

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 154

Summary of the Cardinal Drilling Company - B. M. Keeler No. 1
Bottineau County, North Dakota
Well No. 1069 - Permit No. 1081

by Richard Maywald

Cardinal Drilling Company - B. M. Keeler No. 1, Bottineau County, North Dakota. Location: NW NW Section 1, T. 159N., R. 82W. Elevation: 1525 ground, 1536 K.B.

The Cardinal Drilling Company - B. M. Keeler No. 1 was spudded January 9, 1956, drilled to a total depth of 6770, found dry, and plugged March 4, 1956. Microlaterolog, Gamma Ray-Neutron, Caliper and electric logs were run by Schlumberger on two series of runs, February 4, 1956 and March 4, 1956. A Hycalog was run from January 11, 1956 to March 3, 1956 by Hycalog, Inc.

Coring Record:

3987 - 3997
4042 - 4071
4330 - 4359

Testing Record:

DST #1 3562-3576 Open 1 hour SI 30 minutes. Open with weak blow, died in 20 minutes. Recovered 125' WCM. IFP 50, FFP 50, SIP 1185, HP 1875.

DST #2 3968-3997 Open 1 hour SI 30 minutes. Very weak blow. Recovered 150' WCM. FP 25-70, SIP 1920, HP 2305-2210. (High gas reading mud log unit.)

DST #3 4033-4042 Open 1 hour SI 30 minutes. Very weak blow. Recovered 240' WCM. FP 40-60, SIP 1800, HP 2370-2360. (Slight show samples - very poor cut.)

DST #4 4070-4096 Open 2 hours SI 45 minutes. Good blow. Recovered 328' Slight MCSW, 812' SW. FP 195-710, SIP 2030, HP 2380. (Oil stain and cut in samples.)

DST #5 5396-5410 Open 2 hours SI 45 minutes. Very strong blow. Recovered 4630' SW, Slight MC at top. IFP 160, FFP 2410, HY 3050, SIP 2490.

DST #6 5751-5781 Straddle packer. Open 2 hours SI 45 minutes. Recovered 480'. Total fluid: 60' water cut mud, 420' slight MCSW. No pressures recorded. Tool failed.

Casing Record:

380.61 feet of 8 5/8" surface casing with 215 sacks cement.

Plugging Record:

Plug No. 1 - 5378 15 sacks
Plug No. 2 - 4320 15 sacks
Plug No. 3 - 3940 15 seeks
Plug No. 4 - 2548 15 sacks
Plug No. 5 - 400 15 sacks

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

FORMATION TOPS

Cretaceous System	
Nicbrara formation	1685
Greenhorn formation	2033
Basal Cretaceous sandstones	2548
Jurassic System	
Piper formation	3417
Triassic System	
Spearfish formation	3687
Mississippian System	
Charles formation	3934
Mission Canyon formation	4283
Lodgepole formation	4570
Englewood formation	5240
Devonian System	
Lyleton formation	5253
Nisku formation	5355
Duperow formation	5472
Prairie Evaporites	6228
Ashern formation	6630
Silurian System	
Interlake Group	6712
Total Depth	6770

390-500	Shale, light gray, lumpy and compact, noticeable scattered flakes of biotite, some dark brown carbonaceous fragments; from 400-410 were some Inoceramus prisms, at 460-470 a gastropod shell was found.
500-530	Shale, medium gray, platy, brittle, scattered fine specks of mica.
530-630	Shale, light brownish gray (5YR8/1), lumpy and compact finely micaceous, brownish gray (5YR4/1) carbonaceous fragments scattered throughout and orientated parallel to bedding; the shale is slightly bentonitic, from 610-630 there are fragments of a light brown (5YR6/4) shale which otherwise has the same characteristics as the above shale.
630-1330	Shale, medium gray, platy, brittle, finely micaceous, some stringers of pyrite running parallel to cleavage. Gradually the color grades into light gray. Occasional Inoceramus prisms in samples.
1330-1350	Shale, light gray as above; shale, pale yellowish brown (10YR6/2), lumpy and brittle, possibly due to caving; some Inoceramus prisms; some shell fragments.
1350-1480	Shale, light gray, essentially the same as above; scattered Inoceramus prisms and shell fragments.
1480-1620	Shale, as above, but the color has graded into medium light gray, some scattered pyrite in the shale.
1620-1690	Shale, light olive gray (5Y6/1), lumpy and spongy, very bentonitic and slightly calcareous; fragments of white bentonite.

1690-1740 Shale, brownish gray (5YR4/1), sooty luster, fissile, brittle, some fragments have numerous "white specks" which are calcareous, fragments without the specks are not calcareous.

1740-1790 Shale, medium gray, platy and compact, abundant "white specks" which are calcareous; shale, brownish gray, probably caving from above; some shell fragments and Inoceramus prisms.

