STATE OF SOUTH DAKOTA
George T. Mickelson, Governor

STATE GEOLOGICAL SURVEY
E. P. Rothrock, State Geologist

REPORT OF INVESTIGATIONS

No. 61

ADDITIONAL WELL BORINGS IN SOUTH DAKOTA
(Supplement to R. I. 57)

by

C. L. Baker

University of South Dakota
Vermillion, South Dakota
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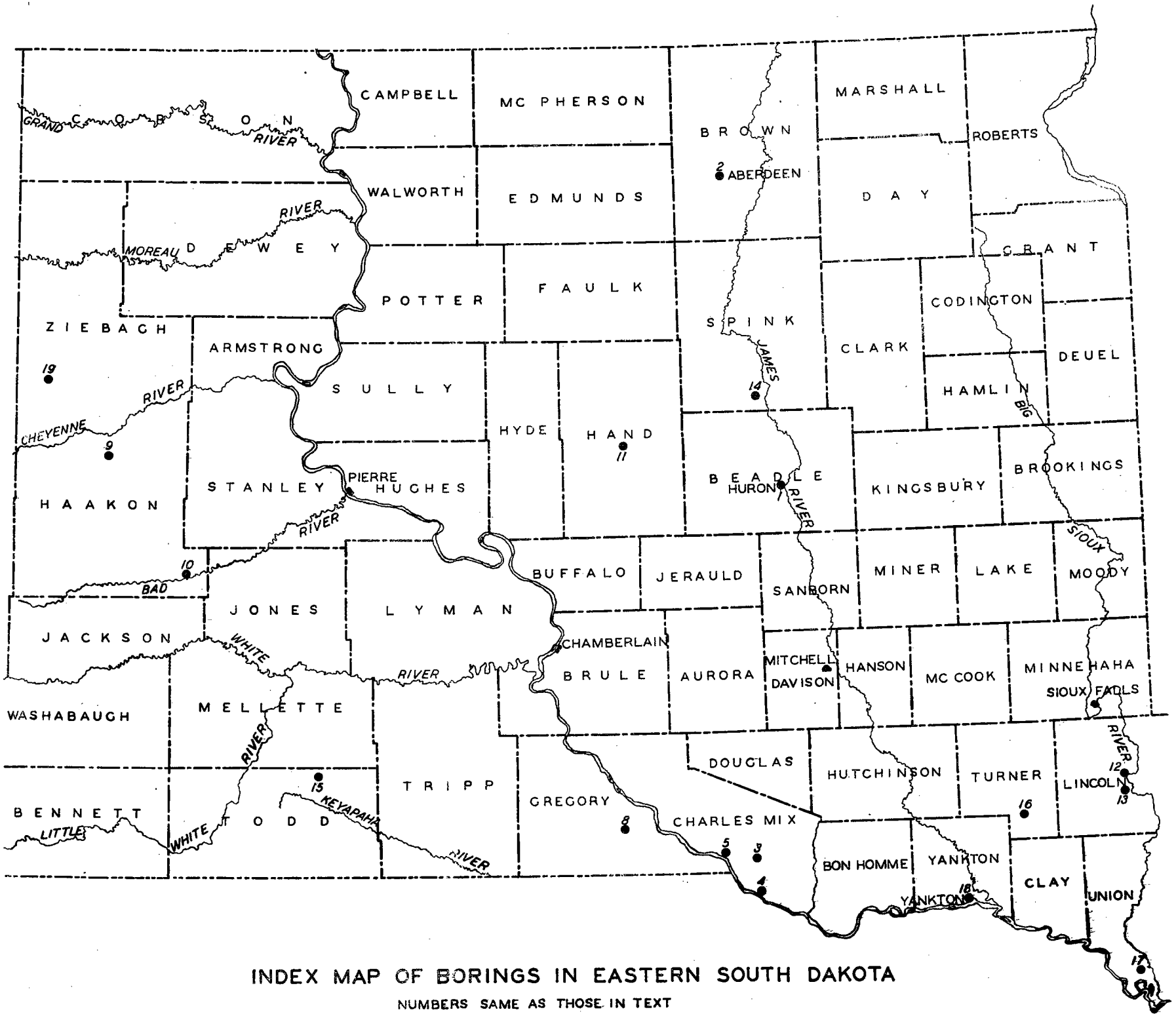

INDEX MAP OF BORINGS IN EASTERN SOUTH DAKOTA

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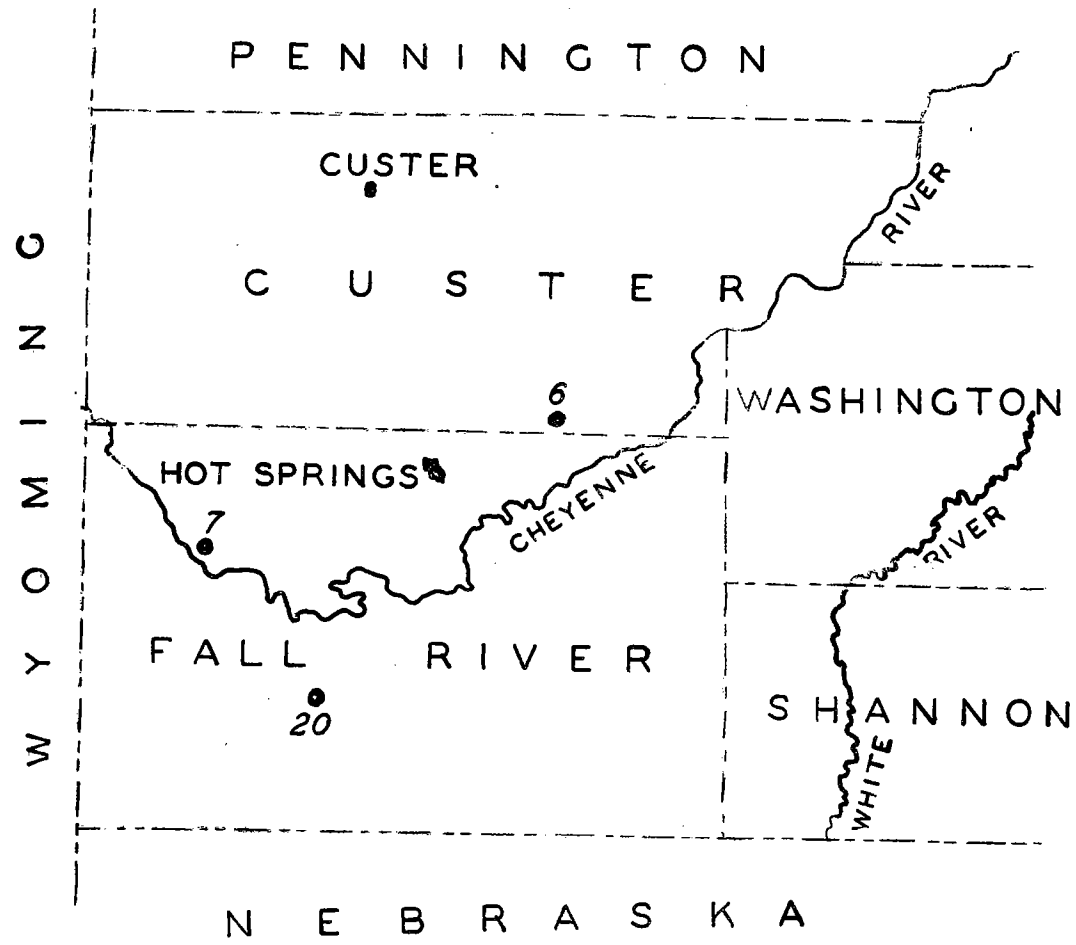

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ADDITIONAL WELL BORINGS IN SOUTH DAKOTA

by

C. L. Baker

INTRODUCTION

This report is a supplement to a compilation of well logs published as Report of Investigations No. 57 by the State Geological Survey, entitled "Deep Borings of Western South Dakota." That report was made from a study of the cuttings of most of the deep wells which had been drilled in the state within recent times and contains the logs of all the important oil tests and some deep water wells drilled west of the one-hundredth meridian.

