

Rock Physics and Mechanics Experiments Data for Samples from the Belloy and Montney Formations

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Introduction

Summary

This document includes the results of geomechanical, petrophysical and geochemical tests performed on 9 pieces of samples from the Duvernay and Belloy Formations. Tests performed here include X-ray Diffraction (XRD), geomechanical static loading, geomechanical acoustic velocity, Mercury Injection Capillary Pressure (MICP), Nuclear Magnetic Resonance T₂ (NMR).

Samples and Tests Description

The samples tested in this study are detailed Table 1. For simplicity, we coded each sample from 1 – 9. Sample 9 is obtained from the same piece of rock as sample 4. MICP, Geomechanical static loading and acoustic velocity measurements are preformed by AGAT laboratories (contact: Jason Tucker at tucker@agatlabs.com). NMR T2 tests are preformed by Perm Inc. (contact: Apostolos Kantzas at akantzas@perminc.com). XRD tests are preformed by Calla Knudson (contact: cjknudso@ualberta.ca) employed by Alberta Geological Survey as a casual worker during Aug, 2021.

Table 1. A summary of materials tested in this study and the assigned code names for brevity

Well	Depth (m), Formation	Sample No.	Tests Preformed
07-30-69-11W6	3255, Montney	1	XRD, Geomechanics (H plug),MICP
07-30-69-11W6	3263, Belloy	2	XRD, NMR,MICP
07-30-69-11W6	3264.20, Belloy	3	XRD, NMR,MICP
04-08-74-05W6	2076.9, Montney	4	Geomechanics (H plug) ,MICP
04-08-74-05W6	2081.4, Montney	5	Geomechanics (H plug) ,MICP
04-08-74-05W6	1999, Belloy	6	XRD, NMR,MICP
10-18-70-10W6	2964.1, Belloy	7	XRD, NMR,MICP
10-18-70-10W6	2971.1, Belloy	8	XRD, NMR,MICP
04-08-74-05W6	2076.9, Montney	9 (from the same rock as #4)	Geomechanics (V plug)

Geomechanical tests:

Static loading test results:

Sample ID	Confining Pressure (MPa)	Triaxial Bulk Modulus (GPa)	Shear Modulus (GPa)	Young's Modulus (GPa)	Avg Poisson's Ratio	Parallel Poisson's Ratio	Perpendicular Poisson's Ratio	Compressive Strength (MPa)
Sample 1	10	10.62	14.56	29.99	0.030	0.016	0.043	NA
	20	14.86	18.97	39.93	0.052	0.055	0.050	NA
	30	15.11	22.67	45.33	0.000	0.000	0.000	NA
	50	29.39	22.58	53.92	0.194	0.173	0.216	461.58
Sample 4	10	8.65	10.36	22.21	0.072	0.080	0.064	NA
	20	11.54	16.13	33.01	0.023	0.004	0.043	NA
	30	29.52	14.80	38.04	0.285	0.342	0.229	NA
	50	38.42	13.36	35.91	0.344	0.369	0.320	309.771
Sample 5	10	41.65	13.15	35.70	0.357	0.234	0.480	NA
	20	18.14	16.46	37.91	0.152	0.116	0.188	NA
	30	26.26	14.48	36.69	0.267	0.323	0.212	NA
	50	19.95	15.23	36.42	0.196	0.127	0.265	332.83
Sample 9	10	7.14	9.23	19.35	0.048	0.251	-0.155	NA
	20	15.32	10.86	26.35	0.213	0.382	0.044	NA
	30	24.54	10.01	26.44	0.320	0.344	0.297	NA
	50	27.51	10.30	27.46	0.334	0.256	0.411	288.27

