

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 246

Summary of the Shell Oil Company - Northern Pacific No. 32-15
McKenzie County, North Dakota
Well No. 2469 - Permit No. 2481

By Clarence G. Carlson
February 1961

The Shell Oil Company - Northern Pacific Railway No. 32-15 well is located in the SW, NE Section 15, T. 145 N., R. 101 W., McKenzie County, North Dakota. Elevations: Kelly bushing 2294; Ground level 2275.

The Shell Oil Company - Northern Pacific Railway No. 32-15 well was spudded October 1, 1959, drilled to a total depth of 9,535 feet, and completed as the discovery well for the Rough Rider field on December 9, 1959.

Logs run:

Radioactivity
Laterolog
Microlaterolog

Core Record: 9300-9535

Tests:

DST 1; 9184-9251; tool open two hours, shut in 1 1/2 hours. Recovered 325 feet of slightly gas, oil, and water cut mud (10% oil, 15% water). Pressures: FP 90-180; ISIP (30 minutes) 4320; FSIP 4050; HP 5135.

DST 2; 9319-9418; tool open 2 1/4 hours, shut in 1 1/2 hours. Gas to surface in 15 minutes. Fluid to surface in 55 minutes. Flowed gas and water cut oil (80% oil) for 80 minutes at indeterminate rate (necessary to flare gas and oil). Recovered 8,149 feet of gas and water cut oil (80-100% oil), 1,170 feet of water. Oil gravity 34.0° API. Pressures: FP 760-2070; ISIP (30 minutes) 4395; FSIP 4350; HP 5320.

DST 3; 9419-9477; tool open 2 hours, shut in 1 1/2 hours. Gas to surface in 95 minutes. Recovered 4,980 feet of slightly oil and mud cut and heavily gas cut water (0-5% oil). Pressures: FP 550-2484; ISIP (30 minutes) 4310; FSIP 4230; HP 5,280.

Casing and Completion:

13 3/8 inch casing set at 817 feet with 600 sacks of cement.
5 1/2 inch casing set at 9,533 feet with 1,875 sacks of cement.
Perforated with 2 Abrasijet shots at 9399. Acidized with 500 gallons of 7 1/2% acid.

Initial Potential Test:

395 barrels of oil in 14 3/4 hours, 922 GOR, 5 to 10% water, 34.8° API, through 2 1/2 inch tubing, 16/64 inch choke, flowing pressure 1200 PSI.

Subsequent Potential Tests:

January 9, 1960:	341 BOPD,	24 BW,	1125 GOR,	12/64" choke,	TP 1225
February 8, 1960:	349 BOPD,	3 BW,	590 GOR,	12/64" choke,	TP 1200
March 7, 1960:	368 BOPD,	21 BW,	583 GOR,	12/64" choke,	TP 1250
April 7, 1960:	361 BOPD,	14 BW,	583 GOR,	12/64" choke,	TP 1200
May 6, 1960:	350 BOPD,	13 BW,	577 GOR,	12/64" choke,	TP 1200
June 7, 1960:	374 BOPD,	15 BW,	622 GOR,	14/64" choke,	TP 1200
July 6, 1960:	492 BOPD,	49 BW,	639 GOR,	20/64" choke,	TP 850
August 3, 1960:	384 BOPD,	94 BW,	665 GOR,	15/64" choke,	TP 750
September 6, 1960:	257 BOPD,	88 BW,	1030 GOR,	15/64" choke,	TP 760
October 7, 1960:	302 BOPD,	84 BW,	955 GOR,	15/64" choke,	TP 720
November 4, 1960:	304 BOPD,	84 BW,	955 GOR,	15/64" choke,	TP 720

Cumulative production to November 1, 1960, was 62,842 barrels of oil.

Formation tops were determined from samples and mechanical logs, corrected to the mechanical logs. Not all formation tops were called in the following list. Colors are from the rock color chart distributed by the Geological Society of America. The mud used in this well was a Gypsum-Q-Broxin base mud; consequently, the samples below the Spearfish salt section beginning at 6667 were of poor quality.

