AAPG Datapages/Search and Discovery Article #90319 ©2018 GEO 2018 13th Middle East Geosciences Conference and Exhibition, Manama, Bahrain, March 5-8, 2018

Petrophysical Characterization of an Interpreted Transition Zone in the Wasia Formation, Rub' Al-Khali Basin, Saudi Arabia

Naser Gomaa[1], Christopher T. Reid[1], Abdulatif Enezi[1], and David Taylor[1]

[1]Saudi Aramco, Dhahran, Eastern, Saudi Arabia.

ABSTRACT

Recent exploration efforts in the Rub' al-Khali Basin have uncovered a unique and complex new reservoir – situated in the Safaniya Member of the Wasi Formation. The multidisciplined interpretation of advanced mud logs, conventional wireline logs, conventional core analysis, detailed sedimentological analysis, mercury injection capillary pressure (MICP) and nuclear magnetic resonance (NMR) measurements demonstrate the entire reservoir section is most likely within a transition zone. Detailed analysis of these datasets has yielded insight into the petrophysical characterization and nature of the unique pore network. Elevated mud-gas and shows were experienced while drilling this Wasia reservoir section, and the initial petrophysical analysis suggested a high water saturation - even in the high total mud-gas section at the top of reservoir. Additionally, the initial application of a T2 (NMR) cutoff of 220 ms resulted in a high bound water saturation evaluation. A fluid sampling survey initiated across the entire reservoir successfully collected downhole oil samples with a systematic decrease in the recovered oil/water ratio with depth. Three drillstem tests (DSTs), subsequently performed over the reservoir, confirmed the fluid sampling oil/water ratios. A further evaluation program was initiated to explain the presence of mobile oil and water on tests. Core NMR, MICP, pore throat distributions and sedimentological analysis showed the reservoir to be a mesoporous, micropeloidal packstone-wackestone carbonate with mono-modal pore size. NMR analysis on sidewall core plugs proved very crucial for NMR T2 log calibration where new calibrated NMR T2 cutoff indicated that initial water saturation (Sw) calculations were a function of the mesoporous nature of the rock. Consequently, the high percentage of bound water dominated the Sw calculation. The interpreted volume of bound water, based on calibrated T2 cutoff, matched the well test oil/water ratios. Free water observed at the top of the reservoir and systematic increase with depth, confirmed the entire reservoir is likely in a transition zone. Application of the calibrated NMR has also been used to support an appropriate water saturation cutoff. This petrophysical workflow has provided valuable insights into the water saturation profile and pore types. In addition, this workflow provides a method to characterize the transition zone in wells with similar reservoir fabric and log signature in the Rub' al-Khali.