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Trial for a hydraulic fracturing design optimisation by integration of fiber optic sensors and cutting samples analyses: the Montney Formation

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Summary

Under the severe gas price environment, North American tight gas operators are focusing on operation cost savings and reduction of capital expenses. Since well completion cost is one the major expenses in tight gas development and the design of hydraulic fracturing (number of clusters, amount of proppant, injection rate, etc.) strongly affects the gas productivity of producing wells, hydraulic fracturing design optimization is a key factor for optimizing project economics.

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When considering hydraulic fracturing design optimization, we should take into account the geological heterogeneity in the area because the gas productivity should in part be controlled by geological properties. Furthermore, we cannot directly evaluate the influences of the hydraulic fracturing design on gas productivity without removing geological heterogeneities.

The objectives of this study are to evaluate reservoir heterogeneity along a horizontal well by integrating rock properties from cutting samples with wireline logs and mud gas data. We have performed several analyses on cutting samples, which were acquired from a 3,000 m horizontal section of a well drilled in the Montney Formation, and have investigated rock mineralogy, grain density and pore size distribution using QEMSCAN, NMR, MICP and He-porosimetry. Results suggest that the geological properties measured from cutting samples are generally aligned with wireline log data and mud gas data.

Fiber optic sensors (DAS) were also installed in a studied well and are monitoring the heterogeneity of gas productivity along the horizontal section. We are also trying to compare the investigated geological heterogeneity and DAS-monitored gas productivity. Correlations between these data sets are thus far not apparent due to production interference by the nearby wells; however, we would like to introduce an integrated monitoring workflow to accurately evaluate the effect of hydraulic fracturing on gas productivity, particularly in situations where detailed geologic data is not available.

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