

*The impact of rock composition on geomechanical properties of a shale formation: Middle and Upper Devonian Horn River Group shale, Northeast British Columbia, Canada*

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**Table S1.** The Concentrations of Major Oxides Including SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, MgO, CaO, Na<sub>2</sub>O, K<sub>2</sub>O, TiO<sub>2</sub>, P<sub>2</sub>O<sub>3</sub> and MnO of Samples From the Horn River Group Shale.

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
EOG Maxhamish	2955.5	9696.5	Muskwa	84.6	3.11	1.97	0.81	1.29	0.4	0.47	0.14	0.08	0.02
EOG Maxhamish	2956	9698.2	Muskwa	70.73	6.44	4.36	1.16	1.51	0.56	1.11	0.3	0.09	0.02
EOG Maxhamish	2965.2	9728.3	Muskwa	85.74	4.42	1.37	0.25	0.22	0.28	0.74	0.14	0.06	0.005
EOG Maxhamish	2967.5	9735.9	Muskwa	73.92	8.32	3.53	0.42	0.19	0.48	1.53	0.32	0.06	0.02
EOG Maxhamish	2968.3	9738.5	Muskwa	85.04	3.95	1.7	0.5	0.73	0.31	0.63	0.13	0.06	0.02
EOG Maxhamish	2969.98	9744.0	Muskwa	77.3	5.76	3.77	0.72	0.89	0.45	1.05	0.2	0.07	0.03
EOG Maxhamish	2970.94	9747.2	Muskwa	76.27	5.94	2.55	0.74	1.13	0.34	1.13	0.24	0.06	0.02
EOG Maxhamish	2971.91	9750.4	Muskwa	70.69	8.64	3.78	0.54	0.36	0.57	1.7	0.34	0.07	0.02
EOG Maxhamish	2972.9	9753.6	Otter Park	72.76	7.04	3.72	0.66	0.61	0.7	1.41	0.36	0.1	0.01
EOG Maxhamish	2973.9	9756.9	Otter Park	61.47	7.8	4.04	3.52	4.88	1.11	1.51	0.38	0.07	0.04
EOG Maxhamish	2978.16	9770.9	Otter Park	83.32	5.57	1.85	0.38	0.25	0.33	1.12	0.21	0.05	0.01
EOG Maxhamish	2980.1	9777.2	Otter Park	84.34	5.33	1.8	0.41	0.28	0.32	1.08	0.19	0.02	0.01
EOG Maxhamish	2982.2	9784.1	Otter Park	84.05	4.32	1.85	0.91	1.15	0.26	0.84	0.15	0.02	0.02
EOG Maxhamish	2985.61	9795.3	Otter Park	86.06	4.68	1.29	0.3	0.19	0.34	0.91	0.15	0.02	0.005
EOG Maxhamish	3000	9842.5	Otter Park	69.63	11.68	3.86	0.76	0.41	0.76	2.5	0.46	0.07	0.01
EOG Maxhamish	3001	9845.8	Otter Park	72.85	9.94	3.09	1.02	0.98	0.56	2.14	0.4	0.05	0.02
EOG Maxhamish	3002	9849.1	Otter Park	76.21	9.03	2.17	0.92	0.85	0.52	1.9	0.36	0.04	0.01
EOG Maxhamish	3003	9852.4	Otter Park	71.84	12.07	2.55	0.82	0.39	0.64	2.54	0.47	0.06	0.01
EOG Maxhamish	3004.1	9856.0	Otter Park	76.88	9.18	2.07	0.71	0.55	0.6	1.91	0.39	0.04	0.01
EOG Maxhamish	3005	9858.9	Otter Park	75.93	9.65	2.04	0.69	0.4	0.61	2.02	0.42	0.04	0.005
EOG Maxhamish	3006	9862.2	Otter Park	50.77	9.07	6.64	5.12	8.41	0.66	1.91	0.36	0.02	0.07
EOG Maxhamish	3007	9865.5	Otter Park	80.54	6.86	2.38	0.68	0.65	0.46	1.38	0.28	0.02	0.01
EOG Maxhamish	3008	9868.8	Otter Park	75.59	9.74	2.23	0.65	0.35	0.6	2.06	0.41	0.03	0.01
EOG Maxhamish	3009	9872.0	Otter Park	75.31	10.34	2.16	0.73	0.41	0.6	2.2	0.41	0.02	0.01
EOG Maxhamish	3010	9875.3	Otter Park	81.31	6.94	1.6	0.56	0.46	0.49	1.42	0.28	0.01	0.01
EOG Maxhamish	3011	9878.6	Otter Park	76.51	8.51	2.22	0.87	0.79	0.6	1.78	0.35	0.03	0.02
EOG Maxhamish	3012	9881.9	Otter Park	69.28	9.25	3.28	2.04	2.69	0.56	1.96	0.39	0.02	0.03
EOG Maxhamish	3013	9885.2	Otter Park	64.1	11.72	5.61	1.95	2.25	0.68	2.52	0.46	0.04	0.03
EOG Maxhamish	3014.02	9888.5	Otter Park	65.76	13.35	4.9	1.25	0.93	0.64	2.87	0.52	0.12	0.02
EOG Maxhamish	3015	9891.7	Otter Park	74.6	10	2.84	0.74	0.4	0.56	2.11	0.4	0.04	0.01
EOG Maxhamish	3016	9895.0	Otter Park	67.65	14.38	3.74	1.01	0.4	0.61	3.1	0.57	0.07	0.01
EOG Maxhamish	3017.03	9898.4	Otter Park	22.88	3.91	8.01	11.42	20.92	0.59	0.68	0.15	0.06	0.14
EOG Maxhamish	3018	9901.6	Otter Park	73.33	10.14	3.53	0.69	0.38	0.58	2.13	0.42	0.05	0.005

(continued)

