Datashare 72

Porosity and pore size distribution in mudrocks from the Belle Fourche and Second White Specks Formations in Alberta, Canada

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Table S1. Vitrinite Reflectance and Rock-Eval T_{max} Values and Maceral Composition (on Mineral Matter Free Basis) for Samples from the Second White Specks and Belle Fourche Formations in Seven Drill Cores from Wells Located in Alberta, Canada

						Liptinite (vol. %)						
							AOM					
Well Name	Formation	Sample	Depth (m [ft])	Vitrinite Reflectance R_o (%)	Rock-Eval T_{max} (°C [°F])	Alginite	Fluorescent	Nonfluorescent	Other Liptinite	Vitrinite (vol. %)	Inertinite (vol. %)	Solid Bitumen (vol. %)
13-34-47-20W4	SWS	1	843.60 (2767.72)	0.40	n.d.	10	60	10	5	3	2	10
		2	844.69 (2771.29)	0.40	417 (783)	20	40	14.5	10	0.5	Trace	15
		3	845.92 (2775.33)	0.44	n.d.	5	60	12	5	2	6	10
		4	850.08 (2788.98)	0.44	424 (795)	10	54	20	10	1	0	5
		5	851.25 (2792.82)	0.45	n.d.	10	40	15	10	3	7	15
	Average			0.43	421 (790)	11	51	14	8	2	4	11
	Range			0.40–0.45	417–424 (783–795)	5–20	40–60	10–20	5–10	0.5–3	0–7	5–15
10-12-28-21W4	SWS	4	1078.72 (3539.11)	0.45	422 (792)	15	40	29	10	0.5	0.5	5
		7	1081.07 (3546.82)	0.43	420 (788)	10	35	33	10	2	Trace	10
		8	1082.37 (3551.08)	0.38	417 (783)	3	62	20	10	1	0	4
	BF	14	1086.40 (3564.30)	0.40	418 (784)	3	50	36	5	1	0	5
		15	1086.95 (3566.11)	0.47	424 (795)	4	65	20.5	6	0.5	Trace	4
		20	1092.42 (3584.06)	0.42	425 (797)	3	55	32.5	5	0.5	0	4
	Average			0.43	421 (790)	6	51	29	8	1	0	5
	Range			0.38–0.47	417–425 (783–797)	3–15	20–50	29–65	5–10	0.25–2	0–0.5	4–10
06-36-63-04W6	SWS	1	1855.37 (6087.17)	0.64	433 (811)	5	44	30	10	1	Trace	10
		2	1858.27 (6096.69)	0.65	434 (813)	5	39	30	15	1	Trace	10
		3	1860.43 (6103.77)	0.64	434 (813)	4	40	30	15	1	Trace	10
		4	1861.62 (6107.68)	0.61	432 (810)	4	44	30	15	1	Trace	6
		5	1863.58 (6114.11)	0.61	432 (810)	5	40	20	18	2	Trace	15
		6	1866.48 (6123.62)	0.61	432 (810)	3	48	20	12	2	Trace	15
		7	1867.23 (6126.08)	0.62	432 (810)	4	45	25	15	1	0	10
		8	1868.62 (6130.64)	0.62	433 (811)	5	40	25	14	1	0	15
		9	1871.84 (6141.21)	0.62	433 (811)	3	40	30	10	2	0	15
		10	1873.85 (6147.80)	0.68	435 (815)	3	60	20	7	2	0	8
		11	1876.32 (6155.91)	0.63	432 (810)	3	55	20	10	1	0	11
		12	1878.16 (6161.94)	0.62	432 (810)	5	45	20	10	2	0	18
		13	1880.10 (6168.31)	0.63	433 (811)	4	50	20	10	1	0	15
		14	1882.03 (6174.64)	0.62	433 (811)	5	45	20	12	3	Trace	15
		15	1883.66 (6179.99)	0.66	434 (813)	3	45	20	13	3	1	15
		16	1884.40 (6182.41)	0.65	434 (813)	5	45	20	12	3	0	15
		17	1886.68 (6189.90)	0.66	434 (813)	3	48	25	10	2	0	12
		18	1889.37 (6198.72)	0.65	433 (811)	3	40	22	15	4	1	15

(*continued*)

