

Figure F1. Location of Site U1516 on the western margin of the Mentelle Basin.

Figure F2. Prestack depth-migrated Geoscience Australia reflection seismic Profile s310_67 with location of Site U1516.

Figure F3. Lithostratigraphic summary, Site U1516.

Figure F4. Lithologies and unit boundaries, Site U1516. A. Subunit Ia. B. Subunit Ia/Ib boundary. C. Subunit Ic/Unit II boundary. D. Unit II/III boundary. E. Unit III with shell fragments. F. Unit IV boundary.

Figure F5. Sediment constituents in Units I–IV, Holes U1516A and U1516C. A. Calcareous ooze with sponge spicules (plane-polarized light [PPL]). B–D. Nannofossil chalk with (B) sponge spicules (cross-polarized light [XPL]) and clay; (C) PPL, (D) XPL. E. Clayey nannofossil chalk (XPL). F. Claystone with nannofossils (PPL).

Figure F6. Siliceous sponge spicules with holes, Hole U1516C. A. Smear slide photomicrograph. B. Scanning electron micrograph (SEM) from siliceous fraction (sample was acidified to remove carbonate).

Figure F7. A–E. XRD results, Site U1516.

Figure F8. Age-depth plot, Site U1516. Vertical bars = depth uncertainty on events (see Tables T5 and T6 for values). Age estimates are from Gradstein et al. (2012).

Figure F9. Selected calcareous nannofossils, Site U1516. 1. *Discoaster tamalis* (U1516A-11H-CC). 2, 3. *Discoaster tamalis* (U1516A-17H-CC). 2. *Discoaster quinqueramus*. 3. *Nicklithus amplificus*. 4. *Minylithus convallis* (U1516A-27F-CC). 5. *Catinaster mexicanus* (U1516A-29F-CC). 6. *Sphenolithus akropodus* (U1516A-10R-CC). 7, 8. *Reticulofenestra oamaruensis* (U1516C-17R-CC). 9. *Clausicoccus subdistichus* (U1516C-15R-CC). 10. *Discoaster nodifer* (U1516C-15R-CC). 11. *Heliolithus riedelii* (U1516C-25R-2, 46–47 cm). 12. *Heliolithus klempellii* (U1516C-25R-2, 46–47 cm). 13. *Quadrum gartnerii* (right) and *Eprolithus floralis* (left) (U1516C-26R-6, 132–133 cm). 14. *Eprolithus octopetalus* (U1516C-30R-CC). 15. *Quadrum intermedium* (five elements) (U1516C-31R-CC). 16. *Ceratolithina naturalisteplateauensis* (U1516C-32R-CC). 17. *Axopodorhabdus biramiculatus* (U1516C-32R-CC). 18. *Lithraphidites acutus* (U1516C-34R-CC). 19. *Eiffellithus equibramus* (U1516C-39R-CC). 20. *Eiffellithus monechiae* (U1516C-40R-CC).

Figure F10. Selected Cretaceous and Cenozoic planktonic foraminiferal taxa, Site U1516. 1. *Truncorotalia truncatulinoides* (U1516A-1H-CC). 2. *Globigerinelloides* sp. (U1516C-26R-CC). 3. *Globoturborotalita nepenthes* (U1516C-2R-CC). 4. *Sphaeroidinellopsis seminulina* (U1516C-43R-CC). 5. *Globorotalia crassaformis* (U1516A-4H-CC). 6. *Microhedbergella praeplanispira* (U1516C-40R-CC). 7. *Globoquadrina dehiscens* (U1516C-7R-CC).

Figure F11. Selected benthic foraminiferal taxa, Hole U1516A. 1. *Planulina rugosa* (14R-CC). 2. *Pullenia* sp. cf. *Pullenia quinqueloba* (14R-CC). 3. *Fissurina* sp. (14R-CC). 4. *Cibicidoides* sp. aff. *Cibicidoides dohmi* (19R-CC). 5. *Oridorsalis* sp. (19R-CC). 6. *Latibolivina reticulata* (20R-CC). 7. *Dorothia brevis* (20R-CC). 8. *Eggerella bradyi* (20R-CC). 9, 10. *Siphonodosaria subspinosa* (19R-CC). 11. *Nodosaria* sp. (19R-CC).

Figure F12. Paleomagnetic results, Hole U1516A. Declination: red = samples from oriented APC cores. Intensity: blue = 0 mT AF demagnetization, red = 20 mT AF demagnetization. Magnetic susceptibility (MS: green = whole-round (10 IU offset), red = point source).

Figure F13. Paleomagnetic results, Hole U1516C. Intensity: blue = 0 mT AF demagnetization, red = 20 mT AF demagnetization. MS: green = whole-round (20 IU offset), red = point source.

Figure F14. Paleomagnetic results, Hole U1516D. Intensity: blue = 0 mT AF demagnetization, red = 20 mT AF demagnetization. MS: green = whole-round (20 IU offset), red = point source.

Figure F15. Vector endpoint diagrams (Zijderveld, 1967) of section halves from Unit I, Site U1516.

Figure F16. Vector endpoint diagrams (Zijderveld, 1967) of section halves from Units (A, B) II, (C, D) III, and (E, F) IV.

Figure F17. Magnetostratigraphic results, Site U1516. Inclinations are after 20 mT AF demagnetization. Polarity: white = normal, black = reversed, gray = uncertain.

Figure F18. Age-depth model based on magnetostratigraphic results, Site U1516. Wavy lines = sedimentary hiatuses.

Figure F19. Physical properties, Hole U1516A. Black data curves = moving average.

Figure F20. Physical properties, Hole U1516C. Black arrows = peaks corresponding to OAE 2 and possible MCE. Black data curves = moving average.

Figure F21. Physical properties, Hole U1516D. Black data curves = moving average.

Figure F22. NGR data, Hole U1516A. Black data curves = moving average. U/Th ratio: vertical dashed line = 1:1 ratio.

Figure F23. NGR data, Hole U1516C. U/Th ratio: vertical dashed line = 1:1 ratio. Black arrows = peaks that correspond to OAE 2 and possible MCE.

Figure F24. NGR data, Hole U1516D. Black arrows = peaks corresponding to OAE 2 and possible MCE. Black data curves = moving average. U/Th ratio: vertical dashed line = 1:1 ratio.

Figure F25. Density, porosity, thermal conductivity (bars = 1σ standard deviation), and P-wave velocity, Site U1516.

Figure F26. Interstitial water alkalinity, pH, and element and ion concentrations, Site U1516. Black circles, red triangles = Hole U1516A, green circles, blue triangles = Hole U1516C.

Figure F27. Carbon and total nitrogen (TN), Site U1516. TOC and TN values are near the detection limit. Lower plots are expanded across the inferred OAE 2 interval.

Figure F28. Source rock analysis (pyrolysis) results, Site U1516. Red = samples from black layers in the suspected OAE 2 interval, green = samples from other lithologies.

Figure F29. Correlation of Holes U1516C and U1516D from 455 to 480 m CCSF. RGB green data is an apparently sensitive color band to locate dark beds in the cores. Yellow shading = intervals selected for the splice.

Figure F30. Site U1516 summary. Hole U1516B (~16 m) was sampled completely on the catwalk. Light blue = Hole U1516A, green = Hole U1516C, dark blue = Hole U1516D. Yellow shading = floating spliced interval.