

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 114

Summary of the California Company - Rough Creek Unit No. 1
McKenzie County, North Dakota
Well No. 5279 - Permit No. 540

By John L. Hainer

California Company - Rough Creek Unit No. 1, McKenzie County, North Dakota. Location - 810 feet from north line and 1980 feet from east line of section 13, T. 148N., R. 98W. Elevation: K.B. 2472 feet. Total Depth: 12,050 feet.

The California Company - Rough Creek Unit No. 1 was spudded February 8, 1954; drilled to a total depth of 12,050 feet; plugged back to 9,764 feet; plugged and abandoned September 4, 1954.

CASING RECORD

| Size | Put in Well | Pulled Out | Left In | Sacks of Cement |
|---------|-------------|------------|---------|-----------------|
| 16" | 41'10" | - - - - - | 41'10" | 75 |
| 10 3/4" | 1190'6" | - - - - - | 1190'6" | 850 |
| 7" | 10,481'9" | 5800'9" | 4681'0" | 800 |

DRILL STEM TEST DATA

DST 1 Interval 8390 to 8420 feet - Packers failed - Misrun.

DST 2A Interval 8328 to 8420 feet - Packers failed - Misrun.

DST 1B Interval 8265 to 8420 feet. 2000 feet water cushion, no bottom hole choke. Tool opened with weak blow remaining fairly steady for 30 minutes, slowly decreasing to dead in 55 minutes, dead thereafter. Tool open 2 hours, shut in 1 hour. Recovered 2000 feet water cushion, 90 feet rathole mud very slightly gas-cut with slight rainbow of oil at base.
Pressures: Top bomb: IF 1125, FF 1125, SI 1300, HH 4650
Bottom Bomb: IF 1150, FF 1150, SI 1625, HH 5000
Formation tested: Heath

DST 2 Stuck drill pipe at 3740 feet - Misrun.

DST 2A Set Johnson packers to test interval 9340 to 9365 feet. No chokes, 1440 feet water cushion. Tool opened with weak blow decreasing to very weak blow in 1/2 hour, decreasing slowly to dead in 2 1/2 hours, total time open 3 hours, shut in 1/2 hour. Recovered 1440 feet water cushion, 90 feet very slightly gas cut drilling mud. Salinity of drilling mud before test 128,000 PPM NACL, salinity of recovered mud 198,000 PPM NACL.
Pressures: IF 740, FF 725, SI 4375, HH 5375
Formation Tested: Charles

DST 3 Set Johnson packers to test interval 9659 to 9683 feet. No chokes, 1600 feet water cushion, tool opened with weak blow decreasing to dead in 2 1/2 hours, total open 3 hours, shut in 1/2 hour. Recovered 1600 feet very slightly gas-cut water cushion, 30 feet slightly gas-cut rathole mud, no show of oil.

Pressures: IF 845, FF 845, SI 1600, PH 5650
Formation Tested: Mission Canyon (Base of last salt)

DST 4 Set Johnson packers to test interval 9672 to 9740 feet. No chokes, no water cushion. Tool opened with very weak blow decreasing to dead in 1 hour, total open 2 1/4 hours, shut in 1 hour. Recovered 120 feet slightly gas-cut rathole mud, no show of oil.
Pressures: IF 125, FF 125, SI 2325, HH 5875
Formation Tested: Mission Canyon (Base of last salt)

DST 5 Interval 9730 to 9814 feet - packers failed - Misrun.

DST 5A Interval 9718 to 9814 feet - tool failed to open - Misrun.

DST 5B Interval 9718 to 9814 feet. No cushion, no choke, tool opened with very weak blow decreasing to dead in 10 minutes. After one hour closed and reopened tool with very weak blow decreasing to dead in 5 minutes. Total open 3 hours, shut in 1 hour. Recovered 540 feet very slightly gas-cut rathole mud.
Pressures: IF 200, FF 275, SI 2875, HH 5655
Formation Tested: Mission Canyon (Base of last salt and Mission Canyon shale)

DST 6 Interval 9829 to 9880 feet. No cushion, no chokes, tool opened with weak blow slowly increasing to fair blow steady thereafter, total open 5 hours, shut in 1 hour, no gas to surface. Recovered 120 feet of fluid as follows: 30 feet slightly gas-cut mud, 90 feet mud apparently very slightly sulphur water-cut and very slightly gas-cut with rainbow of oil.
Pressures: IF 0, FF 0, SI 450, PH 5650
Formation Tested: Mission Canyon Shale.

DST 7 Interval 9895 to 9937 feet, no cushion, no chokes, tool opened with very weak blow increasing to strong blow in 15 minutes, slowly decreasing to fair blow after 1 hour. Gas to surface in 1 hour 15 minutes, gas flame very rich, approximately one gallon of 59° API. Distillate collected in surface connections while gas was flowing. Tool open 3 hours, shut in 1 hour. Recovered 280 feet fluid as follows: top 20 feet water-cut mud, black, strong sulphur odor, 170 feet very heavily gas-cut mud black, with very strong sulphur odor, 90 feet heavily oil and gas-cut mud black, very strong sulphur odor, oil gravity 35° API. Salinities run on mud samples did not indicate salt content higher than that of drilling mud.
Pressures: IF 0, FF 0, SI 1550, HH 5600.
Formation Tested: Mission Canyon Shale.

DST 8 Interval 9936 to 9994 feet. Tool plugged, did not fully open, misrun.

