

First exposure ages from the Amundsen Sea embayment, West Antarctica: the Late Quaternary context for recent thinning of Pine Island, Smith and Pope Glaciers

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Dramatic changes (acceleration and thinning of major ice streams) in the Pine Island Bay sector of the West Antarctic Ice Sheet (WAIS) have been observed during the last few decades, but the millennial-scale context for these changes is not yet known. We present the first reconnaissance surface exposure ages recording thinning of Pine Island, Smith and Pope Glaciers, which all drain into the Amundsen Sea. From these we infer progressive thinning of Pine Island Glacier at an average rate of $3.8 \pm 0.3 \text{ cm yr}^{-1}$ over the last 14.5 k.y., and of Smith and Pope Glaciers at $2.3 \pm 0.2 \text{ cm yr}^{-1}$ for at least the last 4.7 k.y.. These rates are more than an order of magnitude lower than the $\sim 1.6 \text{ m per year}$ recorded by satellite altimetry for Pine Island Glacier in the period 1992-1996. Similarly low long-term rates (2.5 to 9 cm yr^{-1} since 10 ka) have been reported further west in the Ford Ranges, Marie Byrd Land, but in contrast, there the rates of thinning continue to the present-day. Our data provide the first evidence that puts into context recent rates of thinning of WAIS in the Pine Island Bay sector; it suggests that these are unusually rapid. Our data also provide improved constraints for ice sheet models, which are essential for predicting the future behaviour of WAIS and hence for determining its likely contribution to sea level rise.

In addition to these reconnaissance data we outline the planned field campaign for season 07/08 during which we will undertake geomorphological mapping and extensive sample collection for cosmogenic exposure dating through the Hudson Mountains and Jones Mountains.