Paper No. 244-9

Presentation Time: 9:00 AM-6:00 PM

RELICT SOIL ENTRAINMENT IN PLEISTOCENE ICE THROUGH OPEN-SYSTEM REGELATION: LATITUDINAL VARIATION IN THE WESTERN GREENLAND ICE SHEET

GRALY, Joseph A.[1], BIERMAN, Paul[2], NEUMANN, Thomas[3], CORBETT, Lee B.[1], LINI, Andrea[1], REUSSER, Lucas J.[1], FINKEL, Robert[4], and ROOD, Dylan[5], (1) Department of Geology, University of Vermont, Delehanty Hall, 180 Colchester Ave, Burlington, VT 05405, jgraly@uvm.edu, (2) Geology Department, University of Vermont, Perkins Hall, Burlington, VT 05405, (3) NASA Goddard Space Flight Center, Cryospheric Sciences Branch, Code 614.1, 8800 Greenbelt Road, Greenbelt, MD 20770, (4) Earth and Planetary Science Department, University of California, Berkeley, Berkeley, CA 94720, (5) Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA 94550-9234

Sediment-rich basal ice samples were collected at three locations along the western margin of the Greenland Ice Sheet (latitudes 67.1º, 69.4º, 72.5º N) in order to date the ice and source its entrained sediment. Silt and sand were isolated from each sample and $\delta^{18}O$ and δD were measured in the melted ice. Meteoric ^{10}Be, high values of which indicate exposure to the atmosphere, was extracted from the sediment.

Although the $\delta^{18}O$ and δD values are largely consistent with values found in Pleistocene age ice from the Summit and Dye 3 ice cores, in many samples the deuterium excess is lower than ice core values. Also, some samples (mostly at the northern two sites) are enriched in $\delta^{18}O$ above ice core Pleistocene values. These results are consistent with an open-system regelation mechanism for the entrainment of the sediment in most of the samples, as this mechanism both enriches $\delta^{18}O$ and reduces deuterium excess.

Meteoric ^{10}Be was measured in concentrations of up to $2.1x10^{8}$ atoms/gram (n= 13 samples). The highest values were found at the northernmost site, with lower maximum values of $6.4x10^{7}$ and $6.7x10^{6}$ measured at the central and southern sites, respectively. Concentrations of ^{10}Be at the northern two sites are consistent with those found elsewhere in well-developed Holocene and Pleistocene soils. The entrained soils must therefore have experienced thousands of years of exposure during interglacial periods or are the remains of erosion-resistant Tertiary regolith. Low ^{10}Be concentrations characteristic of the southern site are consistent with amounts typically found in weathered bedrock below soil profiles, suggesting deep erosion after prior exposure.

This latitudinal variation in ^{10}Be concentration is best explained by slower rates of erosion and/or longer sediment transport times at the northern field sites. Higher abundance of surface-melt-derived basal water at southern latitudes could explain the difference in sub-ice erosion rates, as such water can both scour subglacial sediments and create conditions for open-system regelation. The two highest ^{10}Be concentration samples from the northernmost field site lack a regelation enrichment stable isotope signature, suggesting that these samples were entrained where open system regelation was not active.

2009 Portland GSA Annual Meeting (18-21 October 2009)
General Information for this Meeting

Session No. 244
Geomorphology (Posters)
Oregon Convention Center: Hall A
9:00 AM-6:00 PM, Wednesday, 21 October 2009