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USING COSMOGENIC NUCLIDES TO STUDY SUBGLACIAL EROSION EFFICIENCY AND LANDSCAPE HISTORY IN WESTERN GREENLAND

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The efficiency of subglacial erosion varied substantially over areas covered by the Greenland Ice Sheet during previous glacial periods. Differences in subglacial erosion caused some landscapes to be young, fresh, and sculpted, and others to be old relict surfaces preserved from earlier in the Quaternary. To investigate differences in subglacial erosion efficiency, we measured ^{10}Be and ^{26}Al in paired bedrock/boulder samples at two locations in western Greenland. The goal of this work is to characterize differences in subglacial erosion efficiency and land surface age and to assess connections between erosion efficiency, ice sheet properties, and landscape features.

In Ilulissat, Greenland (51°W, 69°N), glacial ice efficiently eroded the landscape during the Last Glacial Period. Cosmogenic ^{10}Be concentrations in 30 bedrock and boulder samples are indistinguishable within bedrock/boulder pairs, indicating that no inherited nuclides are preserved from earlier periods of exposure. All calculated ^{10}Be exposure ages are indicative of deglaciation between ~10 and 8 ka. These observations corroborate field evidence; bedrock surfaces are young, fresh, sculpted, and striated.

In Upernavik, Greenland (55°W, 72°N), glacial ice has not been erosive throughout much of the Quaternary. Analysis of cosmogenic ^{10}Be and ^{26}Al in 33 bedrock and boulder samples demonstrates that bedrock samples systematically preserve inherited nuclides from earlier periods of exposure. Dual-isotope analysis suggests that landscape surfaces have minimum limiting exposure durations up to 112 ka, minimum limiting burial durations up to 900 ka, and minimum limiting total histories up to 990 ka. We infer that these surfaces have been preserved beneath cold-based, non-erosive ice for the latter half of the Quaternary. These observations support field observations of deeply weathered surfaces, particularly in the uplands.

Factors governing the efficiency of subglacial erosion are varied and complex, but are chiefly driven by meltwater availability at the glacier's bed. Discrepancies between the two sites investigated here may be due to regional climatic differences (Upernavik is colder) and/or differences in ice thickness and velocity (sample sites in Ilulissat are proximal to the large ice stream Jakobshavn Isbrae).

Session No. 33

T11. Dates and Rates: Two Decades of Cosmogenic Studies in Eastern North America, the Canadian Arctic, and Greenland
Tuesday, 19 March 2013: 8:00 AM-12:00 PM

Dartmouth Room (Omni Mount Washington Resort)

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Back to: T11. Dates and Rates: Two Decades of Cosmogenic Studies in Eastern North America, the Canadian Arctic, and Greenland

<< Previous Abstract | Next Abstract >>