FORMATION TOPS

Cretaceous System

Pierre formation	1636
Niobrara formation	3920
Greenhorn formation	4464
Newcastle sandstone	5064
Fall River formation	5374

Jurassic System

Piper limestone	6406
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Triassic System

Spearfish formation "A" salt	6667
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Permian System

Minnekahta formation	7237
Opeche formation	7266

Pennsylvanian System

Amsden formation	7556
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Mississippian System

Big snowy group	7932
Kibbey limestone	8409
Madison group	
Poplar interval	8556
Ratcliffe interval	9040
Frobisher-Alida interval	9319

60-90	Lignite.
120-150	Lignite; a little sandstone, very light gray, fine grained, argillaceous; a little shale, pale orange, soft, silty.
150-240	Lignite.
240-270	Lignite; a little sandstone, very light gray, fine grained, argillaceous, calcareous.
270-300	Lignite.

300-450 Lignite; a little sandstone, very light gray, fine grained, argillaceous, calcareous.

450-540 Lignite.

540-810 Lignite; a little sandstone, very light gray, fine grained, argillaceous, calcareous; a little siltstone, very light gray to very pale orange, calcareous.

810-840 Shale, medium gray to medium light gray; some sandstone, very light gray to light olive gray, fine grained, argillaceous, very calcareous.

840-900 Shale, light brownish gray and medium gray to medium light gray, a little sandstone, as above.

900-960 Siltstone, very light gray, argillaceous, calcareous; some shale and sandstone, as above.

960-1020 Lignite; a little sandstone, very light gray, fine to medium grained, argillaceous, calcareous.

1020-1050 Shale, light brownish gray and medium gray; some sandstone, as above.

1050-1080 Lignite.

1080-1170 Lignite; a little siltstone, light brownish gray, calcareous.

1170-1200 Siltstone, medium gray, argillaceous, calcareous; a little sandstone, light gray, fine grained, argillaceous, calcareous.

1200-1230 Lignite; some sandstone, fine to medium grained, subangular, weakly cemented.

1230-1260 Shale, medium gray to brownish gray, soft; some siltstone, very light gray, argillaceous.

1260-1290 Shale, as above; some sandstone, very light gray, fine grained, argillaceous, very calcareous.

1290-1350 Shale, as above; some siltstone, very light gray, argillaceous.

1350-1470 Shale, very light gray to medium gray, silty; a little sandstone, very light gray, fine to medium grained, subangular, argillaceous, calcareous.

1470-1500 Sandstone, very light gray, fine to medium grained, subangular to subrounded, calcareous, argillaceous; some shale and siltstone, light gray to medium light gray.

1500-1560 Sandstone, as above; some lignite; some shale and siltstone, as above.

1560-1650 Shale, medium gray to brownish gray, soft, fissile in part, platy in part; some siltstone, very light gray, calcareous.

1650-1680 Shale, medium gray to medium dark gray, soft, fissile.

1680-1710 Shale, light gray, lumpy, silty.

1710-1980 Shale, medium light gray to medium gray, soft, fissile.

1980-2040 Shale, pale yellowish brown, 10YR6/2, and medium gray, soft, fissile.

2040-2100 Shale, medium gray to medium light gray, soft, fissile in part, lumpy in part.

2100-2190 Shale, medium light gray to light gray, platy to lumpy.

2190-2280 Shale, medium gray, soft, fissile; some lumpy shale, as above.

2280-2430 Shale, medium light gray to medium gray, fissile in part, lumpy in part.

2460-2490 Shale, medium gray to medium light gray, platy.

2490-2520 Shale, medium light gray to medium gray, fissile, bentonitic; traces of white, micaceous bentonite.

2520-2610 Shale, medium light gray, soft, lumpy, bentonitic.

2610-2640 Shale, pale yellowish brown, 10YR6/2, soft, lumpy to fissile; shale, medium light gray, fissile.

