

Marzuq Basin Palaeozoic Petroleum System

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Abstract : In the Southwest Libya area, the Palaeozoic deposits are an important petroleum system, with Silurian shale considered a hydrocarbon source rock and Cambro-Ordovician recognized as a good reservoir. The Palaeozoic petroleum system has the greatest potential for conventional and is thought to represent the significant prospect of unconventional petroleum resources in Southwest Libya. Until now, the lateral and vertical heterogeneity of the source rock was not well evaluated, and oil-source correlation is still a matter of debate. One source rock, which is considered the main source potential in Marzuq Basin, was investigated for its uranium contents using gamma-ray logs, rock-eval pyrolysis, and organic petrography for their bulk kinetic characteristics to determine the petroleum potential qualitatively and quantitatively. Thirty source rock samples and fifteen oil samples from the Tannezzuft source rock were analyzed by Rock-Eval Pyrolysis, microscopely investigation, GC, and GC-MS to detect acyclic isoprenoids and aliphatic, aromatic, and NSO biomarkers. Geochemistry tools were applied to screen source and age-significant biomarkers to high-spot genetic relationships. A grating heterogeneity exists among source rock zones from different levels of depth with varying uranium contents according to gamma-ray logs, rock-eval pyrolysis results, and kinetic features. The uranium-rich Tannezzuft Formations (Hot Shales) produce oils and oil-to-gas hydrocarbons based on their richness, kerogen type, and thermal maturity. Biomarker results such as C₂₇, C₂₈, and C₂₉ steranes concentrations and C₂₄ tetracyclic terpane/C₂₉ tricyclic terpane ratios, with sterane and hopane ratios, are considered the most promising biomarker information in differentiating within the Silurian Shale Tannezzuft Formation and in correlating with its expelled oils. The Tannezzuft Hot Shale is considered the main source rock for oil and gas accumulations in the Cambro-Ordovician reservoirs within the Marzuq Basin. Migration of the generated and expelled oil and gas from the Tannezzuft source rock to the reservoirs of the Cambro-Ordovician petroleum system was interpreted to have occurred along vertical and lateral pathways along the faults in the Palaeozoic Strata. The Upper Tannezzuft Formation (cold shale) is considered the primary seal in the Marzuq Basin.

Keywords : heterogeneity, hot shale, kerogen, Silurian, uranium

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