

NORTH DAKOTA
GEOLOGICAL SURVEY CIRCULAR 7
Summary of the California Company Thompson No. 1 Well
Bottineau County, North Dakota
By Donald Towse
Introduction

The California Thompson No. 1 well, SW SW SE Section 31, T. 160 N., R. 81 W., Bottineau County, North Dakota, was cored for a total of 2349 feet, with nearly 100 percent recovery. More than 500 feet of continuous core is in the Mississippian Charles and the Mission Canyon formations, and more than 1500 feet of continuous core begins a little below the top of the Devonian system and extends into the Silurian system.

Because of the wildcat interest in the general Ward-Bottineau County area and because of the preservation of an excellent large diameter core of a large part of the Madison group and almost the entire Devonian system, results of sample examination and core studies of the California Thompson well are presented at this time.

A brief summary of the well is included. The lithologic log extends from the top of the Charles formation core at 4071 feet to 8262, feet total depth. Some formation tops based on electric log correlation above the Charles formation are listed.

The Devonian system is here divided into eight units, some of them new. The new Devonian units are temporarily designated A, B, C, and F. These units are not intended to correspond with the "Da", "Db", and "Dc" units of Sloss and Laird in northwestern Montana. 1/ Present studies by the writer indicate that the units here set up may be extended to Manitoba and as far west as the Beaver Lodge and Tioga Pools in North Dakota. Discussion of their correlations extent, and nomenclature must await further study.

1/ Sloss, L. L. and Laird, W. M., 1947, "Devonian System in Central and Northwestern Montana, " Bull. Amer. Assoc. Petrol. Geol., Vol. 31, No. 8, pp. 1404-1430.

The character of the units may be noted in the lithologic logs and they have distinctive gamma log and electric log characteristics. All the Devonian above the Manitoban formation is considered to be Upper Devonian, whereas the Manitoban and lower formations are considered Middle Devonian. The thick rubble bed near the top of the Winnipegosian Formation in the Thompson well is essentially equivalent to the thick Middle Devonian evaporite strata at Beaver Lodge and elsewhere in the basin.

The Silurian system is divided into four convenient, mappable, and temporarily numbered units. Steep dips and porous corals in Silurian Unit 2 are of interest as an indication of possible reefing.

The top of the Stony Mountain Shale is the horizon previously reported by the water as the top of the Stony Mountain Formation and the Ordovician system. 2/ As indicated here, the Stony Mountain shale is a member within the Stony Mountain Formation. Whereas the Stony Mountain Shale for all practical purposes is the most convenient and mappable unit in the upper part of the Ordovician System

in this region, the actual systematic contact lies a short distance above the shale. That contact is tentatively identified in this report.

2/ "Geology of the Williston Basin," The Petroleum Engineer, November, 1951, pp. A-49-66, and "Subsurface Geology of South Central North Dakota", N. D. Geol. Survey Bull. 27, 1952.

Cores, samples, and logs of the California Thompson well are available for examination at the North Dakota Geological Survey, Grand Forks, North Dakota.

SUMMARY

Location: SW 1/4 S 1/4 SE 1/4, Section 31 T. 160 N., R. 81W., Bottineau County, North Dakota.
Elevation: 1526' K.B.
Spud: October 5, 1951.
Plugged & Abandoned: February 6, 1952.
Total Depth: 8262' in Pre-Cambrian

HISTORY

The California Company's Blanch Thompson No. 1 location was made after seismograph survey and the well was spudded October 5, 1951.

Casing - Casing was set as follows: 20" casing at 112' with 225 sacks, and 13 3/8" casing at 1200' with 1200 sacks.

Cores - The following intervals were diamond cored: 2740-2767' and 2802-2822' (in Dakota group); 4064-4628' (Charles and Mission Canyon formations); 5006-5056' (Lodgepole formation); 5500-7020' (Devonian and Silurian); 7286-7336' and 7685-7735' (Red River formation); 7990-8040' (Winnipeg sand); and 8251-8262' (basement).

Tests - A Core Laboratories mud-logging truck was on location throughout the drilling of the well. Although no shows of oil or gas were encountered, six drill stem tests were made.

DST#1: 5480-5600'. Open 30 minutes, shut-in 15 minutes, good blow throughout. Recovered 3300' of salt water through 1/2" choke. FP 1250-2150 PSI; SIP; 2650 PSI; Hydro 3450 PSI. Formation: Devonian "A" unit.

The well was drilled to a total depth of 8262 feet and five more tests were made while progressively setting plugs up the hole.

DST #2: 6600-6650'. Open 18 minutes, shut-in 10 minutes, strong blow throughout. Recovered 2 stands of rathole mud and 14 stands of salt water through 5/8" choke. FP 560-1175 PSI; SIP 3110 PSI; Hydro 3505 PSI. Formation: Silurian No. 1 Unit.

DST #3: 5318-5453'. Open 75 minutes, shut-in 15 minutes, very weak blow throughout. Recovered 310' heavy mud and 90' water cut mud through 5/8" choke. FP 330-305 PSI; SIP 942 PSI; Hydro 2915 PSI. Formation: Englewood and Lyleton.

DST #4: 4395-4520'. Open 18 minutes, shut in 10 minutes, strong blow.

Recovered 31 stands of salt water, with the top 2 stands mud-cut, 5/8" choke. FP 1050-1450 PSI (Bourdon Tube 645-1320 PSI); SIP 2000 PSI (BT 985 PSI); Hydro 2500 PSI (BT 2395 PSI), Formation: Top of Mission Canyon.

DST #5: 4240-4317'. Open 15 minutes, shut-in 15 minutes, strong blow. Recovered 1250' of salt water through 5/8" choke. FP 600-1100 PSI; SIP 1400 PSI; Hydro 2600 PSI; no Bourdon Tube pressures. Formation: Charles.

DST #6: 4020-4118'. Open 30 minutes, shut-in 10 minutes, very weak blow for 5 minutes, then dead. Recovered 700' of mud through 5/8" choke. Bourdon Tube pressures; FP 415-500 PSI; SIP 525 PSI; Hydro 2120 PSI. Had trouble getting packer to hold and took some mud. Formation: Charles.

Small flows of salt water were encountered at 3897 and 3989 feet. Circulation was lost at 6450 and 6624 feet.

Velocity survey, electric logs, dipmeter surveys and radioactivity logs were run, and the well was plugged and abandoned on February 6, 1952.

Formation Tops

Cretaceous system

Niobrara formation	1635 feet
Greenhorn member	1985
Dakota ?	2520

Jurassic System

Morrison formation	2860
Ellis group	3010
Piper formation	3400

Triassic System

Spearfish formation	?
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Mississippian System

Charles formation	3855
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(The formation tops above are incomplete and based on electric log correlation. These below are based on core and sample information).