2640-2760 Shale, medium light gray, soft, bentonitic, fissile to lumpy; traces of white bentonite.

2760-2820 Shale, medium light gray, soft, fissile, slightly bentonitic.

2910-2940 Shale, medium light gray and medium dark gray, platy.

2940-3120 Shale, medium dark gray, platy.

3120-3150 Shale, medium light gray to medium gray, platy,

3150-3180 Shale, medium dark gray to medium gray, platy.

3180-3210 Shale, medium light gray, fissile.

3210-3300 Shale, medium light gray to medium gray, platy.

3300-3330 Shale, medium dark gray, fissile.

3330-3390 Shale, medium light gray, platy.

3390-3600 Shale, medium gray to medium dark gray, platy.

3690-3930 Shale, medium gray, platy.

3930-4050 Shale, medium dark gray, fissile to platy, calcareous, "white specks."

4050-4110 Shale, medium gray, platy.

4110-4260 Shale, medium gray and medium dark gray, platy.

4350-4470 Shale, medium gray and medium dark gray, platy.

4470-4560 Shale, medium dark gray, platy, calcareous, "white specks;" numerous Inoceramus fragments, some cemented into an argillaceous limestone.

4560-4590 Shale, medium dark gray, fissile.

4650-4710 Shale, medium dark gray, fissile in part, platy in part.

4740-4800 Shale, as above.

4860-4890 Shale, medium dark gray, fissile.

4950-5070 Shale, medium dark gray, fissile.

5070-5100 Sandstone, very light gray to white, very fine grained, silty; some siltstone, very light gray; shale as above.

5150-5200 Shale, medium dark gray, fissile.

5200-5250 Shale, as above; and shale, medium gray, fissile.

5300-5330 Shale, medium dark gray, fissile.

5330-5370 Siltstone, very light gray, micaceous; shale, as above.

5370-5380 Siltstone very light gray, micaceous; some sandstone, very light gray to white, very fine grained, silty.

5380-5400 Sandstone, very light gray to white, very fine to fine grained, subangular, clean, quartzose; some siltstone, as above.

5400-5420 Sandstone, as above, some siderite "pellets"; some siltstone, as above.

5420-5470 Sandstone, very light gray to white, very fine to fine grained, subangular, clean, quartzose; some shale, medium light gray, silty, micaceous; some siderite "pellets."

5470-5490 Sandstone, very light gray to white, very fine grained, silty, micaceous; some shale, medium light gray to light olive gray, soft, greasy, micaceous; a little siltstone, medium light gray.

5490-5500 Sandstone, grayish orange, very fine to fine grained, subangular, clean, quartzose, firmly cemented; some sandstone and shale, as above.

5500-5510 Sandstone, very light gray to white, very fine to fine grained, clean, quartzose, firmly cemented; traces of shale, medium light gray to olive gray, soft, lumpy, greasy.

5510-5530 Sandstone, very light gray to white, very fine to medium grained, subangular, clean, quartzose; a little siltstone, very light gray; traces of shale, light olive gray to medium light gray.

5530-5560 Sandstone, very light gray to white and grayish orange, very fine to fine grained, silty; some shale, medium light gray and light olive gray, soft, lumpy.

5560-5570 Shale, medium light gray, silty, micaceous; some siltstone, very light gray, micaceous.

5570-5580 Shale, light olive gray to medium light gray, lumpy; some sandstone, very light gray, very fine grained, silty.

5580-5600 Sandstone, very light gray to grayish orange, very fine grained, silty, well cemented; some shale, medium light gray, light olive gray, and grayish red, soft, lumpy, some siderite "pellets."

5600-5650 Shale, medium light gray to light olive gray and grayish red, lumpy, soft, some siderite "pellets"; some siltstone, very light gray.

5650-5690 Sandstone, very light gray to white, fine grained, subangular, clean, quartzose; some shale, as above.

5700-5710 Shale, light olive gray to medium light gray, soft, lumpy.