Table S1. Continued

Well Name	Formation	Sample	Depth (m [ft])	Vitrinite Reflectance R_o (%)	Rock-Eval T_{max} (°C [°F])	Liptinite (vol. %)				Vitrinite (vol. %)	Inertinite (vol. %)	Solid Bitumen (vol. %)
							AOM		Other Liptinite			
						Alginite	Fluorescent	Nonfluorescent				
		19	1890.36 (6201.97)	0.68	435 (815)	3	40	23	15	3	1	15
		20	1892.03 (6207.45)	0.66	434 (813)	4	40	25	15	3	1	12
		21	1893.08 (6210.89)	0.68	436 (817)	5	50	20	10	2	Trace	13
		22	1895.31 (6218.21)	0.65	435 (815)	3	50	20	15	2	Trace	10
		23	1898.39 (6228.31)	0.70	436 (817)	3	60	20	10	2	0	5
		24	1898.99 (6230.28)	0.68	436 (817)	5	50	22	15	3	0	5
		25	1900.35 (6234.74)	0.65	433 (811)	4	55	20	13	2	Trace	6
		26	1901.27 (6237.76)	0.67	434 (813)	3	50	29	10	2	Trace	6
		27	1902.27 (6241.04)	0.67	434 (813)	2	60	20	10	2	0	6
		28	1903.05 (6243.60)	0.66	434 (813)	4	60	19	10	2	Trace	5
		29	1904.13 (6247.15)	0.66	434 (813)	3	50	26	10	2	1	8
		30	1905.15 (6250.49)	0.70	437 (819)	3	50	20	16	3	Trace	8
		31	1906.65 (6255.41)	0.70	437 (819)	2	50	25	12	0.5	0.5	10
		32	1907.77 (6259.09)	0.70	437 (819)	2	50	27	15	1	Trace	5
		33	1908.16 (6260.37)	0.72	439 (822)	2	60	22	10	1	0	5
	Average			0.65	434 (813)	4	48	23	12	2	0.2	11
	Range			0.61–0.72	432–439 (810–822)	2–5	39–60	19–30	7–18	0.5–4	0–1	5–18
04-31-52-13W5	SWS	3	1802.60 (5914.04)	0.78	n.d.	5	40	22	10	2	1	20
		4	1804.30 (5919.62)	0.77	439 (822)	6	38	25	10	1	Trace	20
		7	1808.10 (5932.09)	0.78	443 (829)	5	34	25	15	1	Trace	20
		8	1810.75 (5940.78)	0.78	440 (824)	5	43	30	15	1	Trace	6
		11	1817.03 (5961.38)	0.78	n.d.	4	45	23	10	2	1	15
		12	1818.90 (5967.52)	0.77	440 (824)	2	46	30	10	2	Trace	10
	Average			0.78	441 (826)	5	41	26	12	2	Trace	15
	Range			0.77–0.78	439–443 (822–829)	2–6	34–46	25–30	10–15	1–2	Trace	6–20
07-19-45-6W5	SWS	1	1794.50 (5887.47)	0.74	439 (822)	5	49	30	10	0.5	0.5	5
		2	1798.40 (5900.26)	0.79	442 (828)	3	56	25	10	2	0	4
		3	1805.60 (5923.88)	0.77	440 (824)	1	58	25	10	1	0	5
		5	1810.25 (5939.14)	0.80	444 (831)	0	5	0	5	0	0	90
		6	1813.70 (5950.46)	0.80	442 (828)	2	48	25	15	1.5	0.5	8
		7	1818.75 (5967.03)	0.78	441 (826)	2	66	10	5	1.5	0.5	15
		8	1821.70 (5976.71)	0.78	442 (828)	2	61	20	10	1.5	0.5	5
		9	1822.60 (5979.66)	0.85	439 (822)	3	63	10	10	3	3	8
	BF	10	1823.70 (5983.27)	0.76	438 (820)	5	45	35	8	2	Trace	5
		11	1826.55 (5992.62)	0.78	441 (826)	8	55	20	10	1.5	0.5	5
		12	1833.30 (6014.76)	0.78	441 (826)	10	50	20	8	1.5	0.5	10
		13	1834.50 (6018.70)	0.75	439 (822)	15	43	20	10	2	Trace	10
		14	1840.90 (6039.70)	0.78	439 (822)	8	45	20	15	2	Trace	10
		15	1846.40 (6057.74)	0.83	442 (828)	5	50	14	15	1	Trace	15
		16	1848.90 (6065.95)	0.78	444 (831)	0	50	13	20	2	Trace	15
		17	1855.20 (6086.61)	0.75	445 (833)	20	40	9	10	1	Trace	20
		18	1860.10 (6102.69)	0.87	446 (835)	5	44	20	10	1	3	17
		19	1863.10 (6112.53)	0.78	441 (826)	10	50	14	8	4	1	13
		20	1869.80 (6134.51)	0.76	440 (824)	3	48	15	5	8	1	20
	Average			0.79	441 (826)	6	49	18	10	2	1	15
	Range			0.74–0.87	438–446 (820–835)	0–20	5–66	0–35	5–20	0–8	0–3	4–90

(*continued*)

Table S1. Continued

Well Name	Formation	Sample	Depth (m [ft])	Vitrinite Reflectance R_o (%)	Rock-Eval T_{max} (°C [°F])	Liptinite (vol. %)				Vitrinite (vol. %)	Inertinite (vol. %)	Solid Bitumen (vol. %)
							AOM		Other Liptinite			
						Alginite	Fluorescent	Nonfluorescent				
12-31-39-9W5	SWS	2	2642.50 (8669.62)	0.85	445 (833)	4	55	20	10	1	0	10
		6	2652.43 (8702.20)	0.84	n.d.	0	20	55	10	4	6	5
		9	2656.03 (8714.01)	0.84	n.d.	trace	15	60	10	1	4	10
	BF	15	2676.23 (8780.28)	0.85	448 (838)	2	47	20	5	1	0	25
		21	2686.27 (8813.22)	0.85	n.d.	trace	20	59	10	2	4	5
		24	2695.44 (8843.31)	0.84	447 (837)	0.5	29	0	10	0.5	Trace	60
	Average			0.85	447 (837)	2	31	36	9	2	3	19
	Range			0.84–0.85	445–448 (833–838)	0–4	15–55	0–60	5–10	0.5–4	0–6	5–60
13-20-51-14W5	SWS	2	2016.50 (6615.81)	0.92	449 (840)	10	34	30.5	10	0.5	0	15
		7	2023.25 (6637.96)	0.89	447 (837)	0.5	63	10	15	1	0.5	10
	BF	8	2071.71 (6796.95)	0.85	446 (835)	5	70	4.5	15	0.5	Trace	5
		10	2072.97 (6801.08)	0.93	n.d.	trace	50	6	10	3	1	30
		11	2073.48 (6802.76)	0.90	448 (838)	5	20	9	10	1	0	55
		15	2077.21 (6814.99)	0.88	447 (837)	5	70	4.5	15	0.5	Trace	5
	Average			0.90	447 (837)	5	51	11	13	1	0	20
	Range			0.85–0.93	446–449 (835–840)	0.5–10	20–70	4.5–30.5	10–15	0.5–1	0–0.5	5–55

See Figure 1. Total number of samples used for petrography was 81, and total number of samples used for Rock-Eval T_{max} was 72. Sample 4 from well 07-19-45-06W5 was excluded.