Mission Canyon formation	4397
Lodgepole formation	4670
Englewood formation	5326
Devonian Systems	
Upper Devonian Series	
Lyleton formation	5380
Devonian "A" Unit	5450
Devonian "B" Unit	5563
Devonian "C" Unit	5912
Middle Devonian Series	
Manitoban formation	6123
Winnipegogan formation	6286
Devonian "F" Unit	6532
Ashern formation	6578½
Silurian Systems	
Silurian "1" Unit	6590
Silurian "2" Unit	6757
Silurian "3" Unit	6894
Silurian "4" Unit	7050

Ordovician System	
Stony Mountain formation	7086?
Stony Mountain Shale fiber	7175
Red River formation	7240
Winnipeg formation	7870
Pre-Cambrian Basement	8245

LITHOLOGIC LOG

Core starts at 4071 feet in Mississippian Charles Formation.

<u>Depth</u>	<u>Description</u>
-4082½	Salt, clear, coarse crystalline.
-4085	Dense anhydrite rubble with salt matrix.
-4088	Anhydrite, light gray, dense, fine crystalline, with small reddish shale inclusions.
-4092½	Anhydrite, light grayish red, dense, fine crystalline. Much clay probably included.
-4095	Anhydrite, light gray, with many irregular grayish red shale streaks.
-4101	Shale, grayish red, dolomitic, slightly sandy.
-4104	No sample.
-4105	Dolomitic shale as above, veining and irregular base.
-4105½	Dolomite, yellowish gray, very fine grained, dense.
-4119	Anhydrite, olive gray to dark gray, very fine crystalline? dense, with grayish red shale and dolomitic shale streaks; 6" bed of very dolomitic shale.
4119-4131	No core.
4131-4149	Anhydrite, olive gray to dark gray, very fine grained, dense. No core: 4149-52; 4158-61; 4170-73.
-4164	Anhydrite, as above.
-4166	Dolomite, grayish red, very fine crystalline, dense, with anhydrite interbedded.
-4179	Anhydrite, as above. No core: 4179-4181 and 4187-4190.
4181-4192½	Anhydrite, olive gray to medium light gray, very fine crystalline, dense.
-4193½	Dolomite, grayish orange pink to pale yellow brown, fine sugary, tight, with many anhydrite inclusions.
-4220	Anhydrite, as above, dolomite streaks 4201-4202.
4220-4226	No core.
4226-4227	Dolomite, very pale brown (5YR6/2), medium sugary, tight with anhydrite inclusions.
-4229	Dolomite, medium light gray, very fine crystalline, dense.
-4230	Dolomite, very pale brown, medium sugary, with small vugs.
-4232	Dolomite, gray, as above fragmentary with dark anhydrite matrix.
-4241½	Anhydrite, medium light gray, very fine crystalline, dense.
-4246	Limestone, yellowish gray, fine to medium sugary with small porosity and much anhydrite included.
Break	
-4247½	Anhydrite, medium light gray, with many pieces of above limestone included.
-4260	Limestone, yellowish gray, medium sugary to fragmental, with oolites at base. Fair to good intergranular, and fine vugular

- porosity. Some very thin grayish green shale streaks, and a few anhydrite inclusions.
- 4267 Limestone, very pale orange to very pale brown, fine sugary, good intergranular porosity.
 - 4270 Limestone, very pale orange, medium fragmental and sugary, with poorly preserved oolites. Brachiopod shell, good intergranular porosity.
 - 4274 No core.
 - 4277 Limestone, pale yellowish brown, medium sugary, with many broken brachiopod fragments, poor porosity. No core 4277-82.
 - 4282-4288 Limestone, very pale orange, fine sugary, medium porous, some vertical fractures.
 - 4295 Limestone, pale yellowish brown, fragmental, with medium sugary material, many brachiopod and echinoderm fragments plus some cup corals. Fair to good vugular plus intergranular porosity. Many thin dark brownish shale seams.
 - 4305 Dolomite, pale yellowish brown, fine sugary, good intergranular porosity, calcitic.
 - 4318 Limestone, as above, with fewer corals, many thin irregular shaly seams. Irregular 3" x 6" beds of vugular clean limestone near base. These may be original organic structures. Shaly beds are draped over irregular top surfaces.
 - 4344 Limestone, pale yellowish brown, medium sugary, slightly fragmental shale and corals in upper part, fair to good porosity. No core 4326½-33.
 - 4351 Anhydrite, white to medium light gray, fine crystalline, broken and veined with gypsum. This is similar to that found associated with thick anhydrites above.
 - 4356 Anhydrite, light olive gray and medium dark gray mottled, very fine crystalline, dense.
 - 4361 Anhydrite, medium dark gray, fragmental, with dark dolomite fragments throughout.
 - 4364 Anhydrite, medium light gray with much very pale orange chalky dolomite, irregularly interbedded.
 - 4368½ Shale, yellowish gray, very calcareous, soft, slightly silty, with many thin irregular dark brownish shale seams. Very calcareous.
 - 4372 Shale, medium dark gray, very calcareous with 50% large irregular solution fragments of white anhydrite.
 - 4386 Dolomite, medium gray, micro crystalline dense, with conchoical fracture; a few thin anhydrite beds.
 - 4394 Dolomite, medium gray, fine crystalline, dense, with a few thin anhydrite beds.
 - 4391 Dolomite, medium light gray, fine crystalline. Thin finely fragmental limestone bed at top.

4397' Top of Mission Canyon Formation

- 4414 Limestone, very pale orange, medium fragmental and oolitic. Has a salt and pepper appearance due to many dark gray and brown grains, good intergranular porosity. Many poorly preserved oolites. Very fine small silty insoluble residue. No core 4399-4402.
- 4427 Limestone, as above, with many poorly preserved fossil fragments (brachiopods and echinoderms). No core 4423-26.

