



Linking Rock Physics Modeling and Time-lapse Seismic Inversion in the Montney Formation

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Summary

Unconventional, ultra-low permeability ('tight') reservoirs play an important role in today's energy market. These reservoirs normally require multi-fractured horizontal wells to achieve commercial production rates. The Montney Formation contains some of the most prolific tight reservoirs in the Western Canadian Sedimentary Basin. However, significant variability in reservoir quality and in-situ fluids exist, requiring detailed reservoir characterization studies to improve development planning. With the goal of improving reservoir characterization methods in the Montney, we present results from an ongoing study which integrates rock physics and seismic properties. The primary objectives of this study are to 1) compare different rock physics models for the low-permeability reservoirs in the Montney Formation, 2) develop and analyze a quantitative relationship between rock physics and PP and PS time-lapse seismic results and 3) determine the uncertainty associated with different lithofacies in the studied Montney reservoir.

Rock physics provides geoscientists with a quantitative bridge between seismic analysis, well data analysis, and engineering results. In this study, rock physics modeling results are linked to PP and PS time-lapse seismic inversion, the later of which having been previously performed in low-permeability siltstone reservoirs in the southern portion of the Pouce Coupe pool in Alberta by Riazi and Clarkson (2017). The experimental outcomes by Riazi et al. (2017) for Montney core plug samples were also used in the rock physics modeling to derive velocities and pressure relationships in the Montney Formation. Each reservoir lithofacies in this section of the Pouce Coupe pool is modeled using specific petro-elastic models (PEMs), and then the predicted changes in elastic properties are compared with time-lapse PP-PS inversion results. The uncertainty associated with each lithofacies prediction in the Montney Formation from the seismic data is quantified by using Monte-Carlo simulations and the Bayesian classification of these results provided.

The results of this study will be useful to geoscientists working in tight Montney reservoirs by providing a better understanding of the variation in elastic properties found in the Montney.

References

Riazi, N., and Clarkson, C.R., 2017. The Use of Time-Lapse Seismic Attributes for Characterizing Hydraulic Fractures in a Tight Siltstone Reservoir. Paper URTeC 2670158 presented at the Unconventional Resources Technology Conference (URTeC) held in Austin, Texas, 24-26 July.

Riazi, N., Clarkson, C.R., Ghanizadeh, A., Vahedian, A., Aquino, S., and Wood, J.M., 2017. Determination of Elastic Properties of Tight Rocks from Ultrasonic Measurements: Examples from the Montney Formation (Alberta, Canada). *Fuel*, v. 196, p. 442–457.