

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 13

Summary of the Fritz F. Leutz No. 1 Well

Mercer County, North Dakota

By Sidney B. Anderson  
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F. F. Kelly - Plymouth Oil Co. - Fritz Leutz No. 1 Well, Mercer County, North Dakota. NW 1/4 NE 1/4, Section 28, T. 142 N., R. 89W. (660' S. of N. line; 660' W. of E. line, Section 28) Elevation: 2284 D.F.

The Kelly - Plymouth, Fritz Leutz No. 1 Well was spudded June 15, 1950 and 13 3/8 inch casing was run at 493 feet. Drilling was completed September 28, 1950 and the well was abandoned.

Tests: DST 10,208' - 10,709' tool open 1 hour. Recovered 1,800' of drilling mud, and 4230' of salt water.

Very slight staining was reported from 11,212 to 11,224, there was no porosity, and the stain was of the dark residual type.

Formation tops determined from sample and electric logs, not all lithologic formation tops called in following list.

	<u>TOPS</u>
Cretaceous System	<u>Depth</u>
Fox Hills Formation	1460
Pierre Formation	1960
Niobrara Formation	3390
Greenhorn Member	3940
"Muddy sand" (Electric log)	4430
Dakota	4690
Jurassic System	
Morrison Formation	5000
Ellis Group	5080
Piper Formation (Sawtooth)	5754
Triassic System	
Spearfish Formation	6070
Mississippian System	
Amsden Formation	6465
Big Snowy Group	6600
Kibbey Formation	7065
Charles Formation	7290
Mission Canyon Formation	7880
Lodgepole Formation	8250
Englewood Formation	8970
Devonian System	
Lyleton Formation	9050
Ashern Formation	10,310
Silurian System	
Stonewall Formation	10,350

	<u>Depths</u>
Ordovician System	
Stony Mountain Shale Member	10,930
Red River Formation	11,150
Winnipeg Formation	11,810
Total Depth	12,526

FRITZ F. LEUTZ NO. 1

50-60	Lignite.
70 -100	Shale, yellow gray 5Y7/2, soft and some gray orange pink soft shale.
100-110	Shale, yellow gray 5Y7/2, soft.
110-130	Shale, light gray N7, soft.
130-160	Shale and lignite, light gray N7 soft shale.
160-190	Shale, light gray N7, silty; little lignite.
190-200	Shale, light gray, silty; lignite.
200-210	Lignite.
210-220	Shale, light to medium gray; sandstone, yellow fine grained.
220-240	Shale, light olive gray 5Y6/1 and a few pieces lignite.
240-250	Lignite.
250-260	Shale, light olive to yellow gray; sandstone, fine to medium grained.
260-270	Shale as above; sandstone, silty and light brown 5YR6/4, fine to medium grained.
270-280	Shale, light olive gray, silty, little lignite.
280-290	Shale as above and much lignite.
290-300	Shale as above and some lignite.
300-310	Shale as above; lignite.
310-320	Siltstone, light olive gray, calcareous; very fine grained sandstone, and some lignite.
320-330	Sandstone, very fine grained; little lignite.
330-350	Siltstone, light olive gray, lumpy.
350-360	Siltstone, light olive gray, lumpy, some lignite.
360-370	Shale, yellow gray 5Y8/1, soft, lumpy.
370-380	Siltstone, light gray N7, soft.
380-390	Sandstone, light olive gray, calcareous, very fine grained.
390-400	Shale, light olive gray, calcareous, soft.
400-420	Shale as above; lignite.
420-450	Shale, light gray, soft.
450-460	Shale as above and lignite.
460-480	Shale as above, silty.
480-490	Shale as above, some lignite.
490-530	Shale as above, soft.
530-550	Shale as above, few pieces of lignite.
550-560	Shale as above.
560-580	Shale as above, some lignite.
580-600	Shale as above, soft.
600-610	Shale, very light gray.
610-630	Shale, light olive gray, soft, some lignite.
630-640	Shale, yellow gray 5Y8/1, soft.
640-650	Shale, yellow gray to very light gray, soft.
650-660	Shale as above, little lignite.

660-730 Shale as above, some lignite.  
730-760 Shale as above, little lignite.  
760-780 Shale, yellow gray 5Y8/1, few pieces of lignite 70 - 80.  
780-900 Shale as above, little lignite.  
900-1020 Siltstone, some very fine grained sandstone, color as above, yellow gray to light olive gray.  
1020-1050 Shale and siltstone as above.  
1050-1150 Shale as above, silty.  
1150-1180 Shale, yellow gray 5Y8/1, silty; some lignite.  
1180-1370 Shale as above, silty, light olive gray.  
1370-1380 Shale as above, light olive gray; some lignite.  
1380-1460 Shale as above.  
1460-1490 Shale, sandstone, and siltstone as above; fine to medium sand.

Fox Hills Formation 1460?

1490-1660 Sandstone, fine to medium grained, sub-rounded to angular.  
1660-1670 Sandstone as above; little lignite.  
1670-1710 Sandstone, lignite as above; with little white silty limestone.  
1710-1760 Shale as above, silty; little sandstone.  
1760-1960 Shale as above, silty.

Pierre Formation?

1960-2020 Shale, light olive gray to green gray 5GY6/1, silty.  
2020-2100 Shale, green gray 5GY6/1, silty.  
2100-2260 Shale as above, slightly bentonitic 2100-2200.  
2260-2270 Shale, green gray 5GY6/1, inoceramus prisms.  
2640 inoceramus prisms  
2680 shell fragments.  
2270-3150 Shale as above.  
3150-3160 Shale as above and some medium gray N5 shale.  
3160-3230 Shale as above, piece of bluish bentonite, few pieces medium gray N5 shale.  
3230-3250 Shale as above, much gray orange silty shale 10YR7/4.  
3250-3260 Shale as above, little gray orange 10YR7/4, little whitish bentonite.  
3260-3300 Shale as above, very little gray orange silty, little white bentonite.  
3310-3330 Shale as above, little gray orange silty shale, little white bentonite.  
3330-3380 Shale as above, very little gray orange silty shale, little white bentonite.

