

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 159

Summary of the Gulf Oil Corp. - Bennie Pierre Federal No. 1
McKenzie County, North Dakota
Well No. 956 - Permit No. 968

by Richard Maywald
November, 1956

Gulf Oil Corporation, Bennie Pierre Federal No. 1, McKenzie County,
North Dakota. Location: C NW SW, Section 28, T. 148 N., R. 104W. Elevation:
2326 grd., 2339 K.B.

The Gulf Oil Corporation, Bennie Pierre Federal No. 1 was spudded
September 5, 1955, drilled to a total depth of 13,503, found dry, and plugged
April 16, 1956. Electrical logs, micro logs, microlaterologs, laterologs,
radioactivity logs were run in a series of three runs, Sept. 20 and Nov. 11,
1955, and Feb. 21, 1956.

Coring Record

9,240- 9,469
10,080-10,732
12,795-13,006

Testing Record

DST 1, interval 9230 to 9290', 1800' water cushion. Recovered water
cushion and 90' drilling mud with slight trace oil specks, no odor, no taste,
slight trace fluorescence. Pressures: ISI 30 minutes, 4050 psi, IF 830 psi, FF
880 psi, FSI 4050 psi, IH 5620 psi, FH 5560 psi.

DST #2, interval 9230 to 9340', 1800' water cushion. Recovered water
cushion, 120' drilling mud, no odor, no gas, very slight trace fluorescence,
very slight oil flecks. Pressures: 45 minutes ISI 4245 psi, IF 855 psi, FF 910
psi, FSI 4210 psi, IH 5630 psi, FH 5590 psi.

DST #3, interval 9355 to 9440', 1800' water cushion. No gas to surface,
no gas above water cushion. Recovered water cushion 270' very slightly oil cut
and heavily gas cut drilling mud, 730' gas out muddy salt water, 600' gas cut
salt water. Pressures: 45 minutes, ISI 5300 psi, IF 970 psi, FF 1600 psi, FSI
4500 psi, IH 5510 psi, FH 5470 psi.

DST #4, interval 9684 to 9765', Recovered 360' drilling mud, 1125' black
salty sulphur water. Pressures: IF - zero, FF 650 psi, SI 4420 psi, IH 4860
psi, FH 4770 psi.

DST #5, interval 10,618 to 10,680', mis-run, packers failed. Recovered
3320' drilling mud.

DST #6, interval, 10,598 to 10,680', mis-run, disc failed to rupture
when dropped bar.

DST #7, interval, 10,587 to 10,680', mis-run, packer failed. Recovered
990' drilling mud.

DST #8, interval, 10,554 to 10,680', open 4 hours, gas to surface 2 hour, 5 minutes, too small to measure. Shut in 1 hour. Recovered 90' oil and gas cut drilling mud, 90' mud cut oil, 90' oil and gas cut drilling mud. No water. Pressures: IF 55 psi, FF 80 psi, SI 1010 psi, IH 5660 psi, FH 5325 psi.

DST #9, interval 12,016 to 12,061', packers failed, recovered 3870' drilling mud.

DST #10, interval 11,960 to 12,061', mis-run, recovered 720' gas cut drilling mud.

DST #11, interval 11,962 to 11,969', mis-run, packers failed. Recovered 30' drilling mud, 360' black, brackish sulphur water, 670' slightly gas cut drilling mud.

DST #12, interval 21,905 to 12,950', 1000' water cushion. Recovered 1000' water cushion, 540' salt water, Pressures: ISI 5950 psi, FSI 5200 psi, IF 600 psi, FF 800 psi, IH 7100 psi, FH 6950 psi.

DST #13, interval 12,961 to 13,006', 1000' water cushion. Recovered 1000' water cushions 1030, salt water. Pressures: ISI 6080 psi, FSI 5450 psi, IF 500 psi, FF 980 psi, IH 7050 psi, FH 6770 psi.

Casing Record

42 feet of 24" conductor with 50 sacks at 42'.
612 feet of 13 3/8" surface casing with 800 sacks at 629'.
9,451 feet of 7 5/8" intermediate casing with 1100 sacks at 9,466'.
10,748 feet of 5 1/2" production casing with 75 sacks at 10,762'.