- 4447 Limestone, very pale orange to pale yellowish browns medium to coarse fragments with fine sugary matrix. Fragments of brachiopods, echinoderms, and a few poorly preserved oolites. A few corals are included. Small porosity, many thin dark brown shaly seams. Base is very fine crystalline with large brown dolomite crystals scattered.
 - 4449 Dolomites medium brownish gray, medium, sugary, tight.
 - 4451 Anhydrite, olive gray, medium to coarse crystalline, with some moderate brown shale, veining in base.
 - 4521 Limestone, very pale orange to very pale yellowish brown, fine to medium crystalline, fair to good porosity, occasional shaly streaks and beds of fossil fragments, including brachiopods, crinoid stems 4 and fenestrate bryozoa. No core 4471-4481.
 - 4535 Limestone, very pale orange, fine sugary, medium porous, with a few scattered fossil fragments. No core 4426-28.
 - 4539 Limestone, as above, with many thin gray green shaly streaks. Brachiopods and fenestrate bryozoa.
 - 4546 Limestone, as above, with large white anhydrite inclusions. No core 4540-43.
 - 4555 No core.
 - 4556 Limestone, yellowish gray, fine sugary medium porous.
 - 4558 Limestone, pale yellowish brown, coarse fragmental with fine matrix, mostly crinoical fragments, medium porous.
 - 4569 Limestone, yellowish gray, medium sugary, with many crinoid fragments. A few beds are entire fragmental, medium porous. No core 4564-4567.
 - 4576 Limestone, yellowish gray, fine to medium sugary, poor to fair porosity. Many green gray shaly streaks and a few anhydrite inclusions.
 - 4597 Limestone, yellowish gray, fine to medium fragmental, with some crinoid joints, fair to medium porosity. No core 4578-4581.
 - 4599 Limestone, pale yellowish, brown, coarse fragmental, good porosity, many brachiopod and echinoderms fragments, and a few oolites.
 - 4602 No core.
 - 4606 Limestone, yellowish gray, fine fragmental, good porosity with a few shaly streaks.
 - 4609 Limestone, pale yellowish brown, coarse fragmental as above, with small cup corals and rounded fragments of greenish gray fine fragmental limestone, good porosity.
 - 4619 Limestone, yellowish gray, medium sugary to fragmental medium to good porosity. Small black carbonaceous specks at 4613.
 - 4626 Limestone, pale yellowish brown, medium fragmental, with crinoid joints, brachiopod fragments, and enestrata bryozoa, good porosity.
 - 4628 No core.
- Bottom of core 4628'
Cuttings begin at 4628'
- 4634 Limestone, as above. Lost circulation material.
 - 4670 No samples.

4670' Top of Lodgepole Formation

- 4680 Limestone, medium light to light gray, medium crystalline with medium gray shale. Much cave. Tight.
- 4720 No samples.
- 4740 Limestone, medium light gray, fine fragmental, with medium gray shale interbedded, tight, small grained gray shale.
- 4750 Limestone, very light gray, chalky to medium fragmental slightly porous.
- 4790 Limestone, light to medium light gray, fine to medium fragmental tight. Some medium gray shale.
- 4800 Limestone, white to very light gray, fine fragmental, slightly porous.
- 4910 Limestone, light to medium light gray, medium fragmental, slightly porous, some medium gray shale; some pyrite. Much medium gray shale 4840-50. Lost circulation material 4850-4900. Loose coarse round quartz grains throughout, possible cave; limestone, coarse fragmental, with large rounded quartz grains, tight 4890-4900. (Much cave including *Ammodiscus* Cretacea from Pierre shale). Few crinoid joints.
- 4950 Limestone, light to very light gray, medium to coarse fragmental, with some chert. Slightly porous. Some medium light gray shale. No samples 4935-50.
- 4970 Limestone, white to very light gray, fine fragmental to chalky, with medium gray shale interbedded.
- 4995 Limestone, light gray, fine fragmental to fine crystalline, and yellowish gray medium crystalline, with medium gray shale, slight porosity.
- 5006 No samples.

Cored 5006 to 5056'

- 5020 Limestone, interbedded medium light gray, fine crystalline clayey, yellowish gray fine sugary to fragmental, olive gray coarse fragmental. Irregular bedding, with a few large fragments. Some small brachiopods and many small fossil fragments. Tight.
- 5031 Limestone, as above, minor thin beds of olive gray coarse fragmental limestone.
- 5038 Limestone, mostly olive gray fragmental and medium light gray to greenish gray shaly limestone as above. Cross lamination and some ripple mark. True dip about 10 degrees. Tight. Glauconite and white to light gray chert fragments common.
- 5043 Limestone, grayish orange pink, coarse fragmental, slightly porous. Fossil fragments and brachiopods and fenestrate bryozoa.
- 5047 Limestone, interbedded olive gray fragmental limestone and medium gray clayey limestone.
- 5050 Shale, calcareous, slightly silty, medium gray, with thin seams of greenish gray shale.
- 5052 Limestone, medium light gray, salt and pepper, slightly oolitic, with glauconite and much pyrite in top part. Brachiopods. Tight.
- 5056 Shale, medium light gray, calcareous.

5056' Bottom of core.
Cuttings Mississippian Below Core 5000-5056.

- 5090 Shale, medium gray, slightly calcareous.
- 5190 Limestone, light gray, medium crystalline to fine fragmental, cherty, tight, with small shale as above. No sample 5166-70.
- 5200 Shale, medium gray, thin bedded.
- 5240 Limestone, yellowish to light olive gray, medium fragmental to chalky, tight, with some shale as above. Pyrite 5226-30.
- 5266 Limestone, light olive gray, medium fragmental to crystalline, tight, and much medium dark grayish shale. No sample 5250-56.
- 5270 Shale, medium gray, thin bedded, soft.
- 5296 Shale, as above, with some light gray fine fragmental limestone.
- 5306 Shale, medium dark gray, thin bedded with fine carbonaceous fragments.
- 5326 Limestone, light gray, fine crystalline, dense, and shale as above.

5326' Top of of Englewood Formation

- 5336 Shale, medium dark gray, thin bedded, with small carbonaceous scraps.
- 5346 Limestone and shale, as above 5326.
- 5380 Shale, medium dark gray, thin bedded, hard, with small pyrite.

5380' Top of Lyleton Formation and Devonian System

- 5426 Limestone, grayish orange pink to light brown, shaly, fine sugary traces of sand in upper part. No sample 5410-26.
- 5460 Dolomite, very pale orange to light olive gray, fine sugary, traces of anhydrite on base. No sample 5456-60.

5450' Top of Devonian "A" Unit

- 5496 Limestone, yellowish gray to light olive gray, fine sugary to crystalline, slightly porous to dense. Traces of medium gray anhydrite at base.