DST 8A Interval 9936 to 9994 feet, no cushion, no chokes, tool opened with a fair blow decreasing slowly to weak in 4 hours, total open 6 hours, shut in 1 hour. Recovered 475 feet fluid as follows: top 100 feet water cut rathole mud, black, strong sulphur odor, slightly gas-cut. 375 feet salt water, black, strong sulphur odor, heavily gas-cut with rainbow of oil, salinity 292,000 PPM NACL.
Pressures: IF 0, FF 250, SI 4200, HH 5775
Formation Tested: Mission Canyon Shale.

DST 9 Interval 10,158 to 10,179 feet, no chokes, no water cushion. Tool opened with fair blow increasing immediately to strong blow, remained steady throughout test. Tool open 4 hours, shut in 1 hour. Recovered 1290 feet gas-cut salt water with very strong sulphur odor, black. Salinity 303,000 PPM NACL.

Pressures: IF 110, FF 484, (4 hours) FF 590 (5 hours), HH 6000
 Tool did not shut in, tool actually open 5 hours.
 Formation Tested: Mission Canyon Shale.

DST 10 Set Johnson double 5" packers in 6" hole at 11,882 feet and 11,874 feet to test interval 11,882 to 11,945 feet. No bottom hole choke, 1500 feet water cushion, tool opened with weak blow slowly decreasing to dead in 2 hours. Total open 5 hours, shut in 1 hour. Recovered 1500 feet water cushion and 1950 feet muddy salt water very slightly gas-cut, salinity 355,000 PPM NACL.
 Pressures: Top Bomb: IF 900, FF (5 hrs.) 1660, FF (6 hrs.) 1720, HH greater than 7500.
 No shut-in pressure recorded, tool did not shut in.
 Bottom Bomb: Clock did not run, no pressures recorded.
 Formation Tested: Duperow.

DST 11 Set Howco Packers at 11,840 and 11,789 feet to straddle test that interval. Total depth 12,050 feet. No water cushion, no bottom hole choke. Tool opened with weak blow decreasing to dead in 55 minutes, after 3 hours and 15 minutes, mud fell in casing and blow increased. Suspected that drill pipe had collapsed, backed off of top of tool and reverse circulated test out of hole, unable to tell when test recovery was circulated out, apparently only small amount of rathole mud. Fished test tools out of hole. Pressure charts no good due to tools being worked to bottom and then jarred loose; however, charts showed that tools had opened. When tool was dismantled, it was found that the packers had failed and that the packing in the tool had been cut out causing the tool not to shut in when it was pulled off bottom. It was decided to not run this test again due to the possibility of losing the tools.
 Formation Tested: Duperow.

PLUGGING RECORD

Cement Plugs Placed: 11,742-12,050 with 55 sacks
 11,516-11,628 with 20 sacks
 10,383-10,579 with 35 sacks
 5,584- 5,797 with 100 sacks
 1,091- 1,316 with 100 sacks

Baker cast iron bridge plug set at 1075' and a 20-sack cement plug placed in top of 10 3/4" surface casing with 4" iron pipe marker extending 4' above ground level.

CORED INTERVALS

| | | | | | |
|----------|------------------|---------|----------|------------------|---------|
| Core #1 | 9683 to 9740 | 57 feet | Core #11 | 11,225 to 11,283 | 58 feet |
| Core #2 | 9740 to 9765 | 25 feet | Core #12 | 11,283 to 11,340 | 57 feet |
| Core #3 | 9765 to 9779 | 14 feet | Core #13 | 11,720 to 11,735 | 15 feet |
| Core #4 | 9779 to 9813 | 34 feet | Core #14 | 11,812 to 11,862 | 50 feet |
| Core #5 | 9816 to 9850 | 34 feet | Core #15 | 11,862 to 11,889 | 27 feet |
| Core #6 | 9850 to 9880 | 30 feet | Core #16 | 11,889 to 11,917 | 28 feet |
| Core #7 | 9880 to 9937 | 57 feet | Core #17 | 11 917 to 11,945 | 28 feet |
| Core #8 | 9937 to 9994 | 57 feet | Core #18 | 11,949 to 11,975 | 26 feet |
| Core #9 | 10,050 to 10,107 | 57 feet | Core #19 | 11,975 to 12,002 | 27 feet |
| Core #10 | 10,490 to 10,497 | 7 feet | | | |

Formation tops picked from samples, electric logs and radioactivity logs; adjusted to electric logs. Colors determined from rock color chart.

FORMATION TOPS

| | |
|------------------------------------|--------|
| Cretaceous System | |
| Pierre Formation | 2,095 |
| Niobrara Formation | 4,305 |
| Greenhorn Formation | 4,805 |
| Dakota Silt | 5,617 |
| Dakota Sand | 5,728 |
| Jurassic System | |
| Morrison Formation | 5,945 |
| Sundance Formation | 6,347 |
| Piper Formation | 6,856 |
| Triassic System | |
| Spearfish Formation | 7,075 |
| Permian System | |
| Minnekahata Formation | 7,513 |
| Opeche Formation | 7,565 |
| Pennsylvanian System | |
| Minnelusa Formation | 7,888 |
| Mississippian System | |
| Amsden Formation | 8,132 |
| Big Snowy Group | 8,320 |
| Kibbey Lime | 8,790 |
| Charles Formation | 8,945 |
| Mission Canyon (base of last salt) | 9,591 |
| Lodgepole Formation | 10,285 |
| Englewood Formation | 11,198 |
| Devonian System | |
| Lyleton Formation | 11,283 |
| Nisku Formation | 11,523 |
| Duperow Formation | 11,620 |
| Souris River Formation | 12,002 |
| Total Depth | 12,050 |

