Overview on the Different Development Techniques in the Tight Ordovician Sandstones of Bir Ben Tartar Field: Vertical vs Horizontal Wells and Mono or Multi-Frack Stages

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Abstract

Since the discovery of the Bir Ben Tartar oil field in 2008, multiple development scenarios have been discussed and implemented for production optimization. The petrophysical assessment of the Lower Jeffara and Upper Bir Ben Tartar pay zones was very challenging due to the mineralogical complexity and the presence of heavy minerals within the reservoir which has led to an erroneous evaluation of the reservoir potential for many years. Low poro-perm and heavy minerals were the reason for intervals within old exploration wells frequently being described as '*Unproduceable Oil*'. Even when oil was tested from the Ordovician reservoir in TT-1, the first exploration well drilled in 1959 by SEREPT on the Bir Ben Tartar structure, the decision was to abandon the well because of no potential. To the middle of 2008, all exploration efforts came to the same conclusion but in late 2008 the TT-2 well was drilled, and the reservoir was hydraulically stimulated, and the result very encouraging. The introduction of hydraulic stimulation and in later years horizontal drilling techniques have paved the way to the economic production of this tight reservoir. After almost 14 years of development and more than 20 wells drilled, optimum development scenarios are still being considered for producing the tight sandstones in the BBT field. Both vertical and horizontal wells have been drilled and results are varied in terms of cumulative production (0.04 - 1.2 MMbbls for the vertical wells and 0.08 - 0.6 MMbbls for horizontal wells). The wide variation in the cumulative production seems to be directly related to the type of well and reservoir quality at each selected location. The BBT field has a high degree of reservoir fairway complexity and therefore the development plan needs to take in consideration the predicted reservoir characteristics at each location. Vertical wells should be limited to the zones where there is high confidence of good reservoirs development and quality, while the horizontal wells need to be drilled in the zones of moderate confidence to increase the contact between the wellbore and the reservoir. Hydraulic stimulation is the key driver of oil production in BBT, and the use of this technology is mandatory for these tight sandstones. Currently, it is allowed to perform a unique hydraulic stimulation per well with limited pumped volume. One hydraulic stimulation per well is potentially enough in case of the vertical well drilled in the right sweet spot, but for horizontal wells a multi-stage stimulation is required and will significantly enhance the economics of the well. This work aims to provide a clear understanding of development techniques selection and its efficiency with reference to field cases based on input from the subsurface, drilling technology, production, and hydraulic stimulation.