Greenland's pronounced glacier retreat not irreversible

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In recent decades, the combined forces of climate warming and short-term variability have forced the massive glaciers that blanket Greenland into retreat, with some scientists worrying that deglaciation could become irreversible. The short history of detailed glacier observations, however, makes pinning the ice loss to either short-term dynamics or long-term change difficult. Research by Young et al. detailing the effects of two bouts of sudden and temporary cooling during an otherwise warm phase in Greenland's climate history could help answer that question by showing just how heavy a hand short-term variability can have in dictating glacier dynamics.

Along the western edge of Greenland, the massive Jakobshavn Isbræ glacier reaches out to the coast, its outflow dropping icebergs into Baffin Bay during the summer months. Flanking the glacier's tongue are the Tasiussaq and Marrait moraines-piles of rock marking the glacier's former extent. Researchers suspected the moraines were tied to two periods of abrupt cooling that hit Greenland 9,300 and 8,200 years ago, and the association was reinforced by the authors' radiocarbon and beryllium isotope analyses of the area surrounding the moraines. Beryllium-10 forms when cosmic radiation travels through the atmosphere and strikes the Earth's surface, with surface rock concentrations indicating how long it has been ice-free.

The authors' analyses show that the moraines were laid down 9,200 and 8,200 years ago, corresponding with periods of sudden cooling. They suggest that the Jakobshavn glacier, which had been retreating prior to

the sudden temperature changes, started to grow. At the end of each cold phase, the glacier deposited a moraine before it resumed its retreat. In detailing the sensitivity of the Jakobshavn glacier to short-term temperature change, the study suggests that while the Greenland glaciers' current retreat is not necessarily irreversible, their extent is tightly bound to the variability of our warming world.

More information: Response of a marine-terminating Greenland outlet glacier to abrupt cooling 8200 and 9300 years ago, Nicolas E. Young, Jason P. Briner, Beata Csatho and Greg S. Babonis, *Geophysical Research Letters*, doi:10.1029/2011GL049639 , 2011

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