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
EOG Maxhamish	3019.1	9905.2	Otter Park	68.51	12.61	4.07	0.91	0.48	0.71	2.69	0.52	0.08	0.01
EOG Maxhamish	3020	9908.1	Otter Park	68.93	11.45	3.78	1.24	1.13	0.67	2.46	0.49	0.06	0.02
EOG Maxhamish	3021.1	9911.7	Otter Park	60.17	15.82	6.15	1.12	0.5	0.7	3.39	0.64	0.07	0.02
EOG Maxhamish	3022	9914.7	Otter Park	68.55	12.53	3.74	0.9	0.56	0.73	2.7	0.53	0.08	0.01
EOG Maxhamish	3022.9	9917.7	Otter Park	51.7	11.13	7.34	3.75	6.84	0.62	2.34	0.43	0.11	0.05
EOG Maxhamish	3024	9921.3	Otter Park	73.01	10.56	2.8	0.74	0.48	0.73	2.24	0.42	0.06	0.01
EOG Maxhamish	3025	9924.5	Otter Park	68.97	12.4	3.05	1.01	0.8	0.61	2.68	0.51	0.09	0.01
EOG Maxhamish	3026	9927.8	Otter Park	77.3	7.7	2.11	0.48	1.08	0.59	1.6	0.31	0.07	0.005
EOG Maxhamish	3027	9931.1	Otter Park	59.21	9.09	4.19	3.75	6.11	0.69	1.88	0.35	0.06	0.05
EOG Maxhamish	3028	9934.4	Otter Park	76.8	6.24	1.73	0.45	2.77	0.63	1.21	0.24	0.08	0.005
EOG Maxhamish	3029	9937.7	Otter Park	72.18	7.44	2.39	0.53	3.92	0.57	1.52	0.31	0.06	0.01
EOG Maxhamish	3030	9940.9	Otter Park	69.33	8.34	2.29	0.71	4.59	0.58	1.72	0.35	0.08	0.01
EOG Maxhamish	3031	9944.2	Otter Park	62.19	8.16	8.53	0.71	3.96	0.52	1.75	0.34	0.08	0.01
EOG Maxhamish	3032	9947.5	Otter Park	73.94	7.05	2.36	0.66	2.55	0.66	1.45	0.31	0.11	0.01
EOG Maxhamish	3033	9950.8	Otter Park	68.06	8.85	2.56	0.77	4.32	0.58	1.87	0.37	0.09	0.01
EOG Maxhamish	3034	9954.1	Otter Park	56.67	10.64	4.39	1.59	6.59	1.09	2.36	0.52	0.11	0.02
EOG Maxhamish	3035	9957.3	Otter Park	31.42	5.26	4.15	7.5	21.17	0.82	1.04	0.25	0.09	0.12
EOG Maxhamish	3036	9960.6	Otter Park	66.54	11.31	3.39	0.8	2.07	0.71	2.51	0.46	0.15	0.01
EOG Maxhamish	3037	9963.9	Otter Park	70	12.15	2.96	0.8	1.32	0.52	2.68	0.46	0.05	0.005
EOG Maxhamish	3038.5	9968.8	Otter Park	58.89	14.92	6.86	1.17	1.52	0.62	3.31	0.58	0.07	0.01
EOG Maxhamish	3039.5	9972.1	Otter Park	70.42	7.73	2.94	1.18	3.78	0.63	1.75	0.34	0.09	0.01
EOG Maxhamish	3041.2	9977.7	Evie	74.22	4.2	1.51	0.99	5.87	0.34	0.91	0.19	0.1	0.01
EOG Maxhamish	3044	9986.9	Evie	24.3	0.73	0.39	0.9	38.7	0.15	0.08	0.03	0.13	0.02
EOG Maxhamish	3047	9996.7	Evie	70.19	2.59	1.8	0.86	10.67	0.19	0.59	0.12	0.06	0.005
EOG Maxhamish	3048.1	10000.3	Evie	25.48	1.24	0.87	0.88	37.69	0.18	0.22	0.05	0.09	0.01
EOG Maxhamish	3050	10006.6	Evie	62.38	9.78	3.22	1.61	6.06	0.62	2.29	0.45	0.05	0.01
EOG Maxhamish	3051.56	10011.7	Evie	37.72	2.14	1.39	0.85	30.83	0.25	0.5	0.08	0.06	0.02
EOG Maxhamish	3052.4	10014.4	Evie	66.5	6.36	2.43	1.24	7.08	0.49	1.54	0.31	0.09	0.02
EOG Maxhamish	3053.5	10018.0	Evie	67.16	7.74	3.21	0.82	5.25	0.39	1.89	0.33	0.06	0.01
EOG Maxhamish	3054.5	10021.3	Evie	62.81	6.51	2.78	1.47	9.17	0.47	1.58	0.31	0.1	0.02
EOG Maxhamish	3055.37	10024.2	Evie	67.67	6.22	2.26	0.66	7.27	0.35	1.45	0.28	0.09	0.01
EOG Maxhamish	3056.5	10027.9	Evie	54.93	7.12	2.73	1.25	13.3	0.44	1.75	0.31	0.1	0.01
EOG Maxhamish	3057.45	10031.0	Evie	23.62	3.12	1.44	11.88	24.84	0.32	0.73	0.15	0.04	0.08
EOG Maxhamish	3058.4	10034.1	Evie	12.29	1.52	0.85	2.18	43.8	0.27	0.29	0.07	0.04	0.03
EOG Maxhamish	3059.5	10037.7	Evie	63.01	10.86	4.44	1.14	4.42	0.63	2.64	0.48	0.08	0.01
EOG Maxhamish	3060.5	10041.0	Evie	8.8	1.61	0.56	1.06	47.73	0.59	0.18	0.07	0.09	0.03
EOG Maxhamish	3061.49	10044.3	Evie	56.8	4.32	1.48	0.89	15.54	0.27	1.05	0.22	0.08	0.005
EOG Maxhamish	3062.5	10047.6	Evie	62.68	5.71	2.11	0.81	9.88	0.34	1.42	0.3	0.11	0.01
EOG Maxhamish	3063.4	10050.5	Evie	60.2	5.93	2.15	0.75	11.01	0.4	1.47	0.31	0.12	0.01
EOG Maxhamish	3066	10059.1	Evie	11.09	1.69	0.58	6.75	38.28	0.28	0.36	0.07	0.19	0.04
EOG Maxhamish	3067	10062.3	Evie	42.8	3.18	1.28	0.88	24.68	0.25	0.84	0.16	0.1	0.01
EOG Maxhamish	3069.31	10069.9	Evie	38.36	1.12	0.48	1.08	29.52	0.1	0.25	0.05	0.1	0.01
EOG Maxhamish	3071	10075.5	Evie	54.2	4.36	1.92	1.18	16.74	0.34	1.12	0.19	0.17	0.02
EOG Maxhamish	3072.1	10079.1	Evie	39.44	3.75	1.65	2.18	25.19	0.08	1.07	0.19	0.08	0.02
Imperial Komie	2224.55	7298.4	Muskwa	75.98	8.1	2.62	1.06	1.25	0.4	1.63	0.37	0.08	0.02