Plugging Record:

13,503-13,385 with 25 sacks;	13,050-12,820 with 50 sacks;
12,100-11,870 with 50 sacks;	10,762-10,714 with 25 sacks;
9,300- 9,200 with 25 sacks;	5,500- 5,450 with 25 sacks;
5,230- 5,168 with 30 sacks;	3,540- 3,500 with 20 sacks;
644- 610 with 30 sacks;	15 sacks at top

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

Pierre formation	1790
Niobrara formation	4090
Greenhorn formation	4585
Muddy formation	5180
Basal Cretaceous sands	5455

Jurassic System

Morrison formation	5935
Sundance group	6260
Piper formation	6665

Triassic System

Spearfish formation	6830
Permian System	
Minnekata formation	7405
Opeche formation	7445
Pennsylvanian System	
Minnelusa formation	7655
Mississippian System	
Amsden formation	7875
Heath formation	7930
Kibbey formation	8260
Kibbey lime 8410	
Charles formation	8537
Mission Canyon formation	
(base of last salt)	9160
Lodgepole formation	9850
Englewood	10,612
Devonian System	
Lyleton formation	10,640
Nisku formation	10,850
Duperow formation	10,930
Souris River formation	11,310
Dawson Bay formation	11,530
Prairie Evaporite	11,610
Ashern formation	11,760
Silurian System	
Interlake formation	11,840
Ordovician System	
Stony Mountain, Upper	12,580
Stony Mountain, Lower	12,710
Red River formation	12,760
Winnipeg Shale	13,315
Winnipeg Sand	13,460
Total Depth	13,478

1080-1320	Lignite, brownish black (5YR2/1), resinous to sooty, brittle, shale, light brownish gray (5YR6/1), carbonaceous, compact.
1320-1590	Shale, light brownish gray, platy and compact, bentonitic, calcareous to slightly calcareous, scattered fragments of lignite, from 1410-1470 largely lignitic.
1590-1650	Shale as above, with scattered shell fragments.
1650-1700	Sandstone, subangular, fine to medium grained, calcareous, composed of quartz and light to dark greenish grains with a white cementing material, fairly well cemented, shale and lignitic fragments as above.
1700-1800	Shale, light brownish gray as above, carbonaceous, small fragments of white bentonite, some pyrite, fragments of sandstone from above.
1800-1830	Sandstone, argillaceous, fine to medium grained, as above.
1830-1860	Missing.
1860-1890	Shale, light brownish gray, as above.
1090-1920	Missing.
1920-1950	Shale and sandstone as above, poor samples.
1950-2010	Missing.

2010-2130	Shale, light olive gray (5Y6/1), platy, compact, some stringers of pyrite.
2130-4260	Missing.
4260-4320	Shale, medium gray, thinly laminated, brittle, some scattered shell fragments, also lignite fragments, caving?
4320-4350	Missing.
4350-4380	Shale, medium light gray, splintery, brittle, scattered shell fragments, scattered lignite fragments.
4380-4410	Missing.
4410-4440	Shale, light gray, lumpy and spongy, bentonitic, scattered shell fragments, Inoceramus prisms, and lignite fragments.
4440-4620	Missing.
4620-4800	Shale, medium dark gray, splinters into tabular fragments, biotitic and calcareous, fragments of medium gray shale with interbedded calcareous "white specks".
4800-5020	Shale, light olive gray (5Y6/1), relatively structureless, with disseminated pyrite, scattered Inoceramus prisms, from 4920-40 shale is bentonitic.
5020-5030	Shale, dark gray, foliated and compact.
5030-5050	Shale, light olive gray, massive and compact, some dark gray shale, possibly cavings.
5050-5130	Shale, medium dark gray, foliated, compact to brittle.
5130-5150	Shale as above, lignite, black, hard, brittle, probably cavings.
5150-5210	Shale as above.
5210-5280	Sandstone, fine grained, composed of semi-angular quartz grains with scattered dark green grains, well cemented with calcareous cement, shale, as above, cavings.
5280-5380	Shale, medium gray, platy and compact.
5380-5540	Shale, medium dark gray, fissile, compact, with brown plant fragments on parting surfaces.
5540-5570	Shale as above, shale medium light gray, compact, laminated, scattered fragments of very fine grained sandstone, biotitic, interlaminated with shale.
5570-5630	Shale as above, sandstone, fine grained sub-angular quartz grains, fairly well cemented.
5630-5700	Shale as above, sandstone as above, scattered coarse quartz grains, angular.
5700-5780	Sandstone, scattered angular to sub-angular, medium to coarse grained quartz grains, shale as above, cavings.
5780-5820	Shale, medium dark gray, fissile, splintery luster.
5820-5910	Shale as above, sandstone, medium grained, semi-angular quartz grains, friable.
5910-5980	Shale, medium light gray, spongy, lumpy.
5980-5990	Shale, medium gray, thinly laminated, sandstone, fine grained, sub-angular quartz grains, fairly well cemented.
5990-6050	Shale as above, shale, greenish gray, waxy luster, scattered.
6050-6100	Shale, medium dark gray, finely laminated to fissile, shale, medium light gray, finely laminated, sandstone, fine grained, well cemented, greenish color.
6100-6280	Shale as above with scattered fragments of greenish gray shale with a waxy luster, sandstone, white, fine grained, friable, in scattered fragments, scattered shell and Inoceramus fragments.

