ONE Planet
Doctoral Training Partnership

Natural Environment Research Council

Project title: Greenland Ice Sheet melt regime and biogeochemical feedback (Ref: OP2221)

Keywords: Glaciers, Climate, Geochemistry, Isotope Tracers

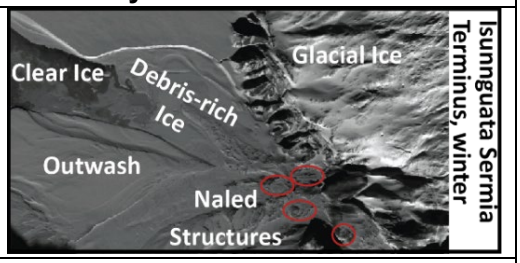
One Planet Research Theme:
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☐

Lead Supervisor: Dr Joseph Graly, Northumbria University

Key Research Gaps and Questions:
Do changes to glacial melt effect the cycling of atmospheric carbon to the lithosphere?

The link between subglacial geochemical processes, glaciology, and glacial hydrology

Mineral and isotopic processes under glaciers



Project Description: Glaciers and ice sheets are major drivers of chemical cycling, exporting large volumes of both sediments and dissolved solutes to the world's oceans. These weathering processes have important carbon cycle / climate feedbacks, both from the drawdown of atmospheric CO_2 through carbonation weathering and through the oxidation of sulphides and organic carbon in the subglacial environment. The fundamental relationship between glacial hydrology and resultant geochemical effects is crucial to understanding the effect of glaciation on geochemical cycles and the biogeochemical consequences of an increasingly deglaciated world.

The doctoral student will design a project aimed at constraining the effects of seasonal melt variability on the biogeochemical outflux of the Greenland Ice Sheet. This work will be enabled by participation in a two-year monitoring study in West Greenland, together with an international (USA – UK) team. The principal field site (pictured above) forms naled ice structures overwinter, meaning that water is continuing to emerge from the glacial forefield and freeze. Sampling of the frozen-on ice will allow characterisation of the chemistry of the low flow glaciohydrologic endmember and comparison to initial spring and peak summer melt. The student will be able to participate in sampling West Greenland naledi and contrasting mid and high flow during the '22-'23 and '23-'24 field seasons.

While the principal task is the aqueous geochemical and stable isotope characterisation of the naled ice and proglacial waters, the student is expected to add contrasting field sites (e.g. alpine glaciers) or additional methods, according to their research interests. This should expand upon the existing scope of work, which characterises microbiology, stable isotopes of carbon and sulphur, sedimentology, mineralogy, and naled physical properties.

The project will train the doctoral student in a wide range of field and analytical skills relating to the geochemical analysis of glacial ice and water. Upon completion, the student will be qualified to pursue an academic career employing chemical and isotopic methods to analyse earth system feedbacks or work in a range of industry or government positions (e.g. energy, environmental) that depend on the analysis of geochemical data.

Prerequisites: Degree in geology, physical geography, or other relevant fields. Coursework or research experience in geochemistry, mineralogy, and/or isotopes is strongly recommended. Field experience in an academic or industry setting is desirable, as is mountaineering training or experience.

For more information, please contact Joseph Graly (joseph.graly@northumbria.ac.uk).

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