The Influence of "Cimmerian" Exhumation on the Hydrocarbon Potential of the Southwest Approaches, Offshore NW Europe

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Abstract

The UK Oil & Gas Authority (OGA) is funding the New Appraisal of the Western Approaches Basins (NAWAB) research project, led by the Universities of Durham, Keele and Leicester, with APT (UK) Ltd, Geospatial Research Ltd and Trace Editors Ltd. NAWAB aims to investigate the hydrocarbon potential of the Southwest Approaches, NW European continental shelf (2°W-12°W and 48°N-52°N).

The area encompasses the Rheic-Rhenohercynian suture, which separates the Variscan fold and thrust belt from Gondwanan crust to the south. Following collapse of the Variscan orogeny during the Permo-Carboniferous, the region experienced multiple Permo-Triassic and Jurassic rift phases, followed by sea floor spreading in the Bay of Biscay during the Cretaceous. Lower Jurassic mudstones constitute the principal source rocks, but their preservation and maturity were strongly influenced by the widespread, but poorly understood "Cimmerian" exhumation event. The timing of generation from the Lower Jurassic relative to the Cimmerian event constitutes the principal exploration risk in the Western Approaches.

Analysis of legacy data suggests that the stratigraphic hiatus across the Cimmerian unconformity increases south-westward towards the Melville Basin and Goban Spur. Here, Lower Jurassic strata have been partly or completely eroded. A correlative conformity, of Late Jurassic age, can be identified within the Brittany Basin and was associated with a relative sea level fall. 1D backstripping of wells in the Brittany Basin indicates that the tectonic subsidence was sharply reduced during the period associated with Cimmerian exhumation.

Existing porosity data indicate that the magnitude of Cimmerian erosion was slightly greater than, or similar to, post-Cimmerian subsidence, whilst 1D burial history models suggest that the vitrinite reflectance data can be reasonably fit by between 0.25 km and 3 km erosion due to a high degree of scatter. We shall address this uncertainty using a multi-disciplinary approach that involves: 1) interpreting the OGA's newly acquired regional 2D seismic survey across the Southwest Approaches; 2) generation of new calibration data (%Ro, SCI); 3) 1D and 2D basin modelling; and 4) use of Re-Os isotopic methods to model the age of hydrocarbon generation. Integrating these results will allow more accurate prediction of the timing and magnitude of source rock maturity and a more robust constraint of the petroleum exploration potential of this lightly explored area.