

Research Experience Placement (REP) Scheme Project

Project Supervisors:

Professor Chris Greenwell & Dr Darren Grocke

Host Organization and Department (if applicable):

Durham University, Department of Earth Sciences/Chemistry

Project Title:

Frozen in or chilled out? Clay mineral-herbicide interactions in freeze-thaw cycles

Project Description:

During freezing of water, salts and dissolved species remain in a brine phase that becomes progressively more concentrated as freezing progresses, and pH effects become amplified. Layered charged minerals, such as the commonly occurring aluminosilicate clay minerals in soils, are able to ion exchange/sorb a range of pollutants and exhibit a complex phase behaviour as a function of salinity, pH and temperature. The uptake of pollutants can exhibit strong hysteresis, with low release of sorbed pollutants (or nutrients). Very little research has been undertaken of the behaviour of layered minerals coupled to freeze-thaw cycles. This project will directly address this gap through studying the directional freezing of clay mineral suspensions containing commonly applied herbicides and fertilisers. The uptake of the species will be measured by stable isotope, thermogravimetric and ion chromatography analysis. The objective of the project is to determine the effect of freeze thaw cycles on concentration of dissolved species on clay minerals, and any subsequent release during thawing.

Skills and Career-Development Opportunities:

The student will gain an introduction to research project planning, risk assessment and delivery, through working within an active research group. The student will gain skills in preparation of minerals, undertaking adsorption experiments and analysis. The data will be written up in a mini-report, providing training in research project writing and literature reviewing.

Wider context of research:

The project will be laboratory based, though, if initial data shows an effect of freeze thaw cycles in model systems, soil cores may be obtained to see if the results can be repeated on natural samples.

Project Timeframe:

The project will be of 8 weeks duration in total (flexible working encouraged) and run between July and end of September 2021.