This supplement presents the results of a study of cuttings of wells all of which, with five exceptions lie east of the Missouri River. These exceptions are the Hollingsworth Childer (oil test) in Fall River County, and the City of Buffalo Gap (water well) in Custer County, two wells in Haakon County and one in Ziebach County. State Geological Survey, Reports of Investigations, numbers 4, 57, and this report, bring together all the subsurface information available from reliable well logs drilled in the state to the beginning of the year 1948 and completes the correlation of all the cuttings on file with the Geological Survey up to that date.

SUMMARY OF RESULTS

The principal results of the investigation presented here follow:

1. South of a line through northern Hanson and Davison Counties, west-northwest to just south of Pierre, thence westward across Stanley County, the basement crystalline rock is Sioux quartzite.

2. The upper 275' thickness of Paleozoic rocks, mainly carbonate sediments, beneath Jefferson in the southeast corner of South Dakota, cannot be assigned to any definite age.

3. The grit composed of coarse white quartz grains, occurring at the base of the known Lakota from Aberdeen south to Huron may be either Lakota or some older formation.

4. The manganese bearing pellet horizon at the top of the Fuson can be traced from outcrop at Sargeant's Bluff, south of Sioux City, Iowa, underground all the way westward to the Black Hills, therefore that formation, the underlying Lakota and the overlying "Dakota" (Fall River) are continuous underground in the Dakota Basin.

5. In the area between Huron and Pierre there appear to be three sandstones in the interval beneath the Greenhorn limestone and above the Dakota sandstone.

6. The Codell sand, whose position is at or near the base of the Niobrara, appears to be widespread beneath eastern South Dakota although the water it contains is of exceedingly poor quality.

BEADLE COUNTY

Huron
STATE FISH and GAME COMMISSION WELL
in State Fair Grounds
Sec. 36, T. 111 N., R 62W. Altitude 1250'

0- 90	Sand, etc-Lake Dakota beds.
90-100	Pierre clay, bentonitic, slate grey.
225-250	Niobrara, chalk pellet marl.
260-310	Codell sandstone, much pyrite and marcasite at top. Sand grains light and dark grey, angular to round, polished, mostly fine grained, poorly cemented.
310-320	Marcasite cemented sandstone.
320-370	Sandstone, light grey, fine angular.
370-390	Carlile clay, slate grey.
390-410	Sand, as higher up.
410-420	Marcasite cemented sand.
420-470	Clay, slate grey, with marcasite.
470-500	Greenhorn limestone, grey sandy, INOCERAMUS prisms and GLOBIGERINA, chalk pellet marl appears to pass downwards into coarse sand, angular to rounded.
500-540	Graneros clay, slate grey.
540-550	Largely sand, grey, firm, rounded to angular.
550-560	Largely sand, with Greenhorn cavings.
560-570	Largely marcasite.
570-580	Largely marcasite, green, abundant fish remains.
580-590	Clay, slate grey, micaceous.
590-600	Marcasite and Greenhorn cavings.
600-720	Clay, slate grey, shaly.
720-730	Some fine grey sandstone.
730-750	Shale, slate grey, micaceous.
750-760	Dakota (?) sandstone, dark grey.
760-800	Shale, slate grey, micaceous.

800- 830	Dakota sandstone, grey, coarse, unsorted, angular to round.
830- 850	Mostly shale (caving?).
850- 870	Fuson with manganese bearing brown pellets.
870- 960	Clay, bentonitic, grey.
960-1050	Lakota sandstone, carbonaceous.
1051-1060	Sandstone, hard, well cemented (quartzitic), coarse, angular, some pink Sioux quartzite grains, quartz is corroded.
1065-1070	A few pink Sioux quartzite but mostly white quartz grains, nodules of brown siderite.
1080-1130	Siderite concretions, white quartz grains with kaolin matrix.
1130-1140	Some fine sericite and light green hydromica matrix, fresh feldspar, some pink microcline.
1151	Granite fragments.
1155	Rounded quartz grains and light green chlorite.
1173	Large piece muscovite.
1176-1178	Pre-Cambrian weathered hornblende granite from 1051 to 1176 feet depth; evidently iron has been leached out overlying sandstone.

BROWN COUNTY

CITY of ABERDEEN NO. 3 WELL
Altitude 1290'

2- 20	Tawny leached Pierre shale with selenite, or boulder clay.
20- 90	Glacial sand and gravel.
90- 185	Pierre clay, Sharon Springs Member, dark grey, bentonitic.
185- 310	Niobrara marl, brown-grey, quite chalky.
310- 600	Carlile clay, grey, sandy.
600- 700	Clay with white bentonite, possibly some Greenhorn limestone.
772	Peculiar coarse angular quartz fragments with small adherent biotite flakes (caving?).
786	Angular coarse quartz particles, much etched.
700- 800	Clay, slate grey, INOCERAMUS prisms.
850	Fuson light green and grey bentonite with manganese bearing pellets.
800- 935	Sand, very fine, angular, clayey.
935-995	Sandstone, brown concretions, bentonite, manganese bearing pellets.
995-1100	Lakota sand, buff, angular to rounded grains, fine muscovitic.
1100-1135	Sand, bentonitic.
1135-1172	Clay ironstone, brown, selenite, brown clay with glauconite.
1172-1191	Bentonite, pink and buff.
1187-1227	Sand, coarse to fine, rough surfaced grains, buff altered feldspar, a little chlorite.
1267-1300	Pre-Cambrian, particles of flesh-colored orthoclase, hornblende, chlorite and quartz.

CHARLES MIX COUNTY

PALENSKY-WEAVER 3
Sec. 15, T. 95 N, R. 64 W

1300	Lakota sand, buff, coarse, poorly sorted, etched, round to angular grains, some marcasite cemented, Greenhorn limestone fragments, lignite, manganese-bearing Fuson pellets.
below 1453	Sioux quartzite, pink.
1600	Some small pebble-sized grains.
1959-1971	Phyllite.
2141-2147	Pink and purplish quartzite with sericite and biotite.
2147-2180	Phyllitic pipestone.
3745-3791	Quartzite with sericite and specularite.
4451-4455	Pipestone, purple, silty argillite to fine sandstone, greasy grey pyrophyllite.
4455-4460	Mainly pyrophyllite, pearly, translucent, honey color, beeswax lustre.
4460-4465	Pyrophyllite, fine grain dark maroon sandstone, pipestone.
4470-4480	Pyrophyllite, and translucent quartz.
4480-4490	Pyrophyllite, brown-grey, pearly, with quartz grains.
4490-5123	Quartzite and aluminum silicate, sericite or muscovite.
5136&5145	Some light-colored argillite.
5152&5159	Somewhat schistose purplish quartzite and pipestone, mica, pyrophyllite.
5160-5180	Some white kaolin or bauxite.
5180-5182	Some white kaolin or bauxite, brown-buff and pink.
5182-5240	Some white kaolin or bauxite, lavender.
	Remainder of cuttings below 1453 are Sioux quartzite.