ROUGH CREEK UNIT #1

| | |
|---------|---|
| 100-120 | Lignite, little shale, light gray, lumpy. |
| 120-130 | Lignite. |
| 130-140 | Lignite, and shale as above. |
| 140-150 | Lignite, and shale as above. Little limestone, pinkish gray, 5YR8/1, crystalline, dense, silty. |
| 150-200 | Shale, light olive gray 5Y6/1 to brownish gray 5YR4/1, lumpy. Some lignite as above. |
| 200-260 | Shale, light gray, pale brown, massive to lumpy. |
| 260-300 | Shale, medium light gray, pale brown, massive to lumpy. |
| 300-360 | Shale, medium light gray as above, little limestone, medium gray, crystalline, silty. |
| 360-390 | Shale, light gray, pale brown, massive to spongy. Little lignite. |
| 390-400 | Shale, light olive gray 5Y6/1, lumpy. |
| 400-410 | Shale, light olive gray, pale brown, little sandstone, white, medium grained, loosely cemented. |

410-430 Shale, light olive gray 5Y6/1, lumpy. Lignite.
 430-440 Shale, light olive gray, sandy, lumpy. Shale, pale brown, lumpy.
 440-480 Quartz sand grains, clear to stained, 1/4 mm in diameter, subangular, individual grains or imbedded in light olive gray shale matrix.
 480-490 Shale, medium gray, pale brown, lumpy.
 490-500 Shale, medium gray to brownish gray 5YR4/1, lumpy. Little lignite.
 500-510 Shale, medium gray, sandy, lumpy.
 510-520 Shale, medium gray, pale brown 5YR5/2, sandy, lumpy.
 520-560 Shale, medium gray, grayish brown 5YR3/2, sandy, lumpy.
 560-570 Shale, light olive gray 5Y6/1, sandy, lumpy.
 570-600 Lignite. Shale, light olive gray, lumpy.
 600-700 Missing.
 700-710 Lignite.
 710-720 Missing.
 720-750 Lignite.
 750-780 Missing.
 780-800 Lignite.
 800-870 Lignite. Little shale, light olive gray, lumpy.
 870-890 Missing.
 890-910 Lignite.
 910-950 Lignite. Shale, light olive gray, lumpy, sandy.
 950-970 Lignite. Shale, light olive gray, lumpy.
 970-980 Lignite, shale as above. Little limestone, light olive gray 5Y6/1, fine grained, crystalline, dense.
 980-1040 Lignite and limestone as above.
 1040-1100 Lignite and limestone as above. Siltstone, grayish orange 10YR7/4.
 1100-1300 Missing.
 1300-1320 Sandy shale, medium light gray, lumpy, with quartz grains 1/4 to 1/2 mm in diameter.
 1320-1330 Lignite, sandy shale as above.
 1330-1340 Shale, medium gray, lumpy.
 1340-1410 Shale, medium gray to grayish red 10R4/2, lumpy to spongy.
 1410-1520 Shale as above. Little sandstone, white to pale brown, calcareous, cement, friable.
 1520-1560 Shale, medium gray to brownish gray 5YR4/1, massive to lumpy.
 1560-1580 Shale, grayish red 10R4/2, silty, lumpy. Shale, medium to dark gray, lumpy.
 1580-1610 Lignite.
 1610-1630 Lignite, shale, medium gray, lumpy.
 1630-1660 Lignite.
 1660-1700 Lignite and little shale, medium to dark gray, lumpy.
 1700-1720 Missing.
 1720-1730 Shale, medium to dark gray, pale brown 5YR5/2, sandy, lumpy to spongy.
 1730-1760 Quartz sand, clear to stained, 1/4 to 1/2 mm in diameter, subangular. Shale, medium to dark gray, sandy, lumpy. Lignite.
 1760-1790 Shale, medium gray, brownish gray, 5YR4/1, lumpy, sandy.
 1790-1800 Sand, free quartz grains up to 0.5 mm in diameter, also poorly cemented calcareous sandstone.
 1800-1820 Sand and sandstone as above. Lignite. Shale, medium to dark gray, massive do spongy.
 1820-1830 Lignite, some sand as above.

