

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 113

Summary of the Phillips Company - Hoehn A-1  
McKenzie County, North Dakota  
Well No. 545 - Permit No. 558

By Clarence Carlson

The Phillips - Hoehn #1, McKenzie County, North Dakota, C NE SE, Section 13, T. 152N., R. 102W. (1980 feet from the south line, 660 feet from the east line). Elevation 2278 K.B.

The Phillips - Hoehn #1 was spudded April 5, 1954 and 13 3/8" casing was set at 970 with 850 sacks of cement. 9 5/8" casing was set at 9534' with 1200 sacks. The well was completed as a dry hole November 11, 1954 at a total depth of 13,853 feet.

Cement plugs were set at:

13,536 feet - 25 sacks	9,462 feet - 30 sacks
13,350 feet - 25 sacks	2,010 feet - 30 sacks
12,460 feet - 25 sacks	999 feet - 110 sacks
9,900 feet - 60 sacks	

TESTS

- DST #1 - 8509-85 - open 125 minutes, shut in 30 minutes, light blow throughout. Recovered 60 feet of drilling mud, no gas or oil FP 45#, SIP 1051#.
- DST #2 - 9050-9107 - open 20 minutes. Slight blow for 20 minutes, packer failed. Recovered 360 feet of drilling mud.
- DST #3 - 9405-9491 - open 22 minutes, packer failed. Recovered 1000 feet of drilling mud.
- DST #4 - 9630-9639 - open 4 hours, shut in 30 minutes. Recovered 120 feet of gas cut mud, 180 feet of gas and water cut mud, 210 feet of gas and muddy water with flakes of oil. FP 85-165#, SIP 70#, HP 4830#.
- DST #5 - 9673-9785 - packer failed.
- DST #6 - 9687-9785 - open 2 hours, shut in 30 minutes. Recovered 120 feet slightly gas cut mud, 180 feet of slightly gas and watery mud. FP 0-140#, SIP 3395#, HP 3395#.
- DST #7 - 10,870-893 - open 4 hours, shut in 45 minutes, weak blow for 30 minutes, then died. Recovered 1000 feet of water cushion, 201' of gas cut drilling mud. FP 480- 510#, SIP 780#, HP 5580#.
- DST #8 - 10,945-10,980 - open 1 1/2 hours, shut in 30 minutes, light blow for 20 minutes, decreased for 15 minutes then died. Recovered 1000 feet water cushion, 90 feet of drilling mud. FP 430-492#, SIP 1038#, HP 5960-5770#.
- DST #9 - 11,500 - 11,594 open 36 minutes, packer failed.
- DST #10 - 11,521 - 11,598 - open 2 1/2 hours, shut in 30 minutes, recovered 1668 feet water cushion, 540 feet slightly muddy salt water FP 1290#, SIP 5350#, HP 6500#.
- DST #11 - 12,545 - 12,648 - open 2 hours, shut in 30 minutes, weak to strong blow throughout, recovered 3000 feet water cushion, 6581 feet of salt water. FP 95-4815#, SIP 4778#, HP 6688#.

DST #12 - 13,316 - 13,343 - packer failed.  
 DST #13 - 13,325 - 13,345 - open 80 minutes, shut in 30 minutes, steady weak blow for 1 hour. Recovered 4230 feet water cushion and 20 feet of very slightly oil cut drilling mud. FP 1910#, SIP 4930#, HP 7135#.  
 Plugged back to 9,778 feet. Ran 5 1/2" liner from 9,778 to 8,394 and cemented with 275 sacks of cement.  
 Perforated 9650-9768, treated with 500 gallons, 1500 gallons and 3000 gallons. Swabbed 20 hours, recovered 35 barrels of salt water with scum of dead black oil. Set retainer at 9610 and squeezed with 50 sacks of cement.  
 Perforated 9495-9587, treated with 1000 gallons and 1500 gallons. No recovery of oil, gas or water.  
 Set retainer at 9492 feet.  
 Perforated 9404-9485, treated with 500 gallons and 1500 gallons of acid. Tested 2.48 barrels of salt water per hour by swabbing through open tubing. No gas and only slight show of dead black oil.

CORES:

9067-70	9876-9958	11,391-11,449
9137-93	10,807-10,886	11,518-11,594
9512-9679	10,895-10,951	12,500-12,558
9684-9785	11,130-11,150	13,215-13,273
		13,347-13,853

Formation tops were picked from samples, electric and radioactivity logs, corrected to the electric logs, not all formation tops called in the following list. Colors are from the rock color chart.

TOPS

Cretaceous System	
Pierre Formation	2010
Niobrara Formation	4290
Greenhorn Formation	4727
Muddy Sand	5288
Dakota Silt	5455
Dakota Sand	5575
Jurassic System	
Jurassic Shale	5985
Jurassic Sand	6273
Piper Lime	6705
Triassic System	
Spearfish Formation	7010
Permian System	
Minnekahta Formation	7510
Opeche Formation	7530
Mississippian System	
Amsden Formation	7765
Big Snowy Group	7990
Kibbey Lime	8512
Charles Formation	8656
Mission Canyon Formation	9600
Lodgepole Formation	10,100
Englewood Formation	10,838
Devonian System	

Lyleton Formation	10,900
Nisku Formation	11,105
Duperow Formation	11,200
Souris River Formation	11,640
Dawson Bay Formation	11,865
Prairie Evaporite	12,000
Winnipegosis Formation	12,170
Ashern Formation	12,350
Silurian System	
Interlake Group	12,470
Ordovician System	
Upper Stony Mountain	13,340
Lower Stony Mountain	13,480
Red River Formation	13,530