Cored 5500-7020'

- 5500-5501 Anhydrite, medium gray, brownish gray, white, mottled, thin bedded, dense.
- 5506 Limestone, dolomitic, pale to medium yellow brown, medium sugary, good irregular pinpoint intergranular porosity.
- 5515 Dolomite, calcitic, pale yellow brown, fine sugary, shaly rubble with much anhydrite (inclusions and veins) some vugular porosity, some carbonaceous film at base.
- 5538 Dolomite, very calcitic, pale yellowish brown, medium sugary, fair to good pinpoint porosity, small anhydrite inclusions throughout.
- 5515-5518 Rubble, slightly shaly, with much anhydrite inclusions and veins. 5533-38 vugular, partially filled.
- 5559 ½ Dolomite, variably calcitic medium to dark yellowish brown; medium sugary, fair pinpoint and fine vugular porosity. Small

anhydrite inclusions scattered throughout. 5538-42, coarse rubble with some shaly material and much anhydrite. 5542-58, many irregular stylolitic shale streaks, 5558-59½, slightly sandy, shaly, and stylolitic, fine rubble with much anhydrite.

-5563 Dolomite, dusky, yellowish brown, medium crystalline, light, some anhydrite, minor shaly streaks at base.

5563' Top of Devonian "B" Unit

-5566 Shale, greenish gray, fine grained, dolomite as above, (6" hand at 6564). Thin irregular beds cross-lamination.

-5577 Anhydrite, medium gray, coarse crystalline with many thin shale beds as above.

-5580 Anhydrite, medium light gray, very fine crystalline, dense.

-5590 Anhydrite, medium olive gray, medium crystalline, dense with many thin beds of limestone, dolomitic, very pale orange, very fine sugary, irregular bedding, some solution. Medium crystalline, dusky yellow brown dolomite 85-86½ and 87½-88½. Small brownish shale in bottom part.

-5599 Dolomite, medium olive gray, medium sugary, slightly porous, with some dark brownish specks. Few shale streaks, gray shale interbedded at top.

-5610 Dolomite, light to medium light grays with brownish streaks, very fine sugary, tight with thin irregular shaly beds; inclusions and stylolitic seams.

-5617 Dolomite, medium to medium light gray, fine sugary, dense, thin bedded, slightly clayey.

-5620 Dolomite, medium gray, very fine grained, shaly, massive, tight.

-5622½ Anhydrite, white, medium light gray mottled, coarse crystalline, thin bedded, dense.

-5624½ Dolomite, yellowish gray to pale yellowish brown, fine to medium fragmental, tight, thin bedded. Top oolitic with anhydrite rubble.

-5630½ Dolomite, medium light gray, fine crystalline, tight, shaly with many very shaly streaks; small anhydrite.

-5633 Limestone, dusky yellowish brown to pale, fine to medium gray, rubble, with shaly streaks. Dip about 15 degrees.

-5638½ Dolomite, medium light gray, shaly, fine grained; dense, anhydrite at base.

-5642 Anhydrite, medium yellowish brown to medium light gray, coarse crystalline, with some dolomite interbedded, grading to dolomite at base.

-5655 Dolomite, medium yellowish-brown, medium sugary, slightly porous, with occasional thin streaks of dark brown shale, and occasional rubble. Small anhydrite.

-5663 Anhydrite, medium gray to medium yellow brown, with much very pale yellow brown thin dolomite interbedded. Some shale interbedded, especially at top; bottom contact gradational.

-5673 Dolomite, pale to grayish-brown, mottled, fine to medium sugary, slightly porous, with a few shale streaks and much anhydrite (some inclusions and veinlets).

-5676½ Shale, medium light gray to dark green gray, fine grain, with numerous medium light gray dolomite streaks and some anhydrite. Thin irregular bedding.

-5684 Dolomite, pale yellow-brown to gray-brown, medium sugary, fair intergranular porosity. Little shale, quite shaly at base.

- 5699 Limestone, dolomitic, dark to dusky yellow-brown, medium crystalline, to sugary, vugular, with some anhydrite.
- 5702 Dolomite, dusky yellow-brown, medium crystalline, tight; base gradational contact.
- 5703 Dolomite, medium light gray, shaly, fine grained "brain-like" mottling, tight.
- 5705 Anhydrite, medium gray to dusky yellow-brown, coarse crystalline, thin bedded.
- 5711 Dolomite, light to pale brown, medium fragment to sugary, calcitic, thin irregular beds, with stylolitic shaly seams. Small intergranular porosity. Some solid anhydrite, and traces of brown shale.
- 5716 Dolomite, as above, very vugular, with mostly altered, organic? Structures, Basal 2' gradational.
- 5719 Dolomite, medium light to very light gray, shaly, mottled irregular steep bedding at base and irregular basal content.
- 5724 Dolomite, light brown, calcitic, fine to medium sugary, middle part vugular, with anhydrite, and some brown shale residue.
- 5725½ Dolomite, medium gray, slightly bluish, slightly mottled. Top shaly with pyrite, base, has anhydrite inclusions.
- 5753½ Dolomite, pale brown, medium to coarse sugary. Many inclusions and veinlets of anhydrite. Vugular "rotten", with much light brown shaly residue, vugular with good intergranular porosity. Thin and stylolitic dark brown to medium gray shale partings throughout. Irregular bedding and irregular dips, 0 to 20 degrees. More veining in top 5'.
- 5756 Shale, dark greenish gray, with much yellow-brown dolomite interbedded, thin beds.
- 5760 Anhydrite, dusky yellow-brown, coarse crystalline, with shale as above, interbedded, Base gradational.
- 5770 Dolomite, yellowish gray, fine sugar to chalky, calcitic, with much dark greenish-gray shale and dusky yellow-brown anhydrite as above interbedded, thin bedded.
- 5785 Dolomite, pale yellowish brown, fine to medium sugary, variably calcitic, fair to good intergranular porosity. Thin streaks of shale as above more common in upper 4 feet. Dark black asphaltic inflammable thin shale seam at base. Some vertical fracturing.
- 5805 Dolomite, pale yellow-brown, medium sugary, good intergranular porosity. Many thin stylolitic black shale seams. Some anhydrite inclusions. A few thin medium fragmental streaks. No core 5800-5803.
- 5802 Dolomite, medium to dark yellowish-brown, medium sugary, slightly intergranular porosity. Vugular, with most vugs partially filled with white anhydrite. Some light brown residue about vugs. Some gray-green shale streaks near base. Bottom contact gradational.
- 5830 Dolomite, light olive gray, medium crystalline, dense. Much anhydrite, many stylolitic seams. Some veining and rubble, a few shale streaks.
- 5843 Dolomite, brownish gray, fine to medium crystalline, dense. Mostly coarse rubble; with anhydrite veining. Some brown residue. Dips from 70 degrees at top to 5 to 10 degrees at base. Some shaly streaks and many irregular solution surfaces.
- 5845 Dolomite, dusky, yellow-brown fine crystalline, dense.
- 5850 Dolomite, dusky, yellow-brown, medium sugary slightly intergranular porosity, with large anhydrite inclusions and veins.

