



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

Project Title: Developing protocols to construct high-resolution 3D petroleum reservoir outcrop analogues
Host institution: Keele University
Supervisor 1: Dr Jamie K. Pringle (Keele)
Supervisor 2: Dr Dominic Tatum (Heriot-Watt University)
Additional Supervisor(s):

Project description:

There has been numerous petroleum reservoir outcrop analogue research studies undertaken; however, these have usually been 2.5D at best which are then interrogated for a variety of uses (fracture densities, sedimentary architectures, etc., see Pringle et al. [2004;2010](#)). More recently ground-based LiDAR systems have been used but, to date, no-one has used its full capabilities, namely the full waveform which contains information on material being scanned. Once data has been analysed and calibrated, this should result in material properties such as grain size and porosity to be determined. This project will use a variety of identified sub-seismic scale outcrop analogues to determine the feasibility of such research and begin to catalogue this variability along more traditional applied sedimentology studies. Structural analysis will also be undertaken. Furthermore high resolution, near-surface geophysical techniques, obtained both behind the outcrop face (as 2D profiles) and down outcrop face (as Vertical Radar Profiles similar to VSPs), can provide fully 3D information which can then be fully integrated with surface information (& sedimentary logs etc.) to provide a high resolution 3D model of the outcrop studied. Ground penetrating radar has shown promise for this (see Pringle et al. 2004;2012) and should therefore be expanded upon here. Sedimentary logs will also be converted into pseudo-well logs, with accompanying synthetic vshale, seismics, etc if of sufficient sizes and scales.

This multi-technique research pushes present outcrop analogue research into fully 3D and thus allows petroleum reservoir knowledge to be improved.

CDT Research theme(s): Both **Effective production of unconventional hydrocarbons:** improved knowledge of how to extract in heterogeneous reservoirs & **Extending the life of mature basins:** will provide improved understanding of reservoirs and enhancing recovery.

Research context: The Basin Dynamics Research Group have a long history of studying sedimentary outcrops, with current PhD students studying digital data capture and virtual outcrop generation. The Applied & Environmental Geophysics Research Group also has a long history of acquiring near-surface geophysical data from outcrops, specialising in GPR data capture and Vertical Radar Profiles on outcrop cliff faces. This will neatly dovetail two groups into one project.

Research costs: Field equipment, including GPR, LiDAR and survey equipment, data processing/analysis/visualisation software are available in-house. This project will be field-based, with UK fieldwork on a variety of sites (£1,000 per year), supported by the Applied & Environmental Geophysics Group at Keele.

Career routes: Hydrocarbon exploration, academia or geotechnical industry, with specialisms in sedimentology and sequence stratigraphy, near-surface geophysics, digital data outcrop capture, numerical and computer modelling of geological processes, geophysical survey design, acquisition, processing and data integration.

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.