5710-5720 Shale, light olive gray to medium light gray and grayish red, lumpy; some sandstone, light olive gray to grayish orange, very fine to fine grained, silty, micaceous.

5720-5130 Shale, as above.

5730-5770 Shale, light olive gray to medium light gray and pale reddish brown, soft, lumpy; some sandstone, very light gray to light greenish gray, very fine to fine grained, slightly calcareous, silty.

5770-5790 Sandstone, light gray to light greenish gray, very fine grained, silty, slightly calcareous; shale as above.

5790-5800 Shale, light olive gray to pale brownish gray, fissile, much shale, medium dark gray, probably cave?

5800-5840 Shale, light olive gray to light gray and pale red, lumpy.

5840-5900 Shale, as above; some sandstone, very light gray, very fine grained, silty, calcareous.

5900-5910 Shale, light olive gray, fissile, silty; much medium dark gray shale cavings.

5910-5980 Shale, light olive gray to medium light gray, fissile in part, lumpy in part.

5980-6010 Shale, as above; some siltstone, light olive gray, calcareous.

6010-6030 Shale, as above; a little sandstone, very light gray to white, very fine to fine grained, calcareous.

6030-6070 Shale, light greenish gray, 5G8/1, platy, calcareous; shale, as above, and much medium dark gray shale.

6070-6090 Sandstone, very light gray to white, very fine to fine grained, subangular, clean, quartzose, slightly calcareous; some shale, olive gray, 5Y4/1, to medium gray, soft, fissile, slightly calcareous.

6090-6100 Sandstone, very light gray, very fine to fine grained, silty, calcareous; shale, as above.

6100-6110 Shale, greenish gray, 5GY6/1, and light olive gray 5Y6/1, fissile, calcareous.

6110-6120 Shale, greenish gray, 5GY6/1, platy, calcareous.

6120-6160 Shale, as above; some sandstone, very light gray to white and light greenish gray, very fine to fine grained, calcareous.

6160-6250 Shale, as above.

6250-6300 Shale, greenish gray, 5GY6/1, to light olive gray 5Y6/1, platy, calcareous.

6300-6360 Shale, greenish gray, 5GY6/1, platy, calcareous; a little sandstone, very light gray to light greenish gray, very fine to fine grained, calcareous.

6360-6370 Shale, greenish gray, 5GY6/1, to light olive gray, 5Y6/1, platy, calcareous, a little sandstone, as above.

6370-6380 Dolomite, very light gray, finely crystalline, limy; shale, greenish gray, 5GY6/1, platy, calcareous.

6380-6410 Shale, as above; a little sandstone, very light gray, very fine to fine grained, calcareous.

6410-6420 Siltstone, moderate orange pink, 10R7/4, calcareous; anhydrite, white to very light gray; a little limestone, light brownish gray, very fine to medium crystalline, dense.

6420-6460 Sandstone, as above; a little limestone, very light gray to light brownish gray, fine to medium crystalline, fragmental.

6460-6470 Sandstone, very light gray to light greenish gray, very fine grained, calcareous; shale, greenish gray, 5GY6/1, platy, calcareous; shale, pale red, 10R6/2, lumpy.

6470 Sample nearly all medium gray to medium dark gray.

6470-6490 Shale cavings.

6490-6500 Limestone, very light gray, fine to medium crystalline, fragmental; some shale, greenish gray to olive gray, 5Y4/1, platy, calcareous.

6500-6530 Limestone, yellowish gray, fine grained, granular, dolomitic; a little very light gray chert.

6530-6550 Limestone, as above; traces of colorless anhydrite.

6550-6580 Limestone, yellowish gray, microcrystalline.

6580-6590 Limestone, as above; shale, pale reddish brown, 10R5/4, lumpy, calcareous.

6590-6600 Shale, pale reddish brown, lumpy and platy, calcareous.

6600-6620 Dolomite, yellowish gray, fine grained, granular, with some white anhydrite; some shale, as above.

