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Weathering in western Greenland occurs in two distinct environments: proglacial watersheds that extend from the margin of the Greenland Ice Sheet (GIS) and derive water from ice melt, and deglacial watersheds that develop on terrains unconnected to the GIS and derive water from annual precipitation. Proglacial and deglacial watersheds currently provide equal amounts of runoff in western Greenland. These watersheds may contribute different solute fluxes to the oceans depending on exposure age, climate, and weathering environment. We test this hypothesis by comparing chemical compositions of streams in four deglacial watersheds (Sisimiut, Nerumaq, Qorlortoq, Kangerlussuaq) and one proglacial watershed (Watson River Akuliarusiarsuup Kuua River; AKR) along a ~160 km transect from the coast to the GIS.

Recent work found that weathering reactions in the deglacial watersheds shift from being dominated by carbonate dissolution inland to sulfide oxidation near the coast. Silicate weathering, based on increased Si, Na and K concentrations, is a minor source of solutes to deglacial streams and is less extensive near the GIS than the coast, where older moraines experience greater precipitation. In general, specific conductivity (SpC: 48-301 µS/cm) and pH (7.0-8.2) increase inland as precipitation decreases and fresh mineral surfaces become more common. The AKR, in contrast, has lower average SpC (11.9 uS/cm) and pH (6.86) than the deglacial streams. Low SpC reflects dilution by ice melt and short residence time of water in the subglacial system. Proglacial flow is enriched in Si compared to deglacial flow particularly near headwaters, indicating higher silicate weathering rates in the pro- and sub-glacial systems. Low pH values indicate: 1) equilibration with atmospheric CO_2 in the supraglacial system near headwaters, and 2) acid production generated by sulfide oxidation in the hyporheic zone identified by elevated SO_4 concentrations. However, Ca, Mg and HCO_3 are the dominant ions over the length of the AKR indicating that dissolution of carbonate is the predominant form of weathering. Our results indicate the two types of watersheds provide distinct fluxes of solutes to the oceans that are likely to change as ice sheets retreat and advance with changing climate.

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T169. It's a Cold, Cold World: Permafrost and Glacial Hydrogeology
Monday, 20 October 2014: 8:00 AM-12:00 PM

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