New radiocarbon dates from glacial deposits in Miers Valley constrain the past behavior of the Antarctic Ice Sheet.

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The Antarctic Ice Sheet (AIS) is by far the largest remaining ice sheet on Earth today. There is concern that ice sheet instability could result in accelerated sea-level rise, but predicting the future behavior of the AIS is an immense challenge. One approach to understanding the sensitivity of this ice sheet to climate change is to investigate the timing of its retreat after the last glacial maximum (LGM). Geophysical models driven by far-field sea-level-rise data have suggested that Antarctica contributed 15-25 meters of sea-level rise to meltwater pulse 1a (MWP1a), a rapid sea-level rise event ~14,500 cal yr BP during the last glacial termination. In contrast, geological evidence from glacial deposits across Antarctica seem to indicate that the entire LGM excess ice volume was less than 15 meters sea-level equivalent, and likely less than 10 meters. Furthermore, previous studies of grounding line retreat and ice-sheet surface lowering indicate that ice loss was delayed until after the occurrence of MWP1a. We present preliminary radiocarbon dates which constrain the history of ice in the Ross Sea sector of Antarctica. During the LGM, the Ross Sea was filled with a grounded ice sheet which extended nearly to the edge of the continental shelf. This Ross Sea Ice Sheet (RSIS) left distinctive glacial and glacial-lacustrine deposits in the foothills and valleys of the Royal Society Range on the west side of McMurdo Sound. Although our work is in its early phases, initial dates indicate that grounded ice was present in the mouth of Miers Valley between 22,000 and 11,500 calendar years BP. These dates are consistent with existing evidence for a delayed post-LGM retreat of Ross Sea ice and reduce the likelihood of a significant Antarctic contribution to MWP1a. This delay of ice retreat until well after the bulk of post-LGM sea-level rise suggests that sea-level change was not the predominant driver of retreat. In addition, the timing of ice-sheet retreat is not consistent with direct forcing by Southern Hemisphere insolation. Instead, our results point to the importance of processes such as internal ice-sheet dynamics or basal melting caused by advection of relatively warm circumpolar deep water beneath ice shelves.