Petroleum Generation History of the Cretaceous Source Rocks in the Sirt Basin, Libya: Insight From Integrated Geochemical Assessment and Basin Modeling

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Abstract

The petroleum generation history of the early and late Cretaceous source rocks in Sirt Basin was investigated using an integrated regional geochemical study and one, two, and three-dimensional basin modeling approaches to obtain the petroleum generation history and phase expulsion from 3 petroleum source rocks in order to provide better understanding to the petroleum system that exists in the Basin. These source rocks from oldest to youngest are, (1) Mid Nubian shale, (2) Etel, and (3) Kalash formations. The thermal maturity levels of the source rocks were identified based on pyrolysis Tmax data, vitrinite reflectance (%VR_o), and 40 calibrated burial history models were used to establish 3 regional present-day maps to include kerogen transformation ratio (TR), total organic carbon (TOC_o), hydrogen index (HI_o), and maturity maps (VR_o). Biomarker and Rock-Eval data, together with stable carbon isotope ($\delta^{13}C$) have been determined in a suite of crude oils to delineate their sources of samples from more than 200 wells and 60 oil and gas fields including 16 giant fields were used to calibrate and screen the geological and geochemical conditions in order to define the sour rocks organofacies type, occurrence and distribution, depositional environment and their geochemical characteristics. Results show Mid Nubian shale, Etel, and Kalash formations are dominated by 2 different types of organofacies (C and F) originated from two different sedimentary environments (lacustrine and terrestrial). The lacustrine source rocks Mid Nubian shale and Etel were dominated by kerogen type I/II showed

good geochemical characteristics (generally TOC_o >2 wt.% and HI_o > 350). In contrast, Kalash formation show rapid lateral and vertical variation in their organic content (TOC_o).

Keywords: Mid Nubian; Etel; Kalash; Petroleum Generation; Source rock; Sirt basin