Geophysical Research Abstracts
Vol. 12, EGU2010-13404, 2010
EGU General Assembly 2010

Indication of early East Antarctic Ice Sheet retreat at the end of the last glacial – a Weddell Sea perspective

Michael Weber (1), Gerhard Kuhn (2), and Werner Ricken (1)

(1) Institute of Geology and Mineralogy, Zuelpicher Str. 49a, 50935 Cologne, Germany, michael.weber@uni-koeln.de, (2) Alfred-Wegener-Institute for Polar and Marine Research, Am Alten Hafen 26, 27568 Bremerhaven, Germany

To understand past ice sheet dynamics in Antarctica is a key to understand current and future climate change, as pointed out by the Intergovernmental Panel on Climate Change. Specifically, the reconstruction of the last sea level rise faces uncertainties because only a few sectors of the Antarctic margin have been sampled so far. Most knowledge comes from the Ross Sea, relating to the West Antarctic Ice Sheet (WAIS), e.g., the ANDRILL program, the Antarctic Peninsula, and from the Prydz Bay region, relating to the East Antarctic Ice Sheet. Modeling studies reconstruct a late ice sheet retreat that started around 12 ka BP and ended around 7 ka BP with a rather large impact of an unstable WAIS and a small impact of the rather stable EAIS. However, data from the Weddell Sea points to a much earlier initial retreat of the EAIS. Here, we present evidence that the EAIS may have started to retreat as early as 19.5 ka BP.

We invested a number of sites from the Weddell Sea, which are mostly located on sediment ridges of the Antarctic continental margin north and east of Crary Fan. The sediments contain ultrahigh-resolution records of bottom-water production and glacial ice-sheet dynamics with sedimentation rates of up to 4 m/ka during the last glacial maximum (LGM; 25-19 ka as deduced by AMS14C dating). The most intriguing characteristic is the abundant mm-scale lamination of relatively coarse (silty) and fine (muddy) layers of detrital composition. Using newly developed software-based tools for laminae recognition (BMPix) and counting (PEAK), as well as AMS14C dating, we were able to prove that the laminae are true varves. In our conceptual model, seasonally variable bottom-water was produced by a combination of brine injection in polynias and shelf-ice plowing in front of the ice shelf, which had advanced toward the shelf edge during the LGM. Apparently, this mechanism operated consistently, producing intense bottom-water in southeast northwest running channels, and creating the fine-scale varvation on parallel running ridges due to Coriolis Force deflection over at least five millennia during the LGM. In all sites the following postglacial record covers the top 1 – 1.5 m. It is characterized by bioturbated sediment, indicative for at least partially open water above the site and occasionally intensified iceberg calving and transport.

The termination of varvation marked the ultimate retreat of the EAIS from the shelf edge at the end of the LGM around 19.5 ka BP, as documented in most sites. Correlation to the EPICA-DML ice core revealed that the termination occurred at the same time as atmospheric temperatures over the continent started to rise. Accordingly, there is evidence for a direct link and a simultaneous response of both the atmosphere and the ocean to this major climate shift.