Niobrara 3390

3380-3390 Shale, mostly green gray as above, white bentonite.  
3390-3430 Shale, mostly green gray, some medium dark gray shale.  
3440-3470 Shale, green gray and dark gray N3, some white specks.  
3470-3600 Shale, green gray, dark gray, medium gray, silty, few white specks.  
3600-3660 Shale, green gray, little medium dark gray, little white bentonite, few shell fragments .  
3660-3680 Shale, lumpy, green gray, slightly calcareous, bentonitic.  
3680-3700 Shale, green gray, little medium dark gray.  
3700-3750 Shale, as above and gray orange silty shale.  
3750-3930 Shale, green gray, little medium dark gray, glauconite at 3790-3800.

Greenhorn member

3930-3940 Shale, green gray, much dark, gray N3 shale.  
3940-3950 Shale, dark gray N3.  
3950-3990 Shale, green gray, little medium gray to dark gray N3.  
3990-4000 Shale as above, dirty sample.  
4000-4180 Shale as above, white specks.  
4180-4270 Shale as above, little glauconite, 4210-30 and 50-60.  
4270-4330 Shale as above, few pieces of fine grained sandstone, little white bentonite not calcareous.

Muddy Sand 4430

4330-4600 Shale as above, few pieces of fine sandstone, 4345-4350, 4380-4390, little white bentonite.  
4600-4620 Shale as above, few pieces of limestone.  
4620-4630 Shale as above, piece of calcite.  
4640-4690 Shale, medium dark gray N4, little white bentonite.

Dakota

4690-4700 Shale, medium dark gray N4, little fine grained sandstone, some glauconite.  
4700-4710 Shale, medium dark gray N4.  
4710-4730 Shale, medium dark gray N4, little white bentonite, little fine grained white sandstone.  
4730-4740 Shale, medium-dark gray N4.  
4740-4750 Shale as above, little fine grained white sandstone.  
4750-4770 Shale as above, some fine grained sandstone.  
4770-4830 Shale as above, little sandstone as above.  
4830-4860 Shale as above, little medium to coarse quartz sand, colorless.  
4860-4940 Shale as above, little fine to medium quartz sand, white, piece of pyrite 4910-20.  
4940-5000 Shale as above, little fine to medium sand at 60-70, piece of glauconitic, sandy or silty gray shale.

Morrison Formation

5000-5010 Shale as above, few pieces of light gray to light olive gray silty shale, little sand as above.  
5010-5030 Shale as above, much white fine grained sandstone as above, piece of glauconite, gray, sandy or silty shale.  
5030-5050 Shale and some sandstone as above.  
5050-5090 Shale and little sandstone as above, 70-80 piece of glauconitic gray silty, shale.

Ellis group 5080

5090-5110 Shale as above, few pieces of greenish shale little sand as above, piece of green sandy shale 5100-10.  
5110-5120 Shale and little sandstone as above.  
5120-5130 Shale as above, medium dark and little light olive gray, to light gray shale, little sandstone as above and little white bentonite.  
5130-5140 Shale as above, one rounded medium grained sand grain with very bright orange red coating.  
5140-5150 Shale as above, little sandstone as above with little glauconite.

5150-5180 Shale, medium dark gray, olive gray 5GY3/2, green, some gray sandy shale; very little fine to medium sand. 70-80 little glauconitic sandstone; little limestone.

5180-5270 Mostly shale as above, little sandstone and very fine grained sandstone, little moderate red orange 10R6/6, little limestone 5230-40.

5270-5360 Shale as above, much white to moderate red, very fine grained sandstone, calcareous.

5360-5370 Some shale as above, sandstone, yellow gray, calcareous, very fine grained.

5370-5380 Sandstone 50% and shale 50% as above.

5380-5390 Shale and sandstone as above.

5390-5450 Mostly shale as above and some sandstone as above, gray, yellow gray to light olive gray.

5450-5460 Shale and little sandstone as above.

5460-5470 Shale and very little sandstone as above, pieces of coal.

5470-5480 Shale as above.

5480-5600 Shale, medium dark gray to very light gray, little sand.

5600-5620 Shale, medium dark gray N4 and dark green gray 5GY4/1, little white to medium gray sandstone.

5620-5700 Shale, as above, little very fine grained, few pieces of coal 5670-80, slightly glauconitic sandstone.

5700-5710 Varigated shale.

5710-5720 Varigated shale and whitish to yellow gray 5Y8/1, very fine grained, limy, sandstone.

5720-5730 Varigated shale, mostly green gray, very little sandstone.

5730-5740 Shale as above, little sandstone as above, fine grained.

5740-5750 Shale as above and medium gray sandstone, fine grained.

Piper formation 5754

5750-5760 Varigated shale, medium dark gray to green gray, little sandstone, some glauconitic.

5760-5770 Shale as above, few pieces of white limestone.

5770-5790 Shale and sandstone as above.

5790-5800 Shale and little sandstone as above, some white limestone, sandy.

5800-5830 Shale, very little sandstone as above; little white, limestone.

5830-5840 Varigated shale few pieces of coal, little white limestone.

5840-5850 Varigated shale, little white fine grained sandstone, slightly glauconitic, medium grained sandstone, little coal, little white to buff limestone, dense.

5850-5860 Shale as above, little gray sandstone, no white sandstone.

5860-5870 Shale as above, little pale yellow brown limestone.

5870-5880 Shale as above, piece of pink anhydrite.

5880-5890 Shale as above, much red staining on gray shale.

5890-5900 Varigated shale, little sandstone, little white to pinkish limestone, some black shiny carbonaceous material, pieces of pink anhydrite.

5900-5910 Varigated shale, little white dense limestone and reddish sandstone.

5910-5920 Varigated shale, little white dense limestone, white to gray sandstone, very fine grained.

5920-5950 Varigated shale, little limestone and sandstone as above, gray red 10R4/2 and pale reddish brown 10R5/4 shale.

5950-5960 Varigated shale, as above; little sandstone as above.

5960-5970 Varigated shale as above; little white to green gray sandstone.

5970-5990 Shale as above, some sandstone, slightly glauconitic.

5990-6000 Shale and sandstone as above, with much pale reddish brown shale, very fine grained sandstone.

6000-6010 Shale as above and much pale reddish brown, very fine grained sandstone.

6010-6030 Shale as above, fine to medium grained; little gray slightly glauconitic sandstone. 20-30.