CHARLES MIX COUNTY

U. S. INDIAN SERVICE
Greenwood
about 40 ft. above Missouri River
Altitude 1234'

420- 440	Greenhorn limestone, with fine sand grains, water-bearing. INOCERAMUS prisms, GLOBIGERINA, a little glauconite.
440- 480	Graneros shale, slate grey.
552- 603	Shale, bentonitic, brown drab, with lignite fragments below 577'.
608- 610	Fuson manganese-bearing pellets in drab bentonite, fine sand and lignite.
618- 620	Fine sand, lignite, manganese-bearing pellets.
640- 651	Lakota sand, 3000 gallons per minute flow, hard water; Note: water flows reported at 482-495', 552-556', (top Dakota) and 577-579'

CHARLES MIX COUNTY

U. S. ARMY CORPS of ENGINEERS
Pickstown (Fort Randall Dam)
drilled by Omaha Drilling Co.
SE ¼, Sec. 4, T. 95 N., R. 65 W., Altitude 1489.1

150- 160	Small size gravel and sand, quartz, orthoclase, limestone and schist fragments.
170- 315	Niobrara marl, chalk spotted, grey, GLOBIGERINA, sub-laminated, purer chalk at base.
315- 340	Codell sand, light grey, fine to medium, angular, GLOBIGERINA, TEXTULARIA.
340	Sand, coarser, polished and etched grains, many angular, some rounded, partly cemented.
400- 420	Sand, medium to fine, cream colored.
420- 440	Carlile clay, light grey
550- 560	Cavings with pure chalk.
570- 600	Greenhorn limestone, impure, composed of GLOBIGERINA and INOCERAMUS prisms.
620	Possibly some fine grained light grey sandstone
630	Clay, grey, bentonitic, VIDALINA, becoming dark grey and bituminous downwards.
660	Bentonite, light blue grey, clay, medium grey.
690	Shale, bentonitic, grey.
720	Some sandstone, light grey, fine grained, friable.
770	Dakota sandstone, fine, light brown, carbonaceous, some chalcopyrite.
790- 820	Sand, loose, fine, angular, buff.
854	Total depth, in sand at bottom.

An analysis of the Codell sand water in the above well, by U. S. Engineers Corps, in parts per million, is as follows:

Calcium	(Ca)	17.0	Sulphate	(SO_4)	171.0
Magnesium	(Mg)	6.0	Chloride	(Cl)	[illegible]4.0
Alkalies as Sodium	(Na)	516.0	Nitrate	(NO_3)	2.8
Iron	(Fe)	0.08	Bicarbonate	(HCO_3)	611.0
Aluminum	(Al)	2.0	Silica	(SiO_2)	22.0
Fluoride	(F)	3.1	Total Solids		1358.0

This water is diluted by intake from Missouri River, water from the same sand at Lake Andes contains 2057 parts per million mineral salts, mostly sodium chloride. Dakota sand water in the above well has the following mineral content, in parts per million:

Calcium	(Ca)	285.0	Sulphate	(SO_4)	815.0
Magnesium	(Mg)	53.0	Chloride	(Cl)	46.0
Alkalies as Sodium	(Na)	46.0	Nitrate	(NO_3)	0.1
Iron	(Fe)	0.09	Bicarbonate	(HCO_3)	154.0
Aluminum	(Al)	3.0	Silica	(SiO_2)	12.0
Fluoride	(F)	2.7	Total Solids		1743.0

CUSTER COUNTY

CITY OF BUFFALO GAP
on rise west of town
Sec. 26, T. 6S., R. 7E., Altitude 3277.5'

12- 30	Apparently alluvial debris, mainly from Dakota-Lakota, quite sandy, foraminiferal, limestone cement, biotite flakes, plant fragments, selenite, fish remains, INOCERAMUS fragments, limy sandstone.
30- 80	Carlile clay, light slate grey, very bentonitic. Shale, black, marly, bituminous, minute chalk specks, GLOBIGERINA.
90- 150	Shale, black, marly, bentonitic, minute chalk specks, GLOBIGERINA, fish fragments, crumbly and grainy, quite bituminous, thin calcite laminae.
150- 160	Some black jet (coal), otherwise as just above.
180- 190	Greenhorn, dark grey, limy, hard, brittle, full of GLOBIGERINA and INOCERAMUS prisms.
200- 210	Graneros clay, dark blue grey, sticky, bentonitic.
210- 220	Lighter grey, GLOBIGERINA rock, may be base Greenhorn.
220- 230	Shale, dark grey, chalky specks, crumbly, grainy.
230- 240	Shale, crumbly, dark blue grey, bentonitic.
250- 400	Large caving chunks of slate colored shale, full of small chalk dots, INOCERAMUS, GLOBIGERINA, fish scales, bentonitic.
400- 410	Some white bentonite.
440- 450	Some white bentonite, glauconite, abundant fish scales
470- 480	Shale, slate grey.
490- 500	Some white bentonite.
530- 540	Shale, silty.
570- 590	Ironstone concretions, brown-red.
640- 650	Silt and fine sand interlaminated with dark shale.
650- 660	Bentonite, light grey, small biotite flakes.
670- 700	Sand, angular, fine, bentonite matrix and bentonitic shale.
700- 790	Muddy (Newcastle) sandstone, grey, fine.

790- 800	Siltstone, grey.
800- 810	Bentonite, light cream.
810- 850	Shale, medium silver grey, silty
850- 860	Sandstone, grey, very fine, brown concretions.
860	Shale, blue grey.
1000-1030	Silt and fine sand, light grey.
1030-1110?	Shale, dark slate grey, finely laminated, bentonitic.
1120-1150	Dakota sand, loose, brown-buff, fine, angular.
1150-1160	Siltstone, purple, and sandstone, manganese carbonate cement, some sericite.
1160-1170	Fuson manganese-bearing pellets, sandy, and brown siltstone.
1170-1180	Sand, buff, fine angular, partly recrystallized.
1185-1212	Very numerous manganese-bearing pellets, in drab, pink and dark dull red silty bentonite and purple, grey and black carbonaceous shale.
1212-1220	Sand, honey yellow, fine.
1227	Shale, grey, carbonaceous, very bentonitic, lignite, marcasite replacing wood.
1230-1240	Shale, carbonaceous, and lignite.
1240-1260	Less lignite, black shiny jet coal, much marcasite. Coal and wood replaced by marcasite, carbonaceous shale, light grey siltstone and fine sandstone.
1275-1280	Sand, light grey, fine to medium, etched rounded grains, many recrystallized.
1285	Bentonite, light grey drab.
1285-1300	Bentonite, light grey drab, veined with Indian red and lavender purple.
1300-1330	Cavings, bentonitic clay and siltstone.
1346	Considerable sand with some large grains.
1350-1360	Bentonite, light cream and green, some coarser sand.
1360-1380	Minnewaste limestone, light cream, very fine grained, dense.
1380-1424	Bentonite, lavender and light drab, some chert and limestone fragments, casing set at 1391'.
1442	Large amount fine sand.
1445-1448	Limestone, as at 1360-1380'.
1458-1460	Largely fine sand.
1462	Base Minnewaste (?).
1462-1465	Limestone, light grey, very fine texture, shale, dark grey.
1469-1473	Bentonite, blue and drab.
1485-1495	Bentonite and limestone.
1510-1515	Morrison (?) grey bentonitic clay.