1830-1850 Shale, medium to dark gray, lumpy, sandy. Little lignite.
 1850-1870 Shale, medium gray, lumpy, dusky brown 5YR2/2, fissile.
 1870-1910 Sandy shale, medium gray, lumpy. Some lignite.
 1910-1950 Shale, brownish gray 5YR4/1, lumpy. Little lignite and sand as above.
 1950-1970 Missing.
 1970-2010 Shale, lignite and sand as above.
 2010-2070 Shale, medium gray, lumpy. Some shale, brownish gray.
 2070-2100 Shale, medium light gray, lumpy, brownish gray 5YR4/1, lumpy.
 2100-2140 Sandy limestone, white to brownish gray, glauconitic. Shale, light olive gray 5Y6/1, micaceous, lumpy.
 2140-2160 Shale, light olive gray 5Y6/1 to olive gray 5Y4/1, silty, lumpy. Sandy limestone as above.
 2160-2170 Shale, light olive gray, compact to spongy.
 2170-2180 Shale, light olive gray to olive gray, lumpy.
 2180-2200 Shale, light olive gray, silty, lumpy. Sandy limestone, very light gray, glauconitic.
 2200-2240 Shale, medium gray, micaceous, lumpy.
 2240-2280 Shale, greenish gray 5GY6/1, medium to dark gray, lumpy.
 2280-2340 Shale, medium gray, lumpy.
 2340-2400 Shale, olive gray 5Y4/1, massive.
 2400-2430 Shale as above. Shale, light olive gray 5Y6/1, lumpy.
 2430-2450 Shale, olive gray 5Y4/1, fissile, light olive gray, lumpy.
 2450-2460 Shale, olive gray to light olive gray, lumpy.
 2460-2470 Shale, olive gray, fissile.
 2470-2490 Shale, light olive gray to olive gray, lumpy.
 2490-2500 Missing.
 2500-2510 Shale as above.
 2510-2530 Missing.
 2530-2550 Shale as above.
 2550-2610 Shale, olive gray, fissile to lumpy.
 2610-2630 Shale, brownish gray 5YR4/1, fissile.
 2620-2630 Missing.
 2630-2640 Shale, olive gray, fissile to lumpy.
 2640-2660 Missing.
 2660-2710 Shale, medium gray to olive gray, lumpy to massive.
 2710-2730 Missing.
 2730-2740 Shale, light olive gray to olive gray, lumpy.
 2740-2760 Missing.
 2760-2770 Shale, brownish gray 5YR4/1, lumpy.
 2770-2780 Missing.
 2780-2790 Shale, brownish gray to olive gray, lumpy.
 2790-2820 Missing.
 2820-2840 Shale, light olive gray to olive gray, lumpy.
 2840-2850 Missing.
 2850-2860 Shale as above.
 2860-2990 Missing.
 2990-3030 Shale, medium light gray, massive to lumpy.
 3030-3050 Missing.
 3050-3060 Shale, dark yellowish brown 10YR4/2, lumpy.
 3060-3090 Missing.
 3090-3100 Shale, medium gray, lumpy.
 3100-3120 Missing.
 3120-3130 Shale, olive gray 5Y4/1, lumpy.

3130-3140 Missing.
 3140-3160 Shale as above.
 3160-3170 Missing.
 3170-3200 Shale, medium light gray, massive to lumpy.
 3200-3300 Missing.
 3300-3380 Shale, medium gray, lumpy.
 3380-3390 Missing.
 3390-3470 Shale, olive gray 5Y4/1, massive to lumpy.
 3470-3550 Shale, light olive gray to olive gray, lumpy.
 3550-3570 Shale, light olive gray 5Y6/1, lumpy.
 3570-3580 Shale, light olive gray, olive black 5Y2/1, lumpy.
 3580-3600 Shale, light olive gray, lumpy.
 3600-3760 Shale, light olive gray to olive gray, massive to lumpy.
 3760-3770 Shale, olive gray 5Y4/1, lumpy, moderate brown 5YR4/4, fissile.
 3770-3830 Shale, olive gray, lumpy.
 3830-3840 Shale, olive black 5Y2/1, lumpy.
 3840-3900 Shale, olive gray to light olive gray, lumpy.
 3900-3920 Shale, olive black 5Y2/1, lumpy.
 3920-3980 Shale, light olive gray to olive gray, lumpy.
 3980-4030 Shale as above. Little limestone, very pale orange, 10YR8/2, sublithographic.
 4030-4060 Shale, olive gray, spongy to fissile. Little limestone as above.
 4060-4070 Shale, olive gray, lumpy to massive.
 4070-4090 Shale, dark yellowish brown, 10YR4/2, spongy to lumpy.
 4090-4140 Shale, olive gray, dense to lumpy.
 4140-4170 Shale, olive gray to dark yellowish brown, spongy to lumpy.
 4170-4200 Shale, medium gray, lumpy.
 4200-4230 Shale, light olive gray, lumpy.
 4230-4240 Shale, olive gray to dark yellowish brown.
 4240-4260 Shale, medium gray, lumpy.
 4260-4310 Shale, medium gray to dark yellowish brown.
 4310-4360 Shale, medium gray.
 4360-4420 Shale, light olive gray, lumpy.
 4420-4480 Shale, light olive gray to olive gray.
 4480-4530 Shale, light olive gray to olive gray. Some white specks.
 4530-4560 Missing.
 4560-4640 Shale, olive gray 5Y4/1. Some shale, olive black 5Y2/1 with white specks.
 4640-4700 Shale, light olive gray to olive black, lumpy to massive.
 4700-4750 Shale, light olive gray, lumpy.
 4750-4780 Shale, light olive gray to olive gray, lumpy.
 4780-4790 Shale, medium light gray, dark yellowish brown 10YR4/2.
 4790-4810 Shale, olive gray, dense.
 4810-4860 Shale, light olive gray to olive black.
 4860-4870 Shale, olive gray to black, few white specks.
 4870-4920 Shale, dark gray to black, white specks.
 4920-4960 Shale, medium dark gray to brownish black 5YR2/1, whitespecks.
 4960-5000 Shale, olive gray to olive black, white specks.
 5000-5040 Shale, medium to dark gray.
 5040-5140 Shale, light olive gray to olive gray, lumpy to foliated, few white specks.
 5140-5190 Shale, olive gray to black, few white specks.
 5190-5210 Shale, olive gray to brownish black 5YR2/1, few white specks.
 5210-5260 Shale, olive gray to black, foliated.

