East Antarctic ice sheet geometries during the past 30 ka: timing of retreat, forcings and opportunities for new research

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Ice free areas near the margin of the East Antarctic Ice Sheet preserve a wealth of paleoclimate and paleoenvironmental records. Glacial sediments provide a broad spatial history of paleoenvironmental conditions, in particular the extent and nature of ice retreat from glacial highstands. Shallow marine and lake sediments provide high temporal resolution records of ice sheet change and paleoenvironmental conditions at the margin of the ice sheet. Advances in dating of ice marginal landforms, and improvements in the distribution of sediment cores has substantially advanced our understanding of former ice extents during the past decade.

A recent community-wide effort has provided a comprehensive reconstruction of changes to the geometry of the ice sheet during the substantial climatic changes that have occurred during the past 30 ka. This paper will presents the results of this review, and highlight new research in the Enderby Land and Prydz Bay area.

Results to date indicate the onset of ice sheet expansion during the Last Glacial Maximum (LGM) is poorly constrained, but the absence of recorded ice free conditions after ~ 30 ka BP suggests ice expansion had overrun many of the marginal oases by this time. The pattern of ice expansion during the LGM was influenced by basin topography and ice dynamics, but ice expanded to the continental shelf break in some sectors. Thickening of the inland ice domes was limited, and in many cases ice sheet surface elevations were lower than present during the LGM. Ice retreat following the LGM began at most sites by 18-12 ka and was complete by 12-7 ka, and was likely driven by a combination of eustatic sea level rise and ocean warming. In most sectors, the margin appears to have remained stable at its present position for much of the time following deglaciation.

The review has also highlighted areas where improved chronologies of ice sheet retreat will enhance understanding of the behaviour of the ice sheet and its contribution to global scale climate events. Key areas for improvement include an assessment of the history of the ice sheet in the interior nunataks, and areas near large subglacial basins.