FALL RIVER COUNTY

HOLLINGSWORTH CHILDER NO. 1
SE¼ NW¼, Sec. 23, T. 8S, R. 2E, Altitude 3570'

0- 200	Graneros shale, dark blue grey.
200	Shale, dark blue grey flaky, bentonitic, with very small sericite flakes.
220	Dakota sandstone, with thin beds of grey carbonaceous sandstone interbedded with shale.
230	Sandstone, light grey, muscovitic, fine angular with shale laminae.
240- 290	Sandstone, light grey, poorly sorted, coarse rounded to fine angular, abundant marcasite cement, wood fragments, mostly angular and coarse grained, some pink feldspar, finer, then coarser and brown grey at 280-290.
290- 300	Marcasite cement.
355	Base Dakota sandstone.
355- 360	Fuson sandstone, grey etched, angular grains, a few rounded fine to medium, with muscovite and manganese-bearing pellets.
360- 370	Same partly cemented by pyrite and marcasite.
370- 380	With light green grey bentonite.
380- 390	Bentonite, hard, grey white.
390- 410	Bentonite, hard, grey drab and light green grey.
410- 420	Clay, dark blue grey, bentonitic.
420- 430	Clay lavender, bentonitic.
430- 450	Clay, lavender and light green grey, bentonitic.
450- 460	Lakota sandstone, light grey, fine angular grains.
470- 680	Sandstone, poorly sorted, finer to coarse, some pyrite and marcasite cement, grey, with white bentonite matrix and some has limy cement (Minnewaste equivalent); larger grains are the more rounded.
680- 690	Morrison clay, light grey, bentonitic, pyrite and marcasite nodules, small dark "greenstone" pebbles.
690- 720	Clay, dark grey, with small balls of light grey bentonite, some carbonized wood.
720- 750	Clay, light grey.
750- 760	Some sand, light brown.
760- 770	Bentonite, white, sandy and limy.

760- 790	Unkpapa sandstone, limy matrix, bentonitic, light grey, etched fine to medium grains, some rounded.
790- 800	Sundance bentonite, light green, limestone, light grey, very fine grained, partly bentonitic.
800- 810	Clay, lavender, bentonitic.
810- 820	Clay, bentonitic, grey drab, possibly basal Morrison (?).
820- 830	Siltstone, grey with small particles of bright green glauconite, muscovitic and bentonitic; may be real top of Sundance.
830- 865	Same with biotite shreds.
865- 870	Bentonite, drab, flaky.
870- 890	Bentonite, grey, some white, flaky.
890- 900	Siltstone and fine sandstone, grey, glauconitic.
900- 920	Sandstone, glauconitic, grey, fine, with white bentonite. Transparent light green glauconite particles are worn.
920- 940	Siltstone, light green grey, muscovitic, matrix is bentonite.
940- 965	Siltstone and fine sandstone, salmon, angular grains, muscovitic.
965- 975	Siltstone and fine sandstone, light grey, some secondary alabaster and satinspar gypsum.
975- 980	Clay, bentonitic, drab and greenish.
980- 985	Siltstone, light salmon.
985- 990	Fine conglomerate, or grit and sandstone, with subangular grains of varicolored chert, bentonite matrix, some pyrite cement.
990- 995	Mostly bentonite.
995-1020	Siltstone, red brown (light salmon), with white alabaster at 1105-10, and some purple-lavender bentonite, 1010-20.
1020-1025	Siltstone, green grey, glauconitic.
1025-1030	Bentonite, light grey, silty.
1030-1050	Siltstone, light green grey, sparse glauconite, muscovitic, bentonite matrix, interlaminae of flaky greenish grey and drab bentonite.
1050-1085	Sandstone, light grey, fine grained, angular, interbedded with darker grey flaky bentonite, a little glauconite, some chert grains. Bentonite is very muscovitic; becomes siltstone lower down.
1085-1090	Bentonite, purple.
1090-1175	Bentonite, grey, silty and micaceous.
1175-1191	Probably bentonite.
1191-1200	Siltstone, dark salmon, clayey.
1200-1215	Bentonite, dark purple to lavender.

1215-1225	Spearfish siltstone, clayey, dark salmon (red brown), muscovitic, some with streaks of gypsum.
1225-1285	Same with veinlets of white alabaster and satinspar, bleached light grey spots.
1285-1300	Claystone, dark salmon with light grey spots, silty, with satinspar.
1300-1340	Siltstone and claystone, dark salmon with light grey spots with satinspar.
1340-1350	Same with red stained anhydrite.
1350-1360	Anhydrite, white, some pink stained.
1360-1390	Siltstone, dark salmon.
1390-1400	Anhydrite, white, pink stained.
1400-1410	Siltstone, salmon, with white spots.
1410-1450	Anhydrite, white.
1450-1460	Siltstone, salmon.
1460-1465	Anhydrite.
1465-1470	Siltstone, salmon.
1470-1485	Anhydrite, white, pink stained.
1485-1495	Siltstone, pink, partly anhydrite.
1495-1590	Siltstone, deep salmon, clayey, with spots of anhydrite.
1590-1635	Minnekahta limestone, buff to lavender, seamed with anhydrite, almost lithographic but coarser, granular near base.
1635-1645	Opeche siltstone, light red brown.
1645-1660	Siltstone, purple lavender, with spots of anhydrite, clayey below.
1660-1690	Anhydrite, buff to orange, at top red, becoming white below, with terra cotta claystone, light green grey spotted; basal anhydrite is orange red.
1690-1715	Siltstone, dark salmon, clayey, with light grey spots.
1715-1725	Claystone, bright brown red.
1725-1735	Siltstone, deep salmon.
1735-1760	Sandstone, fine grained grading down to siltstone, light brown red.
1760-1781	Minnelusa sandstone, white, fine to medium, subround to subangular, Converse.
1781-1810	Sandstone, orange, fine to medium, etched, subround and subangular grains, Converse.
1810-1835	Cavings of basal Sundance bentonite, resistivity log indicates sandstone.
1835-1840	Sandstone, orange, anhydrite cement, with some blue white milky chert, Converse.
1840-1895	Anhydrite, white and grey, sandy, pink stained; some salmon claystone.
1895-1910	Claystone, mottled salmon and light grey.
1910-1925	Anhydrite and orange sandstone with anhydrite cement; some fine crystalline buff dolomite.