6030-6040 Shale as above, much pale reddish brown sandstone, some pale red 10R6/2 and gray and brown sandstone. Piece of pink anhydrite.

6040-6050 Much sandstone as above, some shale, little pink anhydrite. Piece of glauconitic sandstone.

6050-6070 Much shale and some sandstone as above, little pale red to white limestone, dense.

Spearfish

6070-6090 Shale, much green gray and red, little pale red brown sandstone.

6090-6100 Varigated shale, little sandstone as above, and a piece of white sandstone.

6100-6140 Varigated shale, pieces of colorless anhydrite.

6140-6150 Varigated shale, mostly medium dark gray.

6150-6160 Shale as above, little gray sandstone, fine grained.

6160-6170 Varigated shale, piece of brown gray fine grained sandstone.

6170-6180 Varigated shale, and little pale red brown and green gray sandstone, fine to medium.

6180-6200 Varigated shale, very little pale red brown sandstone, fine grained.

6200-6210 Varigated shale, little pale red brown and gray sandstone, fine grained.

6210-6220 Varigated shale, mostly gray and green gray.

6220-6230 Varigated shale, very little pale red brown and light olive gray sandstone, fine grained.

6230-6240 Varigated shale, pale red 5R6/2 sandstone, fine grained, some pinpoint porosity.

6240-6260 Varigated shale, as above, fair pinpoint porosity.

6260-6270 Shale as above, some pale red 5R6/2 sandstone, fine grain.

6270-6280 Varigated shale, little sandstone as above and piece of pink anhydrite.

6280-6290 Varigated shale, little sandstone as above, piece of white anhydrite.

6290-6310 Varigated shale, little sandstone as above, white anhydrite. 90-6300.

6310-6350 Varigated shale, little white sandstone, slightly calcareous, one large rounded sand grain 20-30.

6350-6370 Varigated shale, little sandstone as above, pinkish white dolomite.

6370-6390 Varigated shale, some silty to sandy glauconitic shale, sandstone as above.

6390-6400 Shale, same as above, dirty sample.

6400-6410 Varigated shale, little pinkish white anhydrite.

6410-6420 Varigated shale, little sandstone as above.

6420-6450 Shale and sandstone as above.  
 6450-6460 Varigated shale, sandstone as above.  
 6460-6470 Varigated shale, very little sandstone, and white anhydrite.  
 6470-6480 Varigated shale, gray orange pink, dense, dolomite, white anhydrite, little sandstone as above.  
 6480-6510 Varigated shale, white to gray orange pink dense dolomite, little sandstone as above.  
 6510-6570 Varigated shale, dolomite and sandstone as above, white to pale red sandstone, white anhydrite.  
 6570-6580 Varigated shale, mostly dolomite and sandstone, little anhydrite as above, moderate pink dolomite 5R7/4, dense.  
 6580-6600 Varigated shale, mostly red dolomite, moderate pink to light brownish gray, dense; little sandstone and white anhydrite.

Big Snowy Group

6600-6610 Varigated shale, some dolomite, moderate pink to pale yellow brown, little white to pale reddish sandstone, fine grained.  
 6610-6620 Varigated shale, dolomite and sandstone as above, white anhydrite.  
 6620-6630 Same as above, mostly red shale, gray red 10R4/2.  
 6630-6660 Varigated shale, some dolomite, little sandstone, white anhydrite as above.  
 6660-6670 Varigated shale, gray red 10R4/2, and gray red 5R4/2, little sandstone and dolomite as above.  
 6670-6680 Varigated shale, as above, and little pale yellow brown dense dolomite, white sandstone.  
 6680-6700 Variegated shale as above, much white dolomite, finely crystalline, dense.  
 6700-6710 Varigated shale, some dolomite as above, little sandstone as above.  
 6710-6720 Shale and some dolomite as above, few pieces of lignite.  
 6720-6730 Varigated shale, little dolomite, little sandstone as above, and a few pieces of anhydrite.  
 6730-6740 Varigated shale, some light brown gray limestone, finely crystalline, dense.  
 6750-6770 Varigated shale, little limestone and sandstone as above.  
 6770-6780 Varigated shale, light brown gray, fragmental to oolitic limestone, dense; little limestone as above.  
 6780-6790 Varigated shale, very little limestone, little sandstone as above, pinkish; few medium to coarse free quartz grains, rounded.  
 6790-6800 Varigated shale, very little limestone, fine crystalline, dense; little white anhydrite.  
 6800-6860 Varigated shale, some light brown shale 5YR5/6, very little limestone as above, few coarse rounded quartz grains. (6820-30)  
 6860-6880 Varigated shale, very little limestone, some oolitic as above, gray red, purplish shale.  
 6880-6900 Shale, light brown 5YR5/6, gray red purplish 5RP4/2, pale red brown, greenish, and gray. Very little white sandstone.  
 6900-7020 Shale, same as above, little reddish sandstone, few pieces of light gray limestone, dense 6940-50, 80-90.  
 7020-7030 Shale, same as above, some fine grained white sandstone, and a little light gray dense limestone.

7030-7040 Shale, same as above, little reddish sandstone, fine grained, little pale brown dolomite and pale yellow brown limestone, dense.  
7040-7050 Shale as above; little red sandstone, fine grained.

Kibbey Formation 7065

7050-7070 Shale, same as above; red and white sandstone, fine grain. Little dolomite as above 60-70.  
7070-7080 Shale, same as above, much reddish sandstone, fine grained, little white sandstone fine  
7080-7130 Shale, same as above; fine to medium, much reddish sandstone; very few pieces of pale yellow brown dense dolomite.  
7130-7140 Shale, same as above, much red sandstone, fine grained, calcareous; some white sandstone.  
7140-7150 Shale as above, much white, fine crystalline, dense limestone; some sandstone.  
7150-7160 Shale as above, much yellow gray to light gray, finely crystalline, dense limestone, little sandstone.  
7160-7170 Much limestone as above, very little shale and sandstone.  
7170-7180 Much limestone as above, some, shale and sandstone.  
7180-7200 Much limestone as above, some shale and little sandstone, light gray, rounded, fine to medium grained.  
7200-7210 Limestone and varigated shale as above; little white, gray and pinkish sandstone, fine to medium, slightly calcareous.  
7210-7260 Much shale as above, some sandstone as above and little limestone, mostly reddish shale.

