

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 210

Summary of the Amerada Petroleum Corporation Iverson-Nelson Unit #1
Williams County, North Dakota
Well No. 1231 - Permit No. 1243

by William P. Eastwood
April, 1959

Amerada Petroleum Corporation - Iverson-Nelson Unit #1, Williams County, North Dakota, C NE 1/4 Section 2, T. 155N., R. 96W. 1421.6 feet from NL and 1220 feet from EL. Elevation: K.B. - 2316, G.L. - 2301.

The Amerada Iverson-Nelson #1 was spudded August 19, 1956 total depth of 13,615 feet was reached on February 2, 1957 and the well was plugged back to a depth of 11,933 feet and completed as a producer in the Silurian and Devonian on December 10, 1957.

Initial Production:

Devonian-351 BOPD, 29 BWPD, 12/64" inch choke, TP 1100, GV 176.4 MCF, GOR 504/1, gravity 40.9°. Silurian-162 B condensate PD, 45 BWPD, 1/2 inch choke, TP 450, GV 1164.6 MCF, GOR 7189/1, gravity 50.5°.

Casing Record:

Size	Put in Well	Sacks Cement
20"	65'	5 1/2 yards
13 3/8"	3878'	2775
9 5/8"	11187'	1800
7"	13160'	550

Tests:

DST #1: 11,187-11,574, 3100' water cushion, open 5 hours, SI 30 minutes, strong blow at once, WC to surface in 55 minutes, gas to surface in 1 hour 10 minutes, oil to surface 4 hours 5 minutes, gas flowed at rate of 3,000 MCF; flowed 5.36 BO, 8.4 barrels mud in 35 minutes, gravity 50.6°, reversed out 8.4 BO and GCM, pulled tool and recovered 270' heavily O and GCM. FHP 5953, IFP 2463, FFP 1988, BHP 5157.

DST #2: 11,566-11,632, 3500' WC, open 5 hours, SI 30 minutes, fair to strong blow in 52 minutes, gas to surface in 3 hours, strong gas blow through-out, unloaded 30 BMCWC after tool was closed, reversed out 20 barrels black highly GCWC, 10 barrels black highly GCM, recovered 610' black highly gas cut, less than 1% oil cut mud, 150' black highly GCSW with slight trace oil, FHP 6148, IFP 1816, FFP 2001, BHP 5147.

Perforations:

13,550'-13,577' with 4/feet. Acidized 250 gallons mud cut acid. Swabbed 16 hours, recovered 21 barrels water, 6 barrels acid water, 16 barrels formation water. Reacidized w/1000 gallons mud acid; swabbed 12 hours, recovered 78.5 barrels load water and 6 barrels acid water. Set plug at 13,530; PB 13,525.

13,470'-13,510' w/4/feet. Acidized w/250 gallons. Flowed 7 hours 48/64" choke and 8 hours 32/64" choke. Gas volume 2,957,925 CFPD. TP 600. Perforated

13,456'-13,390', flowed 18 hours, 32/64" choke, TP 700, GV 4,062 MCF. SITP 5200. Acidized w/500 gallons and 180 Neoprene balls through perforation 13,390'-13,456' and 13,470'-13,510'. Flowed 6 BO, 1 BW, 8 hours 1/2" choke, TP 1450, GV 2,723 MCF, corrected gravity 53.9. Set plug 13,350'; PB 13,345'. Set plug 12,920.

Perforated 12,846-12,876' w/4/feet. Acidized w/1000 gallons. Flowed 9 1/2 hours, 5 barrels condensate, 1 BW, 16/64" choke, TP 4275, GV 5,531 MCFPD, corrected gravity 55.7.

Perforated 12,810'-12,846' w/4/feet. Flowed 19 hours, 155 barrels condensate, 21 BW, 3/8" choke. TP 2925, GV 6,498,000 cubic feet/19 hours. GOR 41,922; corrected gravity 53.9. Acidized w/3000 gallons through perforations 12,810'-12,846'. Flowed 16 hours, 241 barrels condensate, 25 BW, 3/8" choke. TP 4100, GV 8,140,000 cubic feet/16 hours. GOR 33,817, corrected gravity 54.2. Set plug 12,794'; PB 12,789.

Perforated 12,696'-12,784 w/4/feet. Attempt to acidize failed.

Drilled plug 12,930'-12,932; washed OH 12,932'-13,345'. Tested through perforation 12,810'-12,876'. Flowed 159 barrels condensate, 12 BW, 13 hours, 3/8" choke, TP 300, GV 5,069 MCF/13 hours. GOR 33,793. SITP 4250, corrected gravity 54.2.

PB 12,670'. Perforated 12,570-12,610 w/4/feet. Acidized w/1000 gallons. Reacidized 3000 gallons. Recovered 1 barrel condensate, 26 BW by thief. Swabbed 7 hours, maximum depth 10,000'; fluid level 10,000'. GV 48 MCF. Set retainer 12,540; squeezed perforation 12,570'-12,610' w/100 sacks.

Perforated 12,380'-12,430' w/4/feet. Attempt to acidize w/1000 gallons and 6500# failed. Perforations 12,304'-12,354' w/4/feet. Attempt to acidize with 6700# TP failed. Perforated 11,990'-12,050' w/4/feet. Acidized w/1000 gallons. Swabbed 20 hours recovered 17 BO, 225 BSW. Set retainer 11,960'. Squeezed formation through perforation 11,990-12,050 w/125 sacks with 50 sacks in formation.

Perforated 11,696'-11,766' w/4/feet. Acidized w/1000 gallons. Swabbed 17 hours. Recovered 30 BO, 37 BW, 19 trips, maximum depth 10,000 gallons. Flowed 10 1/2 hours. Recovered 121 BO, 118 BSW, 24/64" choke. TP 1000, GV 1,117 MCF, GOR 9231, corrected gravity 52.5. Flowed 9 hours 24164" tbg, 15 hours 32/64" choke. Recovered 197 BO, 167 BW, TP 400, GV 2217 MCF, GOR 11,254. Flowed 24 hours, 32/64" choke. Recovered 147 BO, 68 BSW, TP 350, GV 1934 MCF, GOR 13,156. Set retainer 11,686; squeezed 11,696'-11,766' w/100 sacks w/50 sacks in formation.

DO 12,028'. Perforated 11,960'-11,990' w/4/feet. Acidized w/1000 gallons. Swabbed load water, acid water, and drilling mud in 11 hours. Attempt to run J-4 Tbg gun blocked at 10,420. Killed well, DO to 12,540', PB to 12,017'.

Perforated 11,990'-12,011' w/4/feet. Acidized w/1000 gallons. Swabbed 23 hours, recovered 10 BO, 213 BW. Set retainer 11,940'. Squeezed 11,960'-12,011' w/100 sacks w/77 sacks in formation.

Perforated 11,628'-11,680' w/4/feet. Acidized w/1000 gallons. Flowed 15 hours, recovered 155 BO, 51 BW, 16/64" choke. TP 700, GU 1,096 MCF, GOR 7,080, corrected gravity 53.1. Reacidized w/5000 gallons. Flowed 159 BO, 17 BW. Flowed 8 hours 28/64" choke, TP 400 and 16 hours 20/64" choke, TP 550. GV 1316 MCF, GOR 8278. Set plug 11,620, PB 11,618.

Perforated 11,566'-11,616' w/4/feet. Acidized w/1000 gallons. Flowed 68 BO, 13.8 BW. Flowed 2 hours 24/64" choke, TP 550 and 9 hours 20/64" choke, TP 550. GV 582 MCF, GOR 8557, corrected gravity 54.5. PB 11,545'.

Perforated 11,441'-11,526' w/4/feet. Acidized w/1000 gallons. Flowed 257 barrels condensate, 0 BW, 23 hours, various sized chokes. GV 2436 MCF, GOR 9479, corrected gravity 58.5. SITP 3800. Previous plug found at 11,609'. Set bridge plug 11,550', PB 11,545'. Set plug 10,800', PB 10,790'.

Perforated 10,682'-10,708' w/4/feet. Acidized w/1000 gallons. Swabbed 3 hours, recovered 0.84 BW. Set retainer 10,652', squeezed perforation w/297 sacks.

Perforated 10,390'-10,460' w/4/feet. Acidized w/1000 gallons. Recovered 71 BO, 13 BSW, swabbed 11 hours. Reacidized w/5000 gallons, recovered 234 BO, 6 BW. Flowed 11 1/2 hours, 20/64" choke. TP 600, GV 179 MCF, GOR 765, corrected gravity 41.4. Perforated 10,360'-10,380' and 10,279'-10,350' w/4/feet. Acidized 10,279'-10,350', 10,360'-10,380', and 10,390'-10,460' w/1000 gallons. Recovered 57 BO, 4 BW, flowed 3 hours, 20/64" choke, TP 800, GV 44 MCF, GOR 772. Reacidized w/1000 gallons gel and 5000 gallons acid. Recovered 188 BO, 10 BW, flowed 1 1/2 hours, 16/64" choke, TP 1500; 1 hour. 12/64" choke, TP 1600, 8 hours 10/64" choke, TP 1675. GV 340 MCFPD, GOR 792, corrected gravity 42.8.