1925-1940	Dolomite, light grey, fine granular, with sponge spicules, mixed with anhydrite.
1940-1955	Anhydrite.
1955-1965	Sandstone, orange to buff, fine to medium, angular to subround grains.
1965-1970	Anhydrite.
1970-1980	Dolomite, buff, fine granular.
1980-1985	Anhydrite and salmon claystone.
1985-1995	Dolomite, light grey, fine granular.
1995-2005	Sandstone, cream, fine angular, with anhydrite.
2005-2010	Dolomite and anhydrite.
2010-2015	Anhydrite, pink stained.
2015-2020	Anhydrite, sandy.
2020-2040	Anhydrite.
2040-2045	Sandstone, pink
2045-2065	Anhydrite.
2065-2070	Anhydrite and salmon siltstone.
2070-2075	Dolomite, buff stained pink.
2075-2080	Mudstone, light pink.
2080-2090	Siltstone, salmon, and claystone, mottled.
2090-2100	Limestone, magnesian, very fine granular, clayey, lavender.
2100-2105	Anhydrite, lavender to white.
2105-2110	Siltstone, lavender, limy.
2110-2120	Anhydrite, cream.
2120-2130	Limestone and fine sandstone, cream and pink.
2135-2140	Siltstone, salmon, and anhydrite.
2140-2150	Anhydrite, light grey to white, and sandstone, limy.
2150-2165	Limestone, light brown, fine granular, intermixed with anhydrite.
2165-2168	Claystone, dark salmon and purple, micaceous.
2168-2180	Shale, dull purple and drab grey, finely fissile, "red marker."
2180-2195	Limestone, magnesian, fairly dark brown, dirty, fine granular, intermixed with anhydrite.
2195-2205	Sandstone, light pink, unsorted, round to subangular grains.
2205-2210	Sandstone and limestone.
2210-2215	Limestone and anhydrite intermixed.
2215-2220	Limestone, magnesian, brown grey, fine granular, dirty.
2220-2223	Sandstone, creamy, fine, anhydrite cement.
2223-2240	Limestone, magnesian, butternut brown, very fine texture, with anhydrite, bituminous, lighter below and spotted with larger calcite crystals.
2240-2245	Sandstone, cream, unsorted, anhydrite cement, limestone pebbles.

2245-2250	Limestone, buff (?).
2250-2260	Anhydrite, limy.
2260-2265	Claystone, dark salmon, mottled, containing small spots of anhydrite.
2265-2270	Limestone, light brown grey, fine textured, fossiliferous.
2270-2275	Sandstone, unsorted, cream anhydrite cement.
2275-2285	Anhydrite, grey to cream.
2285-2300	Limestone, magnesian, dark grey, very fine granular, some black bituminous shale, possible sandstone near base, oil show.
2302-2312	Sandstone, white, all sizes of grains, etched, sub-round to angular, very large subangular to subround quartz grit grains.
2321-2326	Shale, dark grey, bituminous.
2316-2335	Sandstone, white (?), films of black oxide or bitumen.
2335-2340	Probably grey, finely granular limestone.
2340-2370	Limestone, magnesian, grey, and dolomite, clayey, fine granular, intermixed with anhydrite, some sandy.
2370-2400	Limestone, light brown grey, finely granular, with milky chert, silty.
2400-2410	Anhydrite, with salmon and grey claystone.
2410-2425	Limestone, magnesian, dove, with spots of anhydrite.
2425-2435	Limestone, light brown, magnesian, silty, with black bituminous shale, mixed with anhydrite.
2435-2445	Limestone, light brown, magnesian, small rhombs in finer matrix, brown chert, black bituminous chert.
2445-2450	Same with anhydrite and sandy.
2450-2456	Anhydrite and milky chert.
2456-2470	Limestone, dark brown, bituminous, FUSILINIDS, spicules, brown chert.
2470-2484	Limestone light brown, with very small sand grains ("Whetstone rock").
2487	Fine brown sandstone reported.
2537	Total depth (?)

FALL RIVER COUNTY

SHILOH WELL
Lakota Development Company
Contractor: H.L. Hollingsworth
S.E.¼ Sec. 20 T. 10S R. 4E Altitude 3600

Note: This record was obtained from H. L. Hollingsworth and the correlation made from the record by C. L. Baker. Cuttings were not available to the State Geological Survey.

The log agrees so well with those of wells correlated from cuttings that it is included with them to complete the record.

0- 40	Sand.	
40- 50	Blue shale.	
50- 185	Grey shale.	
185- 365	Black shale.	
365- 373	Grey shale.	Mixed log
373- 407	Black shale.	
407- 416	Grey shale.	
416- 427	Newcastle (?), sand(water).	
427- 436	Sand--2' lime.	
436- 444	Sand.	
444- 451	Sand and shale.	
451- 455	Yellow shale.	
455- 464	Grey lime.	
464- 492	Sand and lime.	
492- 520	Sand and shale.	
520- 524	Lime.	
524- 560	Sandy shale.	
560- 580	Grey shale.	
580- 596	Grey shale (sandy).	
596- 608	Red shale.	
608- 630	Pink lime.	
630- 660	Sandy shale.	
660- 686	Sandy shale.	
686- 694	Lime and shale.	
694- 708	Grey shale.	
708- 754	Black shale.	
754- 760	Dark shale.	
760- 780	Grey shale and lime.	
780- 825	Dakota, grey sand.	

825- 850	Sand.
850- 870	Coal.
870- 885	Sand.
885- 900	Sand and grey shale.
900- 922	Fuson, sandy shale.
922- 965	Shale and lime.
965-1000	Sandy lime.
1000-1026	Lakota, hard sand (water).
1026-1056	Grey shale.
1056-1080	Hard grey shale.
1080-1110	Hard grey sand.
1110-1130	Hard grey lime.
1130-1150	Morrison, black shale.
1150-1180	Red shale.
1180-1190	Hard shells (layers).
1190-1275	Sundance, red shale.
1275-1285	Blue shale.
1285-1350	Black shale.
1350-1355	Black sandy shale.
1355-1425	Sand and shale (water).
1425-1560	Spearfish, red beds.
1560-1568	Sand (water).
1568-1573	Red beds.
1573-1590	Shells and sand.
1590-1690	Red beds.
1690-1725	Minnekahta, pink lime etc.
1725-1800	Opeche, red sandy clay.
1800-1810	Minnelusa, sand converse.
1810-1830	Lime and sand.
1830-1950	Red sandy shale.
1950-1990	Lime.
1990-1995	Brown shale.
1995-2025	Lime.
2025-2030	Sand.
2030-2073	Lime.
2073-2075	Red white sand (water).