Abbreviations: AOM = amorphous organic matter; BF = Belle Fourche Formation; n.d. = not determined; R_o (%) = vitrinite reflectance; SWS = Second White Specks Formation; T_{max} = temperature (°C) reached during maximum generation of hydrocarbons measured on S2 peak in the Rock-Eval pyrogram.

Table S2. Total Organic Carbon Content for Samples from the Second White Specks and Belle Fourche Formations in Seven Drill Cores from Wells Located in Alberta, Canada

Well Name	Formation	Sample	Depth (m [ft])	TOC (wt. %)
13-34-47-20W4	SWS	1	843.60 (2767.72)	4.57
		2	844.69 (2771.29)	5.20
		3	845.92 (2775.33)	5.23
		4	850.08 (2788.98)	2.02
		5	851.25 (2792.82)	3.14
	Average			4.03
	Range			2.02–5.23
10-12-28-21W4	SWS	1	1077.22 (3534.19)	2.51
		2	1077.72 (3535.83)	3.46
		3	1078.37 (3537.96)	2.86
		4	1078.72 (3539.11)	3.60
		5	1079.42 (3541.40)	4.88
		6	1080.27 (3544.19)	5.22
		7	1081.07 (3546.82)	4.16
		8	1082.37 (3551.08)	5.23
		9	1083.14 (3553.61)	5.10
		10	1083.80 (3555.77)	4.90
	BF	11	1084.95 (3559.55)	3.47
		12	1085.25 (3560.53)	3.96
		13	1085.95 (3562.83)	3.36
		14	1086.40 (3564.30)	3.20
		15	1086.95 (3566.11)	1.71
		16	1088.03 (3569.65)	1.59
		17	1088.93 (3572.61)	3.18
		18	1089.65 (3574.97)	2.78
		19	1090.40 (3577.43)	2.88
		20	1092.42 (3584.06)	2.40
	Average			3.52
	Range			1.59–5.23
06-36-63-04W6	SWS	1	1855.37 (6087.17)	2.84
		2	1858.27 (6096.69)	2.64
		3	1860.43 (6103.77)	2.59
		4	1861.62 (6107.68)	3.80
		5	1863.58 (6114.11)	3.57
		6	1866.48 (6123.62)	5.45
		7	1867.23 (6126.08)	5.66
		8	1868.62 (6130.64)	5.31
		9	1871.84 (6141.21)	4.67
		10	1873.85 (6147.80)	3.73
		11	1876.32 (6155.91)	4.37
		16	1884.40 (6182.41)	6.68
		17	1886.68 (6189.90)	5.17
		18	1889.37 (6198.72)	6.68
		19	1890.36 (6201.97)	7.95
		20	1892.03 (6207.45)	5.00
		21	1893.08 (6210.89)	3.95
		22	1895.31 (6218.21)	3.85
		23	1898.39 (6228.31)	5.89
		24	1898.99 (6230.28)	5.61
		25	1900.35 (6234.74)	7.55
		26	1901.27 (6237.76)	5.66
		27	1902.27 (6241.04)	7.25
		28	1903.05 (6243.60)	7.14
		29	1904.13 (6247.15)	6.95
		30	1905.15 (6250.49)	3.60
		31	1906.65 (6255.41)	1.97
		32	1907.77 (6259.09)	2.22
		33	1908.16 (6260.37)	1.44
	Average			5.03
	Range			1.44–10.04
04-31-52-13W5	SWS	1	1800.00 (5905.51)	2.81
		2	1800.50 (5907.15)	2.93
		3	1802.60 (5914.04)	3.47
		4	1804.30 (5919.62)	3.58
		5	1805.35 (5923.06)	3.42
		6	1806.90 (5928.15)	3.23
		7	1808.10 (5932.09)	3.02
		8	1810.75 (5940.78)	2.69
		9	1812.70 (5947.18)	3.10
		10	1815.10 (5955.05)	2.73
		11	1817.03 (5961.38)	3.52
		12	1818.90 (5967.52)	3.23
	Average			3.14
	Range			2.69–3.58
07-19-45-06W5	SWS	1	1794.50 (5887.47)	2.98
		2	1798.40 (5900.26)	2.68
		3	1805.60 (5923.88)	3.32
		5	1810.25 (5939.14)	1.74
		6	1813.70 (5950.46)	3.37
		7	1818.75 (5967.03)	2.04

(*continued*)

Table S2. Continued

Well Name	Formation	Sample	Depth (m [ft])	TOC (wt. %)	Well Name	Formation	Sample	Depth (m [ft])	TOC (wt. %)
		12	1878.16 (6161.94)	3.60			8	1821.70 (5976.71)	3.54
		13	1880.10 (6168.31)	6.52			9	1822.60 (5979.66)	2.60
		14	1882.03 (6174.64)	6.72		BF	10	1823.70 (5983.27)	3.18
		15	1883.66 (6179.99)	10.04			11	1826.55 (5992.62)	2.22
		12	1833.30 (6014.76)	2.01			18	2683.80 (8805.12)	1.66
		13	1834.50 (6018.70)	2.48			19	2684.10 (8806.10)	1.94
		14	1840.90 (6039.70)	2.78			20	2684.31 (8806.79)	1.95
		15	1846.40 (6057.74)	3.62			21	2686.27 (8813.22)	2.40
		16	1848.90 (6065.95)	3.35			22	2686.74 (8814.76)	2.08
		17	1855.20 (6086.61)	3.15			23	2690.12 (8825.85)	2.20
		18	1860.10 (6102.69)	2.58			24	2695.44 (8843.31)	2.38
		19	1863.10 (6112.53)	3.27			25	2696.30 (8846.13)	2.54
		20	1869.80 (6134.51)	3.41		Average			2.01
	Average			2.86		Range			0.15–3.16
	Range			1.74–3.62	13-20-51-14W5	SWS	1	2015.43 (6612.30)	2.12
12-31-39-09W5	SWS	1	2638.70 (8657.15)	2.43			2	2016.50 (6615.81)	2.57
		2	2642.50 (8669.62)	3.16			3	2017.58 (6619.36)	2.91
		3	2646.07 (8681.33)	2.67			4	2019.02 (6624.08)	2.78
		4	2650.63 (8696.29)	1.95			5	2020.61 (6629.30)	2.94
		5	2651.25 (8698.33)	0.75			6	2022.19 (6634.48)	2.55
		6	2652.43 (8702.20)	2.47			7	2023.25 (6637.96)	1.46
		7	2653.66 (8706.23)	0.15		BF	8	2071.71 (6796.95)	4.52
		8	2654.86 (8710.17)	0.84			9	2072.23 (6798.66)	2.62
		9	2656.03 (8714.01)	2.70			10	2072.97 (6801.08)	3.72
		10	2658.00 (8720.47)	2.55			11	2073.48 (6802.76)	2.95
	BF	11	2661.39 (8731.59)	2.36			12	2074.33 (6805.54)	2.00
		12	2667.90 (8752.95)	2.51			13	2075.14 (6808.20)	1.93
		13	2670.08 (8760.11)	1.78			14	2076.30 (6812.01)	2.87
		14	2671.21 (8763.81)	1.75			15	2077.21 (6814.99)	2.09
		15	2676.23 (8780.28)	1.74			16	2077.85 (6817.09)	2.23
		16	2678.55 (8787.89)	1.66			17	2079.86 (6823.69)	2.22
		17	2680.77 (8795.18)	1.54		Average			2.62
						Range			1.46–4.52

