# GeoNetZero Centre for Doctoral Training (CDT): Geoscience and its Role in the Low Carbon Energy Transition

(2022 start)

**Project Title**: **Assessing the viability of the onshore lava fields of the British and Irish Paleogene Igneous Province (BIPIP) in sequestration of CO2**


**Host institution: University of Aberdeen**

**Supervisor 1: Nick Schofield**

**Supervisor 2: David Jolley, David Muirhead, Simon Holford (Adelaide), John Underhill (Heriot-watt)**


**Project description (250 words max.):** CO2 sequestration will form a route for the UK to attain Net-Zero. Basalt, sometimes referred to as the "gold standard for CO2 injection", has been shown in the lava fields of Iceland to be highly effective at sequestering CO2 into a solid form.

The West Coast of Scotland and Northern Ireland contains substantial thicknesses (> km) of basaltic lava sequences which form part of the British and Irish Paleogene Igneous Province (BIPIP). The aim of this project is to conduct detailed investigation of the lava fields of the British and Irish Paleogene Igneous province to assess their suitability for potential future CO2 sequestration.

Several key factors need to be considered in reservoir characterization to assess the suitability of a lava sequence to sequester substantial quantities of CO2. This includes overall silica content (with lower silica rocks being more suitable) and the presence of ample source of divalent cations in the form of primary and secondary Fe and Ca-rich minerals within the rock. Importantly permeability through vesicles and fractures is a key aspect of mineral precipitation. Of importance will be assessing the fracture stratigraphy within the much older (~ 58 Ma) BIPIP lava fields which possess a much more complex diagenetic history (when compared to C02 lava injection sites in Iceland). This project will seek to build a detailed stratigraphy of the BIPIP lava fields (Skye, Mull and Northern Ireland) with key petrological, structural (e.g. vesicular zones and fracture stratigraphy) and geochemical information to assess potential zones suitable for CO2 sequestration.

**Stated link to the overarching theme of the CDT i.e. The Role of Geoscience in the Energy Transition and the challenge to meet the net zero emission targets (NOTE: In order to qualify for NEO Energy CDT funding, there must be an explicit link to the Energy Transition with a clear application to the UK's Continental Shelf (UKCS). For projects supported by 100% matched funding from your University, links to the broader Energy Transition remit are sufficient):**

Attaining Net-Zero by C02 sequestration within the UK continental shelf. Understanding the ability for onshore lava fields onshore the UK to sequester C02 will also aid in assessing viability of the time equivalent lava sequences offshore along the Atlantic Margin (e.g. UK, Ireland and Norway)

**Details of mapping/fieldwork locations/data to be used by the project and confirmation of access to key data being secured (please attach map as an appendix if relevant)**:

This project will seek to build a detailed stratigraphy of the BIPIP lava fields (Skye, Mull and Northern Ireland) with key petrological, structural (e.g. vesicular zones and fracture stratigraphy) and geochemical information to assess potential zones suitable for CO2 sequestration. A key aspect will be integration of outcrop data, with collection of 3D virtual outcrops, with well data through the BIPIP lava fields (e.g. Upper-Glen 1 on the Isle of Skye).

All well data is already secured (or already open access) and all field sites are easily accessible, with no special requirements

**Outline of planned work schedule for the 4-year research period**:

**Year 1** – Literature Review, Field Season on Isle of Skye and Mull, including the collection of drone data
**Year 2** – Analytical work of collected outcrops and well data, petrography, petrology, fracture analysis. Field Season in Northern Ireland incl. collection of drone data
**Year 3** – Consolidation of work and paper writing of completed work (e.g. Isle of Skye and Mull). Conference attendance.
**Year 4** – Continued consolidation of work, paper, and thesis writing. Conference attendance

**Any Additional Research Costs (NOTE**: **Each CDT studentship includes an individual Research Training and Support Grant (RTSG) budget of £20k for the full 4-year study period)**

None needed

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**Supervisory arrangements and involvement of external partners (NOTE: Please indicate the area(s) of expertise covered by each supervisor. External collaboration is encouraged, but if proposed partner is not currently providing support to the CDT, please outline the extent of the partner's involvement with the project.)**

**Nick Schofield (University of Aberdeen) –** Expert on geology and volcanism of the Atlantic Margin, seismic and well analysis. Extensive drone experience.
**David Jolley (University of Aberdeen)–** Foremost expert on stratigraphy of the North Atlantic Lava fields (both onshore and offshore)
**David Muirhead (University of Aberdeen) –** Geochemist with expertise in analytical analysis of basalts and associated mineralogy.
**Simon Holford (University of Adelaide)–** Expert on volcanism, well and structural analysis. Award winning work on viability of sequestration of C02 into lava sequences offshore Australia
**John Underhill (Heriot-Watt) –** Foremost expert on UKCS and conducting several research projects on C02 sequestration across UKCS

**Likely graduate career routes**:

Academia, governmental or industry.