

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 189

Summary of the Felmont-Atlantic - North American Wm. Kalanek #1
Stark County, North Dakota
Well No. 1466 - Permit No. 1478

by Jay Garske
February 1958

Felmont-Atlantic - North American Wm. Kalanek #1. Location: Center SW/4 NW/4 Section 32 T. 140N. R, 96W. Elevation: 2516 K.B. Total Depth: 9100 feet.

The Felmont Atlantic-North American Wm. Kalanek #1 was spudded July 6, 1957 and completed as a producing well September 22, 1957.

Logs: Microlaterolog, and Laterolog- Gamma Ray

Cores:

#1 8872 - 8916
#2 8916 - 8944

Tests:

DST #1; 8640-8667. Open 2 hours, shut in 1 hour. Recovered: 64 feet of mud, no oil, gas or water, Pressures: HP 5010-4960#, FP 10-125#, SIP 185#.

DST #2; 8742-8769. Open 4 hours, moderate air blow. Recovered: 90 feet of mud, and 270 feet of heavily oil and gas cut mud. Pressures: ISIP (30 minutes) 150#, FSIP (45 minutes) 365#, HP 5125-4950#, FP 125-175#.

DST #3; 8749-8808. Open 4 hours; gas to surface in 30 minutes, burned 3' to 6' flare. Recovered: 3550 feet of clean black oil, 450 feet of muddy oil, no water. Pressures: HP 5150-4550#, ISIP (30 minutes) 3975#, FSIP (120 minutes) 3800#, FP 220-1490#.

DST #4; 8800-8835. Failed.

DST #5; 8810-8835. Open 4 hours, weak air blow, died in 30 minutes. Recovered: 35 feet of slightly gassy watery mud. Pressures: HP 5310-5215#, FP 75-100#, ISIP (60 minutes) 100#, FSIP (120 minutes) 2885#.

DST #6; 8390-8944. Open 4 hours. Recovered: 55 feet of mud, no oil, gas or water. Pressures: HP 5300-4960#, FP 20-30#, ISIP (60 minutes) 20#, FSIP (120 minutes) 1290#.

DST # 7; 9050-9100. Open 4 hours, weak air blow. Recovered: 90 feet of mud and 500 feet of black, salty sulphur water. Pressures: HP 5400-5015#, FP 125-250#, ISIP (60 minutes) 3890#, FSIP (120 minutes) 3800#. Perforations: 4 shots per foot.

8690-8724; acidized with 250 gallons of mud acid, and 1000 gallons of regular. Swabbed and recovered 10 barrels of black, 20 gravity oil per hour, cleaned out to 8845'.

8746-8766'; Acidized with 250 gallons of mud acid, and 500 gallons of regular. Swabbed and recovered 43 1/2 barrels of oil in 4 hours, 5% B.W. Reacidized with 1500 gallons. Swabbed and recovered 90.1 barrels of oil in 7 hours, 10-12% BS.

8800-8810'; Acidized with 250 gallons of mud acid and 500 gallons of regular.

Completion Data:

Initial production was 140 barrels of oil (on 24 hour pump test); 10% water, API gravity 25.

Casing Record:

9 5/8" casing set at 735' with 550 sacks of cement
5 1/2" casing set at 8874' with 600 sacks of cement

Formation tops were determined from samples and electric logs. Doubtful or obscure formations were not picked. Colors and descriptive numbers were taken from the Goddard, et. al., 1951 Rock color chart distributed by the Geological Society of America, New York, N.Y.

FORMATION TOPS

Cretaceous System

Pierre formation	2104
Greenhorn formation	4662
Newcastle ("Muddy") sandstone	5214
Basal Cretaceous sandstone	5494

Jurassic System

Piper limestone	6320
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Triassic System

Spearfish formation	6691
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Permian System

Minnekahta formation	7102
Opeche (?) formation	7150

Pennsylvanian System

Minnelusa formation	7305
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Mississippian System

Amsden formation	7429
Big Snowy group	7588
Kibbey sandstone	8044
Kibbey limestone	8190
Charles formation	8335

0-30	Shale, brownish gray, lignitic, some medium dark gray to grayish black, compact and some fine to medium, clear, free quartz grains.
30-60	Shale, silty, lumpy, spongy, light greenish gray 5GY8/1; some lignite dark brownish gray 5YR3/1, to brownish black 5YR2/1 and some shale as above.
60-120	Shale soapy, lumpy, spongy, and silty in part, light greenish gray, little lignite, brownish black to black.
120-180	Shale, as above light greenish gray to light olive gray 5Y6/1.
180-210	Lignite, brownish gray to black, woody.
210-270	Shale, as above (120-180).

