

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 155

Summary of the Texas Company-Government - M. S. Pace No. 1  
Well No. 859 - Permit No. 872

by Clarence Carlson  
February, 1957

Texas Company-Government - M. S. Pace No. 1, Billings County, North Dakota. Location: C SW NE Section 31, T. 144 N., R, 100 W. Elevation: Ground 2452 K.B. 2463. Total depth 12,000 feet.

The Texas Company-Government - M. S. Pace No. 1 was spudded May 22, 1955; drilled to a total depth of 12,000 feet; found non-commercial and plugged October 16, 1955. Electric, Laterolog and a Microlaterolog were run by Schlumberger, Gamma Ray-Neutron logs were run by Lane Wells.

Cores:

9,180 - 9,498  
9,508 - 9,624  
9,642 - 9,758  
10,920 - 10,968  
11,122 - 11,240  
11,891 - 12,000

Drill Stem Tests:

DST. 1 - 9224 to 9284; tool open 3 hours; shut in 30 minute; opened with weak blow of air and died in 1 hour and 15 minutes. Recovered 260 feet of slightly gas and water cut mud. IFP 60#, FFP 170#, SIP 3930#, IHP 5450#, FHP 5400#.

DST. 2 - 9288 to 9344; 3 hour test, shut in 30 minutes; weak blow of air increasing to fair blow in 7 minutes, decreasing to weak blow in 2 hours and 15 minutes, continued weak for the remainder of the test. Recovered 90 feet of gas cut salt wafer and mud, 180 feet of gas cut salt water, 313,000 PPM. IFP 55#, FFP 210, SIP 3720#, HIP 5505#, FHP 5535#.

DST. 3 - 9344 to 9414; Misrun.

DST. 4 - 9362 to 9414; 2 hour test, shut in 30 minutes; opened with weak blow of air, died in 1 hour. Recovered 70 feet of slightly gas cut mud. IFP 20#, FFP 50#, SIP 1257#, IHP 5520#, FHP 5505#, B.H. Temp, 240°.

DST. 5 - 9498 to 9511; 2 hour test, shut in 30 minutes; opened with a weak blow of air and died in 1 hour. Recovered 70 feet of slightly gas cut mud. IFP 95#, FFP 275#, SIP 4230#, IHP 5510#, FHP 5500#.

DST. 6 - 9655 to 9700; open 2 1/2 hours, shut in 30 minutes; opened with weak blow of air for 1 hour, decreasing to dead in 1 1/2 hours. Recovered 100 feet of slightly gas cut rifling mud. IFP 0#, FFP 60#, SIP 3160#, IHP 5450#, FHP 5290#.

DST. 7 - 9705 to 9758; tool open 3 1/2 hours; opened with weak blow of air, increasing to a good blow in 1 hour and continued throughout test.

Recovered 100 feet of gas and water cut mud, 860 feet of black gas cut salty sulfur water. IFP 110#, FFP 550#, IHP 5450#, FHP 5400#.

DST. 8 - 10,914 to 10,968; Misrun, packer failed.

DST. 9 - 10,907 to 10,971; test 2 1/2 hours, shut in 1 hour, opened with weak blow of air, decreasing to slight blow which lasted throughout test. Recovered 1260 feet of water cushion, 558 feet of muddy water. IFP 510#, FFP 915#, SIP 4730#, IHP 5885#, FHP 5865#.

DST. 10 - 11,110 to 11,181; tool open 1 hour and 53 minutes, shut in 1 hour; opened with weak blow and died in 8 minutes. Recovered 1260 feet of water cushion and 570 feet of salt water. IFP 600#, FFP 800#, SIP (30 Minutes) 4830#, IHP 5860#, FHP 5720#.

DST. 11 -11,875 to 11,911; tool open 1 hour and 20 minutes with weak blow of air, died in 22 minutes. Packer started leaking after 58 minutes. Recovered 1530 feet of water cushion, 1100 feet of slightly gas cut drilling mud. IFP 660#, FFP 960#, IHP 6660#, FHP 6380#.

DST. 12 -11,920 to 12,000; tool open 2 hours, shut in 40 minutes; opened with weak blow of air for 20 minutes and died. Recovered 1530 feet of water cushion and 540 feet of salt water. IFP 725#, FFP 980#, SIP 5165#, IHP 6705#, FHP 6615#.

#### Tests:

Perforations 9470-9490, 9540-9562: swabbed 40 barrels of load oil, set packer 9445. Acidized with 1500 gallons, swabbed 73 feet of black sulfur water with a trace of oil in 6 hours; swabbed 13 barrels of oil and 59 barrels of water in 11 hours, 33.8 gravity. Swabbed 8 barrels of oil and 34 barrels of water in 7 hours, pulled tubing and packer.

