Section «Innovative natural resources management»

Oil and Gas Accumulation in Palaeozoic Deposits of Murzuq Basin

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The Murzuq Basin covers an area of over 350,000 km^2, and is one of several intracratonic sag basins located on the North African Platform. The present-day borders of the basin are defined by tectonic uplifts, each of multi-phase generation, and the present basin geometry bears little relation to the much broader North African sedimentary basin which existed during the Early Palaeozoic. Several generations of fault movement are recognized in the basin but the resultant degree of deformation is relatively minor. The basin contains a sedimentary fill that reaches a maximum thickness of about 4000 m in the basin centre and comprises a predominantly marine Palaeozoic section and a continental Mesozoic.

Many of the discovered fields and exploration prospects identified in the Murzuq Basin involve high angle reverse faults and are typically found in the hanging wall or in tip-line folds above the faults. Fault orientations in the basin show considerable variation but a dominant clustering around a north-south trend suggests the influence of a Late Precambrian Pan-African grain in the underlying basement. Initial Palaeozoic fault movements are recognized in the Cambrian-Ordovician part of sedimentary section with significant growth occurring across steeply dipping faults. Subsequent reactivation during Late Silurian – Early Devonian compression resulted in reverse displacement on many of the larger faults, creating the presently observed trapping structures. Further reverse fault movements and transgression also occurred during the mid-Carboniferous, mid-Cretaceous (Austrian) and Early Tertiary (Alpine) compressive tectonic phases, all of which were associated with regional uplift and erosion.

The principal hydrocarbon play in the basin consists of an Ordovician per-glacial sandstone reservoir and sealed by overlying Silurian shales. This play has proved very successful and accounts for about 1500 MMB of recoverable oil discovered.

Based on thermal modelling suggests that Silurian hot shales entered the oil window during the Permian but did not reach peak maturity until the Late Cretaceous and are still in the oil window at the present time. Subsequent regional uplift and erosion has resulted in cooling of the source rocks which are no longer generating oil over large parts of the basin. At present day the Silurian source rock remains within the oil generating window only in a limited area of the basin centre. The key to better understanding of this play is the relative timing of oil generation compared to Cretaceous and Tertiary inversion tectonics which influenced burial depth of the source rock, reactivated faults on the trapping structures and reorganized migration pathways.

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