270-300	Shale, as above and lignite as above.
300-330	Shale, yellowish gray 5Y8/1, spongy very silty, lumpy, spongy.
330-360	Siltstone, shaly, poorly cemented, calcareous, light olive gray to olive gray 5Y4/1.
360-390	Sandstone, fine grained, angular, poorly cemented, yellowish gray 5Y8/1, to olive gray.
390-410	Sandstone, as above and little lignite brownish gray 5YR4/1 to black.
410-450	Sandstone, fine to medium grained, very shaly, poorly cemented, light greenish gray 5G8/1 shale matrix, and varicolored sand grains.
450-480	Lignite, vitreous to woody, brownish black to black.
480-510	Claystone, light olive gray 5Y6/1, bentonitic, lumpy and spongy with included fragments of lignite and fine to medium sized sand grains.
510-540	Claystone, as above, and few pieces of fine grained, well cemented calcareous, white sandstone.
540-570	Claystone, as above and some brownish gray 5YR4/1 to black shaly lignite.
570-600	Claystone, as above, and some very fine crystalline, dense, argillaceous limestone, light olive gray 5Y6/1 to greenish gray 5GY6/1.
600-690	Claystone, and limestone, as above, and little black lignite.
690-720	Lignite, shaly, brownish black to black.
720-740	Claystone, light olive gray 5Y6/1, lumpy spongy, calcareous and slightly bentonitic, with included fragments of lignite and fine to medium sand grains.
740-770	Lignite, brownish black to black, woody to shaly.
770-800	Lignite, brittle, black.
800-830	Shale, light olive gray 5Y6/1 to yellowish gray 5Y8/1, lumpy, compact to brittle, and calcareous, with some included lignite fragments, little free lignite, as above.
830-860	Limestone, very fine crystalline, dense, olive gray 5Y4/1 to light olive gray.
860-890	Limestone, as above and much shale, yellowish gray, some medium light gray to dark gray, lumpy, spongy.
890-950	Limestone, and shale as above and some dark, gray to black lignite.
950-980	Shale, light greenish gray 5G8/1, lumpy, compact to spongy.
980-1040	Shale, as above, to olive gray 5Y4/1, and some black lignite.
1040-1070	Lignite, brownish black to black.
1070-1100	Missing.
1100-1130	Shale, olive gray to yellowish gray 5Y8/1, lumpy, compact, and little black lignite.
1130-1160	Lignite, black vitreous to dull, and little shale as above.
1160-1190	Shale, pale yellowish brown 10YR6/2, silty, calcareous, lumpy, spongy.
1190-1280	Shale, pale yellowish brown, calcareous, lumpy, compact, silty in part.
1280-1340	Shale, olive gray 5Y4/1, calcareous, lumpy, compact, silty in part.
1340-1370	Limestone, fine crystalline, dense, greenish gray 5GY6/1 to olive gray, little brownish gray 5YR4/1.
1370-1430	Shale, light olive gray 5Y6/1, slightly calcareous, lumpy, compact.

1430-1460 Shale, olive gray to light olive gray, slightly calcareous, lumpy, spongy, some with lignite fragment inclusions, and little free lignite.

1460-1490 Lignite, sooty, black.

1490-1520 Shale, olive gray to yellowish gray 5Y8/1, silty, slightly bentonitic, lumpy, spongy, few pieces of fine crystalline, dense, greenish gray 5GY6/1 limestone.

1520-1550 Shale, olive gray to light olive gray, silty in part, slightly calcareous, lumpy, compact to spongy.

1550-1610 Shale, as above, little dark gray lignitic shale, and some black lignite.

1610-1640 Lignite, vitreous black.

1640-1670 Shale, greenish gray 5GY6/1 and olive gray 5Y4/1, silty, lumpy, compact to spongy.

1670-1700 Lignite, black, shaly in part, and little shale as above.

1700-1790 Shale as above.

1790-1820 Shale, greenish gray to light greenish gray and olive gray, very silty, lumpy, compact to spongy, and some very fine grained, poorly cemented, shaly, olive gray and greenish gray 5GY6/1, slightly calcareous sandstone.

1820-1910 Shale and sandstone as above and some fine to medium grained, sharp, moderately well cemented, highly calcareous, sandstone, light greenish gray 5GY8/1, to yellowish gray 5Y8/1.

1910-2030 Shale, and sandstone as above, and some medium to coarse free quartz.

2030-2090 Shale and sandstone as above, some olive gray lumpy shale with lignite inclusions and some black lignite.

2090-2120 Shale, pale yellowish brown 10YR6/2, light brown 5YR6/4, and greenish gray 5GY6/1, lumpy, compact.

2120-2270 Shale, greenish gray 5GY6/1, lumpy, compact.

2270-2300 Shale, greenish gray, lumpy, compact to brittle.

2300-2330 Shale, greenish gray to dark greenish gray 5GY4/1, lumpy, compact to brittle.

2330-2360 Shale, light olive gray 5Y6/1 to olive gray, lumpy, compact to spongy.

2360-2810 Shale, greenish gray 5GY6/1, to dark greenish gray 5GY4/1, lumpy, spongy to compact.

2810-2870 Shale, as above and little light olive gray, lumpy, compact to spongy shale.

2870-2960 Shale, as above and little light greenish gray 5G8/1, lumpy, compact shale.

2960-3140 Shale, greenish gray to dark greenish gray, lumpy, compact to spongy.

3140-3320 Shale, as above, to light olive gray 5Y6/1.

3320-3410 Shale, as above, some fragments from clay ironstone concretions, pale yellowish brown 10YR6/2 to dusky yellowish brown 10YR2/2 and few pieces of light brown and white calcite from probable septarian nodules.

3410-3470 Shale, and clay ironstone concretion fragments as above, and a few pearly, soft, iridescent, calcareous shell fragments.

3470-3500 Shale, and clay ironstone fragments as above.

3500-3650 Shale, greenish gray 5GY6/1 to dark greenish gray 5GY4/1, some light olive gray 5Y6/1 and little dark gray N3, lumpy to fissile, spongy to compact, and numerous shell fragments as above.

3650-3710 Shale, greenish gray to dark greenish gray, light olive gray to olive gray 5Y4/1, mostly fissile to splintery and compact to brittle, little soft lumpy.

3710-3740 Shale, greenish gray to dark greenish gray, much ironstone, light brown 5R5/6 to dusky yellowish brown 10YR2/2, some nodular calcite, yellowish gray 5Y8/1 to white, and little pyrite.

3740-3800 Shale, and little ironstone as above, few pieces of calcite, as above.

3800-4010 Shale, as above to light olive gray 5Y6/1.

4010-4110 Missing.

4110-4140 Shale, light olive gray 5Y6/1, fissile to lumpy, compact to spongy.

4140-4200 Shale, as above to greenish gray.

4200-4310 Shale, as above and some dark gray shale, lumpy to fissile, compact with soft, white calcareous specks.

4310-4340 Shale, greenish gray 5GY6/1, and dark gray to black, splintery, fissile and lumpy, compact to spongy.

