

Reconstructing late-Quaternary surface profiles of Reedy Glacier, Antarctica - 2

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Glacier surfaces in the Transantarctic Mountains are graded to the thickness of ice in the Ross Sea - advance and retreat of the Ross Sea grounding line forces thickening and thinning of outlet glaciers along the mountain front. Previous studies have tracked the retreat of grounded ice in the western Ross Sea since the last glacial maximum (LGM) using carbon-14 dates of marine deposits and sediment from ice-marginal lakes (Stuiver et al., 1981; Bockheim et al., 1989; Denton et al., 1989; Anderson et al., 1992; Shipp et al., 1999; Licht et al., 1996; 1999; Conway et al., 1999; Hall and Denton, 2000; Anderson et al., 2004). These studies have shown that the grounding line adjacent to the western Ross Sea coast retreated from a position near Coulman Island (74 degrees S) to a position south of Hatherton Glacier (80 degrees S) between approximately 17 cal. kyr B.P. and 7.1 cal. kyr B.P. The subsequent retreat history of the grounding line to its present position (at 85 degrees S) in the inner Ross Sea is less well established. Reedy Glacier is the southernmost outlet for ice flowing from the polar plateau into the Ross Sea. Because the outlet of Reedy Glacier is south of the grounding line, and thus still blocked by grounded ice, its thinning history records grounding line behavior up to the present day (Mercer, 1968). Here we present preliminary exposure ages for lateral moraine deposits of Reedy Glacier which allow us to reconstruct this thinning history, and will eventually help to constrain grounding-line migration through the late Holocene.

In the Quartz Hills, approximately 90 km upstream from the grounding line at the mouth of Mercer Ice Stream, ice-cored deposits at approximately 1400 m indicate LGM thickening of approximately 260 m (Bromley and Hall, this volume). Cosmogenic Be-10 measurements on two erratics from these deposits yield preliminary exposure ages of 15,900 $\pm$ 1000 and 17,100 $\pm$ 1100 yr B.P. A third sample gives an age of 55,200 $\pm$ 3500 years, which may be attributable to recycling from an older deposit. We collected, but have not yet analyzed, samples lying between the LGM ice limit and the modern glacier, whose ages will constrain the timing of glacial retreat.

At Cohen Nunatak (740 m), close to the confluence of Reedy Glacier and Mercer Ice Stream, we collected from scattered fresh erratics extending from summit level to the ice margin. Two samples, from the summit and 20 m below the summit of the nunatak, give preliminary exposure ages of 5800 $\pm$ 430 and 5600 $\pm$ 370 yr B.P., respectively. A sample from the foot of the mountain, 110 m lower, gives an age of 1700 $\pm$ 130 yr B.P. Although we cannot determine the LGM ice thickness at this site, or the timing of onset of deglaciation, these results suggest either: (i) a more gradual retreat of grounded ice through the second half of the Holocene, following the relatively rapid retreat along the Scott Coast to Hatherton Glacier, or (ii) steady thinning throughout the Holocene from a maximum ice elevation of only a few hundred meters above the modern ice surface. The cessation of thinning on Reedy Glacier 1700 years ago may be linked to re-organization of flow in the nearby WAIS, where radar profiles on Conway Ice Ridge show a transition from disturbed layering to undisturbed reflectors at a depth of 300 m.

More detailed interpretation of our results depends on knowing how the thickness and gradient of Reedy Glacier respond to changes in temperature, accumulation and boundary conditions such as the location of the Ross Sea grounding line. In the coming year we plan to explore these relationships using a flowband model coupled with radar data from the glacier and present-day velocity measurements (cf. Anderson et al., 2004).

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