WAIS wasting in the Amundsen Sea Embayment since the Last Glacial Maximum

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The Amundsen Sea sector of the West Antarctic Ice Sheet (WAIS) is the most rapidly changing part of the Antarctic ice sheet and could have a significant impact on future sea level rise. However, sea level rise predictions in the recent Intergovernmental Panel on Climate Change Summary for Policymakers excluded the possible effects of future rapid dynamic changes in ice flow because ice sheet model predictions were not considered to be sufficiently reliable.

One approach to testing and refining ice sheet models would be to examine their ability to reproduce ice sheet changes since the Last Glacial Maximum (LGM). Records of ice margin retreat and ice surface elevation change since the LGM also provide a context for recent changes. Until recently, however, knowledge of the chronology of change in the Amundsen Sea sector of WAIS since the LGM has been based on just seven radiocarbon dates from continental shelf sediment cores collected in 1999 on RV *Nathaniel B. Palmer*[1]. These dates indicated that there was already seasonally open water over the middle part of the shelf by 15,800 +/- 3900 radiocarbon years ago, and open water extended to within 100 km of the modern ice margin in Pine Island Bay before 10,150 +/- 370 radiocarbon years ago.

Over the past 18 months we have obtained 34 new AMS radiocarbon dates on samples from 25 Amundsen Sea shelf sediment cores collected during research cruises in early 2006 on RRS *James Clark Ross* and RV *Polarstern*. Some dates are on carbonate (foraminifera) but most are on the acid insoluble organic fraction. Several dates are on modern surface sediment samples to evaluate the marine reservoir correction and the effect of reworked 'fossil' carbon. We have also obtained the first surface exposure ages from the region by analysing cosmogenic isotopes in samples collected from sites accessed using helicopters operating from RV *Polarstern*. These ages provide the first data on long-term changes in surface elevation of ice in the Amundsen Sea sector of the WAIS.

Our new radiocarbon dates, together with swath bathymetry data collected on the same cruises and some previous cruises[2], confirm that the ice grounding line advanced to the continental shelf edge in the Amundsen Sea at the LGM. The retreat of the ice margin to its present position represents a loss of more than 150,000 km^2 of ice sheet, i.e. more than 35% of the area that remains in the Amundsen Sea sector of the WAIS. Our new data are generally consistent with the timing of ice margin retreat suggested previously, and in the western part of the embayment most of the retreat to the present ice margin position was certainly complete by early Holocene time. Average rates of retreat and surface elevation change are more than an order of magnitude slower than those observed over recent decades, but we cannot discount the possibility that there might have been previous short-lived episodes of rapid change since the LGM.

1. Lowe, A.L. & Anderson J.B., 2002. *Quaternary Science Reviews*, 21, 1879-1897.
2. Evans, J., Dowdeswell, J.A., Ó Cofaigh, C., Benham, T.J. & Anderson, J.B., 2006. *Marine Geology*, 230, 53-72.