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
Imperial Komie	2226.56	7305.0	Muskwa	15.51	3.41	5.33	13.32	24.43	0.18	0.71	0.18	0.11	0.24
Imperial Komie	2228.54	7311.5	Muskwa	70.78	11.61	3.65	0.95	0.6	0.64	2.4	0.47	0.08	0.01
Imperial Komie	2230.54	7318.1	Muskwa	75.74	9.01	2.29	0.97	0.95	0.46	1.77	0.34	0.07	0.01
Imperial Komie	2233.13	7326.5	Muskwa	74.49	9.75	2.82	0.8	0.63	0.57	1.83	0.41	0.11	0.01
Imperial Komie	2235.03	7332.8	Muskwa	84.46	4.33	1.43	0.5	0.59	0.23	0.82	0.19	0.07	0.005
Imperial Komie	2237.03	7339.3	Muskwa	76.79	4.13	7.25	0.63	0.89	0.26	0.74	0.18	0.06	0.005
Imperial Komie	2238.96	7345.7	Muskwa	78.92	6.38	2.02	0.64	0.63	0.42	1.15	0.27	0.08	0.005
Imperial Komie	2240.96	7352.2	Muskwa	83.69	5.3	1.65	0.53	0.6	0.53	0.89	0.2	0.06	0.005
Imperial Komie	2242.97	7358.8	Muskwa	77.97	6.72	2.02	0.63	0.58	0.45	1.25	0.29	0.09	0.01
Imperial Komie	2245.03	7365.6	Muskwa	80.1	6.22	2.24	0.45	0.34	0.35	1.11	0.25	0.09	0.005
Imperial Komie	2247.05	7372.2	Muskwa	67.23	13.51	3.21	1.12	0.67	0.71	2.77	0.59	0.15	0.01
Imperial Komie	2249.55	7380.4	Muskwa	39.69	5.73	3.35	7.69	16.59	0.49	1.11	0.32	0.17	0.1
Imperial Komie	2251.55	7387.0	Muskwa	75.43	5.01	2.39	0.85	2.14	0.5	0.91	0.26	0.07	0.01
Imperial Komie	2253.53	7393.5	Muskwa	46.23	7.59	3.14	6.2	12.77	0.65	1.5	0.38	0.13	0.09
Imperial Komie	2257.55	7406.7	Muskwa	64.18	15.67	3.45	1.33	0.88	0.64	3.29	0.65	0.11	0.02
Imperial Komie	2259.53	7413.2	Muskwa	35.67	7.5	11.4	5.37	10.81	0.9	1.33	0.41	0.08	0.09
Imperial Komie	2261.55	7419.8	Muskwa	72.64	10.11	3.3	0.91	0.96	0.63	1.94	0.42	0.09	0.01
Imperial Komie	2263.54	7426.3	Muskwa	53.5	15.21	4.84	3.24	5.59	0.63	3.23	0.63	0.1	0.06
Imperial Komie	2265.55	7432.9	Muskwa	53.52	15.26	5.34	3.14	5.65	0.62	3.18	0.68	0.11	0.05
Imperial Komie	2267.53	7439.4	Muskwa	73.39	7.25	3.56	0.96	3.17	0.46	1.39	0.36	0.09	0.02
Imperial Komie	2269.54	7446.0	Muskwa	70.1	9.01	3.66	1.11	3.4	0.48	1.75	0.41	0.1	0.02
Imperial Komie	2271.55	7452.6	Muskwa	64.9	12.05	4.48	1.42	3.23	0.6	2.35	0.55	0.09	0.02
Imperial Komie	2274.05	7460.8	Muskwa	58.65	17.1	4.68	1.91	2.57	0.85	3.51	0.79	0.1	0.03
Imperial Komie	2276.03	7467.3	Otter Park	49.8	13.98	3.77	1.85	10.41	0.84	2.86	0.62	0.09	0.04
Imperial Komie	2278.05	7473.9	Otter Park	39.41	10.7	4.05	2.93	18.39	0.59	2.2	0.48	0.09	0.06
Imperial Komie	2280.05	7480.5	Otter Park	34.96	8.89	3.53	3.13	22.43	0.53	1.8	0.4	0.09	0.06
Imperial Komie	2282.55	7488.7	Otter Park	72.62	6.58	2.48	0.83	4.93	0.41	1.25	0.29	0.07	0.02
Imperial Komie	2284.64	7495.6	Otter Park	39.17	12.09	7.48	4.65	13.09	0.53	2.48	0.53	0.09	0.11
Imperial Komie	2286.55	7501.8	Otter Park	53.43	17.04	5.68	2.14	5.7	0.65	3.3	0.74	0.1	0.05
Imperial Komie	2288.545	7508.3	Otter Park	51.77	17.02	6.06	2.34	6.24	0.65	3.34	0.74	0.11	0.06
Imperial Komie	2290.55	7514.9	Otter Park	51.36	16.38	5.65	2.29	7.16	0.66	3.23	0.73	0.1	0.06
Imperial Komie	2292.55	7521.5	Otter Park	50.46	16.06	5.66	2.29	7.88	0.63	3.19	0.72	0.1	0.07
Imperial Komie	2294.55	7528.1	Otter Park	48.95	15.87	5.49	2.33	9.14	0.63	3.06	0.69	0.09	0.06
Imperial Komie	2296.55	7534.6	Otter Park	50.04	15.93	5.35	2.24	8.73	0.65	3.1	0.68	0.1	0.06
Imperial Komie	2298.54	7541.1	Otter Park	43.05	13.16	4.24	2.05	15.58	0.6	2.55	0.56	0.1	0.05
Imperial Komie	2300.05	7546.1	Otter Park	39.53	11.94	3.63	2.01	19.03	0.61	2.33	0.49	0.08	0.05
Imperial Komie	2302.04	7552.6	Otter Park	27.6	7.97	5.16	4.69	24.27	0.46	1.59	0.33	0.06	0.08
Imperial Komie	2304.54	7560.8	Otter Park	52.56	11.61	2.71	1.47	12.37	0.76	2.33	0.47	0.09	0.03
Imperial Komie	2306.52	7567.3	Otter Park	52.53	13.51	2.96	1.58	11.02	0.86	2.77	0.53	0.07	0.03
Imperial Komie	2308.55	7574.0	Otter Park	31.07	7.62	3.29	2.99	26.07	1	1.39	0.27	0.06	0.05
Imperial Komie	2310.58	7580.6	Otter Park	58.53	12.72	3	1.39	7.58	0.87	2.55	0.49	0.1	0.02
Imperial Komie	2312.50	7587	Otter Park	61.48	10.64	2.52	1.16	8.31	0.85	2.08	0.42	0.08	0.02
Imperial Komie	2315.05	7595.3	Otter Park	49.72	10.19	2.26	1.4	15.82	0.77	1.89	0.39	0.09	0.02
Imperial Komie	2317.05	7601.9	Otter Park	29.69	7.02	6.66	6.47	20.25	0.32	1.39	0.28	0.1	0.1
Imperial Komie	2319.05	7608.4	Otter Park	66.66	12.69	3.03	1.3	3.04	0.54	2.44	0.54	0.08	0.02

