Cosmogenic Dating of Surficial Features on Baffin Island

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In-situ produced 26-Al and 10-Be, measured in over 140 samples from the Pangnirtung Fjord area on Baffin Island, provide the first direct age estimates for glacial features in this region and allow us to refine the glacial chronology and evaluate the temporal significance of previously defined altitudinal weathering zones.

Most important, cosmogenic nuclide measurements indicate that during marine oxygen isotope Stage II, ice extent in the Pangnirtung area was far greater than previously believed. Cosmogenic nuclide data demonstrate that the Duval moraines, which were thought to mark the maximum Wisconsinan ice advance and to be >60,000 years old, were in fact deposited between 25,000 and 10,000 years ago. These, and other isotopic data from recessional moraines and from the fjord area, imply that climatic and glaciologic conditions were sufficient to support an expanded ice margin in the eastern Canadian arctic during the late Wisconsinan and that full fjord deglaciation occurred rapidly after about 10,000 years ago.

In addition, the Duval moraines do not mark a distinct temporal boundary as suggested by relative weathering studies; rather, nuclide abundances in samples collected from weathering zone II, outside of the Duval moraines, are similar to those measured on samples collected from Duval moraine boulders. In contrast, nuclide abundances in samples collected from high tors (weathering zone I) are five to ten times higher than those measured for Duval moraine samples and show significant disequilibrium between 26-Al and 10-Be ages, with 26-Al/10-Be ratios consistently lower than the production ratio of 6.0. Such disequilibrium indicates that the sample sites were buried during or after exposure to comic radiation. Cover could have been provided by snow, ice, or till. Due to the presence of rare erratics on these surfaces, we favor the presence of cold-based, non-erosive ice at times during the late Pleistocene. Although our nuclide measurements do not allow us to constrain the timing of such ice cover, they do allow us to constrain erosion rates in parts of the upper weathering zone. The sites from which we collected samples eroded no more quickly than 1 m/My over the mid to late Pleistocene.