See Figure 1. Total number of samples is 131. Sample 4 from well 07-19-45-06W5 was excluded.
Abbreviations: BF = Belle Fourche Formation; SWS = Second White Specks Formation; TOC = total organic carbon.

Table S3. Porosity Data for Samples from the Second White Specks and Belle Fourche Formations in Seven Drill Cores from Wells Located in Alberta, Canada

Well Name	Formation	Sample	Depth (m [ft])	Total Pore Volume (V_t) (cm^3/g)	Micropore (CO_2 Gas Adsorption)		
					Volume* (cm^3/g)	Surface Area† (m^2/g)	Width‡ (nm)
13-34-47-20W4	SWS	1	843.60 (2767.72)	0.0412	0.0094	14.6	1.3
		2	844.69 (2771.29)	0.0383	0.0072	15.7	1.2
		3	845.92 (2775.33)	0.0385	0.0064	9.4	1.3
		4	850.08 (2788.98)	0.0374	0.0066	11.3	1.3
		5	851.25 (2792.82)	0.0371	0.0065	9.1	1.4
	Average			0.0385	0.0072	12.0	1.3
	Range			0.0371–0.0412	0.0064–0.0094	9.1–15.7	1.2–1.4
10-12-28-21W4	SWS	4	1078.72 (3539.11)	0.0338	0.0085	11.9	1.3
		7	1081.07 (3546.82)	0.0191	0.0063	9.3	1.2
		8	1082.37 (3551.08)	0.0595	0.0095	12.4	1.4
	BF	14	1086.40 (3564.30)	0.0280	0.0077	12.2	1.3
		15	1086.95 (3566.11)	0.0414	0.0066	11.9	1.3
		20	1092.42 (3584.06)	0.0183	0.0051	13.3	1.3
	Average			0.0334	0.0073	11.8	1.3
	Range			0.0183–0.0595	0.0051–0.0095	9.3–13.3	1.2–1.4
06-36-63-04W6	SWS	1	1855.37 (6087.17)	0.0073	0.0042	5.2	1.1
		2	1858.27 (6096.69)	0.0079	0.0039	6.9	1.1
		3	1860.43 (6103.77)	0.0084	0.0038	5.1	1.0
		4	1861.62 (6107.68)	0.0096	0.0045	4.1	1.0
		5	1863.58 (6114.11)	0.0104	0.0054	4.1	0.8
		6	1866.48 (6123.62)	0.0124	0.0058	2.4	0.7
		7	1867.23 (6126.08)	0.0155	0.0076	2.6	0.7
		8	1868.62 (6130.64)	0.0127	0.0029	2.3	0.8
		9	1871.84 (6141.21)	0.0101	0.0093	3.1	0.5
		10	1873.85 (6147.80)	0.0110	0.0085	2.9	0.7
		11	1876.32 (6155.91)	0.0109	0.0034	5.5	0.9
		12	1878.16 (6161.94)	0.0071	0.0035	3.9	0.1
		13	1880.10 (6168.31)	0.0143	0.0083	5.1	0.4
		14	1882.03 (6174.64)	0.0133	0.0087	4.4	0.4
		15	1883.66 (6179.99)	0.0139	0.0126	5.8	0.2
		16	1884.40 (6182.41)	0.0132	0.0126	4.0	0.4
		17	1886.68 (6189.90)	0.0116	0.0108	3.8	0.5
		18	1889.37 (6198.72)	0.0121	0.0091	3.9	0.4
		19	1890.36 (6201.97)	0.0136	0.0021	4.5	0.1
		20	1892.03 (6207.45)	0.0135	0.0099	2.7	0.7
		21	1893.08 (6210.89)	0.0119	0.0080	4.2	0.5
		22	1895.31 (6218.21)	0.0114	0.0108	3.4	0.6
		23	1898.39 (6228.31)	0.0140	0.0130	2.8	0.4
		24	1898.99 (6230.28)	0.0139	0.0131	3.2	0.2
		25	1900.35 (6234.74)	0.0143	0.0019	7.2	0.1
		26	1901.27 (6237.76)	0.0133	0.0091	3.7	0.1
		27	1902.27 (6241.04)	0.0137	0.0133	2.7	0.1
		28	1903.05 (6243.60)	0.0133	0.0127	2.9	0.4
		29	1904.13 (6247.15)	0.0135	0.0126	3.3	0.6
		30	1905.15 (6250.49)	0.0104	0.0101	3.5	0.2
		31	1906.65 (6255.41)	0.0099	0.0068	5.2	1.1
		32	1907.77 (6259.09)	0.0092	0.0058	6.4	1.0
		33	1908.16 (6260.37)	0.0087	0.0046	7.9	1.3
	Average			0.0117	0.0078	4.2	0.6
	Range			0.0071–0.0155	0.0019–0.0133	2.3–7.9	0.1–1.3