- 5857 Dolomite, brownish gray, medium sugary, tight, with a few large anhydrite inclusions.
- 5858½ Dolomite, shaly, medium light to medium gray, mottled "brain-like", very fine grained.
- 5860 Anhydrite, gray-brown, fine crystalline, dense, with 6 inches of white gypsum, with moderate brown shale veining.
- 5864½ Dolomite, light brown, fine crystalline, tight, with thin dark shale partings.
- 5875½ Dolomite, grayish brown, with some olive gray mottling, fine sugary, tight, with a few small vugs. A few anhydrite inclusions. Base gradational.
- 5877½ Dolomite, shaly, gray mottled as above, gradational top and base.
- 5883½ Limestone, pale yellow-brown, medium sugary to fragmental, thin bedded, some cross bedding; some thin dusky yellow-brown shaly layers, slightly porous.
- 5884 Anhydrite, dusky yellow brown, coarse crystalline, dense.
- 5894 Limestone, yellowish gray, fine sugary to chalky, with thin medium gray shaly streaks tight, base gradational.
- 5895 Dolomite, shaly mottled gray as above.
- 5896½ Anhydrite, white to medium light gray, fine crystalline, dense, with dolomite streaks and inclusions.
- 5898 Dolomite, shaly, mottled, with a few small round fragments (algal?).
- 5899½ Anhydrite, light brownish gray, dense.
- 5912 Dolomite, light to brownish gray, fine sugary, slightly porous, with thin shaly streaks throughout. Gray mottled to fragmental 5901-02, dip 45°; shale 5907½-5908. Small anhydrite inclusions.

5912' Top of Devonian "C" Unit

- 5922 Shake, medium light gray, dolomitic, fine grained; 5912-5913: Thin bedded with inclusions and thin beds of yellowish gray dolomite.
- 5930 Dolomite, grayish brown, fine to medium crystalline, tight, 5925-26½: Dolomite, very shaly, mottled gray.
- 5933 Shale, medium light grays to greenish gray, dolomitic, with thin irregular beds.
- 5933½ Anhydrite, medium gray, dense.
- 5941 Dolomite, pale yellowish brown, fine crystalline, tight, with many irregular gray shale streaks and inclusions. Few anhydrite veins.
- 5955 Dolomite, very shaly, medium gray to medium light gray, fine grained, tight, with many thin dolomitic shale beds. Bedding thin, irregular, 5946-47: Yellow-gray dolomite with shale streaks. 5947-48: Mottled gray shaly dolomite.
- 5956 Anhydrite, olive gray, dense.
- 5965 Dolomite, medium to light olive gray, fine crystalline, tight, with many irregular greenish-gray shale partings. Some rounded (algal?) dolomite fragments.
- 5971½ Dolomite, medium gray, fine crystalline, tight, shaly. Irregular, bedding and shale streaks throughout. Anhydrite inclusions and veins at base.
- 5974½ Anhydrite, olive gray, dense.
- 5982 Dolomite, pale yellow-brown, fine to medium crystalline, dense, with many thin irregular darker beds and some rounded (organic ?) fragments. Near vertical fractures filled with anhydrite.

- 5990 Dolomite, medium to medium light gray, fine crystalline, shaly, tight, with thin anhydrite streaks. Irregular to stylolitic bedding.
- 5999 Dolomite, medium dark to medium gray, tight, fine grained, shaly, with relatively more thin anhydrite beds. Irregular thin to stylolitic bedding.
- 6006 Dolomite, yellowish to light olive gray, fine sugary, tight, with scattered thin stylolitic shale seams. No core 6006-6009.
- 6009-6016 Dolomite, pale yellowish brown, fine to medium sugary, slight intergranular porosity. Gradational basal contact. Thin slightly asphaltic black shale film at 6015.
- 6025 Dolomite, brown-gray to light olive gray, fine sugary, slight intergranular porosity; shale, medium gray to medium dark gray, very shaly, fine grained, interbedded with thick beds 15-16, 18-20, 21-22. Anhydrite 19-19½. Thin irregular beds.
- 6030 Dolomite, medium gray to medium light gray, fine grained, shaly, mottled, with streaks of yellowish gray dolomite at base. Basal contact gradational.
- 6034 Dolomite, light olive gray, very fine crystalline to earthy, with many thin greenish-gray shaly streaks, tight, small anhydrite plus 6" anhydrite at base.
- 6047 Dolomite, medium to light olive gray, fine sugary, tight, with many shaly streaks. Thin irregular beds, with solution contacts and microfaults. Some vertical fractures with anhydrite fillings. Small black asphaltic shale @ 45'.
- 6049 Anhydrite, dusky yellow-brown, dense.
- 6050 Dolomite, dark yellow-brown, fine sugary, tight, anhydrite filled fractures.
- 6054 Dolomite, olive gray, very shaly, fine grained thin bedded, some small folds and faults.
- 6057 Anhydrite, dark yellow-brown to very light gray, dense.
- 6059 Dolomite, grayish orange pink, very fine grained, with many inclusions of anhydrite. Base gradational, and top solution contact. May be originally organic.
- 6063 Dolomite, dark yellow-brown to gray-brown, fine to medium crystalline, tight with many thin shaley streaks. Thin bedded, with irregular bedding and high angle microfaults.
- 6067½ Dolomite, shaly, light olive gray to medium dark gray, with thin irregular, micro-folded beds, tight.
- 6071½ Anhydrite, brownish-gray, dense.
- 6076 Dolomite, brownish-gray, fine sugary, tight. Few thin dark asphaltic shaley streaks.
- 6086 Dolomite, medium gray, slightly greenish, fine crystalline. Shaly, thin irregular beds, some mottling, with some anhydrite inclusions. No core 6082-85.
- 6091 Dolomite, light olive gray, fine crystalline, with shale streaks. Beds dip 10 to 15 degrees.
- 6095 Dolomite, light olive gray, fine sugary, with a few thin stylolitic shale seams.
- 6098½ Dolomite, light olive gray, fine to medium sugary, slightly porous with thin stylolitic seams. Dark shale and rubble 6095-96. Dip 45°; 6" anhydrite at base.
- 6103½ Dolomite, light olive gray, fine sugary, slightly porous, with anhydrite veins.

