Early- to Mid-Holocene ice sheet thinning at Mt Murphy

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Terrestrial data that would provide evidence for the magnitude and timing of past ice sheet change since the Last Glacial Maximum are needed to improve the reliability of model predictions of the future evolution of the Amundsen Sea sector of the West Antarctic Ice Sheet. During a field campaign at Mt Murphy in 2015-16, we acquired a high density of terrestrial glacial-geological data – both geomorphological observations and rock samples – that record past ice sheet change in the central Amundsen Sea Embayment. Here we present results from a program of cosmogenic surface exposure dating on the erratic cobbles and bedrock, which provide evidence for rapid ice sheet thinning in this area during the early- to mid-Holocene. We also compare our observations with results of high resolution ice sheet modelling.

The nunataks adjacent to Mt Murphy on its western and southern side are strewn with quartz-bearing erratic cobbles and boulders up to 893 m above sea level. 47 erratics yielded ^{10}Be ages in the range 4.7 to 21.3 ka from elevations 326-893 m asl, with the majority between 6-16 ka. Above 893 m above sea level, and also at lower elevations (146-350 m asl) on the northern side of Mt Murphy (ridges north of Kay Peak), erratics appear to be absent, but widespread striated bedrock surfaces nevertheless imply that those sites were ice-covered at some time in the past. *In situ* ^{14}C dating of striated bedrock from a ridge extending north of Kay Peak – adjacent to the Crosson Ice Shelf – suggests that the ice surface there had lowered to within 260 m of the modern ice sheet surface by 7.9 ka; ongoing analyses should provide exposure ages from samples that were collected from within a few tens of meters of the modern ice surface.

Comparison of our results from Mt Murphy with those from the Hudson Mountains – situated adjacent to Pine Island Glacier, ~300 km to the ENE – suggests that the ice sheet surface had thinned to its present elevation at a broadly similar time at the two sites, i.e. by the early- to mid-Holocene. Ongoing ice sheet modelling undertaken as part of this project predicts a similar ice sheet response to forcing at both sites, but as yet the model is unable to match the timing of thinning implied by the exposure age data.