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A potential gradual buildup of Antarctic cryosphere in the Middle Eocene.

P.K. Bijl (1), S. Schouten (2), H. Brinkhuis (1), A. Sluijs (1), G. Reichart (3), and J.C. Zachos (4)

(1) Institute of Environmental Biology, Faculty of Sciences, Utrecht University, Palaeobotany and palynology, Utrecht, Netherlands (p.k.bijl@uu.nl, +31 302539056), (2) Department of Marine Organic Biogeochemistry, NIOZ Royal Netherlands Institute of Sea Research, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands., (3) Organic Geochemistry, Faculty of Geosciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, the Netherlands., (4) Earth Sciences Department, University of California–Santa Cruz, Santa Cruz, California 95060, USA.

Around the Eocene-Oligocene Boundary, large and permanent Antarctic ice sheets developed, as a culmination of Eocene global climate cooling. However, uncertainties exist if there were significant Antarctic continental ice prior to the Eocene- Oligocene boundary. Traditionally, δ^{18}O of benthic foraminifera, in combination with an independent temperature proxy are used to gauge the extent of (Antarctic) ice volume in the Paleogene, but available records are of short temporal range, low resolution, discontinuous and not well calibrated to the International Time Scale. Here we generated a quasi continuous Paleogene sea surface temperature (SST) record of the South Pacific by applying TEX_{86} paleothermometry to sediments retrieved from the East Tasman Plateau (Ocean Drilling Project Leg 189, Site 1172, ~65ºS paleolatitude). Trends in South Pacific Paleogene SSTs remarkably mimic those of the global stack record of Paleogene benthic foraminiferal δ^{18}O, with values ranging between ~34ºC during the Early Eocene Climatic Optimum (EECO) and ~21ºC in the Paleocene and Middle and Late Eocene. Detailed comparison of the two records shows an increasing ice volume effect on benthic δ^{18}O from ~47 Ma onwards, ~14 Myrs prior to the Eocene-Oligocene glaciation. Comparisons of the East Tasman Plateau Paleogene TEX_{86}SSTs with coeval TEX_{86}SSTs reconstructions from New Zealand, Tanzania and the Arctic shows that equator-to-pole SST gradients were remarkably low in the Early Eocene, and dramatically increased during the Middle and Late Eocene, concurrently with the establishment of an Antarctic cryosphere.