- 6108 Dolomite, yellowish gray to light olive gray, very fine sugary, calcitic, thin bedded with thin shale beds. Small red-brown shale near base. Small anhydrite, tight.
- 6112 Dolomite, pale yellowish brown to brownish gray, fine to medium crystalline, thin bedded. Algal ? Structure 6110-12.
- 6113½ Dolomite, brownish gray, fine crystalline, tight.
- 6117½ Dolomite, yellowish-gray to olive gray, interbedded, fine crystalline to chalky. Irregular beds, (soft rock deformation). Mottling at top, few round fragments.
- 6123 Dolomite, dark yellowish-brown, coarse sugary, slightly porous, finer and with a few stylolitic seams near base.
- 6123' Top of Manitoba Fomation
- 6128 Dolomite, olive to light olive gray, fine crystalline tight, thin bedded, stylolitic. Small rubble 6125-26.
- 6134 Dolomite, fine-medium sugary, brownish to light olive gray, with many shaly stylolitic seams, tight. Slight rubble. Irregular bedding, may have been organic.
- 6138½ Dolomite, medium yellowish brown, medium crystalline, tight with a few thin stylolitic seams. Thin black asphaltic shale at base.
- 6156 Dolomite, yellowish gray, slightly greenish, fine crystalline, calcitic, tight, many thin inclusions and films of greenish-gray shale. Shale beds 6142-43. Fine rubble some at base. Bottom contact stylolitic.
- 6160½ Limestone, yellowish gray, fine sugary to chalky, small pinpoint porosity. Inclusions and veinlets of anhydrite. Shale beds top 1".
- 6168 Limestone, pale yellowish brown, dolomitic, very fine crystalline, Thin beds of dusky yellowish-brown, slightly asphaltic, dense pyritic limestone, especially at 60-61, 63-64, 67-68. Slightly porous.
- 6172 Dolomite, light olive brown, fine sugary, tight. Rounded pebbles and dusky, yellow-brown pyrite, dense dolomite veins and matrix. Calcitic.
- 6177 Limestone, very pale orange to yellowish-gray, medium sugary, poor to fair intergranular porosity. Thin streaks of dusky yellowish-brown dolomite.
- 6180 Limestone, dusky yellowish-brown, medium crystalline, tight, few stylolites. Anhydrite veins.
- 6191 Dolomite, pale brown to dusky yellowish-brown, medium crystalline to sugary. Large vugs and anhydrite veins. No core 6183-89. (Lost interval is similar lithology according to micrology).
- 6198 Dolomite, pale yellowish brown, medium sugary, fair to good pinpoint porosity; a few vugs. A few stylolitic seams plus some anhydrite.
- 6200 Dolomite, pale yellowish brown, medium sugary with a few shale streaks, good intergranular plus vug porosity.
- 6204 Dolomite, pale yellow brown, medium sugary, good intergranular plus vug porosity. Silicified stromatoporoid at 6202.
- 6218 Dolomite, grayish-orange-pink to pale yellowish brown, medium sugary, good intergranular porosity.
- 6225½ Dolomite, pale yellowish-brown, to yellowish-gray, fine sugary, slightly porous, with many thin stylolitic shale seams, few anhydrite inclusions.

- 6232½ Dolomite, pale yellowish brown, fine crystalline, tight. Many stylolitic greenish-gray shale seams. Many anhydrite veinlets. A few vugs.
- 6242 Dolomite, yellowish gray, fine sugary, slightly porous, with thin greenish gray stylolitic shale seams throughout.
- 6245 Dolomite, as above, vugular.
- 6250 Dolomite, light olive gray, fine crystalline, tight, with many thin shale seams.
- 6283 Dolomite, light olive gray, fine sugary, slightly porous, with scattered shaly streaks and anhydrite-filled fractures.
- 6286 Dolomite, pale brown to pale yellowish brown, medium sugary, tight, with much anhydrite veining. Greenish gray shale streaks dip 30°.

6286' Top of Winnipegosan Formation

- 6297 Dolomite, pale yellowish brown and medium gray, very fine crystalline, tight, alternating in 1 to 2 foot beds. Dip 45°. Solution contacts.

6297' Top of Winnipegosan Rubble

- 6315 Rubble, angular pieces of above rocks in large matrix and chunks of rocks below. Dip irregular, as high as 45 degrees. Small amount of anhydrite.
- 6328 Dolomite, pale yellow brown, medium sugary, with anhydrite veins and inclusions, broken in streaks as much as 1 foot thick. At least 50% of interval is rubble as above, with relatively more fragments of the dolomite described here. Dips to 45 degrees. Rubble is slightly finer, and there are shaly and stylolitic streaks.
- 6335 Dolomites, light olive gray, fine crystalline, with many rubble streaks.
- 6343 Rubble, majority lithology dolomite, as above.

6343' Base of Winnipegosan Rubble

- 6352 Dolomite, light olive gray, as above, broken coarse slightly rounded gravel, with some fine rubble and with mostly olive gray shaly matrix.
- 6357 Dolomite, light olive gray, to pale yellowish brown, fine crystalline, tight, with shale streaks plus anhydrite. Vugular in base.
- 6366 Dolomite, grayish-orange-pink, coarse sugary, good intergranular porosity. Some anhydrite and altered branching corals.
- 6380 Dolomite, grayish-orange-pink to pale yellowish brown, coarse sugary, with good intergranular porosity and vugs. Much anhydrite, many corals and some crinoid joints. Shaly streaks.
- 6394 Dolomite, pale yellowish brown, fine to medium sugary, fair to good intergranular porosity. Small amounts of anhydrite and thin shale seams.
- 6409 Dolomite, pale yellowish-brown, medium sugary, fair to good intergranular porosity.

- 6414 Dolomite, as above, with many thin stylolitic shale seams.
- 6433 Dolomite, pale yellowish brown, medium sugary, fair to good intergranular porosity, scattered stylolitic seams.
- 6455 Dolomite, pale yellowish brown, fine sugary, with many brownish-black stylolitic shale seams. Some rounded irregular lighter inclusions (possibly organic?). Porosity poor to fair.
- 6475 Limestone, pale yellowish brown, fine to medium sugary, dolomitic. Fewer stylolitic seams than above and more light-colored inclusions. Poor to fair intergranular porosity.
- 6491 Dolomite, calcitic, light brown to grayish-orange-pink, coarse sugary, with very good intergranular porosity, crinoid stems and brach impressions, abundant.
- 6508 Dolomite, dark yellowish gray, (5Y7/1), calcitic, fine-medium sugary, slightly porous, irregular streaks of shale.
- 6517 Dolomite, dark yellowish brown, medium sugary, good pin-point porosity. Few small salt inclusions near base.
- 6525 Limestone, very pale orange to pale yellowish brown, medium to coarse crystalline, slightly fragmental, tight, to slightly porous. Small salt inclusions and some thin shale. Brachiopods moderately abundant.
- 6531 Dolomite, pale yellowish brown, medium crystalline, tight, with some anhydrite inclusions. Traces of salt.
- 6532 Coarse rubble of above dolomite, with dense dolomite matrix (vertical fracture).

