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Preliminary Report on the Bakken Formation, North-Central North Dakota

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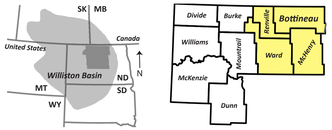


Figure 1 - Index map with the area of interest indicated in yellow.

Bakken Formation - North Dentral North Dakota

A preliminary investigation into the Bakken on the east flank of the Williston Basin began with the drilling and completion of the Renegade Petroleum (ND), Inc. – A. Trout 6H 3-14 (Lot. 3, Sec. 6, T162N, R84W) in Renville County. The Bakken and Three Forks section was examined in four cores in a southwesterly direction across the study area from the Renegade well to the Hess Corp. – IM Shorty 150-88-0805 H1 (SESE Sec. 8, T159W, R88W)(Cross-Section A-A'). In addition, samples were taken from the "False Bakken" and Bakken shale for RockEval analysis. Results are shown in Table 1.

Core data and isopachs maps of the area, Figs. 2A-2C, show significant variations from one well to the next. The Renegade well to the northeast has numerous unconformities within the Middle Member, and rests unconformably on the underlying Three Forks. It also has a pronounced thickening of unit 6 in the upper Three Forks section. In the Murex Petroleum Corp. – Heather Lynne 1 (NENE Sec. 16, T162N, R86W) well, the section is condensed, but all of the lithofacies are present. There is an increase in silt towards the base of the Lower Member. A significant unconformity occurs between the shale and Three Forks unit 6 characterized by the thinning of the unit. As the wells move basinward, the thickness of the Middle Member section increases as observed in the core of the Golden Eye Resources, LLC – Steinberger 1-16 (SENW Sec.16N, T159N, R87W) and Hess wells. Lithofacies 3 in both wells occurs as a channel sandstone unconformably overlying Lithofacies 1. The Lower Member appears to have three different organic facies based on core, RockEval analyses, and wireline log characteristics. Although it is thin (less than 2 ft), the Pronghorn Member is also present within these wells. Section A-A' shows the expected consistent increase in thickness of the Three Forks from the Murex well to the southwest.

Examination of the isopach maps for the Bakken Members, Fig. 2A-C, help to explain some of the anomalies observed in the cored wells. All of the members show isopachs that indicate a strong correlation to the dissolution of the Devonian Prairie salt shown in Figure 3. Associated with the dissolution and collapse is the presence of the Pronghorn Member in wells within the study area (Fig. 5). Additionally, a map of the temperatures taken from Bakken or deeper wells and DST data show a heat flow anomaly associated with the absence of the Prairie salt and east of the wells depicted in the cross-section.

The higher heat flow in the area of central Bottineau County may be attributed to the province boundary between the Superior Craton and the Trans-Hudson orogenic belt (Fig. 6). This area contains a series of north-south trending faults that are rooted in the basement. These faults comprise the Birdtail-Waskada axis that occurs in southern Manitoba. They could also allow warmer fluids to move vertically in the study area raising the temperature and removing the salts. All of these observations raise the question as to whether or not the Bakken shales are generating oil in the Bottineau County area. If this hypothesis is correct, then it's possible that the Manitoba fields that produce Bakken oil may have been sourced just south of the international border in North Dakota.

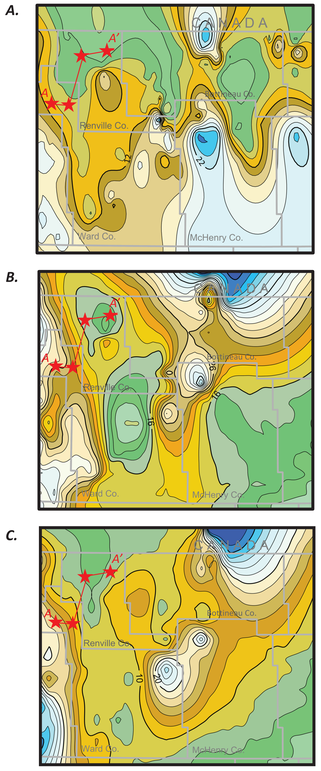


Figure 2 - Isopach maps of all three members of the Bakken Formation in north-central North Dakota. A. Upper Member isopach shows the prominent north-south trend in thickness aligned with the Precambrian plate boundary and the Newburg syncline. The thickness changes trend progressively westward in isopachs B (Middle Member) and C (Lower Member). Cross-section line indicated in red.

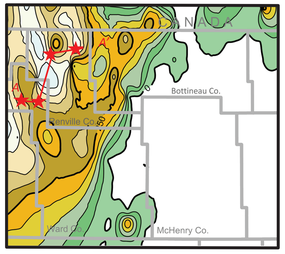


Figure 3 - Isopach map of the Devonian Prairie Salt showing the dissolution edge within the study area. Notice the correlation between the thicker sections on the Bakken Isopachs and the edge of the Prairie (Data from R. LeFever, University of North Dakota).