0-30	Shale, light gray, flaky, spongy, sand, fine grained subangular.
30-90	Sand, fine grained, subangular, micaceous, light gray.
90-180	Shale, light gray, silty, bentonitic, micaceous, spongy, lumpy.
180-210	Shale, as above, some sand fine grained, subangular.
210-360	Shale, light gray, some siltstone, light gray, micaceous.
360-420	Shale, light gray, bentonitic, silty, micaceous, some light gray sandy siltstone, little lignite.
420-510	Shale, light gray, bentonitic, lumpy, spongy, little lignite.
510-630	Shale, light gray, light brown, bentonitic, lumpy, compact, little lignite.
630-720	Shale, light gray, light brown, bentonitic, lumpy, compact and spongy.
720-780	Shale, vary light gray, bentonitic, lumpy, spongy to compact.
780-930	Shale, light to medium gray, bentonitic, lumpy, spongy, some lignite.
930-990	Shale, light gray, bentonitic, lumpy, spongy, sand, light gray, fine grained, argillaceous, micaceous.
990-1020	Shale, light to medium gray, bentonitic, lumpy, spongy, some siltstone, light gray argillaceous.
1020-1050	Shale, light gray, bentonitic, lumpy, spongy, some lignite.
1050-1080	Shale, as above, siltstone, light gray, argillaceous.
1080-1170	Shale, siltstone, as above, some lignite.
1170-1230	Shale, siltstone as above.
1230-1270	Shale, light gray, light brown, bentonitic, lumpy, spongy, compact.
1270-1300	Shale, light gray, light brown, bentonitic, lumpy, compact.
1300-1330	Shale, light gray, bentonitic, silty, lumpy, spongy.
1330-1360	Shale, light to medium gray, light brown, bentonitic, lumpy, compact.
1360-1430	Shale, as above, some lignite.
1430-1450	Shale, light to medium gray, light brown, bentonitic, silty, lumpy, compact, some lignite.
1450-1490	Lignite.
1510-1520	Lignite, sandstone, light gray, fine grained, micaceous, argillaceous.
1540-1550	Lignite, sandstone, as above, some shale, light gray.

1570-1580 Shale, light gray, lumpy, compact, some sandstone as above.  
 1600-1610 Lignite, shale, light to medium gray, bentonitic, silty.  
 1630-1640 Lignite.  
 1660-1670 Lignite, shale, light gray, silty, bentonitic.  
 1690-1700 Lignite, shale as above.  
 1720-1730 Sandstone, light gray, fine grained, subangular, shaly.  
 1740-1760 Sandstone, as above, some shale, light to medium gray, silty, lignite.  
  
 1810-1820 Sandstone, light gray, fine grained, shaly, shale, as above.  
 1840-1850 Sandstone, shale as above.  
 1870-1880 Sandstone, as above, little shale, as above, lignite.  
 1900-1910 Sandstone, light gray, fine to medium grained, subangular to angular shaly, some lignite.  
 1930-1940 Sandstone as above, lignite.  
 1960-1970 Shale, light gray, bentonitic, silty, some sandstone and lignite.  
 1990-2000 Shale, as above, some sandstone and lignite.  
 2020-2030 Shale, light gray, silty, bentonitic, lumpy, compact.  
 2050-2060 Shale, as above, some sandstone, light gray, fine grained, shaly.  
 2080-2100 Shale, as above.  
 2100-2150 Shale, light to medium gray, bentonitic, lumpy, spongy to compact.  
 2140-2150 Shale, medium gray, bentonitic, lumpy, spongy.  
 2170-2180 Shale, medium gray, bentonitic, lumpy spongy to compact.  
 2200-2300 Shale as above.  
 2330-2340 Shale, medium gray, bentonitic, lumpy, compact.  
 2350-2720 Shale, as above.  
 2740-2750 Shale, medium light to medium dark gray, bentonitic, lumpy, compact spongy.  
 2770-2780 Shale, medium light gray, bentonitic, lumpy, compact.  
 2800-2870 Shale, as above.  
 2890-2900 Shale, medium light to medium dark gray, bentonitic, lumpy, compact.  
 2920-2960 Shale, as above.  
 2980-3000 Shale, medium light gray, bentonitic, lumpy, spongy.  
 3000-3100 Shale, medium gray, bentonitic, lumpy, compact.  
 3100-3120 Shale, medium light to medium gray, bentonitic, lumpy, spongy.  
 3120-3320 Shale, medium gray, bentonitic, lumpy, spongy to compact.  
 3350-3400 Shale, medium gray, bentonitic, lumpy to fissile, spongy.  
 3400-3410 Shale, medium to medium dark gray, lumpy, spongy to compact, some white bentonite.  
 3410-3510 Shale, medium light to medium dark gray, lumpy to fissile, spongy.  
 3510-3550 Shale, medium gray, lumpy to fissile, spongy.  
 3550-3900 Shale, medium gray, fissile to splintery, spongy to compact.  
 3900-4030 Shale, medium gray, lumpy, spongy to compact.  
 4030-4220 Shale, medium to medium dark gray, lumpy to fissile, spongy to compact.  
 4220-4240 Shale, as above, some white bentonite.  
 4240-4300 Shale, medium gray, lumpy, compact.  
 4300-4400 Shale, medium gray, calcareous, lumpy, spongy to compact white specks.  
 4400-4450 Shale, medium dark gray, calcareous, lumpy, compact.

