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Fingerprinting Investigation of Selected Crude oils From Middle East using Results of Compound Specific Isotope Analysis of Biomarkers

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SUMMARY

Conventional plays are the familiar type in the petroleum industry. In these plays the petroleum is found in a reservoir separated from the source rock – usually both structurally and vertically. In an unconventional play, the source rock and the reservoir are the same, with the source unit itself acting as the reservoir. Unconventional gas resources are an underutilized strategic resource for countries and exploration companies alike. These producible hydrocarbon resources are often ignored except for their hydrocarbon source potential for conventional reservoirs.

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Most domestic E&P companies are rapidly shifting their effort from developing shale reservoirs that contain dry gas to liquid-rich shale reservoirs that contain wet gas or crude oil

CSIA, also known as isotope ratio monitoring – Gas Chromatography- Mass Spectrometry (IRM-GCMS), is a new technique which adds a whole new dimension to oil-oil and oil-source rock correlations. In conjunction with high-resolution biomarker analyses, CSIA provides the most in-depth and most source- specific analysis currently possible for correctly identifying in detail and understanding the petroleum systems in a basin.

A total of fourteen (14) crude oils from Tertiary (T1-T5) and Cretaceous (C1-C9) reservoirs have been selected and analyzed using a suite of geochemical methods, including CSIA of alkane and biomarkers (CSIA/A and CSIA/B) to investigate their source relationship.

Absolute values and comparisons of biomarker isotope ratios between compound types and between samples provide a clear distinction between the two source-age types, i.e. Tertiary and Cretaceous.

Compound specific isotope analysis of alkanes (CSIA/A) was difficult for the Tertiary oil samples selected because they were biodegraded and their n-alkane concentrations were very weak for measurement. This accounts for the high variability of the measurements and unevenness of the trend lines. Results of compound specific isotope analysis of biomarkers failed to distinguish any samples in this group (Tertiary samples). The numbers for both the hopanes and the steranes are isotopically relatively light on the whole, which is typical for an anoxic depositional environment of deposition for the source rock

Compound specific isotope analyses (CSIA) were performed on only seven Cretaceous oils (C1-C7). The CSIA-B isotope curves show relatively consistent patterns, except for those of oil samples C1 and C2. The Cretaceous oil C1 shows the most radical differences, suggesting that it may be from an entirely different source or source facies compared to the other Cretaceous oils analyzed in this study. The Cretaceous oils investigated in this study show relatively flat n-alkane isotope curves that do not differentiate them further into distinct families.