2075-2080	White sand and lime.
2080-2095	Brown sandy lime.
2095-2125	Lime.
2125-2130	Sand (water).
2130-2140	Red sand
2140-2170	White lime.
2170-2230	Grey lime.
2230-2235	Brown shale.
2235-2240	Purple lime.
2240-2265	White lime.
2265-2290	Red shale.
2290-2305	Brown and black shale with lime.
2305-2337	Brown shale.
2337-2350	Hard sand shell.
2350-2365	Red shale.
2365-2404	Brown shale
2404-2435	Sand.
2435-2440	Lime.
2440-2485	Lime.
2485-2540	Lime.
2540-2550	Limy sand and black shale (shale particles when pulverized and wet will leave black smear on the hand. Carbonaceous).
2550-2570	Grey lime (water).
2570-2600	Grey sandy lime.
2600-2610	Pink lime.
2610-2635	Red shale.
2635-2642	Grey lime.
2642-2695	Red shale, caving.
2695-2698	Lime and shells, caving.
2698-2703	Purple and grey lime, caving.
2703-2720	Pink and white lime, caving.
2720-2785	Red shale and brown shale, caving, basal laterite.
2785-2800	Madison, pink lime and white talc.
2800-2820	Grey lime and sand--very hard.

A different record for the interval 2550-2820', obtained from the company, is as follows:

2550-2580	Streaks of red grey limestone.
2580-2610	White sand (water).
2610-2623	Talc and red shale.
2623-2743	Bad caves, broken lime shells and shale.
2743-2780	Red sandy shale.
2780-2815	Hard grey limestone.
2815-2820	White sand and gas.

2820-2930	Grey limestone.
2830-2842	Pink limestone.
2842-2854	Hard grey limestone.
2854-2865	Pink limestone.
2865-2875	Grey and pink limestone.
2875-2890	Red water sand.
2890-2895	Grey sandy limestone.
2895-2905	Grey limestone.
2905-2935	Pinkish limestone.
2935-2950	Pink limestone.
2950-2960	Reddish lime.
2960-2964	Grey limestone.
2964-2970	Coarse pink limestone.
2970-2985	Reddish limestone.
2985-2995	Reddish limestone.
2995-3003	Grey limestone.
3003-3012	Dark grey lime.
3012-3030	Grey lime.
3030-3050	Pink lime.
3050-3070	Grey lime.
3070-3082	Pink lime.
3082-3109	Red shale.
3109-3135	Blue shale.
3135-3195	Red lime.
3195-3210	Red sandy lime.
3210-3218	Grey sandy lime with brown specks.
3218-3220	Pink sandy lime. (Englewood?)
3220-3231	Dark grey sandy lime.
3231-3238	Grey sandy lime with red specks.
3238-3240	Sand contains quartz-mica-feldspar.
3240-3250	Pre-Cambrian biotite granite.

GREGORY COUNTY

RAY WILLIAMS
Omaha Drilling Co.
Sec. 5, T. 96 N., R. 69 W., Altitude 1647'

50- 70	Pierre, selenite, clay and some sand.
160- 212	Clay, light blue grey, forams, INOCERAMUS prisms, ironstone concretions, selenite.
212- 330	Niobrara firm chalk, blue grey.
330- 355	Chalk, purer and lighter colored, some white and drab bentonite, forams and INOCERAMUS.
355- 370	Carlile grey marl, GLOBIGERINA and GLOBIGERINA "chalk" pellets.
370- 380	Same, but driller logged Codell sand.
380- 420	Some light brown siltstone, TEXTULARIA.
420- 430	Considerable sand at 425'.
430- 440	Codell sand, unsorted, up to coarse grains, rounded and polished, some shale, many GLOBIGERINA, TEXTULARIA and other forams.
440- 450	Not so much sand, bentonite, many forams.
460	Mostly loose forams.
470- 540	Shale, light slate grey, bentonitic, many forams.
540, 580, 600	Considerable sand, medium size, subround to angular.
670	Bentonite.
670- 720	Shale, light slate grey.
720- 750	Greenhorn limestone, INOCERAMUS and forams.
770- 780	Still mostly Greenhorn.
795	Logged as base Greenhorn.
795	Graneros shale.
860- 920	No cuttings.
930- 980	Dakota sand, buff, fine, angular.
980-1000	Some chalcopyrite cementing angular sand grains, considerable brown firm marl. Most of Dakota is cemented by sulphides.
1020-1070	Fuson manganese-bearing pellets in flaky light grey bentonitic shale.
1070-1090	Some light grey fine sandstone.
1090-1100	Clay, dark slate grey and sandstone.
1100-1110	Clay, bentonitic, some lavender carbonaceous bentonite.

1112-1171	Sand, light grey poorly sorted, larger grains polished or etched and subangular, medium and fine grains angular.
1230-1240	Clay, grey, bentonitic.
1250-1275	Large amount of disc-rosette selenite (present in all cuttings), drilling mud very yellow bentonite, sand and grey clay.
1275-1360	Lakota sand, grey, unsorted, well rounded to angular, much of it etched, a few pink and rose grains may be derived from Sioux Quartzite.

HAAKON COUNTY

DANIEL BIERWAGON NO. 1
Sec. 11, T6N, R21E, Altitude 2079'
(barometer)

20-1206	Pierre bentonitic clay, slate grey with following particularities:
20- 21	Brown, weathered, half selenite.
40- 44	With fine grained limestone, appears to be Mobridge Member slumped from rim of West Fork Canyon.
60	Contains INOCERAMUS and bentonite.
76	Aragonite prisms.
84	Brown ironstone silty concretions and hauerite.
117	Brown ironstone silty concretions with fine mica specks.
220	White bentonite.
238	With buff marly films.
274	BACULITES and marcasite.
354	Many small shell fragments, much selenite, grey marl with red brown crystalline specks, aragonite.
358- 384	With fine white mica specks.
394	Concretions with aragonite.
414	Concretions with aragonite, marcasite.
512	Many INOCERAMUS prisms and a little bentonite.
515	Much light grey bentonite, large biotite flakes, blue grey aragonite concretions.
618	Shale, dark slate grey, sand, fine to coarse, mostly angular.
659	Some light grey bentonite.
679	Much aragonite.
689	Brown concretions, considerable light grey bentonite.
740	Much hauerite, some light grey marl.
758	Hauerite and concretions.
830- 855	Considerable bentonite.
902-1206	Sharon Springs Member, darker grey, more shaly (laminated), bentonitic, bituminous.
1002-1206	Contains some light grey marly laminae.
1206-1400	Niobrara chalky marl, light grey, with shale at 1345'.
1403-1815	Carlile shale, light grey, with some angular unsorted sand, light yellow brown, Codell sand.
1397-1420	Much marcasite, buff to brown compact volcanic ash, sand logged 1418½-20½.

1453	Much marcasite.
1473	Shale, dark grey, minute flattened disks of chalk.
1480-1512	Marcasite.
1500-1553	Marcasite.
1600-1620	INOCERAMUS prisms.
1670	Bentonite, light blue grey.
1680	Marcasite, pyrite and shale.
1700	Marcasite, pyrite and shale with selenite.
1721	Largely marcasite.
1740&1760	Shale somewhat chalky with marcasite and selenite.
1815?-1835	Greenhorn limestone, composed of GLOBIGERINA and INOCERAMUS prisms, dark grey chalky shale.
1873	Graneros shale, dark grey, considerable white bentonite.
1935	TEXTULARIA, GLOBIGERINA, INOCERAMUS prisms.
2013	Some angular sand, mostly black shale.
2020	Sand angular, fine, light grey.
2050	Black shale, a little fine sandstone.
2070	Sand, grey, fine angular, partly recrystallized.
2090	Total depth, well probably did not reach Dakota sand.