4450-4580 Shale, medium dark to dark gray, lumpy to splintery, compact.  
4580-4730 Shale, medium dark to dark gray, lumpy to flaky, spongy to compact.  
4730-4910 Shale, medium dark to dark gray, calcareous, lumpy to flaky, spongy white specks, many *Inoceramus* fragments.  
4910-4920 Shale, dark gray, fissile to splintery, spongy, some white specked shale.  
4920-4940 Shale, dark gray, fissile to splintery, spongy, some white bentonite.  
4940-5160 Shale, dark gray, fissile to splintery, spongy to compact.  
5160-5190 Shale, dark gray, splintery, compact.  
5190-5220 Shale, medium gray, lumpy, compact, dark gray as above.  
5220-5230 Shale, dark gray, flaky to splintery, spongy to compact.  
5230-5290 Shale, dark gray as above, some medium gray, lumpy, compact.  
5290-5300 Shale, as above, sandstone very light gray, very fine grained.  
5300-5320 Shale, as above, little white, micaceous bentonite.  
5320-5340 Shale, medium to dark gray, flaky to splintery, spongy and compact.  
5340-5400 Shale, medium gray, lumpy, compact.  
5400-5460 Shale, medium to dark gray, flaky to lumpy, compact.  
5460-5480 Shale, as above, some light brownish gray siltstone.  
5480-5540 Shale, medium gray, lumpy, compact.  
5540-5570 Shale, as above, little siltstone, light brownish gray.  
5570-5580 Shale, as above, some sandstone very light gray, fine grained.  
5580-5610 Sandstone, very light gray, fine grained, micaceous, some medium gray shale.  
5610-5640 Sandstone, very light gray to colorless, some fine grained, some fine to medium grained, subangular quartz grains.  
5640-5650 Shale, dark gray, flaky to splintery, compact.  
5650-5660 Shale, as above, some sandstone very light gray, fine grained.  
5660-5690 Sandstone, very light gray, fine grained, shale medium gray.  
5690-5750 Sandstone, very light gray, fine to medium subangular to subrounded quartz grains, well cemented.  
5750-5840 Sandstone, very light gray, fine to very fine grained, firmly cemented.  
5840-5880 Sandstone as above, some shale, medium gray, flaky, spongy.  
5880-5890 Shale, dark gray, flaky spongy, some sandstone as above.  
5890-5900 Sandstone, very light gray, fine grained, quartzose, firmly cemented.  
5900-5910 Sandstone as above, some shale, dark to medium gray flaky, spongy.  
5910-5940 Shale, dark gray, flaky, spongy, some shale, light greenish gray, flaky, spongy with siderite pellets, sandstone as above.  
5940-5950 Shale, dark gray as above, some sandstone as above.  
5950-5980 Sandstone, light gray, fine grained, shale as above.  
5980-6010 Shale, medium gray, flaky, spongy.  
6010-6020 Shale, medium gray, micaceous, flaky, spongy to compact, little light gray, very fine grained sandstone.  
6020-6050 Shale, medium gray, light brownish gray, lumpy, spongy to compact, sandstone light brownish gray, light gray, fine grained.  
6050-6060 Sandstone, light gray, very fine grained, firmly cemented, shale as above.

6060-6080 Shale, medium to medium light gray, flaky, spongy, some sandstone as above.

6080-6100 Shale, as above and light brownish gray, some sandstone as above.

6100-6120 Sandstone, light gray to light brownish gray, fine grained, some shale, light to medium gray, flaky, spongy.

6120-6150 Shale, light to medium gray, flaky, spongy, micaceous, some light greenish gray, flaky, spongy.

6150-6180 Shale, as above, sandstone light gray, very fine grained, calcareous.

6180-6270 Shale, light greenish gray, flaky and splintery, spongy micaceous, calcareous, shale light brownish gray, flaky spongy, calcareous.

6270-6280 Shale, as above, sandstone light gray, fine grained, calcareous, with pyrite and glauconite.

6280-6320 Sandstone light gray, fine grained, calcareous, micaceous.

6320-6330 Sandstone as above, some shale, light greenish gray, micaceous flaky, spongy.

6400-6480 Shale, light greenish gray, light olive gray, flaky and splintery, spongy to compact, calcareous, micaceous.

6490-6570 Shale, as above.

6570-6600 Shale, greenish gray, 5G6/1 calcareous, foliated, spongy to compact.

6600-6630 Shale, light greenish gray to greenish gray, calcareous, foliated, spongy to compact, sandstone light brownish gray, fine grained calcareous.

6630-6720 Shale, as above.

6720-6740 Limestone, very light gray to white, fine grained, much shale as above.

6740-6770 Shale, light greenish gray, 5G8/1, grayish red 10R4/2, calcareous, splintery, brittle, little sandstone light greenish gray, fine grained calcareous.

6770-6790 Shale, as above, mostly light greenish gray.

6790-6820 Shale, light greenish gray, calcareous, flaky and splintery, compact, little sandstone light greenish gray, fine grained calcareous little grayish red shale as above.

6820-6840 Limestone, very light gray, sublithographic.

6840-6870 Limestone, as above, some shale, light greenish gray to greenish gray calcareous, splintery, compact.

6870-6900 Limestone, light gray, very finely crystalline, shale, light greenish gray, light olive gray, calcareous, splintery, compact.

