Hydrocarbon Potential Evaluation of the Organic Rich Najmah Formation (NJ) in West Kuwait Fields (WK) - A Case Study

Rasha R. Al-Murakhi[1], Prasanta K. Mishra[1], Riyad Quttaina[1], Charles Smart[2], and Fernandes Warren G[2]

[1]Kuwait Oil Company , Kuwait, Kuwait.
[2]Baker Hughes, Kuwait, Kuwait.

ABSTRACT

Study has investigated the unconventional shale oil potential within the NJ formation of WK. The unconventional potential has been characterized & ranked across a study area encompassing the Dharif,Abduliyah, Minagish & Umm Gudair Fields.A multi-disciplinary approach was utilized integrating analyses derived from core,petrophysical data,image log & geomechanical analysis.The NJ Formation has a consistent stratigraphy across the study area within organic-rich argillaceous wackestones and mudstones of NJ Unit III form the primary target.Limestones cover NJ Unit III.NJ Unit III is generally high in TOC,whose original form is dominated by pore filling pyrobitumen. RockEval data & vitrinite reflectance confirm the expected overall increase in present day thermal maturity with depth within the NJ, but variation within individual fields is also notable.The NJ Formations are in the oil generation window across thestudy area. A ranking and 2D composite risk mapping exercise of the target NJ Unit III has determined the most prospective areas for further appraisal &exploitation.Lateral porosity increases are offset by additional trends in depth,thickness & TOC requiring an understanding of all parameters.In a vertical sense,a stratigraphic ‘sweet-spot is noted in the upper half of the NJ IIIC & overlying IIIB with uniformly high TOC & porosity.Geomechanical analysis sought understanding on rock stress across NJ. High stress contrasts between target,organic rich UnitIII & the bounding organic poor limestones provide very good stress barriers for hydraulic fracture containment in certain fields.Strong stress barriers will reduce the risk of out of zone propagation of hydraulic fractures and increases the treatment efficiency required to generate a stimulated reservoir volume.Notably it is the organic unit that remains the target Formation,not any juxtaposed organic poor horizons. Depletion effects related to existing production were also investigated & found to severely reduce the stress barriers in those fields because of poroelastic effects.Pore pressure is a development risk and should be confirmed via testing.Certain natural fractures in the NJ are critically stressed under current reservoir pressure will become conductive following stimulation caused by hydraulic treatment.Relative comparison of wells and fields performed based on weighted contribution of several geomechanical parameters that have direct impact on hydraulic fracture ,complexity &fluid flow