Late Quaternary history of Hatherton Glacier, Antarctica

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During Marine Isotope Stage 2 (MIS-2), grounded ice in the Ross Sea extended to a limit near Coulman Island (73.5 S). Constraints on the extent of this ice can be obtained from deposits alongside glaciers in the Transantarctic Mts. We are working to map and date deposits of Hatherton and Darwin Glaciers. In earlier work, Bockheim *et al.* (1989) mapped Hatherton Glacier deposits and assigned an LGM age to the Britannia II drift and a post-LGM age to the Britannia I drift, based on minimal soil development and a limited number of radiocarbon ages of algae from former ice-dammed marginal ponds. Recently, Storey *et al.* (2010) and Joy *et al.* (2014) dated deposits at Lake Wellman, Dubris and Bibra Valleys using cosmogenic nuclides; they inferred an MIS-5 age for Britannia-II drift, with little or no thickening of Hatherton Glacier (and Ross Sea ice) during MIS-2, and interpreted Britannia I drift as the result of a Holocene re-advance.

During the 2013-2014 season, we re-examined deposits at these same middle and upper glacier sites. Our initial mapping closely confirms the drift limits proposed by Bockheim *et al.* (1989); the two Britannia limits are distinct at Dubris Valley, but may coincide at Lake Wellman. In addition, we collected several hundred samples of cobbles for exposure dating and algae for radiocarbon analyses. Our initial exposure ages for the Britannia II limit at Dubris Valley indicate that it is older than 130 ka. We did not find any ancient algae associated with this unit, consistent with a drift age older than MIS-2. Ages from Britannia I drift limits on bedrock ridges above Dubris and Bibra Valleys are 8.5 ± 0.3 ka (n=4) on Danum Platform and 7.1 ± 0.3 ka (n=2) on the ridge west of Bibra Valley. Exposure ages from an elevation transect below the Britannia-I limit on Danum Platform show that Hatherton Glacier subsequently thinned by >150 m over ~2,000 years. This thinning continued into the late Holocene. Radiocarbon dates on algae from former ice-marginal ponds at the Britannia I limit at Lake Wellman indicate ice was near its maximum at ~9.5 kyr B.P. Dates in elevation transects at Lake Wellman and Bibra Valley suggest that retreat was underway by ~9.0 kyr B.P. and continued until at least ~4.0 kyr B.P. Collectively, these results indicate a glacial history like that of comparable sites at Reedy, Scott, and Shackleton Glaciers.

Joy *et al.* (2014) interpreted dates from Hatherton Glacier as evidence of limited Ross Sea ice during the LGM, followed by a Holocene advance. In contrast, our previous work in the

southern Transantarctic Mts has shown Holocene thickening at up-glacier sites was preceded by thickening at glacier mouths ~ 19-14 ka. Planned fieldwork at Diamond Hill at the mouth of Darwin Glacier will determine whether the Darwin-Hatherton glacier system experienced a similar history.

References: Bockheim *et al.*, *Quat. Res.* 31, 229 (1989); Storey *et al.*, *Ant. Sci.* 22, 603 (2010); Joy *et al.*, *Quat. Sci. Rev.*, 83, 46 (2014). Supported by NSF award PLR-1246110.

Theme: Marine ice sheet instability (*Free Fallin')*