Set plug 19,248', PB 10,243'. Perforated 10,100' w/4/feet. Acidized w/500 gallons. Swabbed dry. Squeezed with 185 sacks. Perforated 10,145'-10,206' w/4/feet. Acidized w/5000 gallons. DO plug to 10,473'. Acidized w/1000 gallons perforations 10,390'-10,460'; 10,360'-10,380'; 10,279'-10,350'; 10,145'-10,206'. Recovered 190 BO, 18.7 BW. Flowed 5 hours 12/64" choke, TP 1300; 6 hours 10/64" choke, TP 1425. GV 152 MCF, GOR 800, corrected gravity 42.6, SI 13 hours, TP 1675.

DO bridge plug and re-perforated 11,696'-11,766' w/4/feet. Set packer at 11,409'. Acidified perforations 11,696'-11,766'; 11,628'-11,680', 11,566'-11,616', and 11,441'-11,526' w/2000 gallons. Flowed 5 hours, 30 barrels condensate, 1/2 BW, 10/64" choke, TP 3100, GV 1363 MCFPD, GOR 9460, corrected gravity, 56.1 (Silurian completion).

Acidized perforations 10,145'-10,206', 10,279'-10,350', 10,360'-10,380', and 10,390'-10,460' w/1000 gallons. Flowed 161 BO, 18 BW, 9 hours, various sized chokes. GOR 839, corrected gravity 41.5. (Devonian completion)

Devonian Potential:

258 BO, OBW, flowed 24 hours, 12/64" choke, TP 1600. Casing 1100, GV 226 MCF, GOR 873, corrected gravity 42.8.

Silurian Potential:

166 barrels condensate, 2 BW, flowed 20 hours, 12/64" choke, TP 2800, GV 1806 MCFPD, GOR 9066, corrected gravity 56.1, SI 4 hours, TP 3800.

FORMATION TOPS

Cretaceous System	
Greenhorn formation	3888
Mowry formation	4192
Basal Cretisis	4595
Jurassic System	
Piper limestone	5650
Triassic	
Spearfish formation	5935
Permo-Penn.	
	62%
Mississippian System	
Big Snowy Group	6775
Kibbey limestone	7347
Charles formation	7500
Base of Last Charles Salt	8136
Midale Beds	8311
Nesson Pay Equivalent	8332
Englewood formation	9623
Devonian System	
Lyleton formation	9731
Nisku equivalent	9924
Duperow formation	10,014
Souris River formation	10,389
Dawson Bay formation	10,722
Prairie evaporite formation	10,851
Winnipegosis formation	11,120
Ashern formation	11,403
Silurian System	
	11,443
Ordovician System	
Stony Mountain formation	
Upper	12,487
Lower	12,614
Red River formation	12,672
Winnipeg formation	
Shale	13,228
Sand	13,378
Cambrian System	
Deadwood formation	13,529
Precambrian System	
	13,589

3500-30	Abundant greenish gray shale, common dark gray shale, common lignite rare medium gray shale; rare light brownish gray shale; very rare pyrite nodules and mollusk fragments. Very rare red-brown siltstone, rare grayish red purple medium grained sandstone.
3530-60	Shale, siltstone and mollusk fragments as above, rare lignite and rare medium gray medium grained siltstone.
3560-90	As above with very rare limy coarse-grained sandstone.
3590-3620	Greenish gray shale, lignite and mollusk fragments m as above.
3620-50	As above with common dark gray to medium gray shale.
3650-80	Shale, lignite and mollusk fragments as above.
3680-3710	As above rare lignite.
3710-40	As above.

3740-70 As above.
 3770-3800 As above.
 3800-30 As above; rare very dusky purple to black shale.
 3830-60 Medium gray greenish gray and dark gray shale as above.

 3888 Top of Greenhorn.
 3860-92 Very abundant dark gray shale, common medium gray shale rare medium gray to white limestone.
 3892-8139 Missing.
 8139-45 Very abundant medium light gray limy anhydrite; common white anhydrite, common red shale and siltstone, rare pale yellowish-brown to dark yellowish brown limestone common dark gray shale (cave?) and rare coarse-grained quartz siltstone.
 8145-50 Anhydrite, red and black shale, and yellow-brown limestone as above with rare medium-grained limestone.
 8150-55 Anhydrite, rare limestone, and shale cavings as above.
 8155-60 As above.
 8160-65 Anhydrite and cavings as above.
 8165-70 Abundant dark yellow-brown to moderate yellow-brown medium crystalline and granular limestone, common medium light gray and bluish gray to white anhydrite as above. Red and black shale cavings.
 8170-75 Abundant anhydrite as above, less common limestone as above. Common red and black shale.
 8175-80 Abundant anhydrite as above; common dark gray to dark yellowish brown granular limestone, red and black shale as above.
 8180-85 Abundant limestone as above, medium crystalline and granular; common very light gray to white, fine-grained, earthy anhydritic limestone; common light gray to medium gray anhydrite; rare red and black shale.
 8185-90 Limestone as above, less common anhydrite as above, red and black shale as above.
 8190-95 Abundant dark yellowish-brown to pale yellowish-brown, fine crystalline and slightly granular limestone, small vugs associated with the granular fraction; common very pale yellowish-brown to white earthy limestone which also has small vugs; less common dark gray fine-crystalline limestone; common red shale and rare black shale (cave?); rare medium gray to bluish gray and bluish white anhydrite.
 8195-8200 Dark gray and yellowish-brown vugular limestone as above; rare anhydrite as above; red and black shale cavings.
 8200-05 Abundant very pale yellowish brown to white earthy limestone as above; common dark gray fine grained granular limestone as above; common pale brown to moderate yellowish brown limestone as above; rare grayish orange anhydritic limestone or dolomitic limestone; no anhydrite seen; rare green, red and black shale.
 8205-10 Limestone as above; rare bluish white anhydrite; shale as above.
 8210-15 As above; very rare bluish white and white anhydrite.
 8215-20 Limestone as above but rare dark gray limestone, rare anhydrite and shale as above.
 8220-25 Abundant pale yellowish-brown to very pale orange earthy limestone with small anhydrite inclusions; common dusky yellowish-brown to pale brown fine to medium crystalline limestone rarely sucrosic and vuggy; common bluish white anhydrite; rare dark gray limestone; red and black shale cavings.

8225-30 As above; sample badly caved.

8230-35 Badly caved; abundant bluish white to pale blue anhydrite.

8235-40 Abundant pale yellowish-brown to very pale orange earthy limestone; common dusky yellowish-brown to pale brown fine crystalline limestone with black carbonaceous material in fine laminae, no glow; common, bluish white anhydrite as above. Red and black shale savings.

8240-45 Abundant pale yellowish-brown limestone as above, common dusky yellowish-brown to pale brown fine to medium crystalline rarely granular limestone; common bluish-white anhydrite; red and black shale cavings.

8245-50 As above with granular moderate yellowish brown limestone.

8250-55 Abundant pale yellowish brown to very pale orange and white earthy limestone; common moderate yellowish-brown and pale brown medium crystalline and granular limestone. Rare anhydrite, as above.

8255-60 As above with rare dusky yellowish-brown fine crystalline limestone.

8260-65 Abundant very pale orange to white earthy limestone; common pale brown to moderate yellowish-brown fine crystalline limestone.

8265-70 Abundant pale brown fine crystalline and granular (pseudo-oolitic) limestone; common earthy limestone as above; common dark gray to dusky yellowish-brown fine crystalline limestone. Rare pieces of the white limestone have black carbonaceous (?) material in hairlike fractures.

8270-75 As above.

8275-80 As above.

8280-85 As above with rare dark gray to dusky yellowish-brown limestone.

8285-90 Abundant pale brown to moderate yellowish-brown granular limestone; common white earthy limestone as above; common dark gray to dusky yellowish-brown fine-crystalline and granular limestone.

8290-95 Missing.

8295-8300 Pale brown and dusky yellowish-brown limestone as above; rare earthy limestone as above.

8300-05 Abundant moderate yellowish brown fine-medium crystalline limestone; common dark gray and pale brown fine crystalline limestone; rare white earthy limestone. Red and black shale cavings.

8305-10 Abundant dusky yellowish-brown and dark gray to fine crystalline limestone with inclusions of moderate yellowish-brown to pale brown coarse crystalline calcite; rare pale brown medium, crystalline limestone. Red and black shale cavings. Rare white earthy limestone.