4340-4400 Shale, as above to dark greenish gray 5GY4/1.

4400-4670 Shale, as above and some olive gray to yellowish gray 5Y8/1 shale, lumpy, spongy.

4670-4730 Shale, dark gray to black, fissile, brittle, much with soft, white, calcareous specks, little greenish gray 5GY6/1 shale, fissile, brittle.

4730-4790 Shale, dark gray to black, fissile and brittle, little greenish gray shale, fissile to lumpy, little brittle, mostly spongy.

4790-4820 Shale, as above, mostly greenish gray.

4820-5010 Shale, dark gray to black, fissile, brittle,

5010-5070 Shale, as above, more light olive gray 5Y6/1, lumpy, spongy shale and little greenish gray 5GY6/1, fissile, compact to brittle shale.

5070-5100 Shale, dark gray to black, fissile, brittle.

5100-5130 Missing.

5130-5190 Shale, dark gray to black, fissile, brittle, some greenish gray 5GY6/1 shale, fissile to lumpy, brittle to spongy.

5190-5250 Shale, as above to light olive gray 5Y6/1.

5250-5270 Shale, as above, and few pieces of sandstone, fine grained, angular, vitreous, friable, white to yellowish gray 5Y8/1.

5270-5280 Shale and sandstone as above and little siltstone, very well cemented, pale yellowish brown 10YR6/2.

5280-5410 Shale, dark gray to black, fissile to splintery, compact, and few pieces of sandstone as above.

5410-5420 Shale, as above.

5420-5470 Shale, as above, and few pieces of sandstone, fine grained, angular, friable white.

5470-5490 Shale, as above and much light olive gray 5Y6/1, lumpy, spongy shale, some with small inclusions of dark gray to black shale as above.

5490-5500 Shale, as above, and little greenish gray 5GY6/1 shale, fissile, brittle.

5500-5520 Shale, dark gray to black, flaky to splintery, brittle, and few pieces of sandstone, very fine to medium grained, friable to well cemented, white to pale yellowish brown 10YR6/2.

5520-5530 Shale, as above.

5530-5560 Shale, as above and some sandstone, very fine grained, very well cemented, light olive gray to yellowish gray 5Y8/1, little light gray.

5560-5630 Shale, as above, and some sandstone, very fine to fine grained, angular, moderately well cemented, light olive gray to yellowish gray, little white.

5630-5650 Shale and sandstone, as above and some medium to coarse, sharp to angular, vitreous, clear quartz grains and few coarse, rounded, frosted, quartz grains.

5650-5670 Shale and free quartz as above.

5670-5750 Shale, as above to compact and little sandstone, very fine to fine grained, angular, friable, yellowish gray, pale yellowish brown 10YR6/2, and white.

5750-5790 Shale and sandstone, as above and some pale yellowish brown, lumpy, spongy, shale.

5790-5800 Shale and sandstone, as above and some fine grained, friable, light gray, glauconitic sandstone.

5800-5810 Sandstone, very fine to fine grained, angular, friable to moderately well cemented, dusky yellowish brown 10YR2/2 to very pale orange 10YR8/2, glauconitic in part, and some shale as above.

5810-5830 Sandstone, very fine to fine grained, friable to moderately well cemented, mostly calcareous, some siliceous, slightly glauconitic, white, and pale yellowish brown 10YR6/2 to very pale orange 10YR8/2, little pyrite and little shale as above.

5830-5850 Sandstone and shale as above.

5850-5870 Sandstone, as above, mostly white with green glauconitic specks, slightly calcareous.

5870-5890 Sandstone and shale as above (5810-5830).

5890-5910 Sandstone, very fine to fine grained, well cemented, slightly calcareous, glauconitic, yellowish gray 5Y8/1 and light gray to very light gray.

5910-5920 Sandstone, as above to dark yellowish brown 10YR4/2 and shale, medium gray to black, flaky to splintery, compact to brittle.

5920-5930 Shale, as above, some very fine grained, very well cemented, light brown 5YR6/4 to dark yellowish brown sandstone, and few medium to coarse, subangular to angular, vitreous, clear quartz grains.

5930-5950 Shale, brownish gray 5YR4/1 to brownish black 5YR2/1, and medium dark gray N4 to black, waxy, foliated and splintery, compact, micaceous, and silty in part.

5950-5960 Shale, greenish gray 5GY6/1, fissile to splintery compact, foliated in part.

5960-5980 Shale, brownish black to black, fissile, compact, and little greenish gray shale as above.

5980-6000 Shale, as above, brownish black to black.

6000-6010 Sandstone, very fine grained, well cemented, slightly calcareous, very pyritic in part, yellowish gray 5Y8/1, and some shale as above.

6010-6030 Sandstone, very fine grained, moderately well cemented slightly calcareous, yellowish gray and pale yellowish brown 10YR6/2, and shale as above.

6030-6070 Shale, brownish black to black, flaky to splintery, compact, and little sandstone as above.

6070-6120 Sandstone, very fine grained, moderately well cemented, calcareous, glauconitic, yellowish gray and pale yellowish brown, some shale as above.

6120-6130 Shale, as above and little sandstone as above to dusky yellowish brown 10YR2/2.

6130-6140 Sandstone, very fine grained, well cemented, calcareous, slightly glauconitic, very light gray, yellowish gray 5Y8/1, and light greenish gray 5GY8/1, some shale as above.

6140-6160 Sandstone, very fine grained, moderately well cemented, calcareous, yellowish gray, and little very light gray.

6160-6180 Sandstone, as above with scattered moderate brown (5YR4/4) staining.

6180-6190 Sandstone, very fine grained, moderately well cemented, calcareous, yellowish gray, little greenish gray 5GY6/1 and some black shale.

6190-6200 Shale, dark gray to black, and greenish gray to dark greenish gray 5GY4/1, fissile to splintery, compact, and little sandstone as above.

