

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

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Project description: CO₂ sequestration is likely to form a major route forward for the UK to reduce its total carbon footprint during the energy transition. Although much focus has been placed on sequestration of CO₂ into depleted reservoirs of the North Sea, questions have remained on the ability for long term storage without leakage occurring. 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 by allowing reaction of CO₂ dissolved in water with primary and secondary minerals present within the basalts

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) (**Fig. 1**). 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 and ultimately identify a potential location for a pilot CO₂ storage experiment.

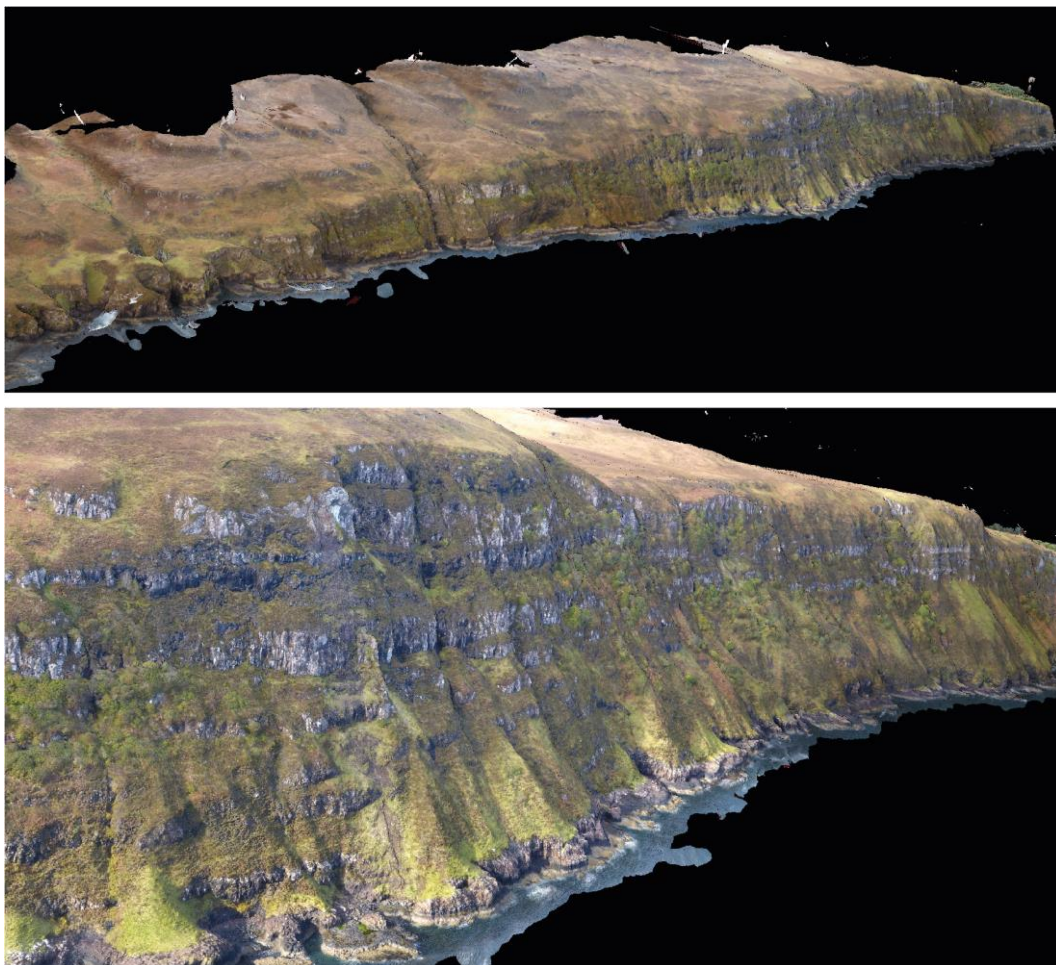


Fig. 1 – Screenshots from 3 km virtual outcrop collected on the Isle of Skye. The lavas sit within the same stratigraphic unit as those penetrated by the Upper-Glen I well located 5 km to south-west of cliff section. Amongst other things, the student will collect and interpret more of these types of data from across the BIPIP.

At the Iceland basalt sequestration project (Carb-Fix), it was found that several key factors need to be considered in reservoir characterization to assess the suitability of the lava sequences 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 was found to be an important aspect for the precipitation of new minerals. Of importance will be assessing the fracture stratigraphy within the BIPIP lava fields which being much older (~ 58 Ma) possesses a more complex diagenetic history than their younger Icelandic counterparts (max age 0.5 Ma).

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 I on the Isle of Skye). Of importance is assessing if the much older (~ 58 Ma) lava fields of the BIPIP province can be as (or more) efficient than their younger Icelandic counterparts (max age 0.5 Ma) in sequestering CO₂ due to presence of multiple secondary mineral deposits.

Training and wider impact

The student will join a vibrant group of PhD students engaged in subsurface interpretation, broadly facing the energy sector. The student will have the opportunity to spend time working in the Australian School of Petroleum and Energy Resources in Adelaide, Australia (dependent on COVID)

As part of the GeoNetZero CDT, the student will undertake 20 weeks of training. The training curriculum covers a broad spectrum of geoscience and its applications e.g. Sedimentology, Stratigraphy, Tectonics, LiDAR, geo-informatics, reservoir management, but also subjects of more general application such as Artificial Intelligence, Machine Learning, Communicating Science and Career Development

The closing date for applications is **29th January 2021**. We plan to hold interviews at **the end of February - early March**. All applications must be made online via: <https://www.abdn.ac.uk/pgap/login.php>

The projects available for a start in October 2021 are listed below. Contact the individual supervisors for project-specific information.