Middle Jurassic to Pleistocene Source Rocks of the Nile Delta Basin: 1D Basin Modeling and Organic Geochemistry

Bandar I. Ghassal[1], Ralf Littke[2], and Haytham El Atfy[3]

[1]Saudi Aramco, Dhahran, Saudi Arabia.
[2]Energy and Mineral Resources Group (EMR), Institute of Geology and Geochemistry of Petroleum and Coal, Aachen, Germany.
[3]Faculty of Science, Mansoura Univerity, Mansoura, Egypt.

ABSTRACT

The depositional environments and source rock potential of Jurassic to Lower Cretaceous and Middle Miocene to Pleistocene successions in onshore Nile Delta were determined in two onshore wells. The study used an integrated organic geochemistry and petrology as well as 1D basin modeling approach. The Abu Hammad-1 well, located in the southeastern Nile Delta basin, penetrated a lower Jurassic to Miocene succession, but only samples from the Middle Jurassic to Lower Cretaceous section were geochemically characterized. TOC and Rock-Eval-6 data reveal fair to good gas prone generative potential with TOC averaging 2.7% and Hydrogen index (HI) maximizing at 130 mgHC/gTOC. Organic petrology indicates low thermal maturity and further supports the low HI values by showing a dominance of vitrinite and inertinite macerals. However, molecular geochemistry indicates mixed marine and terrestrial organic matter. Low thermal maturities of the Middle Jurassic and Lower Cretaceous succession is also indicated by 1D burial and thermal model; only the Lower Jurassic attained peak oil window maturity. The Miocene to Pleistocene source rock potential was characterized in the Matariya-1 Well, located in northeastern Nile Delta Basin. It hosts a thick middle Miocene source rock with average TOC of 1.4% and maximum HI of 183 mgHC/gTOC. Organic petrology and molecular geochemistry denote mixed terrestrial and marine organic matter with a dominance of vitrinite and inertinite macerals. This indicates gas prone source rocks. The basin modeling and organic petrology elucidate onset of oil window maturity at the base of the source rock. The results of the two wells were integrated with regional data to provide an overview of source rock potential of the Nile delta basin. The Mesozoic source rocks are expected to have better qualities and higher thermal maturity levels towards the north where they are situated at greater depth. On the other hand, the Middle Miocene source rocks presumably have a better generative potential in the central and western Nile Delta basin as well as in the offshore area.