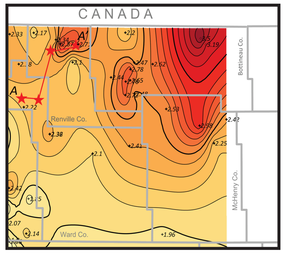


Figure 4 - Geothermal gradient over the area of study. Data is from wells that are Bakken or deeper and conventional DSTs (Data from D. Fischer).

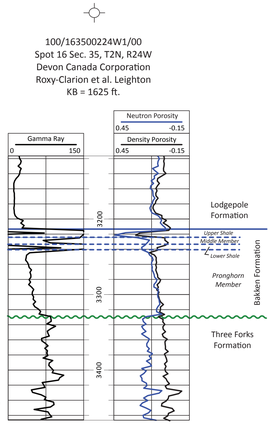
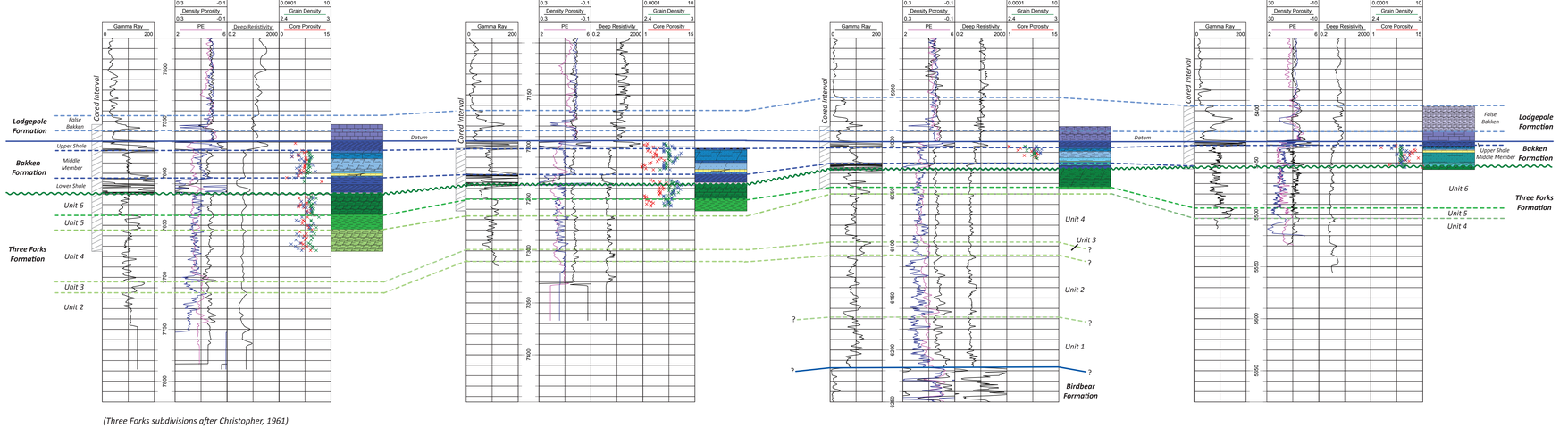


Figure 5 (shown on left) - Well log from the Devon Canada Corp. 16-35-2-24 W1 Roxy-Clarion et al. Leighton showing the presence of the Pronghorn Member. Well is located in a salt collapse feature in southern Manitoba.



(Three Forks subdivisions after Christopher, 1961)

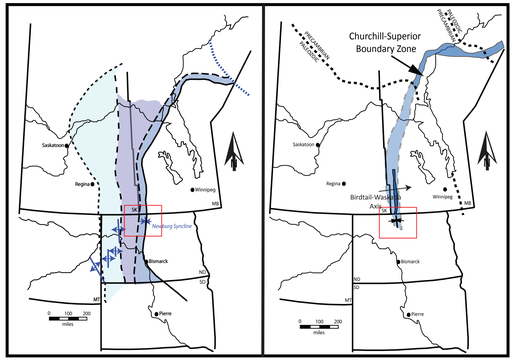


Figure 6 - Basement trends in the Precambrian surface have strongly influenced existing structures present in the subsurface of the Williston Basin. These existing zones of weakness act as pathways for fluid to move up section, allowing for an increase in temperature and for the dissolution of the Devonian Prairie Salt. Area of interest is outlined by the red box.