Perforated 9356-9380, 9394-9408, 9415-9427, 9228-9254, set plug at 9320. Acidized with 2000 gallons; swabbed 161 barrels of load oil, swabbed 20 barrels of fluid, 70% water, packer leaked, swabbed 12 barrels of oil, no water in 4 hours; swab stuck at 6800 feet, shut in 12 hours, swabbed 5 barrels of oil in 1 hour, swabbed 4 barrels of salt water in 3 hours, set bridge plug at 9320, packer at 9126 feet; acidized with 1500 gallon through perforations at 9228-9254 and 9265-9276; swabbed 16 barrels of oil and 16 barrels of water in 14 hours; swabbed 25 barrels of salt water in 12 hours; swabbed 34 barrels of oil and 17 barrels of salt water in 12 hours; swabbed 2 1/2 barrels of oil and 17 3/4 barrels of salt water in 5 hours; swabbed 16 barrels of oil and 16 barrels of water in 7 hours, swabbed with packer unseated 23 barrels of oil and 30 barrels of water in 12 hours, slight blow of gas. Swabbed 7 barrels of oil and 38 barrels of water in 12 hours.

#### Casing Record:

Set 13 3/8" surface casing at 616 feet with 250 sacks of HOWCO regular bulk cement and 250 sacks mixed with 4% gel and 2% calcium chloride.

Set 7" casing at 9750 with 600 sacks of cement.

Recovered 7500 feet of 7" casing.

Plugging Record:

Ground level	15 sacks cement
550 - 650	50 sacks cement
1,700 - 1,800	50 sacks cement
5,430 - 5,710	100 sacks cement
7,450 - 7,550	50 sacks cement
9,730 - 9,830	50 sacks cement
11,800 - 11,900	50 sacks cement

Formation tops were determined from samples and electric logs. Doubtful or obscure formation tops were not picked. Color, names, and identifying numbers are from the 1948 color chart distributed by the National Research Council, Washington D. C.

\*The interval from 7625 to 7760 is placed in the Minnelusa formation although the samples contain dolomite similar to that of the Amsden formation.

FORMATION TOPS

Cretaceous System	
Pierre formation	1755
Niobrara formation	3978
Greenhorn formation	4507
Dakota group	5006
Muddy sandstone	5137
Dakota group sandstone	5480
Jurassic System	
Piper limestone	6488
Triassic System	
Spearfish formation	6634
Permian System	
Minnekahta formation	7276
Opeche formation	7326
Pennsylvanian System	
*Minnelusa formation	7625
Mississippian System	
Amsden formation	7760
Big Snowy group	8035
Kibbey limestone	8500
Charles formation	8650
Mission Canyon formation	
"Base of the last Salt"	9173
Lodgepole formation	9880
Englewood formation	10630
Devonian System	
Lyleton formation	10710
Nisku formation	10872
Duperow formation	10968
Souris River formation	11290
Dawson Bay formation	11484
Elk Point group	11552
Silurian System	
Interlake group	11840

630-650 Lignite.

670-690 Lignite and shale, light gray, lumpy, spongy.

710-750 Lignite and shale, light gray to medium gray, lumpy compact.

750-790 Shale, light gray to medium gray, lumpy, compact, a little lignite.

790-830 Shale, light gray to medium dark gray and light brownish gray, lumpy, spongy to compact; a little lignite.

910-970 Sandstone, very light gray with a yellowish green cast, very fine to fine grained, subangular, very calcareous; some shale, light brownish gray and medium gray, lumpy, slightly bentonitic.

970-1030 Shale, light brownish gray, lumpy, soft, silty, slightly bentonitic,

1050-1110 Shale, medium gray to medium light gray, lumpy, bentonitic, slightly silty; a little lignite.

1110-1130 Shale, as above.

1130-1190 Shale, as above, some lignite.

1190-1210 Lignite.

1210-1230 Sandstone, light gray, fine grained, argillaceous, a little lignite and shale, light gray.

1230-1250 Shale, medium to medium light gray and light brownish gray, lumpy, silty in part, slightly bentonitic.

1250-1270 Lignite and Shale, light brownish gray, salty, bentonitic.

1270-1290 Shale, medium gray and light brownish gray, bentonitic; some sandstone white to very light gray, clay cement, fine to medium grained.

1310-1350 Shale, medium gray and light gray, bentonitic, lumpy; a little lignite.

1350-1370 Lignite, some shale, as above.

1370-1410 Shale, medium gray, lumpy, bentonitic.

1410-1430 Shale, light brownish gray, and medium gray, silty, bentonitic; a little lignite.

1430-1470 Shale, as above; a little sandstone very light gray, fine to medium grained, argillaceous, calcareous.

1470-1510 Sandstone as above; some shale, as above.

1510-1550 Sandstone, very light gray, fine to medium; subangular grains calcareous, argillaceous.

