
Anatomy of a World-Class Source Rock: Distribution and Depositional Model of Silurian Organic-Rich Shales in Jordan and Implications for Hydrocarbon Potential

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Silurian organic-rich ("hot") shales have sourced large amounts of hydrocarbons in northern Gondwana, with super-giant and giant fields in Saudi Arabia, Iran, Qatar, Libya and Algeria. A study of these black shales has been carried out in Jordan where they represent the source for the Risha Gas Field. Two organically enriched horizons occur in the Silurian in Jordan, termed the Lower and the Upper Hot Shale. Deposition of the transgressive Lower Hot Shale occurred during the Early Llandovery and was restricted to earliest Silurian palaeodepressions. Three Lower Hot Shale depocentres have been identified in Jordan which are located in the western Risha, eastern Wadi Sirhan and Jafr areas. The eastern Risha area was part of a larger-scale palaeohigh covering NE Jordan, most of Syria and Iraq, and north-central Saudi Arabia (Qusaiba area). At least in Jordan the high coincides with the depocentre of the latest Ordovician glaciation. Sedimentation of the Upper Hot Shale took place around peak sea-level during the Late Llandovery - Wenlock and was limited to the distal parts of the shelf (Risha area), in front of the prograding silty-sandy deltaic front.

Thermal maturity increases from immature in the Southern Desert outcrops to late/post-mature in northern Jordan. Organic-richness and pyrolysis data deteriorate significantly with increasing thermal maturity due to hydrocarbon generation. Prior to maturation, maximum organic richness is interpreted to have well exceeded 10% with good S₂ yields, as reflected in the values of the immature Lower Hot Shale in shallow borehole BG-14 in the Southern Desert Outcrop area and exploration well JF-1 in the Jafr area.
