

PETROLEUM SYSTEM ANALYSIS OF THE TRIASSIC SEQUENCE IN CENTRAL AND EASTERN SAUDI ARABIA

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Compared to the Jurassic and the Paleozoic, the Triassic sequence of Saudi Arabia has not heretofore been invoked as a significant petroleum system. However, Triassic oil and gas–condensate has been recovered throughout the Arabian Peninsula. Sharland *et al.*, (2001) identified potential petroleum source rocks in dark limestones and dolostones of late Triassic age from Syria and Iraq. Hassan (1989) reports high Total Organic Carbon (TOC) contents of up to 5% for the Middle Triassic Gulailah Formation in the Ghasha field, offshore the United Arab Emirates with thermal maturities attaining levels that are transitional from oil to wet-gas generation. Triassic gas shows are common in eastern Saudi Arabia, Bahrain and the United Arab Emirates (Loutfi and Abdel Sattar, 1987). In Qatar, commercial gas accumulations in the Middle Triassic Jilh Formation were reported. The giant Sarakhs gas field in northeastern Iran is probably sourced from the late Triassic and early Jurassic Elika and Kashaf Formations.

The discovery of significant amounts of hydrocarbons in Triassic reservoirs provides a unique opportunity to study the petroleum potential of the Triassic System using standard geochemical screening and correlation techniques. Firstly, we have determined the source rock potential on selected core and cutting samples from the Minjur, Jilh and Sudair Formations using TOC and Rock-Eval analyses. Secondly, oil-oil and oil-source correlations have been completed on a suite of Jilh reservoir oils and source rock samples to assess the origin of the oils and their possible correlation to Triassic source rocks. For comparison, we also analyzed representative Jurassic and Paleozoic oils.

Although source bed thickness is limited, the Middle and Upper Triassic sequences contain excellent oil-and gas-prone source rocks with organic carbon contents of up to 7.4% and Hydrogen-Index (HI) values up to 700 mg/g TOC. However, the petroleum potential is quite small compared to the well-known Jurassic and Silurian petroleum systems. Visual kerogen revealed that the samples mainly contain amorphous organic matter. Vitrinite reflectance and other thermal maturity parameters indicate that these sequences are thermally mature only in Eastern Saudi Arabia. Oils in Triassic reservoirs have a number of distinctive characteristics compared to Qusaiba (Paleozoic) and Hanifa (Jurassic) sourced oils. Typical features of many Jilh reservoir oils are Pristane/Phytane ratios between 0.8 and 1.2,

relatively high abundances of the C_{34} homohopanes and occasionally high gammacerane indices which suggests source rock deposition under restricted, sometimes hypersaline environmental conditions. Carbon isotope and biomarker data of the Triassic fluids suggest generation from localized middle and upper Triassic source rocks with limited areal extent. All these data verify the existence of a minor Triassic petroleum system in eastern Saudi Arabia (see Figure 1).

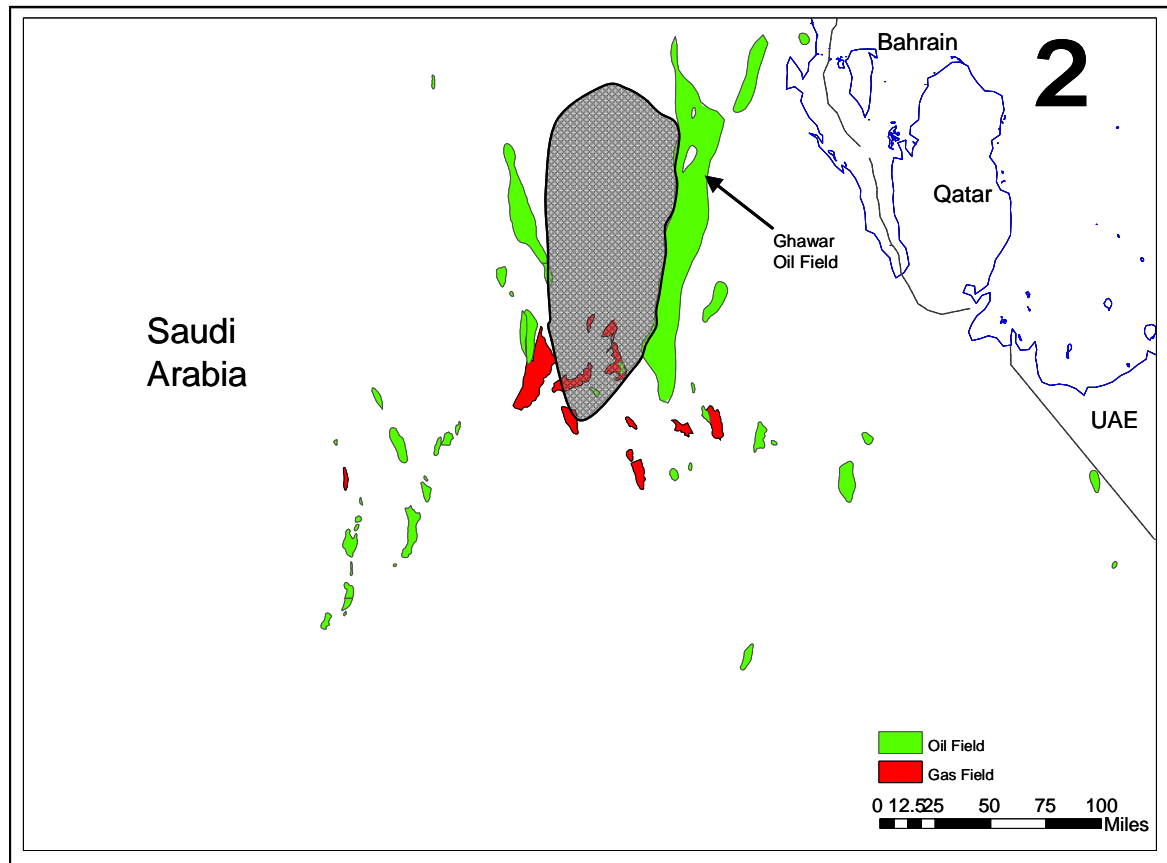


Figure 1. Map view showing the major oil and gas fields in Saudi Arabia. As illustrated by dark shading, this is the general region in which Triassic oils have been recovered.

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