5260-5280 Shale, olive gray to brownish black, foliated.
 5280-5310 Shale, dark gray, foliated.
 5310-5340 Shale, dark gray, brownish black 5YR2/1.
 5340-5360 Shale, dark gray.
 5360-5370 Shale, light olive gray, lumpy, dark gray, foliated.
 5370-5390 Shale, brownish black, foliated.
 5390-5420 Missing.
 5420-5460 Shale, light olive gray, lumpy, dark gray, foliated.
 5460-5470 Shale, dark yellowish brown 10YR4/2 to brownish black 5YR2/1, lumpy to spongy.
 5470-5480 Shale, brownish black, foliated.
 5480-5570 Shale, light olive gray, lumpy, dark gray, foliated.
 5570-5580 Shale, dark yellowish brown 10YR4/2, light olive gray and dark gray.
 5580-5600 Shale, light olive gray to olive gray, lumpy.
 5600-5620 Shale, dark yellowish brown, spongy.
 5620-5640 Shale, light olive gray to olive gray, lumpy.
 5640-5650 Shale, dark yellowish brown to brownish black.
 5650-5700 Shale, light olive gray to olive gray, lumpy.
 5700-5710 Shale, as above. Little sandstone, white, medium grain size.
 5710-5750 Shale as above.
 5750-5760 Shale, olive gray, dark yellowish brown, lumpy.
 5760-5790 Shale, as above, little sandstone, white, medium grain size.
 5790-5820 Shale, dark yellowish brown to brownish black. Sandstone, white medium grained. Siltstone, pale yellowish brown 10YR6/2.
 5820-5840 Shale, light olive gray to brownish black. Siltstone as above.
 5840-5890 Shale and siltstone as above. Little sandstone, white, fine grained.
 5890-5910 Shale, light olive gray to dark gray.
 5910-5930 Shale, light olive gray, lumpy. Sandstone, white, fine grained. Little siltstone, pale yellowish brown, little siltstone, brownish gray, glauconitic.
 5930-5950 Shale, brownish gray, lumpy. Little sandstone as above.
 5950-5980 Shale, olive gray to dark gray. Sandstone as above.
 5980-6000 Shale, brownish black, foliated.
 6000-6010 Shale, dark gray, foliated.
 6010-6020 Shale as above. Little sandstone, white, fine grained.
 6020-6060 Shale as above Little sandstone, white to pale yellowish brown, some glauconitic sandstone.
 6060-6100 Shale, brownish gray to grayish black, foliated. Sandstone, clear with brownish gray stain, fine grained. Little glauconitic sand and silt.
 6100-6160 Shale, dark gray, foliated. Sandstone, fine grained, white, glauconitic, friable.
 6160-6190 Shale, dark yellowish brown, spongy, dark gray foliated.
 6190-6200 Shale as above. Little sandstone, white to pale yellowish brown, some glauconitic.
 6200-6240 Shale, light olive gray, lumpy, dark gray, foliated. Little sandstone, white to pale yellowish brown, fine grained.
 6240-6250 Shale, grayish black, foliated. Little sandstone as above.
 6250-6300 Shale, dark gray, foliated. Sandstone, white, fine grained.
 6300-6350 Shale as above. Sandstone, pale yellowish brown, fine grained.
 6350-6390 Shale, light olive gray, lumpy.
 6390-6400 Shale as above. Shale, dark gray, foliated.

6400-6420 Shale, dark gray, light gray, dark greenish gray 5GY4/1, brownish gray 5YR4/1, foliated to fissile.

6420-6440 Shale as above. Sandstone, white, fine grained, some glauconitic.

6440-6460 Shale, light olive gray, medium gray, lumpy.

6460-6560 Shale, light olive gray, lumpy, greenish gray 5GY6/1, waxy, fissile. Siltstone, greenish gray 5GY6/1, calcareous.

6560-6660 Shale, greenish gray 5GY6/1, brownish gray 5YR4/1, fissile to foliated. Siltstone as above.

6660-6720 Shale, greenish gray 5GY6/1, fissile to foliated. Siltstone as above.

6720-6760 Shale, greenish gray, splintery, grayish red 10R4/2. Siltstone as above.

6760-6820 Shale and siltstone as above. Little limestone, pale yellowish brown 10YR6/2, fragmental.

6820-6850 Shale, greenish gray, 5GY6/1, moderate red. Calcareous siltstone, pale red 5R6/2.

6850-6870 Limestone, pale red, 5R6/2, finely crystalline. Shale as above.

6870-6930 Limestone as above. Dolomitic limestone, white, finely crystalline, shale as above.

6930-6960 Limestone, pale red, pale yellowish brown, finely crystalline, shale as above.

6960-6970 Limestone, pale yellowish brown, finely crystalline.

6970-6990 Shale, greenish gray 5GY6/1, fissile, moderate reddish brown 10R4/6, massive. Limestone as above. Little gypsum.

6990-7050 Dolomite, white to grayish pink 5R8/2, finely crystalline. Shale and little gypsum as above.

7050-7090 Shale and gypsum as above.

7090-7110 Siltstone, pale reddish brown 10R5/4, friable. Shale, dark greenish gray 5GY4/1, foliated.

7110-7180 Siltstone and shale as above. Few loose quartz grains, frosted, 0.25 to 0.50 mm in diameter.

7180-7210 Siltstone and shale as above.

7210-7260 Siltstone, pale reddish brown 10R5/4, friable. Shale, dark greenish gray 5GY4/1, foliated. Few loose sand grains, frosted.

