Paper No. 6
Presentation Time: 9:30 AM

IN SITU PRODUCED ^{10}BE IN MARINE SEDIMENT RECORDS 7 MILLION YEARS OF GREENLAND ICE SHEET EROSION IN RESPONSE TO CHANGING CLIMATE

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Marine sediments preserve material shed from the continents over time. Continental sediment usually contains >100,000 atoms g^{-1} of *in-situ* produced ^{10}Be, the result of subaerial exposure to cosmic rays, primarily neutrons which penetrate only a meter or two into regolith. Once Earth's surface is covered by glacial ice, ^{10}Be production ceases and glacial erosion removes the highly-dosed, near-surface material first before excavating material at depth containing progressively less ^{10}Be.

To understand when the Greenland Ice Sheet eroded pre-glacial, Tertiary regolith, we isolated 30 samples of quartz from a core at ODP site 918, off the southeastern margin of Greenland and extracted *in-situ* produced ^{10}Be. The age model for the core suggests that we analyzed sediment ranging in age from <0.1 to ~7 My, when ice-rafted debris first appeared at this site. To estimate ^{10}Be concentration at deposition, we decay-corrected measured ^{10}Be concentrations using core model ages.

Measured ^{10}Be concentrations are low, 2100 to 40,000 atoms g^{-1}. Decay-corrected concentrations are highest in the oldest sediment (~7 My, 170,000 atoms g^{-1}) and decrease steadily to values between 10,000 and 50,000 atoms g^{-1} between 3.5 and 2.6 My. At 2.6 My, a single sample has a decay-corrected ^{10}Be concentration of 160,000 atoms g^{-1}. Between 2.6 My and 0.8 My, the decay-corrected concentration of ^{10}Be generally declines first reaching contemporary values for ice-contact and fiord sediment (thousands of atoms g^{-1}) with a step-like decrease at 0.8 My.

The isotopic data clearly show progressively deeper erosion of once-stable Tertiary regolith between 7.3 and 2.6 My by ice caps or small ice sheets. We interpret the high ^{10}Be concentration of sediment at 2.6 My, which coincides with the onset of large-scale Northern Hemisphere glaciation, as reflecting Greenland-wide expansion of ice and the consequent continent-wide erosion and export of highly-dosed near-surface regolith. After 2.6 My, progressive erosion of regolith by the ice, results in decreasing ^{10}Be concentration. By 0.8 My, ^{10}Be concentrations in the core are similar to those issuing from the Greenland Ice Sheet today, suggesting that most near-surface regolith had been removed by then and that the ice sheet was eroding rock, the ^{10}Be in which was produced in the Tertiary by deeply penetrating muons.

Session No. 101

T30. Past Records and Future Challenges of Glacier and Ice Sheet Response to Climate Change I: Honoring and Building on the Legacy of Mark Meier
Monday, 28 October 2013: 8:00 AM-12:00 PM

Mile High Ballroom 4EF (Colorado Convention Center)

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