6900-6920 Limestone as above.

6920-6930 Limestone, as above, shale light greenish gray, grayish red.

6940-6970 Shale, greenish gray, light olive gray, calcareous, splintery, compact, some shale grayish red, calcareous, compact.

6970-7010 Shale, grayish red, calcareous, splintery, compact, little gypsum, shale greenish gray as above.

7010-7080 Salt, samples, shale, grayish red, gypsum.

7080-7090 Shale, pale reddish brown, calcareous, lumpy.

7090-7180 Siltstone, moderate reddish orange, calcareous, little gypsum.

7180-7310 Siltstone, as above, gypsum, some shale, grayish red, calcareous, lumpy, compact.

7310-7440 Salt, samples are little grayish red shale and much greenish gray shale, some moderate reddish orange siltstone.

7440-7460 Siltstone, moderate reddish orange, some gypsum.

7460-7510 Siltstone as above, gypsum, some shale, moderate reddish orange, grayish red, calcareous, lumpy, compact.

7510-7520 Limestone, light pinkish gray, fine grained, dolomitic, siltstone as above.

7520-7540 Siltstone, moderate reddish orange, calcareous, shale, grayish red calcareous, lumpy, compact, gypsum.

7540-7580 Shale, grayish red, calcareous, lumpy, compact, gypsum.

7580-7600 Siltstone, moderate reddish orange, calcareous, some shale as above, little gypsum.

7600-7670 Shale, grayish red, calcareous, lumpy, compact, some siltstone as above.

7670-7720 Siltstone as above.

7720-7770 Siltstone, moderate reddish orange, calcareous, shale, moderate reddish orange, grayish red, calcareous, lumpy, compact.

7770-7780 Dolomite, pinkish gray, fine grained, limey, sandstone very light gray fine grained, calcareous.

7780-7800 Dolomite, light gray to pinkish gray, fine grained, limey.

7800-7810 Dolomite, as above, some shale, moderate red, splintery.

7810-7850 Dolomite, light gray, fine grained, limey, some shale as above, a little white chert, 7830-40.

7850-7920 Dolomite, light gray, pinkish gray, fine grained, limey.

7920-7960 Dolomite, as above, shale, moderate red, grayish red purple lumpy and splintery, compact.

7960-7990 Shale, as above, some dolomite, as above.

7990-8170 Shale, variegated, pale reddish brown, moderate red, dusky yellow, dark gray, splintery, brittle.

8170-8200 Limestone, light gray, fine grained, some variegated shale.

8200-8220 Shale, variegated as above.

8220-8240 Limestone, light gray, pinkish gray, very finely crystalline, shale as above.

8240-8330 Shale, variegated, splintery, brittle.

8330-8350 Shale, as above, some sandstone, light gray, very fine grained, silty.

8350-8360 Sandstone, white to colorless, fine grained, shale as above.

8360-8400 Shale, variegated, splintery, brittle, some sandstone as above.

8400-8430 Sandstone, pinkish gray, very fine grained, calcareous.

8430-8500 Sandstone, as above, also sandstone fine to medium, subrounded grains some shale, variegated.

8500-8510 Sandstone, white to very light gray, fine to medium grained, also pinkish gray, fine grained, calcareous.

8510-8520 Anhydrite, and gypsum, some sandstone as above.

8520-8550 Limestone, light brownish gray, medium crystalline and very finely crystalline, anhydrite.

8550-8570 Sandstone, light gray, very fine grained, calcareous.

8570-8600 Sandstone as above, some shale, light to medium gray.

8600-8650 Sandstone moderate reddish orange, very fine grained, calcareous.

8650-8700 Sandstone as above, some shale, pale reddish brown, calcareous, some anhydrite.

8700-8730 Salt.

8730-8740 Shale, pale red, calcareous, lumpy, compact.

8740-8780 Salt.  
 8780-8790 Shale, pale red, calcareous, lumpy, compact, anhydrite.  
 8790-8850 Salt.  
 8850-8870 Anhydrite, shale, pale red, calcareous, lumpy, compact.  
 8870-8900 Salt.  
 8900-8915 Anhydrite, shale as above.  
 8915-8925 Salt.  
 8925-8933 Anhydrite, shale as above.  
 8933-8954 Salt.  
 8954-8970 Anhydrite, shale pale red, calcareous.  
 8970-8995 Limestone, light gray, finely crystalline, some shale anhydrite, as above.  
 8995-9040 Salt.  
 9040-9067 Limestone, brownish gray, finely crystalline, dense.

Core

9067-9070 Limestone, light gray, fine grained, fragmental.  
 9080-9110 Limestone, light gray to brownish gray, fine grained.  
 9110-9140 Anhydrite.  
 9140-9155 Salt.  
 9155-9160 Anhydrite.  
 9160-9180 Anhydrite, limestone, light gray, very fine grained, dense.  
 9180-9230 Limestone, brownish gray, fine grained, rounded fragmental and very finely crystalline dense, some anhydrite.  
 9230-9250 Anhydrite.  
 9250-9260 Anhydrite, limestone brownish gray, fine grained, rounded fragmental.  
 9260-9300 Limestone, brownish gray, very finely crystalline, dense.  
 9300-9340 Salt, a few shale partings.  
 9340-9360 Limestone, brownish gray, very finely crystalline.  
 9360-9390 Anhydrite.  
 9390-9400 Limestone, brownish gray, very finely crystalline.  
 9400-9438 Limestone, light gray, fine grained, slight fluorescence, spotty, limestone, brownish gray, finely crystalline.