CHEMICAL ANALYSIS
DANIEL BIERWAGON NO. 1

This well yields gas and the fairly hot water found in all surrounding wells. The water has the following mineral composition, in parts per million; as analysed by Smith Emory and Co., Los Angeles:

Sodium	(Na)	2512.0	Chlorine	(Cl)	632.0
Ammonia	(NH_3)	3.4	Carbonate	(CO_3)	0.0
Calcium	(Ca)	69.6	Bicarbonate	(HCO_3)	126.9
Magnesium	(Mg)	22.8	Silica	(SiO_2)	11.3
Sulphate	(SO_4)	4554.0	Iron and Alumina	(R_2O_3)	2.4

Total solids 7933.6

HAAKON COUNTY

JOHN STROPPEL, Midland Hotel
Sec. 6, T IN, R25E, Lots 5&6, Block 3, Altitude 1880'

0- 20	Alluvial sand and Pierre yellow grey clay.
20- 35	Pierre weathered brownish, bentonitic clay, with alluvial sand.
30- 55	Mainly alluvial sand.
55- 175	Clay, blue grey, bentonitic, with a little brown silt.
175- 190	Clay, slate grey, INOCERAMUS prisms, other shell fragments, CRISTELLARIA.
374- 396	Clay, somewhat silty.
495- 516	Bentonite, whitish, with biotite, some green bentonite, clay is lighter grey.
596- 617	Aragonite concretions.
617- 635	Bentonite, white.
635- 640	Clay is shaly or flaky from here downwards.
740- 745	Brown coal.
745- 780	Shale, light slate colored, flaky.
780- 785	Bentonite, white.
900-downwards	Color is dark blue grey.
945	Niobrara marl, with white chalk pellets.
1150	Less chalky. Base Niobrara likely at 1145'.
1190	Possibly near top Carlile shale.
1420-1450	Greenhorn limestone.
1450	Graneros shale.
1555-1560	Abundant forams.
1615	A little fine sandstone.
1630	Siltstone.
1735	Dakota sandstone, grey, fine, angular.
1765-1770	Sandstone, fine, carbonaceous.
1770-1780	Fuson manganese-bearing pellet horizon.

Last sample is sandstone and drillers log shows flowing water sands at 1786-87', 1809-10', 1826-28', and 1878-1880'.

The water has the following mineral composition, analysed by the State Chemist; in parts per million;

Silica	(SiO_2)	23.0	Magnesium	(Mg)	1.5
Sulphate	(SO_4)	2.0	Iron	(Fe)	1.0
Chloride	(Cl)	850.0	Fluoride	(F)	2.5
Calcium	(Ca)	6.5			

Total solids 2686.0 parts per million

This water has a temperature of 116° F. and comes perhaps mainly from the Lakota sandstone. Upon calculation of the State Chemist it has 1395 parts per million of common salt (NaCl) and 1225 parts per million of soda (Na_2CO_3).

HAND COUNTY

MILLER CITY WELL
Altitude 1565'

500- 650	Niobrara chalky marl, flattened chalk pellets, cavings of Sharon Springs Member shale.
650	Carlile shale, dark grey bentonite.
690- 700	Some shelly limestone, like Greenhorn.
750- 830	Greenhorn limestone, light brown grey, a breccia of GLOBIGERINA and INOCERAMUS prisms, probably largely cavings.
830	Graneros shale, grey.
870	Sandstone, fine, grey.
910	Limestone, medium grey, fine texture, very clayey.
930	Sand.
960- 970	Siltstone, grey, with brown ironstone concretions.
970- 980	Shale, grey, bentonitic.
1010-1030	Considerable silt to fine sandstone.
1030-1060	Same, with white mica.
1060-1120	Shale, grey, finely flaky, large amount of brown ironstone concretions.
1120-1130	Dakota sand, grey, largely angular, some rounded and etched grains, coarse to medium sizes.

Analysis of Dakota water from one of the Miller wells, made by the State Chemist in January, 1939, is as follows:

Silica	(SiO_2)	16.0	Calcium	(Ca)	192.0
Sulphate	(SO_4)	1214.0	Magnesium	(Mg)	58.0
Chloride	(Cl)	99.0	Iron	(Fe)	1.0
Fluoride	(F)	2.4	Hardness as	($CaCO_3$)	721.0

Total solids 2120. parts per million

LINCOLN COUNTY

CITY of CANTON WELL NO. 2
Altitude 1300'

122- 340	Marl, with chalk spots, GLOBIGERINA, INOCERAMUS, some blue-white bentonite.
340- 344	Greenhorn limestone, INOCERAMUS, GLOBIGERINA.
344- 413	Graneros clay, dark slate grey, bentonitic.
413- 580	Sand, fine grey.

LINCOLN COUNTY

WILDCAT OIL TEST
in Lot 2
Sec. 2, T. 97N, R. 49W, Altitude 1400' more or less

600- 605	Dakota (?) sand, fine to medium, larger grains rounded and etched, very small manganese-bearing pellets.
615- 620	Sand, a little coarser, cream, some grains from Sioux quartzite.
620- 625	Sand, clayey.
625- 635	Fuson, mainly manganese-bearing pellets, carbonized wood.
649- 656	Arkose, cream-buff, mainly clouded feldspar, angular, etched, fine to medium sand size, some granite, striated feldspar, chlorite, biotite, subordinate quartz.
656- 687	Arkose of metamorphic rock and flesh colored feldspar fragments.

SPINK COUNTY

BUDLONG

SW¼, Sec. 18, T. 14N, R. 62W, Altitude 1300'

800	Sand, fine, cream colored, angular, with muscovite.
866- 891	Dakota dicotyledenous leaves in clay ironstone concretions, possibly some quartzose grit.
936	Lakota, coarse angular quartz grains, a little chlorite, conglomerate of manganese-bearing pellets, feldspar, granitic debris. Another sample has coarse quartz grains with white fine volcanic ash matrix, or perhaps kaolin.
930- 940	Lignite, angular quartz and feldspar.
944	Same, but finer.
954	Same, bornite, considerable biotite.
960	Same, arkosic.
965	Same, some grit.
970- 990	Same, finer.
988	Pre-Cambrian quartz-feldspar pegmatite.
990-1002	Biotite granite, with plagioclase.

