Plio-Pleistocene evolution and variability and the West Antarctic Ice Sheet from the ANDRILL, AND-1B geological record

Naish T.R[1,2], Powell R.D[3], Levy[4], R & ANDRILL McMurdo Ice Shelf Science Team

1 *Antarctic Research Centre, Victoria University of Wellington, Kelburn Parade, PO Box 600, Wellington, New Zealand.*
2 *GNS Science, 1 Fairway Drive, PO Box 30-368, Lower Hutt, New Zealand.*
3 *Department of Geology & Environmental Geosciences, Northern Illinois University, DeKalb, IL 60115 USA*
4 *ANDRILL Science Management Office, Department of Geosciences, University of Nebraska-Lincoln, Lincoln, NE 68588-0340, USA*

While the West Antarctic Ice Sheet (WAIS) is considered to be vulnerable to future anthropogenic warming, projections of its likely behavior are hampered by a limited understanding of past variations and the main forcing mechanisms. Here we present a new proximal Plio-Pleistocene climate record constructed from the upper 600m of a sediment core (AND-1B) recovered from beneath the northwest corner of the Ross Ice Shelf by the ANDRILL program. More than forty, well-dated, sedimentary cycles in the core link ice extent to orbital-scale climate cycles dominated by obliquity during the Pliocene and Early Pleistocene - a 100,000 year-duration cycle dominates the Middle and Late Pleistocene. Our data provide the first direct evidence for an oscillating marine-based ice sheet in Ross Embayment, which periodically contracted onto terrestrial Antarctica when planetary temperatures were up to ~3°C warmer than today and atmospheric *p*CO2 likely no higher than 400 ppm. We describe significant change in thermal regime of the ice sheet coincident with a global cooling trend between 3 and 2.5 million years ago, evident in oxygen isotope records and associated with the onset of northern hemisphere glaciations. During this time the ephemeral WAIS and the coastal margins of the East Antarctic Ice Sheet (EAIS) cooled towards their present polar state, expanding and developing more permanent marine termini and ice shelves. Further expansion occurred across the Mid-Pleistocene Climate Transition. Thereafter, extensive ice shelves rather than open marine conditions, dominated the Ross Embayment during interglacial periods.