1630-1670 Shale, medium gray, bentonitic, lumpy; a little lignite, some sandstone as above.

1670-1700 Sand, loose, fine to medium subangular to subrounded grains.

1700-1740 Sandstone, very light gray, fine to medium grained, subangular, calcareous, argillaceous; shale, medium gray, bentonitic, silty.

1740-1780 Sandstone, very light gray, fine grained, argillaceous calcareous; some shale, as above.

1780-1800 Shale, light gray to light brownish gray, silty, bentonitic.

1840-1860 Shale, medium gray, lumpy, compact, bentonitic.

1880-1900 Shale, as above.

1920-2000 Shale, medium light gray, lumpy, compact, bentonitic.

2000-2060 Shale, medium light gray, lumpy, spongy to compact, bentonitic.

2080-2120 Shale, medium light to medium gray, lumpy to platy compact.

2140-2220 Shale, medium light gray, flaky to platy, compact.

2220-2240 Shale, medium light gray and light olive gray 5Y6/1, flaky, spongy.

2240-2360 Shale, medium light gray to medium gray, flaky, spongy to platy.

2360-2400 Shale, medium gray, platy, compact, some flaky.

2500-2540 Shale, medium light gray, flaky, disaggregated, bentonitic, some platy, compact.

2540-2620 Shale, medium light gray, platy to lumpy, compact and flaky, spongy, bentonitic.

2640-2700 Shale, as above.

2800-2920 Shale, as above.

2920-3400 Shale, medium light gray, lumpy to flaky, spongy to compact.

3420-3500 Shale, medium light to medium gray, lumpy, compact to flaky, spongy.

3500-3740 Shale, medium gray, platy, compact to flaky, spongy.

3740-3980 Shale, medium gray, flaky, spongy.

3980-4040 Shale, medium gray, calcareous, white specks, foliated, compact.

4040-4080 Shale, medium gray to medium dark gray, platy, compact.

4080-4160 Shale, medium light gray, foliated, spongy to compact.

4160-4460 Shale, medium dark gray, platy, compact.

4480-4500 Shale, medium dark gray, platy, compact.

4500-4540 Shale, medium dark gray, as above; a little white speckled shale.

4540-4600 Shale, medium dark gray, lumpy, compact, calcareous, white specked, some platy compact shale.

4600-4720 Shale, medium dark gray, platy, compact.

4740-4980 Shale, medium dark gray, platy, compact to foliated, compact.

5000-5140 Shale, as above.

5140-5175 Shale, light gray to very light gray, lumpy; some sandstone very light gray, very fine to fine grained.

5175-5185 Shale, as above, some sandstone fine to medium grained colorless to white.

5185-5285 Shale, medium dark gray, platy and flaky, compact to spongy.

5285-5305 Shale, as above and little bentonite, very light gray.

5320-5380 Shale, medium dark gray, fissile to platy, spongy to compact.

5420-5440 Shale, as above a little light gray to light brownish gray siltstone.

5470-5480 Shale, medium dark gray and medium gray, fissile to platy, spongy to compact; a few fine to medium, loose, subangular sand grains.

5480-5500 Sandstone white, fine to very fine grained; some sand, colorless fine to medium, subangular quartz.

5530-5537 Sandstone colorless, fine to medium, subangular grains.

5537-5547 Shale, medium gray and medium dark gray, platy, compact.

5547-5567 Shale, as above, a little sandstone white, very fine grained; a little light brownish gray siltstone.

5567-5577 Shale, light gray to light brownish gray, lumpy compact, soapy; a little loose, medium, subangular quartz grains.

5577-5600 Sandstone white to very light gray, fine to medium grained, some shale, as above.

5600-5630 Shale, medium gray and medium dark gray, flaky and platy, spongy to compact.

5630-5680 Sandstone fine to medium grained, subangular colorless quartz; much shale, as above.

5680-5730 Shale, light gray and light brownish gray, lumpy compact, waxy; also much medium dark gray and medium gray shale, as above.

5730-5760 Shale, as above, a little sandstone white to very light gray, fine grained.

5760-5780 Sandstone white to very light gray, very fine to fine grained; shale, light brownish gray, light greenish gray 5G8/1, light gray, platy to lumpy, compact.

5780-5800 Shales, as above, a little sandstone as above and a few loose, medium, subangular sand grains.

5800-5850 Shale, light greenish gray, light brownish gray, medium gray, foliated to platy, spongy to compact.

5850-5860 Shale, medium gray, flaky, spongy; a little sandstone, very light gray, fine grained.

5860-5890 Shale, as above and light greenish gray, foliated, a little sandstone very light gray to light greenish gray, 5GY8/1, fine grained, argillaceous, calcareous.

5890-5940 Shale, greenish gray 5GY6/1, lumpy, waxy compact, some foliated; much shale, medium gray and medium dark gray, foliated.

