Project acronym: CARBFLUX-2

Project title: Chemical weathering and the inorganic carbon flux of a High Arctic River

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Discipline: Earth Sciences & Environment: Other - Earth Sciences

Station(s): Zackenberg Research Station (Greenland/Denmark)

Climate warming-induced changes in high latitude polar regions have the potential to significantly influence the future of Earth's biogeochemical cycles and landscape evolution through permafrost thawing, glacial retreat and cryogenic weathering processes. The alteration of both surface and subsurface water flow-paths and changing freshwater fluxes may substantially change mineral, elemental, nutrient and carbon fluxes (dissolved and particulate) into the ocean and atmosphere. Chemical weathering of silicate rocks is a fundamental process in the carbon cycle, and through the sequestration of the greenhouse gas carbon dioxide (CO2), plays a key role in climate stability over geological timescales. However, chemical weathering by sulfuric acid produced by the weathering of sulfide minerals does not involve atmospheric CO2 drawdown. In fact, carbonate weathering by sulfuric acid may become an important source of CO2, counteracting CO2 consumption by silicate weathering. It is therefore critical to constrain the roles that weathering processes play in controlling global biogeochemical cycles, quantifying the contribution to global chemical weathering fluxes and CO2 drawdown.
This proposed research project will utilise a multi-proxy approach to examine chemical weathering in the Zackenberg River Catchment (ZRC), Eastern Greenland, utilising measurements of stable lithium and strontium isotopes, stable isotopes of sulfate and major elemental abundances of river water and sediments. These unique tracers fingerprint silicate, carbonate and sulfate weathering, allowing for the calculation of CO2 fluxes, and comparison of the rates of CO2 uptake and release in this region, and ultimately establish whether the ZRC acts as a source or a sink for inorganic carbon.