# Factors Affecting the Permeability of Shales in the Western Canadian Sedimentary Basin

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## Summary

The matrix permeability of major shales in the Western Canadian Sedimentary Basin (WCSB) were investigated in order assess their gas shale potential. Potential gas shales in the WCSB range from comparable shallow and soft water sensitive shales in the east to relative deep, brittle and silica rich shales in the deeper parts of the basin to the west. We have measured the permeability and stress sensitivity of the permeability using the transient pulse decay method in an attempt to resolve the correlation between mineralogy and fabric of permeability and permeability anisotropy.

Permeability of all shales declines exponential with increasing effective stress however the amount of which (stress-sensitivity) depends on mineralogy and fabric. In clay rich shales the permeability (K) decreases from 6.06E-01 md to 1.1.7E-04 md as the effective pressure increases from 3.45 MPa to 20.65 MPa and in quartz-rich shales k decreases from 1.90E+00md to 1.20E-04md with the effective pressure increasing from 6.89 MPa to 44.83 MPa. Clay mineralogy, notably illite and kaolinite play an important role in determining permeability and which in turn is dependent on the porosity, fabric and mechanical properties of the strata. Clay-rich shales show a decrease in permeability with increase in quartz content and decrease of illite and kaolinite content. Biogenic quartz-rich shales have a comparatively low permeability and permeability decreases with increase in biogenic quartz content and decrease of illite and kaolinite content. Increasing carbonate content in clay rich shales is positively correlated with permeability whereas there is no trend in permeability with increasing carbonate content in quartz rich shales.

All shales have at least two to three orders of magnitude low permeability perpendicular to bedding as compared to parallel to bedding. Overall permeability anisotropy is more marked for clay rich shales.