6200-6210 Sandstone, fine grained, well cemented, calcareous, light olive gray 5Y6/1 and little shale as above.

6210-6230 Sandstone, as above and much shale as above.

6230-6240 Sandstone, fine grained, well cemented, calcareous, light olive gray and light gray, some shale as above.

6240-6250 Shale, as above and few pieces of sandstone as above.

6250-6300 Sandstone, very fine grained, very well cemented, calcareous, greenish gray 5GY6/1 and light gray, little yellowish gray 5Y8/1, much shale, dark gray to black, and greenish gray 5GY6/1 to dark greenish gray 5GY4/1, fissile to splintery, compact.

6300-6310 Shale, as above.

6310-6330 Limestone, fine grained pseudo-oolitic, moderately soft, with probable interstitial porosity, and some shale olive gray 5Y4/1 to olive black 5Y2/1 and black N1, fissile to splintery, compact.

6330-6350 Shale, dark gray to black and greenish gray 5GY6/1 to dark greenish gray 5GY4/1, fissile to splintery, compact.

6350-6360 Limestone, cryptocrystalline, dense, brownish gray 5YR4/1 to dark brownish gray 5YR3/1 and much shale as above.

6360-6370 Shale, as above and some limestone as above.

6370-6380 Shale, as above, silty in part, and limestone as above.

6380-6390 Limestone, cryptocrystalline, dense, brownish gray 5YR4/1 to brownish black, and dark greenish gray, some shale brownish black 5YR2/1 to black and dark greenish gray, fissile to splintery, compact.

6390-6400 Limestone, cryptocrystalline to fine crystalline, dense, light gray, yellowish gray 5Y8/1 and greenish gray 5GY6/1 to dark greenish gray 5GY4/1, to some shale as above.

6400-6440 Limestone, as above, with some dolomitic, dark reddish brown 10R3/4, very dense, brittle, shale, and much shale as above.

6440-6460 Sandstone, very fine grained, friable to moderately well cemented, calcareous, yellowish gray 5Y8/1 to light olive gray, light greenish gray 5GY8/1, and white, some limestone and shale as above.

6460-6470 Sandstone, as above with little shale and limestone as above.

6470-6480 Sandstone and shale, as above, and much fine granular, dense, limestone, yellowish gray to light olive gray.

6480-6500 Shale, dark gray to black, greenish gray 5GY6/1 to dark greenish gray 5GY4/1, fissile to splintery, compact, little dark reddish brown 10R3/4, brittle, dolomitic shale, little very fine crystalline, dense, light olive gray 5Y6/1, limestone and little fine granular, dense, yellowish gray arenaceous limestone.

6500-6520 Limestone, very fine crystalline, dense, brownish gray 5YR4/1, olive gray 5Y4/1 and dark greenish gray 5GY4/1 and little shale as above.

6520-6530 Limestone, very fine crystalline to sublithographic, dense, very, pale orange 10YR8/2.

6530-6540 Dolomite, subcrystalline, dense, very pale yellowish brown 10YR7/2, and limestone, dolomitic, very fine crystalline, dense, very pale orange 10YR8/2.

6540-6550 Limestone, dolomitic, very fine crystalline, mostly dense, little with tubular to cavernous porosity, very pale yellowish brown 10YR7/2, and little dolomite, as above.

6550-6560 Limestone and little dolomite, as above and much shale, grayish black, brownish gray 5YR4/1, olive gray 5Y4/1, greenish gray 5GY6/1, and dark reddish brown, fissile to splintery, compact.

6560-6570 Limestone, very fine to fine crystalline, dense, very pale orange 10YR8/2, and pale red 5R6/2 to grayish red 5R4/2, some shale as above.

6570-6580 Limestone, as above to pale yellowish brown 10YR6/2, and shale as above.

6580-6590 Limestone, very fine crystalline, dense, dark yellowish brown 10YR4/2 to very pale orange.

6590-6630 Limestone, as above and, much dolomite, argillaceous, fine crystalline to fine granular, some dense, some with pinpoint to tubular porosity, moderate reddish orange 10R6/6 to grayish red 10R4/6.

6630-6640 Limestone and dolomite, as above, and much medium dark gray N5 to grayish black shale, brittle and dolomitic in part.

6640-6650 Shale, dark gray to grayish black, greenish gray, fissile to splintery, compact, some moderate reddish orange 10R6/6 to grayish red 10R4/2 shale dolomitic, brittle.

6650-6680 Shale, as above to moderate reddish brown 10R4/6 and some sandstone, very fine to fine grained, friable, some iron oxide cementation and staining, moderate reddish brown 10R4/6, little moderate reddish orange and little white.

6680-6720 Sandstone, very fine grained, moderately well cemented, calcareous, iron oxide staining, moderate reddish brown 10R4/6, little greenish gray 5GY6/1 and grayish black, fissile to splintery, compact shale.

6720-6730 Sandstone and shale as above, and little clear, vitreous, gypsum.

6730-6740 Shale, greenish gray 5GY6/1, compact, and little sandstone as above.

6740-6760 Sandstone, as above to moderate orange pink 10R7/4, and some shale as above to grayish black.

6760-6770 Sandstone, and shale as above and little gypsum, moderate orange pink and white.

6770-6800 Sandstone, very fine to fine grained, friable to moderately well cemented, slightly calcareous, moderate reddish brown 10R4/6 to moderate reddish orange 10R6/6 and little white, vitreous, gypsum.

6800-6810 Shale, dark gray to grayish black, fissile to splintery, compact, and little sandstone as above.

6810-6830 Shale and sandstone as above and much gypsum, vitreous and clear to white, some stained moderate reddish brown to moderate reddish orange.

6830-6870 Sandstone and gypsum, as above and shale as above to greenish gray 5GY6/1.