6280-6300 Sandstone, fine grained, fairly well cemented with calcareous cement, composed essentially of sub-angular grains of quartz, very light gray color, shale cavings.

6300-6360 Shale, medium gray, thinly laminated, brittle, sandstone, medium light gray, fine grained, slightly calcareous.

6360-6370 Limestone, light gray, oolitic, dense.

6370-6450 Shale, medium light gray, brittle, flaky, numerous scattered blackish red (5R2/2) calcareous oolites.

6450-6580 Argillaceous limestone, medium light gray, dense.

6580-6590 Shale, brownish gray, calcareous, limestone as above.

6590-6630 Shale as above and shale, medium gray, non-calcareous.

6630-6650 Limestone, light gray, very finely crystalline.

6650-6705 Limestone as above, but medium gray to light gray.

6705-6710 Limestone, medium gray, micro-fossiliferous, dense.

6710-6770 Shale, medium gray, thinly laminated, brittle.

6770-6840 Dolomite, very light gray, very finely crystalline.

6840-6900 Shale, medium light gray, thinly laminated, brittle.

6900-6960 Shale, grayish red (10R4/2), structureless, dense, fragments of sucrosic anhydrite, according to microlaterolog salt from 6920-6970, shale as above, cavings.

6960-7150 Shale, medium to medium dark gray, broken into tabular fragments, brittle, also grayish red shale and pale reddish brown siltstone fragments.

7150-7240 Shale as above, fragments of anhydrite, according to the microlaterolog salt is from 7150-7250, however, there is no recognizeable salt in samples.

7240-7270 Dolomite, pinkish gray, very fine grained, fragments are rounded, shale as above, cavings.

7270-7410 Shale, medium gray, as above, fragments of grayish red shale, and pale reddish brown siltstone, and some scattered anhydrite, some scattered salt crystals.

7410-7460 Argillaceous limestone, moderate orange pink (10R7/4), fine grained texture grading to a microsucrosic texture, and grading from no pore spaces to many pore spaces, shale as above, caving.

7460-7510 According to the microlaterolog there is salt from 7460-7480 and there are some salt crystals in the samples.

7510-7670 Argillaceous, very fine grained, sandstone, moderate red (5R5/4), friable, shale, medium gray, caving.

7670-7730 Dolomite, grayish orange pink (5YR7/2), very finely crystalline, angular to sub-angular fragments.

7730-7750 Shale, medium dark gray, thinly laminated, compact, dolomite as above.

7750-7820 Dolomite as above, the texture becoming more sublithographic.

7820-7890 Dolomite, as above, dolomite, pale red (5R6/2), microsucrosic texture.

7890-7930 Limestone, grayish red (10R4/2), very fine grained, dense, angular fragments.

7930-8080 Shale, dark gray, fissile, brittle, thinly laminated shale and calcareous layers, fragments of argillaceous fine grained, moderate reddish brown sandstone.

8080-8130 Dolomitic limestone, medium dark gray, very finely crystalline, dense.