7260-7280 Missing.

7280-7350 Shale, dark greenish gray 5GY4/1, foliated, moderate reddish brown 10R4/6 to grayish red 10R4/2, subwaxy.

7350-7390 Shale as above. Siltstone, pale reddish brown 10R5/4. Little gypsum.

7390-7400 Shale, medium gray, lumpy to foliated. Little shale and siltstone as above.

7400-7480 Shale, moderate reddish brown 10R4/6, subwaxy. Shale, dark greenish gray 5GY4/1, foliated.

7480-7510 Shale, moderate reddish brown as above, medium to dark gray.

7510-7540 Shale as above, Some gypsum. Little limestone, grayish pink 5R8/2, finely crystalline.

7540-7560 Siltstone, moderate reddish orange 10R6/6, highly calcareous. Little gypsum.

7560-7590 Shale, medium gray, lumpy, greenish gray 5GY6/1, foliated, little siltstone as above.

7590-7610 Shale, moderate reddish brown 10R4/6, foliated, slightly dolomitic.

7610-7660 Shale as above. Shale, pale reddish brown 10R5/4, silty, dolomitic.

7660-7690 Shale, moderate reddish brown 10R4/6, foliated, slightly dolomitic.

7690-7740 Shale as above with little anhydrite.

7740-7800 Shale, moderate reddish brown 10R4/6, foliated to lumpy, dolomitic. Some anhydrite, white.

7800-7860 Shale, moderate reddish brown, lumpy, dolomitic, some anhydrite, white.

7860-7950 Shale and anhydrite as above. Siltstone, moderate reddish brown, friable.

7950-7980 Dolomite, very pale orange 10YR8/2 to pale pink 5RP8/2, finely crystalline, little anhydrite.

7980-8000 Dolomite, very pale orange, pale red, crystalline to granular, anhydritic.

8000-8030 Dolomite, very pale orange, little pale red, granular, anhydritic, anhydrite, white.

8030-8060 Dolomite, pale yellowish brown 10YR6/2, crystalline. Dolomite and anhydrite as above.

8060-8070 Dolomite as above, some silty. Anhydrite. Shale, pale reddish brown 10R5/4, lumpy, dolomitic.

8070-8094 Dolomite, pale red 10R6/2, crystalline to granular, pale yellowish brown, silty.

8094-8140 Dolomite as above. Shale, pale reddish brown, lumpy, dolomitic. Little anhydrite.

8140-8210 Dolomite, very pale orange, finely crystalline, dense.

8210-8250 Dolomite, very pale orange to moderate red 5R5/4, finely crystalline.

8250-8290 Dolomite, pale red to grayish red, finely crystalline. Limestone, light olive gray 5Y6/1, fine grained, dense.

8290-8330 Limestone, grayish red, pale yellowish brown, very pale orange, fine grained.

8330-8360 Shale, grayish red 5R4/2, splintery, greenish gray 5GY6/1, splintery.

8360-8400 Shale, grayish red as above, also black carbonaceous, splintery.

8400-8420 Shale, black, highly carbonaceous, splintery to fissile.

8420-8480 Shale, black, moderate red 5R5/4, splintery.

8480-8510 Limestone, brownish gray 5YR4/1, fossiliferous, finely crystalline. Shale as above.

8510-8550 Dolomite, very pale orange 10YR8/2, finely crystalline.

8550-8590 Limestone, medium light gray, argillaceous. Shale, dark greenish gray, 5GY4/1, calcareous.

8590-8600 Shale, dark gray, calcareous.

8600-8620 Varigated shale.

8620-8700 Sandstone, white to grayish orange pink 5YR7/2, very fine grained, angular quartz grains, calcareous cement.

8700-8760 Sandstone, white to grayish pink 5R8/2, fine to medium grained, friable, calcareous cement.

8760-8800 Sandstone as above, siltstone, pale reddish brown 10R5/4, calcareous.

8800-8810 Sandstone and siltstone as above. Gypsum, white.

8810-8830 Limestone, brownish black, finely crystalline.

8830-8900 Limestone as above, gypsum, white.

8900-8906 No returns.

8906-8990 Limestone as above.

8990-9040 Missing - Microlog indicates salt.

9040-9126 Salt indicated on microlog but not present in samples as gypsum base mud was used.

9126-9150 Dolomite, pale yellowish brown, anhydritic, granular.

9150-9170 Salt indicated as above. Anhydrite, white.

9170-9180 Anhydrite, white.

9180-9210 Salt indicated as above. Anhydrite, white.

9210-9230 Dolomite, pale yellowish brown, granular. Anhydrite, white.

9230-9250 Anhydrite, white. Limestone, medium gray to brownish black, finely crystalline.

9256-9313 Missing - Salt indicated on microlog.

9313-9330 Anhydrite, white. Little limestone, pale yellowish brown to brownish black, finely crystalline.

9330-9360 Limestone, pale yellowish brown, finely crystalline, anhydrite, white.

9360-9370 Limestone as above. Limestone, dark yellowish brown 10YR4/2, oolitic, anhydrite, white.

9370-9400 Anhydrite, white. Little limestone as above.

9400-9410 Missing.

9410-9430 Salt indicated on microlog. Anhydrite, white. Dolomite, dark yellowish brown, granular.

9430-9450 Anhydrite, white. Dolomite, pale yellowish brown, finely granular.

9450-9460 Limestone, dark yellowish brown, crystalline. Anhydrite.