6620-6670 Shale, grayish red, 10R4/2, platy, slightly calcareous; some anhydrite, white.

6670-6720 Sample all cavings; logs indicate salt beginning at 6676.

6720-6810 Siltstone, moderate reddish orange, calcareous; traces of colorless anhydrite and white anhydrite.

6810-6910 Siltstone, moderate reddish orange, slightly calcareous, with some rounded, frosted, medium sand grains.

6910-7100 Samples all cavings; logs indicate salt with interbedded siltstone or shale from 6910 to 6950 and salt from 6950 to 7100.

7100-7230 Traces of siltstone, moderate reddish orange, slightly calcareous; mostly shale cavings.

7230-7250 Traces of siltstone, as above; some shale, pale reddish brown, platy to lumpy.

7250-7270 Limestone, very light gray to pinkish gray, very fine to finely crystalline, dense in part, granular in part; siltstone and shale, as above.

7270-7290 Limestone, as above; a little anhydrite, white to pinkish gray; siltstone and shale, as above.

7290-7300 Siltstone, moderate reddish orange, slightly calcareous; shale, pale reddish brown, lumpy to platy, much medium gray and greenish gray shale cavings.

7300-7440 Samples contain traces of siltstone, as above, but are mostly greenish gray and medium gray shale cavings; logs indicate that section is probably salt from 7296 to 7405 and possibly to 7445.

7440-7490 Siltstone, moderate reddish orange; and shale, moderate reddish orange to pale reddish brown; a little white anhydrite; much shale cavings.

7490-7570 Shale, moderate reddish orange, lumpy and white anhydrite; much shale cavings in samples.

7570-7590 Sample, mostly as above; a trace of sandstone, pinkish gray, fine grained, rounded to subangular.

7590-7600 Sandstone, pinkish gray, very fine to medium and coarse grained, rounded to subrounded, frosted, clean, quartzose; sample mostly shale cavings.

7600-7610 Sandstone as above; traces of dolomite, pinkish gray, finely crystalline.

7610-7650 Sandstone, as above.

7650-7680 Shale, medium dark gray and greenish gray, splintery; a little dolomite, pinkish gray, finely crystalline; some sandstone, as above.

7680-7720 Sandstone, pinkish gray to very light gray, very fine to fine grained, slightly calcareous; dolomite, pinkish gray, finely crystalline; some shale, as above.

7720-7730 Dolomite, pinkish gray, finely crystalline.

7730-7760 Sandstone, pinkish gray, very fine to fine grained; some dolomite, as above.

7800-7830 Dolomite, pinkish gray, finely crystalline; some sandstone, pinkish gray, very fine grained, slightly calcareous.

7830-7935 Dolomite, very light gray to pinkish gray, finely crystalline; some sandstone, as above; traces of white chert.

7935-7945 Shale, moderate red, 5R5/4, splintery, calcareous; dolomite, as above.

7945-7965 Shale, moderate red, 5R5/4, and greenish gray, 5GY6/1, splintery and platy, calcareous; dolomite, as above.

7965-7970 Shale, moderate red, 5R5/4, dark gray, platy.

7970-8010 Shale, moderate red, 5R5/4, olive gray, 5Y4/1, splintery, calcareous and dark gray, splintery.

8010-8020 Shale, variegated, moderate red, 5R5/4, pale red, 5R6/2, olive gray, 5Y4/1, greenish gray, 5G6/1, dusky yellow, 5Y6/4, platy, splintery.

8020-8040 Shale, variegated as above, but mostly dark gray.

8040-8065 Shale, variegated, splintery.

8065-8150 Shale, variegated, splintery, mostly dark gray.

8150-8220 Shale, variegated, splintery; traces of limestone, very light gray, finely crystalline.

8210-8280 Shale, variegated, splintery, platy.

8280-8305 Shale, mostly dark gray, some variegated, platy and splintery.

8305-8315 Shale, as above; some sandstone, very light gray, very fine grained, calcareous.