Cores 9438-9494

9438-9445 Limestone, brownish gray, very finely crystalline, with secondary crystals of calcite.  
 9445-9448 Limestone, brownish gray, fine grained fragmental, with some secondary crystals of calcite in fractures and vugs.  
 9448-9450 Limestone, brownish gray, finely crystalline, secondary crystalline of calcite petroliferous odor on fresh break.  
 9450-9455 Limestone, yellowish gray, fine grained, oolitic with secondary crystals of calcite, oolites very fine to coarse sizes.  
 9455-9461 Limestone, very light gray, fine grained, fragmental to oolitic.  
 9461-9466 Limestone, brownish gray, very fine to medium crystalline.  
 9466-9469 Limestone, as above, with stylolitic seams, petroliferous odor on fresh break.  
 9469-9474 Limestone, light yellowish gray, fine grained, fragmental.  
 9474-9477 Limestone, light brownish gray, fine to medium crystalline.  
 9477-9479 Limestone, light brownish gray, fine grained, rounded fragmental in part.  
 9479-9480 Limestone, light gray, microsucrosic.



9480-9483 Limestone, light brownish gray, fine grained, rounded fragmental in part.  
9483-9484 Limestone, brownish gray, fine to medium crystalline.  
9484-9491 Limestone, light brownish gray, fine grained, rounded fragmental with some inclusions of anhydrite.  
9491-9493 Limestone, brownish gray, fine to medium crystalline, dense.  
9493-9494 Limestone, light brownish gray, fine to medium crystalline, end of core.  
9504-9512 Limestone, brownish gray, fine to medium crystalline.

Cores

9512-9524 Limestone, brownish gray, fine to medium crystalline, fragmental, limestone, medium dark gray, very fine grained, shaly, petroliferous odor.  
9524-9537 Limestone, brownish gray, fine to medium crystalline, fragmental in part, dark staining in part with petroliferous odor.  
9537-9538½ Limestone, light brownish gray, fine to medium crystalline, fossiliferous fragmental, petroliferous odor.  
9570-9575 Limestone, brownish gray, fine to medium crystalline, fossiliferous, fragmental, petroliferous odor.

End of Cores

9606-9620 Limestone, brownish gray, fine to medium crystalline.  
9670-9710 Limestone, as above, some scattered staining.

Cores

9711-9734 Limestone, light brownish gray, fine to medium grained, fossiliferous fragmental.  
9734-9739 Limestone, brownish gray, fine to medium grained, fossiliferous fragmental.  
9739-9774 Limestone, light brownish gray, fine to medium grained, fossiliferous fragmental, some coarse crystals.  
9774-9788 Limestone, light brownish gray, fine to coarsely crystalline, fragmental fossiliferous.

Samples

9800-9810 Limestone as above.  
9840-9860 Limestone, light gray to yellowish gray, fine grained.  
9870-9877 Limestone, brownish gray, fine to medium crystalline, fragmental.

Cores

9877-9888 Limestone, light gray to light brownish gray, fine to medium crystalline, fossiliferous, fragmental, some stylolites.  
9888-9905 Limestone, light brownish gray, fine to medium crystalline, fossiliferous fragmental, limestone, medium gray, very fine to finely crystalline.  
9907-9918½ Limestone, light brownish gray, fine to medium crystalline, fossiliferous fragmental.  
9918½-9937 Limestone, light yellowish gray, medium to coarsely crystalline, fragmental, with some carbonaceous residue.  
9937-9938 Limestone, light brownish gray, fine to medium crystalline, fossiliferous.

9938-9958 Limestone, brownish gray, fine to medium crystalline.

#### Samples

9958-9980 Limestone, brownish gray, fine to medium crystalline.  
9990-10,010 Limestone, light gray, light brownish gray, fine grained.  
10,010-10,020 Limestone, light to medium gray, finely crystalline.  
10,030-10,090 Limestone, light gray, fine grained, some medium gray as above.  
10,090-10,110 Limestone, light brownish gray, finely crystalline.  
10,120-10,260 Limestone, light gray, brownish gray, fine grained, fossiliferous, shaly.  
10,260-10,290 Limestone, brownish gray, finely crystalline, fossiliferous.  
10,290-10,370 Limestone, as above, light gray, fine grained, shaly.  
10,390-10,400 Limestone, brownish gray, finely crystalline, dense.  
10,440-10,470 Limestone, as above.  
10,500-10,550 Limestone, brownish gray, finely crystalline, dense.  
10,570-10,630 Limestone, brownish gray, finely crystalline, dense.  
10,630-10,680 Limestone, light to medium gray, fine grained.  
10,760-10,780 Limestone, light gray, fine grained, argillaceous, limestone medium gray very finely crystalline, dense.

#### Cores

10,807-10,815 Limestone, medium gray, very finely crystalline, argillaceous in part.  
10,815-10,826 Limestone, brownish gray, very finely crystalline, some fossil fragments.  
10,857-10,872 Siltstone, medium gray, very fine grained, calcareous.  
10,872-10,874 Limestone, light gray, finely crystalline.  
10,895-10,915 Shale, dark gray, laminated, compact.  
10,915-10,920 Shale, medium gray, calcareous, laminated, compact.  
10,920-10,925 Shale, as above, some limestone medium gray, finely crystalline.  
10,925-10,930 Shale, limestone as above, dolomite, yellowish gray finely crystalline, limey with some light greenish gray shale layers.  
10,930-10,945 Dolomite as above with light greenish gray, shale partings, some pyrite.  
10,945-10,950 Dolomite and shale, as above, shale, grayish red, lumpy, compact.  
10,950-10,951 Shale, grayish red, calcareous.

