The grounding-zone wedge inventory on the Amundsen Sea Embayment shelf, West Antarctica: formation processes and significance for establishing reliable post-LGM retreat chronologies

Grounding-zone wedges (GZW) have been mapped on many of the formerly glaciated continental shelves around Antarctica. These GZW records periods of grounding-line (GL) stillstand during general ice-sheet retreat following the Last Glacial Maximum (LGM; 26–19 ka BP; kiloyears before present). The presence of GZWs along the axis of a palaeo-ice-stream trough therefore indicates a style of episodic GL retreat during the migration from its initial position at the LGM to its modern position. However, precise chronological constraints for both the onset and duration of these stillstands are still lacking. Consequently, the role of GZW formation in modulating post-LGM ice-sheet retreat, and therefore ice-sheet stability cannot be reliably quantified. Additionally, this information is also vital for calculating reliable retreat rates during the past, which are essential for evaluating and understanding the significance of modern highly elevated ice sheets and the past rates of glaciers draining into the Amundsen Sea Embayment.

Formation processes

- Inter-ice stream ridge (cold-based)
- Ice stream (wet-based)
- Seafloor
- GZWS
- Time difference in GL retreat
- CL = core location
- Distal GL: Fine-grained microfossils (PC), laminated strata, high-water content
- Proximal GL: Unconsolidated, sandy diamictic, crudely stratified, ooze, microfossils

Subglacial geology

- Old and hard (sometimes illitized) strata with a higher resistance to subglacial erosion than the ice sheet base and likely decreased the ice flow velocity. During retreat, the normal bed gradient of the resistant material (arrows) leads to slower grounding-line retreat and caused in situ accumulation of till.

Timing of GL halts

- Sample locations for micro-13C
- Massive diamict
- Gravelly sandy mud
- Ice Rafted Debris

Conclusions:

This knowledge will help refine available post-LGM retreat chronologies, which, in turn, serve as a basis for gauging and improving ice-sheet models.

References:


