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Mg/Casea surface temperatures during the Marine Isotope Stage 31 collapse of the Ross Ice Shelf

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The recovery of the AND-1b and CRP-1 drill cores from the Southwest Ross Sea highlighted the potential instability in of the Ross Ice Shelf and the West Antarctic Ice Sheet it buttresses. Both cores recovered a few individuals of the planktonic foraminifera *Neogloboquadrina pachyderma* from marine isotope stage (MIS) 31. This interval is significant because it marks the youngest occurrence of open ocean diatom sediment at AND-1b, which is now situated under the McMurdo Ice Shelf, indicating a substantial retreat of the Ross Ice Shelf occurred during this interglacial. However, sediment deposited after MIS 31 at both sites is represented only by glacial-dominated sediment, suggesting a critical environmental threshold had been crossed enabling the Ross Ice Shelf to form and persist. Numerical modeling by Pollard and DeConto (Nature, 2009) suggested that sub-ice oceanic melting is a critical element in the stability of ice shelves and that "WAIS will begin to collapse when nearby ocean temperatures warm by roughly 5ºC." Laser ablation ICPMS measurement of the Mg/Ca content of *N. pachyderma* shows that although there is considerable heterogeneity in the distribution of Mg in their tests the mean Mg/Ca of a sample population appears proportional to calcification temperature. By empirically calibrating Mg/Ca in CRP-1 *N. pachyderma* against values measured in modern populations collected from Ross Sea and Southern Ocean sites with SSTs ranging from 1.2°C to 14°C it is concluded that SST during MIS 31 was warmer than today by 5-9ºC, consistent with model projections.