8311 Top of Midale.

8310-15 Abundant dark gray to dusky yellowish-brown limestone as above; common pale brown to moderate yellowish-brown limestone as above; rare very pale yellowish-brown earthy limestone. Rare white anhydrite.

8315-20 As above.

8320-25 Missing.

8325-30 Abundant dark gray to dusky yellowish-brown limestone as above; common pale brown to moderate yellowish-brown medium crystalline slightly granular limestone; very rare white earthy limestone.

8333 Top of Nesson.

8330-35 Abundant pale yellowish-brown to moderate yellowish-brown fine crystalline and granular limestone; common dark gray limestone as above, rare earthy limestone as above.

8335-40 As above.

8340-45 Abundant dark gray to dusky yellowish-brown fine crystalline limestone; common very pale orange to white earthy limestone; common pale brown to pale yellowish-brown fine to medium crystalline limestone.

8345-50 As above.

8350-55 Abundant very pale yellowish-brown to white earthy limestone with white anhydrite inclusions and black carbonaceous material in fine hairlike fractures; common dark gray limestone as above; rare pale brown limestone as above.

8355-60 As above.

8360-65 As above, pale brown limestone has small vugs lined with calcite.

8365-70 Abundant white, earthy anhydritic (?) limestone as above; common pale brown oolitic limestone, common pale brown fine-crystalline limestone; rare dark gray to dusky yellowish-brown limestone as above.

8370-75 As above; rare white anhydrite.

8375-80 As above, with rare fragmental yellowish-brown limestone, no oolitic limestone seen.

8380-85 Common white limestone as above; common very pale yellowish-brown fine crystalline limestone, rest as above; very rare oolitic pale brown limestone.

8385-90 Abundant dark gray to dusky yellowish-brown limestone as above; common white limestone as above; common fragmental and oolitic pale brown limestone.

8390-95 As above.

8395-8400 As above with less common white limestone.

8400-05 As above, no oolitic limestone seen.

8405-10 Abundant dark gray to dusky yellowish-brown fine crystalline limestone; common very pale yellowish-brown to white earthy limestone; rare pale brown to moderate yellowish-brown fragmental limestone.

8410-15 As above.

8415-20 As above with common fragmental yellowish-brown limestone and rare oolitic limestone.

8420-25 As above.

8425-30 Abundant pale brown to moderate yellowish-brown fragmental and oolitic limestone; common dark gray to dusky yellowish-brown limestone as above; common earthy limestone as above.

8430-35 As above; rare dark gray limestone; sample badly caved.

8435-40 Fragmental, oolitic, and earthy limestone as above. Abundant black shale cavings; rare olive gray shale (caving?).

8440-45 Limestone as above, badly caved.

8445-50 Abundant pale yellowish-brown to white earthy limestone; common pale brown to moderate yellowish brown fragmental limestone and rare white to bluish white anhydrite. Red and black shale cavings.

8465-70 As above.

8470-75 Granular and fragmental limestone as above; common dark gray to dusky yellowish-brown slightly dolomitic fine crystalline to fragmental limestone; rare very pale orange to white granular limestone.

8475-80 As above, rare earthy limestone as above.
 8480-85 As above.
 8485-90 Abundant pale brown to moderate yellowish-brown fragmental and granular limestone; common dark gray to dusky yellowish-brown fine-crystalline limestone; common very pale orange to white earthy limestone.
 8490-95 As above.
 8495-8500 Abundant earthy limestone as above common pale brown and dusky yellowish-brown limestone as above. Badly caved.
 8500-05 Abundant pale yellowish brown to white granular and earthy limestone; common dusky yellowish brown to pale brown fine-crystalline to fragmental limestone.
 8505-10 Very abundant pale yellowish brown to white limestone as above; rare dusky yellowish-brown to pale brown limestone as above.
 8510-15 As above.
 8515-20 As above.
 8520-25 As above.
 8525-30 As above.
 8530-35 As above
 8535-40 As above.
 8540-45 As above.
 8545-50 As above; rare pale yellowish-brown granular dolomite.
 8550-55 Limestone, as above.
 8555-60 Abundant earthy limestone as above; common pale brown and dusky yellowish-brown, fragmental limestone; rare pale yellowish-brown granular dolomitic limestone.
 8560-65 As above.
 8565-70 As above.
 8570-75 As above; no granular dolomitic limestone seen.
 8575-80 As above.
 8580-85 As above.
 8585-90 As above.
 8590-95 As above; rare masses of pale yellowish-brown calcite crystals.
 8595-8600 As above (?) Very small amount of sample.
 8600-05 Abundant pale brown to white fragmental and earthy limestone; rare dusky yellowish-brown fine crystalline and fragmental limestone.
 8605-10 As above.
 8610-15 As above.
 8615-20 As above.
 8620-25 As above; rare white anhydrite.
 8625-30 As above; rare pale yellowish-brown pseudo-oolitic limestone.
 8630-35 As above, rare white anhydrite.
 8635-40 Abundant dusky yellowish-brown fine crystalline and fragmental limestone; common very pale yellowish-brown to white earthy limestone.
 8640-45 As above rare fragmental limestone, mostly fine-crystalline.
 8645-50 As above.
 8650-55 As above.
 8655-60 As above.
 8660-65 Abundant pale yellowish-brown to white earthy limestone; common pale brown fragmental and fine crystalline limestone.
 8665-70 As above.
 8670-75 Very abundant earthy limestone; rare fragmental limestone as above.

8675-80 As above.
 8680-85 As above.
 8685-90 As above.
 8690-95 Very abundant very pale orange to white earthy limestone; rare dusky yellowish-brown fine crystalline limestone.
 8695-8700 As above.
 8700-05 As above.
 8705-10 As above.
 8710-15 As above, rare granular very pale orange limestone.
 8715-20 As above.
 8720-25 As above. Badly caved.
 8725-30 Earthy limestone as above; common dark yellowish-brown fine-crystalline and fragmental limestone.
 8730-35 Very abundant earthy limestone as above; rare fragmental limestone as above.
 8735-40 Earthy limestone as above; common fragmental limestone as above; rare dusky yellowish-brown fine crystalline limestone. Badly caved.
 8740-45 Common fragmental limestone as above; common earthy limestone as above; rare fine crystalline limestone as above. Badly caved.
 8745-8750 As above.
 8750-55 Abundant earthy limestone as above, rest as above.
 8755-60 Very abundant earthy limestone as above; rare fine crystalline limestone as above.
 8760-65 As above.
 8765-70 Abundant white earthy limestone as above; rare pale yellow brown fragmental limestone; rare pale yellowish brown chert.
 8770-75 Chert and earthy limestone as above; common dusky yellowish-brown fine crystalline limestone.
 8775-80 As above with pale yellowish-brown granular limestone and moderate yellowish-brown limy dolomite.
 8780-85 Abundant pale to dark yellowish-brown fine-crystalline and finely granular limestone, common dusky yellowish-brown fine-crystalline limestone, chert and earthy limestone common.
 8785-90 As above.
 8790-95 As above; rare dusky yellowish-brown limestone.
 8795-8800 Abundant earthy limestone as above; common dark yellowish-brown and dusky yellowish-brown limestone as above, rare chert.
 8800-05 As above.
 8805-10 Very abundant earthy limestone as above; less common yellowish-brown limestone as above; no chert seen.
 8810-15 As above.
 8815-20 As above.
 8820-25 As above, rare pale yellowish-brown chert.
 8825-30 Common pale yellowish-brown granular limestone; common dusky yellowish-brown fine-crystalline limestone; common white earthy limestone; rare pale yellowish brown chert. Badly caved.
 8830-35 As above. Badly caved.
 8835-40 Abundant dusky yellowish-brown fragmental limy dolomite; common pale yellowish brown fragmental limestone; rare white earthy limestone; no chert seen.
 8840-45 Abundant dusky yellowish-brown to pale yellowish-brown to fine to medium crystalline limy dolomite; rare limestone as above.
 8845-50 Limy dolomite as above medium-crystalline and fragmental.

8850-55 As above, with common white earthy limestone.

8855-60 As above with rare pale yellowish-brown fragmental limestone.

8860-65 Limestone and limy dolomite as above.

8865-70 Abundant white earthy limestone; common yellowish-brown fragmental limestone; rare limy dolomite as above; rare pale yellowish-brown chert.

8870-75 Abundant dark yellowish-brown medium crystalline limy dolomite; common pale yellowish-brown sucrosic vugular limy dolomite; rare pale yellowish-brown granular limy dolomite; rare white earthy limestone.

8875-80 As above with rare pale brown granular (silty?) limestone.

8880-85 Abundant granular limy dolomite as above; common dusky yellowish-brown to dark yellowish-brown limy dolomite as above; less common vugular and sucrosic limy dolomite as above; rare earthy white limestone.

