

## **Unconventional Petroleum Potential of the Gainsborough Trough, East Midlands, United Kingdom**

**Francesco Palci<sup>1</sup>, Alastair Fraser<sup>1</sup>, Kate Parkin<sup>2</sup>, Tom Wilson<sup>2</sup>, Thomas W. Goode, and Martin Neumaier<sup>3</sup>**

<sup>1</sup>Imperial College London, London, United Kingdom.

<sup>2</sup>IGas Energy PLC, London, United Kingdom.

<sup>3</sup>Schlumberger, Montpellier, France.

### **ABSTRACT**

The Gainsborough Trough in the UK East Midlands has a long history of conventional exploration activity and its Carboniferous sequences have been important targets for hydrocarbon resources since the 1920's. The Gainsborough Trough has been considered a well understood sedimentary basin – or so we thought. The development of technological advancements in horizontal drilling and hydraulic fracturing stimulation techniques has allowed the rapid exploitation of unconventional petroleum resources in the US and has led to a re-evaluation of the basin for its shale oil and gas potential. A Type II source rock was deposited during the Pendleian sub stage (Late Mississippian) known collectively as the Bowland Shale Formation; which is demonstrated to be thermally mature for both oil and gas generation and deposited in a relatively simple tectonic setting. A sophisticated petroleum systems model has been generated to provide an improved assessment of the unconventional petroleum resources in the basin. The petroleum systems modelling incorporates the burial and uplift history of the basin allowing the prediction of the generation and expulsion of the various hydrocarbons phases. Additionally, the breakdown of hydrocarbon accumulations within either the free or adsorbed phase was also possible. In-place volumes of shale oil and gas resources were estimated resulting in the production of unconventional hydrocarbon sweet spot maps consistent with the present day oil and gas conventional fields in the area. A total of 18 billion barrels of oil and 25 Tcf of gas in place has been estimated within the Bowland Shale Formation in the Gainsborough Trough. Critically, in terms of recoverable hydrocarbons, the natural fracture system present in the Bowland Shale is not fully understood due to the lack of direct well bore information and only future drilling and testing will allow explorers to fully understand the potential recoverable resources of the Gainsborough Trough.