Charles Formation

7260-7300 Varigated shale, mostly reddish, some gray, green, red, and pink; little sandstone as above.  
7300-7320 Varigated shale, little white anhydrite 10-20; very little sandstone.  
7320-7340 Varigated shale, oolitic limestone, light gray with dark gray, oolites.  
7340-7350 Shale and limestone as above; little white anhydrite.  
7350-7360 Shale and limestone as above, brown gray limestone 5YR4/1, fine crystalline, dense.  
7360-7370 Same as above and brown gray limestone, saccharoidal, pinpoint porosity, good.  
7370-7380 Varigated shale, some light gray oolitic limestone as above and brown gray, some porosity; mostly shale.  
7380-7400 Limestone, medium light gray, fine crystalline, dense; some oolitic and brown gray limestone; some shale as above.  
7400-7420 Limestone and some shale as above; much white anhydrite.  
7420-7440 Limestone as above, dolomitic gray limestone, and some brown limestone; shale as above, medium light gray anhydrite.  
7440-7470 Mostly varigated shale, white anhydrite, little, brown and gray limestone as above.  
7470-7480 Shale and limestone as above; some pale yellow brown, dense limestone, little white anhydrite; little brown gray oolitic limestone.  
7480-7490 Limestone very, pale yellow brown, fine crystalline to slightly saccharoidal to medium light gray, finely crystalline limestone; little white anhydrite, some shale as above, dense.

7490-7510 Limestone, mostly medium light gray, fine crystalline, dense, some very pale yellow brown to yellow gray, dense. Little shale and white anhydrite as above.

7510-7520 Varigated shale, mostly gray, medium dark gray; some limestone as above, oolitic to fine crystalline; little white anhydrite.

7520-7530 Shale as above, much light brown gray to brown gray, saccharoidal limestone, good pinpoint porosity; white anhydrite.

7530-7540 Shale and limestone same as above; very few pieces of pale red sandstone.

7540-7550 Shale and limestone as above, little medium light gray, dense, fine crystalline limestone, few pieces white anhydrite.

7550-7560 Shale as above, mostly gray limestone, dense, little white anhydrite.

7560-7570 Limestone and shale as above, little brown gray limestone.

7570-7580 Same as above, medium light gray dolomitic limestone or dolomite.

7580-7590 Dolomite and shale, same as above.

7590-7600 Dolomite and shale as above, little brown gray limestone, dense.

7600-7610 Varigated shale, little dolomite as above, brown gray limestone, dense; some white anhydrite.

7610-7620 Varigated shale, light gray, dolomite, white anhydrite, and little limestone as above.

7620-7630 Light gray dolomite, sublithographic: little slightly saccharoidal brown gray limestone; white anhydrite.

7630-7640 Dolomite as above; fine crystalline to saccharoidal limestone, fair pinpoint porosity; little white anhydrite.

7640-7650 Limestone, light brown gray to brown gray as above, little dolomite and shale, white anhydrite; little porosity.

7650-7660 Limestone as above, little dolomite and shale, anhydrite, poor to fair porosity.

7660-7670 Same as above, mostly dolomite, little shale, poor to fair porosity in limestone.

7670-7690 Limestone, dolomite, anhydrite, same as above.

7690-7700 Same as above, mostly pale yellow brown limestone, poor to fair porosity.

7700-7710 Dolomite as above, pale yellow brown 10YR6/2 to yellow gray 5Y8/1, dense limestone, oolitic; phosphorous pellet.

7710-7720 Limestone, yellow gray to brown gray, fragmental to oolitic.

7720-7730 Limestone, same as above, dense to oolitic.

7730-7740 Limestone, pale yellow brown, oolitic, little porosity.

7740-7750 Limestone, pale yellow brown, oolitic to fragmental, little white anhydrite, light gray fine crystalline dolomite, dense.

7750-7770 Same as above and much varigated shale (cave?).

7770-7780 Limestone as above, oolitic, little porosity; much shale as above, little dolomite and anhydrite.

7780-7790 Same as above, mostly shale (cave?).

7790-7800 Shale as above, little reddish to white sandstone, fine grained; little limestone dolomite and anhydrite as above.

7800-7840 Dolomite, medium gray, fine crystalline, dense; little limestone and anhydrite as above, shale as above (cave?).

7840-7860 Dolomite as above, much pale red shale, little limestone and anhydrite.

Mission Canyon Formation

7860-7870	Dolomite as above, mostly pale yellow brown limestone, fine crystalline to oolitic, little gray oolitic limestone.
7870-7880	Limestone, pale yellow brown oolitic to fragmental, poor porosity; little dolomite as above.
7880-7890	Limestone, same as above, little dolomite, some white anhydrite.
7890-7900	Limestone as above and much red and gray shale, little white anhydrite and gray dolomite.
7900-7910	Limestone, pale yellow brown to brownish gray, crystalline, dense, brachiopod fragments.
7910-7930	Limestone, as above, slightly saccharoidal, fragmental, some oolitic, poor porosity.
7930-7940	Limestone as above, much gray; some shale.
7940-7950	Limestone, same as above.
7950-7980	Limestone as above, some dolomite as above.
7980-7990	Limestone and some dolomite as above; some red and gray shale.
7990-8000	Limestone as above, little dolomite, some shale, Ecinoid Spine?
8000-8010	Limestone and shale as above, mostly gray shale, little white anhydrite, dolomite as above.
8010-8020	Limestone and shale as above, much shale, mostly gray.
8020-8030	Limestone as above, poor porosity.
8030-8040	Limestone, very pale yellowish brown, oolitic to fragmental, little pinpoint porosity.
8040-8050	Limestone, very pale yellow brown, to very light gray, oolitic to fragmental, poor pinpoint porosity.
8050-8070	Limestone, same as above, little porosity.
8070-8080	Limestone, oolitic to fragmental fine crystalline, little porosity, mostly yellow gray limestone.
8080-8100	Limestone, color as above, fine crystalline, dense.
8100-8120	Limestone, color as above, fine crystalline to oolitic, dense.
8120-8130	Limestone, color as above, slightly saccharoidal to oolitic, dense.
8130-8140	Limestone, pale yellow brown to yellow gray, slightly saccharoidal to oolitic, dense.
8140-8160	Limestone, pale yellow brown to yellow gray, slightly saccharoidal to oolitic, much gray shale, some reddish.
8160-8170	Limestone, very pale yellow brown oolitic, poor to fair oolitic porosity.
8170-8220	Limestone, very pale yellow brown to pale yellow brown, oolitic to fragmental.
8220-8230	Limestone as above, some slightly saccharoidal, dense.
8230-8240	Limestone as above, to brown gray, fine crystalline, dense.
Lodgepole 8250	
8240-8260	Limestone as above oolitic; red and gray shale.
8260-8270	Limestone as above, medium gray, fine crystalline, dense, brachiopod fragments.
8270-8290	Little limestone as above, mostly variegated shale, dirty sample.
8290-8300	Limestone, oolitic, pale yellow brown to medium gray, fine crystalline, dense.

