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Pressure Mapping of the Kiskatinaw Seismic Monitoring and Mitigation Area, Northeastern British Columbia

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Summary

Induced seismicity attributed to hydraulic fracturing of Montney horizontals is a significant concern in the Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) of NEBC. Maps of pore pressure and their depth gradients of the Upper, upper Middle, lower Middle and Lower Montney in a study area ranging from Dawson Creek to Ft St John as part of a larger study of the geomechanical factors contributing to induced seismicity.

These maps display significant pressure compartmentalization most likely the result of recurring movements along normal and strike-slip faults resulting from the rise and collapse of the Peace River Arch and transpression during the Columbia and Laramide Orogenies.

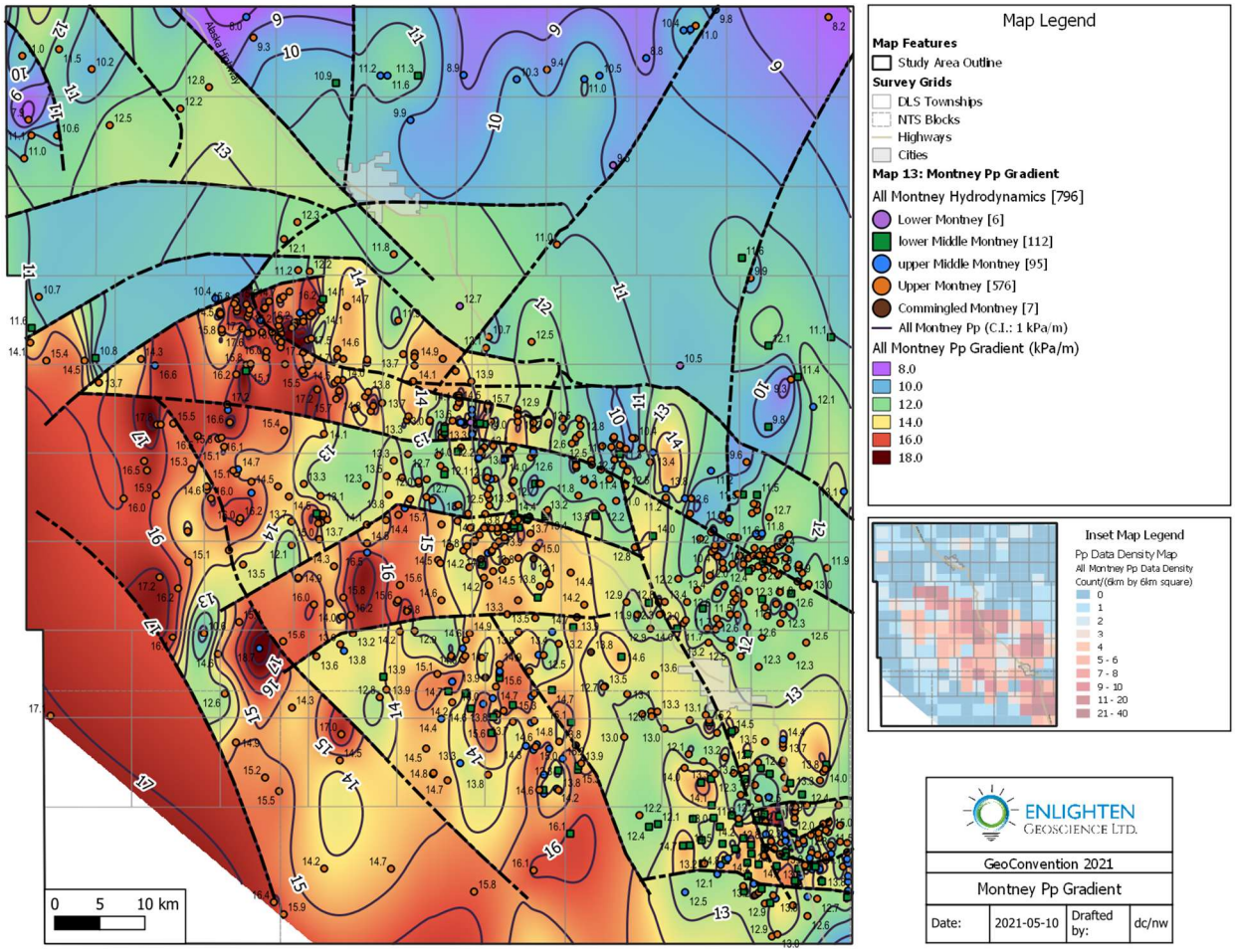
Theory / Method / Workflow

A database of all available pressures from the Triassic to the base of the Debolt was compiled. This database included a custom review of every DFIT (minifrac) within the study area. This data was correlated to the stratigraphic model and screened through a detailed quality control process to eliminate low quality tests, tests displaying likely production induced drawdown and other deficiencies. Data was iteratively reviewed in various formats including pressure vs elevation plots and pressure vs depth ratio maps until a robust dataset representing the original pressure setting was developed.

This dataset was used to develop pressure vs depth machine gridded and contoured maps for the entire Montney and each of the key stratigraphic intervals. Maps and grids of the true vertical depth (TVD) to each of the stratigraphic horizons were developed to allow the convolution of the pressure gradient and TVD grids to create pressure maps for each interval. The TVD grids were amended relative to a third order trend surface to compensate for discrete and significant topographic variations within the AOI.

Results, Observations, Conclusions

The KSMMA has been subjected to significant pressure compartmentalization resulting from enhanced localized permeability along discrete fracture trends and faults. The boundaries of these pressure compartments display a very strong alignment with seismic events understood to have been the result of hydraulic fracturing.



Novel/Additive Information

The pressure regime in a Deep Basin setting is generally considered to be primarily controlled by the thermal maturity of the source rocks. In addition to providing an important input to the investigation of induced seismicity, the high data density and well understood structural and stratigraphic relationships in this study allowed for the determination of significant pressure compartmentalization. The initial pressure system has been altered through compartmentalization by leakage along conductive fracture and fault trends.

Additional Information

A complete report documenting the KSMMA study is available via the website of the B.C. Oil and Gas Research and Innovation Society: http://www.bcogris.ca/projects/complete.

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