

Project Title: Tectonic and Stratigraphic Controls on Petroleum Systems of the Faroe-Shetland Basin.

Host institution: Heriot-Watt University

Supervisors: John Underhill, Rachel Jamieson

Project description: The Faroe-Shetland Basin is one of a suite of basins developed along the NW European Atlantic continental margin. Exploration success led to development in a variety of Cenozoic and Palaeozoic clastic reservoirs such as the Devonian-Carboniferous Clair Group (Clair Field) and Mesozoic clastics (e.g. the Jurassic Solan and Strathmore Fields and Cretaceous Victory Field) and Palaeocene deep water sandstones (e.g. Schiehallion, Foinaven, Laggan and Tormore Fields). Discoveries continue to be made in the basin including in recent years: the Pre-Cambrian fractured Lewisian metamorphic basement play opened up by the Lancaster Discovery, the exploitation of Triassic and Jurassic reservoirs at Solan and Strathmore. In addition, the Cretaceous clastic play fairway was found to extend further along and adjacent to the Rona Ridge and mixed Palaeocene volcanoclastic-sedimentary deposystems were found to be prospective (e.g. at Cambo and Rosebank).

The continued exploration success suggests that the basin contains significant yet-to-find reserves but the prolonged drilling campaign also suggests that the geological understanding of the Faroe-Shetland Basin still lacks clarity in some key components that together are vital to a full understanding of its petroleum systems. These include in particular: the maturation and charge history that dictates fluid type and distribution, the controls on and extent of Cenozoic, Mesozoic and Paleozoic clastic deposition and the role that any late-stage uplift, exhumation and fault reactivation may have played in the area.

The main objective of this project is to investigate the above points using a full suite of geological data and in doing so, to place the Faroe-Shetland Basin in its regional context. The study will primarily aim to understand the tectonic and stratigraphic development of the basin through the use of an extensive seismic and well database and will involve a high resolution seismic stratigraphic and structural interpretation of the Upper Palaeozoic and Mesozoic succession and its Late Cretaceous-Recent post-rift cover, calibrated and complemented by well log analysis, core logging and possible field-based analog studies.

Particular focus will be upon: (1) investigating the timing and mode of formation of the original basin morphology, including the basement highs that form the focus of exploration efforts. It will also investigate the role that Upper Palaeozoic fault scarp degradation has had in controlling the preservation and distribution of Devonian-Carboniferous reservoir sequences and the effect of late stage uplift on fault systems bounding these highs; (2) the impact that rift flank uplift and erosion of basement ridges had in controlling Triassic, Jurassic and Lower Cretaceous clastic play fairways; (3) understanding the role that Paleogene uplift had on both the structures in the basin and petroleum systems therein.

CDT Research theme(s): The PhD is relevant to two of the four themes in the CDT initiative, namely: Extending the life of mature basins and exploration in challenged environments

Research context: The project complements existing PhD students and their projects in the Centre for Exploration Geoscience at HWU.

Research costs: All the key budget costs for hardware, software, data purchase, field and lab costs are covered either by the NERC RTSG or as part of the support from HWU. The seismic data has been accessed through Common Data Access (CDA), the portal by which offshore subsurface data is released into the public domain. Additional data is being supplied by PGS.

Career routes: The project will be ideal for a candidate seeking future employment in the oil and gas sector as an exploration geologist or geophysicist be it with an oil company or in the service sector. The project also lends itself to a career in academia, the BGS or government departments such as OGA & BIS.