8300-8310 Limestone, mostly pale yellow brown oolitic, little oolitic porosity, fine crystalline, dense, little medium gray. Much gray shale cave?

8310-8320 Limestone, little pale yellow brown oolitic, mostly medium gray oolitic to fine crystalline.

8320-8330 Limestone, medium gray, fragmental and oolitic.

8330-8390 Limestone as above, dense.

8390-8400 Limestone as above, little very light gray, dense.

8400-8410 Limestone as above, slight brown tinge.

8410-8420 Limestone as above, slight brown tinge, saccharoidal.

8420-8430 Limestone, light gray N7, as above.

8430-8440 Limestone as above, fragmental.

8440-8490 Limestone, as above to finely crystalline, dense.

8490-8500 Limestone, medium gray N5 crystalline, dense, sandy and silty.

8500-8530 Limestone as above, pyrite.

8530-8570 Limestone as above.

8570-8580 Limestone, medium gray N5 crystalline, dense.

8580-8590 Limestone, very light gray to medium gray, crystalline, dense.

8590-8640 Limestone as above.

8640-8650 Limestone as above and some reddish shale, dirty sample.

8650-8660 Limestone as above, little red shale, piece of anhydrite, pieces of white sandstone cave?

8660-8670 Limestone as above, to slightly saccharoidal, piece of anhydrite and, red sandstone, fine to medium.

8670-8690 Limestone as above, crystalline, dense.

8690-8700 Limestone as above, crystalline, dense, piece of white sandstone and little red shale cave?

8700-8710 Limestone as above, crystalline, dense, piece of white sandstone, little white anhydrite and red shale cave?

8710-8740 Limestone as above, dense, few pieces of red shale.

8740-8750 Limestone as above, dense, piece of limey sandstone or sandy limestone.

8750-8770 Limestone as above, finely crystalline dense.

8770-8780 Limestone, very light gray to medium gray, fine crystalline dense.

8780-8790 Limestone as above, few pieces of pale yellow brown, dense.

8790-8800 Limestone as above, pale yellow brown dense, dirty sample.

8800-8810 Limestone as above, pale yellow brown, dense.

8810-8820 Limestone as above, few pieces of red shale.

8820-8830 Limestone as above, mostly gray, little red shale and white anhydrite.

8830-8840 Limestone as above, mostly gray, little red shale.

8840-8850 Limestone as above, mostly gray, few pieces of red shale, white sandstone.

8850-8860 Limestone, very, light gray to medium gray, dense.

8860-8870 Limestone as above, some gray and red shale.

8870-8900 Limestone as above, little gray to red shale.

8900-8910 Limestone as above, some medium dark gray N4 shale, little red shale.

8910-8920 Limestone as above, little shale as above, dirty sample.

8920-8930 Limestone as above, some gray and little red shale.

8930-8960 Limestone, as above, very dirty samples.

8960-8970 Limestone as above, little white anhydrite.

Englewood  
8970-8980 Limestone, light gray, fine crystalline, dense; dark gray shale, carbonaceous.

8980-9000 Limestone and shale as above.

9000-9010 Shale as above and light gray oolitic limestone with medium light to medium gray oolites.

9010-9020 Shale as above, medium gray fine crystalline, dense limestone; light gray oolitic limestone.

9020-9030 Shale as above, little oolitic and fine crystalline limestone as above, little pale yellow brown dense limestone.

9030-9040 Same as above, little gray and red shale; medium gray to pale yellow brown fine crystalline limestone, 1 piece of sandstone? white.

9040-9050 Little gray shale, gray limestone, dense; and little gray orange pink dolomite, slightly saccharoidal.

Lyleton  
9050-9080 Dolomite, gray, orange pink slightly saccharoidal, sandy or silty.

9080-9090 Dolomite, gray orange pink, finely granular.

9090-9100 Dolomite, gray orange pink to very light gray, granular to slightly saccharoidal.

9100-9120 Dolomite, grayish orange pink, silty; few pieces, of red and gray shale.

9120-9130 Dolomite as above, some reddish green and gray shale.

9130-9140 Limestone, gray orange pink, and very fine grained sandstone or siltstone banded; shale.

9140-9150 Limestone, gray orange pink, sandy or silty limestone, gray limestone, dense; little shale.

9150-9160 Dolomite, gray orange pink, finely granular, may be silty as above, little shale; gray dense, finely crystalline limestone.

9160-9170 Dolomite and limestone as above, little gray dense limestone.

9170-9180 Dolomite as above, red, gray and green shale.

9180-9200 Dolomite and shale as above.

9200-9210 Dolomite and shale as above, few pieces of gray limestone with red shale coating.

9210-9220 Dolomite and shale as above, few pieces of gray limestone.

9220-9230 Dolomite, shale and limestone as above.

9230-9240 Dolomite and shale as above; some pieces of limestone, gray, to pale yellow brown limestone, white, anhydrite.

Break Manitoban  
9240-9250 Shale as above, very pale orange 10YR8/2 slightly saccharoidal dolomite little gray to brown gray dense limestone.

9250-9254 Circulation 30 minutes. Limestone, very pale orange 10YR8/2 slightly saccharoidal, some gray to brown gray, few places very pale yellow brown anhydrite, little shale and white anhydrite.

9254-9260 Limestone as above to fine crystalline, brown gray dense limestone; little anhydrite white to light brown tinge.