1790-1840 Shale, medium light gray, lumpy and spongy, very bentonitic, scattered fragments of white bentonite, shell fragments and Inoceramus prisms.

1840-1920 Shale, medium light gray, platy and compact; shale, bentonitic, as above, but probably due to cavings.

1920-2080 Shale, brownish gray (5YR4/1), platy to fissile and compact, sooty luster, scattered micaceous specks; shale, as above, caving; scattered Inoceramus prisms.

2080-2150 Shale, brownish gray to medium gray, platy and compact, extremely abundant soft calcareous "white specks", scattered Inoceramus prisms, forams (Globigerinidae), and shell fragments.

2150-2200 Shale, as above, but also bentonitic, with scattered fragments of white bentonite.

2200-2490 Shale, medium dark gray, platy to thinly laminated, compact; bentonitic shale, medium gray, disaggregated, scattered fragments of white bentonite, slightly calcareous, scattered Inoceramus fragments and shell fragments.

2490-2560 Shale, medium light gray, lumpy, disaggregated to spongy, very bentonitic and slightly calcareous; scattered shell fragments; shale, medium dark gray, possibly cavings.

2560-2610 Sandstone, very fine to fine grained angular quartz grains, brownish gray color, well cemented by a calcareous cement; shale, as above, due to caving. At 2570-80 fragments of white medium-grained sandstone composed of well-rounded quartz grains, and cemented with a calcareous cement. From 2580 medium to coarse-grained sandstone composed of semi-angular, quartz grains, well-cemented.

2610-2670 Shale, medium dark gray, thinly foliated to fissile, brittle; from 2650 are pale yellowish brown spherical siderite concretions which are fine to coarse in size.

2670-2770 Sandstone, fine to coarse sized semi-angular quartz grains, some of which have pyrite between them; shale and concretions, as above, from cavings.

2770-2790 Shale, medium dark gray, platy to thinly laminated, brittle, some shale fragments have abundant brownish plant fragments; some coarse quartz sand grains; possibly caving.

2790-2810 Shale, as above, plus a light gray bentonitic shale, spongy to disaggregated, and fragments of white bentonite; the medium dark gray shale and the bentonitic shale are interbedded in thin layers.

2810-2900 Sandstone, medium to coarse-grained, semi-angular grains of quartz, some of the grains featuring a frosted surface, some of the grains are cemented with pyrite, but most grains in sample are uncemented; shale as above, cavings.

2900-2960 Shale, medium light gray, lumpy and compact; shale, medium dark gray, thinly laminated, brittle; some scattered medium sized semi-angular quartz grains.

2960-3000 Shale, dark gray, thinly laminated, brittle, finely micaceous, some plant fragments or shale fragments.

3000-3050 Shale, medium dark gray, as above, scattered pale red purple (5RP6/2) shale fragments, structure is platy.

3050-3100 Shale, greenish gray (5GY6/1), waxy luster, platy and brittle, slightly calcareous; medium dark gray shale, as above.

3100-3150 Shale, as above; shale, grayish red (10R4/2), lumpy and brittle; fragments of sandstone, fine-grained, light greenish gray (5G8/1), well cemented, slightly calcareous.

3150-3220 Shale, as above, but also fragments of yellowish gray (5Y8/1) bentonite to bentonitic shale; also some fragments of mottled light gray finely crystalline limestone from 3160-3180.

3220-3260 Shale, light gray, lumpy and spongy, bentonitic and very calcareous.

3260-3310 Shale, grayish red (10R4/2), platy and brittle, shale, medium dark gray, thinly laminated and brittle; shale, greenish gray, as above.

3310-3400 Shale, as above, but also fragments of sandstone, fine grained, very light gray, essentially pure quartz, friable. At 3360-70 a pentagonal crinoid stem button.

3400-3450 Limestone, yellowish gray, (5Y8/1), fine grained, subangular fragments; fragments of light brownish gray, vitreous, angular quartzitic or chert material; shales, as above, probably caving.

3450-3500 Limestone, light brownish gray, sublithographic, subangular fragments, subcrystalline texture; fragments show a laminated or banded structure.

3500-3540 Limestone, very light gray, as above.

3540-3550 Shale, light brownish gray, platy and brittle, calcareous; shale, medium gray, waxy luster, fissile and brittle; limestone as above.

3550-3580 Limestone, as above; shale, as above.

3580-3600 Limestone, as above; shale, light gray, platy and compact, calcareous; shale, medium dark gray, fissile and brittle, plant remains between partings.

3600-3670 Shale, as above, increasing amounts of limestone, possibly very interbedded sequence.

3670-3690 Sandstone, fine-grained, moderate brown (5YR4/4), friable, argillaceous, gypsum, white, surcrosic; shale, medium light gray, foliated and brittle, possibly caved material.