9460-9470 Missing.

9470-9500 Limestone, dark yellowish brown to dusky brown, finely crystalline. Little anhydrite.

9500-9510 Missing.

9510-9550 Limestone as above. Little anhydrite.

9550-9590 Salt indicated on microlog. Limestone and anhydrite as above.

9590-9594 Missing.

9594-9683 Limestone, dark yellowish brown to brownish black, finely crystalline. Anhydrite, white.

Core #1

9683-9693 Limestone, dusky brown, coarsely crystalline.

9693-9703 Anhydrite, white, dense with dolomite, medium dark gray interbeds.

9703-9713 Dolomite, dusky brown, finely crystalline.

9713-9740 Limestone, brownish gray 5YR4/1, coarsely crystalline, dense.

Core #2

9740-9750 Limestone as above with some carbonaceous residue.

9750-9760 Limestone, brownish black 5YR2/1, coarsely crystalline.

9760-9765 Limestone, brownish gray 5YR4/1, crystalline to fragmental.

Core #3

9765-9773 Limestone as above.

9773-9779 Missing.

Core #4

9779-9785 Limestone, brownish black 5YR2/1, finely crystalline, dense.

9785-9790 Limestone, pale yellowish brown, finely granular to fragmental.

9790-9810 Limestone, brownish black, finely crystalline, to fragmental, dense.

9810-9813 Limestone, brownish gray 5YR4/1, finely crystalline with scattered medium to course crystals.

9813-9816 Missing.

Core #5

9816-9820 Anhydrite, white.
9820-9830 Anhydrite, brownish gray to olive gray.
9830-9840 Anhydrite as above. Dolomite, yellowish gray 5Y7/2, finely crystalline. Limestone, brownish gray, coarsely crystalline.
9840-9850 Dolomite, light brownish gray 5YR6/1, medium crystalline. Limestone as above with pockets of white anhydrite.

Core #6

9850-9860 Limestone, brownish black, coarsely crystalline. Limestone, medium light gray, slightly oolitic.
9860-9880 Limestone, brownish gray to brownish black, medium crystalline.

Core #7

9880-9900 Anhydrite, white, limestone as above.
9900-9920 Limestone, pale yellowish brown to dark yellowish brown, medium to coarsely crystalline. Dense to vuggy with anhydritic filling.
9920-9937 Limestone, brownish gray, medium crystalline, dense.

Core #8

9937-9950 Limestone, brownish gray, finely crystalline, dolomitic.
9950-9960 Limestone, brownish gray, medium crystalline, dense.
9960-9994 Limestone, brownish gray to brownish black, medium crystalline, dark oil stain, petroliferous odor.

Samples

9994-10,000 Missing.
10,000-10,044 Limestone, grayish brown, medium crystalline.
10,044-10,050 Missing.

Core #9

10,050-10,070 Limestone, grayish brown, medium crystalline, slight petroliferous odor, dense.
10,070-10,090 Limestone, dark yellowish brown, finely crystalline to fragmental, dolomitic, residual carbonaceous material.
10,090-10,100 Missing.
10,100-10,107 Limestone, dark yellowish brown, fragmental.

Samples

10,107-10,150 Limestone, pale yellowish brown, microsucrosic to dark yellowish brown, fragmental.
10,150-10,160 Limestone, light gray, microsucrosic, dolomitic.
10,160-10,200 Limestone, brownish gray, fragmental. Limestone as above.
10,200-10,260 Dolomite, dark yellowish brown, microsucrosic.
10,260-10,280 Limestone, pale yellowish brown, fragmental, dolomite as above.
10,280-10,300 Limestone, brownish gray, microsucrosic, argillaceous.
10,300-10,330 Limestone, medium light gray to dark gray, argillaceous, thin bedded.
10,330-10,370 Limestone, pale yellowish brown to grayish brown, argillaceous.
10,370-10,484 Limestone, medium gray to dark gray, argillaceous.
10,484-10,497 Missing.
10,497-10,550 Limestone, brownish gray, medium crystalline.

10,550-10,560 Missing.
 10,560-10,730 Limestone, medium dark to dark gray, fine to medium crystalline, argillaceous.
 10,730-10,790 Limestone, medium dark gray, finely crystalline, argillaceous.
 10,790-10,940 Limestone as above, splintery,
 10,940-10,990 Limestone, medium dark gray to brownish gray, finely crystalline, argillaceous, splintery.
 10,990-11,020 Limestone as above, little free quartz, white.
 11,020-11,070 Limestone, medium dark to dark gray, finely crystalline, splintery.
 11,070-11,115 Limestone, dark gray to olive gray 5Y4/1, finely crystalline, argillaceous.
 11,115-11,130 Limestone as above. Anhydrite, pale yellowish brown, dolomitic.
 11,130-11,140 Anhydrite as above.
 11,140-11,180 Limestone, dark gray, finely crystalline, argillaceous. Little anhydrite as above.
 11,180-11,195 Missing.
 11,195-11,200 Limestone, dark gray, argillaceous, thin bedded, finely crystalline.
 11,200-11,205 Missing.
 11,205-11,225 Shale, black, carbonaceous, fissile.

Core #11

11,225-11,245 Calcareous sandstone composed of angular quartz grains up to 1/16 mm in major diameter with muscovite, little pyrite and calcareous cement, dense.
 11,245-11,260 Calcareous shale, dark gray with little silt.
 11,260-11,283 Shale, black, carbonaceous, dense.