9260-9270 Limestone and much anhydrite as above.

9270-9280 Limestone, pale yellow brown, saccharoidal and little medium gray crystalline dense. Little anhydrite as above.

9280-9290 Limestone, brown gray 5YR4/1, pale yellow brown 10YR6/2, finely crystalline, dense, little light gray dense, saccharoidal.

9290-9300 Limestone as above, slightly saccharoidal, few pinpoint vugs.  
9300-9330 Limestone, little light gray, light brown gray 5YR6/1 to brown gray 5YR4/1 to slightly saccharoidal to fine crystalline, dense.  
9330-9340 Limestone, as above, little medium light gray, dense, crystalline; dolomite.  
9340-9350 Limestone, pale yellow brown saccharoidal to brown gray, fine crystalline dense. Little dolomite as above.  
9350-9360 Limestone as above, gray shale cave?  
9360-9370 Limestone, pale yellow brown, saccharoidal, little brown gray crystalline; little white anhydrite, and little very pale yellow brown, dense, crystalline dolomite.  
9370-9380 Limestone, pale yellow brown saccharoidal to brown gray, fine crystalline dense to saccharoidal, little medium light gray, dense dolomite.  
9380-9390 Limestone as above, little white anhydrite; little medium dark gray dense limestone.  
9390-9400 Limestone as above, mostly very pale yellow brown to buff.  
9400-9410 Limestone as above.  
9410-9420 Limestone as above and little medium light gray N6, dense fine grained dolomite.  
9420-9440 Limestone, very pale yellow brown to buff, saccharoidal and little brown gray, crystalline dense.  
9440-9460 Limestone as above; light brown gray, crystalline dense.  
9460-9470 Limestone as above, piece of colorless crystalline anhydrite, 1 coarse rounded frosted quartz grain.  
9470-9480 Limestone as above, mostly very pale yellow brown to buff, saccharoidal, little gray shale.

Break Winnepegosan

9480-9490 Limestone as above, but more brown gray crystalline, dense.  
9490-9500 Limestone as above.  
9500-9510 Limestone, light brown gray, little light gray crystalline dense.  
9510-9520 Limestone, olive gray 5Y4/1, brown gray 5YR4/1, finely crystalline dense and little pale yellow brown, saccharoidal.  
9520-9530 Limestone, pale yellow brown to brown gray, saccharoidal, some brown gray crystalline limestone as above.  
9530-9540 Limestone as above to light brown gray, saccharoidal.  
9540-9550 Limestone as above, few pieces of medium light gray crystalline limestone.  
9550-9560 Limestone as above, mostly gray crystalline, dense.  
9560-9570 Limestone as above, finely crystalline, dense.  
9570-9580 Limestone, pale yellow brown to light brown gray, saccharoidal, little pinpoint porosity and brown gray fine crystalline, dense.  
9580-9590 Limestone, pale yellow brown to light brown gray, saccharoidal, little brown gray finely crystalline; little gray shale cave?  
9590-9600 Limestone as above.  
9600-9610 Limestone, pale yellow brown to light brown gray, saccharoidal, little brown gray to pale yellow brown, fine crystalline, dense.  
9610-9620 Limestone, pale yellow brown to medium light gray N6 saccharoidal. Little brown gray to pale yellow brown, fine crystalline, dense limestone.

9620-9630 Limestone, pale yellow brown to medium light gray, fine crystalline, dense.

9630-9640 Limestone, pale yellow brown to medium light gray, little brown gray saccharoidal, dense, finely crystalline.

9640-9650 Limestone, brown gray and little medium light gray, little fine crystalline, dense to saccharoidal.

9650-9660 Limestone, medium gray to pale yellow brown, dense, finely crystalline to saccharoidal.

9660-9670 Limestone as above, mostly saccharoidal.

9670-9680 Limestone, very light gray, saccharoidal to medium gray crystalline, dense.

9680-9690 Limestone, medium gray crystalline dense, little brown saccharoidal; pieces of red sandstone, fine grained, red limy shale.

9690-9700 Limestone, medium light gray saccharoidal, little brown saccharoidal, pale yellow brown; little gray shale.

9700-9710 Limestone, light gray to medium gray crystalline to saccharoidal dolomitic.

9710-9720 Limestone, light gray to medium gray dolomitic and brown gray limestone, saccharoidal.

9720-9730 Limestone, light to medium gray with slight brown tinge, dense, crystalline, light gray saccharoidal.

9730-9740 Limestone, light to medium gray, mostly saccharoidal, little brown gray crystalline, dense.

9740-9750 Limestone, brown gray to light gray crystalline, dense, little saccharoidal, little medium gray crystalline.

9750-9760 Limestone, brown gray crystalline dense, and yellow gray 5Y8/1 saccharoidal dolomite.

9770-9780 Limestone and dolomite as above.

9780-9790 Limestone, brown gray crystalline dense and light gray saccharoidal; little dolomite as above.

9790-9800 Limestone as above

9800-9810 Limestone, brown gray, dense, medium light gray crystalline, dense; dolomite; white to very light gray saccharoidal.

9810-9820 Limestone white fragmental? light gray crystalline, dense little medium dark gray dense limestone.

9820-9830 Limestone, white floury and light gray crystalline, dense.

9830-9840 Limestone, yellow gray to slightly saccharoidal and light gray crystalline, dense.

9840-9850 Limestone, very light gray dense, finely crystalline.

9850-9860 Limestone very light gray, light brown gray, brown gray, finely crystalline, dense.

9860-9870 Limestone, very light gray, light brown gray, finely crystalline dense; much gray, little red and green shale.

9870-9880 Limestone, very light gray, brown gray, finely crystalline dense, and yellow gray to floury saccharoidal.

Break

9880-9890 Limestone, medium gray N5 with slight brown tinge, finely crystalline, dense.

9890-9900 Limestone, brown gray 5YR4/1 as above.

9900-9910 Limestone as above and light brown gray 5YR6/1 and pale yellow brown 10YR6/2, finely crystalline, dense.

9910-9920 Limestone, same as above.

