

APPLICATION OF RESERVOIR GEOCHEMISTRY IN THE SOUTHEASTERN GHADAMIS BASIN, LIBYA

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Geochemical techniques have been employed to analyse a suite of samples from the Libyan sector of the Ghadames basin. Samples consisted of source rock from the lower Silurian Tanezzuft Hot shale have been selected from three wells, core material of Devonian to Ordovician age stained with residual oil from one well and five produced oils from Devonian reservoirs within the Ghadames basin. Maturity studies indicate considerable variation in the maturity of the lower Silurian Tanezzuft Hot shale source rock. Samples analysed range from early mature to late mature for oil generation. Source rock characterisation shows that the lower Silurian Tanezzuft Hot shale is a good quality source rock which has already generated significant quantities of hydrocarbons. Correlative analysis shows there is a strong compositional and source similarity between the residual oils extracted from core material from A1-NC40 well and crude oils produced from the Ghadames basin. These oils appear to have been produced from a middle mature source rock of lower Palaeozoic age. Gas chromatography analyses of both the whole oil and the gasoline range fraction (C₄-C₇) have allowed the use of fingerprint analysis on the oils. Plotting of a number of compound ratios in star plots and ribbon diagrams has allowed the discrimination of the oils into three distinct groups: first group is distributed across a large geographic area and more than one reservoir horizon and is thought to have been generated by a single kitchen. Second group has been affected by significant biodegradation, but may have been generated by the same system as the main group. The final group is likely to have been generated by a slightly different kitchen, or to have undergone post-generation alteration not experienced by the other oils.

Biomarker analysis of the aromatic fraction allows the calculation of approximate levels of maturity of the source rock from which the oil was generated, at the time of generation. For three oils analysed, these ratios indicate the oils were generated from a source rock of approximately middle maturity. Lower Silurian source rock in the wells analysed could have been at this level of maturity, especially the Tanezzuft Hot shale in well B1-NC100, the maturity of the source rock in C1-NC100 well has not yet reached this level of

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maturity, it is possible that the wells analysed for source rock characteristics are outside, or near the margin of, the main source kitchen for the produced oils analysed. Stable carbon isotope for the alkane and aromatic fractions of the hydrocarbons of oils and extracted samples from the source a rock are isotopically light, typical of oils sourced from lower Palaeozoic rocks and shows a relatively tight cluster indicating a similarity of source material.