8885-90 Limy dolomite as above.

8890-95 As above, rare white fragmental dolomite.

8895-8900 Limy dolomite, as above.

8900-05 As above; rare white earthy limestone.

8905-10 As above; badly caved.

8910-15 As above with rare oolitic limestone and rare very light gray granular limestone. Sample badly caved.

8915-20 Abundant dark gray to dusky yellowish-brown fine crystalline limestone; rare dark yellowish-brown granular dolomite, rare pale yellowish-brown medium-crystalline dolomite; rare white limestone.

8920-25 As above.

8925-30 Very abundant fine-crystalline limestone as above, very rare pale yellowish-brown fine-crystalline limestone.

8930-40 Dark-colored limestone as above; rare white earthy limestone.

8940-50 Abundant white earthy limestone as above; common fine-crystalline as above; very rare pale brown limestone.

8950-60 As above.

8960-70 Abundant pale brown to white earthy limestone; common fine-crystalline limestone as above, rare pale yellowish-brown sucrosic limestone.

8970-80 Abundant earthy limestone as above; common sucrosic limestone as above; common fine crystalline limestone as above; rare pale brown chert.

8980-90 Common pale brown fine-crystalline to finely granular limestone; sucrosic limestone and fine crystalline as above; common earthy limestone as above. No chert seen.

8990-9000 Abundant pale brown crystalline limestone as above; common earthy limestone as above rare sucrosic limestone and dark-colored fine crystalline limestone.

9000-10 Abundant very pale brown to medium light gray fine-crystalline limestone, common white earthy limestone; common dark yellowish-brown limestone; rest as above. Badly caved. Lost circular material.

9010-20 As above. Badly caved.

9020-30 As above. Badly caved, much lost circular material.

9030-40 As above. Badly caved.

9040-50 As above.

9050-60 As above.

9060-70 As above; no dark yellowish brown limestone seen.
 9070-80 As above.
 9080-90 As above.
 9090-9100 As above.
 9100-10 Abundant very pale yellowish-brown to very light gray and white finely granular (silty?) limestone, common dusky yellowish-brown limestone as above and earthy white limestone as above.
 9110-20 As above.
 9120-30 Finely granular limestone as above; rare dusky yellowish-brown limestone as above and rare white limestone as above.
 9130-40 Very abundant finely granular limestone as above.
 9140-50 As above with common dark gray fine-crystalline limestone and rare white earthy limestone.
 9150-60 As above; badly caved.
 9160-70 Limestone, as above.
 9170-80 As above.
 9180-90 As above.
 9190-9200 As above.
 9200-10 Abundant very light gray finely granular limestone as above; common dark gray to dusky yellowish-brown fine-crystalline limestone as above.
 9210-20 As above.
 9220-30 As above.
 9230-40 As above.
 9240-50 As above. Badly caved(?) black and red shale.
 9250-60 Abundant dark gray to dusky yellowish-brown limestone as above; common finely granular limestone as above.
 9260-70 As above.
 9270-80 Abundant granular limestone as above; common fine-crystalline limestone as above.
 9280-90 As above.
 9290-9300 As above.
 9300-10 Abundant granular limestone as above; common dark yellowish-brown very fine-crystalline limestone; common dark gray and dusky yellowish-brown limestone is above.
 9310-20 As above.
 9320-30 As above.
 9330-40 As above.
 9340-60 As above.
 9350-60 As above.
 9360-70 As above; rare dark yellowish-brown limestone.
 9370-80 As above.
 9380-90 As above.
 9390-9400 As above, no dark yellowish-brown limestone seen.
 9400-10 As above.
 9410-20 As above.
 9420-30 As above.
 9430-40 As above.
 9440-50 As above.
 9450-60 As above with rare medium-light gray fine-grained limestone.
 9460-70 As above.
 9470-80 Abundant dark gray to dusky yellowish-brown fine crystalline limestone; common very light gray to white finely granular limestone.

9480-90 As above with rare pale brown granular limestone.
 9490-9500 As above.
 9500-10 As above; no pale brown granular limestone seen.
 9510-20 As above.
 9520-30 As above.
 9530-40 As above, common dark brown fine-grained limestone.
 9540-50 As above.
 9550-60 As above.
 9560-70 As above.
 9570-80 As above.
 9580-90 As above; rare pale brown granular limestone.
 9590-9600 Very abundant dark gray to dusky yellowish-brown fine-crystalline;
 less common very light gray to white granular limestone.
 9600-10 As above.
 9610-20 As above.

 9623 Top of Englewood
 9620-30 As above; rare very pale brown granular limestone.
 9630-40 As above; rare pieces of black shale.
 9640-50 Abundant black shale; common very light gray to white finely
 granular limestone; common dusky yellowish-brown limestone as
 above.
 9650-60 Very abundant black shale; rare limestone as above; very rare
 very light gray very fine grained silty and slightly calcareous
 sandstone.
 9660-70 Shale, limestone, and very rare sandstone as above.
 9670-80 As above.
 9680-90 As above with rare medium gray limestone.
 9690-9700 Shale as above; common fine to medium grained sandstone as above,
 common white limestone as above; rare medium gray limestone as
 above.
 9700-10 As above with red shale which may be cavings.
 9710-20 As above.
 9720-30 As above.

 9731 Top of Lyleton
 9730-40 Very abundant black shale as above; very rare sandstone and
 limestone as above; very rare pyrite.
 9740-50 Shale, limestone, and sandstone as above. One small piece of green
 shale.
 9750-60 Black shale as above; common sandstone as above; rare limestone
 as above; very rare green shale.
 9760-70 As above with rare very pale pink dolomitic, friable, sandstone,
 very rare pyrite.
 9770-80 Black shale as above; green shale as above; sandstone as above;
 rare very light pink medium-crystalline dolomite.
 9780-90 As above.
 9790-9800 Black shale as above; green shale as above; common very pale
 orange to very pale pink, fine to medium-grained dolomite; rare
 limestone as above.
 9800-10 Abundant dolomite as above; common black shale as above; rare dark
 to dusky yellowish-brown limestone.
 9810-20 As above.
 9820-30 Very abundant dolomite as above; rare limestone and shale as
 above.

9830-40 As above; very rare medium gray and medium-grained sandstone.
 9840-50 Dolomite, shale, and very rare limestone as above.
 9850-60 As above.
 9860-70 As above with common very light gray to white earthy limestone.
 9870-80 As above.
 9880-90 As above with rare medium gray limestone.
 9890-9900 Dolomite, shale and limestone as above. Badly caved.
 9900-10 Dolomite as above; common white limestone.
 9910-20 As above.

9924 Top of Nisku Equivalent.
 9920-30 As above.
 9930-40 Common dark yellowish-brown fine-crystalline limestone as above, common very pale yellowish-brown finely granular limestone; common dolomite and shale as above.
 9940-50 Abundant limestone as above; common dolomite and shale as above.
 9950-60 Missing.
 9960-70 Missing.
 9970-80 Limestone, dolomite and shale as above.
 9980-90 Abundant very pale yellowish-brown to white finely granular limestone; common dark gray to dusky yellowish brown to medium-crystalline limestone; black shale and dolomite cavings.
 9990-10,000 As above with rare pale brown medium crystalline dolomite.
 10,000-05 Limestone and dolomite as above; very rare white and pale brown oolitic limestone.
 10,005-10 As above with common medium gray fine crystalline limestone.

10,0014 Top of Duperow.
 10,010-15 Common white earthy limestone as above; common pale yellowish-brown medium crystalline limestone; common dusky yellowish-brown fine crystalline limestone.
 10,015-20 As above with rare pale-yellowish-brown medium-crystalline dolomite and rare yellowish brown granular limestone.
 10,020-25 As above.
 10,025-30 Abundant white limestone as above; common dark gray to dusky yellowish-brown limestone as above; rare pale yellowish-brown granular limestone; rare pale brown fine-crystalline limestone; very rare pale yellowish-brown fine-crystalline dolomite.
 10,030-35 As above.
 10,035-40 As above.
 10,040-45 As above.
 10,045-50 Limestone, as above.
 10,050-55 Abundant white limestone as above; common dusky yellowish-brown to dark yellowish-brown limestone as above, black shale cavings.
 10,055-60 As above with rare pale yellowish-brown fine-crystalline limestone; white limestone slightly iron-stained.
 10,060-65 Abundant pale yellowish-brown limestone; common dusky yellowish-brown dolomitic limestone; common very pale yellowish-brown limestone; rare anhydrite.
 10,065-70 Abundant dusky yellowish-brown fine-crystalline limestone; common very pale yellowish-brown earthy limestone; rare white anhydrite; rare pale brown granular limestone.
 10,070-75 As above.