9920-9930 Limestone, same as above, little very light gray, dense.  
 9930-9940 Limestone, brown gray 5YR4/1, finely crystalline dense, little very light gray, floury soft, dense limestone.  
 9940-9950 Limestone, same as above, little light gray saccharoidal dolomitic limestone.  
 9950-9960 Limestone same as above, little light gray with slight brown tinge, saccharoidal, dolomitic.  
 9960-9970 Limestone, same as above.  
 9970-9980 Limestone, brown gray, finely crystalline dense, little light gray, slightly saccharoidal.  
 9980-9990 Limestone, brown gray as above, little light olive gray lithographic, medium gray, dense, crystalline dolomite.  
 9990-10000 Same as above and little medium dark gray shale, little pale yellow brown crystalline, dense, little gray saccharoidal dolomitic limestone.  
 10000-10010 Limestone as above, dirty sample.  
 10010-10020 Limestone, brown, gray dense, finely crystalline, little gray shale, little light brown gray, dense crystalline limestone.  
 10020-10030 Limestone, brown gray, dense, finely crystalline; medium gray N5 crystalline dense dolomite.  
 10030-10040 Limestone, brown gray, dense, finely crystalline, and dolomite, as above.  
 10040-10050 Limestone and dolomite as above; some yellow gray limestone with some fine to coarse quartz grains.  
 10050-10060 Limestone, dolomite as above.  
 10060-10070 Limestone, brown gray crystalline dense, medium gray crystalline dense dolomitic limestone; little pale yellow brown crystalline dense.  
 10070-10080 Limestone as above.  
 10080-10090 Limestone, brown gray, light gray to pale yellow brown crystalline, dense.  
 10090-10100 Limestone, medium gray slightly brown tinge, light gray crystalline, dense, little gray shale.  
 10100-10200 Limestone, medium gray slightly brown tinge and light gray crystalline dense; little gray shale.  
 10200-10210 Limestone, medium gray, slight brown tinge and light gray crystalline dense; little gray shale, few pieces of calcareous red shale.  
 10210-10230 Limestone as above.  
 10230-10240 Limestone as above and white saccharoidal, few pieces of calcareous red shale.  
 10240-10250 Limestone, yellow gray to pink gray 5YR8/1 saccharoidal and some brown gray and gray limestone as above.  
 10250-10310 Limestone, white to gray orange pink, medium crystalline to very fine crystalline, traces of red shale and anhydrite inclusions. Slightly sandy at top. Moderate orange pink to gray orange pink interbedded and mottled.  
 Ashern  
 10310-10340 Limestone, gray red and gray orange pink, very fine crystalline, dense, slightly shaley.  
 10340-10350 Limestone, pale yellow brown, very fine crystalline, dense thin bedded. Small gray orange pink to pale brown mottled and shaley limestone at base.

#### Stonewall

- 10350-10390 Dolomite, white to yellow gray, medium to coarse, crystalline, possibly stromatolitic.
- 10390-10450 Dolomite, white, medium crystalline, with rhombic crystals, with good intergranular porosity, traces of red shale 40-50.
- 10450-10530 Dolomite as above becoming yellow gray with traces of green gray shale, slightly less porous.
- 10530-10740 Dolomite, very pale yellow brown, fine sugary to crystalline with vugular streaks. Traces of red brown shale, some thin medium gray shale.
- 10740-10830 Dolomite, white to pinkish gray, very fine crystalline to chalky or lithographic. Few floating quartz grains at top. Small yellow gray chert.
- 10830-10860 Dolomite, gray orange pink, very fine crystalline to slightly fragmental, slightly sandy. Traces of red and brown shale. Base gradational.
- 10860-10890 Dolomite, pink gray to gray orange pink, very fine crystalline, thin bedded.
- 10890-10910 Dolomite, pinkish gray, lithographic, flaky.
- 10910-10930 Limestone, light brown gray, fine granular, very silty, very slight CC/4 fluorescent cut.

#### Stony Mountain Shale Member

- 10930-10970 Dolomite, yellow gray to light olive gray; very fine crystalline with green gray, pale brown pale yellow brown shale and shaley dolomite. Small scattered sand grains.
- 10970-11010 Limestone, medium light gray, fine crystalline, partly fragmental, tight. Small medium to slightly green gray shale.
- 11010-11040 Limestone, light olive gray, very fine crystalline, dense with medium gray shale.
- 11040-11060 Dolomite, light brown gray to light olive gray, medium crystalline to fragmental with many fine sand grains.
- 11060-11070 Dolomite, very pale yellow brown, fine sugary, with thin medium dark gray shale partings.
- 11070-11090 Limestone, brown gray to medium light gray, very fine crystalline, dense.
- 11090-11120 Limestone, medium to medium light gray, fine crystalline, slightly fragmental. Small medium gray to medium brown gray shale.
- 11120-11150 Limestone, medium gray to light olive gray; shale, medium brown gray to medium gray, slightly greenish.

#### Red River Formation

- 11150-11200 Limestone, light gray, fine fragmental, to fine crystalline, some light olive gray.
- 11200-11220 Limestone, light gray to light brown gray, fine fragmental to fine crystalline, dense.
- 11220-11230 Limestone, mostly light brown gray 5YR6/1, finely crystalline, dense.
- 11230-11240 Limestone as above.
- 11240-11250 Limestone, dark brown gray under scope, medium dark gray, finely crystalline on color chart, dense.
- 11250-11260 Limestone as above, 1 piece of fragmental gray.
- 11260-11290 Limestone as above, and some very pale yellow brown, slightly saccharoidal limestone.

