New geophysical and sediment core data reveal a large-scale post-LGM West Antarctic stacked grounding-zone wedge on the Amundsen Sea Embayment shelf

Johann P. Klages[1], Claus-Dieter Hillenbrand[2], James A. Smith[2], Gabriele Uenzelmann-Neben[1], Jan-Erik Arndt[1], Catalina Gebhardt[1], Robert D. Larter[2], Alastair G. C. Graham[3], Karsten Gohl[1], Gerhard Kuhn[1], Robin Zindler[1], and PS104 Shipboard Scientific Party

[1]Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany, Johann.Klages@awi.de
[2]British Antarctic Survey, Cambridge, UK
[3]College of Life and Environmental Sciences, University of Exeter, Exeter, UK

Abstract

Grounding-zone wedges (GZW) have been mapped on the sea floor in various sectors of the formerly glaciated continental shelf around Antarctica. In most cases, these wedges record periods of grounding-line stillstands during ice-sheet retreat following the Last Glacial Maximum (~26-19 ka BP). The presence of GZWs along the axis of a palaeo-ice stream trough therefore indicates episodic retreat of the grounding line from its LGM to modern position. However, information about their internal structure is sparse, and precise chronological constraints for both the onset and the duration of the stillstands they represent are still lacking. Consequently, the role of GZW formation in modulating post-LGM ice-sheet retreat cannot be reliably quantified. This information is vital, however, for calculating reliable retreat rates during the past, which are essential for evaluating and understanding the significance of modern retreat rates, particularly for the rapidly changing Amundsen Sea sector. Here we present a novel combination of swath bathymetric, reflection seismic, and sub-bottom sediment profiler data from a newly discovered stacked GZW in the Cosgrove-Abbot palaeo-ice stream trough in the eastern Amundsen Sea Embayment. In total, six generations of overlapping GZWs were mapped over a distance of ~40 km. We will present first estimates of GZW volumes through integration of the different geophysical datasets. Additionally, we recovered eight sediment cores, sampling most of the individual GZWs within the stack, which may allow us to establish age constraints for each grounding-line retreat episode. Together with the estimated GZW volumes, the ages from sediment cores may also enable the calculation of sediment flux rates at grounding lines, which remain elusive for Antarctic grounding lines. This knowledge will help refine available post-LGM retreat chronologies for the Amundsen Sea Embayment, which, in turn, serve as a basis for validating and improving ice-sheet models in an area where precise simulations of future retreat are urgently needed.

Keywords: Amundsen Sea Embayment, Last Glacial Maximum, Episodic grounding-line retreat