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Antarctic and Southern Ocean influences on Late Pliocene global cooling

T. Naish (1), R. McKay (1), L. Carter (1), C. Riesselman (2), C. Sjunneskog (3), D. Winter (4), R. Dunbar (5), F. Sangiorgi (6), C. Warren (7), M. Pagani (8), V. Wilmott (6), R. Levy (9), R. Powell (10), and R. DeConto (11)

(1) Victoria University of Wellington, New Zealand (tim.naish@vuw.ac.nz), (2) Eastern Geology and Paleoclimate Science Center, U.S. Geological Survey, USA, (3) Antarctic Research Facility, Florida State University, USA., (4) Rhithron Associates, Inc, USA., (5) Department of Environmental Earth Systems Science, Stanford University, USA, (6) Biomarine Sciences, University of Utrecht, (7) Department of Geology and Geophysics, Yale University, USA., (8) NIOZ Royal Netherlands Institute for Sea Research, Department of Marine Organic Biogeochemistry, Den, (9) GNS Science, New Zealand, (10) Department of Geology and Environmental Geosciences, Northern Illinois University, USA, (11) Department of Geosciences, University of Massachusetts, Amherst, USA.

The influence of Antarctica and the Southern Ocean in Late Pliocene global climate reconstructions has remained ambiguous due to a lack of well-dated Antarcticproximal, paleoenvironmental records. Here we present sea-ice and sea-surface temperature reconstructions from the ANDRILL AND-1B sediment core recovered from beneath the Ross Ice Shelf. We provide evidence for a major expansion of an ice sheet in the Ross Sea that began at ∼3.3 Ma, followed by a coastal sea surface temperature

cooling of ∼2.5°C, a step-wise expansion of sea ice, and the development of a large summer polynya in the Ross Sea between 3.3 and 2.5 Ma. The intensification of Antarctic cooling resulted in strengthened westerly winds and invigorated ocean circulation. The associated northward migration of Southern Ocean fronts has been linked with reduced Atlantic Meridional Overturning Circulation by restricting surface water connectivity between the ocean basins, with implications for heat transport to the high latitudes of the North Atlantic. While our results do not exclude low-latitude mechanisms as drivers for Pliocene cooling, they indicate an additional role played by southern high-latitude cooling during development of the bipolar world.