5940-5950 Shale, greenish gray 5GY6/1, splintery compact; same shale, light olive gray, flaky.

5950-5960 Shale, as above; a little sandstone light greenish gray 5GY6/1, very fine grained.

5960-6000 Shale, greenish gray and light olive gray, splintery and flaky, compact and medium gray, flaky and platy.

6000-6020 Shale, greenish gray and light olive gray, splintery brittle, slightly calcareous.

6020-6040 Shale, as above; some sandstone light greenish gray, very fine grained, calcareous.

6060-6070 Shale, as above; a little sandstone as above.

6080-6100 Sandstone, light greenish gray, very fine grained, calcareous some shale, greenish gray, splintery, brittle, slightly calcareous.

6100-6110 Shale, greenish gray, splintery to platy, brittle, slightly calcareous.

6120-6170 Shale, as above.

6180-6220 Shale, as above.

6220-6290 Shale, greenish gray, splintery to flaky, compact, slightly calcareous; a little sandstone, light greenish gray, very fine grained, calcareous.

6300-6310 Shale, as above.

6340-6370 Shale, greenish gray, 5GY6/1, splintery to platy, compact to brittle, slightly calcareous.

6370-6390 Shale, as above, some sandstone, light greenish gray, very fine to fine grained.

6390-6410 Shale, as above; some sandstone as above; a little limestone, very light gray, fine grained, fragmental.

6410-6430 Shale, greenish gray, splintery to platy, compact, slightly calcareous, some sandstone, as above.

6440-6470 Shale, greenish gray, as above; some sandstone, light greenish gray, very fine to fine grained, calcareous.

6470-6500 Shale, greenish gray, platy to splintery, compact.

6500-6520 Limestone, light gray, sublithographic.

6520-6540 Limestone, light gray, very finely crystalline, dense.

6540-6550 Limestone, light gray to light brownish gray, very finely crystalline, dense.

6550-6570 Shale, greenish gray, platy, compact.

6570-6580 Shale, as above; some limestone, white to very light gray, very fine grained.

6580-6590 Shale, as above and pale reddish brown, lumpy to platy, compact, slightly calcareous.

6600-6610 Shale, as above.

6610-6630 Shale, pale reddish brown, lumpy, compact, slightly calcareous; a little colorless gypsum some siltstone, moderate reddish orange, calcareous.

6630-6650 Shale, as above; a little gypsum.

6650-6770 Shale, pale reddish brown, lumpy to platy, compact, slightly calcareous; a little gypsum, colorless and white.

6770-6840 Shale, pale reddish brown, as above; some gypsum, white and colorless; some siltstone moderate reddish orange.

6840-6900 Siltstone, moderate reddish orange, calcareous, some gypsum.

6920-6970 Siltstone, moderate reddish orange, calcareous; some gypsum, white and colorless; some shale, pale reddish brown, lumpy, compact, slightly calcareous.

6970-6990 Siltstone and shale, as above; some gypsum; a little sandstone, light brownish gray, fine grained.

7000-7060 Shale, pale reddish brown, lumpy, compact; some gypsum; a little siltstone as above.

7060-7100 Shale, as above; some gypsum, colorless, medium to coarse crystals, some white, fibrous.

7105-7130 Shale, as above; some gypsum.

7130-7260 Poor samples.

7260-7270 Siltstone, moderate reddish orange, slightly calcareous.

7280-7310 Poor samples - a little siltstone as above, mostly gray shale cavings.

7310-7340 Limestone, white to grayish pink, fine grained, grainy to finely crystalline, dense; some siltstone, moderate reddish orange, slightly calcareous.

7340-7360 Siltstone, pale reddish brown, slightly calcareous; some white gypsum; some limestone as above.

7360-7380 Shale and siltstone, pale reddish brown to moderate reddish orange, slightly calcareous; a little white gypsum.

7380-7450 Siltstone, moderate reddish orange to pale reddish brown, slightly calcareous; a little white and colorless gypsum.

7450-7510 Siltstone, as above; some colorless gypsum; some shale, pale reddish brown, lumpy, compact, slightly calcareous.

7510-7660 Shale, pale reddish brown, to moderate reddish brown, lumpy compact, slightly calcareous; some gypsum, some siltstone, as above.

7660-7680 Sandstone, grayish pink, very fine to fine grained, subangular, friable much shale, as above.

7680-7720 Poor samples - mostly shale, medium to medium dark gray, platy, compact; a little dolomite, grayish pink, very fine grained, limey.

7720-7740 Poor samples - mostly shale, as above; some dolomite, pale red 5R6/2, very fine grained; a little sandstone, grayish pink, fine grained.

7740-7750 Sandstone, pinkish gray, very fine to fine grained.

7750-7760 Sandstone, as above; some dolomite, pale red, very fine grained, dense.

