

Shines Bright for Jurassic Exploration Targets: Study Case of Geochemistry Shale Oil Characteristic

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Abstract

An integrated understanding of the shale oil characters will be supplies a brightly light in the darkness of an exploration target. The previous study of the most reliable correlation parameters of biomarker and carbon stable isotope (Rita and Awatif, GEO 2010) proved that Najmah Shale oil Jurassic age as effective source rock. Crude oils trapped between the Najmah effective source rock and overburden rock Gotnia Formation having 95% similarity. These correlation parameters can be as effective tools to characterizing or correlating oil-source of Jurassic age within regional area of Middle East.

It believed that each period or each basin would be distinct by abundance or disappearance of certain biomarkers. Furthermore, each shale oil layer may represent the unique characteristics in biomarker abundances reflection of the chemical and physical reactions during sedimentation and preservation of organic matter through geological time. Due to the accuracy and capability to maintain their carbon skeleton like “DNA” which produced by relatively expensive analysis Gas Chromatograph Mass Spectrometry (GCMS), thus can be utilized to answer a big question in exploration of “where ” the accumulation or active pod kitchen were located. Distribution of active pod from a numerous effective oil shale layers may offer clues as delineation path that enable to reduce the uncertainty level in exploration target.

Shale oils of Jurassic age (Calloviaian to Oxfordian) that preserved within Dibdibba basin in Kuwait characterized by presence of terpanes (m/z 191) includes pentacyclic, tetracyclic, and tricyclic terpanes with variety of predominance ratios in each potential layer of shale oil. Tricyclic terpane (t23), tetracyclic terpane (T24), 28,30-Bisnorhopane, and homohopanes (C31 to C35) are among of the terpanes biomarker families that present relatively abundance in the Jurassic shale oil. The presence of these biomarkers indicates that source of organic matter possible originated from algae or marine microorganisms, which deposited in carbonate or evaporate depositional environment.

Steranes (m/217) in Jurassic shale oil appear relatively less abundant compared to terpanes. These imply the steranes nearly reach the equilibrium level or window of the disappearance. Nevertheless, the diversity of steranes spikes C27, C28, and C29 within each Jurassic shale oil layer indicates the organic matter supplied from at least three main sources.

Due to the sensitivity of sterane isomerization ratios (20S/20R) for moderate to high stage of maturities, it seems more realistic to use this valuable ratio to define the degree of maturity for Najmah shale oil in study area. The active pod kitchen in North Kuwait appears to be mature zone by having sterane isomerization ratios ranges 0.49 – 0.55. This additional evidence supports the previous study that the effective shale oils in North Kuwait as most important area to be developed.

Degrees of sterane isomerization ratios 20S/20R tend to decreasing from northern part to southern part within ranges 0.49 – 0.55 and 0.29 – 0.42 respectively. Despite having a lower range, but these indices imply that potential shale oil in South East Kuwait were reach the oil window. Maturity investigation from biomarker arise good news and brightly shines for South East Kuwait due to contained the potential shale oil to charge the surrounded reservoirs.