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
Imperial Komie	2321.05	7615.0	Otter Park	59.14	17.74	5.04	1.81	2.65	0.64	3.46	0.68	0.09	0.03
Imperial Komie	2322.94	7621.2	Otter Park	35.01	9.23	3.89	2.37	22.82	0.72	1.74	0.31	0.07	0.06
Imperial Komie	2325.05	7628.1	Otter Park	54.6	15.86	5.33	2.12	6.31	0.61	3.08	0.64	0.09	0.05
Imperial Komie	2327.07	7634.8	Otter Park	58.37	15.64	5.82	1.95	3.84	0.63	3.01	0.63	0.1	0.04
Imperial Komie	2329.01	7641.1	Otter Park	61.48	15.7	4.3	1.61	3.08	0.61	3.13	0.64	0.08	0.03
Imperial Komie	2331.05	7647.8	Otter Park	54.23	16.02	3.81	1.68	7.69	0.76	3.26	0.59	0.08	0.03
Imperial Komie	2333	7654.2	Otter Park	47.26	12.86	4.48	3.6	10.41	0.67	2.62	0.52	0.1	0.06
Imperial Komie	2335.05	7660.9	Otter Park	62.38	14.46	3.13	1.33	3.86	0.72	2.94	0.62	0.1	0.02
Imperial Komie	2337.05	7667.5	Otter Park	58.03	15.25	3.08	1.55	6.18	0.77	3.13	0.64	0.12	0.03
Imperial Komie	2339.04	7674.0	Otter Park	67.09	13.77	3.43	1.11	1.79	0.57	2.77	0.54	0.08	0.02
Imperial Komie	2341.55	7682.3	Otter Park	65.08	8.31	3.34	1.48	4.49	0.61	1.59	0.38	0.08	0.02
Imperial Komie	2344.05	7690.5	Otter Park	59	8.25	3.54	2.6	7.49	0.79	1.62	0.42	0.09	0.03
Imperial Komie	2346.08	7697.1	Otter Park	33.54	5.71	6.58	8.05	16.51	0.52	1.09	0.28	0.12	0.17
Imperial Komie	2348.03	7703.5	Otter Park	68.62	13.29	2.96	1.11	0.63	0.56	2.73	0.51	0.08	0.01
Imperial Komie	2350.06	7710.2	Otter Park	66.12	16.34	3.1	1.23	0.42	0.63	3.33	0.6	0.05	0.01
Imperial Komie	2352.05	7716.7	Otter Park	60.54	19.83	4.67	1.45	0.35	0.76	4.05	0.68	0.05	0.01
Imperial Komie	2354.02	7723.2	Otter Park	59.27	19.65	4.24	1.69	1.09	0.86	4.19	0.7	0.06	0.02
Imperial Komie	2356.95	7732.8	Otter Park	52.02	18.8	7.01	2.57	3.49	0.47	3.87	0.66	0.08	0.05
Imperial Komie	2359.61	7741.5	Otter Park	57.14	20.96	3.12	1.87	1.77	0.44	4.69	0.67	0.08	0.04
Imperial Komie	2361.46	7747.6	Otter Park	54.41	19.54	5.23	2.29	2.59	0.61	4.23	0.65	0.08	0.05
Imperial Komie	2363.51	7754.3	Otter Park	59.12	21.12	3.1	1.39	0.61	0.75	4.53	0.71	0.08	0.01
Imperial Komie	2365.05	7759.4	Otter Park	56.58	19.58	4.14	1.86	1.81	0.79	4.17	0.68	0.08	0.03
Imperial Komie	2365.89	7762.1	Otter Park	57.39	18.56	4.57	1.75	1.54	1.07	4	0.6	0.08	0.02
Imperial Komie	2368.45	7770.5	Evie	84.49	2.98	1.04	0.33	1.69	0.26	0.48	0.14	0.07	0.005
Imperial Komie	2370.95	7778.7	Evie	13.85	0.71	1.29	8.14	37.34	0.28	0.07	0.04	0.08	0.09
Imperial Komie	2373.03	7785.5	Evie	57.94	18.5	4.66	1.92	2.5	0.79	3.87	0.73	0.06	0.02
Imperial Komie	2375.06	7792.2	Evie	75.6	5.05	1.7	0.56	2.72	0.45	0.97	0.22	0.07	0.005
Imperial Komie	2377.03	7798.7	Evie	67.8	7.3	2.37	0.85	5.19	0.76	1.51	0.34	0.17	0.01
Imperial Komie	2379.04	7805.3	Evie	56.32	10.28	3.19	2.3	7.65	0.98	2.2	0.47	0.09	0.02
Imperial Komie	2380.98	7811.6	Evie	15.25	2.1	2.06	15.19	25.87	0.48	0.23	0.1	0.1	0.09
Imperial Komie	2383.04	7818.4	Evie	52.47	7.51	2.81	1.8	14.14	0.63	1.46	0.3	0.12	0.02
Imperial Komie	2385.40	7826.1	Evie	62.91	5.65	1.77	0.99	8.58	0.42	1.1	0.29	0.09	0.01
Imperial Komie	2387.55	7833.2	Evie	12.29	1.32	0.46	2.3	42.78	0.43	0.07	0.07	0.06	0.02
Imperial Komie	2390.05	7841.4	Evie	12.53	0.74	0.33	0.95	46.12	0.24	0.09	0.04	0.1	0.01
Imperial Komie	2392.1	7848.1	Evie	24.02	1.74	0.63	1.3	38.15	0.17	0.48	0.08	0.11	0.005
Imperial Komie	2394.02	7854.4	Evie	3.05	0.2	0.1	0.57	53.11	0.03	0.005	0.01	0.03	0.005
Imperial Komie	2396.05	7861.1	Evie	7.58	0.61	0.32	0.85	48.54	0.02	0.11	0.03	0.05	0.005
Nexen Gote	2392.5	7849.4	Muskwa	63.84	15.36	5.61	1.89	0.63	0.53	2.84	0.63	0.04	0.03
Nexen Gote	2395.25	7858.4	Muskwa	57.37	15.23	5.09	2.97	3.48	0.51	2.95	0.66	0.04	0.07
Nexen Gote	2397.05	7864.3	Muskwa	59.4	15.52	5.68	2.63	2.55	0.54	2.94	0.66	0.08	0.06
Nexen Gote	2399.01	7870.8	Muskwa	67.37	12.88	5.18	1.74	0.99	0.52	2.37	0.53	0.09	0.03
Nexen Gote	2401.05	7877.5	Muskwa	59.81	13.85	5.16	2.8	3.44	0.56	2.68	0.61	0.08	0.05
Nexen Gote	2403.04	7884.0	Muskwa	70.74	10.1	4.17	1.8	2.03	0.44	1.97	0.46	0.08	0.03
Nexen Gote	2405.06	7890.6	Muskwa	73.3	10.39	3.42	1.35	1.03	0.42	2.05	0.44	0.06	0.02
Nexen Gote	2407.04	7897.1	Muskwa	74.01	9.51	3.22	1.12	0.81	0.44	1.89	0.41	0.08	0.01

(continued)