Dynamic velocities

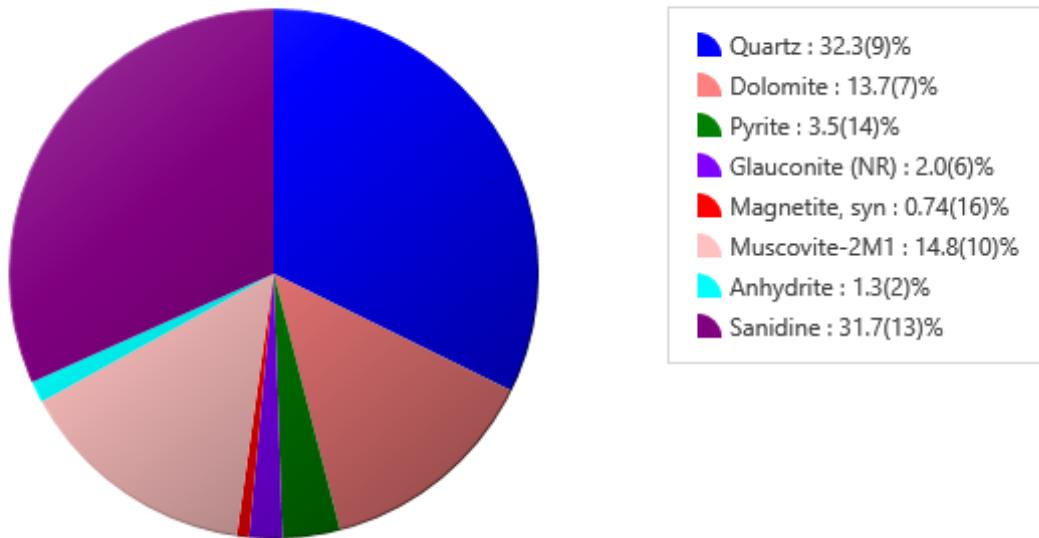
Sample ID	Confining Pressure (MPa)	Deviatoric Stress (MPa)	Total Stress (MPa)	AR P-0 (m/s)	AR P-45 (m/s)	AR P-90 (m/s)	AR P-135 (m/s)	Platen P-Wave (m/s)	Platen S1-Wave (m/s)	Platen S2-Wave (m/s)
Sample 1	10.01	20.01	30.02	4406.63	4439.89	5120.54	4615.81	4914.34	3337.35	3020.09
Sample 1	20.02	50.01	70.02	4556.81	4570.75	5256.67	4767.59	5085.44	3370.61	3084.21
Sample 1	30.01	60.00	90.01	4664.71	4663.26	5345.02	4868.57	5178.52	3406.76	3127.76
Sample 1	50.01	150.43	200.44	4927.27	4873.88	5552.11	5105.58	5506.54	3527.94	3295.15
Sample 4	10.01	19.99	30.01	4077.28	4122.23	4982.71	4355.21	5180.59	3005.43	3016.25
Sample 4	20.02	50.07	70.09	4247.05	4250.66	5105.26	4488.77	5272.83	3303.31	3057.03
Sample 4	30.01	100.00	130.01	4403.23	4386.55	5194.55	4630.50	5332.00	3332.12	3094.36
Sample 4	50.01	150.35	200.37	4583.42	4546.52	5316.93	4796.99	5387.54	3359.47	3125.93
Sample 5	10.01	20.00	30.01	4374.24	4379.77	5059.35	4589.96	5178.26	3265.29	2940.52
Sample 5	20.02	50.00	70.01	4514.55	4489.52	5160.02	4703.09	5235.00	3271.88	2971.78
Sample 5	30.01	100.00	130.01	4622.37	4573.74	5237.93	4803.13	5296.38	3283.00	2998.45
Sample 5	50.01	150.32	200.34	4731.88	4671.51	5322.79	4902.16	5349.99	3299.80	3022.73
Sample 9	10.01	19.99	30.00	5066.48	4768.24	5204.66	5391.66	4851.72	3070.67	3029.62
Sample 9	20.02	49.99	70.01	5153.94	4828.77	5281.79	5454.37	4919.49	3081.86	3038.51
Sample 9	30.01	100.01	130.02	5216.11	4899.74	5363.72	5540.21	4996.59	3105.28	3055.26
Sample 9	50.01	150.31	200.33	5295.24	4974.65	5431.97	5609.45	5060.80	3127.46	3072.63