(*continued*)

Table S3. Continued

Mesopore (N_2 Gas Adsorption)			Macropore Volume[#] (cm^3/g)	Total Porosity (vol. %)	Micropores (vol. % of Total Pore Volume)	Mesopores (vol. % of Total Pore Volume)	Macropores (vol. % of Total Pore Volume)
Volume[§] (cm^3/g)	Surface Area[¶] (m^2/g)	Width[‡] (nm)					
0.0254	10.3	11.2	0.0064	9.5	23	62	15
0.0221	8.2	11.2	0.0090	8.8	19	58	24
0.0226	9.3	10.3	0.0096	8.9	17	59	25
0.0217	9.0	10.0	0.0091	9.0	18	58	24
0.0221	9.2	10.4	0.0085	8.9	17	60	23
0.0228	9.2	10.6	0.0085	9.0	19	59	22
0.0217–0.0254	8.2–10.3	10.0–11.2	0.0064–0.0096	8.8–9.5	17–23	58–62	15–25
0.0164	5.6	12.0	0.0089	7.9	25	48	26
0.0115	3.8	12.5	0.0013	4.7	33	60	7
0.0140	6.0	9.8	0.0361	12.8	16	23	61
0.0180	10.2	7.6	0.0023	6.8	28	64	8
0.0183	12.0	6.7	0.0165	9.8	16	44	40
0.0132	11.5	6.9	0.0000	4.6	28	72	0
0.0152	8.2	9.3	0.0108	7.8	24	52	24
0.0115–0.0183	3.8–12.0	6.7–12.5	0.0000–0.0361	4.6–12.8	16–33	23–72	0–60
0.0025	0.8	13.1	0.0005	2.2	58	35	7
0.0039	1.3	12.0	0.0002	2.4	49	49	3
0.0021	0.8	11.7	0.0025	2.6	45	25	29
0.0016	0.5	13.1	0.0035	2.9	47	17	37
0.0032	0.8	16.5	0.0018	3.2	52	31	17
0.0011	0.3	16.9	0.0054	3.7	47	9	44
0.0024	0.5	20.9	0.0056	4.7	49	15	36
0.0013	0.3	16.3	0.0084	4.0	23	11	66
0.0008	0.3	16.4	0.0000	3.0	93	7	0
0.0011	0.3	15.8	0.0014	3.3	78	10	12
0.0044	1.2	15.2	0.0031	3.3	31	40	29
0.0010	0.2	18.2	0.0027	2.1	49	13	38
0.0020	0.4	23.1	0.0040	4.3	58	14	28
0.0016	0.4	16.8	0.0030	3.9	66	12	22
0.0009	0.2	18.5	0.0004	4.0	91	6	3
0.0006	0.2	17.3	0.0000	3.9	95	5	0
0.0008	0.4	15.2	0.0000	3.6	93	7	0
0.0018	0.5	16.0	0.0013	3.5	75	14	11
0.0008	0.2	17.6	0.0107	3.8	15	6	79
0.0020	0.4	20.8	0.0017	4.0	73	14	13
0.0018	0.4	20.3	0.0021	3.8	67	15	18
0.0006	0.2	19.5	0.0000	3.4	95	5	0
0.0011	0.3	18.6	0.0000	4.2	92	8	0
0.0007	0.2	18.3	0.0000	4.0	95	5	0
0.0005	0.1	21.3	0.0119	4.2	13	3	84
0.0007	0.2	18.6	0.0035	3.9	68	5	26
0.0004	0.1	19.9	0.0000	4.0	97	3	0
0.0007	0.2	15.4	0.0000	4.0	95	5	0
0.0010	0.3	17.5	0.0000	4.0	93	7	0
0.0003	0.2	16.4	0.0000	3.2	97	3	0
0.0031	1.1	15.8	0.0000	3.0	68	32	0
0.0034	1.3	13.5	0.0000	2.9	63	37	0
0.0041	2.1	12.0	0.0000	2.8	53	47	0
0.0016	0.5	16.9	0.0022	3.5	66	16	18
0.003–0.0044	0.09–2.10	11.7–23.1	0.0000–0.0119	2.1–4.7	13–97	3–49	0–84

(*continued*)

