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Documenting the retreat of the southeastern margin of the Laurentide Ice Sheet in Québec-Labrador using cosmogenic nuclide exposure dating

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The Laurentide Ice Sheet was the largest ice mass in the Northern Hemisphere during the Last Glacial Maximum, and its decay exerted a major influence on global sea level and climate during the subsequent deglaciation. Despite its importance, the chronology of ice-margin fluctuations along its southeastern sector remains debated, limiting correlations with ice-core and climate archives. We present more than 75 cosmogenic nuclide exposure ages from boulders collected across multiple moraine systems in eastern Québec and Labrador (Canada), establishing a robust geochronological framework for the southeastern margin of the Laurentide Ice Sheet. This extensive chronological dataset documents several episodes of ice-margin stabilization and/or readvance during the Younger Dryas and early Holocene. Some of these stillstands can be traced almost continuously over distances of 1000 km, indicating large-scale responses to climate forcing. The timing of these stabilization phases coincides with cooling events recorded in Greenland ice cores, highlighting a strong sensitivity of the southeastern Laurentide Ice Sheet margin to Northern Hemisphere temperature fluctuations. Our results further support the hypothesis that meltwater discharge into the North Atlantic modulated ocean circulation, triggering negative feedbacks that contributed to repeated cold reversals during the last deglaciation. This new regional chronology provides key constraints on ice-sheet dynamics during the Younger Dryas and early Holocene—an interval of rapid cryospheric reorganization—and offers an important analogue for assessing the response of modern polar ice sheets to ongoing climate change. Further sampling across key moraine systems will expand the cosmogenic exposure-age dataset and refine correlations with ice-core records, strengthening constraints on ice-sheet sensitivity to abrupt climate forcing and associated ocean–cryosphere feedbacks.