Petrophysical Evaluation and Surveillance Models Used for Carbonate Tight Relatively Heavy Oil Reservoir to Improve Wells Productivity

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Abstract

Occidental develops a tight, relatively heavy oil, carbonate reservoir in south Oman. The company continues developing and appraising the reservoir and up to date 80+ penetrations have been drilled with a large amount of petrophysical data acquired. This reservoir is divided into three zones: Upper, Middle and Lower, with the main development interval being in the Upper zone. It has an average porosity of 8%, average permeability of 4 mD and oil saturation of approximately 80%. Initial reservoir pressure was around 3900 psi, and the initial temperature was 160°F. Oil gravity ranges from 16^{o} to 25^{o} API and generally decreases with depth. Improving well productivity and extending project economic life in a tight and heavy oil reservoir is the main objective in development of the field. As with any horizontally developed field, well placement in the best reservoir is essential for maximum well productivity. Therefore, a specialized petrophysics team was formed to build petrophysical models and methodologies for the reservoir based on data analyzed from the field. The evaluation and models were completed considering the geological, petrophysical, and production engineering data of the reservoir. This paper will discuss in detail the development of rock typing, water risk flags, and geo-mechanical models. Open hole well logs and core data were utilized and studied to build these models, enabling identification of best reservoir facies for horizontal well placement, whist minimizing the risk of water production. Additionally, the results of the analysis were used as inputs to improve stimulation programs and increase overall well productivity. A clear correlation was observed from both production of the wells and petrophysical modeling work. Consequently, it has been observed that the application of these petrophysical models solves issues with low performing wells. It is recommended to continue acquiring advanced open hole logs, production logs and core data to further improve the models, increasing the success of undeveloped patterns in the field and accelerating the expansion and development of the reservoir.