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Sedimentological Heterogeneity and its Geomechanical Implications: Case Study from the Montney Formation

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Sedimentological fabric directly influences geomechanical properties and likely plays an important role impacting how hydraulic fractures develop within unconventional reservoirs. In this study, we investigate representative samples from seven different stratigraphic intervals of the Montney Formation within the 06-03-079-13W6 core (Figure 1) to compare hardness data to lithologic facies and sedimentological heterogeneity. Cored intervals were assigned a sedimentological heterogeneity ranking of low, moderate, or high based on variability in the observed rock fabric (grain size, mineralogy, sedimentary structures, bioturbation, etc.). An Equotip Piccolo Bambino handheld microhardness tool with a 3 mm diameter impact area was used to collect hardness measurements along the slabbed cored face about every 5 cm. Results are shown in Table 1 and suggest that intervals with high sedimentological heterogeneity (more complex rock fabric) have more variance in hardness data (standard deviation >37, whereas intervals with moderate to low sedimentological heterogeneity (homogeneous rock fabric) exhibit a smaller range of hardness data (standard deviation < 32). Mineralogical composition influences hardness with carbonate-cemented coarse silt beds and bioclastic intervals showcasing higher hardness values, whereas fine grained silt beds, bituminous-rich layers, and clay beds exhibit lower hardness values. Although these trends are not unexpected, this study aims to quantify the variability in hardness on the centimeter-scale to highlight lithologic heterogeneity typically overlooked when evaluating and upscaling geomechanical trends throughout the Montney Formation.

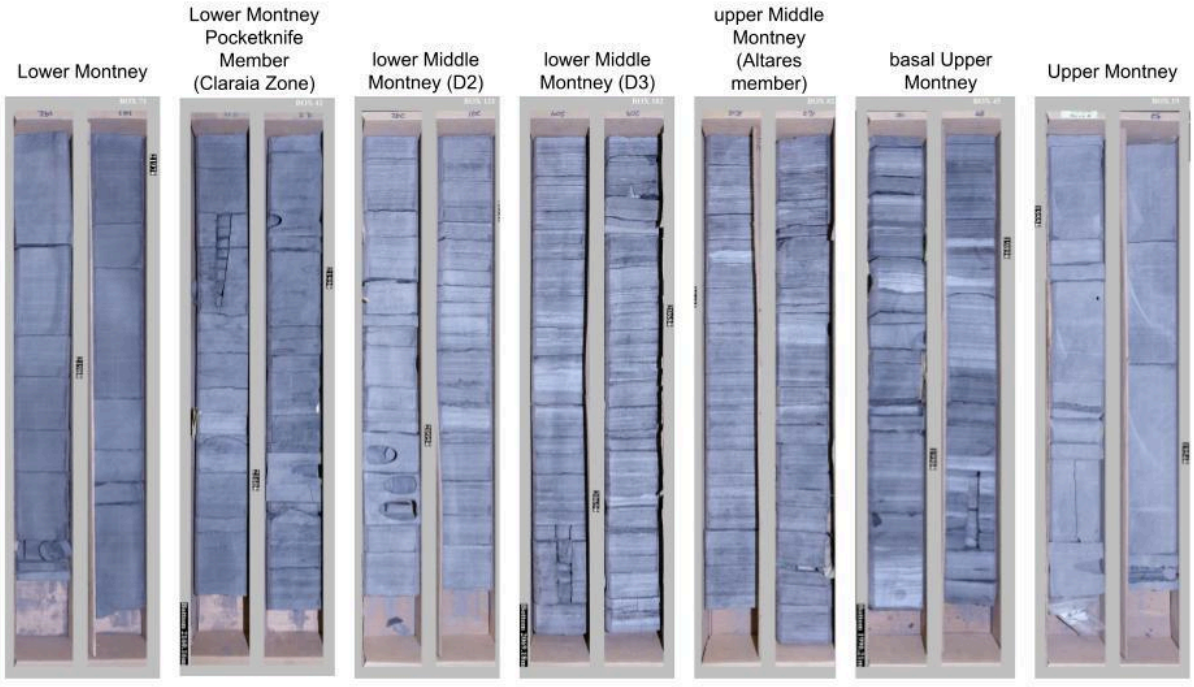


Figure 1. Core boxes used for hardness characterization of different stratigraphic intervals from the Montney Formation in the 06-03-079-13W6.

Stratigraphy	Sedimentological Heterogeneity	Minimum Hardness (HLD)	Maximum Hardness (HLD)	Average Hardness (HLD)	Standard Deviation
Upper Montney	low	729	788	758	14.3
basal Upper Montney	high	629	798	750	37.5
upper Middle Montney (Altares member)	high	526	810	748	48.5
lower Middle Montney (D3)	high	662	846	766	40.9
lower Middle Montney (D2)	moderate	685	822	776	26.2
Lower Montney Pocketknife Member (Claraia Zone)	moderate	630	785	743	31.8
Lower Montney	low	688	771	739	28.4

Table 1. Hardness characteristics of seven representative core boxes from the Montney Formation in the 06-03-079-13W6.