10,075-80 As above, rare fragmental quartz.
 10,080-85 As above; very rare anhydrite and very rare quartz.
 10,085-90 As above.
 10,090-95 Abundant dusky yellowish-brown limestone as above; anhydrite and quartz as above.
 10,095-10,100 As above.
 10,100-05 As above; no quartz seen.
 10,105-10 Limestone and anhydrite as above; rare pale brown granular limestone with white anhydrite crystals.
 10,110-15 Dusky yellowish-brown limestone as above; common pale brown granular limestone; common white anhydrite.
 10,115-20 As above with rare dusky yellowish-brown oolitic limestone.
 10,120-25 Limestone, as above; rare white anhydrite; no oolitic limestone seen.
 10,125-30 As above.
 10,130-35 Abundant dusky yellowish-brown to dark yellowish-brown fine-crystalline limestone; common pale yellowish-brown to white earthy limestone; rare white to very pale-brown anhydrite.
 10,135-40 As above with rare pale brown granular limestone and common pale yellowish-brown earthy limestone.
 10,140-45 Abundant dark yellowish-brown limestone; common pale yellowish-brown to white earthy limestone; less common light bluish gray limy anhydrite; rare white anhydrite; very rare dusky yellowish-brown limestone.
 10,145-50 Common pale yellowish-brown finely granular limestone with rare white anhydrite inclusions; common dusky yellowish-brown limestone; rare anhydrite as above.
 10,150-55 As above.
 10,155-60 Common dusky yellowish-brown to dark yellowish-brown to white earthy limestone; rare pale brown granular limestone; rare anhydrite as above.
 10,160-65 As above.
 10,165-70 As above.
 10,170-75 As above.
 10,175-80 Abundant pale yellowish-brown to white earthy limestone; common pale yellowish-brown granular limestone; less common dusky yellowish-brown limestone; rare light bluish gray and white anhydrite.
 10,180-85 As above.
 10,185-90 As above.
 10,190-95 As above, dusky yellowish-brown limestone more common.
 10,195-10,200 As above with rare pale-brown granular limestone.
 10,200-05 Abundant dusky yellowish-brown fine-crystalline limestone; common pale yellowish-brown to white earthy limestone; rare pale brown granular limestone; rare anhydrite.
 10,205-10 As above with rare pale yellowish-brown limestone with white anhydrite.
 10,210-15 As above.
 10,215-20 As above, pale yellowish-brown limestone more common; rare pale yellowish-brown oolitic limestone.
 10,220-25 As above.
 10,225-30 As above.
 10,230-35 As above.
 10,235-40 Limestone and anhydrite as above with rare very pale yellow brown laminated light gray dolomite.

10,240-45 Limestone and anhydrite as above.
 12,245-50 Very abundant dusky yellowish-brown limestone as above; common earthy limestone as above rare light bluish gray anhydrite as above.
 10,250-55 As above.
 10,255-60 As above.
 10,260-65 As above with rare pale brown granular limestone and very rare pyrite.
 10,265-70 As above with rare pale brown to pale yellowish-brown oolitic limestone.
 10,270-75 As above, no oolitic limestone seen.
 10,275-90 Missing.
 10,290-95 Limestone as above; abundant red and black shale cavings(?).
 10,295-10,300 As above.

Core #1

10,279-85 Limestone, dark yellowish-brown, granular, four porosity; good glow.
 10,285-90 Limestone, dusky yellowish-brown, fine crystalline low porosity; no glow.
 10,290-95 Limestone as above; bituminous material in small pinpoint vugs.
 10,295-10,300 Limestone, dark yellowish-brown, fine-crystalline, low porosity, no glow.
 10,300-05 Limestone, dusky yellowish-brown, fine-crystalline, low porosity, no glow; with crystalline gypsum.
 10,305-10 Limestone, as above; slightly dolomitic; slightly granular; no gypsum.
 10,310-15 Limestone, as above.
 10,315-20 Limestone, pale yellowish-brown, granular, faint glow, sub-sucrosic, small vugs filled with clear gypsum.
 10,320-25 Limestone as above with carbonaceous residue; no glow.
 10,325-30 Limestone as above with carbonaceous residue; faint glow.
 10,330-35 Limestone, pale brown, sucrosic, no glow.
 10,335-40 Limestone, as above, oil in interstices; good glow.

Core #2

10,340-45 Limestone, dark brown, granular, much carbonaceous material, good glow, many small open vugs.
 10,345-50 Limestone, dusky yellowish-brown, fine-crystalline, tight; and yellowish-brown to white anhydrite.
 10,350-55 Anhydrite, as above.
 10,355-60 Limestone, pale brown, fine-crystalline, tight with brachiopod fossils.
 10,360-65 Limestone as above; pinpoint porosity.
 10,365-70 Limestone as above; bituminous material in small veins, no glow.
 10,370-75 Anhydrite, pale brown to white.
 10,375-80 Pale brown anhydrite as above with pale yellowish-brown finely granular limestone.
 10,380-85 Limestone, dusky yellowish-brown, sublithographic.

10,389 Top of Souris River.
 10,385-90 Limestone, as above.
 10,390-93 Limestone as above with dusky yellowish-brown fine-crystalline stylitic limestone.

Core #3

10,393-10,400 Limestone, dark yellowish-brown, fine crystalline with small linear algae (?) and with white anhydrite.
10,400-05 Limestone, as above, slightly granular; fair glow.
10,405-10 Limestone as above black color caused by oil; good glow.
10,410-15 Limestone as above, pale brown in color, bituminous material in scattered small pores and seams; small pyrite crystal. Fair glow.
10,415-20 Limestone, pale brown, fine-crystalline, tight, no glow.
10,420-25 Limestone, pale brown, fine-crystalline, tight.

Core #4

10,425-30 Limestone as above and pale brown limy anhydrite.
10,430-35 Limestone, as above.
10,435-40 Limestone, as above with masses of calcite crystals. Brachiopod fossil.
10,440-50 Dolomite, dusky yellowish-brown fine-crystalline.
10,450-55 Limestone, dark gray to dusky yellowish-brown, fine-crystalline, tight, carbonaceous material in small seams; no glow.
10,455-60 Limestone, dusky yellowish-brown, as above.
10,460-65 Siltstone, grayish olive, limy.
10,465-70 As above.
10,470-75 Anhydrite, yellowish-brown, limy.
10,475-80 As above.
10,480-83 As above.

Samples

10,480-85 Abundant dusky yellowish-brown fine-crystalline limestone; common pale brown granular limestone; rare yellowish-brown to white anhydrite.
10,485-90 As above with rare grayish olive shale.
10,490-95 Limestone and anhydrite as above with rare very light gray earthy limestone.
10,495-10,500 Limestone and anhydrite as above.
10,500-05 Abundant dusky yellowish-brown limestone as above; common granular limestone as above; common earthy limestone as above rare anhydrite; rare pale brown finely granular dolomite.
10,505-10 Common dusky yellowish-brown limestone as above; common pale brown granular limestone and dolomite as above, rare earthy limestone as above; rare anhydrite.
10,510-15 Abundant pale brown dolomite as above; rest as above.
10,515-20 As above; earthy limestone more common.
10,520-30 Abundant dusky yellowish-brown limestone as above; rare pale brown dolomite as above; rare earthy limestone as above.
10,530-40 As above with anhydrite.
10,540-50 Dusky yellowish-brown limestone as above; pale brown and earthy limestone as above.
10,550-60 As above.
10,560-70 Limestone as above with light gray shaly dolomite and pale brown fine-crystalline dolomitic limestone.
10,570-80 As above.
10,580-90 As above.
10,590-10,610 Missing.

10,610-20 As above with common dark gray fine-crystalline dolomite.

10,620-30 Dusky yellowish-brown limestone as above; common light gray earthy limestone; rare light gray dolomitic limestone.

10,630-40 Dusky limestone as above; common light gray finely granular dolomitic limestone; rare very light gray to white anhydritic earthy limestone; rare dark yellowish-brown anhydritic limestone.

10,640-50 As above with very rare very pale orange to white oolitic limestone.

10,650-60 Abundant dolomitic limestone as above; common dusky yellowish-brown limestone as above; rare earthy limestone as above.

10,660-70 As above.

10,670-80 As above with rare oolitic limestone as above and rare white anhydrite.

10,680-90 As above.

10,690-10,700 Dusky yellowish-brown limestone as above; common dolomitic limestone as above; rare earthy limestone as above.

10,700-10 Abundant dusky limestone as above; rare dolomitic limestone as above; common very pale orange very fine grained slightly limy dolomite.

Core #5

10,710-15 Limestone, dark gray to black, fine crystalline, slight porosity, no glow.

10,715-20 Limestone as above dusky yellowish-brown.