Client ID	Well Name	Operator	Depth	Sample Type	Leco TOC	RE			Tmax (°C)	**	HI	OI	S2/S3	S1/TOC* 100	PI
						S1	S2	S3							
19472-5409	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5405.0	Core	9.02	2.79	57.89	0.68	432		642	8	85.1	31	0.05
19472-5411	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5407.0	Core	2.34	0.55	12.28	0.61	431		524	26	20.1	23	0.04
19472-5413	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5409.0	Core	1.93	0.39	7.65	0.61	431		397	32	12.5	20	0.05
19472-5413.8	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5409.8	Core	7.40	1.85	40.20	0.84	428		544	11	47.9	25	0.04
19472-5415.5	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5411.5	Core	0.73	0.17	1.48	0.51	434		202	69	2.9	23	0.10
19472-5417.5	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5413.5	Core	0.32	0.08	0.38	0.46	431	**	120	145	0.8	25	0.17
19472-5434.8	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5430.8	Core	15.81	4.54	77.75	1.18	425		492	7	65.9	29	0.06
19472-5435.8	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5431.8	Core	16.33	4.47	75.61	1.32	424		463	8	57.3	27	0.06
19472-5437	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5433.0	Core	15.20	5.49	70.46	1.31	421		464	9	53.8	36	0.07
19472-5438	A. Trout 6H 3-14	Renegade Petroleum Ltd.	5434.0	Core	25.67	8.69	113.94	1.45	423		444	6	78.6	34	0.07
20249-5995.75	Heather Lynne 1	Murex Petroluem	6000.8	Core	0.91	0.26	1.94	0.52	433		212	57	3.7	28	0.12
20249-5996.5	Heather Lynne 1	Murex Petroluem	6001.5	Core	9.86	3.49	51.37	0.56	429		521	6	91.7	35	0.06
20249-5997.5	Heather Lynne 1	Murex Petroluem	6002.5	Core	8.37	2.94	43.31	0.51	430		518	6	84.9	35	0.06
20249-5998	Heather Lynne 1	Murex Petroluem	6003.0	Core	14.04	5.23	74.41	0.64	426		530	5	116.3	37	0.07
20249-5999	Heather Lynne 1	Murex Petroluem	6004.0	Core	23.09	9.88	107.67	0.82	423		466	4	131.3	43	0.08
20249-5999.2	Heather Lynne 1	Murex Petroluem	6004.2	Core	25.19	9.34	111.96	0.90	423		444	4	124.4	37	0.08
20249-6000	Heather Lynne 1	Murex Petroluem	6005.0	Core	22.94	9.86	108.31	0.74	423		472	3	146.4	43	0.08
20249-6018.5	Heather Lynne 1	Murex Petroluem	6023.5	Core	2.68	0.22	1.03	0.24	418		38	9	4.3	8	0.18
20249-6019.5	Heather Lynne 1	Murex Petroluem	6024.5	Core	1.68	0.21	0.78	0.44	428		46	26	1.8	12	0.21
20249-6020.5	Heather Lynne 1	Murex Petroluem	6025.5	Core	1.87	0.24	0.66	0.38	424		35	20	1.7	13	0.27
17377-7223	Seinberger 1-16	Golden Eye Resources, Inc.	7227.2	Core	2.65	0.37	1.22	0.55	424		46	21	2.2	14	0.23
17377-7224	Seinberger 1-16	Golden Eye Resources, Inc.	7228.2	Core	2.35	0.27	0.76	0.69	414		32	29	1.1	11	0.26
17377-7225	Seinberger 1-16	Golden Eye Resources, Inc.	7229.2	Core	2.27	0.44	1.70	0.37	424		75	16	4.6	19	0.21
17377-7226.1	Seinberger 1-16	Golden Eye Resources, Inc.	7230.3	Core	3.89	1.18	8.46	0.46	433		218	12	18.4	30	0.12
17377-7227	Seinberger 1-16	Golden Eye Resources, Inc.	7231.2	Core	3.44	0.50	1.87	0.86	424		54	25	2.2	15	0.21
17377-7228	Seinberger 1-16	Golden Eye Resources, Inc.	7232.2	Core	5.08	1.18	9.14	0.52	429		180	10	17.6	23	0.11
17377-7229	Seinberger 1-16	Golden Eye Resources, Inc.	7233.2	Core	8.41	2.14	20.02	0.59	427		238	7	33.9	25	0.10
17377-7230	Seinberger 1-16	Golden Eye Resources, Inc.	7234.2	Core	13.73	4.29	61.19	0.64	431		446	5	95.6	31	0.07
17377-7231	Seinberger 1-16	Golden Eye Resources, Inc.	7235.2	Core	13.76	6.57	48.48	0.61	425		352	4	79.5	48	0.12

Table 1 - RockEval data for three of the wells on Cross-section A-A'. Light blue are samples from the False Bakken in the Lower Lodgepole section. Medium blue represents samples collected from the Upper Shale Member of the Bakken Formation. Dark blue refers to samples collected from the Lower Shale of the Bakken Formation. All depths have been adjusted to the wireline log.