

[Start](#) | [Author Index](#) | [View Uploaded Presentations](#) | [Meeting Information](#)

Northeastern Section - 48th Annual Meeting (18–20 March 2013)

Paper No. 6

Presentation Time: 9:25 AM

WHERE DOES SEDIMENT IN THE GREENLAND ICE SHEET COME FROM?

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We are using ^{10}Be (produced both in situ and in the atmosphere) to understand how and where the Greenland Ice Sheet erodes its bed and the history/source of glacial sediment delivered to the ice margin and at the base of the GISP2 ice core.

The basal 6.5 meters of the GISP2 ice core collected from the summit of the Greenland Ice Sheet contain silt and rock fragments and is known as “dirty ice” zone. In 17 samples of this basal ice, we measured the concentration of total organic carbon, nitrogen, and meteoric ^{10}Be , an isotope formed in the atmosphere and delivered to Earth’s surface by precipitation and dry fall. The GISP2 silt has high concentrations (0.6 to 3.8×10^8 atoms g^{-1}) of meteoric ^{10}Be , significant percentages of organic carbon (0.3 to 1.7%), and an average C/N ratio of ~ 10 , all consistent with derivation from a long-lived cold-region soil. The existence of this ancient soil for several million years after formation of the Greenland Ice Sheet indicates extremely low rates of sub-ice erosion at Summit, Greenland. The survival of the soil is consistent with the ice at Summit having been frozen to the bed for most, if not all, of the Quaternary. Meteoric ^{10}Be adhered to silt and sand in ice collected from the margins of the present-day GIS has highly variable concentrations (10^6 to 10^8 atoms/g). The lower concentrations measured in most marginal samples indicate higher rates of bedrock erosion away from the center of the ice sheet.

Analysis of 86 clasts, collected directly from the GIS in Upernavik, Ilulissat, and Kangerlussuaq, indicates that most have measurable but low levels of in situ 10-Be. Most clasts have the equivalent of only a few hundred years of surface exposure. Nine clasts have over 5000/g; these likely record either mid-Holocene exposure and reworking or less deep excavation of regolith. One clast has $>100,000$ atoms/g, consistent with interglacial exposure and reworking without erosion. Sand-sized sediment collected from outwash streams exiting the ice margin at Kangerlussuaq (west), Narsarsuaq (south), and Tasilaq (east) has thousands of atoms/g of 10-Be – several times the median amount of in situ ^{10}Be in clasts. Silt, clasts, and sand appear to be sourced from different sub-ice locations.

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 >>](#)