Title: Directly dating post-glacial emergence in western and southern Greenland at high resolution using *in situ* ^{10}Be

Authors and affiliations:

Paul Bierman, University of Vermont, Department of Geology, Burlington, VT 05045

Lee Corbett, , University of Vermont, Department of Geology, Burlington, VT 05045

Abstract:

Postglacial land-surface emergence curves are used to infer mantle rheology, delimit past ice extent, and test models of Earth's response to changing water and ice loads. Such curves are rarely produced by direct dating of land emergence from the sea; rather, most rely on the presence of radiocarbon-datable organic material and inferences made between the age of sedimentary deposits and landforms indicative of former sea-level. Here, we demonstrate a new approach using ^{10}Be exposure dating of bedrock, beach cobbles, and boulders to determine time/elevation relationships. We use these expopsure ages to determine rates of post-glacial emergence in two geomorphically different settings. In southern Greenland, we use *in situ* produced ^{10}Be to date directly the exposure, as relative sea level fell, of gravel beaches and rocky outcrops allowing detection of extremely rapid, post-Younger Dryas emergence from 11.4 to 9.7 ky. In western Greenland, we better constrain mid-Holocene isostatic response (6 ky to 3 ky) by dating the sequential stripping of terrace sediment from a bedrock channel driven by land surface uplift and concomitant relative sea-level fall. The technique we employ to date emergence provides high temporal and elevation resolution important for detecting rapid emergence immediately after deglaciation as well as more subtle isostatic response during the middle Holocene. ^{10}Be-constrained emergence curves have the potential to improve knowledge of relative sea level at high latitudes by dating emergence along rocky coasts, at elevations where datable lake sediments are not present, and without the lag time needed for radiocarbon datable organic material to accumulate.

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