MICP Tests

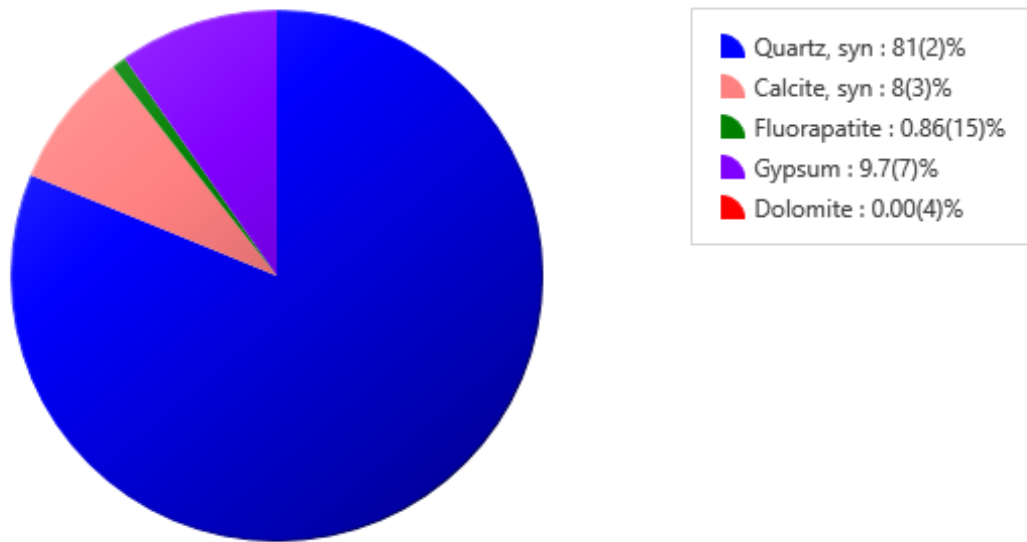
Sam ple ID	Total Intrusion Volume (cc)	Total Pore Area (m ² /g)	D2 (nm)	D2 5 (nm)	D5 0 (nm)	D7 5 (nm)	D9 8 (nm)	Medi an Pore Diam eter (Area)	Avera ge Pore Diam eter (4V/A)	Bulk Dens ity at 1.52 psia (g/cc)	Appar ent skelet al Densit y (g/cc)	Measu red Porosi ty (%)	Peak Rang e (D2- D98) (nm)	Moda l Peak (nm)	Permea bility (md)
#1	5.71E-03	2.54	113	32	11	5	4	5.3	9.0	2.678	2.720	1.53	4 - 110	4	1.33E-04
#2	9.46E-03	2.84	764	240	36	7	4	5.2	13.3	2.621	2.688	2.48	4 - 760	522, 4	1.05E-02
#3	3.76E-02	3.46	3503	1026	493	141	4	5.6	43.5	2.412	2.652	9.07	4 - 3500	674	1.23E+00
#4	3.05E-02	3.18	14120	2379	393	106	4	5.8	38.3	2.540	2.753	7.75	4 - 14120	2846, 206	2.06E+01
#5	7.51E-03	4.34	70	12	7	5	4	5.2	6.9	2.657	2.711	1.99	4 - 70	4	3.54E-04
#6	1.68E-02	5.15	92	36	20	10	4	7.8	13.0	2.578	2.695	4.32	4 - 90	23	3.93E-04
#7	1.52E-02	3.03	922	463	139	15	4	5.4	20.1	2.578	2.683	3.93	4 - 920	480	2.90E-02
#8	3.90E-02	3.21	4366	2300	1164	233	4	5.5	48.6	2.448	2.707	9.55	4 - 4370	2212	1.80E+00

