

Tracing Oil Migration using Oil Geochemistry and Fluid-Inclusion Volatiles

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Abstract

Interpretation of the hydrocarbon systems of the Middle East is complicated due to multiple source rocks generating oil and gas that migrate vertically to multiple reservoirs. We have combined conventional interpretations of oil occurrences in wells with the results of analyses of biomarkers and stable isotopes of oils and source rocks and of fluid-inclusion volatiles of cuttings and core samples to elucidate the occurrence and pathways of vertical migration of oil and the effectiveness of sealing rocks.

Oils from Lower Cretaceous, Jurassic, Triassic and Silurian source rocks can be distinguished using a combination of geochemical parameters. The occurrence of oils closely matches the distribution of the mature source rocks which generated the oils, although there is generally an updip zone of lateral migration. Oil source correlations prove vertical migration from deeply buried source rocks to much shallower reservoirs. Analysis of fluid-inclusion volatiles (FIV) illuminates pathways and mechanisms of vertical migration. In many cases an impressively large FIV signal supports cross-stratal flow through anhydrite and shale seals. More rarely there are intervals without FIV signals that underlie shallow oil occurrences, the chemistry of which indicates that the oil has migrated vertically in discrete faults or fractures.