

Mesozoic Petroleum Systems of Abu Dhabi, United Arab Emirates

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The United Arab Emirates is located on the stable Arabian foreland and is separated from the unstable Iranian fold belt by the Arabian Gulf. During the Late Paleozoic to the Cenozoic Eras the vast Arabian platform lay along the southern margin of the Tethys Ocean. From the Late Permian to the Late Tertiary mainly epeiric shelf carbonates associated with only minor clastics and evaporites were deposited. Sedimentation patterns were controlled by many factors such as epeirogenic vertical movements due to basement tectonism, deep seated salt growth, climatic variations, and, most importantly, sea-level variations.

Abundant giant oil and gas reservoirs have been found in Jurassic (Araej and Arab formations), Cretaceous (Thamama Group: Habshan, Lekhwair, Kharaib, Shuaiba, Mishrif, and Simsim formations), and the Tertiary (Asmari and Gachsaran formations) carbonates. Gas was discovered in the Pre-Permian sandstones and in Upper Permian carbonates in offshore Abu Dhabi. All hydrocarbon accumulations are related to structural traps, although combined stratigraphic-structural or stratigraphic traps exist in some areas. In western Abu Dhabi, most of the oil and gas are in Jurassic reservoirs, whereas in the central areas most of the oil is in Lower Cretaceous reservoirs. In the eastern offshore areas (Abu Dhabi and Dubai) oil and gas reservoirs are of Pre-Permian, Permian, and Middle Cretaceous age. In western Abu Dhabi, structural traps started developing in the Upper Jurassic, getting progressively younger towards the east. The main tectonic event that shaped most of the onshore structures occurred at the end of the Middle Cretaceous.

The Silurian Qasaiba Formation is the main source rock for the pre-Permian and Permian gas reservoirs. The Upper Jurassic Diyab/Hanifa Formation and the Middle Cretaceous Shilaif/Khatiyah Formation are the main source rocks for the giant Jurassic and Cretaceous carbonate reservoirs, respectively. Other potential source rocks are also identified within the Lekhwair and the Shuaiba (Bab Member) formations. The Tithonian Hith anhydrite and the Albian Nahr Umr shale are the two principal sealing formations for the oil and gas accumulations in the Jurassic and Cretaceous reservoirs. However, secondary seals and barriers also exist throughout the stratigraphic sequence.