XRD Tests

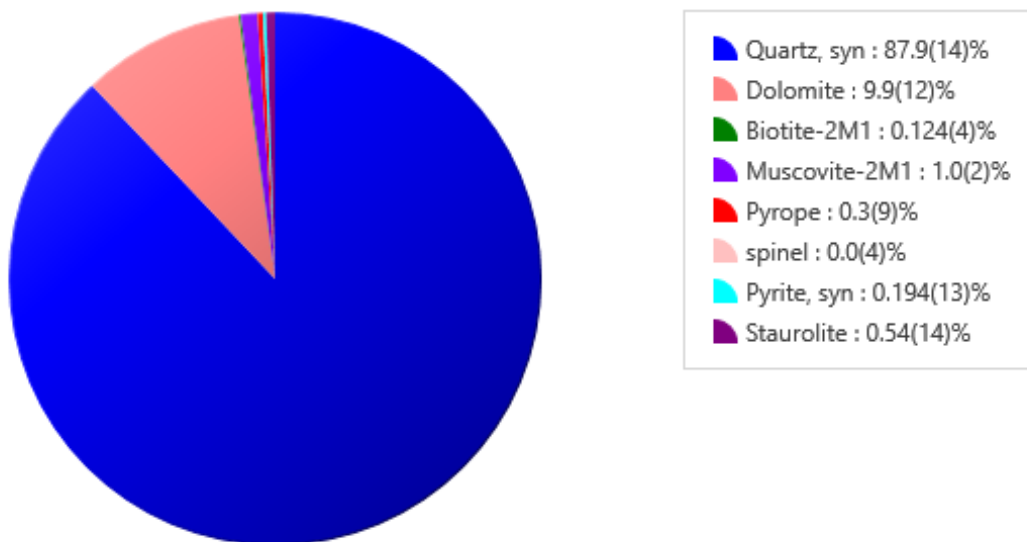
Sample 1



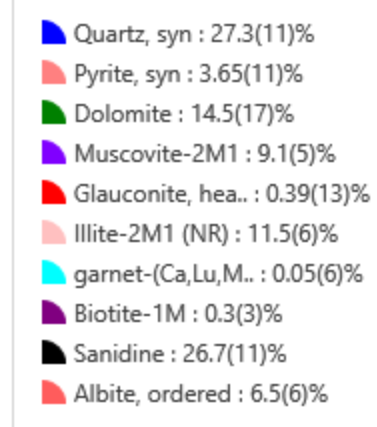
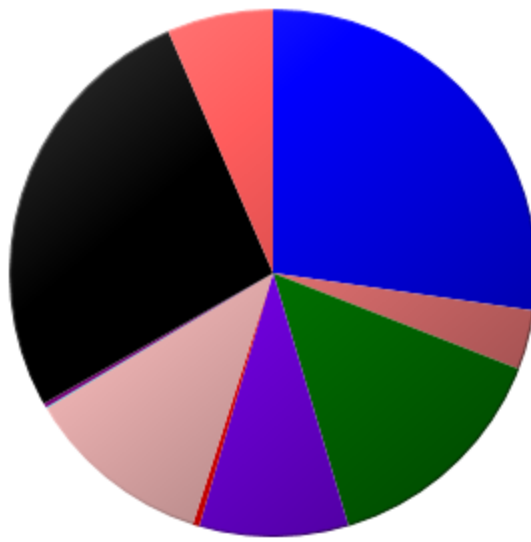
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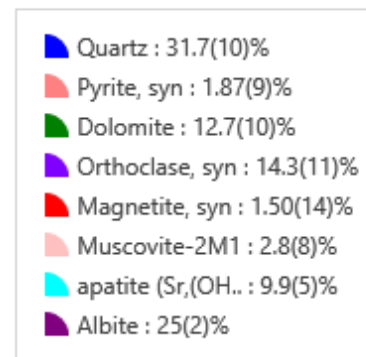
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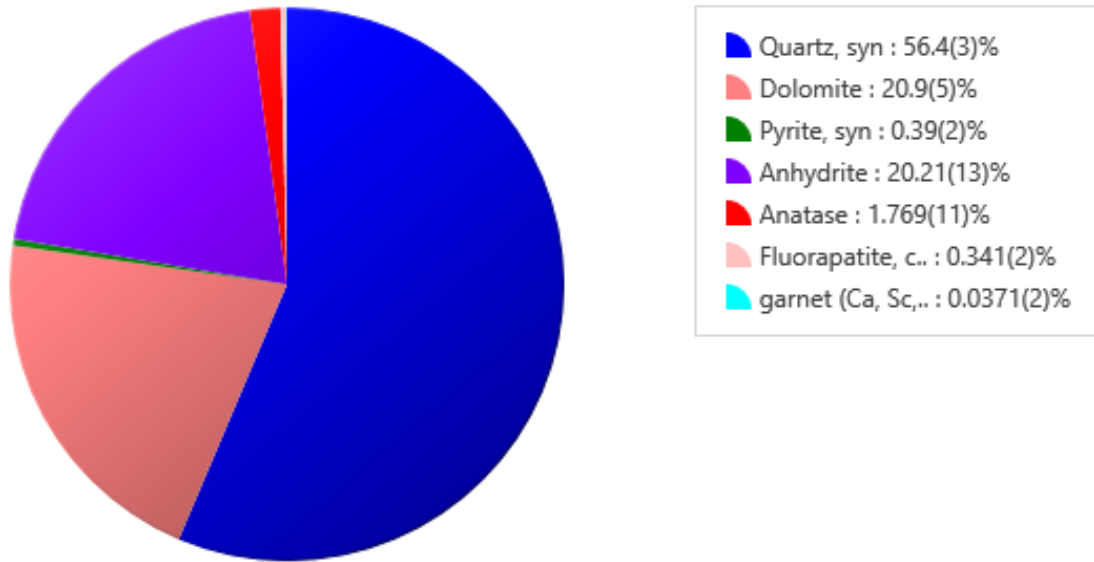
