Source Rock Potential and Depositional Environment of Late Albian, Mouelha Member and Their Relationship to Crude Oils and Oil Seeps Tunisia

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Abstract

The Late Albian Oceanic Anoxic Event OAE1d of Mouelha member (Lower Fahdene Formation) is still poorly understood. Outcrop samples from Jebel Edjehaf, Jebel Cherich, Jebel Oust, Jebel Zebbas and Beni Ayech (SE of Jebel Ressas) locations were studied to evaluate the organic matter content, their thermal maturity, depositional environment, and to assess their hydrocarbon generation potential using Rock-Eval pyrolysis, molecular organic geochemistry, and compound-specific isotope. The studied outcrop successions consist of alternating dark black laminated limestones and marls. Data indicates that the Mouelha member has good to excellent source potential, as indicated by high TOC values up to 16 wt% and excellent petroleum potential up to 60 mg HC/g of rock, and reached the main oil window in terms of thermal maturity. The Late Albian organic matter is composed by mostly Type II mixed with minor Type III kerogen and is characterized by have unimodal n-alkanes distribution maximizing at n-C14 and n-C15, moderate to high diasterane content, moderate to high C28/C29 steranes ratios, medium C35 homohopane index, presence of Gammaceran and C30 steranes. These parameters indicate a mainly aquatic OM (algal/bacterial) with subordinate terrigenous OM deposited in marine depositional setting with a sub to anoxic, stratified water column. Crude oil and oil seeps/Source rock correlation based on biomarker data and compound-specific isotope data suggest that the Mouelha member is the best source rock candidate for many oil seeps encountered different stratigraphic levels outcropping at Jebel Zebbas (Cenomanian), near Jebel Resass (Abiod), at Jebel Cherich (top Albian), Edjehaf (Aleg, Abiod), Zrass (Serdj), Jebel Garci (Abiod, Serdj) as well as of crude oils or oil shows from the Serdj and Allam reservoirs in MAH-1, MAH-3, MAH-E1, and KSF-1 well from the Gulf of Hammamet. Future exploration should focus on locations of the Mouelha member where the organic-rich levels are well developed, and where structural traps have been recorded together with potential reservoir rocks mainly Aptian, Allam and Abiod reservoirs.