ONE Planet Doctoral Training Partnership

Natural Environment Research Council

Project title: Glacial Impact on Earth's Geochemical Cycling and Climate

Ref: OP2453

Keywords: Glaciers, Climate, Geochemistry, Mineralogy

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:

- Does glaciation enhance the cycling of atmospheric carbon to the lithosphere?
- Which glacial settings have the greatest impact on the global geochemical system?
- How do glacial and deglaciated landscapes differ in rates of chemical cycling?

Project Description: The principal project goal is to understand the impact of subglacial geochemical processes on global chemical cycling and how these impacts will change in an increasingly deglaciating world. Past research has identified large chemical fluxes emerging at glacial termini and in the subglacial environments of large ice bodies. However, questions remain regarding the degree to which the chemical activity beneath glaciers is driven by atmospheric CO_2 drawdown or by oxidation of sulfur and organic matter, which have opposing effects for global geochemical cycling. Deglaciated proglacial forelands can also be areas of active chemical weathering and may substantailly contrast with the subglacial environment.

The funded doctoral student will be able to access archived sediment samples previously collected in Greenland and Antarctica. Fieldwork can flexibly include Greenland, Iceland, Jan Mayen or other sites of the student's choosing. Here, new samples of subglacial water, subglacial sediment, and sediment-bearing ice can be collected with the goal of understanding the varying impact of diverse glacial settings on chemical weathering. Together, new and archived samples will allow for a survey of glacial weathering products from the world's largest ice sheets and from various smaller sites that are potential weathering hotspots. Analyses will focus on the chemistry, sedimentology and mineralogy of these samples, as relevant to determining the underlying chemical pathways active in the subglacial or proglacial system. The doctoral student will have broad freedom to develop a plan for analysis, including of stable or radioisotopes constituents of dissolved inorganic carbon, glacial ice, and newly formed minerals such carbonates and clays.

The project will train the doctoral student in a wide range of field and analytical skills relating the geochemical analysis of rock, sediment, and water. It will be connected with ongoing research in Greenland and Antarctica led by supervisor Graly and will include collaborations with international colleagues. Upon completion, the student will be qualified to pursue an academic career employing chemical and isotopic methods to analyse earth system feedbacks or to pursue a range of industry or government positions (e.g. energy, environmental) that depend on the analysis of geochemical or mineralogical 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.

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

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