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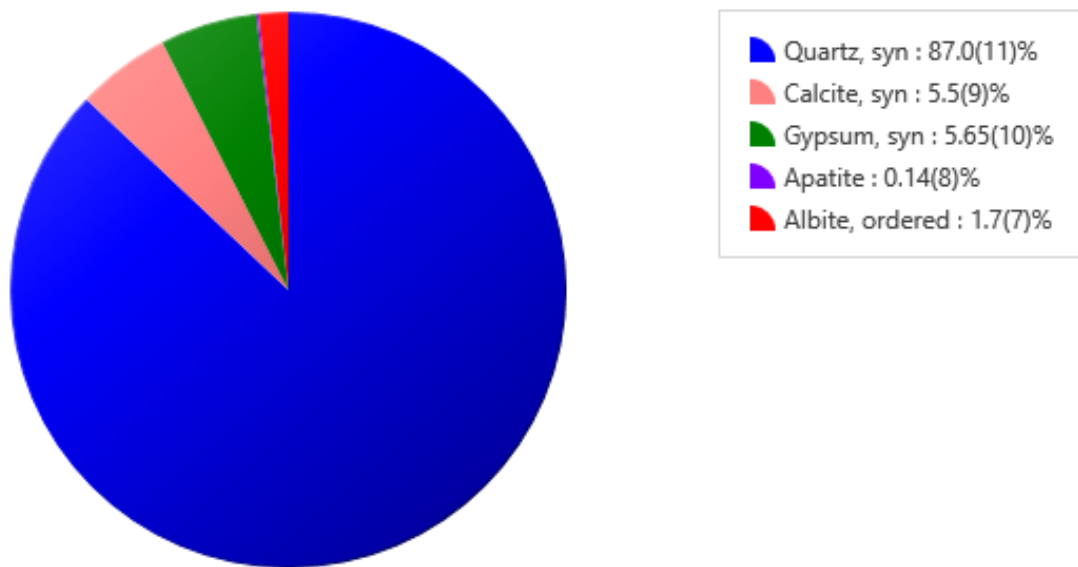
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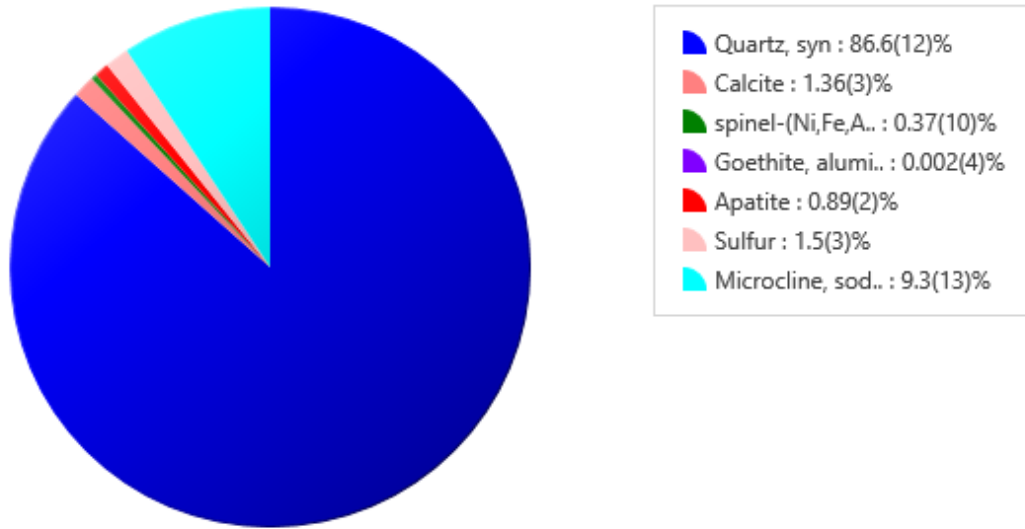
Sample 6



Sample 7



Sample 8



NMR Tests

Please see attached PDF report