8130-8280	Dolomite, light brownish gray, finely crystalline, limestone, very light gray, micro-fossiliferous.
8250-8280	Shale, pale reddish brown (10R5/4), platy, silty.
8280-8415	Sandstone, light brownish gray, fine grained, friable.
8415-8440	Shale, dark gray, fissile, splinters into slender fragments, probably due to caving (?), fragments of white anhydrite, and fine grained sandstone.
8440-8475	Limestone, light gray mottled, subangular fragments, anhydrite fragments, scattered as above, shale fragments as above.
8475-8625	Shale, dark gray, fissile, as above, less limestone than in above samples, shale, light brown (5YR6/4), slightly calcareous.
8625-8750	Shale, dusky brown (5YR2/2), platy, brittle.
8750-8790	Shale, medium dark gray, fissile.
8790-8850	Shale as above, with a scattering of white anhydrite fragments.
8850-8900	Shale as above, limestone in scattered fragments, variegated medium gray, micro-fossiliferous, dense, scattered white anhydrite fragments, as above.
8900-8970	Limestone, light brownish gray, dense to soft, finely crystalline to a micro-sucrosic texture, shale as above.
8970-8990	Limestone, very light gray, very porous, soft and crumbly, shale, cavings, as above.
8990-9050	Anhydrite, white, micro-sucrosic texture, hard to soft, in scattered fragments, shale caving, as above, limestone as above.
9050-9180	Limestone, light brownish gray, very finely crystalline to micro-sucrosic texture, dense to soft and spongy, scattered white anhydrite fragments.
9180-9185	Salt, white, fine to large crystals, clear to semi-transparent.
9185-9210	Limestone, light brownish gray to very light gray, dense to soft, some fragments are porous with micro-sucrosic texture.
9210-9235	Anhydrite, white to light gray, dense, very fine grained texture, limestone as above.
9235	Limestone, variegated light gray, dense, some of it appears oolitic.

Core Chip Description

9240-9245	Limestone, brownish gray (5YR4/1), micro-crystalline texture with scattered authigenic calcite crystals, very dense, stylitic.
9245-9248	Limestone, pale brown (5YR5/2), dense, grainy texture, micro-fossiliferous.
9248-9260	Limestone, light brownish gray, micro-crystalline, dense, stylitic.
9260-9265	Limestone as above, but brownish gray.
9265-9274	Limestone, light brownish gray, finely crystalline, grainy texture, dense, stylitic.
9274-9281	Limestone, medium dark gray, as above, some fossil cup corals.
9281-9287	Limestone, light brownish gray, finely crystalline, scattered microfossils and shell fragments which are replaced by calcite, dense.
9287-9293	Limestone, medium dark gray, finely crystalline, scattered authigenic calcite prisms, very dense.
9293-9296	Limestone as above, light brownish gray.

9296-9313	Limestone, medium light gray, finely crystalline, shell fragments replaced by calcite, dense.
9313-9334	Limestone, medium dark gray, fine to medium grain size, thinly laminated structure, dense, with scattered fossil fragments, some thin intervals highly recrystallized, composed largely of calcite rhombohedrons.
9334-9347	Limestone, medium dark gray, very fine grained, dense, largely structureless, some scattered fossil fragments.
9347-9358	Anhydrite, light bluish gray, microsucrosic texture, very dense.
9358-9363	Limestone, the first foot of which is coarsely crystalline and has fissures filled with above anhydrite, but below grading into pale yellowish brown, fine grained limestone.
9363-9380	Limestone, brownish gray, sublithographic texture, very dense and hard.
9380-9388	Limestone, pale yellowish brown (10YR6/2), microsucrosic texture, scattered small fossil fragments, dense.
9388-9391	Limestone, medium dark gray, fine textured, shaly.
9391-9394	Limestone, medium dark gray, medium sized grains, abundant small fossil shells, dense.
9394-9400	Limestone as above, but finer grained, and fewer fossils.
9400-9418	Limestone, dark gray, very fine grained texture with scattered larger authigenic calcite crystals, very dense.
9418-9445	Limestone, as above, but medium gray.
9445-9464	Limestone as above, but light brownish gray, with occasional fossils.

