The Ups and Downs of the Faroe-Shetland Basin

3 year - Fully Funded PhD Scholarship

PhD Supervisory Team
Dr. Nick Schofield (Aberdeen), **Prof. David Jolley** (Aberdeen), **Dr. Simon Holford** (Adelaide), **Dr. Clayton Grove** (Siccar), **Dr. Alex Finlay** (Chemostrat), **Prof. Rob Strachan** (Portsmouth), **Dr. Julian Moore** (APT), **Dr. Chris Forster** (Siccar), **Dr. Christian Eide** (Bergen), **Dr. David Muirhead** (Aberdeen).

Introduction

As part of a major new industry funded project within the Faroe-Shetland Basin (FSB), we are seeking an enthusiastic, dynamic, hardworking and inquisitive individual to undertake a fully funded PhD (complete with a large analytical budget) to investigate the regional uplift and exhumation of the Faroe-Shetland Basin, with particular focus on boosting knowledge to aid in further exploration within the basin.

Background

The NW European margin has experienced a complex Palaeozoic–Cenozoic history with multiple phases of extension, subsidence and compression. Knowledge of exhumation and burial associated with these tectonic events is a fundamental requirement for accurate prediction of hydrocarbon generation and migration, reservoir quality and seal integrity. Across sub-basins in the Faroe-Shetland Basin (FSB), margin-wide uplift and exhumation has been further complicated by multiple tectonic factors, including magmatism, inversion and regional-scale uplift and tilting, that have resulted in spatially variable exhumation across sub-basins. Factors such as igneous overthickening (see Mark et al. 2018) and the formation of volcanic centres (e.g. Erlend), also acted to cause localised

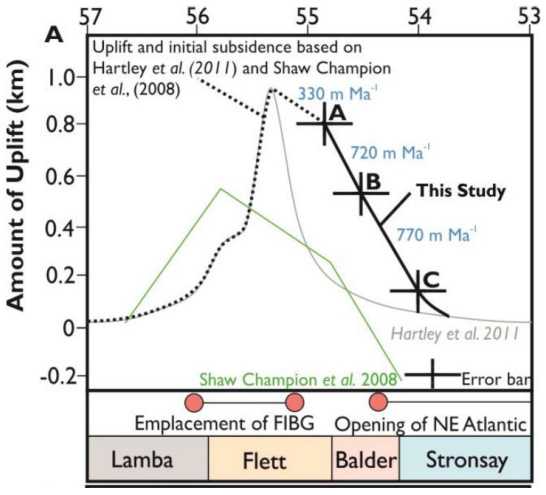

Figure 1 – Figure showing uplift and subsidence during the Paleocene within the FSB (From Hardman et al. 2017)

uplift, which imprinted and interacted with more regional aspects to change basin-floor geometry and topography creating localized sedimentary depocenters. Together, all the factors described above have created a very complex geological history of the FSB which needs to be correctly defined.

