9-28-2016

GLACIAL FORELAND WEATHERING IN WESTERN GREENLAND: IMPLICATIONS FOR PAST AND FUTURE WEATHERING CONDITIONS

Kelly M. Deuerling

Ellen E. Martin

Jonathan B. Martin

GSA Annual Meeting in Denver, Colorado, USA - 2016

Paper No. 286-4
Presentation Time: 9:00 AM

GLACIAL FORELAND WEATHERING IN WESTERN GREENLAND: IMPLICATIONS FOR PAST AND FUTURE WEATHERING CONDITIONS

DEUERLING, K.M., MARTIN, Ellen E. and MARTIN, Jonathan B., Department of Geological Sciences, University of Florida, 241 Williamson Hall, P.O. Box 112120, Gainesville, FL 32611-2120, kdeuer@ufl.edu

Variations in the extent and type of chemical weathering across glacial forelands should impact the global carbon cycle and solute and radiogenic isotope fluxes to the ocean as continental ice sheets retreat. However, little is known of the relationships between weathering and gradients of exposure age and climate as watersheds shift from draining ice sheet melt in proglacial watersheds to runoff from nonglacial sources in deglacial watersheds. In this study we identify trends in carbonate and silicate mineral weathering by carbonic (H_2CO_3) and sulfuric (H_2SO_4) acids based on elemental mass balances and Sr isotopic composition of stream waters and bedload sediments. We evaluate these chemical weathering trends in one proglacial and four deglacial watersheds across a ~170 km transect in western Greenland between the coast at Sisimiut and the Greenland Ice Sheet (GrIS) at Kangerlussuaq. H_2CO_3 silicate weathering and H_2SO_4 carbonate weathering increase while H_2CO_3 carbonate weathering decreases toward the coast. The increase in silicate weathering in coastal deglacial watersheds indicates a more intense weathering environment compared to inland deglacial watersheds that are dominated by weathering of trace reactive minerals. More extensive coastal weathering is also shown by a decrease in the difference between stream water and bedload $^{87}Sr/^{86}Sr$ values ($\Delta^{87}Sr/^{86}Sr$) from 0.029 inland to 0.000 by the coast. High $\Delta^{87}Sr/^{86}Sr$ (0.025) and silicate weathering in the proglacial system likely records enhanced biotite weathering in this young watershed. At present, weathering is a net sink of CO_2 and inland deglacial watersheds provide greater CO_2 sequestration per liter of water than coastal deglacial watersheds due to high solute concentrations and H_2CO_3-driven weathering. Weathering in coastal deglacial watersheds with elevated H_2SO_4-driven weathering and proglacial watersheds with low solute concentrations have similar magnitudes of CO_2 drawdown per liter of water. As the GrIS retreats the proportion of deglacial watersheds will grow. Related changes in precipitation patterns may affect the weathering intensity in the foreland, and therefore CO_2 sequestration and oceanic fluxes of solutes and radiogenic isotopes.

Session No. 286

T111. Polar Changes
Wednesday, 28 September 2016: 8:00 AM-12:00 PM

Room 501 (Colorado Convention Center)

Geological Society of America *Abstracts with Programs.* Vol. 48, No. 7
doi: 10.1130/abs/2016AM-283384

Back to: T111. Polar Changes

<< Previous Abstract | Next Abstract >>