10,722 Top of Dawson Bay

10,720-25 As above.

10,725-30 Limestone, dusky yellowish-brown, very fine crystalline, very tight.

10,730-35 Limestone as above with rare yellowish-brown calcite crystals.

10,735-40 As above.

10,740-45 Limestone, dark yellowish-brown, fine to medium crystalline; much carbonaceous residue, no fluorescence.

10,745-50 Limestone with carbonaceous residue as above; rare clear gypsum crystals.

10,750-55 Dolomite, dark yellowish-brown, medium-crystalline, slightly granular.

10,755-60 Dolomite as above, slightly limy.

10,760-65 Dolomite as above with scattered calcite crystals. Good secondary porosity.

10,765-68 Dolomite as above; gypsum and anhydrite inclusions.

Samples

10,770-80 Common dusky yellowish-brown fine-crystalline limestone; common medium granular limy dolomite; rare white earthy limestone; rare very pale orange dolomite. Sample badly caved.

10,780-90 Abundant dusky limestone as above; common granular limy dolomite as above; rare pale orange dolomite as above; red and black shale cavings

10,790-10,800 Abundant granular dolomite as above, very common dusky limestone as above; rest as above.

10,800-10 Abundant very light gray to white finely granular to earthy limestone; common dusky limestone and granular dolomite as above.

10,810-20 As above.
 10,820-30 Missing.
 10,830-40 Abundant very light gray limestone and dusky yellowish-brown limestone as above; rare granular dolomite as above.
 10,840-50 As above.

 10,851 Top of Prairie evaporite.
 10,850-60 As above with rare yellowish-brown oolitic limestone and rare anhydrite.
 10,850-11,110 Missing.
 11,110-20 Pale yellowish-brown to very pale orange fine crystalline dolomite, contains areas of secondary porosity; very rare dusky yellowish brown dolomite.

 11,120 Top of Winnipegosis.
 11,120-30 As above with rare pale yellowish-brown anhydrite.
 11,130-40 Common pale gray granular dolomite; common dusky yellowish-brown limestone, rare anhydrite; red, black and green shale cavings.
 11,140-50 As above granular dolomite more common.
 11,150-60 Abundant granular (sandy?) pale brown porous dolomitic limestone; common dusky yellowish-brown limestone as above. Lost circulation material.
 11,160-70 As above.
 11,170-80 Abundant light gray granular to earthy limestone; common yellowish-brown limestone as above.
 11,180-90 As above.
 11,190-95 Missing.
 11,195-11,205 Abundant dusky limestone as above; common granular limestone as above; rare anhydrite; rare white earthy limestone.
 11,205-15 Abundant dark gray to dusky yellowish-brown medium-crystalline limestone; common pale brown to white granular and earthy limestone.
 11,215-25 As above.
 11,225-35 Dark gray to dusky yellowish-brown limestone.
 11,235-40 As above.
 11,240-50 As above; dark gray limestone contain brachiopods.
 11,250-60 As above.
 11,260-70 Limestone as above with rare white anhydrite.
 11,270-80 As above.
 11,280-90 As above.
 11,290-11,300 As above.
 11,300-10 Abundant pale brown to light gray finely granular limestone; common dark gray limestone as above.
 11,310-20 Abundant dark gray fine crystalline, shaly limestone; rare pale brown granular limestone; rare dark gray and dusky yellowish-brown limestone as above.
 11,320-30 As above.
 11,330-40 As above with common light gray to very light gray granular limestone.
 11,340-50 As above.
 11,350-60 Very abundant dark gray fine crystalline limestone; rare granular limestone as above.
 11,360-70 As above; rare anhydrite.

11,370-80 As above.
 11,380-90 As above with common earthy, very soft, very pale orange limestone.
 11,390-95 As above.
 11,395-11,400 As above.

Core #6
 11,400-05 Limestone, dusky yellowish-brown, fine crystalline, tight.

11,403 Top of Ashern
 11,405-10 As above.
 11,410-15 As above.
 11,415-20 As above.
 11,420-25 As above.
 41,425-30 Dolomite, moderate brown to moderate yellowish-brown, fine crystalline, with anhydrite inclusions.
 11,430-35 As above, no anhydrite, rare small pyrite crystals.
 11,435-40 Limestone, dolomitic, light brown to pale reddish brown, fine-crystalline.

11,443 Top of Silurian.
 11,440-45 Limestone, dolomitic, moderate orange pink, fine crystalline.
 11,445-50 Limestone, very light gray, coarse crystalline; with anhydrite inclusions.
 11,450-55 Limestone, pale brown to very light gray, dolomitic, finely granular to fine crystalline, algae in the light gray part.
 11455-60 As above.

Core #7
 11,460-65 Limestone, dolomitic, very fine crystalline, yellowish gray.
 11,465-70 Limestone, dolomitic, dark gray, very fine crystalline.
 11,470-75 Yellowish-gray, dolomitic limestone as above.
 11,475-80 Dolomite, limy mottled dark yellowish-brown to pale yellowish-brown.
 11,480-85 Dolomite, limy, mottled as above; with anhydrite inclusions, vugular.
 11,485-90 Dolomite, limy, as above; carbonaceous residue in numerous small vugs.
 11,490-95 Vugular limy dolomite as above and very pale orange fine-crystalline limy dolomite.
 11,495-11,500 Limestone, dolomitic, medium-crystalline, mottled pale yellowish-brown and dark yellowish-brown and very pale yellowish-brown fine crystalline dolomitic limestone.
 11,500-05 Light gray, fine crystalline dolomitic limestone with inclusions of white calcite.
 11,505-10 Mottled dolomitic limestone as above.
 11,510 As above.

Core #8
 11,515-20 Limestone, dolomitic; pale yellowish-brown, fine crystalline.
 11,520-25 Mottled, dolomitic limestone as above.
 11,525-30 Dolomite, limy, pale yellowish-brown, fine crystalline.
 11,530-35 Dolomite, limy, light gray, fine crystalline.
 11,535-40 Limy dolomite as above, scattered small vugs.

11,540-45 Very light gray, limy, fine crystalline dolomite with inclusions of pale yellowish-brown dolomite crystals.

11,545-50 Medium gray, fine-crystalline limy dolomite mottled with pale brown granular limestone.

11,550-55 Pale yellowish-brown fine-crystalline limy dolomite.

11,555-60 Very light gray limy oolitic dolomite.

11,560-65 Pale brown medium-crystalline limy dolomite with inclusions of medium gray dolomite.

11,565-70 Very light gray, fine-crystalline, limy dolomite.

11,570-75 Very pale yellowish-brown to very light gray limy dolomite.

Core #9

11,575-80 As above; carbonaceous material liming fractures; very faint glow.

11,580-85 Limestone, very light gray, fine crystalline.

11,585-90 Dolomite, pale yellowish-brown, limy, fine crystalline.

11,590-95 Dolomite, as above, slightly vugular.

11,595-11,600 Vugular dolomite as above; some vugs and cavities filled with pale brown granular dolomite.

11,600-05 Vugular medium brown fine to medium crystalline dolomite with many vugs filled with gypsum.

11,605-10 Dolomite, limy, very pale orange, fine crystalline, with scattered pale yellowish-brown specks.

11,610-15 Dolomite, limy, calcirudite, interstices filled with pale brown; silt; scattered small vugs.

11,615-20 Dolomite, limy, very pale orange with scattered pale yellowish-brown specks.

11,620-25 Dolomite, limy, very light gray, very finely granular, slight porosity.

11,625-30 Dolomite, limy, calciarenite, interstices fairly well filled with carbonates; scattered small vugs. Slight porosity.

11,630-32 Dolomite, limy, scattered vugs lined with yellowish-brown drusy dolomite crystals.

Core #10

11,632-35 Limy dolomite pale yellowish-brown, fine crystalline, low porosity.

11,635-40 Dolomite, as above.

11,640-45 As above with inclusions of dark yellowish-brown dolomite.

11,645-50 Pale yellowish-brown limy dolomite as above.

11,650-55 As above.

11,655-60 Dolomite, limy medium yellowish-brown.

11,660-65 As above; rare small vugs.

11,665-70 Fine-crystalline, limy pale yellowish-brown dolomite.

11,670-75 As above.

11,675-80 As above, rare fine fractures.

11,680-85 Dolomite as above; rare small vugs.

11,685-89 As above, no vugs seen.

Core #11

11,689-95 Dolomite, limy medium yellowish-brown, scattered small vugs lined with small dolomite crystals.

11,695-11,700 Pale yellowish-brown, fine-crystalline limy dolomite, low porosity.

11,700-05 Dolomite as above and dark yellowish-brown, fine-crystalline dolomite.
 11,705-10 Pale yellowish-brown dolomite as above with many fine clear carbonate laminae.
 11,710-15 Limy dolomite as above.
 11,715-20 As above.
 11,720-25 As above.
 11,725-27 As above.
 11,727-30 As above.