6870-6930 Sandstone, very fine grained, very well cemented, dolomitic, moderate reddish brown 10R4/6, and little shale and gypsum as above.

6930-6950 Limestone, dolomitic, fine crystalline to fine granular, dense, dark reddish brown 10R3/4 to moderate reddish orange 10R6/6 and little sandstone as above.

6950-6960 Shale, greenish gray 5GY6/1, compact, and little limestone and sandstone as above.

6960-6970 Shale, dark gray to black, and greenish gray 5GY6/1, fissile to splintery, compact, little limestone and sandstone as above.

6970-7090 Limestone and sandstone as above, some shale as above, and little clear to white, vitreous gypsum.

7090-7110 Dolomite, very fine crystalline, dense, light red 5R6/6 to moderate pink 5R7/4, some fine granular dense, dolomite dark reddish brown 10R3/4 to moderate reddish orange 10R6/6, some shale, fissile to splintery, compact, grayish black to black and greenish gray 5GY6/1.

7110-7120 Dolomite and shale as above, and some white to clear, granular gypsum.

7120-7230 Dolomite, shale and gypsum as above and some grayish red 5R4/2 to pale red 5R6/2 dolomite.

7230-7260 Dolomite, shale and gypsum as above, and some fine to coarse, frosted, white and moderate reddish orange 10R6/6, loose quartz grains.

7260-7270 Dolomite, microcrystalline to fine crystalline, dense, dusky red 5R3/4 to moderate red 5R5/4, very pale orange 10YR8/2, and dark reddish brown 10R3/4, with little shale, grayish black and greenish gray 5GY6/1, fissile, compact.

7270-7280 Dolomite, very fine to fine crystalline, mostly dense, little scattered pinpoint porosity, very pale orange 10YR8/2, and little shale and dolomite as above.

7280-7300 Shale, as above and little dolomite as above.

7300-7310 Shale, medium dark gray to grayish black, and greenish gray 5GY6/1, to dark greenish gray 5GY4/1, fissile to splintery, compact to brittle, dolomitic in part, and some dolomite, very fine crystalline, dense dark reddish brown 10R3/4 to moderate reddish brown 10R4/6.

7310-7340 Shale and dolomite, as above, some gypsum, vitreous, clear to white, and moderate reddish brown to moderate orange pink 10R7/4, and little sandstone, fine to medium grained, subangular to rounded, friable, light red 5R6/6.

7340-7350 Sandstone, fine grained, subangular to rounded, friable, slightly calcareous, moderate reddish orange 10R6/6, and pale red 5R6/2 to grayish red 5R4/2, little shale as above.

7350-7380 Sandstone and much shale as above.

7380-7400 Sandstone and shale as above, and some gypsum, earthy to vitreous, clear to white, and grayish pink 5R8/2.

7400-7420 Sandstone, shale and gypsum as above, and some fine to medium, subangular to rounded, frosted, clear, loose quartz grains.

7420-7430 Shale, medium dark gray to grayish black, and greenish gray, fissile to, splintery, compact.

7430-7450 Sandstone, fine grained, friable, grayish orange pink 10R8/2 to moderate pink 5R7/4, and white, some shale as above.

7450-7480 Sandstone and shale as above and little limestone, dolomitic, very fine crystalline, very hard, dense, pale red 10R6/2 and pale yellowish brown 10YR6/2, few pieces with grayish red, carbonate crystal inclusions.

7480-7500 Dolomite, microcrystalline and very fine crystalline, dense, grayish red 5R4/2 to grayish pink 5R8/2 and pale yellowish brown 10YR6/2 to very pale orange 10YR8/2, some shale as above.

7500-7530 Dolomite and shale as above, and little very fine to fine grained, friable, white sandstone.

7530-7550 Sandstone, very fine to fine grained, friable, pale red 5R6/2 to grayish orange pink 10R6/2 and pale yellowish brown to very pale orange, little dolomite, as above and little anhydrite, white to grayish pink 5R8/2, earthy.

7550-7560 Shale, greenish gray 5G6/1 to greenish black 5G2/1 and dark reddish brown 10R3/4 dolomitic, fissile to splintery, brittle, hard.

7560-7570 Dolomite, fine crystalline to fine granular, dense, grayish red 5R4/2 to pale red 5R6/2 and pale yellowish brown 10YR6/2 to very pale orange 10YR8/2, anhydritic in part.

7570-7580 Dolomite as above, and some white, soft, earthy, anhydrite.

7580-7590 Dolomite, calcitic, very fine to fine crystalline, dense, very pale purple 5P8/2 to pale purple 5P6/2.

7590-7620 Dolomite, as above, to moderate red 5R4/6 and light red 5R6/6.

7620-7640 Shale, greenish gray 5GY6/1 to dark greenish gray 5GY4/1, dark gray to grayish black, and moderate reddish brown 10R4/6, fissile to splintery, compact to brittle, mostly dolomitic, little vitreous gypsum and little dolomite as above.

7640-7650 Limestone, dolomitic, very fine crystalline, dense, moderate pink 5R7/4 to grayish orange pink 10R8/2, and very pale orange 10YR8/2.

7650-7660 Limestone, as above and little shale, moderate red, 5R5/4 to dusky red 5R3/4 and grayish red 5R4/2, fissile to splintery, brittle.

7660-7680 Limestone and shale as above and some dolomite, calcitic, very fine crystalline dense, moderate reddish orange 10R6/6 and moderate red 5R5/4 to dusky red 5R3/4.

7680-7690 Limestone, dolomite, and shale, as above and some very pale orange to dark yellowish brown 10YR4/2 dolomite, very fine crystalline, dense.

7690-7700 Dolomite, fine crystalline, dense, grayish red 5R4/2 to grayish pink 5R8/2, and very pale orange, some shale, greenish gray, compact.

