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The timing of post-LGM ice-sheet retreat in West Antarctica: An integrated palaeomagnetic and radiocarbon approach

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The timing of the grounding-line retreat of marine-based ice sheets from the Antarctic shelf after the last glacial maximum (LGM) is not well constrained. Most of the published deglaciation ages are AMS ^{14}C dates obtained from the acid-insoluble fraction of the bulk organic matter (AIO) or from calcareous (micro-)fossils in biogenic glaciomarine sediments recovered with cores. Actually, these dates provide ages for the post-LGM onset of seasonal open-marine conditions on the Antarctic shelf, and thus only minimum ages for ice-sheet retreat. Moreover, the AIO dates suffer from a variable down-core contamination with reworked, fossil organic material (which especially affects sediments deposited in the vicinity of an ice-sheet grounding-line), while calcareous (micro-)fossils are often absent from Antarctic shelf sediments. If calcareous material is present in cores, it often occurs at a stratigraphic level significantly younger than the grounding-line retreat.

Over the last decade, progress in more precise dating of Antarctic ice-sheet retreat since the LGM has been made by i) correlating the palaeomagnetic intensity records of post-LGM sedimentary sequences with global or regional reference curves and ii) compound-specific AMS ^{14}C dating of organic matter in sediments deposited subsequent to grounding-line retreat. Here we present the initial results of our attempt to obtain more reliable chronologies for the retreat of marine-based ice streams that drained the Antarctic Peninsula Ice Sheet and the West Antarctic Ice Sheet at the LGM. We measured the palaeomagnetic intensity records of selected sediment cores recovered from glacial troughs that were eroded by the palaeo-ice streams into the West Antarctic shelf. In addition, we AMS ^{14}C dated the AIO in the sediments deposited subsequent to grounding-line retreat by sample combustion at a relatively low temperature of 300 ˚C. The hypothesis underlying sample combustion at this low temperature step is that younger, more labile carbon, which we assume to be more representative of the organic material that was recently alive at the time of sediment deposition, will pyrolise at a lower temperature than more recalcitrant fossil carbon that was transported and reworked at the base of the ice streams. We will compare the chronological results obtained from the two dating techniques, highlight their specific advantages and shortfalls, and present time lines of post-LGM grounding-line retreat for individual West Antarctic palaeo-ice streams.