7760-7780 Shale, medium gray, platy to foliated,

7780-7790 Dolomite, pinkish gray, fine grained limey; shale, as above.

7790-7800 Dolomite, pinkish gray, fine grained to finely crystalline.

7800-7820 Shale, medium gray, platy to foliated.

7820-7860 Shale, as above; some dolomite, pinkish gray, fine grained to finely crystalline.

7860-7880 Dolomite, pinkish gray, fine grained to finely crystalline; shale, as above.

7880-7920 Shale, medium gray, platy and foliated.

7920-7960 Dolomite, very light gray, fine grained, limey; shale, as above, probably cave.

7960-7990 Dolomite, very light gray and pale red, fine grained, limey.

7990-8010 Dolomite, as above; some shale, moderate red, platy, compact, slightly calcareous.

8010-8050 Dolomite, as above.

8050-8070 Limestone, light gray to light brownish gray, very finely crystalline, dense; some dolomite, as above, and shale, medium to medium dark gray and moderate red, platy to splintery.

8070-8110 Limestone, light brownish gray, very finely crystalline.

8110-8170 Limestone as above, and medium gray, fine grained, argillaceous; some shale; moderate red, and medium dark gray, platy, compact.

8140-8210 Shale, moderate red and medium to medium dark gray, foliated and splintery; a few pieces of light greenish may and dusty yellow from 8190-8210.

8210-8220 Shale, as above; a little limestone, light to medium gray, very finely crystalline, dense.

8220-8240 Shale, light greenish gray, medium gray, dusky yellow, splintery, brittle; some limestone, light gray and light greenish gray, finely crystalline.

8240-8280 Shale, as above; some limestone very light gray, sub-lithographic.

8280-8310 Shale, as above; some limestone, very light gray, fine grained, fragmental in part.

8310-8320 Shale, medium gray, medium dark gray and light olive gray, splintery, brittle.

8320-8390 Shale, medium dark gray, light greenish gray, dusky yellow, moderate red, splintery, brittle.

8390-8400 Shale, variegated, as above; some sandstone very light gray to pinkish gray, fine grained, slightly calcareous.

8400-8410 Sandstone, pinkish gray, very fine to fine grained, slightly calcareous, some shale, as above.

8410-8420 Shale, variegated, as above, mostly medium to medium dark gray; a little sandstone, as above.

8420-8430 Shale, variegated, splintery, compact to brittle.

8430-8440 Sandstone, pinkish gray, very fine to fine grained, slightly calcareous; shale as above.

8440-8520 Shale, variegated, splintery, brittle to compact, some sandstone, as above.

8520-8540 Sandstone, light gray to pinkish gray, very fine to fine grained, a little medium grained, calcareous.

8540-8560 Shale, variegated as above; a little sandstone, as above.

8560-8580 Limestone, light gray, sublithographic, some light brownish gray, finely crystalline, dense.

8580-8590 Shale, variegated, splintery; some siltstone, moderate reddish orange, calcareous, some limestone, light brownish gray, very finely crystalline, dense.

8590-8600 Siltstone, moderate reddish orange, calcareous some limestone and shale, as above.

8600-8620 Shale, variegated, splintery, compact, some siltstone, as above.

8620-8650 Shale, variegated, as above, a little sandstone, pinkish gray, very fine to fine grained, calcareous.

8650-8745 Salt indicated by Microlog.

8745-8755 Siltstone, moderate reddish orange, calcareous.

8755-8765 Salt indicated by Microlog.

8765-8775 Siltstone, moderate reddish orange, calcareous.

8775-8790 Salt indicated by Microlog.

8790-8805 Siltstone and shale, moderate reddish orange, calcareous; a little white anhydrite.

8805-8830 Salt indicated by Microlog.

8830-8840 Shale and siltstone, pale reddish brown to moderate reddish orange; a little anhydrite.

8840-8850 Limestone, very light gray finely crystalline; a little anhydrite.

8850-8870 Anhydrite, white to light gray, dense.

8870-8920 Salt indicated by Microlog.

8920-8940 Dolomite, light gray, fine to very fine grained, grainy, slightly limey; some anhydrite, light gray to white, dense.

8950-8980 Limestone, brownish gray, very finely crystalline, dense.

8980-9012 Limestone, brownish gray, as above; some anhydrite, light gray, dense.

9012-9026 Salt indicated by Microlog.

9026-9030 Limestone, brownish gray finely crystalline, dense; anhydrite, light gray to white, dense.

9030-9080 Anhydrite, white and light gray dense; a little limestone, as above.

9080-9136 Limestone, brownish gray very finely crystalline, dense; a little anhydrite, light gray.

9136-9163 Salt indicated by Microlog.

9163-9180 Limestone, brownish gray, finely crystalline, dense.