7700-7770 Dolomite, as above to pale yellowish brown 10YR6/2, and some shale, greenish gray, grayish black and moderate red 5R4/6, fissile to splintery, compact.

7770-7780 Shale, black, little dark gray, moderate red 5R4/6, and, dark reddish brown 10R3/4, fissile to splintery, compact to brittle, very calcareous.

7780-7800 Limestone, very fine crystalline, very hard, dense, mostly dusky yellowish brown 10YR2/2, some dark yellowish brown to very pale orange 10YR8/2.

7800-7820 Shale, grayish black, greenish gray, and moderate reddish brown 10R4/6, fissile to splintery, compact to brittle, calcareous in part.

7820-7840 Shale, as above to grayish red 5R4/2, and some limestone, fine crystalline, dense, light gray to dark gray, and little brownish gray, some fluorescence, few pieces with fair cut.

7840-7860 Shale, as above, mostly moderate reddish brown.

7860-7870 Shale, as above and few pieces of sandstone, fine grained, well cemented, calcareous, no fluorescence or cut.

7870-7880 Shale, as above and little sandstone, fine grained, subrounded to rounded, well cemented, very calcareous, no fluorescence or cut.

7880-7890 Shale, moderate olive brown 5Y4/4, grayish black, grayish red 5R4/2, and moderate reddish brown, fissile to splintery, compact to brittle and some limestone, very fine crystalline, dense, medium gray to grayish black, no fluorescence or cut.

7890-7920 Limestone, shaly, very fine to medium crystalline, dense, light gray to grayish black, no fluorescence or cut.

7920-7940 Limestone, as above, few pieces with fair fluorescence, and slight cut, much varicolored shale as above (7880-7890) and much pyrite.

7940-7950 Shale, medium dark gray to grayish black, moderate reddish brown, moderate red 5R4/6, grayish red 5R4/2, and light olive brown 5Y5/6, fissile to splintery, waxy compact.

7950-7960 Shale, as above, and few small pieces of sandstone, very fine grained to silty, moderately well cemented, calcareous, some black staining, no fluorescence or cut.

7960-7970 Shale, dark gray to black, splintery, compact, some sandstone, very fine grained to silty, moderately well cemented, greenish gray 5GY6/1 and brownish gray, some black staining, no fluorescence or cut, and some limestone, very fine crystalline, to very fine granular, dense, light greenish gray 5GY8/1 to greenish gray 5GY6/1 and olive gray.

7970-8000 Shale, and sandstone as above, and limestone as above, some to very pale orange and pale yellowish brown.

8000-8010 Shale, dark gray to black, moderate reddish brown, grayish red 5R4/2 and greenish gray 5GY6/1, fissile to splintery, compact, and some limestone as above.

8010-8020 Shale, black, splintery, and compact.

8020-8040 Limestone, dolomitic, microsugrosic to very fine crystalline, dense, light gray and yellowish gray, some very fine grained sandstone and little siltstone, moderately well cemented, shaly in part, dark gray and brownish gray, some brown to black staining, no fluorescence or cut, and much black shale, as above.

8040-8050 Shale, medium light gray to black, mostly hard and brittle, very calcareous, some compact.

8050-8060 Dolomite, calcitic, microsugrosic to very fine crystalline, dense greenish gray 5GY6/1 to light olive gray, and dark reddish brown, and some shale as above.

8060-8070 Sandstone, very fine grained, friable to moderately well cemented, very pale orange to pale yellowish brown, slightly calcareous, and some shale as above.

8070-8090 Sandstone, as above, and little shale, black and greenish black, fissile, compact.

8090-8100 Sandstone, as above to light brown 5YR6/4, shale as above to greenish gray 5GY6/1, and little siltstone, soft, calcareous, stained dark brown, fair fluorescence, good cut.

8100-8110 Sandstone, as above, and much shale as above.

8110-8160 Sandstone, very fine grained, well cemented, pale yellowish brown to dusky yellowish brown, and some black, compact shale.

8160-8190 Sandstone, very fine to fine grained, friable, very pale orange to dusky yellowish brown, and moderate brown 5YR3/4, some with fair fluorescence, and cut.

8190-8200 Limestone, medium oolitic, elliptical to spherical, very pale orange to dark yellowish brown.

8200-8210 Limestone, very fine crystalline, dense, chalky in part, very pale orange to dusky yellowish brown 10YR2/2.

8210-8230 Limestone, as above, some sandstone, very fine grained, friable, calcareous, light gray, and little oolitic limestone as above (8190-8200).

8230-8240 Shale, medium dark gray to grayish black, fissile, compact.

8240-8280 Dolomite, calcitic, mostly microcrystalline, some fine crystalline, dense, light brown 5Y6/4 to dusky brown 5YR2/2, and some shale as above.

8280-8290 Shale, as above and little dolomite as above.

8290-8300 Dolomite, as above and some shale as above to greenish gray 5GY6/1.

8300-8310 Dolomite, very fine crystalline, dense, pale reddish brown to very dark reddish brown, 10R2/4.

8310-8320 Dolomite, microcrystalline and little very fine crystalline, dense, very pale orange to dusky yellowish brown, and little anhydrite, soft, white, chalky.

8320-8330 Dolomite, as above, and some limestone, very fine crystalline, dense, brownish black.

8330-8340 Limestone, sublithographic, soft, white, little possible carbonaceous residue, fair fluorescence, no cut, and much caved material from above.

8340-8350 Limestone, medium oolitic, dense, light brownish gray to brownish black, much shale, black, fissile, compact, and little limestone, as above.

8350-8360 Limestone, very fine crystalline, dense, pale yellowish brown, and little shale and limestone as above.

8360-8370 Cavings, very poor sample.

8370-8380 Limestone, lithographic, dense, micro-fractures, dark yellowish brown, grading into sublithographic, dense, very pale orange limestone.

