Controls on Sedimentary Fill in Salt-Walled Mini-Basins of the Triassic and Jurassic, Melville Basin, Western Approaches, United Kingdom

Stuart Jones[1], Stuart Clarke[2], Stephan Stricker[1], Jonathan Imber[1], Jim Henderson[3], Stuart Egan[2]

[1]Earth Sciences , Durham University , Durham, United Kingdom.
[2]Earth Sciences , Keele University, Keele, Staffordshire, United Kingdom.
[3]Trace Editors Limited , Fleet, Hampshire, United Kingdom.

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Abstract

The Melville Basin, Western Approaches UK, preserves a Triassic succession with poorly characterized hydrocarbon prospectivity. Clastic sediments – some of which exhibit good source rock potential – are interbedded with evaporitic strata, and both the burial and preservation of potential source intervals are, at least in part, controlled by salt movement. Consequently, the role of halokinesis in source rock maturity and preservation is a key risk for hydrocarbon exploration in this basin.

The fill of the Melville Basin during the Lower and Middle Triassic was initially dominated by playa and ephemeral fluvial fans fringed by aeolian dunes. During the Late Triassic Carnian, ongoing extensional activity saw widespread expansion of the rift network and the opening of new access routes for marine waters in to the basin. Rifting along the Atlantic and Biscay regions resulted in the extensive development of halite bodies through northern Spain, southern France and the UK Western Approaches. By the Norian, the northward drift of Pangaea had begun to distance the northwest European region from the equatorial arid zone, limiting the formation of any further evaporites in the Western Approaches.

This was followed by an episode of so-called Late Cimmerian uplift, during which the area was domed and uplifted with extensive erosion of Jurassic sediments, except within the salt-walled mini basins of the Melville Basin.

The Triassic Carnian evaporites record a series of actively subsiding salt-walled mini-basins, the development and evolution of which significantly influenced the preservation of later sediments, including marine mudstones of the Lower Jurassic section that are the principle source rocks in the region. The resultant preserved sedimentary architecture in the mini-basins was controlled by the following: i) the inherited structural state of the mini basins at the time of infill, ii) the rate of sediment supply, iii) temporal changes in the regional climate and iv) variability in mini-basin subsidence rates and associated salt-wall uplift.

Detailed appraisal and interpretation of recently acquired new 2D seismic and reprocessed legacy seismic data across the Western Approaches has afforded the opportunity to identify the complex spatial changes in preserved thickness of the late Triassic Carnian evaporites and recognise their important influence upon the preservation of Lower Jurassic source rocks.

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