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
Nexen Gote	2409.015	7903.6	Muskwa	73.75	9.84	3.61	1.03	0.51	0.43	1.9	0.39	0.09	0.01
Nexen Gote	2411	7910.1	Muskwa	74.54	8.8	4.2	0.75	0.47	0.56	1.71	0.35	0.1	0.01
Nexen Gote	2413.15	7917.2	Muskwa	81.36	6.7	1.99	0.46	0.27	0.37	1.43	0.27	0.08	0.005
Nexen Gote	2415.06	7923.4	Muskwa	83.46	5.84	1.86	0.46	0.45	0.44	1.24	0.26	0.1	0.01
Nexen Gote	2417.05	7930.0	Muskwa	81.45	6.26	2.64	0.7	0.8	0.6	1.31	0.26	0.06	0.01
Nexen Gote	2419.05	7936.5	Muskwa	80.57	7.51	2.18	0.55	0.4	0.51	1.46	0.31	0.1	0.005
Nexen Gote	2421.04	7943.1	Muskwa	83.53	5.28	2.88	0.41	0.41	0.43	1.06	0.23	0.08	0.01
Nexen Gote	2423.05	7949.6	Muskwa	86.36	4.44	1.96	0.35	0.34	0.38	0.91	0.2	0.06	0.01
Nexen Gote	2425.06	7956.2	Muskwa	68.52	8.98	6.86	0.59	0.33	0.88	1.73	0.41	0.07	0.02
Nexen Gote	2427.14	7963.1	Muskwa	74.42	8.2	4.35	0.54	0.34	0.61	1.64	0.39	0.08	0.01
Nexen Gote	2429.07	7969.4	Muskwa	61.54	9.55	11.46	0.67	0.45	0.82	1.86	0.49	0.09	0.02
Nexen Gote	2431.05	7975.9	Muskwa	75.01	7.71	3.58	0.95	1.02	0.69	1.55	0.35	0.09	0.02
Nexen Gote	2432.99	7982.3	Muskwa	80.05	5.29	1.94	0.84	1.01	0.61	1.05	0.24	0.06	0.01
Nexen Gote	2435.06	7989.1	Muskwa	65.11	10.05	4.93	1.84	2.18	1.29	1.87	0.5	0.08	0.02
Nexen Gote	2436.9	7995.1	Muskwa	84.6	4.15	1.59	0.36	0.3	0.3	0.89	0.16	0.04	0.005
Nexen Gote	2439.05	8002.1	Muskwa	70.94	10.26	4.52	0.68	0.32	0.85	1.97	0.41	0.08	0.01
Nexen Gote	2441.05	8008.7	Muskwa	66.33	11.87	5.17	0.81	0.3	1.02	2.34	0.54	0.1	0.02
Nexen Gote	2442.965	8015.0	Muskwa	85.16	5.33	1.89	0.41	0.29	0.34	1.14	0.2	0.05	0.005
Nexen Gote	2445.05	8021.8	Muskwa	75.49	9.39	2.57	0.68	0.32	0.52	1.97	0.4	0.04	0.01
Nexen Gote	2447.07	8028.4	Muskwa	81.22	6.88	2.02	0.52	0.33	0.46	1.47	0.29	0.05	0.005
Nexen Gote	2449.09	8035.1	Muskwa	76.31	8.43	2.66	0.67	0.47	0.55	1.75	0.37	0.05	0.01
Nexen Gote	2450.95	8041.2	Muskwa	79.28	7.17	2.45	0.62	0.57	0.62	1.47	0.3	0.06	0.01
Nexen Gote	2453.05	8048.1	Muskwa	77.1	7.47	3.16	0.65	0.51	0.56	1.42	0.28	0.05	0.005
Nexen Gote	2455.05	8054.6	Muskwa	79.63	6.86	2.11	0.58	0.54	0.51	1.29	0.26	0.05	0.005
Nexen Gote	2457.05	8061.2	Muskwa	41.51	6.15	4.21	7.5	14.61	1.26	1.09	0.33	0.06	0.08
Nexen Gote	2459.05	8067.7	Muskwa	69.73	11.6	3.8	0.84	0.85	0.83	2.29	0.54	0.07	0.01
Nexen Gote	2461.05	8074.3	Otter Park	63.62	4.66	4.01	3.32	8.37	0.65	0.79	0.22	0.1	0.04
Nexen Gote	2463.01	8080.7	Otter Park	68.26	7.09	4.39	1.8	5.24	0.78	1.28	0.35	0.09	0.02
Nexen Gote	2465	8087.3	Otter Park	67.96	9.01	4.99	0.92	3.36	0.79	1.67	0.42	0.08	0.01
Nexen Gote	2467.08	8094.1	Otter Park	61.2	7.56	4.06	2.56	7.56	0.9	1.42	0.37	0.09	0.04
Nexen Gote	2469.05	8100.6	Otter Park	78.18	5.69	2.44	0.79	2.89	0.49	1.05	0.25	0.08	0.01
Nexen Gote	2471.05	8107.1	Otter Park	66.2	10.32	4.09	1.36	3.4	0.78	2.07	0.45	0.08	0.02
Nexen Gote	2473.07	8113.7	Otter Park	63.69	11.81	3.72	1.24	3.79	0.9	2.48	0.52	0.1	0.02
Nexen Gote	2475.06	8120.3	Otter Park	66.73	8.46	2.87	1.18	6.17	0.67	1.63	0.35	0.08	0.02
Nexen Gote	2477.07	8126.9	Otter Park	64.76	11.48	3.72	1.12	4.13	0.72	2.33	0.5	0.1	0.02
Nexen Gote	2479.06	8133.4	Otter Park	57.07	9.06	7.68	1.2	7.5	0.8	1.73	0.41	0.12	0.02
Nexen Gote	2480.98	8139.7	Otter Park	69.98	7.76	2.69	0.79	5.41	0.62	1.49	0.35	0.09	0.02
Nexen Gote	2483.05	8146.5	Otter Park	72.14	6.38	2.21	0.69	5.61	0.6	1.16	0.28	0.09	0.02
Nexen Gote	2485.05	8153.1	Otter Park	62.94	10.46	3.45	1.51	5.5	0.65	2.15	0.43	0.14	0.03
Nexen Gote	2486.94	8159.3	Otter Park	62.85	11.7	3.47	1.48	4.68	0.7	2.4	0.48	0.11	0.03
Nexen Gote	2493.05	8179.3	Otter Park	50.82	6.92	16.4	0.87	5.48	0.55	1.35	0.3	0.07	0.02
Nexen Gote	2495.07	8185.9	Otter Park	66.2	7.2	2.56	0.98	6.21	0.66	1.39	0.31	0.11	0.02
Nexen Gote	2497.02	8192.3	Otter Park	64.96	7.85	3.59	1.33	4.62	0.89	1.53	0.38	0.11	0.02
Nexen Gote	2499.05	8199.0	Otter Park	62.23	8.71	4.55	1.45	4.38	0.95	1.8	0.43	0.09	0.02
Nexen Gote	2501.03	8205.5	Otter Park	64.11	8.12	2.69	1.45	4.39	0.86	1.64	0.37	0.12	0.02