8315-8335 Shale, variegated grayish red to moderate yellowish brown, sandy; some sandstone, as above.

8335-8340 Siltstone, moderate reddish orange; same sandstone, very light gray, very fine to fine grained, calcareous.

8340-8360 Sandstone, very light gray to very light brownish gray, very fine grained, silty, calcareous.

8360-8375 Sandstone, as above, and some sandstone, white, fine to medium grained, rounded.

8375-8385 Sandstone, pinkish gray, very fine to fine grained, calcareous, silty.

8385-8405 Sandstone, pinkish gray, very fine to fine grained, silty, calcareous with scattered medium sand grains; some siltstone, pale reddish brown, calcareous.

8405-8420 Siltstone, pale red, 10R6/2, to pale reddish brown, calcareous with some sand grains; a little sandstone, as above.

8420-8445 Sample mostly variegated shale, Big Snowy cavings and some siltstone, as above.

8445-8470 Traces of limestone, light brownish gray, finely crystalline; sample mostly cavings, as above.

8470-8545 Siltstone, moderate reddish orange, pale red, 10R6/2, calcareous; much shale cave.

8545-8555 Siltstone, very light gray, calcareous; siltstone, as above; much shale cave.

8555-8670 Logs indicate salt to 8672; samples are mostly shale and siltstone cavings.

8670-8675 Siltstone, moderate reddish orange, calcareous; traces of white anhydrite.

8675-8700 Siltstone, as above; traces of limestone, brownish gray, very finely crystalline.

8700-8715 Logs indicate salt from 8796 to 8714; samples contain siltstone, as above.

8715-8740 Siltstone, pale red, 10R6/2, calcareous; traces of white anhydrite and siltstone, moderate reddish orange, calcareous.

8740-8790 Siltstone, as above; traces of limestone, brownish gray, very finely crystalline.

8790-8845 Logs indicate salt from 8790 to 8844; samples as above.

8845-8890 Traces of limestone, brownish gray, very finely crystalline; siltstone, moderate reddish orange, calcareous; anhydrite, white.

8890-8920 Limestone, light brownish gray, very finely crystalline, dense.

8920-8980 Limestone, very light brownish gray, fine grained, granular in part, very finely crystalline in part; logs indicate salt from 8931 to 8944.

8980-9060 Limestone, light brownish gray to brownish gray, very finely crystalline, dense.

9060-9115 Logs indicate salt; samples contain limestone, as above, moderate reddish orange siltstone and variegated shale.

9115-9165 Limestone, light brownish gray to brownish gray, very finely crystalline.

9165-9240 Limestone, as above; some limestone, brownish gray, finely crystalline, argillaceous.

9250-9300 Limestone, light brownish gray, fine grained, granular in part, finely crystalline, dense in part.

Cores

9300-9302 Limestone, brownish gray, very fine to medium crystalline, slightly argillaceous; a few shell fragments visible.

9302-9307 Limestone, brownish gray, very fine to medium crystalline, fossiliferous, fragmental with a microcrystalline matrix.

9307-9308 Limestone, brownish gray, as above, and medium to coarsely crystalline, fossiliferous, fragmental, fragments mostly brachiopods.

9308-9309 Limestone, brownish gray, fossiliferous, fragmental with a finely crystalline matrix; thin bands of medium dark gray, calcareous shale.

9309-9310 Limestone, brownish gray, fossiliferous, fragmental, fine to medium crystalline.

9310-9312 Limestone, light brownish gray, fossiliferous with a finely crystalline matrix with some intergranular porosity, slightly argillaceous.

9312-9315 Limestone, brownish gray, fossiliferous with a finely crystalline matrix, slightly argillaceous.

9315-9316 Limestone, light brownish gray; fossiliferous, fragmental, with finely crystalline matrix, some stylolites.

9316-9319 Limestone, as above, with some coarse crystals of pale brown anhydrite.

9319-9321 Limestone, light brownish gray, very anhydritic, very finely crystalline matrix with medium to very coarse pale brown crystals of anhydrite.

