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

Project Title: Towards the quantitative prediction of sandstone body connectivity within distributive fluvial systems through numerical modelling and field studies

Host institution: University of Aberdeen

Supervisor 1: John Howell

Supervisor 2: Adrian Hartley

Additional Supervisor (s): Amanda Owen

Project description:
Fluvial reservoirs are traditionally challenging, primarily due to the heterogeneity associated with complex facies architecture. The performance of fluvial reservoirs is primarily controlled by sandbody connectivity controlled to the stacking arrangement of channel belts. Recent advances in understanding the large scale spatial distribution of fluvial facies from both modern and ancient systems has led to the development of the Distributive Fluvial System Model (DFS). This model provides a qualitative framework to predict the distribution of different channel stacking patterns depending on location within the DFS (proximal, medial or distal). The model is at present largely qualitative and does not currently account for accommodation driven controls predicted by Leeder, Allen and Bridge in the original LAB model. Attempts to quantify the DFS model are hindered by the limited number of suitable case studies from outcrops that provide continuous exposure across the scale of an entire DFS.

This project will address the problem from a process based modelling approach, where the different parameters can be constrained in a way that is not achievable in outcrop. An experimental design will be established that will numerically recreate a point sourced fluvial system. The model will include parameters such as channel belt size, downstream changes in channel belt size and character, avulsion frequency, and accommodation creation rates. Realistic ranges for these parameters will be constrained from literature and from selected field studies from a range of DFS including the Ebro system (Spain), the Morrison Formation, SW USA, the previously unstudied Colton Formation (Utah), and the modern Mitchell DFS in the Gulf of Carpentaria, Australia.

Results will include a series of models which cover the spectrum of accommodation, sediment supply and climate scenarios. Models will be compared by analysis of connectivity within different portions and quality controlled against the case study examples. The result will be a new and greatly improved model for understanding and predicting reservoir connectivity in fluvial systems.

CDT Research theme(s):
The analysis of reservoir connectivity sits within Theme B – Extending the life of mature basins and also has significant implication in exploration in frontier areas.

Research context:
This research fits within the umbrella of two major JIPs with the University of Aberdeen. Hartley and Owen run FSRG which has been largely responsible for the development of the DFS concept and its application. Howell runs Safari which includes large volumes of numerical data pertaining to the geometries, connectivity and architecture of clastic reservoirs. The project will form a bridge between those research themes

Research costs:
The principal costs associated with this work is fieldwork which will be covered by the RTSG. Additional funds if required will be provides by FSRG and/or SAFARI

Career routes:
This project will provide a solid grounding in sedimentology, reservoir characterisation, numerical and reservoir modelling and, geological field studies.

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.