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
Nexen Gote	2503.07	8212.2	Otter Park	56.82	9.17	3.57	1.36	9.05	0.95	1.81	0.41	0.14	0.02
Nexen Gote	2505.05	8218.7	Otter Park	56.8	11.99	3.5	0.99	7.86	0.69	2.59	0.47	0.13	0.02
Nexen Gote	2507.04	8225.2	Otter Park	49.31	14.26	4.86	3.16	8.05	0.57	3.12	0.51	0.13	0.05
Nexen Gote	2509.04	8231.8	Otter Park	66.27	13.33	4.26	1.13	1.13	0.57	2.83	0.52	0.1	0.01
Nexen Gote	2510.95	8238.0	Otter Park	60.81	14.63	4.61	1.84	2.87	0.57	3.18	0.56	0.08	0.03
Nexen Gote	2513.005	8244.8	Otter Park	65.14	17.3	2.99	1.11	0.49	0.61	3.73	0.64	0.08	0.01
Nexen Gote	2515.05	8251.5	Otter Park	62.23	19.69	3.07	1.2	0.4	0.73	4.35	0.67	0.06	0.01
Nexen Gote	2517.05	8258.0	Otter Park	26.37	7.35	7.78	8.49	19.01	0.51	1.58	0.27	0.06	0.11
Nexen Gote	2519.05	8264.6	Otter Park	56.43	18.97	5.58	1.72	1.73	0.7	4.28	0.66	0.06	0.03
Nexen Gote	2521.05	8271.2	Otter Park	56.22	17.61	5.52	1.92	2.32	0.7	3.95	0.59	0.08	0.02
Nexen Gote	2523.06	8277.8	Otter Park	38.73	9.35	12.88	5.46	10.97	0.52	2	0.35	0.07	0.06
Nexen Gote	2525.30	8285.1	Otter Park	71.45	5.8	2.97	1.35	3.5	0.56	1.1	0.29	0.1	0.01
Nexen Gote	2526.92	8290.4	Otter Park	25.62	0.46	0.78	0.88	39.8	0.13	0.06	0.03	0.02	0.02
Nexen Gote	2530.09	8300.8	Evie	77.84	0.51	0.95	0.26	10.98	0.06	0.08	0.02	0.03	0.005
Nexen Gote	2532.18	8307.7	Evie	68.85	4.59	1.7	1.08	8.61	0.33	1.04	0.21	0.09	0.005
Nexen Gote	2533.975	8313.6	Evie	2.1	0.04	0.09	0.67	54.14	0.03	0.01	0.005	0.02	0.01
Nexen Gote	2535.91	8319.9	Evie	57.91	5.07	1.86	1.01	13.81	0.4	1.14	0.23	0.07	0.01
Nexen Gote	2538.05	8326.9	Evie	52.48	12.19	4.23	1.68	7.91	0.95	2.91	0.62	0.11	0.02
Nexen Gote	2539.99	8333.3	Evie	23.84	2.7	1.95	10.42	26.32	0.4	0.56	0.13	0.07	0.07
Nexen Gote	2542.06	8340.1	Evie	66.19	7.34	2.32	0.87	7.18	0.58	1.56	0.34	0.12	0.01
Nexen Gote	2544.09	8346.8	Evie	69.31	6.84	2.39	0.77	5.35	0.79	1.28	0.32	0.08	0.005
Nexen Gote	2545.93	8352.8	Evie	25.84	4.06	1.45	2.01	33.83	0.6	0.86	0.19	0.09	0.02
Nexen Gote	2548.05	8359.7	Evie	13.42	2.27	0.85	8.2	35.33	0.42	0.48	0.12	0.04	0.05
Nexen Gote	2550.05	8366.3	Evie	54.12	3.74	1.15	0.96	17.39	0.29	0.85	0.21	0.1	0.005
Nexen Gote	2552.05	8372.9	Evie	64.47	3.87	1.35	0.66	10.42	0.31	0.9	0.21	0.08	0.005
Nexen Gote	2554.06	8379.5	Evie	54.25	5.73	2.02	0.95	14.71	0.26	1.41	0.28	0.11	0.005
Nexen Gote	2556.04	8386.0	Evie	51.23	3.65	1.56	0.67	16.19	0.24	0.95	0.17	0.09	0.005
Nexen Gote	2558.90	8395.4	Evie	76.57	1.96	1.02	0.5	8.53	0.14	0.47	0.08	0.08	0.005
Nexen Gote	2561.05	8402.4	Evie	45	4.14	1.71	2.75	21.44	0.32	1.21	0.21	0.12	0.02
Nexen Gote	2564.66	8414.3	Evie	73.98	2.36	1.24	0.49	8.59	0.18	0.58	0.13	0.07	0.005
Nexen Gote	2566.57	8420.5	Evie	36.81	3.95	1.53	0.86	28.9	0.34	1.15	0.21	0.09	0.005
Nexen Gote	2568.94	8428.3	Evie	54.96	4.58	1.73	1.4	16.78	0.3	1.31	0.23	0.08	0.01
Nexen Gote	2577.21	8455.4	Evie	64.15	3.02	1.45	0.71	12.19	0.21	0.74	0.15	0.1	0.005
ConocoPhillips McAdam	2719.59	8922.5	Muskwa	61.97	13.21	5.65	2.11	1.77	0.55	2.56	0.57	0.09	0.03
ConocoPhillips McAdam	2721.66	8929.3	Muskwa	70.92	11.45	3.84	1.42	0.94	0.42	2.09	0.46	0.08	0.02
ConocoPhillips McAdam	2723.66	8935.9	Muskwa	63.19	9.92	4.14	3.1	4.54	0.46	1.98	0.48	0.07	0.05
ConocoPhillips McAdam	2725.7	8942.6	Muskwa	72.81	10.38	2.8	1.29	1.12	0.42	2.03	0.45	0.08	0.02
ConocoPhillips McAdam	2728.19	8950.8	Muskwa	71.23	10.99	3.08	1.1	0.77	0.46	2.18	0.45	0.08	0.01
ConocoPhillips McAdam	2730.44	8958.1	Muskwa	70.96	10.05	3.09	1.41	1.48	0.41	1.98	0.45	0.1	0.02