3690-3710 Shale, medium dark gray, fissile, brittle; shale, medium gray, platy and brittle; sandstone, as above, and gypsum.

3710-3750 Sandstone, very fine grained, light brown (5YR6/4), calcareous, with white gypsum; shale, as above, cavings.

3750-3780 Sandstone, fine to medium grained, light brown, rounded poorly sorted grains, calcareous, friable; interbedded white gypsum.

3780-3900 Sandstone, very fine grained, silty, grayish orange pink (5YR7/2) to moderate orange pink (5YR8/4), argillaceous, slightly calcareous, with interbedded gypsum.

3900-3950 Caved material, shales, medium dark to medium gray, thinly laminated, brittle; also gypsum, and dark reddish brown shale (10R3/4), caved material; shell fragments, medium gray, very calcareous.

3950-3987 Missing.

Core Chip Description

- 3987-3992 Limestone, pale yellowish brown (10YR6/2), very fine to finely crystalline, microsucrosic to subcrystalline texture, very dense, shows banding or laminations of grayish brown running parallel to bedding, calcite in good crystals replacing original fossil shells, and scattered fossil ostracodes inbedded throughout the limestone.
- 3992-3996 Limestone, medium gray, finely crystalline, very dense and has a uniform crystalline texture, somewhat shaly.
- 3996-3997 Limestone, pale yellowish brown, medium sized crystals, grainy texture, very dense.

Sample Description

- 3990-4000 Limestone, pale yellowish brown, fine-grained, dense; limestone, pinkish gray, sublithographic, dense; caved material, shale, medium dark to medium gray, laminated.
- 4000-4040 Poor samples, predominantly shales of varied hues of gray, with fragments of limestone, pinkish gray, sublithographic, very dense. The shale is largely cavings.

Core Chips Description

- 4042-4071 Anhydrite, light bluish gray (5B7/1) to bluish white (5B9/1), microcrystalline to microsucrosic texture, very dense.

Sample Description

- 4070-4080 Anhydrite, as above, limestone, pale yellowish brown to pinkish gray, fine to medium sized grains, dense, grainy; shale caving, medium dark gray, fissile, brittle.
- 4080-4110 Limestone, pinkish gray, fine grained to sublithographic, dense; shale caving, as above.
- 4110-4120 Limestone, as above, but also anhydrite fragments, light bluish to medium bluish gray, very dense.
- 4120-4320 Anhydrite, as above; some limestone, as above. From 4200 the color grades into pinkish to light brownish gray. From 4250 the color is white to very light gray.
- 4320-4330 Dolomitic limestone, pale yellowish brown (10YR6/2), microcrystalline, sublithographic, dense.

Core Chips Description

- 4330-4331 Dolomitic limestone, pale yellowish brown, oolitic, with numerous scattered vugular pore openings between oolites. White to clear crystalline calcite cementing oolites and filling the openings between the oolites.
- 4331-4339 Limestone, very pale orange (10YR8/2), very fine grained, microsucrosic, shows little structure, has very fine pinpoint porosity with few scattered vugular openings. From 4336-37 good vugular pore spaces.
- 4339-4346 Dolomite, with some characteristics as limestone above. From 4343-45 oolitic, with good vugular porosity.
- 4346-4349 Limey dolomite, as above.
- 4349-4351 Limestone, same characteristics as above, more dense, less porosity.
- 4351-4353 Dolomite, very pale orange, very fine grained, microsucrosic texture, fair to good pinpoint porosity.

4353-4355 Dolomite, as above, but color is now pale yellowish brown.

4355-4359 Dolomite, as above, less porosity, slightly limey, has grayish brown (5YR2/2) specks of material scattered through the dolomite (bituminous material?).

4360-4370 Limey dolomite, pale yellowish brown, very fine grained, microsugrosic, very fine pinpoint porosity, has grayish brown specks scattered throughout the dolomite.

4370-4430 Limestone, with same characteristics as above, somewhat dolomitic.

4430-4500 Limestone, pinkish gray (5YR8/1), oolitic, well cemented between oolites, dense, subcrystalline.

4500-4570 Limestone, pale yellowish brown, finely crystalline, grainy texture, very fine pinpoint porosity, grayish brown organic specks scattered throughout limestone.

4570-4640 Limestone, grayish orange pink (5YR7/2), fragmentally fossiliferous, partially oolitic, finely crystalline grainy texture between fossil fragments and oolites.

4640-4670 Shale, brownish gray (5YR4/1), fissile and brittle, scattered plant fragments on parting surfaces.

4670-4710 Limestone, pinkish gray (5YR8/1), microfossiliferous, grainy texture, finely crystalline, scattered shell fragments.