6532' Top of Devonian "F" Unit

- 6564 Dolomite, very light gray, clayey, fine to medium crystalline, dense, tight, massive. Stringers of underlying lithology in basal 1 foot. (interfingering or gradational contact).
- 6568½ Gypsum, clear to very light gray, coarse crystalline, mostly replacing dolomite as above. Slight medium brown shaly mottling in basalt 2 feet; dense.
- 6571½ Dolomite, very light gray as above, with few reddish brown mottles. Base in replacement contact with underlying unit.
- 6571½-6578½ Gypsum, as above, in a rubble of light gray dolomite, pink to brown irregular coloring or stain in basal part.

6578½ Top of Ashern Formation

- 6581 Dolomite, light brown, fine crystalline, dense, shaly, with much gypsum replacing.
- 6584 Limestone, medium light gray to light brown mottled, solid breccia, with much gypsum, tight.
- 6586 Limestone, solid breccia, with dark reddish brown shale matrix, vugular.
- 6590 Limestone, very pale red, (10R7/2), lithographic, with many anhydrite veinlets plus inclusions; few vugs.

6590' Top of Silurian System and Silurian Unit No. 1

- 6593 Dolomite, white to yellowish gray, medium crystalline, tight, some anhydrite, some tight incipient vertical fractures.
- 6600 Dolomite, moderate orange pink, fine sugary, slightly porous,

- few vugs plus vertical fractures. Much anhydrite interbedded and included. 6698-99: Dolomite, white to very light gray; some stylolites.
- 6615 Dolomites grayish-orange-pink to orange-pink, medium crystalline, banded. Many vugs, some as large as 1/4". Much fracturing. Some concentrations of colored shale. Gypsum vug lining.
- 6623 Dolomite, white to slightly pink-gray, calcitic, fine grained to chalky slightly fragmental, vugular and fractured. 6623.1 to 6625: No core.
- 6625-6638½ Dolomite, white, chalky calcitic. Few scattered streaks of small vugs, and slightly fragmental reddish shale in very fine cracks.
- 6640 Dolomite, pink-gray, medium crystalline, vugular.
- 6659 Dolomite, white to pink-gray, chalky with irregular altered fragments. Vertical fractures. Rock is dense.
- 6661 Dolomite, white, medium-coarse sugary and crystalline vugular. (These thin vugular zones may be originally fragmental or fossiliferous).
- 6661-6680 Dolomite, white, chalky as above, with vertical fractures: vugular medium crystalline dolomite zones at 69-71, 72-73, 76-77.
- 6690 Dolomite, medium sugary to crystalline, vuggy, probably partly altered, fragmental, vertical fractures.
- 6694 Dolomite, white chalky, vertical fractures.
- 6697 Dolomite, white, lithographic to medium crystalline, vugular in coarser parts. Vertical fractures.
- 6701 Dolomite, white, chalky, vertical fractures. Thin vugular streak 6699.
- 6708 Dolomite, white, lithographic to medium crystalline, vugular, part was originally fragmental.
- 6710 Dolomite, white, chalky, vertical fractures.
- 6718 Dolomite, very pale orange, fine crystalline to lithographic, vugular. More vugular and grading to white at base. Vertical fractures. 6718-6720 - No core (Lost circulation).
- 6720-6746 Dolomite, very pale orange, fine sugary to lithographic, vugular, with fragment relicts.
- 6752 Dolomite, grayish-orange-pink, fine sugary, vuggy, with vertical fractures. Fewer vugs in basal part. White specks, (algal ?).
- 6752-6755 Dolomite, yellowish gray, fine crystalline, dense, tight.
- 6757 Dolomite, white, chalky, with many fragments of darker dolomite and some red and green shale, increasing toward base, slightly porosity.

6757' Top of Silurian Unit No. 2

- 6761½ Shale, light brown, (5YR5/6) calcareous with much crystalline calcite and limestone fragments. Basal part is limestone breccia of material below.
- 6817 Limestone, pale yellowish brown, lithographic, much solution and brecciation matrix filling of light brown shale plus reddish to purplish mottling and stain. Slightly porosity. Some green-gray shale. Bottom contact gradational.
- 6829 Limestone, pale yellowish brown, lithographic, with thin seams plus stylolitic seams of green-gray shale, small reddish shale in top part.

- 6831 Shale and limestone mixture, green-gray and light brown shale with much intermixing of rotten limestone rubble. Some hematite on bedding planes.
- 6856 Limestone, pale yellowish brown, lithographic, with some green-gray, shale inclusions. Few vugs, red shale and breccia zones at 36½-38, 47-49, 53-54, and 55-56.
- 6894 Dolomite, very pale orange, coarse sugary, very vugular, with many tabulate corals. Dips to 20°; many rubble layers and some greenish shale corals abundant 6882-88.

6894' Top of Silurian Unit No. 3

- 6897 Dolomite, very pale orange, lithographic, vugular at base.
- 6920 Dolomite, very pale orange, lithographic. Rare vugular or fragmental. Thin streaks dip 15 to 20°.
- 6936 Dolomite, very pale orange, calcitic, fine crystalline, to fine sugary, or slightly chalky. Slightly porous, mostly dense. Top gradational. Top 2 feet, very light pink, with some green shale.
- 6936-6940 Dolomite, very pale orange, medium fragmental, vugular.
- 6944 Limestone, light olive gray, dolomitic, fine sugary, dense, with green-gray shale streaks. Dip about 5°.
- 6948 Dolomite, yellowish gray, fine crystalline to lithographic. Thin bedded, dense.
- 6950 Dolomite, white to yellowish gray, fine crystalline to coarse fragmental, small vugs, calcitic.
- 6955 Dolomite, light gray to light olive gray, chalky, with much interbedded greenish shale, tight.
- 6968 Dolomite, very pale orange, lithographic to chalky, dense, thin bedded. Some stylolites and few thin shaly seams. Vertical fractures.
- 6974 Dolomite, very light gray to light olive gray, fine grained to chalky, with many thin gray-green shale streaks.
- 6978 Dolomite, light olive gray, calcitic, lithographic, dense, with a few stylolites.
- 6980 Dolomite, light olive gray, medium fragmental, vugular with anhydrite fillings.
- 7020 Dolomite, white to very pale orange, lithographic to chalky green shale and rubble 6991-92, 95-97. Thin fragmental zones at top of unit. Tight, vertical fractures.
- 7004-7009 Green shale, interbedded.
- 7010-7012 Rubble 7019-7020.

