

“Leveraging the Outcrops” – The Key to Successful Exploration for Mesozoic Plays Offshore the Central Atlantic Margin

Jonathan Redfern¹, Giovanni Bertotti², Aude Duval-Arnould¹, Jianpeng Wang¹, Remi Charton², Luc Bulot¹, Leonardo Muniz-Pichel¹, Mads Huuse¹, and Tim Luber¹

¹School of Earth and Environment, University of Manchester, Manchester, Greater Manchester, United Kingdom.

²TuDeft, Delft, Netherlands.

ABSTRACT

Exploration for commercial hydrocarbons in the Central Atlantic has had mixed fortunes to-date. Although recent discoveries in Senegal and Mauritania prove working prolific petroleum systems along the margin; the challenge is to extend this success north. Understanding basin evolution and depositional systems of the different segments in a “source to sink” transect is essential to decipher the processes controlling reservoir and source rock development in this underexplored region. Onshore Morocco provides exceptional exposures of the entire Mesozoic section and results from a series of integrated studies on key stratigraphic intervals from the Triassic syn-rift through to Jurassic and Cretaceous passive margin sections, combined with analysis of the hinterland dynamics and integration with offshore and onshore subsurface data the results can de-risking future exploration. Basin evolution is constrained by low-temperature geochronology and structural studies that indicate dynamic Mesozoic vertical movements, transposing provenance terrains and leading to km-scale uplift/exhumation in the Jurassic and Cretaceous. In the “Sink” segment, the Triassic rift provides an inherited fabric that influences later deposition and structural deformation. Late rift deposition of salt has a significant control on overlying plays and sedimentary fairways. Jurassic carbonate sequences evolve from open-marine ramp deposits to barrier reef, with the occurrence of evaporites and tempestites. Detailed mapping is yielding a better understanding of facies development and diagenetic controls on reservoir. So far, late Jurassic to Early Cretaceous deep-water sandstone reservoirs offshore Morocco have proven elusive. Onshore, detailed sedimentological, sequence stratigraphic and biostratigraphic studies (integrated ammonite, calcareous nannofossil, foraminifera, TOC, and carbon isotopes stratigraphy) provides high resolution control for better targeting of prospective intervals. Sequential GDE maps illustrate reservoir potential in the reef plays of the Oxfordian and coarse-clastic delivery in the Barremian/Aptian. Work on the Cenomanian /Turonian OAE2 interval further provides valuable data on source rock distribution and quality. The integrated series of projects are improving our understanding of the controls on depositional facies throughout the Mesozoic, the paleogeography and source to sink analysis with implications for exploration offshore.