#### CORES

9192-9193 Limestone, brownish gray, fine grained, fragmental, with stylolites; slight fluorescence and fair cut with  $\text{ccl}_4$ .

9196-9197 Limestone, brownish gray, finely crystalline, dense, some staining and very slight cut with  $\text{ccl}_4$ .

9197-9200 Limestone, medium gray, finely crystalline, thinly laminated and anhydrite, white, dense.

9200-9205 Dolomite, medium light gray, sublithographic, slightly limey.

9210-9215 Limestone, medium gray, very fine grained, slightly argillaceous and dolomitic, with lenses of colorless, dense anhydrite.

9215-9220 Limestone, medium gray, finely crystalline and fine grained.

9220-9225 Anhydrite, light gray, dense.

9230-9235 Limestone, brownish gray, finely crystalline, dense, with anhydrite, pale brown and colorless, medium to coarse crystals.

9235-9240 Anhydrite, white to light gray dense, with limestone stringers, light gray, argillaceous.

9240-9245 Limestone, brownish gray, finely crystalline with interbedded anhydrite, white, dense and pale brown, medium crystals.

9245-9255 Limestone, light brownish gray, fine grained, fragmental with a few medium crystals of pale brown anhydrite.

9255-9260 Anhydrite, very light gray, dense.

9260-9265 Anhydrite, light gray, limey.

9270-9280 Limestone, light brownish gray, fine grained to finely crystalline, with a few medium crystals of pale brown anhydrite.

9280-9284 Limestone, light brownish gray, finely crystalline, dense.

9285-9315 Limestone, light brownish gray, fine grained, with a few shell fragments, a little scattered staining and fluorescence.

9315-9320 Limestone, brownish gray, finely crystalline with some medium to coarse crystals and a few shell fragments.

9320-9325 Limestone, light gray, very fine grained, dense.

9325-9344 Limestone, light brownish gray, finely crystalline, with some medium crystals, some shell fragments and some stylolites.

9344-9355 Limestone, brownish gray, finely crystalline to medium crystalline, a few shell fragments and a few thin shaly streaks.

9355½-9360 Limestone, medium dark gray, finely crystalline, with shaly streaks.

9360-9365 Limestone, brownish gray, fine to medium crystalline.

9365-9370 Limestone, light brownish gray, finely crystalline with some medium crystals.

9370-9375 Limestone, light brownish gray, medium to coarsely crystalline with a fine grained matrix, some shell fragments.

9375-9380 Limestone, light brownish gray, fine grained, grainy.

9380-9385 Anhydrite, light gray, dense.

9385-9390 Anhydrite, medium light gray, dense, limey.

9390-9395 Limestone, light gray to light brownish gray, fine grained fossiliferous, fragmental.

9395-9400 Limestone, light gray, fine grained.

9400-9414 Anhydrite, medium light gray.

9416-9420 Limestone, light brownish gray, fine grained, interspersed with white anhydrite lenses or pockets.

9420-9425 Limestone, light brownish gray, fine to medium crystalline.

9425-9430 Anhydrite, medium light gray, dense.

9430-9440 Limestone, light brownish gray, fine to medium crystalline.

9440-9445 Anhydrite, medium light gray, dense.

9445-9455 Limestone, brownish gray, fine to medium crystalline, tight.

9455-9460 Limestone, light brownish gray, finely crystalline, tight.

9460-9465 Limestone, light brownish gray, fine grained, rounded fragmental with colorless anhydrite filling of the original porosity.

9465-9470 Limestone, light brownish gray, finely crystalline, pseudo oolitic in part.

9470-9485 Limestone, light brownish gray, very fine to finely crystalline, tight.

9485-9490 Light brownish gray, very finely crystalline, with a few medium to coarse crystals, some stylolites.

9490-9498 Limestone, light brownish gray, very fine to finely crystalline.

9508-9515 Limestone, light brownish gray, fine grained, fair intergranular porosity.

9515-9520 Limestone, light brownish gray, very fine to finely crystalline.

9520-9525 Limestone, as above, with shale, medium dark gray.

9525-9540 Limestone, light brownish gray, very fine to finely crystalline, with scattered, coarse crystals.

9540-9550 Limestone, brownish gray, very finely crystalline matrix with some medium to coarse crystals and some shell fragments.

9550-9575 Limestone, light brownish gray, fine to medium crystalline with a few shell fragments.

9575-9605 Limestone, light brownish gray, fine to medium crystalline, fossiliferous, fragmental.

9605-9624 Limestone, light brownish gray, finely crystalline with a few shell fragments.

9642-9680 Limestone, light brownish gray, fine to medium crystalline with a few shell fragments.

9680-9685 Limestone, very light brownish gray, fine grained, grainy with a few shell fragments.

9685-9720 Limestone, light brownish gray, fine to medium crystalline with some shell fragments.