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
ConocoPhillips McAdam	2733.95	8969.7	Muskwa	77.96	7.81	2.42	0.52	0.28	0.34	1.45	0.32	0.08	0.005
ConocoPhillips McAdam	2736.2	8977.0	Muskwa	58.97	4.99	3.62	5.25	8.33	0.26	0.95	0.23	0.08	0.06
ConocoPhillips McAdam	2739.45	8987.7	Muskwa	82.33	5.72	1.88	0.72	0.91	0.38	1.06	0.26	0.08	0.01
ConocoPhillips McAdam	2742.3	8997.0	Muskwa	89.38	3.37	1.03	0.28	0.26	0.2	0.61	0.14	0.05	0.005
ConocoPhillips McAdam	2744.58	9004.5	Muskwa	78.24	7.25	2.47	0.7	0.8	0.52	1.38	0.29	0.07	0.01
ConocoPhillips McAdam	2746.9	9012.1	Muskwa	87.26	4.18	1.23	0.46	0.54	0.25	0.75	0.15	0.04	0.005
ConocoPhillips McAdam	2748.96	9018.9	Muskwa	81.01	6.37	2.46	0.53	0.53	0.45	1.16	0.21	0.07	0.005
ConocoPhillips McAdam	2751.35	9026.7	Muskwa	87.22	3.79	1.3	0.23	0.2	0.24	0.64	0.14	0.05	0.005
ConocoPhillips McAdam	2753.78	9034.7	Muskwa	80.6	6.17	1.96	0.38	0.26	0.42	1.09	0.22	0.09	0.005
ConocoPhillips McAdam	2755.8	9041.3	Muskwa	59.51	11	6.71	1.95	2.34	1.28	2.01	0.54	0.08	0.02
ConocoPhillips McAdam	2758.06	9048.8	Muskwa	81.61	5.93	1.36	0.49	0.43	0.34	1.08	0.25	0.07	0.005
ConocoPhillips McAdam	2760.34	9056.2	Muskwa	82.99	5.28	1.45	0.46	0.6	0.5	0.9	0.19	0.08	0.005
ConocoPhillips McAdam	2762.08	9061.9	Muskwa	78.17	6.29	3.35	0.33	0.2	0.47	1.06	0.3	0.07	0.01
ConocoPhillips McAdam	2764.07	9068.5	Muskwa	77.82	6.8	2	0.68	0.65	0.56	1.25	0.26	0.07	0.01
ConocoPhillips McAdam	2766.57	9076.7	Muskwa	72.37	9.05	2.28	0.77	0.61	0.76	1.72	0.39	0.1	0.01
ConocoPhillips McAdam	2768.53	9083.1	Muskwa	65.39	12.99	3.89	1.24	1.11	0.87	2.66	0.61	0.19	0.02
ConocoPhillips McAdam	2770.15	9088.4	Muskwa	54.36	8.65	3.5	4.88	8.15	0.79	1.69	0.42	0.2	0.08
ConocoPhillips McAdam	2771.49	9092.8	Muskwa	79.85	6.73	1.37	0.48	0.32	0.49	1.27	0.28	0.06	0.005
ConocoPhillips McAdam	2773.61	9099.8	Muskwa	77.33	8.49	1.67	0.56	0.23	0.52	1.67	0.34	0.07	0.005
ConocoPhillips McAdam	2775.61	9106.3	Muskwa	83.35	4.78	1.53	0.64	0.86	0.49	0.84	0.19	0.07	0.01
ConocoPhillips McAdam	2777.77	9113.4	Muskwa	68.31	10.45	3.62	1.26	1.38	0.78	2.08	0.41	0.07	0.02
ConocoPhillips McAdam	2779.79	9120.0	Muskwa	77.55	8.63	1.93	0.58	0.29	0.69	1.78	0.28	0.07	0.005

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
ConocoPhillips McAdam	2781.84	9126.8	Muskwa	72.42	6.22	6.01	0.46	0.32	0.53	1.22	0.25	0.07	0.005
ConocoPhillips McAdam	2784.04	9134.0	Muskwa	73.09	7.78	2.08	0.7	2.14	0.55	1.48	0.29	0.06	0.005
ConocoPhillips McAdam	2786.13	9140.8	Muskwa	41.08	6.32	3.87	5.65	15.76	1.02	1.14	0.33	0.07	0.09
ConocoPhillips McAdam	2788.48	9148.6	Muskwa	71.43	11.17	2.73	0.9	0.92	0.75	2.25	0.48	0.07	0.01
ConocoPhillips McAdam	2789.9	9153.2	Muskwa	73.81	9.17	2.78	0.78	1.18	0.63	1.79	0.39	0.07	0.01
ConocoPhillips McAdam	2792.15	9160.6	Otter Park	39.95	8.85	3.64	2.74	19.91	0.57	1.8	0.39	0.09	0.12
ConocoPhillips McAdam	2794.2	9167.3	Otter Park	47.04	13.26	6.74	3.73	8.43	0.54	2.81	0.61	0.1	0.06
ConocoPhillips McAdam	2796.32	9174.3	Otter Park	52.72	15.22	4.84	2.74	6.08	0.61	3.19	0.71	0.09	0.05
ConocoPhillips McAdam	2797.81	9179.2	Otter Park	53.61	15.11	5.94	2.3	5.68	0.63	3.15	0.71	0.1	0.05
ConocoPhillips McAdam	2807.76	9211.8	Otter Park	45.54	12.39	4.65	1.96	13.49	0.64	2.55	0.59	0.09	0.05
ConocoPhillips McAdam	2809.8	9218.5	Otter Park	43.96	11.37	5.36	2.22	14.44	0.6	2.36	0.57	0.14	0.06
ConocoPhillips McAdam	2811.8	9225.1	Otter Park	42.5	10.45	5	2.41	15.25	0.53	2.14	0.5	0.1	0.06
ConocoPhillips McAdam	2813.75	9231.5	Otter Park	41.91	8.71	3.14	2.04	19.38	0.72	1.72	0.37	0.08	0.05
ConocoPhillips McAdam	2815.93	9238.6	Otter Park	44.78	8.07	3.43	2.13	18.45	0.54	1.65	0.36	0.11	0.04
ConocoPhillips McAdam	2817.9	9245.1	Otter Park	34.98	7.31	2.9	2.17	24.43	0.56	1.48	0.31	0.06	0.04
ConocoPhillips McAdam	2820.05	9252.1	Otter Park	29.19	6.83	2.28	2.09	28.63	0.67	1.37	0.27	0.06	0.03
ConocoPhillips McAdam	2822.14	9259.0	Otter Park	27.63	6.48	1.8	1.82	30.4	0.66	1.3	0.26	0.07	0.03
ConocoPhillips McAdam	2824.25	9265.9	Otter Park	24.86	4.64	1.77	1.83	33.09	0.68	0.88	0.19	0.05	0.03
ConocoPhillips McAdam	2826.02	9271.7	Otter Park	26.77	5.15	2.25	2.23	30.98	0.73	0.98	0.21	0.05	0.03
ConocoPhillips McAdam	2827.54	9276.7	Otter Park	57.64	8.71	2.25	1.36	11.5	0.61	1.78	0.36	0.09	0.02
ConocoPhillips McAdam	2829.54	9283.3	Otter Park	43.84	7.39	3.67	3.39	17.55	0.58	1.5	0.3	0.08	0.05
ConocoPhillips McAdam	2831.51	9289.7	Otter Park	45.18	7.3	4.17	3.27	16.38	0.45	1.47	0.31	0.09	0.06

