



NERC Centre for Doctoral Training in Oil & Gas (2017 start)

Project Title: Structural, stratigraphic and geodynamic controls on the evolution of the Carboniferous succession of northern England and southern Scotland
Host institution: Keele University
Supervisor 1: Dr Stuart Egan (Keele)
Supervisor 2: Dr Graham Leslie (BGS) & Dr Stuart M. Clarke (Keele)
Additional Supervisor (s):

Project description: The structural and geodynamic processes that have controlled the evolution of the Carboniferous basin system of northern England and southern Scotland, as well as interactions with the neighbouring North Sea, are very poorly understood. As a consequence, correlations of sedimentary fill, and sequence stratigraphical controls upon them, remain elusive. The main aim of this project will be to apply and further develop 3D lithosphere-scale tectonic modelling techniques in order to determine the interplay of geological and geodynamic processes that have controlled the evolution of the Carboniferous succession within the Northumberland Trough, Solway Basin, Stainmore Trough, Vale of Eden Basin and Midland Valley, as well as their offshore extensions and intervening areas of relative uplift such as the Alston Block, which contain large granitic intrusions within the pre-Carboniferous basement. The models will be constrained by regional-scale cross-sections constructed from the BGS database and the public domain, with selected profiles sequentially restored to provide a “snapshot” of structural and stratigraphical architecture during the Carboniferous Period. Further constraint will be provided by the wealth of subsurface mining-related sedimentary data, combined with the field acquisition of structural data. The study will provide insights into the importance of deep processes, such as depth-dependent extension, and how they interact with basin-controlling processes, such as bathymetry and sedimentary infill, within intra-continental, ‘basin and block’ settings. In particular, model results will provide insights into the development of accommodation space through time in response to sea level, tectonics and sediment supply, providing a structural and geodynamic framework for the sequence stratigraphical interpretation of the Carboniferous succession within this relatively poorly understood basin system.

CDT Research theme(s): The proposed project is fully compatible with the research themes ‘Extending the life of mature basins’ and ‘Environmental Impact and Regulation’. An increased understanding of 3D regional-scale geodynamic processes and the structural / stratigraphical relationships they can produce within the basin fill has far reaching implications for carbon dioxide sequestration and hydrocarbon exploration, the latter of which is of particular significance given recent renewed interest in the gas potential of the onshore Northumberland trough and its relationship to the neighbouring North Sea.

Research context: This project links to existing PhD projects that are underpinned by the expertise with the Basin Dynamics Research Group at Keele in basin/geodynamic modelling, sedimentology/sequence stratigraphy and structural geology. In addition, recent work at Keele University, in collaboration with BGS, has examined the large-scale geodynamic and structural evolution of the Alston Block and Northumberland Trough in 2D. This work provided, for the first time, well-constrained control on differential subsidence through time across the area, and represents a unique starting point on which the proposed project will build.

Research costs: This project is based largely on desk-based interpretation of existing data along with the use and further development of numerical/computer modelling software (Keele will provide access to computer hardware and modelling software). A component of fieldwork is envisaged (i.e. two field seasons at £1000 per year) which will be supported by the Research Group

Career routes: Hydrocarbon exploration or academia, with specialisms in basin analysis and modelling, structural geology, sedimentology and sequence stratigraphy, and numerical and computer modelling of geological processes.

Submissions must conform to this single-sided A4 format. The Awards Committee reserves the right not to consider submissions that do not adhere to this condition.