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Supplementary Figure 1. Location bathymetry map of DSDP Site 593 (this study) in the Tasman Sea, and other localities discussed in the text. Position of important frontal regions is also shown. Antarctic Intermediate Water, that currently bathes Site 593, forms between the two fronts. Map adapted from Elmore et al. (ref. 1).
Supplementary Figure 2. Summary of previously-published Mid Pleistocene nannoplankton records. a, Orbital eccentricity², showing prolonged insolation minima at ~0.8 Ma due to minimum tilt. b, assemblage % small placoliths (which includes small *Gephyrocapsa*, along with other small species) from various sites³⁴⁵. c, % of small *Gephyrocapsa* from Sites 1087 (South Atlantic⁶), MD 97-2114 (SW Pacific⁷) and 1209 (North Pacific⁸). Yellow bar indicates the approximate position of the diachronous global benthic foraminiferal extinction.
Supplementary Figure 3. Nannoplankton and extinct benthic foraminiferal assemblages compared at the same sites. a-b, DSDP Site 593 (this study). c, ODP Site 980 (ref. 9). d, ODP Site 980 (this study). Note how dominance of small Gephyrocapsa within nannoplankton is coincident with low abundance of the benthic foraminifera extinction group in both ocean basins in distal locations.
Supplementary Figure 4. Age model for DSDP593. Plots show the correspondence between $\delta^{18}$O$_{P. wuellerstorfi}$ from DSDP593 (blue; left axis) with the LR04$^{10}$ benthic foraminiferal $\delta^{18}$O stack (black; right axis). Average analytical reproducibility for $\delta^{18}$O of the calcite standard is < 0.1‰.
Supplementary Figure 5. Scanning electron microscope photographs of selected abundant taxa from the elongate uniserial extinction group. 1. Chrysalogonium deceptorum (593Z, 3H, 2W, 130-132 cm); 2-3. Cribroconica stimulate (593Z, 3H, 4W, 100-102 cm); 4. Chrysalogonium rudis (593Z, 3H, 6W, 40-42 cm); 5. Chrysalogonium rudis
(593Z, 3H, 6W, 40-42 cm); 6. **Orthomorphina perversa** (593Z, 3H, 4W, 100-102 cm); 7. **Orthomorphina perversa** (593Z, 3H, 2W, 130-132 cm); 8. **Mucronina compressa** (593Z, 3H, 2W, 130-132 cm); 9. **Mucronina compressa** (593Z, 3H, 2W, 130-132 cm); 10. **Staffia tostata** (593Z, 3H, 6W, 40-42 cm); 11. **Staffia tostata** (593Z, 3H, 6W, 40-42 cm); 12. **Siphonodosaria pomuligera** (593Z, 3H, 4W, 100-102 cm); 13. **Siphonodosaria pomuligera** (593Z, 3H, 4W, 100-102 cm); 14. **Strictocostella matanzana** (593Z, 3H, 6W, 40-42 cm); 15-16. **Siphonodosaria jacksonensis** (593Z, 3H, 4W, 100-102 cm); 17. **Siphonodosaria lepidula** (593Z, 3H, 2W, 130-132 cm); 18. **Siphonodosaria lepidula** (593Z, 3H, 4W, 100-102 cm); 19. **Siphonodosaria lepidula** (593Z, 3H, 6W, 40-42 cm); 20-21. **Siphonodosaria lepidula** (593Z, 3H, 2W, 130-132 cm); 22. **Stilostomella fisticuca** (593Z, 3H, 4W, 100-102 cm); 23. **Stilostomella parexilis** (593Z, 3H, 6W, 40-42 cm); 24-25. **Strictocostella scharbergana** (593Z, 3H, 4W, 100-102 cm); 26. **Strictocostella scharbergana** (593Z, 3H, 6W, 40-42 cm); 27. **Ellipsoglandulina labiate** (593Z, 3H, 4W, 100-102 cm); 28. **Pleurostomella alternans** (593Z, 3H, 2W, 130-132 cm); 29. **Pleurostomella alternans** (593Z, 3H, 2W, 130-132 cm). Scale bars in μm.

**Supplementary Table 1.** *Planulina wuellerstorfi* oxygen isotope data between 0.4 and 1.1 Ma for DSDP Site 593.

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5.60 0.332 Ref. 1
5.80 0.341 Ref. 1
7.61 0.370 Ref. 1
8.07 0.421 Ref. 1
9.81 0.491 This study
10.31 0.513 This study
10.51 0.530 This study
11.01 0.584 This study
11.12 0.600 This study
12.00 0.650 This study
12.26 0.695 This study
12.81 0.706 This study
14.90 0.718 This study
15.10 0.735 This study
15.67 0.766 This study
15.88 0.790 This study
16.80 0.809 This study
17.17 0.831 This study
17.70 0.858 This study
18.10 0.874 This study
18.35 0.907 This study
18.56 0.92 This study
19.59 0.954 This study
21.20 0.987 This study
21.50 1.000 Potaka Tephra (This study)
23.50 1.070 Base of Jaramillo (ref. 13)
25.22 1.128 This study

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63 Supplementary References

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