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Rapid thinning of the Laurentide Ice Sheet in coastal Maine, USA during late Heinrich Stadial 1

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Authors [Koester, A J*](#), [Boston College, Chestnut Hill, MA, United States](#)
[Shakun, J D](#), [Boston College, Chestnut Hill, MA, United States](#)
[Bierman, P R](#), [University of Vermont, Burlington, VT, United States](#)
[Davis, P T](#), [Natural & Applied Sciences, Bentley University, Waltham, MA, United States](#)
[Corbett, L B](#), [University of Vermont, Burlington, VT, United States](#)
[Zimmerman, S R H](#), [Lawrence Livermore National Laboratory, Livermore, CA, United States](#)

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Abstract

Direct measurements of Laurentide Ice Sheet (LIS) thickness during the last deglaciation are limited, especially in coastal Maine where the LIS had a marine-terminating margin that was susceptible to abrupt climate shifts in the North Atlantic. We measured 31 ^{10}Be exposure ages down coastal mountainsides in Acadia National Park and from the slightly inland Pineo Ridge Moraine Complex, a ~100 km long glaciomarine delta, to date the timing and rate of LIS thinning and subsequent retreat in coastal Maine. The vertical transects in Acadia have indistinguishable exposure ages over a 300 m range of elevation, suggesting rapid, century-scale thinning centered at ~15 ka, similar to abrupt thinning inferred from cosmogenic nuclide ages at Mt. Katahdin in central Maine (Davis et al., 2015). This rapid ice sheet surface lowering during the latter part of the cold Heinrich Stadial 1 event may have been due to rapid calving in the Gulf of Maine, perhaps related to regional oceanic warming associated with weakened Atlantic Meridional Overturning Circulation (AMOC) at this time. Our ^{10}Be ages are substantially younger than radiocarbon constraints on LIS retreat in the coastal lowlands, suggesting that the deglacial marine reservoir effect in this area was greater than the 450 - 600 year correction previously used, perhaps also related to the sluggish AMOC. In addition, the Pineo Ridge Moraine Complex dates to 14.4 ± 0.4 ka, indicating that the LIS margin began retreating from coastal Maine near the onset of the Blling Interstadial warming.

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