9720-9725 Limestone, light brownish gray, fine to medium crystals, fossiliferous, fragmental.

9725-9730 Limestone, light brownish gray, fine to medium crystalline, some shell fragments.

9730-9745 Limestone, light brownish gray, fine to medium crystalline, fossiliferous, fragmental.

9745-9755 Limestone, light brownish gray, fine grained, grainy with some shell fragments.

9755-9758 Limestone, light brownish gray, fine to medium crystalline, fossiliferous, fragmental.

#### Samples

9760 9780 Limestone as above.

9785-9865 Limestone, light brownish gray, finely crystalline.

9865-9875 Limestone, light brownish gray, fine grained, microcrystalline and finely crystalline.

9875-9885 Limestone, light gray, fine grained and light brownish gray, finely crystalline.

9890-9905 Limestone, light gray to light brownish gray, fine grained to finely crystalline.

9905-9940 Limestone, light brownish gray, finely crystalline, dense.

9940-10,005 Limestone, light brownish gray, finely crystalline to fine grained, fragmental, some shell fragments.

10,010-10,115 Limestone, light brownish gray, finely crystalline, dense, some fine grained, a few shell fragments.

10,115-10,135 Limestone, as above, with a little chert, light gray.

10,135-10,180 Limestone, light brownish gray, fine grained to finely crystalline, fossiliferous, fragmental in part.

10,200-10,250 Limestone, as above, with some chert, light gray.

10,250 10,490 Limestone, light brownish gray, fine grained to finely crystalline, fossiliferous, fragmental.

10,500-10,520 Limestone, medium gray, fine grained, very argillaceous.  
 10,520-10,640 Limestone, brownish gray, very finely crystalline, dense.  
 10,640-10,650 Shale, medium dark gray, calcareous. Limestone as above.  
 10,656- Circulation: Shale, medium dark gray, thinly laminated slightly calcareous.  
 10,650-10,660 Shale, medium dark gray to dark brownish gray, thinly laminated, slightly calcareous.  
 10,660-10,670 Shale, as above; some limestone, light brownish gray, fine grained, argillaceous.  
 10,670-10,710 Limestone, light brownish gray, fine grained, argillaceous.  
 10,710-10,720 Shale, greenish gray, 5G6/1, platy, brittle, calcareous; some interbedded dolomite, light brownish gray, fine grained.  
 10,720-10,740 Dolomite, very pale orange, fine grained, limey, shale, greenish gray as above.  
 10,740-10,750 Dolomite, as above; shale, grayish red, calcareous.  
 10,750-10,760 Shale, as above; some dolomite, as above.  
 10,760-10,770 Limestone, very pale orange, fine grained; some shale, as above.  
 10,770-10,790 Limestone, very pale orange, fine grained to finely crystalline; some shale, as above.  
 10,790-10,810 Shale, grayish red, compact, very calcareous.  
 10,810-10,820 Limestone, very light gray, fine grained, slightly argillaceous; some shale, as above and greenish gray, platy, compact, calcareous.  
 10,820-10,840 Dolomite, grayish orange pink and light greenish gray 5GY8/1, slightly silty, some shale, as above.  
 10,840-10,860 Dolomite, light greenish gray, fine grained to finely crystalline; some shale, grayish red, very calcareous.  
 10,860-10,890 Dolomite, grayish orange, finely crystalline; some dolomite and shale, as above.  
 10,890-10,910 Limestone, brownish gray, finely crystalline.  
 10,910-10,920 Limestone, as above; some anhydrite, white to colorless, dense.  
 10,920- Circulation 1 hour: Limestone, light brownish gray, fine grained to finely crystalline, fragments, anhydritic.

Cores 10,920-10,968, recovered 39 feet.

1-5 Limestone, light brownish gray, finely crystalline.  
 6-10 Limestone, light brownish gray, microsucrosic.  
 11-36 Limestone, light brownish gray, finely crystalline, dense, slightly anhydritic, a few shell fragments.  
 36-39 Limestone, brownish gray, very finely crystalline slightly anhydritic, with some thin dark gray shale partings.

#### Samples

10,970-10,990 Limestone, medium light gray, very finely crystalline, slightly anhydritic; dense.  
 10,990-11,030 Limestone, as above; some anhydrite, white.  
 11,030-11,050 Limestone, very light gray, finely crystalline.  
 11,050-11,120 Limestone, light brownish gray, very finely crystalline slightly anhydritic.  
 11,122- Circulation 2 hours: Limestone, light brownish gray finely crystalline to microsucrosic.