8380-8410 Limestone, as above to dusky yellowish brown and some chalky, soft, crumbly, very pale orange limestone, with very good tubular to vermicular porosity, little with brown stain, fair fluorescence, no cut.

8410-8430 Limestone, very fine crystalline, dense, very pale orange to dusky yellowish brown, and little white anhydrite.

8430-8440 Limestone, as above and some anhydrite, vitreous, translucent, brittle, mostly white, some with brown stain.

8440-8460 Dolomite, very fine crystalline, dense, medium bluish gray 5B5/1, some anhydrite as above and much caved material.

8460-8480 Anhydrite, as above and cavings.

8480-8500 Limestone, very fine crystalline, dense, fossiliferous, dusky yellowish brown, and very pale orange.

8500-8510 Shale, black, fissile, compact.

8510-8520 Limestone, very fine crystalline, dense, pale yellowish brown to dark yellowish brown.

8520-8530 Limestone, as above, and some white and pale yellowish brown to very pale orange anhydrite and anhydritic dolomite.

8530-8540 Anhydrite, and calcitic anhydrite, earthy to vitreous, white and very pale orange.

8540-8550 Limestone, very fine granular, chalky in part, good tubular to vermicular porosity, very pale orange to pale yellowish brown 10YR6/2, much with shale, anhydrite, and limestone inclusions.

8550-8560 Limestone, very fine crystalline, dense, dark yellowish brown to dusky yellowish brown, and brownish black.

8560-8580 Shale, medium gray to black, fissile, compact, and much caved material.

8580-8610 Dolomite, and calcitic dolomite, very fine crystalline, dense, light gray to medium dark gray and very pale orange, argillaceous in part.

8610-8640 Dolomite, as above, with some anhydrite and anhydritic dolomite, qqqwhite and yellowish gray.

8640-8650 Limestone very fine granular, chalky in part, good pinpoint to tubular porosity, very pale orange to pale yellowish brown, and some fragmental limestone, mostly dense, some with pinpoint porosity, brownish gray to brownish black, little brown stain, fair fluorescence, slight cut.

8650-8660 Anhydrite, earthy, soft, white and very pale orange to pale yellowish brown, with limestone and shale inclusions.

8660-8680 Anhydrite, brittle, vitreous, white to light gray, and some limestone and anhydritic limestone, very fine crystalline, dense, very pale orange to pale yellowish brown.

8680-8690 Anhydrite, earthy, soft, yellowish gray, much with limestone and shale inclusions.

8690-8700 Limestone, medium oolitic, isolated pinpoint porosity, very pale orange to dusky yellowish brown, fair fluorescence, slight cut.

8700-8710 Limestone, very fine granular, pinpoint porosity, very pale orange, good fluorescence, no cut.

8710-8715 Limestone, very fine crystalline, dense, pale yellowish brown and some very fine granular limestone as above, with good fluorescence and fairly, good cut.

8715-8725 Limestone, chalky, soft, very pale orange and white, fair fluorescence and cut, and some very fine crystalline, limestone as above.

8725-8730 Limestone, very fine granular, little pinpoint porosity, chalky in part, very pale orange to pale yellowish brown, fair fluorescence and slight cut, and some very fine crystalline, limestone, dense, pale yellowish brown to dark yellowish brown.

8730-8745 Limestone, fragmental, dense, dusky yellowish brown and some chalky, soft, limestone, very pale orange to pale yellowish brown, slight fluorescence, no cut.

8745-8750 Shale, grayish black to black, fissile, compact, and little limestone as above.

8750-8755 Limestone, very fine granular, chalky in part, yellowish gray to light olive gray, fair to good fluorescence, no cut, and some shale, as above to greenish gray 5GY6/1.

8755-8769 Missing.

8769- Circulation sample. 1 3/4 hours: Limestone, fine crystalline, dense, dusky yellowish brown, much chalky, moderately soft limestone, very pale orange to pale yellowish brown, and some very fine granular limestone, with pinpoint porosity, brown staining, good fluorescence, and good cut.

8765-8770 Limestone, as above, poor sample, mostly shale cavings.

8770-8775 Limestone, very fine to fine crystalline, dense, very pale orange to dusky yellowish brown, fair fluorescence, no cut.

8775-8785 Limestone, medium fragmental, angular to subangular, scattered pinpoint porosity, very pale orange to dark yellowish brown, little black carbon residue, fair fluorescence, and cut.

8785-8790 Limestone, dolomitic, very fine granular, dense, yellowish gray, 5Y8/1, good fluorescence and fairly good cut.

8790-8800 Anhydrite, dense, hard, slightly calcareous in part, medium gray, and some limestone as above.

8800-8805 Limestone, very fine crystalline, dense, pale yellowish brown to dusky yellowish brown, and some anhydrite and very fine granular limestone, as above.

8805-8808 Circulation sample: Limestone and anhydrite as above.

8808-8810 Limestone, fine to medium fragmental, dense, dark yellowish brown to dusky yellowish brown, and some very fine crystalline, dense limestone, very pale orange.

8810-8815 Limestone, as above, and little white, earthy to vitreous anhydrite.

8815-8820 Anhydrite, as above, and little limestone as above.

8820-8835 Anhydrite, earthy and soft to vitreous and brittle, white to dark gray.

8835-8850 Anhydrite, vitreous, brittle, white to dark gray and very pale orange to pale yellowish brown.

8850-8860 Limestone, dolomitic, fine crystalline, dense, dark yellowish brown to dusky yellowish brown, little very fine crystalline, dense dolomitic limestone, medium gray and little anhydrite as above.

8860-8870 Anhydrite, hard, brittle, calcareous in part, white to medium dark gray and very pale orange to dark yellowish brown.

Core #1 (8872-8916)

8872-8874 Anhydrite, brittle, very dense, olive gray 5Y4/1.

8874-8875 Anhydrite, as above to light olive gray 5Y6/1.

