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Petroleum Geology and Hydrocarbon Potential of the Eastern Offshore United Arab Emirates

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ABSTRACT

The eastern offshore of the United Arab Emirates (UAE) is surrounded by the Musandam Peninsula to the north and the Gulf of Oman to the northeast and south. There are no publish work in this region. Hence, even basic geological information is far from adequate. Therefore, in this study, we aim to better understand the geological setting and hydrocarbon potential of the region. The region is affected by three major tectonic events: the emplacement of Semail Ophiolite during the Late Cretaceous, the collision between the Arabian Plate and the Iran-western Makran continental margin during the Late Oligocene to Early Miocene, and the continent-continent collision between the Arabian and Eurasian Plates during the Pliocene.

For this project, we acquired 925 line km of seismic reflection data in the eastern offshore of the UAE using a large-volume airgun source (7060 cubic inches) and 5 km long streamer. The seismic data were processed up to PSDM (Pre-Stack Depth Migration). In addition, we used three exploration wells (Fujairah-1, Fujairah-2, and FM-A1) to tie the seismic and well data. Furthermore, seismic data together with geochemical and micropaleontology data obtained from the wells were used to investigate petroleum geology and hydrocarbon potential of the study area.

From the seismic and well data, we interpreted six major sequences : (1) the Upper Cretaceous acoustic basement sequence (Semail Ophiolite / Hawasina Nappe), (2) the Paleocene sequence, (3) the Eocene to Oligocene sequence, (4) the Miocene sequence, (5) the Pliocene sequence, and (6) the Pleistocene to Holocene sequence. In addition, we recognized normal and reverse faults, horst and graben structures, drag faults, rollover anticlines, large local basins, possible strike-slip faults and flower structures throughout the seismic profiles. Furthermore, bright spots were discovered in some of the interpreted seismic sections. Moreover, the seismic velocity shows presence of anomalous low velocity areas, which correspond to overpressure zones and bright spots.

The 1D petroleum system modeling using the three exploration wells demonstrated possible oil windows, oil maturation zone, and low level of transformation ratio. In addition, we used two seismic lines for the 2D petroleum system modeling. The models demonstrated the possibility of hydrocarbon generation, migration, and accumulation in the study area.