7020' Bottom of Core

- 7030-7050 Dolomite, as above, small medium light gray shale. Much caves plus lost circulation material.

7050' Top of Silurian Unit No. 4

- 7064 Dolomite, white to very pale orange, fine to medium sugary, slightly reddish shale at top.
- 7086 Dolomite, pinkish gray, yellowish gray, fine sugary, with small amounts of anhydrite. Traces of fine grained sandstone.

7086' Top of Ordovician Stony Mountain Formation

- 7106 Shale, medium dark gray, soft and some light olive dolomite and green-gray shale. Some light brownish gray, fine grained dolomite.
- 7120 Dolomite, pale yellowish brown, very fine crystalline to medium fragmental, slightly silty, tight.
- 7136 Dolomite, white to yellowish gray, slightly reddish stains, fine crystalline to medium fragmental, slightly silty. Scattered porosity.
- 7180 Dolomite, pale yellowish-brown, fine crystalline, tight; slightly pyritic, with scattered fine vugular porosity.

7175' Top of Stony Mountain Shale Member

- 7200 Shale, medium gray and pale yellowish calcareous, and traces of shale, dark reddish brown.
- 7210 Limestone greenish gray, very fine crystalline, limestone, yellowish gray, medium crystalline, dolomitic, and dolomite, light olive gray, medium sugary.
- 7240 Limestone, light yellowish brown, coarse fragmental with many medium gray limestone fragments, probably organic, tight. Some gray shale, traces of bryozoa. No sample 7216-26. Much lost circulation material.

7240' Top of Red River Formation

7286-7336 Cored.

- 7290 Limestone, yellowish gray, fine grained, shaly.
- 7297 Anhydrite, brownish gray, dense, very fine grained, with thin streaks yellowish gray dolomite. Thin irregular beds. No core 7301-7304'.
- 7301 Dolomite, very pale brown, (5YR6/2), medium to coarse sugary, very slightly porous; has irregular dark streaks of anhydrite scattered throughout, calcitic.
- 7304-7310 Dolomite, yellowish gray, fine sugary, many veinlets and inclusions of coarse crystalline brown dolomite. Some fractures coated with black asphaltic film. Rock is tight.
- 7318 Limestone, very pale orange, dolomitic, fine sugary, slightly porous, with very thin shale streaks and thin beds. Fair pinpoint porosity in base.
- 7320 Limestone, pale yellowish brown dolomitic medium to coarse fragmental, fossiliferous, with some brachiopods, crinoid stems, and bryozoa, fair intergranular porosity. Anhydrite inclusions.
- 7334 Limestone, pale to dusky yellowish brown, mottled and streaked, with many thin dark irregular shale streaks, medium to coarse fragmental, few fossils as above. Scattered veinlets and inclusions of anhydrite; poor to fair porosity.
- 7335 Dolomite, white, and sugary to chalky. 3" shale bed at top.
- 7336 Shale, medium light gray to brown gray, fine grained, thin irregular beds.

Bottom of Core 7336'

- 7340 Shale, medium light gray, calcareous.
- 7360 Limestone, pale yellowish brown, medium crystalline to fragmental, with scattered anhydrite inclusions, tight, some light olive gray fine crystalline anhydrite 7350-60.
- 7400 Dolomite, yellowish gray, fine crystalline, with thin brownish shale films interbedded, light gray to light olive gray, fine crystalline anhydrite 7380-90.
- 7420 Dolomite, light olive gray, calcitic, slightly porous, fine sugary to medium crystalline, with thin dark gray shale interbedded.
- 7450 Dolomite, yellowish gray, fine sugary, to medium fragmental, with thin shale seams. Fair porosity.
- 7500 Limestone, pale yellowish brown, medium crystalline to fragmental, tight. Much lost circulation material 7470-7500.
- 7630 No samples.
- 7685 Limestone, yellowish gray, fine crystalline, mixed with limestone, very pale yellowish brown, fine fragmental, dolomitic. (probably mottled). Scattered slight porosity. No Sample 7680-85.
- 7685-7735 Limestone very pale yellowish brown (10YR7/2), medium sugary, slightly porosity, mottled, with many irregular, thin shaly beds; a few scattered brachiopods, slightly fragmental, some possible recrystallization. Slightly less shale in bottom half.
- 7740 (Cuttings) Shale, medium gray.
- 7870 Limestone and shale, as in core; lost circulation material 7794-7800; no samples 7820-36. Some medium light gray limestone 7800-7870. More dark gray shale and some lost circulation material in basal part.
- 7870' Top of Winnipeg Formation
- 7900 Shale, dark greenish gray, very fine grained, splintery, some black shale, interbedded.
- 7920 Shale, as above, and limestone, fine crystalline, yellow gray shale, and fine mottled moderate orange brown, with small pyrite.
- 7960 Shale as above, with a few thin limestone bands.
- 7980 Limestone, yellowish brown, sandy, a few loose coarse quartz grains. Small sandstone, red to brown shale, and a few large iron oxide oolites.
- 7990 Sandstone, medium grained, quartz, angular, porous.
- 8016 Sandstone, medium grained, quartz, surrounded. Friable to slightly cemented with occasional calcite. Some quartz recrystallization, good porosity. Many very thin irregular shaly streaks. Some brown iron stain, and a few dark chert or quartz grains; more green-gray shale 8000-8016; in thin beds and films. Salty taste.
- 8029 Sandstone, yellowish gray to medium light gray, salt-and-pepper, medium grained quartz as above, well cemented, fair to good porosity. Small amount of grayish green shale in scattered thin irregular beds.
- 8040 Sandstone, white friable, with some shale as 7990-8016.
- 8080 Sandstone, as in core.
- 8100 Shale, medium gray, soft.
- 8110 Sandstone, medium grained, quartzose, subrounded, fair porosity. Shale streaks.
- 8130 Shale, as above, with sandstone streaks.

- 8136 Sandstone, medium light gray, medium grained quartzose, with much glauconitic, slightly porous.
- 8226 No samples.
- 8246 Sandstone, coarse to conglomeratic, quartzose, glauconitic; tight. Fine white clay 8236-40.

8245' Top of Pre-Cambrian

- 8250 Small quartz plus hornblende.
- 8251-59½ Gneiss, dark greenish gray, (5GY4/1), medium grained, hornblende, quartz, minor biotite. Quartz veins slight lineation, and schlichen-sides dip 40°. One vertical fracture.