Table S3. Continued

Well Name	Formation	Sample	Depth (m [ft])	Total Pore Volume (V_t) (cm^3/g)	Micropore (CO_2 Gas Adsorption)		
					Volume* (cm^3/g)	Surface Area† (m^2/g)	Width‡ (nm)
04-31-52-13W5	SWS	3	1802.60 (5914.04)	0.0018	0.0013	3.4	1.1
		4	1804.30 (5919.62)	0.0056	0.0024	3.5	0.4
		7	1808.10 (5932.09)	0.0047	0.0045	2.6	0.3
		8	1810.75 (5940.78)	0.0102	0.0083	3.1	0.9
		11	1817.03 (5961.38)	0.0014	0.0007	5.3	1.1
		12	1818.90 (5967.52)	0.0058	0.0053	2.7	0.6
	Average			0.0049	0.0037	3.4	0.7
	Range			0.0014–0.0102	0.0007–0.0083	2.6–5.3	0.3–1.1
07-19-45-06W5	SWS	1	1794.50 (5887.47)	0.0082	0.0024	7.3	0.2
		2	1798.40 (5900.26)	0.0098	0.0034	5.3	0.9
		3	1805.60 (5923.88)	0.0065	0.0035	4.9	0.7
		5	1810.25 (5939.14)	0.0096	0.0043	2.7	1.2
		6	1813.70 (5950.46)	0.0176	0.0047	5.4	1.1
		7	1818.75 (5967.03)	0.0122	0.0007	9.8	0.1
		8	1821.70 (5976.71)	0.0108	0.0047	6.3	1.1
		9	1822.60 (5979.66)	0.0093	0.0037	4.1	1.2
	BF	10	1823.70 (5983.27)	0.0200	0.0022	9.8	0.4
		11	1826.55 (5992.62)	0.0113	0.0037	7.8	1.2
		12	1833.30 (6014.76)	0.0161	0.0051	7.9	1.3
		13	1834.50 (6018.70)	0.0171	0.0042	8.1	1.2
		14	1840.90 (6039.70)	0.0141	0.0036	6.7	1.0
		15	1846.40 (6057.74)	0.0116	0.0053	5.5	1.0
		16	1848.90 (6065.95)	0.0105	0.0045	5.8	0.5
		17	1855.20 (6086.61)	0.0134	0.0041	6.6	1.2
		18	1860.10 (6102.69)	0.0090	0.0029	5.4	1.1
		19	1863.10 (6112.53)	0.0118	0.0038	5.4	1.2
		20	1869.80 (6134.51)	0.0075	0.0045	3.2	0.8
	Average			0.0119	0.0038	6.2	0.9
	Range			0.0065–0.0200	0.0007–0.0053	2.7–9.8	0.1–1.3
12-31-39-9W5	SWS	2	2642.50 (8669.62)	0.0168	0.0016	9.8	0.3
		6	2652.43 (8702.20)	0.0140	0.0053	3.0	1.2
		9	2656.03 (8714.01)	0.0080	0.0039	6.6	1.1
	BF	15	2676.23 (8780.28)	0.0078	0.0029	5.9	0.9
		21	2686.27 (8813.22)	0.0115	0.0042	9.1	1.2
		24	2696.30 (8846.13)	0.0037	0.0011	2.4	0.7
	Average			0.0103	0.0031	6.1	0.9
	Range			0.0037–0.0168	0.0011–0.0053	2.4–9.8	0.3–1.2
13-20-51-14W5	SWS	2	2016.50 (6615.81)	0.0109	0.0037	5.9	0.6
		7	2023.30 (6638.12)	0.0064	0.0024	3.5	0.9
	BF	8	2071.70 (6796.92)	0.0053	0.0034	6.1	1.1
		10	2072.97 (6801.08)	0.0010	0.0005	5.8	1.0
		11	2073.50 (6802.82)	0.0029	0.0012	5.5	1.1
		15	2077.20 (6814.96)	0.0010	0.0005	6.5	1.1
	Average			0.0046	0.0020	5.5	1.0
	Range			0.0010–0.0109	0.0005–0.0037	3.5–6.5	0.6–1.1

See Figure 1. Porosity data include volume, surface area, pore width, and total porosity. Total number of samples was 81. Sample 4 from well 07-19-45-06W5 was excluded.
Abbreviations: BF = Belle Fourche Formation; SWS = Second White Specks Formation.
*Dubinin–Astakhov: limiting micropore volume.
†Dubinin–Radushkevich: micropore surface area.
‡Adsorption average pore width (4V/A by Brunauer, Emmett, and Teller).
§Barret–Joyner–Halenda adsorption cumulative volume of pores between 2.0- and 50.0-nm width.
¶Brunauer, Emmett, and Teller: mesopore surface area.
#Calculated macropore volume: the difference between total pore volume and the sum of micropore and mesopore volumes.

Table S3. Continued

Mesopore (N_2 Gas Adsorption)			Macropore Volume[#] (cm^3/g)	Total Porosity (vol. %)	Micropores (vol. % of Total Pore Volume)	Mesopores (vol. % of Total Pore Volume)	Macropores (vol. % of Total Pore Volume)
Volume[§] (cm^3/g)	Surface Area[¶] (m^2/g)	Width[‡] (nm)					
0.0006	0.6	15.3	0.0000	0.5	70	30	0
0.0014	0.4	16.1	0.0018	1.4	42	26	33
0.0003	0.2	17.1	0.0000	1.2	95	5	0
0.0020	0.8	13.3	0.0000	2.6	81	19	0
0.0007	1.3	13.9	0.0000	0.3	49	51	0
0.0005	0.2	14.3	0.0000	1.5	92	8	0
0.0009	0.6	15.0	0.0003	1.2	71	23	5
0.0003–0.0020	0.2–1.3	13.3–17.1	0.0000–0.0018	0.3–2.6	42–95	5–51	0–33
0.0055	1.9	12.0	0.0004	2.1	29	67	4
0.0051	1.8	11.9	0.0013	2.5	35	52	13
0.0030	2.3	10.2	0.0000	1.7	54	46	0
0.0052	1.6	14.6	0.0000	2.5	45	55	0
0.0059	1.8	13.8	0.0070	4.4	27	34	40
0.0045	1.1	17.2	0.0069	3.2	6	37	57
0.0061	2.3	11.9	0.0000	2.7	44	56	0
0.0056	1.8	14.2	0.0000	2.5	40	60	0
0.0071	2.4	12.4	0.0107	5.0	11	36	54
0.0076	2.9	12.0	0.0000	3.0	33	67	0
0.0081	2.8	12.2	0.0029	4.1	32	50	18
0.0073	2.7	11.5	0.0056	4.3	25	43	33
0.0069	2.2	13.1	0.0037	3.5	25	49	26
0.0040	2.1	8.3	0.0023	2.9	46	34	20
0.0045	1.5	12.5	0.0014	2.6	43	43	14
0.0071	2.4	12.7	0.0022	3.3	31	53	17
0.0060	2.6	11.9	0.0000	2.2	33	67	0
0.0056	1.6	14.7	0.0024	2.9	32	48	20
0.0030	0.8	17.4	0.0000	2.0	60	40	0
0.0057	2.0	12.9	0.0025	3.0	34	49	17
0.0030–0.0081	0.8–2.9	8.3–17.4	0.0000–0.0107	1.7–5.0	6–60	34–67	0–57
0.0064	1.6	16.2	0.0089	4.2	9	38	53
0.0044	1.0	16.0	0.0043	3.6	38	31	31
0.0041	3.2	10.3	0.0000	2.1	48	52	0
0.0049	1.2	22.0	0.0000	2.0	37	63	0
0.0073	3.3	11.7	0.0000	3.0	36	64	0
0.0026	0.6	18.9	0.0000	1.0	30	70	0
0.0050	1.8	15.8	0.0022	2.7	33	53	14
0.0026–0.0073	0.6–3.3	10.3–22.0	0.0000–0.0089	1.0–4.2	9–48	31–70	0–53
0.0034	1.9	8.0	0.0038	2.8	34	31	35
0.0040	1.4	13.0	0.0000	1.7	37	63	0
0.0019	1.1	13.1	0.0000	1.3	65	35	0
0.0005	2.0	8.9	0.0000	0.3	52	48	0
0.0017	3.3	7.6	0.0000	0.7	42	58	0
0.0005	1.9	11.8	0.0000	0.3	46	54	0
0.0020	2.0	10.4	0.0006	1.2	46	48	6
0.0005–0.0040	1.1–3.3	7.6–13.1	0.0000–0.0038	0.3–2.8	34–65	31–63	0–35