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
ConocoPhillips McAdam	2833.56	9296.5	Otter Park	58.22	14.14	3.67	1.67	5.75	0.54	2.94	0.59	0.07	0.03
ConocoPhillips McAdam	2835.7	9303.5	Otter Park	55.69	14.15	3.12	1.7	7.72	0.6	2.92	0.57	0.09	0.04
ConocoPhillips McAdam	2837.49	9309.4	Otter Park	33.59	9.09	3	2.04	24.19	0.57	1.88	0.34	0.07	0.05
ConocoPhillips McAdam	2839.4	9315.6	Otter Park	31.61	8.7	2.92	2.04	25.84	0.57	1.8	0.34	0.07	0.05
ConocoPhillips McAdam	2841.42	9322.2	Otter Park	54.31	12.43	4.75	1.64	8.65	0.53	2.54	0.52	0.11	0.05
ConocoPhillips McAdam	2843.7	9329.7	Otter Park	56.74	10.02	6.04	1.7	8.12	0.47	2.01	0.43	0.13	0.05
ConocoPhillips McAdam	2845.86	9336.8	Otter Park	60.34	13.85	3.24	1.18	5.53	0.6	2.82	0.59	0.12	0.02
ConocoPhillips McAdam	2847.85	9343.3	Otter Park	60.43	11.86	2.88	1.08	7.22	0.62	2.36	0.53	0.11	0.02
ConocoPhillips McAdam	2849.8	9349.7	Otter Park	55.53	9.73	2.97	1.41	11.71	0.7	1.89	0.45	0.09	0.03
ConocoPhillips McAdam	2852	9357.0	Otter Park	43.95	9.09	3.31	2.69	17.26	0.64	1.81	0.41	0.11	0.06
ConocoPhillips McAdam	2853.91	9363.2	Otter Park	55.73	10.24	3.23	1.56	10.81	0.65	2.03	0.48	0.12	0.05
ConocoPhillips McAdam	2855.85	9369.6	Otter Park	64.83	8.75	2.92	1.18	7.08	0.59	1.72	0.42	0.09	0.03
ConocoPhillips McAdam	2857.82	9376.1	Otter Park	68.29	13.19	2.99	0.86	1.56	0.61	2.73	0.52	0.07	0.005
ConocoPhillips McAdam	2859.78	9382.5	Otter Park	61.48	11.81	5.78	0.9	1.29	0.83	2.35	0.53	0.08	0.005
ConocoPhillips McAdam	2862.35	9390.9	Otter Park	55.89	13.97	4.72	1.6	2.86	1.24	2.94	0.59	0.11	0.02
ConocoPhillips McAdam	2864.28	9397.2	Otter Park	66.1	15.58	3.19	1.15	0.47	0.65	3.31	0.58	0.05	0.005
ConocoPhillips McAdam	2866.25	9403.7	Otter Park	59.99	19.12	3.92	1.31	0.38	0.78	4.11	0.7	0.05	0.005
ConocoPhillips McAdam	2868.25	9410.3	Otter Park	52.86	17.45	4.99	2.78	3.69	0.79	3.8	0.57	0.08	0.03
ConocoPhillips McAdam	2870.25	9416.8	Evie	81.07	3.96	1.29	1.15	2.17	0.36	0.85	0.19	0.07	0.01
ConocoPhillips McAdam	2872.5	9424.2	Evie	78.9	4.02	1.71	0.84	1.93	0.41	0.79	0.18	0.11	0.005
ConocoPhillips McAdam	2874.5	9430.8	Evie	81.53	3.55	1.24	0.65	3.18	0.38	0.73	0.16	0.07	0.005
ConocoPhillips McAdam	2876.55	9437.5	Evie	75.58	6.2	1.77	1	2.96	0.58	1.33	0.26	0.08	0.01

*(continued)*

**Table S1.** Continued

Well Name	Depth (m)	Depth (ft)	Formation	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	CaO (%)	Na <sub>2</sub> O (%)	K <sub>2</sub> O (%)	TiO <sub>2</sub> (%)	P <sub>2</sub> O <sub>5</sub> (%)	MnO (%)
ConocoPhillips McAdam	2878.75	9444.7	Evie	76.6	6.04	1.56	0.57	2.75	0.46	1.22	0.23	0.1	0.005
ConocoPhillips McAdam	2880.4	9450.1	Evie	73.93	6.94	1.81	0.65	2.62	0.5	1.46	0.27	0.06	0.005
ConocoPhillips McAdam	2882.45	9456.9	Evie	73.22	5.35	1.72	0.99	5.02	0.57	1.12	0.23	0.1	0.01
ConocoPhillips McAdam	2884.35	9463.1	Evie	64.9	9.5	2.75	1.18	3.92	0.76	2.14	0.42	0.08	0.01
ConocoPhillips McAdam	2889.4	9479.7	Evie	63.98	10.35	3.84	1.39	4.18	0.67	2.29	0.44	0.1	0.02
ConocoPhillips McAdam	2891.5	9486.5	Evie	65.66	9	3.47	1.3	4.68	0.87	1.97	0.39	0.08	0.02
ConocoPhillips McAdam	2893.45	9492.9	Evie	64.65	6.79	2.14	0.69	7.4	0.54	1.51	0.32	0.09	0.005
ConocoPhillips McAdam	2895.55	9499.8	Evie	67.7	6.16	1.98	0.51	7.79	0.87	1.29	0.26	0.06	0.005
ConocoPhillips McAdam	2897.59	9506.5	Evie	67.12	4.11	1.41	0.57	7.86	0.36	0.93	0.21	0.13	0.005
ConocoPhillips McAdam	2899.6	9513.1	Evie	64.14	4.8	1.92	0.64	7.11	0.54	1.21	0.25	0.12	0.005
ConocoPhillips McAdam	2901.6	9519.7	Evie	70.47	3.37	1.44	0.64	6.73	0.27	0.85	0.16	0.08	0.005
ConocoPhillips McAdam	2904.1	9527.9	Evie	64.87	4.61	1.76	0.61	8.83	0.36	1.16	0.2	0.12	0.005
ConocoPhillips McAdam	2906.03	9534.2	Evie	39.67	2.73	1	1.16	27.85	0.41	0.62	0.13	0.18	0.01
ConocoPhillips McAdam	2908.65	9542.8	Evie	67.27	4.58	1.82	1.2	8.47	0.41	1.16	0.21	0.09	0.01
ConocoPhillips McAdam	2910.5	9548.9	Evie	65.96	4.52	1.8	0.84	9.91	0.39	1.13	0.22	0.13	0.005
ConocoPhillips McAdam	2912.5	9555.4	Evie	5.27	0.45	0.39	4.45	47.07	0.03	0.12	0.03	0.06	0.02