Unlocking Miqrat Potential with New Integrated Evaluation

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Abstract

The Miqrat Formation is a complex low permeability sandstone reservoir in Block 61 in the northern part of Oman. The reservoir quality of this Cambrian aged reservoir is controlled by series of geological and diagenesis processes and subsequent emplacement/displacement of gas and condensate. Therefore, the development of Miqrat reservoir is challenging. This study builds a robust integrated (static to dynamic) workflow aiming to generate a comprehensive development plan.

Miqrat Formation which is situated 5000m below ground surface was deposited in a semi-arid alluvial plain environment. The variable geological environment along with long history of diagenesis and structural alterations pose high challenges in understanding the reservoir deliverability. Due to limited dynamic data, lateral reservoir continuity, bitumen plugging, porosity type (vuggy vs matrix) and anhydrate cement add a lot of uncertainty and risk in developing Miqrat reservoir.

At the beginning, Data gap analysis was run followed by data collection and comprehensive understanding of the reservoir is updated. Reservoir deliverability is believed to be mainly related to diagenesis and heterogeneity. A very detailed special core analysis programme was accomplished including but not limited Nuclear Magnetic Resonance (NMR), and thin section petrology to identify the complex diagenetic and sedimentological controls on reservoir sand. Porosity has been optimized for the value of the matrix density and fluid density considering different drilling fluid muds above and below seven percent porosity.

The integration with dynamic data which is mainly related to short and extend well test, pressure transient analysis and analogues used to refine/calibrate the static description. Effective permeability has been identified as one of the key challenging petrophysical parameters and main cause of static to dynamic mismatches. In this study, the proposed model for permeability with the integration of the dynamic data such as IP30(Initial Potential for the first 30 days of production) and EWT(Extended well test) helps to predict the Miqrat reservoir performance with the given irregularities of the geological depositions and associated facies.

A sector model has been created as a platform for the integration of static and dynamic data as well as to predict the future performance of the wells. Additionally, it has been used to run sensitivity analysis on wells performance related to well types, frac sizes and well spacing. Based on this comprehensive evaluation for both static and dynamic data and the understanding of the existing uncertainties, detailed field development plan for Miqrat reservoir is taking place and to be implemented soon.

This paper determines an integrated (static to dynamic) multi-scale workflow that essentially reduce the risk of drilling poorly performing wells and selected further locations for additional EWT to continue reducing uncertainties.