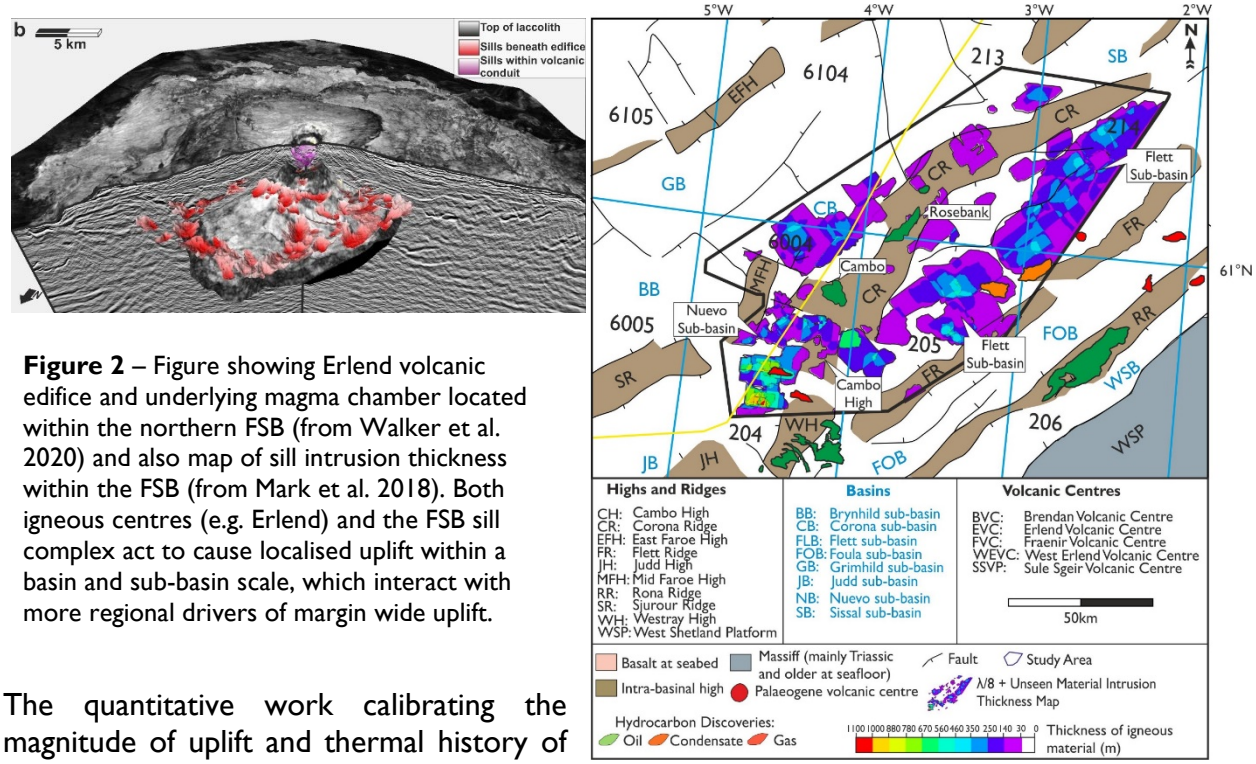

Figure 2 – Figure showing Erlend volcanic edifice and underlying magma chamber located within the northern FSB (from Walker et al. 2020) and also map of sill intrusion thickness within the FSB (from Mark et al. 2018). Both igneous centres (e.g. Erlend) and the FSB sill complex act to cause localised uplift within a basin and sub-basin scale, which interact with more regional drivers of margin wide uplift.

The quantitative work calibrating the magnitude of uplift and thermal history of the FSB has been mainly concentrated within the southern FSB (e.g. Judd areas) and within the region of the Rona Ridge. In other areas of the FSB, namely the prospective Corona Ridge, and northern FSB (e.g. Quad 208, 209, 214, 219, 220), the distribution, magnitude and chronology of exhumation, is still poorly constrained. Within the northern FSB, which was an area which was hoped to provide a key replenishment to the UKCS future gas supplies, disappointing well results (e.g. Lyon (208/02-1) and the Cragganmore appraisal (208/17a-4) have re-emphasised the need to fully re-evaluate reservoir distribution, sediment pathways and transport into and within the FSB sub-basins.

The effect of potential deep-seated basement structures, that may have reactivated at various times through the FSB and affected uplift and exhumation, also requires further investigation on a basin wide scale. Debate continues with regard to the presence, or not, of "transfer lineaments" which may cross the basin, and their possible role in sediment supply throughout the Mesozoic to Cenozoic. Additionally, recent work on basement rocks within the FSB has tentatively suggested the potential extension of the Moine Thrust northern splay into the FSB which may eventually cut across the basin in a NE orientation away from the Rona Ridge.

The Energy Transition is an important part of the UK's future and the University of Aberdeen is working at the forefront of this transition. However, even at the most rapid transition, the UK will still need substantial Oil and Gas production till 2050, to support the transition and increase energy security by reducing the UK's reliance on oil and gas imports. The Faroe-

Shetland Basin is likely to form much of the UKCS future oil and gas reserves needed during this transition period.

The large analytical budget for this PhD project, coupled with the collection of new analytical data as part of the wider research programme in which the PhD sits, will enable the PhD student to fully investigate the existing assumptions on the burial history of the FSB and to identify new exploration opportunities which can be utilised by industry.

Study Aim - ***New Data Collection and Creation placed in a Correct Geological Context***
The aim of this study is to undertake a comprehensive review of the uplift and thermal history across the FSB, with respect to those areas with poor current understanding (i.e. the northern FSB and the Corona Ridge). One focus of the PhD will be analysis of 25+ wells which will have new AFTA analysis undertaken. A general criticism of previous uplift and exhumation studies is that many of these studies have often been done in isolation, in smaller geographic areas and not integrated with detailed subsurface seismic reflection, biostratigraphy and palynological data across the Faroe-Shetland Basin.

It will be primarily the job of the PhD student to identify 25+ key wells suitable for new AFTA analysis to be undertaken in the area of the Corona Ridge and northern FSB as part of the wider work programme. This analysis will then be fully integrated by the PhD student with existing AFTA and compressional sonic transit-time compactional analysis. The data will then be placed into context with released seismic data across the FSB. Additionally, the AFTA analysis will also be fully integrated with biostratigraphy and palynology, which will help to identify maximum flooding surfaces and uplifted areas undergoing active exhumation and erosion. Targeted radiometric dating will also be undertaken on key sections to understand more exact timings in relation to overthickening and basin uplift.

The PhD project has a very generous analytical budget, which is designed to generate a large volume of new analysis data across the basin (e.g. Radiometric dates, Basement Fission Track Analysis, Petrographic and SEM analysis). The supervisory team has been assembled to give the student ready access to highly knowledgeable industrialists and academics with specialisation in different scientific areas of the margin.

The student will join the Atlantic Margin Research Group in Aberdeen which has a long track record and is respected in industry for actively sharing its research and bringing new ideas to the margin. This group has a vibrant mix of PhD students and Post-Docs who are passionate about furthering petroleum exploration knowledge within the UK continental shelf and further afield.

The student will be based at the University of Aberdeen. Depending on future COVID restrictions, the chosen student will spend time during the PhD working at Chemostrat (Wales), University of Adelaide and at Portsmouth University. These visits will be fully funded by the project at no cost to the successful applicant.

Application

Individuals with MSc in Petroleum Geoscience (or equivalent) and/or industry experience are preferred.

Exceptional BSc graduates will also be considered.

CLOSING DATE – 15th of March 2021

To apply, please send a PDF Cover letter and CV to Nick Schofield n.schofield@abdn.ac.uk

Further questions to Nick Schofield n.schofield@abdn.ac.uk

Please note, due to funding constraints this project is open to UK applicants only.