



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

Project Title: Basin-scale variability of mudstone in structurally-controlled basins

Host institution: University of Manchester

Supervisor 1: Rhodri Jerrett

Supervisor 2: Steve Flint

Additional Supervisor (s): Julian Mecklenburgh

Project description: The Silurian Welsh Basin was a structurally controlled basin primarily filled with mudstone. Sediment deposition was strongly controlled/segmented by local syn-sedimentary structural topography. The southern and eastern margin of the basin, including the shelf-slope-basin-floor transition is preserved onshore across Wales and the west Midlands. The aim of this research is to (a) describe the basin scale variation in mudrock reservoir quality from the shelf through slope and across the basin floor; (b) generate a sedimentary depositional model for the Welsh Basin, that can readily be exported to predict mudstone reservoir quality in potentially productive mudstone reservoirs in other structurally controlled basins.

The student will undertake sedimentological logging and outcrop characterisation of selected intervals comprising the shelf, slope and proximal-to-distal sectors of the basin floor, of the Welsh Basin succession. Variability in grain size, mineralogical composition, organic carbon richness will be determined by both bulk sample analysis (X-ray diffraction, TOC analysis, XRF analysis). Ultra-thin polished thin-sections will be made for collected samples, and will be scanned and photographed at low- to high-power using optical microscopy. Observations on detrital grain size mineralogy will be made using scanning electron microscopy under backscattered electron mode and EDS element analysis. Regional-scale correlations of observed trends will be underpinned by a robust in-place graptolite biostratigraphic framework.

CDT Research theme(s): Effective production of unconventional hydrocarbons.

Research context: There have been significant recent developments in the understanding of depositional processes relating to mudstone deposition, which likely strongly influence the capacity of different mudstone facies to behave as unconventional reservoirs (in terms of, for example TOC content, and mechanical properties). This understanding is currently biased towards “shelf” mudstones, and there is a lack of understanding of the basin-scale variability in mudstone properties, and how these relate to basin-scale processes. This project specifically addresses these two issues.

Research costs: Fieldwork in the UK, analytical costs and attendance at conference £3000 per annum.

Career routes: The PhD student will receive research training that will provide them with the skills to enter academia or the oil and gas industry. They will join a large group of other PhD students, post-docs and academic staff in the Petroleum Geoscience and Basin Studies Group at Manchester, with an active research programme on basin-scale sedimentology and stratal architectures, shale sedimentology, diagenesis, petrophysics, mechanics and porosity/permeability measurements. The project spans the fields of sedimentology, petrology and geochemistry.