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CONSTRAINING MULTI-STAGE EXPOSURE-BURIAL SCENARIOS FOR BOULDERS PRESERVED BENEATH COLD-BASED ICE IN THULE, NORTHWEST GREENLAND

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Landscapes preserved beneath cold-based, non-erosive glacial ice violate assumptions associated with simple cosmogenic exposure dating. Because rock surfaces are not deeply eroded during glaciation, they contain nuclides from previous periods of exposure. Boulders sourced from long-preserved rock surfaces yield exposure ages that are older than expected and complex age distributions. Alternate approaches are required to constrain the multi-stage exposure/burial histories of samples from such landscapes.

To study the exposure and burial history of boulders from Thule, northwest Greenland, we analyzed the cosmogenic radionuclides ^{10}Be and ^{26}Al in 28 samples. We employed numerical models of exposure and burial to constrain the chronology of glaciation and Monte Carlo simulations to quantify the uncertainties associated with these models. We investigate three cases that can arise with paired nuclide data: (1) exposure ages coeval with deglaciation and ^{26}Al/^{10}Be ratios consistent with constant exposure; (2) exposure ages pre-dating deglaciation and ^{26}Al/^{10}Be ratios consistent with burial; and (3) exposure ages pre-dating deglaciation and ^{26}Al/^{10}Be ratios consistent with constant exposure.

Although several glacially transported boulders in Thule have simple exposure ages coincident with deglaciation, most have longer, more complex histories. Modeled minimum limiting exposure durations range up to 96 ky and modeled minimum limiting burial durations range up to 627 ky. Monte Carlo simulations show that uncertainties are smaller for modeled exposure duration (average 7%) than modeled burial duration (average 37%). The boulders we sampled were likely recycled through different generations of till over multiple glacial/interglacial cycles, experiencing partial or complete shielding during interglacial periods due to rotation or shallow burial by sediments. Forward models suggest that boulders with old exposure ages and ^{26}Al/^{10}Be ratios consistent with constant exposure were likely exposed during both marine isotope stages 5e and 1, but the duration of intervening burial was not sufficient to cause a detectable change in ^{26}Al/^{10}Be ratio. Boulders with old exposure ages and ^{26}Al/^{10}Be ratios consistent with burial preserve longer histories, some extending back to the mid-Quaternary.

Session No. 283

T191. Reconstructing Arctic Glaciers and Ice Sheets: Chronology, Geomorphology, and Climate Records
Wednesday, 4 November 2015: 8:00 AM-12:00 PM

Room 307 (Baltimore Convention Center)

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