9321-9322 Limestone, light gray, finely crystalline, some intergranular porosity; with large inclusions of white to colorless anhydrite.

9322-9324 Anhydrite, white, dense.

9324-9326 Limestone, brownish gray, very finely crystalline, dense with some thin bands of medium to coarsely crystalline anhydrite.

9326-9327 Limestone, light brownish gray, fragmental with a finely crystalline matrix with fair intergranular porosity, argillaceous.

9327-9331 Anhydrite, white, with inclusions of limestone, as above.

9331-9334 Anhydrite, medium gray, slightly calcareous and white anhydrite.

9334-9340 Anhydrite, white.

9340-9341 Anhydrite, medium gray, with thin layers of medium gray shale.

9341-9344 Anhydrite, pale brown to light gray, dense.

9344-9345 Limestone, brownish gray, finely crystalline, interbedded with thin argillaceous bands.

9345-9347 Limestone, brownish gray, very fine to finely crystalline.

9347-9348 Limestone, light brownish gray, finely crystalline, good intergranular porosity, good oil stain, fluorescence and cut.

9348-9349 Limestone, light brownish gray, finely crystalline, fair intergranular porosity, scattered spotty stain; numerous dark sponge(?) spicules.

9349-9352 Limestone, light brownish gray, finely crystalline, fair intergranular porosity.

9352-9353 Limestone, brownish gray, very fine to finely crystalline, dense with a few medium crystals of pale brown anhydrite.

9353-9354 Limestone, light brownish gray to brownish gray, pelletoidal with a very finely crystalline matrix, dense.

9354-9355 Limestone, light brownish gray, very finely crystalline, dense in part and finely crystalline with intergranular porosity and oil stained in part.

9355-9357 Limestone, light brownish gray, very finely crystalline, dense.

9357-9358 Limestone, light brownish gray, very fine to medium crystalline, dense.

9358-9359 Anhydrite, pale brown, medium to very coarsely crystalline, with inclusions of very finely crystalline limestone.

9359-9360 Limestone, light brownish gray, finely crystalline, fair intergranular porosity, some pale brown anhydrite.

9360-9363 Anhydrite, white.

9363-9364 Limestone, brownish gray, very finely crystalline, dense; with numerous inclusions of pale brown, coarse crystals of anhydrite.

9364-9365 Limestone, light brownish gray, pelletoidal with a fine to medium crystalline matrix; numerous fine to medium crystals of anhydrite.

9365-9366 Limestone, brownish gray, very finely crystalline, dense, with scattered medium to coarse crystals of pale brown anhydrite.

9366-9367 Anhydrite, white interbedded with limestone, light brownish gray, microsucrosic, good intergranular porosity.

9367-9371 Limestone, light brownish gray, finely crystalline, and fine to medium crystalline, granular with scattered crystals of anhydrite; some spotty oil stains.

9371-9375 Limestone, light brownish gray, fine to medium crystalline, granular texture, some scattered crystals of anhydrite; good oil stain and cut with Ccl_4 .

9375-9379 Limestone, light brownish gray, fine to medium crystalline, granular, good intergranular porosity, scattered medium crystals of anhydrite.

9379-9380 Limestone, light brownish gray, very finely crystalline, dense, numerous medium crystals of pale brown anhydrite.

9380-9381 Limestone, light brownish gray, fine to medium crystalline, fair intergranular porosity; numerous medium to coarse crystals of pale brown anhydrite.

9381-9383 Anhydrite, very light gray, very finely crystalline, slightly calcareous; some inclusions of light brownish gray limestone.

9383-9386 Limestone, light brownish gray, fine to medium crystalline, granular with inclusions of white anhydrite.

9386-9387 Limestone, brownish gray, very finely crystalline, dense, a few scattered medium crystals of pale brown anhydrite.

9387-9388 Limestone, light brownish gray, fine to medium crystalline, poor intergranular porosity, some oil stain.