4710-4800 Limestone, light gray, finely fossiliferous, finely crystalline, grainy texture, very dense; shale, medium gray, possibly cavings, scattered small light gray nodules of chert.

4800-4930 Limestone, medium gray, fine grained, dense, with small rounded nodules of interbedded chert and angular fragments of chert; shale cavings, medium dark gray; a few fossil (micro) fragments. From 4900-4930 chert increases.

4930-4970 Limestone, very light gray, finely crystalline, with scattered medium gray microfossils.

4970-5000 Shale, medium dark gray, fissile, brittle; limestone, as above, caving.

5000-5050 Limestone, as above, but medium light gray.

5050-5170 Limestone, as above, but abundance of chert fragments.

5170-5210 Shale, medium gray, thinly laminated, brittle, some plant fragments between parting planes; limestone cavings.

5210-5240 Limestone, pinkish gray, finely crystalline, dense, slightly cherty.

5240-5250 Shale, brownish-gray (5YR4/1), thinly laminated, compact.

5250-5270 Shale, as above, but also sandstone, very fine-grained to silty, light gray, fairly well cemented, slightly calcareous.

5270-5340 Shale, moderate brown (5YR4/4), silty; slightly calcareous, limestone, pale yellowish brown, very fine grained, dense. Scattered fragments of anhydrite.

5340-5360 Shale, medium dark gray, fissile and brittle, possibly due to cavings.

5360-5380 Limestone, grayish orange pink (5YR7/2), finely crystalline, microsugrosic texture; scattered fragments of white anhydrite.

5380-5400 Dolomitic limestone, pale yellowish brown, very dense microcrystalline.

5400-5490 Dolomitic limestone, as above, but granular, dense, and has scattered fine vugular pore spaces, some of which are filled with anhydrite. At 5470 trace of shale.

5490-5510 Limestone, very pale orange (10YR8/2), very fine grained, microsugrosic texture, dense.

5510-5550 Dolomitic limestone, light gray, very finely to finely crystalline, dense, argillaceous.

5550-5700 Limestone, grayish orange pink, very fine grained, chalky-like to finely granular texture; some fossil fragments (brachs).

5700-5790 Dolomite, light brownish gray, fine grained, grainy texture, dense, somewhat limey.

5790-5800 Shale, medium gray, fissile, brittle; limestone, pinkish gray, sublithographic.

5800-5850 Limestone, very light to pinkish gray, very finely crystalline to sublithographic, dense and hard; shale, as above.

5850-5870 Limestone and shale, as above, and some fragments of anhydrite, light brownish gray, very dense.

5870-5890 Limestone and dolomitic limestone, pale yellowish brown to pinkish gray, fine grained, sublithographic to microsucrosic, dense and hard.

5890-5990 Limestone and limey dolomite, as above, and shale, as above.

5990-6080 As above, but some fragments of anhydrite.

6080-6100 Limestone and limey dolomite, as above.

6100-6550 Dolomite and limey dolomite, pale brownish yellow (10YR6/2), fine grained, grainy texture, dense.

6150-6190 Dolomite, as above, fine-grained, fair intragranular porosity.

6190-6240 Dolomite, as above, but dense, no porosity.

6240-6280 Limestone, grayish orange pink (5YR5/2), very finely crystalline, fairly dense, uniform texture. From 6260-6270 there is shale, medium gray, fissile and brittle, possibly cavings.

6280-6310 Dolomite, pale yellowish brown, very finely crystalline, dense; argillaceous dolomite, grayish orange pink (5YR7/2), very fine-grained; argillaceous dolomite, pale red (5R6/2), very finely crystalline, shale, brownish gray, fissile.

6310-6350 Limestone, pale yellowish brown, very fine grained, subcrystalline texture, brittle; argillaceous dolomite, very fine grained, brittle, shows little structure; shale, medium gray, fissile, flaky.

6350-6390 Dolomite, pale yellowish brown, as above; shales, as above.

6390-6400 Limestone, pale red (5R6/2), very fine grained, dense and brittle.

6400-6420 Dolomite, very light gray, finely crystalline, dense.

6420-6480 Dolomite, as above; anhydrite, very light gray, microsucrosic; shale, medium gray, fissile and brittle; shale, light brown (5YR6/4), platy and compact.

6480-6500 Shale, medium gray, very calcareous, platy and brittle.

6500-6550 Missing.

6550-6640 Limey dolomite, very pale orange (10YR8/2), finely crystalline, dense.

6640-6690 Shale, medium gray, fissile and brittle; dolomite, as above; shale, light brown, platy and compact, possibly caving.

6690-6730 Limestone, pinkish gray, lithographic to sublithographic, subcrystalline texture.

6730-6770 Dolomitic limestone, pinkish gray, sublithographic, dense.

6770 Total Depth