

Callovian-aged debris flow stratigraphic play in northeastern Saudi Arabia

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ABSTRACT

Based on new results from recently drilled wells, the Callovian-aged Upper Hadriya Formation has the capacity to naturally flow oil in some areas where it was initially interpreted as a source rock interval. By analyzing seismic data, cores and well logs, this reservoir has been interpreted as a laminated debris flow. The reservoir interval is surrounded by the basinal source rock of the Tuwaiq Mountain Formation, which acts as an excellent seal for the stratigraphic trap. Shallow-water shell fragments observed in the cores taken from these wells support this debris-flow play concept. The thinly laminated reservoir is similar to the proven hydrocarbon system in the large Poza Rica Field in Mexico.

No coring or testing is generally conducted in the Tuwaiq Mountain Formation in basinal areas where the targeted Hadriya reservoir interval is expected to be a source rock facies. High mud gas shows and anomalous resistivity log profiles have been observed in some wells, which indicate an oil accumulation in the zone of interest. Conventional core acquired in selected wells show that the potential reservoir interval is composed of centimeter-scale laminae and cased-hole testing has demonstrated the ability of the reservoir to flow naturally. Sub-regional mapping with seismic attributes has helped to identify the paleo-depositional environment of the region. Future prospecting challenges for this reservoir concept are hampered by the relatively subtle seismic signature. In addition, definition of petrophysical cut-offs for net reservoir and porosity calculations are problematic. Should this concept prove to be successful, it will lead to a new and unrecognized exploration play in the Kingdom.