9388-9390 Limestone, light brownish gray, fine to medium crystalline, fair intergranular porosity.

9390-9391 Limestone, mottled light brownish gray, microsucrosic, oil stained and brownish gray, finely crystalline.

9391-9392 Limestone, light brownish gray, microsucrosic, heavily oil stained, fair to good intergranular porosity; some scattered crystals of pale brown anhydrite.

9392-9393 Limestone, mottled, very light brownish gray, fine to medium crystalline, fragmental, fossiliferous, good porosity and light brownish gray, microsucrosic, oil stained throughout.

9393-9404 Limestone, light brownish gray, microsucrosic, oil stained; some scattered crystals of anhydrite.

9404-9407 Limestone, light brownish gray, fine to medium crystalline, dense to microsucrosic.

9407-9408 Limestone, light brownish gray, finely crystalline, anhydritic.

9408-9410 Limestone, light brownish gray, fine to medium crystalline, scattered shell fragments, fair porosity, scattered slight oil stain.

9410-9415 Limestone, light brownish gray, microsucrosic, some scattered shell fragments.

9415-9420 Limestone, light brownish gray, very fine to finely crystalline.

9420-9421 Limestone, light brownish gray, very fine to finely crystalline, some white anhydrite filling a large vug.

9421-9423 Limestone, light brownish gray, very fine to finely crystalline, with scattered medium to coarse crystals.

9423-9424 Limestone, light brownish gray, finely crystalline, granular texture, good intergranular porosity; some stylolites.

9424-9436 Limestone, light brownish gray, fine to medium crystalline, fair porosity, some scattered shell fragments; good oil stain, fair cut with Ccl_4 9430-9433; scattered light stain 9433-9436.

9436-9446 Limestone, light brownish gray, fine to medium crystalline, fossiliferous, fragmental, with some spotty staining.

9446-9449 Limestone, light brownish gray, fine to medium crystalline, some vuggy porosity, good oil stain, fluorescence and cut with Ccl_4 .

9449-9454 Limestone, light brownish gray, as above, with slight to good oil stain and cut with Ccl_4 .

9454-9455 Limestone, brownish gray, fine to medium crystalline, fragmental, fossiliferous, good intergranular porosity.

9455-9456 Limestone, brownish gray, very finely crystalline, dense.

9456-9460 Limestone, light brownish gray, fine to medium crystalline, fragmental, slightly dolomitic, good intergranular porosity, some light oil stain.

9460-9463 Limestone, light brownish gray, fine to medium crystalline, fragmental, fossiliferous, good intergranular porosity, some spotty oil stains.

9463-9465 Limestone, brownish gray, finely crystalline, dense; some stylolites.

9465-9471 Limestone, light brownish gray, fine to medium crystalline, good intergranular porosity, slightly dolomitic.

9471-9472 Limestone, medium light gray, finely crystalline, interlaminated with shale, medium dark gray.

9472-9474 Limestone, light brownish gray, fine to medium crystalline, good intergranular porosity, slightly dolomitic.

9477-9493 Limestone, light brownish gray, fine to medium crystalline, poor intergranular porosity, slight spotty stains.

9493-9501 Limestone, light brownish gray, fine to medium crystalline, with a few coarse crystals.

9501-9503 Limestone, light brownish gray, fine to medium crystalline, granular, fair intergranular and slight vuggy porosity, good oil stain and cut with Ccl_4 .

9503-9506 Limestone, light brownish gray, fine to coarsely crystalline, fragmental, fossiliferous.

9506-9510 Limestone, light brownish gray, fine to medium crystalline, granular, good oil stain and cut with Ccl_4 .

9510-9513 Limestone, light brownish gray, fine to coarsely crystalline, fragmental, fossiliferous, good oil stain.

9513-9535 Limestone, light brownish gray, fine to coarsely crystalline, fossiliferous, fragmental, fair intergranular porosity, some spotty oil stain to 9516; good stain 9523-9528; some staining 9528-9532 and 9534-9535.