Table S4. Mineral Composition and Brittleness Index for Samples from the Second White Specks and Belle Fourche Formations in Seven Drill Cores from Wells Located in Alberta, Canada

Well Name	Formation	Sample	Depth (m [ft])	Quartz (wt. %)	Albite (wt. %)	Calcite (wt. %)	Dolomite (wt. %)	Ankerite (wt. %)	Illite (wt. %)	Kaolinite (wt. %)	Chlorite (wt. %)	Pyrite (wt. %)	Brittleness Index (%)
13-34-47-20W4	SWS	1	843.60 (2767.72)	45	9	4	1	0	27	6	3	4	51
		2	844.69 (2771.29)	39	8	6	2	0	25	12	5	4	44
		3	845.92 (2775.33)	38	8	9	1	0	29	8	2	5	42
		4	850.08 (2788.98)	49	9	4	2	0	23	5	4	4	58
		5	851.25 (2792.82)	41	8	16	2	0	21	7	2	3	47
	Average			43	8	8	2	0	25	8	3	4	48
	Range			38–49	8–9	4–16	1–2	0	21–29	5–12	2–5	3–5	42–58
10-12-28-21W4	SWS	4	1078.72 (3539.11)	40	8	13	4	0	21	6	4	4	49
		7	1081.07 (3546.82)	39	13	18	3	0	16	5	3	4	48
		8	1082.37 (3551.08)	31	9	21	3	0	25	5	1	5	38
	BF	14	1086.40 (3564.30)	38	11	4	2	0	28	6	4	7	47
		15	1086.95 (3566.11)	40	9	2	2	0	32	7	4	4	47
		20	1092.42 (3584.06)	45	10	2	2	0	26	6	5	5	53
	Average			39	10	10	3	0	24	6	3	5	47
	Range			31–45	8–13	2–21	2–4	0	16–32	5–7	1–5	4–7	38–53
06-36-63-04W6	SWS	1	1855.37 (6087.17)	45	6	2	1	0	31	7	4	4	49
		2	1858.27 (6096.69)	41	6	1	1	0	35	8	3	5	46
		3	1860.43 (6103.77)	42	5	2	1	0	35	8	4	4	46
		4	1861.62 (6107.68)	41	6	2	1	0	35	7	3	4	45
		5	1863.58 (6114.11)	41	5	2	1	0	33	7	4	6	46
		6	1866.48 (6123.62)	37	5	4	1	0	35	8	4	6	40
		7	1867.23 (6126.08)	39	5	6	1	0	34	7	3	6	42
		8	1868.62 (6130.64)	37	5	3	1	0	35	9	4	5	40
		9	1871.84 (6141.21)	36	6	2	1	0	35	8	5	5	40
		10	1873.85 (6147.80)	39	7	2	1	0	36	7	3	5	43
		11	1876.32 (6155.91)	27	9	3	2	0	25	21	9	3	32
		12	1878.16 (6161.94)	38	6	7	2	0	32	8	2	5	43
		13	1880.10 (6168.31)	31	7	11	1	0	33	9	2	6	35

(*continued*)