Core #12

11,730-35 As above, speckled with medium yellowish-brown dolomite.
 11,735-40 As above, no specks.
 11,740-45 As above.
 11,745-50 Dolomite, limy, medium-crystalline, medium yellowish-brown.
 11,750-55 As above.
 11,755-60 As above.
 11,760-65 As above.
 11,765-70 As above, vuggy, dark yellowish-brown.
 11,770-75 As above.
 11,775-80 Dolomite, limy pale yellowish-brown fine-crystalline.
 11,780-85 Dolomite, lime, medium yellowish-brown, medium crystalline; scattered small vugs.

Samples

11,785-90 Missing.
 11,790-11,800 Abundant pale yellowish-brown to very pale orange fine-crystalline limy dolomite; common medium to dark yellowish-brown, fine crystalline, sometimes vuggy, limy dolomite, rare pale brown and very pale orange granular limy dolomite.
 11,800-10 As above.
 11,810-20 Very abundant very light gray to very pale orange dolomite as above; rare medium to dark yellowish-brown limestone as above.
 11,820-30 As above; very rare very light gray limy shale.
 11,830-40 Limy dolomite as above.
 11,840-50 As above.
 11,850-60 Pale yellowish brown to very pale orange to very light gray limy dolomite as above; rare medium to dark yellowish-brown limy dolomite as above.
 11,860-70 As above.
 11,870-80 As above.
 11,880-90 As above.
 11,890-11,900 Abundant pale dolomite as above; common medium yellowish-brown dolomite as above some of the pale dolomite is iron-stained.
 11,900-10 As above.
 11,910-20 As above.
 11,920-30 As above with common moderate red dolomite, rare blackish red dolomite, rare grayish green dolomite.
 11,930-40 Abundant medium gray dolomite; common pale dolomite as above; common reddish dolomite as above; rare coarse-grained quartz sandstone with dolomite cement and reddish stain.
 11,940-50 Medium gray and pale dolomite as above; rare greenish, red stained dolomite as above; coarse-grained, slightly friable, quartz sandstone that does not have a red stain.

11,950-60 Abundant pale dolomite as above; common medium gray dolomite as above; rare medium gray granular dolomite; rare dark gray fine crystalline dolomite and light pink dolomite; no sandstone seen.

11,960-70 Pale dolomite as above; rare medium-gray dolomite as above; rare dusky yellowish-brown; fine-crystalline dolomite; rare quartz sandstone with dolomite cement and reddish stain.

11,970-80 Very abundant very light gray to very pale orange to white fine crystalline, slightly limy dolomite; rare medium-gray limy dolomite.

11,980-90 As above.

11,990-12,000 As above with rare pale yellowish-brown dolomite.

12,000-05 As above.

12,005-10 Pale dolomite as above, rarely vugular, rare pale reddish brown dolomite.

12,010-15 Pale dolomite and yellowish-brown dolomite as above.

12,015-20 As above.

12,020-28 As above.

Core #13

12,028-30 Pale yellowish-brown fine-crystalline dolomite.

12,030-35 As above with scattered small vugs.

12,035-40 As above.

12,040-45 Moderate yellowish-brown, fine-crystalline, slightly vuggy dolomite.

12,045-50 Moderate yellowish-brown dolomite as above with large inclusion (?) of pale yellowish-brown dolomite.

12,050-55 Moderate yellowish-brown dolomite as above.

12,055-60 Pale yellowish-brown, fine to medium crystalline dolomite; carbonaceous residue in fractures.

12,060-65 Dolomite as above.

12,065-70 As above.

12,070-75 As above.

12,075-80 As above.

12,080-86 Medium yellowish-brown fine-crystalline dolomite.

Samples

12,086-90 Abundant, pale yellowish-brown to very light gray to white dolomite; rare moderate yellowish-brown dolomite.

12,090-12,100 As above, oil stained, faint glow.

12,100-10 Pale yellowish-brown dolomite as above.

12,110-30 Missing.

12,130-40 Moderate yellowish-brown fine-crystalline dolomite.

12,140-50 As above.

12,150-60 Moderate to dark yellowish-brown medium-crystalline dolomite; very rare white fine-crystalline dolomite.

12,160-70 Moderate to dark yellowish-brown dolomite as above.

12,170-80 As above.

12,180-90 As above; rare pale yellowish-brown dolomite.

12,190-12,200 As above; lost circulation material; rare medium gray limestone.

12,200-10 Dolomite as above.

12,210-20 As above.

12,220-30 As above

12,230-40 As above.
 12,240-50 As above.
 12,250-60 As above.
 12,260-62 As above; rare subrounded quartz grains in the dolomite.

Core #14
 12,262-64 Moderate to dark yellowish-brown fine-crystalline, dolomite with scattered subrounded quartz grains.
 12,264-69 Dolomite as above; no quartz grains seen.
 12,269-74 Dark yellowish-brown, fine-crystalline dolomite.
 12,274-79 As above.
 12,279-84 As above.
 12,284-89 Moderate yellowish-brown dolomite, faintly laminated with dark yellowish-brown dolomite.

Core #16
 12,289-95 Dolomite as above; carbonaceous residue in thin fractures.
 12,295-12,300 As above.
 12,300-05 Dolomite, dark yellowish-brown medium-crystalline, mottled with white dolomite.
 12,305-10 Dusky yellowish-brown granular dolomite; no glow.
 12,310-16 Dusky yellowish-brown fine-crystalline dolomite.

Core #17
 12,316-20 As above.
 12,320-25 As above; carbonaceous residue in thin fractures, very weak glow.
 12,325-30 Moderate yellowish-brown fine-crystalline dolomite.
 12,330-35 Dark yellowish-brown fine-crystalline dolomite.
 12,335-40 As above.
 12,340-45 As above.
 12,345-50 As above.
 12,350-55 As above.
 12,355-60 As above.
 12,360-65 As above.
 12,365-70 As above.
 12,370-74 As above.

Core #18
 12,374-80 Moderate yellowish-brown dolomite.
 12,380-85 As above.
 12,385-90 As above.
 12,390-95 Dark yellowish-brown dolomite, slightly granular, no glow.
 12,395-12,400 As above.
 12,400-05 As above.
 12,405-10 As above.
 12,410-15 As above.
 12,415-20 As above.
 12,420-25 As above.
 12,425-30 As above.
 12,430-32 Medium-crystalline, dark yellowish-brown dolomite.

Core #19
 12,432-37 Moderate yellowish-brown fine-crystalline dolomite.

12,437-42 As above.
 12,442-47 As above.
 12,447-52 As above.
 12,452-57 Dusky yellowish-brown fine-crystalline, dolomite.
 12,457-62 As above.
 12,462-67 As above.
 12,467-72 As above.
 12,472-80 Missing.

12,487 Top of Stony Mountain.

Samples

12,480-90 Abundant medium bluish gray fine-crystalline dolomite with scattered fine quartz grains; common dusky yellowish-brown fine crystalline dolomite; rare moderate to pale yellowish-brown dolomite.
 12,490-12,500 Very abundant dusky yellowish-brown to dark gray dolomite; very rare pale yellowish brown dolomitic limestone.
 12,500-10 As above.
 12,510-20 Abundant dusky yellowish-brown dolomite as above; common pale yellowish-brown dolomite; common pale brown granular limy dolomite.
 12,520-30 Dusky yellowish-brown dolomite as above.
 12,530-35 As above.
 12,535-40 Missing.

Core #20

12,540-45 Dusky yellowish-brown fine-crystalline dolomite.
 12,545-50 As above.
 12,550-55 As above.
 12,555-60 As above; carbonaceous residue in thin laminae.
 12,560-65 As above.
 12,565-70 As above.
 12,570-75 As above.
 12,575-80 As above.
 12,580-85 As above.
 12,585-90 Moderate yellowish-brown fine-crystalline limy dolomite.
 12,590-95 As above.
 12,595-98 Dolomite, dark to moderate yellowish-brown.

Samples

12,599-12,610 Abundant dark yellowish brown dolomite; common pale yellowish-brown dolomite; rare dusky yellowish-brown dolomite.
 12,610-20 Common dark yellowish-brown fine-crystalline dolomite; common white very fine-crystalline dolomite; common pale yellowish-brown fine-crystalline dolomite; rare white to light gray earthy limestone; rare white anhydrite; rare black shale.
 12,620-30 Abundant dusky yellowish-brown very silty limestone; common white earthy limestone with specks of dark gray; rare pale yellowish-brown dolomite; rare pale brown granular dolomite.
 12,630-40 Limestone as above; rare pale yellowish-brown dolomite.
 12,640-50 As above.
 12,650-60 Dark gray to dusky yellowish brown, silty limestone as above, rest as above.

