

The Significance of Petrographical and Geochemical Analysis in Understanding the Unconventional Potential of Najmah Formation in the West Kuwait Fields

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ABSTRACT

The objective of the study is a preliminary evaluation of the unconventional potential of the Najmah Formation that has a consistent stratigraphy in Umm Gudair, Minagish and Dharif fields of West Kuwait. This Formation is divided into three main sub-units based on lithological variations: Upper, Middle and Lower. The Upper unit is divided into Upper Najmah shale (I), Upper Najmah Limestone (II), Middle Najmah kerogen (III), which is further subdivided into IIIA, IIIB, IIIC and Lower Najmah Limestone (IV). Najmah Formation is an organic rich bituminous source rock. It is composed of argillaceous wackestones and mudstones with a thickness that ranges from 63 to 90 m. The Upper Najmah shale unit is composed of mudstones with high TOC values that reaches as high as 4.82 % wt. The Upper Najmah Limestone unit is composed of packstone to grainstone. TOC values are relatively high with a maximum value of 7.1 % wt in West Minagish Field and a minimum TOC value of 0.16% wt in Dharif Field. Relatively higher organic content is observed in the mudstone to packstone and grainstone lithology of Middle Najmah Kerogen with a maximum value of 18.5 % wt in West Minagish Field. Lower Najmah Limestone unit is composed of mudstone, wackestones to packstone. The TOC values are also varies where the highest values (10.43 % wt) are in Dharif Field. The high gamma readings layers of unit I and III are organic rich zones and have thickness of 15 feet and 180 feet respectively in the studied wells. The unconventional potential has been characterised, quantified and ranked across the study area encompassing the Dharif, Minagish and Umm Gudair fields. A multi-disciplinary approach was utilized to characterise, quantify and rank the unconventional succession. In a vertical sense, a stratigraphic 'sweet-spot' is noted in the upper half of the Najmah IIIC and overlying IIIB with uniformly high TOC and porosity. The self-sourcing kerogen rich interval of unit III along with the associated non-kerogen rich intervals (unit II and IV), are considered to have good unconventional potential.