.15 Ma). Annotated arrows along top of figure = depth relationships of corresponding magnetochron reversals in Site U1536 stratigraphy to Site U1537 NGR record confirming that ties established between the two stratigraphies are plausible.

Figure F47. APCT-3 temperature-time series, Site U1537.

Figure F48. Heat flow calculation, Site U1537. Right panel shows Bullard plot of heat flow calculated from linear fit of temperature data. DSF = drilling depth below seafloor.

Figure F49. Physical property measurements and comparison with MCS Profile SCAN2004-L07, Holes U1537A and U1537D. MAD = wet bulk density, yellow line = PWL trend. MD = measured depth.

Figure F50. MCS Profile SCAN2004-L07 and physical properties, Holes U1537A and U1537D. Green dots = PWC, black line = PWL, magenta line = GRA, open dots = discrete wet bulk density (MAD), black line = MSL, blue line = NGR. CDP = common depth point, SP = shotpoint.

Figure F51. Physical property measurements and comparison with TOPAS Line SCAN2004-L07, Holes U1537A and U1537D. MAD = wet bulk density.

Figure F52. TOPAS Line SCAN2004-L07 and physical properties, Holes U1537A and U1537D. Green dots = PWC, black line = PWL, magenta line = GRA, open dots = discrete wet bulk density (MAD), black line = MSL, blue line = NGR.