12,660-70 Limestone; as above.

12,672 Top of Red River

12,670-76 Missing.

Core #21

12,676-80 Dark gray to dusky yellowish-brown, fine-crystalline, very silty limestone.

12,680-85 As above.

12,685-90 Limestone, dark gray to dusky yellowish-brown, fine crystalline not silty.

12,690-95 Dark yellowish-brown, fine-crystalline, pure limestone as above.

12,695-12,700 Dark yellowish-brown, very fine-crystalline limy dolomite with splotches of dark gray limestone tight. No glow.

12,700-12,705 As above.

12,705-10 As above.

12,710-15 Dark yellowish-brown fine crystalline limestone.

12,715-20 Dark yellowish-brown very fine crystalline limy dolomite. No glow. Tight.

12,720-25 As above.

12,725-30 As above.

12,730-34 Moderate yellowish-brown limy dolomite.

Core #22

12,734-40 As above.

12,740-45 Moderate yellowish-brown medium-crystalline limy dolomite.

12,745-50 Moderate yellowish-brown anhydrite.

12,750-55 Moderate yellowish-brown fine-crystalline limestone; black shaly partings.

12,755-60 Moderate yellowish-brown finely granular tight dolomite and moderate yellowish-brown bioclastic silty limy dolomite.

12,760-65 Dark yellowish brown fine-crystalline limestone.

12,765-70 Limestone, as above.

12,770-75 Moderate yellowish-brown fine-crystalline limestone.

12,775-80 Yellowish-brown slightly limy anhydrite.

12,780-85 Anhydrite, yellowish-brown, not limy.

12,785-92 Moderate yellowish-brown, fine-crystalline dolomite.

Core #23

12,792-95 As above.

12,795-12,800 Moderate yellowish-brown anhydrite.

12,800-05 Moderate yellowish-brown fine crystalline dolomitic, carbonaceous residue in thin fractures.

12,805-10 Dolomite as above.

12,810-15 As above with thin laminae of carbonaceous material, slightly limy, brachiopod (?) shell fragments, no glow.

12,815-20 As above.

12,820-25 As above.

12,825-30 Moderate yellowish-brown fine-crystalline limy dolomite.

12,830-35 As above.

12,835-40 Yellowish-brown granular dolomite, faint glow.

12,840-45 As above, with inclusion of dark yellowish-brown fine crystalline dolomite.

12,845-50 Dark yellowish-brown fine-crystalline limy dolomite as above.

Core #24

12,850-55 Granular limy dolomite as above and fine crystalline dolomite as above; faint glow.

12,855-60 As above.

12,860-65 As above, faint glow.

12,865-70 Dark gray granular dolomitic limestone; very faint glow.

12,870-75 As above.

12,875-80 As above; good glow.

12,880-85 As above, faint glow.

12,885-90 Dark yellowish-brown, fine crystalline limestone, no glow.

12,890-95 As above.

12,895-12,900 Dark yellowish-brown, fine crystalline limestone as above and moderate yellowish-brown granular limestone as above.

12,900-05 Fine-crystalline limestone as above.

12,905-08 As above.

Core #25

12,908-15 As above.

12,915-20 As above.

12,920-25 As above.

12,925-30 As above with moderate yellowish-brown fossiliferous limestone.

12,930-35 Dark yellowish-brown limestone as above.

12,935-40 As above.

12,940-45 As above, medium-crystalline.

12,945-50 As above, fine-crystalline.

12,950-55 Fine-crystalline, dark yellowish-brown limestone as above.

12,955-60 As above.

12,960-66 As above.

Samples

12,966-70 Very abundant dark to moderate yellowish-brown fine-crystalline limestone; rare white to pale yellowish-brown silty and earthy limestone; very rare pale yellowish-brown limy dolomite.

12,970-75 As above with rare medium-crystalline dark yellowish-brown limestone.

12,975-80 Limestone, as above

12,980-85 As above.

12,985-90 As above.

12,990-94 As above with rare very pale yellowish-brown limy dolomite.

12,994-13,000 Limestone, as above.

13,000-05 Limestone, as above; much lost circulation material.

13,005-22 Missing.

13,022 Circulation 2 hours 10 minutes. Limestone as above.

13,022-25 Limestone, fine to medium crystalline as above with rare pale yellowish-brown dolomite, and rare white limestone; very rare anhydrite.

13,025-30 Missing.

13,030-40 Abundant fine to medium crystalline dark yellowish-brown limestone; common pale yellowish-brown fine-crystalline limestone; rare pale yellowish-brown dolomite; rare white earthy limestone.

13,040-47 As above.

13,047-57 Abundant pale yellowish-brown limestone and white earthy limestone; common dark yellowish-brown limestone as above.
 13,050-60 As above; very rare pale yellowish-brown granular limestone.
 13,060-70 As above.
 13,075-80 As above with very rare pale yellowish brown dolomite.
 13,085-90 Common white earthy limestone; common dark yellowish-brown limestone as above.
 13,090-95 As above.
 13,095-13,100 As above.
 13,100-05 As above; white limestone more common.
 13,105-10 As above.
 13,110-20 As above with dusky yellowish-brown dolomite cavings.
 13,120-37 Limestone as above; dark yellowish-brown limestone more common.
 13,130-40 As above.
 13,140-50 As above.
 13,150-60 As above.
 13,160-70 Missing.
 13,170-80 As above; white limestone more common.
 13,180-90 As above.
 13,190-13,200 As above.
 13,200-10 As above.
 13,210-20 As above.
 13,220-30 Dark gray granular (sandy?) dolomite; limestone as above.
 13,230-40 As above with rare pyrite.
 13,240-50 Abundant sandy dolomite as above and dark gray sandstone; rare limestone as above.

 13,249 Top of Winnipeg Shale.
 13,250-60 Very abundant dusky yellowish-green shale; rare dolomite sandstone, limestone as above.
 13,260-70 As above.
 13,270-80 As above; rare light gray quartz sandstone.
 13,280-90 As above; common lost circulation material.
 11,290-13,300 Shale as above.
 13,300-10 As above.
 13,310-20 Shale, as above.
 13,320-30 Shale, as above.
 13,330-40 As above.
 13,340-50 Shale, as above; rare medium to dark gray coarse-grained quartz sandstone.
 13,360-70 Shale as above; common dark gray and light gray quartz sandstone as above.

 10,378 Top of Winnipeg Sand.
 13,370-80 As above; rare white limestone (cavings?)
 13,380-90 Shale and very common sandstone as above.
 13,390-13,420 Missing.
 13,420-30 Very abundant sandstone as above rare shale as above.
 13,430-35 As above.
 13,435-40 As above.
 13,440-50 As above; rare pyrite in the sandstone.
 13,450-60 Quartz sandstone as above.
 13,460-70 Sandstone as above rarely with green shaly partings.
 13,470-73 Sandstone, as above; light gray to dark gray.

Core #26
13,473-80 Medium gray coarse-grained quartz sandstone.
13,480-85 As above.
13,485-92 As above.
13,492-95 Missing.

Core #27
13,495-13,501 Sandstone as above, tight.
13,501-05 Missing.

Samples
13,505-10 Sandstone, medium-gray, coarse grained with rare green shale and white limestone.

13,514 Top of Cambrian.
13,510-15 Abundant light gray to white or pale yellowish-brown coarse-grained sandstone; common dark to medium gray sandstone; rare shale and limestone as above.
13,515-20 As above; rare medium-gray light gray sandstone.
13,520-25 Missing.
13,525-30 Sample not washed; very abundant lost circulation material.
13,530-35 Sandstone as above; much of the sandstone containing scattered grains of a dark-colored mineral; common loose rounded quartz grains. Shale and limestone cavings as above.
13,535-40 Missing.
13,540-45 As above.
13,545-48 Rare sandstone as above; common dark yellowish-green and reddish-brown shale; much lost circulation material.

13,548 Top of Deadwood.
13,548-50 Common medium-coarse-grained light gray to medium gray quartz sandstone with rare pyrite in the sandstone; common green and black shale.
13,550-55 Sandstone as above, some sandstone stained red; shale as above.
13,555-60 Quartz sandstone as above; rare shale as above; rare loose rounded quartz grains, common lost circulation material.
13,560-65 Abundant medium gray very coarse grained quartz sandstone; rare shale as above.
13,565-74 Missing.
13,574-80 Sandstone as above.
13,580-85 Sandstone as above with common reddish-brown medium-grained sandstone.
13,585-90 Abundant black shale; common reddish-brown sandstone as above; rare light gray sandstone as above.
13,590-92 Missing.

Core #28
13,592-13,600 Pink syenite.
13,600-05 White syenite.
13,605-10 As above.
13,610-15 As above.
13,615 Total Depth