#### Samples

10,950-10,970 Shale as above.  
10,970-10,990 Dolomite, grayish orange pink, fine grained.  
10,990-11,010 Shale, grayish red, calcareous, lumpy, compact.  
11,010-11,040 Shale, as above and light greenish gray, calcareous, dolomite, light gray, fine grained.  
11,040-11,070 Dolomite, light gray to grayish red, fine grained, shaly.  
11,070-11,100 Dolomite, as above, some greenish gray, calcareous shale.  
11,100-11,110 Dolomite, as above.  
11,110-11,130 Limestone, light gray to brownish gray, finely crystalline, to fine grained some anhydrite.

#### Cores

11,130-11,137 Anhydrite, light to medium gray, massive dense.

- 11,137-11,147 Limestone, yellowish gray, finely crystalline, limestone brownish gray fine to medium crystalline, petroliferous odor on fresh break.
- 11,147-11,150 Limestone, light brownish gray, fine to medium crystalline.

#### Samples

- 11,150-11,160 Limestone, light brownish gray, fine grained.
- 11,160-11,220 Limestone, light brownish gray, finely crystalline.
- 11,220-11,230 Limestone, as above, anhydrite.
- 11,230-11,350 Limestone, brownish gray to light gray, finely crystalline.
- 11,350 11,390 Limestone, as above, light brownish gray, microsucrosic.

#### Cores

- 11,391-11,396 Limestone, brownish gray, finely crystalline few fossil fragments.
- 11,396-11,398 Limestone, light brownish gray, fine to medium crystalline fragmental fossiliferous.
- 11,398-11,399 Limestone, light brownish gray, fine grained.
- 11,399-11,401 Limestone, light gray, fine grained.
- 11,401-11,405 Limestone, brownish gray, very finely crystalline, dense, petroliferous odor.
- 11,405-11,408 Limestone, light gray, fine grained, sandy.
- 11,408-11,410 Anhydrite, light gray, massive, dense.
- 11,410-11,411 Limestone, light gray, fine grained with thin shaly partings.
- 11,411-11,413 Limestone, brownish gray, fine to medium crystalline.
- 11,413-11,435 Limestone, light brownish gray finely crystalline with some small anhydrite inclusions, some chips with a petroliferous odor on fresh break and darker brown in color.
- 11,435-11,438 Limestone, as above, anhydrite, light gray, massive.
- 11,438-11,449 Limestone, brownish gray, fine to medium crystalline, petroliferous odor on fresh break.

#### Samples

- 11,450-11,490 Limestone, light brownish gray to brownish gray, finely crystalline.
- 11,490-11,519 Limestone, as above, limestone light brownish gray, fine grained.

#### Cores

- 11,519-11,522 Limestone, brownish gray, very finely crystalline, petroliferous odor on fresh break, dense.
- 11,522-11,538 Limestone, light brownish gray, very fine to finely crystalline, with some carbonaceous residue along scattered stylolitic partings.
- 11,538-11,539 Limestone, light gray, finely crystalline, dense.
- 11,539-11,541 Anhydrite, light to medium gray, massive.
- 11,541-11,543 Limestone, brownish gray, very fine to medium crystalline, dense, petroliferous odor on fresh break.
- 11,543-11,546 Anhydrite, light brownish gray.
- 11,546-11,550 Limestone, brownish gray, finely crystalline dense, petroliferous odor.
- 11,550-11,555 Limestone, light brownish gray, fine to medium crystalline, scattered pyrite.
- 11,555-11,561 Limestone, light brownish gray, very finely crystalline.

- 11,561-11,570 Limestone, light gray, very finely crystalline with some medium to coarse crystals, also light brownish gray, finely crystalline, some medium to coarse crystalline, a few shell fragments.
- 11,570-11,574 Anhydrite, light gray with some interbedded, limestone brownish gray, fine grained.
- 11,574-11,577 Limestone, brownish gray, finely crystalline, dense with some inclusions of anhydrite.
- 11,587-11,588 Anhydrite, light gray, massive finely crystalline with some limestone light gray.
- 11,588-11,594 Limestone, brownish gray, finely crystalline, dense with a few coarse crystals and some carbonaceous, material along stylolitic seams.