11290-11300 Limestone, brown gray 5YR4/1, finely crystalline, dense.  
 11300-11310 Limestone as above, few pieces of white anhydrite.  
 11310-11320 Limestone as above.  
 11320-11330 Limestone, brown gray as above, little very pale yellow brown slightly saccharoidal; few pieces of white to pale brown anhydrite.  
 11330-11340 Limestone as above.  
 11340-11350 Limestone as above, much very pale yellow brown, slightly saccharoidal.  
 11350-11360 Limestone as above, slightly saccharoidal dolomitic.  
 11360-11370 Limestone as above, much very pale yellow brown slightly saccharoidal limestone.  
 11370-11380 Limestone, very pale yellow brown, slightly saccharoidal, some brown gray, finely crystalline, dense.  
 13380-11400 Limestone as above.  
 11400-11410 Limestone, light brown gray, slightly saccharoidal.  
 11410-11440 Limestone, light brown gray, slightly saccharoidal.  
 11440-11450 Limestone as above, dolomitic and some brown gray fine crystalline, dense limestone.  
 11450-11470 Limestone as above, light brown gray saccharoidal.  
 11470-11480 Limestone, light brown gray saccharoidal, some brown gray, fine crystalline, dense; few pieces of white anhydrite.  
 11480-11510 Limestone as above, dirty sample.  
 11510-11520 Limestone, brown gray, dense, finely crystalline, some saccharoidal limestone as above.  
 11520-11530 Limestone, brown gray and light brown gray, finely crystalline, some saccharoidal limestone as above.  
 11530-11560 Limestone as above.  
 11560-11570 Limestone as above, dirty sample.  
 11570-11600 Limestone, brown gray and light brown gray, finely crystalline to saccharoidal.  
 11600-11610 Limestone, as above, few pieces of white anhydrite.  
 11610-11620 Limestone, brown gray and light brown gray, finely, crystalline to saccharoidal.  
 11620-11640 Limestone, light brown gray, finely crystalline to saccharoidal to fragmental.  
 11640-11650 Limestone, finely crystalline to saccharoidal, light brown gray.  
 11650-11660 Limestone as above.  
 11660-11670 Limestone, light brown gray, saccharoidal.  
 11670-11680 Limestone as above,, few pieces of white anhydrite.  
 11680-11690 Limestone, light brown gray, saccharoidal, some brown gray finely crystalline; few pieces of white anhydrite.  
 11690-11700 Limestone as above.  
 11700-11710 Limestone, light brown gray, saccharoidal.  
 11710-11800 Limestone as above.  
 11800-11810 Limestone as above to finely crystalline.  
 11810-11850 Limestone as above.  
 11850-11870 Limestone, brown gray, dense, finely crystalline.

Winnipeg Formation

11870-11880 Limestone as above, few pieces of red shale.  
 11880-11890 Limestone as above, much red shale.  
 11890-11900 Limestone, brown gray, finely crystalline to slightly saccharoidal and a little red shale.

11900-11910 Limestone as above, gray and green shale, piece of fine grained colorless sandstone.  
 11910-11920 Limestone and shale as above, little red shale.  
 11920-11930 Limestone and shale as above; little colorless fine grained sandstone.  
 11930-11940 Shale, gray to green, little red shale and shale coating, little colorless sandstone.  
 11940-11950 Limestone, few pieces of brown gray; gray and green shale.  
 11950-11960 Shale as above, few pieces of white sandstone.  
 11960-11970 Shale as above, brown gray limestone, dense.  
 11970-11990 Shale as above.  
 11990-12000 Shale as above, gray and green.  
 12000-12020 Shale as above.  
 12020-12030 Shale as above, few pieces of sandstone.  
 12030-12040 Shale as above, one large piece of fine grained colorless sandstone.  
 12040-12070 Shale as above, few pieces of sandstone as above.  
 12070-12090 Shale and sandstone as above, one piece of light gray sandstone glauconitic (not in 90), fine to medium grained.  
 12090-12100 Shale, sandstone as above, fine to coarse medium grained.  
 12100-12140 Shale and sandstone as above.  
 12140-12150 Shale, sandstone as above, some light brown sandstone.  
 12150-12180 Some reddish shale, sandstone as above, little shale as above.  
 12160-12170 Shale and some sandstone as above, colorless to light brown sandstone, fine to medium grained.  
 12170-12180 Shale, sandstone as above, very slight oil cut in sandstone, carbon tetrachloride test. Little brown gray fragmental limestone.  
 12180-12190 Shale, gray and green, colorless to light brown sand, fine to coarse grained.  
 12190-12200 Shale as above, some white sandstone, fine to medium grain.  
 12200-12210 Shale as above, colorless to light brown calcareous, little brown gray sandy limestone.  
 12210-12220 Shale and sandstone as above.  
 12220-12230 Shale as above, much sandstone, little brown gray fragmental limestone.  
 12230-12240 Shale and sandstone as above, very little limestone as above.  
 12240-12250 Shale and some sandstone as above.  
 12250-12270 Shale, sandstone and some limestone as above, some red shale.  
 12270-12280 Shale, sandstone as above; little gray orange pink, fine crystalline, dense limestone.  
 12280-12290 Shale, limestone as above, little brown gray dense limestone, little red shale.  
 12290-12300 Shale as above, much sandstone as above, fine to coarse grained.  
 12300-12310 Shale and sandstone as above, some sandstone very rounded.  
 12310-12320 Shale and sandstone as above, little brown gray and gray orange pink, dense limestone.  
 12320-12330 Shale and sandstone as above.  
 12330-12340 Much sandstone as above, some shale, few pieces brown gray limestone.  
 12340-12350 Shale and sandstone as above.  
 12350-12360 Sandstone and shale as above, brown gray sandy limestone.  
 12360-12370 Sandstone, shale as above, some sandy limestone.

12370-12380	Sandstone and shale as above, olive gray limestone.
12380-12390	Sandstone and shale as above, sandy limestone, olive gray to brown gray.
12390-12400	Same as above.
12400-12410	Shale and some sandstone as above, limestone, light brown gray to olive gray.
12410-12420	Shale, limestone, some sandstone as above.
12420-12430	Shale and some sandstone as above, tan to gray, sandy limestone.
12430-12440	Same as above.
12440-12450	Sandstone and shale as above; tan to gray fine crystalline to sandy limestone, little, glauconite.
12450-12460	Sandstone, shale and limestone as above.
12460-12470	Same as above, mostly limestone.
12470-12480	Sandstone, shale and limestone as above, shell fragments.
12480-12490	Sandstone, shale and limestone as above, little white limestone.
12490-12500	Sandstone, shale and limestone as above, little red shale.
12500-12510	Some limestone and shale as above; mostly sandstone.
12510-12520	Mostly, sandstone fine to coarse grained calcareous; little gray and green shale, very little limestone.
Circulation 22	Sandstone, shale and limestone as above. Sandy limestone.
Circulation 24	Sandstone, shale and limestone as above.
Circulation 26	As above, sandy limestone, very little light brown gray fine crystalline dense limestone.
12526	Total Depth