Sample Description

4970-9520	Limestone, pale brown (5YR5/2), fine grained, dense.
9520-9625	Limestone, light brownish gray, medium to fine grained, quite fossiliferous with microfossils which are largely replaced by large calcite crystals, dense.
9625-9670	Limestone, medium gray, fine grained, grainy texture, dense, some scattered fossil fragments, with some fossils replaced by pyrite.
9670-9700	Limestone, light brownish gray, fine grained, grainy to micro-sucrosic texture, interbedded microfossils.
9700-9770	Limestone, pinkish gray, coarse angular grains, rhombic texture, very fragmental, small interbedded microfossils.
9770-10620	Limestone, medium dark gray, fine grained, subcrystalline texture, thin angular platy fragments, no noticeable structure.
10620-10645	Shale, dark gray, sooty luster, shows fair cleavage, in platy fragments, slightly calcareous, compact, limestone fragments from above.
10645-10655	Shale, as above, oolitic limestone, medium dark gray oolites imbedded a lighter calcareous matrix.
10655-10680	Limestone, light brownish gray, fine sized grains, granular texture, thin angular platy fragments.

Core Chip Description

10680-10690	Interbedded shale and dolomite, wide layers of very light gray finely crystalline dolomite with narrower wavy layers of greenish gray shale, with pyrite scattered through both the dolomite and shale.
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10690-10697 As above, but more shale.
 10697-10700 Dolomite, grayish orange pink (5YR7/2), fine grained, subcrystalline texture, dense, some of above shale interbedded in dolomite.
 10700-10729 Shale, pale brown (5YR5/2), massive structure, compact.
 10729-10731 Dolomite, grayish orange pink and greenish gray mottled texture, very finely crystalline, dense.

Sample Description

10735-10760 Dolomite, mottled grayish orange pink and greenish gray, very finely crystalline, shale and limestone caving, various shades of gray.
 10760-10780 Argillaceous dolomite, pale brown (5YR5/2), fine grained size, not too compact.
 10780-10800 Argillaceous dolomite, as above, anhydrite, white, micro-sucrosic texture.
 10800-10855 Argillaceous dolomite, as above.
 10855-10880 Limestone, pale brown, very fine grained, subcrystalline texture, limestone, grayish brown, as above.
 10880-10940 Dolomite, brownish gray, microsucrosic texture, some fossil fragments.
 10940-10950 Dolomitic limestone, grayish orange pink, very fine sized grains, subcrystalline texture.
 10950-10980 Limestone, grayish brown, very fine grained, subcrystalline, to microcrystalline texture.
 10980-10990 Limestone as above, anhydrite, pinkish gray, microsucrosic texture.
 10990-11000 Dolomite, pale brown, very fine grained, with some imbedded well rounded quartz grains.
 11000-11010 Anhydrite, pinkish gray.
 11010-11020 Limestone, light brownish gray, fine grained, granular texture, microfossiliferous.
 11020-11050 Limestone, brownish gray, very fine grained, microcrystalline texture, anhydrite from 11080-11090.
 11050-11125 Limestone, light brownish gray, fine grained, granular texture.
 11125-11165 Limestone, medium to medium dark gray, very fine grain size, microcrystalline texture.
 11165-11210 Anhydrite, light gray, very finely crystalline, limestone, as above, mostly due to caving.
 11210-11255 Limestone, grayish brown (5YR3/2), very fine grained, sub-crystalline texture.
 11255-11290 Anhydrite, very light gray, very finely crystalline, limestone as above.
 11290-11440 Limestone, brownish gray, fine to very fine grained, micro-crystalline, dense, angular fragments, some scattered anhydrite fragments.
 11440-11500 Limestone, medium dark gray, very fine grained, scattered microfossils.
 11500-11530 Dolomitic limestone, very light gray, fine grained, micro-sucrosic texture, scattered pore openings.
 11530-11560 Limestone, brownish gray, sublithographic texture, sharp angular fragments.
 11560-11590 Limestone, light brownish gray, micro-sucrosic texture.
 11590-11610 Limestone, medium dark gray, very finely crystalline.