Core #12

11,283-11,313 Dolomite, pale red 10R6/2, crystalline, interbedded with shale, greenish gray 5GY6/1.
 11,313-11,318 Dolomite and shale as above with pyrite crystals imbedded in the shale.
 11,318-11,328 Dolomitic shale, pale red and greenish gray interbedded, few imbedded pyrite crystals.
 11,328-11,333 Limestone, blackish red, finely crystalline, some pyrite, dense.
 11,333-11,340 Shale, dark gray, carbonaceous.

Samples

11,340-11,350 Shale, medium light gray, dolomitic. Calcareous silt, light gray.
 11,350-11,390 Dolomite, pinkish gray 5YR8/1, and greenish gray 5GY6/1, fine grained, dense, argillaceous.
 11,390-11,400 Dolomite as above, calcareous shale, light gray.
 11,400-11,420 Calcareous shale, pale red 10R6/2, and greenish gray 5GY6/1.
 11,420-11,440 Dolomite, pale red 10R6/2, greenish gray 5GY6/1, finely crystalline.
 11,440-11,445 Calcareous shale, yellowish gray 5Y8/1, anhydrite, white.
 11,445-11,485 Calcareous shale, pale red and greenish gray.
 11,485-11,490 Missing.
 11,490-11,515 Calcareous shale, pale brown 5YR5/2, greenish gray 5GY6/1, dolomite, grayish red 10R4/2, anhydritic.

11,515-11,525 Anhydrite. Calcareous shale as above.
 11,525-11,550 Limestone, brownish gray 5YR4/1, finely crystalline, dense.
 11,550-11,555 Limestone as above, little anhydrite.
 11,555-11,565 Limestone, brownish gray to brownish black, medium grained, anhydritic.
 11,565-11,575 Limestone, brownish gray 5YR4/1, medium grained, some pinpoint porosity, few oolites, little anhydritic.
 11,575-11,600 Limestone, brownish gray, medium grained, little anhydritic.
 11,600-11,625 Limestone, brownish gray, fine grained, dense.
 11,625-11,635 Limestone as above, little anhydritic.
 11,635-11,650 Limestone as above, anhydritic. Anhydrite, white.
 11,650-11,680 Limestone, brownish gray to brownish black, medium grained, dense.
 11,680-11,685 Anhydrite, white to light gray, limestone as above.
 11,685-11,705 Limestone, brownish gray to brownish black, fine to medium grained, dense.
 11,705-11,715 Limestone, as above, anhydrite, white.
 11,715-11,720 Limestone, pale yellowish brown, medium grained.

Core #13

11,720-11,730 Limestone, grayish brown 5YR3/2, finely crystalline, dense.
 11,730-11,732 Anhydrite, medium gray.

Samples

11,735-11,750 Limestone, brownish gray, fine grained, dense.
 11,750-11,790 Limestone, brownish gray to brownish black, fine to medium grained, dense.
 11,790-11,805 Limestone, as above, anhydrite, white.
 11,805-11,812 Limestone, as above, dolomite, pale yellowish brown, microsugrosic.

Core #14

11,812-11,817 Anhydrite.
 11,817-11,822 Dolomite, dark yellowish brown, microsugrosic, medium light gray, crystalline with few included quartz pebbles.
 11,822-11,827 Limestone, grayish brown 5YR3/2, finely crystalline, dense, fractured with carbonaceous residue in fractures.
 11,827-11,832 Limestone as above. Limestone, dark yellowish brown, finely crystalline, vugs filled with secondary anhydrite.
 11,832-11,847 Limestone, light to dark yellowish brown, fine to medium grained, fossiliferous.
 11,847-11,852 Anhydrite, brownish black to white.
 11,852-11,867 Dolomite, dark yellowish brown, microsugrosic, carbonaceous residue.

Core #15

11,867-11,872 Dolomite, grayish brown, extremely fine grained to sugrosic.
 11,872-11,882 Anhydrite. Dolomite, brownish gray, finely crystalline, dense.
 11,882-11,887 Limestone, brownish gray, finely crystalline, dense.
 11,887-11,889 Limestone, grayish brown, coarse crystalline, pinpoint porosity.

Core #16

11,889-11,900 Dolomite, pale brown, sucrosic. Limestone, grayish brown, finely crystalline, dense, anhydrite.
11,900-11,910 Limestone, brownish gray, finely crystalline, dense, anhydrite.

11,910-11,917 Limestone, dusky brown 5YR2/2, finely crystalline, dense.

Core #17

11,917-11,920 Limestone, as above. Dolomite, dark yellowish brown, sucrosic.
11,920-11,925 Limestone, grayish brown, finely crystalline, dense.
11,925-11,945 Limestone, dark yellowish brown, finely crystalline, dense.
11,945-11,949 Missing.

Core #18

11,949-11,960 Limestone, grayish brown to grayish black, finely crystalline, dense.
11,960-11,962 Anhydrite, brownish black.
11,962-11,975 Missing.

Core #19

11,975-11,985 Limestone, brownish black, fine to medium crystalline, dense.
11,985-11,990 Limestone as above, anhydrite.
11,990-12,002 Dolomite, pale yellowish brown, sucrosic, anhydritic.

Samples

12,002-12,025 Limestone, brownish black, finely crystalline.
12,025-12,045 Limestone as above, anhydrite, white.
12,045-12,050 Limestone as above. Dolomite, pale yellowish brown, microsucrosic.
12,050 Total Depth.