#### Samples

- 11,594-11,620 Limestone, light brownish gray, fine grained to finely crystalline.
- 11,620-11,660 Limestone, brownish gray, finely crystalline, dense.
- 11,660-11,690 Limestone, light brownish gray, fine grained.
- 11,690-11,780 Limestone, brownish gray, finely crystalline some limestone as above.
- 11,780-11,800 Limestone, light yellowish gray fine grained, silty.
- 11,800-11,850 Limestone, brownish, gray, finely crystalline with some medium to coarse crystalline, some limestone as above.
- 11,850-11,860 Limestone, very light gray, argillaceous with some vugular porosity limestone very light gray, fine grained, clastic with intergranular porosity.
- 11,860-11,880 Limestone, very light gray, fine grained, argillaceous.
- 11,880-11,890 Limestone, light brownish gray, microsucrosic and finely crystalline.
- 11,890-11,900 Limestone, brownish gray, finely crystalline dense.
- 11,900-11,940 Dolomite, light brownish gray, microsucrosic, limey.
- 11,940-11,950 Limestone, brownish gray, finely crystalline dense.
- 11,950-11,960 Limestone, brownish gray, as above, and light brownish gray, microsucrosic.
- 11,960-11,970 Limestone, light brownish gray, fine grained, argillaceous, some limestone finely crystalline and microsucrosic as above.
- 11,970-11,990 Limestone, light brownish gray, fine grained, slightly argillaceous.
- 11,990-12,170 Salt.
- 12,170-12,190 Limestone, brownish gray, finely crystalline light gray, fine grain.
- 12,200-12,250 Limestone, light brownish gray, fine grained, some limestone, brownish gray finely crystalline, dense.
- 12,250-12,270 Dolomite, light brownish gray, limey argillaceous, microsucrosic some limestone, brownish gray to medium dark gray, finely crystalline.
- 12,270-12,350 Limestone, medium dark gray, finely crystalline, dense, some medium to coarse crystals and shell fragments.
- 12,350-12,380 Shale, grayish pink to pale red 5R6/2, lumpy, compact, very calcareous.
- 12,380-12,460 Shale, as above, limestone light to medium gray, finely crystalline some shell fragments.

12,460-12,480 Shale as above, some dolomite, pale red, fine grained, argillaceous.  
12,480-12,490 Limestone, grayish pink, fine grained.  
12,490-12,500 Limestone, very light gray, sublithographic, limestone pinkish gray, as above.

#### Cores

12,500-12,502 Limestone, very light gray, fine grained, thinly banded with some medium to fine crystalline layers, chert, pale red 5R6/2.  
12,502-12,504 Chert, very light gray, some limestone light gray, fine grained.  
12,504-12,518 Limestone, pale red, very light gray, fine grained, rounded fragmental, cherty.  
12,518-12,521 Limestone, light gray, finely crystalline matrix with fragments of white fine grained limestone and some medium crystalline, cherty sandy.  
12,521-12,525 Limestone, very light gray to pinkish gray, sublithographic to finely crystalline dolomitic.  
12,525-12,526 Dolomite, medium gray, fine grained argillaceous.  
12,526-12,533 Limestone, very light gray, sublithographic, slightly dolomitic cherty.  
12,533-12,544 Limestone, very light gray, fine grained, fragmental, cherty.  
12,544-12,550 Limestone, very light gray, finely crystalline with some medium crystals.  
12,550-12,551 Limestone, light brownish gray, finely crystalline cherty with some very light gray, fine grained, fragmental limestone.  
12,551-12,558 Limestone, very light gray, fine grained, cherty.

#### Samples

12,560-12,630 Limestone, very light gray, fine grained, dolomitic, cherty, some limestone light to medium light gray, fine grained, fragmental.  
12,630-12,660 Limestone, very light gray, sublithographic, some chert, pinkish gray.  
12,660-12,700 Chert, very light gray, pinkish gray, some limestone as above.  
12,700-12,710 Dolomite, light gray, very fine grained, chert, as above.  
12,710-12,730 Chert, pinkish gray, light gray, some dolomite as above.  
12,730-12,790 Dolomite, light gray to medium light gray, fine grained, limey, a little chert, light gray.  
12,790-12,820 Dolomite, light gray to light pinkish gray, finely crystalline.  
12,820-12,840 Dolomite, as above, dolomite, very light gray sublithographic, limey.  
12,840-12,860 Dolomite, light gray, finely crystalline, dolomite light gray, fine to medium grained, fair intergranular porosity.  
12,860-12,910 Dolomite, light gray, fine grained to finely crystalline.  
12,910-12,960 Dolomite, as above with a few pieces of white chert.  
12,960-13,000 Dolomite, light gray to light brownish gray, fine to medium grained, a little light gray chert.  
13,000-13,060 Dolomite, light gray to light brownish gray, finely crystalline.  
13,060-13,080 Dolomite, light brownish gray, finely crystalline.  
13,080-13,120 Dolomite, very light gray, sublithographic, limey, some dolomite as above.  
13,120-13,150 Dolomite, light brownish gray finely crystalline.

13,150-13,215 Dolomite, brownish gray, finely crystalline, dense.

#### Cores

13,215-13,217½ Dolomite, brownish gray, finely crystalline, dense.  
13,217½-13,227 Anhydrite, white, massive, dolomite as above.  
13,227-13,240 Dolomite, brownish gray, very finely crystalline matrix with some medium crystals.  
13,240-13,273 Dolomite, brownish gray, finely crystalline, limey.

#### Samples

13,273-13,300 Dolomite, light brownish gray, finely crystalline.  
13,300-13,310 Dolomite, as above, some white anhydrite.  
13,310-13,348 Dolomite, brownish gray, finely crystalline.

