

## **Petroleum Systems of the Northern Red Sea**

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The integration of data from onshore samples, basin modelling, and oil and source rock geochemistry, has resulted in a better understanding of the petroleum systems of the Northern Red Sea (NRS), Egypt.

The primary source rock in the NRS is thought to be the pre-rift Dakhla Formation. These Maastrichtian marls and calcareous shales outcrop onshore on the western rift shoulders of the NRS. They were probably deposited as part of the southerly marine transgression of the Neo-Tethys during the mid-late Cretaceous. There is also a lesser contribution from the syn-rift source rocks of the Miocene Rudeis Formation. Onshore pre-rift samples were analysed to quantify organic carbon content, hydrogen index, and geochemical characteristics. From these results, it appears that the Maastrichtian Dakhla Formation is a rich oil-prone source rock, analogous and genetically related to the prolific late Campanian - early Maastrichtian Brown Limestone in the Gulf of Suez.

Saturate biomarkers from oil shows in offshore cuttings from NRS were used to identify the relative contributions from pre-rift and syn-rift source rocks. Oils sourced from the Dakhla/Brown Limestone are characterised by low oleanane and high C<sub>29</sub> hopane indices, and isotopically light  $\delta^{13}\text{C}$  values (depleted in <sup>13</sup>C), indicating a more carbonate-rich source rock. Meanwhile syn-rift sourced oils have higher oleanane and are isotopically heavier (enriched in <sup>13</sup>C). Offshore NRS oil shows can be typed to both syn-rift and pre-rift source rocks, indicating that the Dakhla is both present and mature in the offshore NRS. Basin modelling, incorporating findings from subsidence studies as well as revised in-house gravity and magnetics, suggests that oil generation in the Dakhla began at 20 Ma and peaked at 17-15 Ma associated with rift formation.

Finally, by comparing the geochemical characteristics of the pre-rift from the NRS to a large number of oil and source rock samples from the Gulf of Suez, a potential proximal-distal marine facies trend within the Brown Limestone/Dakhla has been identified. This allows for a better understanding of the environment of deposition of these world-class source rocks.