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An Integrated Approach to Well Completions in the Montney Formation, N.E British Columbia

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Introduction

The Montney Formation in British Columbia, Canada is a world-class unconventional siltstone reservoir. It covers more than 2600 square kilometers (O.G.C. 2012) and has been mapped in excess of 300 meters thick with gas-in-place values in excess of 200Bcf per square kilometer.

Initially, Oil and Gas commentators were citing the Montney as a large unconventional shale deposit, which could be drilled just about anywhere in the trend and yield equally economic results. As development progressed and new drilling results were integrated, it became apparent that the Montney formation was not ubiquitously the same. In fact, even the assumption of shale lithology turned out to be incorrect: the Montney is predominantly a siltstone, very unlike unconventional shale deposits. (Nieto et al 2009). Analysis and mapping of petrophysical properties began to indicate that there were depositional fairways with better rock properties in the Montney. These fairways were thicker and had higher net pay than surrounding areas. The addition of 3D seismic data with coherency maps and inversion volumes added another layer of complexity, indicating heterogeneity throughout the Montney fairway. This heterogeneity can sometimes be seen along a horizontal wellbore, which is the business driver for our technique.

Method

This work demonstrates a multidisciplinary approach to completing Montney horizontal wells using geological correlation, petrophysics and porosity mapping, coupled with 3D seismic inversion work to identify porosity, Young's modulus and Poisson's ratio trends along each horizontal wellbore. Key in this process was the cutting of a 254m core through the Montney interval in our "Main Fault Block" (MFB) which has formed the basis for lithology and petrophysical property calibration. In addition, pump-down neutron porosity logs add resolution to supplement the 3D seismic picture and have been used to identify both lithological and mechanical property variances along the wellbores. These wellbore scale variances have been cross-referenced with detailed seismic coherency work to better characterize drilling targets and completion intervals.

The completion strategy which results from this integrated work is a departure from the norm, in that the improved characterization of the wellbore permits selection of specific intervals for placement of both plugs and perforations, rather than the industry standard 'geometric' approach.

Examples

Examples of this strategy are discussed in the talk, showing how, in an experimental well cutting across two distinct layers, changes in rock properties resulted in distinctly different responses on the respective frac treatment charts. Based on the subsurface characterization of the well bore, these different rock types can be expected to produce at different rates. This hypothesis was confirmed using chemical tracers monitored during flowback, which are shown in the talk. This has led to a better understanding of horizontal well placement and where lower porosity calcite stringers are occasionally intersected by the wellbore, the strategy is to place plugs in them, rather than perforations.

Conclusions

This method of placing fracs has improved our ability to get fracks 'away' and produces a better, more complex, fracture in the porous intervals of the Horizontal wells.

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