#### Cores

13,348-13,352 Dolomite, brownish gray, finely crystalline, dense, limey.  
13,352-13,361 Limestone, brownish gray, very finely crystalline, dense with dark gray shaly stringers.  
13,361-13,366 Limestone, brownish gray, fine to medium crystalline fragmental with a few shell fragments, slightly shaly.  
13,366-13,373 Limestone, brownish gray, finely crystalline with a few medium crystals, a few shell fragments.  
13,373-13,377 Limestone, light gray, finely crystalline dolomitic.  
13,377-33,379 Anhydrite, white massive.  
13,379-13,381 Limestone, light gray and medium dark gray, finely crystalline slightly shaly, anhydrite white, massive.  
13,381-13,383 Limestone, medium gray, finely crystalline argillaceous.  
13,383-13,388 Limestone, dark gray, finely crystalline with a few medium crystals slightly argillaceous, few shell fragments.  
13,388-13,398 Limestone, light to medium gray, finely crystalline, with some medium crystals, few shell fragments.  
13,398-13,399 Limestone, dark gray, finely crystalline, dense, anhydrite, white massive.  
13,399-13,401 Limestone, light gray, fine to medium, crystalline, fossiliferous, fragmental.  
13,401-13,402 Limestone, medium gray, finely crystalline, thinly laminated with medium gray shale partings.  
13,402-13,403 Anhydrite, medium gray, massive.  
13,403 13,408 Limestone, light brownish gray, finely crystalline, with some medium to coarse crystals.  
13,408-13,409 Limestone, light gray, finely crystalline.  
13,409-13,411 Anhydrite, medium gray.  
13,411-13,418 Limestone, medium gray to brownish gray very finely crystalline.  
13,418-13,421 Limestone, light gray to medium gray, finely crystalline, thinly laminated slightly argillaceous.  
13,421-13,423 Limestone, light gray, fine to medium crystalline.  
13,423-13,425 Dolomite, very light brownish gray, fine grained, limey.  
13,425-13,434 Limestone, light to medium gray, finely crystalline and fine grained.  
13,434-13,438 Limestone, light gray, fine grained, fragmental, fossiliferous.  
13,438-13,442 Limestone, light gray to light brownish gray, fine to medium crystalline, a few shell fragments.

13,442-13,451 Dolomite, light brownish gray, fine grained, granular limey, with stylolites.

13,451-13,468 Limestone, light brownish gray, finely crystalline, with a few fossil fragments and a few stylolites.

13,468-13,482 Limestone, light brownish gray, fine to medium crystalline few fossil fragments.

13,482-13,497 Limestone, light to medium gray, finely crystalline matrix, fragmental, fossiliferous in part.

13,497-13,510 Limestone, light to medium gray, fine to medium grained, fragmental, fossiliferous, slightly argillaceous, dolomitic.

13,510-13,523 Limestone, light gray to medium gray, fine to medium grained fragmental, fossiliferous some limestone medium gray, fine grained argillaceous, fossiliferous.

13,523-13,524 Limestone, light to medium gray, very finely crystalline.

13,524-13,537 Limestone, light to medium gray fine to medium grained, fossiliferous fragmental, limestone medium gray, fine grained, argillaceous.

13,537-13,552 Limestone, light to medium gray, finely crystalline, with some fossil fragments.

13,552-13,571 Limestone, light to medium gray finely crystalline, fragmental and fossiliferous in part.

13,571-13,573 Anhydrite, light gray, massive.

13,573-13,576 Limestone, light gray, very finely crystalline.

13,576-13,597 Limestone, medium gray, very finely crystalline, dense.

13,597-13,606 Anhydrite, medium gray, massive with limestone, filled fractures.

13,606-13,608 Limestone, light brownish gray, fine to medium crystalline.

13,608-13,615 Limestone, light brownish gray, very finely crystalline.

13,615-13,620 Limestone, light brownish gray to medium gray, fine to medium crystalline, containing scattered pyrite.

13,620-13,623 Limestone, light to medium gray, very finely crystalline, some stylolites.

13,623-13,625 Limestone, medium gray fine to medium grained fragmental.

13,625-13,633 Limestone, brownish gray, finely crystalline, with a few medium crystals.

13,633-13,650 Limestone, brownish gray, fine to medium crystalline, fragmental.

13,650-13,653 Dolomite, medium gray fine grained and anhydrite, medium gray, massive.

13,653-13,657 Anhydrite, light gray, massive.

13,657-13,668 Dolomite, light brownish gray, finely crystalline.

13,668-13,670 Anhydrite, medium gray.

13,670-13,676 Dolomite, light brownish gray, fine to medium grained.

13,676-13,679 Dolomite, light brownish gray, finely crystalline.

13,679-13,680 Dolomite, light brownish gray, fine grained, oolitic limey.

13,680-13,695 Dolomite, light brownish gray, finely crystalline, limey.

13,695-13,708 Limestone, light brownish gray, finely crystalline to fine grained.

13,708-13,709 Chert, very light gray.

13,709-13,715 Limestone, light brownish gray, fine grained, little light gray chert.

13,715-13,724 Limestone, light brownish gray, fine grained.

13,724-13,727 Limestone, light brownish gray, finely crystalline.

- 13,727-13,730 Limestone, light brownish gray, fine to medium crystalline, fossiliferous fragmental.
- 13,730-13,752 Limestone, light brownish gray, fine to medium crystalline, dolomitic slightly silty.
- 13,752-13,757 Limestone, light brownish gray, fine grained, microsucrosic and finely crystalline, dense, some stylolites.
- 13,757-13,760 Limestone, light brownish gray, fine grained, microsucrosic, slightly argillaceous, dolomitic.
- 13,760-13,768 Limestone, as above and limestone medium gray, finely crystalline, dolomite.
- 13,768-13,780 Limestone, light brownish gray to medium gray, finely crystalline, slightly argillaceous.
- 13,780-13,798 Limestone, light brownish gray, fine grained, fragmental in part, microsucrosic, some finely crystalline.
- 13,798-13,850 Limestone, light brownish gray, fine to medium crystalline, fragmental in part.