Table S4. Continued

Well Name	Formation	Sample	Depth (m [ft])	Quartz (wt. %)	Albite (wt. %)	Calcite (wt. %)	Dolomite (wt. %)	Ankerite (wt. %)	Illite (wt. %)	Kaolinite (wt. %)	Chlorite (wt. %)	Pyrite (wt. %)	Brittleness Index (%)
		14	1882.03 (6174.64)	38	7	6	1	0	30	8	2	7	42
		15	1883.66 (6179.99)	36	8	4	1	0	32	8	3	8	39
		16	1884.40 (6182.41)	38	7	5	1	0	33	6	4	6	42
		17	1886.68 (6189.90)	37	9	1	1	0	37	8	3	3	41
		18	1889.37 (6198.72)	40	7	2	1	0	31	9	3	5	44
		19	1890.36 (6201.97)	37	9	2	1	0	32	9	4	5	41
		20	1892.03 (6207.45)	39	6	0	1	0	34	10	5	4	43
		21	1893.08 (6210.89)	42	6	0	1	0	32	10	5	4	45
		22	1895.31 (6218.21)	40	8	0	1	0	34	8	5	3	45
		23	1898.39 (6228.31)	38	8	3	1	0	32	9	5	4	42
		24	1898.99 (6230.28)	35	8	5	1	0	32	10	4	5	39
		25	1900.35 (6234.74)	29	13	12	2	0	25	8	5	5	35
		26	1901.27 (6237.76)	36	5	2	1	0	35	10	5	5	40
		27	1902.27 (6241.04)	39	5	1	1	0	34	10	5	4	41
		28	1903.05 (6243.60)	33	5	1	1	0	34	12	7	6	36
		29	1904.13 (6247.15)	42	5	3	1	0	28	10	5	5	45
		30	1905.15 (6250.49)	41	8	1	1	0	32	9	5	2	46
		31	1906.65 (6255.41)	49	10	0	1	0	27	7	5	2	55
		32	1907.77 (6259.09)	48	9	0	1	0	28	8	6	1	52
		33	1908.16 (6260.37)	55	7	0	1	0	23	8	5	1	60
	Average			39	7	3	1	0	32	9	4	5	43
	Range			27–55	5–13	0–12	1–2	0	23–37	6–21	2–9	1–8	42–68
04-31-52-13W5	SWS	3	1802.60 (5914.04)	36	8	9	2	0	32	6	2	5	42
		4	1804.30 (5919.62)	36	8	11	4	0	30	5	2	4	44
		7	1808.10 (5932.09)	31	10	13	3	0	25	9	4	4	39
		8	1810.75 (5940.78)	36	9	10	3	0	30	5	3	4	44
		11	1817.03 (5961.38)	32	8	12	3	0	31	6	3	5	39
		12	1818.90 (5967.52)	35	10	8	3	0	32	5	3	4	42
	Average			34	9	10	3	0	30	6	3	4	42
	Range			31–36	8–10	8–13	2–4	0	25–32	5–9	2–4	4–5	39–44

(*continued*)

Table S4. Continued

Well Name	Formation	Sample	Depth (m [ft])	Quartz (wt. %)	Albite (wt. %)	Calcite (wt. %)	Dolomite (wt. %)	Ankerite (wt. %)	Illite (wt. %)	Kaolinite (wt. %)	Chlorite (wt. %)	Pyrite (wt. %)	Brittleness Index (%)
07-19-45-06W5	SWS	1	1794.50 (5887.47)	34	11	12	3	0	28	4	3	4	42
		2	1798.40 (5900.26)	34	11	12	3	0	31	5	1	3	42
		3	1805.60 (5923.88)	32	8	21	3	1	24	5	1	5	39
		5	1810.25 (5939.14)	14	4	21	44	0	12	2	1	2	60
		6	1813.70 (5950.46)	34	10	13	3	1	28	6	1	4	41
		7	1818.75 (5967.03)	22	4	13	36	0	18	3	1	3	61
		8	1821.70 (5976.71)	36	4	9	4	0	34	6	2	5	43
		9	1822.60 (5979.66)	33	9	4	12	9	21	6	2	5	51
	BF	10	1823.70 (5983.27)	34	10	0	3	1	36	8	3	5	42
		11	1826.55 (5992.62)	35	10	0	2	1	36	7	3	5	43
		12	1833.30 (6014.76)	38	10	2	1	0	34	7	4	4	45
		13	1834.50 (6018.70)	36	15	1	1	0	33	5	5	4	45
		14	1840.90 (6039.70)	36	14	2	1	0	33	5	4	4	44
		15	1846.40 (6057.74)	22	8	25	0	0	29	8	2	5	25
		16	1848.90 (6065.95)	30	12	14	0	0	32	6	1	5	35
		17	1855.20 (6086.61)	34	12	4	0	0	35	7	3	4	39
		18	1860.10 (6102.69)	35	9	10	4	0	25	6	4	7	45
		19	1863.10 (6112.53)	44	12	1	1	0	27	6	4	5	52
		20	1869.80 (6134.51)	36	12	0	0	0	27	10	3	12	46
	Average			33	10	9	6	1	29	6	2	5	44
	Range			14–44	4–15	0–25	0–44	1–9	12–36	2–10	1–5	2–12	25–61
12-31-39-9W5	SWS	2	2642.50 (8669.62)	34	10	9	10	2	24	5	1	4	50
		6	2652.43 (8702.20)	50	8	8	7	0	19	2	2	4	62
		9	2656.03 (8714.01)	40	8	7	4	0	31	3	1	5	49
	BF	15	2676.23 (8780.28)	42	14	1	1	0	30	5	4	4	51
		21	2686.27 (8813.22)	39	9	1	2	0	36	6	3	4	45
		24	2696.30 (8846.13)	16	5	5	47	1	18	3	2	3	67
	Average			37	9	5	12	1	26	4	2	4	54
	Range			16–50	5–14	1–9	1–47	0–2	18–36	2–6	1–4	3–5	45–67

(*continued*)

Table S4. Continued

Well Name	Formation	Sample	Depth (m [ft])	Quartz (wt. %)	Albite (wt. %)	Calcite (wt. %)	Dolomite (wt. %)	Ankerite (wt. %)	Illite (wt. %)	Kaolinite (wt. %)	Chlorite (wt. %)	Pyrite (wt. %)	Brittleness Index (%)
13-20-51-14W5	SWS	2	2016.50 (6615.81)	37	8	7	2	0	33	6	3	5	43
		7	2023.30 (6638.12)	13	3	8	55	0	13	4	1	2	71
	BF	8	2071.70 (6796.92)	33	7	3	2	0	36	9	4	8	38
		10	2072.97 (6801.08)	29	7	18	1	0	33	6	2	4	33
		11	2073.50 (6802.82)	23	7	26	2	0	29	6	3	5	27
		15	2077.20 (6814.96)	43	10	1	1	0	31	7	4	2	49
	Average			30	7	10	11	0	29	6	3	4	43
	Range			13–43	3–10	1–26	1–55	0	13–36	4–9	1–4	2–8	27–71

See Figure 1. Total number of samples is 81. Sample 4 from well 07-19-45-06W5 was excluded.
Abbreviations: BF = Belle Fourche Formation; SWS = Second White Specks Formation.