Title:

High Levels Of Meteoric ^{10}Be Indicate That Relict Soils Are Preserved In The Western Greenland Ice Sheet

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The cycle of glacial and interglacial periods through the Quaternary has resulted in significant variability in the surface extent of the world's ice sheets over the past 3 million years. During several periods in the Pleistocene, climate conditions were warmer than present and much of Greenland may have been ice-free, most recently during the Eemian period, 130-116 ka before present. Our data indicated that rock and sediment presently emerging from ablating Greenland glacial ice was exposed to surface processes during earlier interglacial periods.

In order to estimate the duration of this previous surface exposure, we measured *in situ* ^{10}Be in ice-entrained rock clasts and meteoric ^{10}Be in sand and silt from basal ice at three locations along the western margin of the Greenland Ice Sheet (latitudes 67.1º, 69.4º, 72.5º N). As neither *in situ* nor meteoric ^{10}Be can develop in sub-ice sediment, any ^{10}Be inventory in ice-bound sediment developed during previous surface exposures.

The meteoric ^{10}Be concentrations in our samples vary from on the order of 10^6 to 10^8 atoms/gram. Order of 10^8 meteoric ^{10}Be concentrations were found at the northernmost site, with maximum ^{10}Be concentrations on the order of 10^7 at the middle site, and 10^6 at the southern site. *In situ* ^{10}Be concentrations were on the order 10^4 atoms/gram and are statistically indistinguishable between field sites.

Comparison with meteoric ^{10}Be inventories in published soil profiles suggests that the northern site saw 50-100 thousand years of surface exposure, requiring multiple glacial cycles to produce its meteoric ^{10}Be inventory. The order of magnitude difference between northern and southern sites suggests that erosion and subglacial sediment transport are significantly more effective at lower latitudes. Measured *in situ* ^{10}Be concentrations only require hundreds of years of exposure to develop, suggesting that during surface exposure, subsequently-entrained rock was shielded by overlying sediment.

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