



Pleistocene fluctuations of the Antarctic Ice Sheet in the Ross Embayment

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Past fluctuations of the marine-based Antarctic Ice Sheet in the Ross Embayment are reconstructed for the Pleistocene by developing a model for the glacial-marine depositional sequences documented from the ANDRILL McMurdo Ice Shelf project drill core AND-1B. This model reveals glacial to interglacial fluctuations of the AIS in the Western Ross Embayment responding at orbital frequencies. Chronology is constrained by an age model based on $^{40}\text{Ar}/^{39}\text{Ar}$ dating of volcanic ashes and magnetostratigraphy. The glacial-marine sequences in AND-1B appear to correlate one-to-one with cycles in the benthic $\delta^{18}\text{O}$ record for the past ~ 0.8 Myr (Marine Isotope Stages 20-2). Five sequences between ~ 1.7 and 1.0 Myr can also be matched with specific intervals in the $\delta^{18}\text{O}$ record, and indicate oscillations of the AIS grounding line operating at a 40-kyr frequency. This record provides new insight into the response of the AIS in the Ross Embayment across the Mid-Pleistocene Transition. Prior to 1.0 Myr, glacial-marine sequences have 40-kyr duration, whereas subsequently 100-kyr glacial-marine cycles can be clearly recognised in the core. During this “100-kyr world”, subglacial to grounding-zone sedimentation dominates at the AND-1B site, with thin intervals of ice-shelf deposition during interglacials also preserved in the AND-1B sedimentary record. An unconformity in AND-1B that spans most (~ 200 kyr) of the Mid-Pleistocene Transition is inferred to represent large scale expansion of AIS in the Ross Embayment at ~ 0.8 Myr. Prior to the Mid-Pleistocene Transition, interglacial periods are characterised by open-water conditions with high abundances of volcanoclastic deposits and occasional diatomaceous sediments, indicating that the marine based ice sheet was more dynamic during this interval.