8875-8876 Anhydrite, brittle, dense, vitreous, very light gray.

8876-8877 Anhydrite, vitreous, brittle, light gray, with many dark yellowish brown dolomite inclusions.

8877-8878 Anhydrite, brittle, dense, dark yellowish brown.

8878-8879 Anhydrite, brittle, dense, slightly calcareous, olive gray 5Y4/1.

8879-8880 Anhydrite, brittle, dense, brownish gray 5YR4/1.

8880-8881 Anhydrite, brittle dense, olive black 5Y2/1.

8881-8882 Anhydrite, vitreous, dense, light brownish gray, with brownish black, very fine crystalline, dense, dolomite stringers.

8882-8883 Anhydrite, vitreous dense, light brownish gray.

8883-8884 Anhydrite, as above to brownish black 5YR2/1.

8884-8885 Anhydrite, pearly, dense, translucent, pinkish gray 5YR8/1.

8885-8888 Dolomite, anhydritic, very fine crystalline, dense, brownish black.

8888-8889 Anhydrite, vitreous, dense, very light gray, with much included dusky yellowish brown fine crystalline, dense, dolomite.
 8889-8890 Dolomite, as above with some inter bedded anhydrite, as above.
 8890-8891 Anhydrite, vitreous, dense, brownish gray.
 8891-8892 Dolomite, fine crystalline, dense, light brownish gray.
 8892-8893 Dolomite, very fine granular, dense, hard, dark gray.
 8893-8894 Dolomite, fine crystalline, dense, very pale orange.
 8894-8898 Dolomite, calcitic, sucrosic, probable interstitial porosity, very light gray.
 8898-8899 Limestone, dolomitic, very fine granular, little possible interstitial porosity, pale yellowish brown.
 8899-8900 Limestone, dolomitic, fine crystalline, dense, pale yellowish brown.
 8901-8902 Limestone, fine crystalline, dense, dark yellowish brown 10YR4/2.
 8902-8903 Limestone, fine crystalline, dense, dusky yellowish brown 10YR2/2.
 8903-8904 Limestone, as above, stylolitic.
 8904-8906 Limestone, fine crystalline, dense, dusky yellowish brown.
 8906-8907 Limestone, anhydritic, earthy to fine crystalline, mostly dense, porous in part, very pale orange and little dusky yellowish brown.
 8907-8909 Limestone, fine crystalline, dense, dusky yellowish brown.
 8909-8910 Limestone, fine crystalline, scattered pinpoint porosity, dark yellowish brown.
 8910-8911 Limestone, fine crystalline, dense, dark yellowish brown, with some black dead oil in fractures, no fluorescence, fairly good cut.
 8911-8912 Limestone, fine crystalline, dense, dark yellowish brown.
 8912-8913 Limestone, very fine crystalline, dense, dusky yellowish brown.
 8913-8914 Limestone, very fine crystalline, dense, pale yellowish brown 10YR6/2.
 8914-8916 Limestone, very fine crystalline, dense, dusky yellowish brown.

 Core #2 (8916-8944)
 8916-8919 Limestone, fine crystalline, dense, dusky yellowish brown.
 8919-8920 Limestone, fine crystalline, dense, pale yellowish brown, some black carbon residue.
 8920-8923 Limestone, fine crystalline, dense, pale yellowish brown.
 8923-8924 Limestone, fine to medium crystalline, dense, dusky yellowish brown, some black dead oil along an open fracture, slight fluorescence, and fair cut.
 8924-8925 Limestone, fine crystalline, dense, dark yellowish brown.
 8925-8930 Limestone, fine to medium crystalline, dense, dusky yellowish brown.
 8930-8931 Limestone, as above with black dead oil in fractures, no fluorescence, fair cut.
 8931-8932 Limestone, fine crystalline, apparently some vugular porosity, dusky yellowish brown.
 8932-8933 Limestone, as above, grading to very fine granular dolomitic limestone, pale yellowish brown.
 8933-8934 Limestone, fine crystalline, dense, dusky yellowish brown.
 8934-8935 Limestone, dolomitic, very fine granular, dark yellowish brown, numerous inclusions of fine crystalline limestone as above, possibly little intergranular porosity, some brown stain, good fluorescence, and very good cut.

8935-8936 Limestone, fine crystalline, dense, dusky yellowish brown, and little interbedded white calcite.

8936-8937 Limestone, fine crystalline, dense, dusky yellowish brown, little black carbon residue, no fluorescence or cut.

8937-8940 Limestone, fine crystalline, dense, light brownish gray 5YR6/1, to brownish gray 5YR4/1.

8940-8942 Limestone, fine crystalline, dense, brownish gray.

8942-8944 Limestone, fine to medium crystalline, dense, brownish gray.

Samples

8944-8950 Limestone, fine crystalline, dense, brownish gray, poor sample, mostly shale cavings.

8950-8955 Limestone, fine crystalline, dense, very pale orange to dusky yellowish brown.

8955-8960 Limestone, as above, with little black staining, fair fluorescence and good cut.

8960-8965 Limestone, chalky, very pale orange to pale yellowish brown, some black staining, good fluorescence and fairly good cut.

8965-8995 Limestone, very fine crystalline, dense, pale yellowish brown to dusky yellowish brown, and some chalky limestone, as above with slight fluorescence and cut.

8995-9020 Limestone, very fine granular to chalky, very pale orange to dusky yellowish brown, some black stain, fair fluorescence and slight cut.

9020-9080 Limestone, fine crystalline, to very fine granular, dense, very pale orange to dusky yellowish brown.

9080-9090 Dolomite, microsucrosic, dense, pale yellowish brown, and little limestone, fine crystalline, dense, pale yellowish brown to dusky yellowish brown.

9090-9100 Limestone, fine crystalline, some chalky, dense, very pale orange to dark yellowish brown.

9100 Total Depth