11610-11635	Limestone as above, with scattered anhydrite fragments.
11635-11650	Anhydrite, grayish red (10R4/2), very finely crystalline, dense, apparently somewhat limey.
11650-11680	Limestone, medium gray, fine grained.
11680-11705	Limestone as above, with some grayish orange pink, micro-sucrosic dolomitic limestone.
11705-11725	Limestone, medium dark gray, very fine grained.
11725-11850	Limestone as above, with scattered dark gray limestone fragments which are finely crystalline.
11850-11865	Dolomite, grayish orange pink, sucrosic texture, fine to medium sized grains.
11865-11985	Dolomite, very pale orange (10YR8/2), sublithographic, grain size.
11985-12000	Limestone, very pale orange, sublithographic to lithographic.
12000-12060	Dolomite, very pale orange, finely crystalline, some with a microsucrosic texture.
12060-12100	Dolomite, pinkish to light brownish gray, fine grained, micro-sucrosic to subcrystalline texture.
12100-12255	Dolomite, brownish gray, micro-sucrosic texture, fine grained.
12255-12400	Dolomite, light brownish gray, very fine, grained, sub-crystalline texture.
12400-12435	Dolomite as above, and dolomite, brownish gray.
12435-12480	Dolomite, grayish orange pink, very fine grained, sub-crystalline texture.
12480-12510	Dolomite as above, but light brownish gray.
12510-12525	Dolomite as above, but brownish gray.
12525-12545	Dolomite, light brownish ,gray, as above.
12545-12565	Dolomite, brownish gray as above.
12565-12575	Dolomite, light brownish gray, as above,
12575-12645	Limestone, medium dark gray, very fine grained, subcrystalline texture.
12645-12700	Dolomite, light brownish gray, very fine grained, sub-crystalline texture, some fragments showing stylolites.
12700-12795	Limestone, medium gray to medium dark gray, very fine grained, subcrystalline texture, microfossiliferous.

Core Chip Description

12795-12797	Limestone, medium gray, very fine grained, subcrystalline texture, fossiliferous.
12797-12800	Dolomite, light brownish gray, very fine grained, sub-crystalline texture, shows a banded structure, micro-fossiliferous.
12800-12820	Limestone, very fine grained, subcrystalline texture, stylolitic structure, fossiliferous.
12820-12822	Argillaceous limestone, medium gray, dense, massive structure.
12822-12835	Anhydrite, medium gray, fine grained, grainy to subcrystalline texture.
12835-12840	Dolomite, light brownish gray, very fine grained, shows a banded structure.
12840-12852	Dolomite as above, but without the banded structure.
12852-12858	Limestone, brownish gray, very fine grained, subcrystalline texture, fossiliferous.

12858-12860	Dolomite, grayish orange pink, very fine grained, micro-sucrosic texture, with brownish gray secondary rhombic dolomite crystals filling what were apparently solution cavities.
12860-12893	Limestone, medium dark gray, very fine grained, micro-fossiliferous with the shells being replaced by secondary calcite crystals.
12893-12897	Dolomite, medium dark gray, fine grained, subcrystalline texture, apparently anhydritic.
12897-12906	Anhydrite, medium gray, fine grained, subcrystalline texture.
12906-12930	Dolomite, dark yellowish brown (10YR4/2), very fine grained, shows styolitic structure.
12930-12948	Dolomite, pale brown, fine grained, fossiliferous with some of it showing elongated tube-like structure which is filled with lighter colored secondary dolomite at 12933-34.
12948-12959	Limestone, pale brown, fine grained, some authigenic calcite crystals present.
12959-13006	Dolomite, pale yellowish brown (10YR6/2), very fine grained, relatively structureless.

Sample Description

13006-13200	Dolomite, light brownish gray, very fine grained with some fragments being sublithographic, some scattered fossil shell fragments.
13200-13320	Limestone, pale brown to brownish gray, very fine grained, some fragments being sublithographic, some imbedded microfossils.
13320-13355	Shale, dark gray, sooty luster, splintery, compact, limestone as above, cavings.
13355-13420	Shale as above, dark gray, in long splintery fragments, with small black spherical grains (?) imbedded in it.
13420-13478	Sandstone, few scattered fragments, fine grained, shale as above.
13478	Total Depth.