

## Delayed deglaciation of Darwin Glacier, Antarctica

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### **Abstract**

The swinging gate model of grounding-line retreat of the Ross Sea Ice Sheet after the Last Glacial Maximum (LGM) was based on data that implied the modern grounding-line was established at the mouth of Darwin Glacier, ~450 km from the modern Ross Ice Shelf front, more than 6.8 kyr BP. We present new exposure ages of glacial erratics from the mouth of Darwin Glacier, which show the modern grounding-line was not established there until less than 2.8 kyr BP, long after glaciers farther south had already reached their modern configurations. Delayed deglaciation in this region may be due to local bed topography, thickening from convergent flow with Byrd and Mulock Glaciers, and/or stabilizing lateral drag at Minna Bluff, which acted to resist rapid grounding-line retreat.

We have mapped and dated drift limits and recessional deposits in four ice-free areas 10 km, 50 km, 70 km, and 85 km from the modern grounding-line, which provide a high-resolution history of glacier retreat through the Holocene. The deposits from the three upglacier areas record LGM ice ~350 m thicker than today, but we found no deposits from the last glaciation higher than 135 m above the glacier mouth. There was no clearly defined limit of deposition at this location, suggesting that cold-based ice likely covered higher elevations, but left no deposits. Therefore, we cannot infer the timing of the LGM, the ice thickness, or the onset of thinning at the mouth of Darwin Glacier from glacial geologic data alone. We use our new data and existing glacial geologic data to constrain a 1.5-D ice-flow model to solve for the ice thickness, timing, and duration of the LGM at the mouth of Darwin Glacier. Using a simple model constrained by geochronological data allows us to examine ice-dynamical effects of individual prescribed parameters, including changes in surface mass balance, thinning at the glacier mouth, and basal sliding, which are largely unknown through time. Our strategy for data-constrained modeling of Darwin Glacier can be applied to other outlet glaciers in the Transantarctic Mountains with available glacial geologic data in order to better understand the controls on glacial-interglacial ice-sheet fluctuations in the Ross Sea sector.

**Keywords:** grounding-line retreat, outlet glaciers, Last Glacial Maximum, Holocene