

Bitumen and Its Impact on Carbonate Source Rock Exploration in the Middle East

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Abstract

Last few years have seen an increase in unconventional exploration activity in Middle Eastern source rock carbonates. As organic matter in these source rocks matures, first bitumen and then oil and gas is produced and stored in pore spaces within the source rock; before expulsion. Bitumen quantity can be particularly high in low mature oil rich source rocks due to lower conversion of organic matter and low rate of migration. Hence quantifying different proportions of bitumen, oil and gas is essential to understanding (a) reservoir quality (b) net oil and, (c) free oil in place.

Conventional logs do not differentiate bitumen from liquid hydrocarbon. NMR (log and stationary measurements) has been the preferred technology in the logging domain to quantify bitumen and free oil in place. In the unconventional core analysis world, a combination of core NMR, retort and extraction based techniques have been used to quantify bitumen and calibrate logging parameters. Recent advances in these measurements along with results and techniques used will be presented on data acquired in regional source rock carbonates.

Jarvie et al. (2012) introduced an index called the oil saturation index (OSI) based on core measured RockEval data to identify good reservoir quality zones in a source rock oil play. Kausik et al. (2015) expanded the concept to the log domain and introduced the reservoir producibility index (RPI) to identify these high reservoir quality intervals under in-situ conditions. These indices rely on a combination of NMR and a new generation spectroscopy measurement that can directly measure the total carbon (including carbon from oil and bitumen) downhole. In this talk we will present results from all the above techniques applied on regional data with estimates of total oil, free oil and producibility. Recommendations on the standard log and core data acquisition that should typically accompany these bituminous environments are also presented as findings from the study.