

# Mineralogy of Duvernay, Muskwa, and Montney Formations for Shale Gas Resource Evaluation

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## Summary

Over the past three to four years we have collected over 1100 core and outcrop samples from a number of shale strata including Duvernay, Muskwa, Montney, Exshaw, Banff and Colorado formations. Our purpose is to determine shale gas resources in all prospective gas shales in Alberta. Our talk will centre on two areas: 1) a brief summary of data that is available for download on the project and new data that will be released, and 2) mineralogy of the Duvernay, Muskwa, Colorado and Montney formations.

In most cases, our mineralogy results indicate that these shales are more complex than many original assumptions with a high percentage of heavy minerals including a variety of metals present in shale. The high heavy mineral content calculated using XRD mineralogy (Table 1) results in a grain density that is often much higher than is previously determined using helium pycnometry. Furthermore, the most dominant clay-sized mineral is often quartz or calcite rather than clay minerals (Tables 2). Both scanning electron microscope imaging and thin section analysis support the XRD mineralogy tests and results.

### Average XRD Mineralogy for 11 Montney Formation Samples

Minerals and their wt% ranges present in all 11 samples		Average wt% of all minerals present in the samples	
Quartz	20.7 – 44.7	Quartz	36.0
Muscovite	3.2 – 31.4	Muscovite	14.7
Dolomite	4.5 – 26.0	Dolomite	13.1
Orthoclase	0.0 – 22.2	Orthoclase	11.6
Albite	2.6 – 10.6	Albite	7.1
Pyrite	0.2 – 8.9	Pyrite	3.8
Fluorapatite	0.4 – 7.5	Biotite	2.2
Biotite	0.0 – 4.3	Fluorapatite	1.5
Illite	0.6 – 4.1	Illite	1.4
		Calcite	1.4
		Ankerite	3.5
		Brookite	0.7
		Kaolinite	0.9
		Total	97.9

Table 1. Summary of semi-quantitative mineralogy of the Montney formation using 11 samples. Analysis performed by SGS Lakefield Research Ltd.

Average clay-sized mineral content for 11 Montney Formation samples		
Major (> 30 wt. %)	Moderate (10-30 wt. %)	Minor (< 10 wt. %)
Quartz	Dolomite	Illite, feldspar, pyrite

Table 2. Summary of qualitative clay mineralogy of the Montney formation using 11 samples. Analysis performed by SGS Lakefield Research Ltd.

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