## Cores

- 11,122-11,125 Limestone, medium gray, very finely crystalline with thin dark gray shale partings.
- 11,125-11,150 Limestone, light brownish gray, finely crystalline, contains few Brachiopod fragments.
- 11,150-11,155 Limestone, brownish gray, finely crystalline.
- 11,155-11,165 Dolomite, light brownish gray, finely crystalline.
- 11,165-11,175 Anhydrite, medium gray, dense.
- 11,175-11,185 Dolomite, light brownish gray, fine to medium crystalline.
- 11,185-11,190 Anhydrite, light brownish gray to medium gray, dense, slightly dolomitic.
- 11,190-11,195 Dolomite, yellowish gray, very finely crystalline.
- 11,195-11,200 Dolomite, brownish gray, very finely crystalline.
- 11,200-11,210 Dolomite, as above with some medium crystals of colorless anhydrite.
- 11,210-11,220 Limestone, light brownish gray, finely crystalline.
- 11,220-11,230 Limestone, light brownish gray, finely crystalline, fair intergranular porosity.
- 11,230-11,235 Limestone light brownish gray, very finely crystalline, dense, slightly dolomitic.
- 11,235-11,240 Limestone, brownish gray, very finely crystalline.

## Samples

- 11,240-11,270 Limestone, light brownish gray, very fine to finely crystalline; a little anhydrite, white to very light gray.
- 11,270-11,310 Limestone, light brownish gray and brownish gray, finely crystalline, and very finely crystalline.
- 11,310-11,340 Limestone, light brownish gray, finely crystalline.
- 11,340-11,430 Limestone, brownish gray, very finely crystalline, dense, some limestone, as above.
- 11,430-11,440 Limestone, brownish gray, very finely crystalline, dense.
- 11,440-11,450 Limestone, as above; a little limestone, very light gray, finely crystalline.
- 11,450-11,470 Limestone, very light gray, very finely crystalline to fine grained, some limestone, brownish gray, very finely crystalline.
- 11,470-11,510 Limestone, light brownish gray, very fine to finely crystalline.
- 11,530-11,570 Limestone, light brownish gray to brownish gray, very finely crystalline, dense.
- 11,570-11,600 Dolomite, very light gray, fine grained, slightly silty.
- 11,600-11,640 Limestone, light brownish gray, fine grained, slightly argillaceous; some limestone brownish gray, very finely crystalline.
- 11,650-11,680 Limestone, brownish gray, very finely crystalline.
- 11,680-11,690 Limestone, very light gray, fine grained, slightly silty.
- 11,690-11,710 Limestone, as above, some limestone, light brownish gray, very finely crystalline.
- 11,710-11,720 Limestone, brownish gray, very finely crystalline.
- 11,720-11,730 Limestone, very light gray and grayish orange pink 5YR7/2, fine grained to very finely crystalline.
- 11,730-11,835 Limestone, brownish gray, very finely crystalline with a few shell fragments.
- 11,835-11,840 Limestone, light gray, fine grained; some limestone, as above.

11,840-11,850 Dolomite, grayish orange pink, fine to medium grained.  
 11,850-11,860 Dolomite, as above and limestone pale red 5R6/2, fine to medium grained.  
 11,860-11,870 Limestone, pale red, fine to medium grained, with some fine to medium quartz grains.  
 11,870-11,880 Limestone, brownish gray, very finely crystalline.  
 11,880-11,885 Limestone, grayish orange pink, very finely crystalline.  
 11,885-11,890 Limestone, very light gray, very finely crystalline, and limestone as above.

Cores

11,891-11,896 Limestone, white, very finely crystalline, chalky.  
 11,896-11,901 Limestone, pale red, very fine to finely crystalline with some thin argillaceous stringers.  
 11,901-11,906 Limestone, pinkish gray, fine to medium grained, fragmental, fragments composed of yellowish gray, finely crystalline limestone.  
 11,911-11,915 Limestone, white to very light gray, fine grained.  
 11,915-11,920 Limestone, grayish orange pink 10R8/2, very finely crystalline.  
 11,920-11,925 Limestone, very light gray, fine grained.  
 11,925-11,930 Limestone, grayish pink, fine grained.  
 11,930-11,933 Limestone, very light gray, very fine to finely crystalline.  
 11,938-11,942 Limestone, pale red 5R6/2, very finely crystalline, slightly argillaceous.  
 11,942-11,945 Limestone, grayish orange pink, sublithographic and limestone, light greenish, finely crystalline.  
 11,945-11,950 Limestone, pale red, 5R6/2, very finely crystalline, slightly argillaceous.  
 11,950-11,955 Limestone, white to very light gray, fine grained fragmental.  
 11,955-11,970 Limestone, light gray, very finely crystalline, dense.  
 11,970-11,975 Limestone, pale red, very fine to finely crystalline.  
 11,975-11,985 Limestone, white, finely crystalline, dense.  
 11,985-11,995 Limestone, pale red, very finely crystalline, dense.  
 11,995-12,000 Limestone, very light gray to white, fine grained, fragmental, slightly dolomitic.