

Hydrocarbon Potential of the Silurian Qusaiba Shales of Saudi Arabia in a Regional Context of the Paleozoic Shales in the Arabian Platform

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Abstract

The Silurian organic rich shales are widespread in the Arabian and north African Plate. In Saudi Arabia, these organic rich shales are named Qusaiba Formation, whereas in other parts of the Arabian Peninsula, the age- and lithology-equivalent formations are named Akkas Fm. in Iraq, Mudawarra Fm. in Jordan, Tanf Fm. in Syria and Dadas Fm. in Turkey. The Qusaiba “hot shale” unit making up the lower part of the Qusaiba Formation of the Qalibah Group was deposited within intra-shelf anoxic depressions during early Silurian (Rhuddanian to Telychian) in response to major transgression following deglaciation. Within the Qusaiba Fm., the “hot shale” unit is overlain by less organic rich but quite thick (>100s ft) “warm shale” unit. The Qusaiba shales are marginally mature to overmature with respect to oil and gas generation in the Saudi Arabia. The hot shales contain dominantly amorphous organic matter (Type II) and are known, based on oil-source rock correlations, to have sourced oil and gas reservoirs in the Paleozoic petroleum system in Saudi Arabia. With respect to unconventional oil and gas resource potential, the Qusaiba shales are promising and some exploration activities have started in the Kingdom. The burial and thermal history modeling of the Qusaiba shales conducted for testing different geological scenarios for estimating present-day gas potentials of these shales suggests that the Qusaiba shales’ “gas potential” are high in both the northwest and the east-central Arabian Basin. Moreover, Qusaiba hot shales present good “oil shale” resource potential in the Tayma depression in the northwestern Saudi Arabia, where immature Qusaiba hot shales containing up to 20 wt % TOC exist at shallow depths (<300 ft). The potential of this organic-rich resource will be presented from the standpoint of “conventional source rock”, “unconventional shale oil and shale gas reservoirs”, and “oil shale reservoir”.