

GEOCHEMICAL RE-EVALUATION AND CORRELATION OF NW OMAN PETROLEUM RESERVES, FOCUSING ON THE CRETACEOUS NATIH FAMILY

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The north west Oman Fahud Salt Basin and Lekhwair High contain different oil types sourced from Precambrian-Cambrian (Huqf and 'Q') to Mesozoic Jurassic ('Tuwaiq') and Cretaceous (Natih) oil Families. These oils migrated either laterally along so-called carrier beds or vertically through deep faults such as Maradi Fault Zone, Natih Fault and Fahud Fault and are accumulated, amongst others in the prolific Natih and Shu'aiba carbonate reservoirs (Grantham et al., 1990; Terken, 1999; Terken et al., 2001a; Al-Kindi and Richard, 2014). Often, the produced oils appear to be a mixture from two, three or more oil families making evaluation of their relative contributions challenging. This created a need for a detailed study using both free biomarkers and biomarkers bound to kerogen, since the reservoir rocks are often rich in indigenous organic matter. This research provided new geochemical data that helped to improve existing knowledge on the NW Oman petroleum systems and their geographical distribution.

This paper focuses on the contribution of the Natih source rock. Natih source rock samples towards the east of the Fahud Salt Basin revealed good to excellent source potential, with mainly Type II organic matter, which had reached maturities ranging from marginal to early oil window. However, Natih oils in NW Oman suggested maturities reaching mid oil window. Biomarker and molecular marker proxies presented in this study, interpreted with the aid of multivariate statistical tools to overcome the interactions between source, depositional environment and maturity parameters, allowed the differentiation of the Natih from the 'Tuwaiq' in mixed reserves. The results also indicated the existence of four distinct oil families (e.g. Figure 1) and the pure end-member oil of each family was defined.

Gas chromatography/mass spectrometry and comprehensive two-dimensional gas chromatography/time-of-flight mass spectrometry analyses reveal the presence of a novel unidentified compound (Peak-K) in the aromatic fractions of Natih oils or oils that contain Natih input, Natih source rock extracts and their corresponding kerogen pyrolysates. This Peak-K compound therefore appears to be a marker for Natih input in these samples, but raises other questions on its possible precursor and/or depositional environment that it may indicate. In addition new records of isorenieratane for photic zone euxinia were also observed in Natih related oils and source rocks, which exhibited a strong positive linear correlation to Peak-K relative abundances. This indicates a need for additional investigations on the possibility that Peak-K can serve as another depositional proxy for photic zone euxinia.

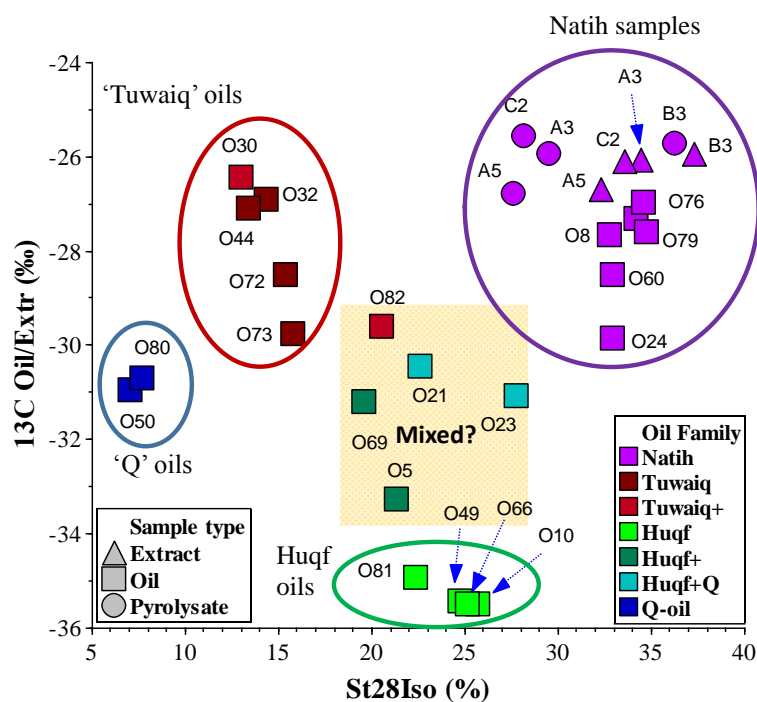


Figure 1: Plot of bulk carbon isotope values (‰) vs. C_{28} iso-steranes (‰) showing four groups of samples representing four oil families and some possible mixed oils at the centre (in the yellow shaded area).

References

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