TODD COUNTY

U. S. INDIAN SERVICE, ROSEBUD AGENCY
on divide between White and Keyapaha Rivers, near SW corner Sec. 10, T. 39N, R. 27W, finished in 1896, cable tools, Altitude 2626'

0- 4	Cenozoic sand, fine bentonite light brown.
60	Silt, yellow green.
70- 100	Silt with bentonite matrix and volcanic glass shards, cream colored.
115- 120	Clay, blue grey, bentonitic.
120- 123	Clay, silty, cream.
135	Clay, bentonitic, with coarse sand, cuttings below to 370' have glass shards.
180	Silt, bentonitic, cream.
260	Largely light cream bentonite.
290	Sandy, drab.
320	Ash, mostly bentonite, light grey drab.
340	Same, with angular sand.
350	Bentonite, faint lavender.
360	Bentonite and sand, cream.
370	Bentonite and sand, light drab or ashy grey.
370	Pierre (top) clay, blue grey, bentonitic.
390	Clay, grey, bentonitic.
400	Clay, grey, bentonitic with altered GLOBIGERINA.
430	Clay, ashy, with biotite.
440	Clay with GLOBIGERINA and fish remains.
480	Clay spotted with flattened chalk pellets.
500- 520	Bentonite, white.
520	Large amount marcasite, hauerite.
540	OSTRACODS and CRISTELLARIA.
550	Chalk, medium grey.
590	Clay, grey.
611- 620	Angular fine sand, bentonite, light grey, very small buckshot concretions insoluble in hydrochloric acid.
620	INOCERAMUS prisms.
640	GLOBIGERINA, some light grey bentonite.
690	Bentonite, cream.
760	Siltstone, brown.
850	Bentonite, blue grey, flaky.
860& 880	Bentonite, light grey, large flakes biotite.

890	Clay, bentonitic, darker grey.
950& 970	Some fine brown sandstone.
980	AMMODISCUS.
1000	Clay, bentonitic, darker grey.
1150	GLOMOSPIRA, grey biotitic bentonite.
1275	Hauerite and concretions.
1320	Sharon Springs Member, dark blue grey, bituminous shale.
1350	Bentonite, light grey.
1390-1410	Niobrara marl, with chalk pellets.
1430	Larger percent chalk.
1490	Marl, with GLOBIGERINA and chalcopyrite.
1500	INOCERAMUS, GLOBIGERINA, OSTREA, TEXTULARIA.
1510	Less chalky, TEXTULARIA, GLOBIGERINA.
1530	Still less chalky.
1600	Carlile shale, dark grey, somewhat chalky, chalcopyrite.
1630	Still somewhat chalky.
1650	Some pure bentonite.
1750-1670	Marcasitized stems.
1670	Some grey siltstone.
1780-1810	Shale.
1830-1850	Greenhorn limestone, grey, composed of INOCERAMUS prisms and fish remains, some fossils pyritized and marcasitized, shale interbeds.
1870	Many INOCERAMUS prisms and GLOBIGERINA in light grey limestone.
1890	Limestone, fine texture, dull, chalky, light grey.
1900	Some dull coal with limestone, chalcopyrite,
1905	Many GLOBIGERINA.
1920	Limestone with a small amount of glauconite.
1960	Graneros (?).
1990	Siltstone, grey.
2000	Dakota, sandstone, light grey.
2020	Concretions, red brown.
2050	Angular sandstone, fused by bit.
2050-2060	Probably fused concretion.
2060-2085	Fuson mudstone, hard, grey, another sample from 2060 and 2070 has sand, coarse, angular, partly recrystallized, some etched grains, also fine sand and manganese bearing pellets, dark purplish brown.
2080	Brown sandstone concretion.

2085	Interbedded fine light grey sandstone and dark grey micaceous siltstone.
2100-2113	Ironstone concretion, shale, dark blue grey.
2140-2155	Sandstone, medium to fine, light grey, angular. micaceous and cherty, hard grey mudstone.
2160	Hard grey bentonite and dark grey shale, full of fish and plant remains.
2215-2225	Siltstone, light grey, micaceous.
2225?2235	Sandstone, carbonaceous, fine, angular.
2220	Cavings with pyrite cemented sandstone, many manganese bearing pellets.
2240	Lakota sand, brown grey, fine, angular.
2250	Sand, brown grey, coarse, angular.
2260	Sand, brown grey, medium, angular.
2270	Sand, brown grey, fine, angular.
2280	Sand, brown grey, medium, angular.
2290	Sand, fine, many manganese bearing pellets (caving?).
2295	Sand, coarse.
2350	Clay, drab, bentonitic.
2380-2390	Cavings, but perhaps sand with some dark grey shale.
2400-2410	Sand, medium recrystallized, many manganese bearing pellets (caving?).
2420	Sand, light grey, medium, angular, recrystallized.
2430-2440	Sand, cream, fine to medium, some etched grains, recrystallized.
2450	Sand, cream, mostly fine, some medium.
2460-2480	Sand cream buff, fine to medium.
2502	Bottom sample, mostly cream buff sand with biotite.

TURNER COUNTY

VIBORG CITY WELL
Omaha Drilling Co.
Altitude 1300'

0- 20	Glacial sand, coarse, buff, angular, particles from Pre-Cambrian, Paleozoic and Cretaceous rocks.
20- 40	Fine gravel, chalk and clay particles.
40- 90	Upper Niobrara chalky, grey, ashy, GLOBIGERINA.
90- 120	Many loose forams, INOCERAMUS prisms, OSTREA CONGESTA.
120- 130	Chalk, cream colored, fairly pure.
140- 160	Some chalk but largely black bituminous chalky marl, biotite, coccoliths, TEXTULARIA, GLOBIGERINA.
160- 170	Codell sand.
170- 180	Sand, unsorted.
180- 190	Cavings.
210- 230	Siltstone, buff, limy.
250- 260	Mostly cavings.
----------	No samples.
360- 370	Marl, speckled white and grey.
370- 390	Greenhorn limestone, many GLOBIGERINA.
390- 430	Graneros marl, dark grey, small chalk splotches (flattened discs), fish remains.
430- 450	Dakota sandstone, buff, limy, fine.
450- 470	Siltstone and fine sandstone, light brown.
470- 480	Siltstone and fine sandstone, with carbonized wood.
480- 490	Sand, fine.
490- 500	Fuson manganese-bearing pellets very abundant, in bentonite; not much change to 630'.
----------	No samples.
630- 670	Lakota sand, largely coarse, angular to sub-angular, with Sioux quartzite particles below 670'.
----------	No samples.
725- 732	Sioux quartzite.

UNION COUNTY

LA FLUER NO. 1
Sioux Valley Oil and Refining Co.
northwest part of town of Jefferson
Sec. 18, T 90 N, R 48 W, Altitude about 1112-15'

60 or 70	Sand, alluvial, light brown, with black chert particles, fairly coarse, subround.
70- 125	Alluvial gravel and sand, with dolomite, amethyst and Pre-Cambrian rock fragments.
125- 128	Grit.
243- 352	Dakota sand, buff, angular, mostly non-sorted, coarse to fine, some etched grains.
352- 380	Fuson colloidal suspensoid bentonite, medium grey and light green.
380- 390	Manganese bearing pellets, variegated, tawny, light green, brown and red orange.
390- 405	Paleozoic limestone, dolomitic, dove grey, fine sugary texture, much fine quartz silt, vuggy.
405- 409	Darker grey limestone.
409- 413	Limestone, buff crystalline, magnesian, marcasite.
413- 418	Limestone, vuggy, mostly buff magnesian crystalline, chalcopyrite.
418- 430	Limestone, magnesian, dove, rhombic, vuggy, dolomite rhombs in calcite matrix.
430- 434	Limestone, fine powdery texture, silty.
458- 461	Limestone, light grey dove, silty.
461- 464	Limestone, magnesian, dark grey, fine grained, quite clayey.
464- 473	Limestone, brown grey.
473- 477	Limestone, light buff, very fine powdered sugar texture, silty, stylolites.
477- 496	Limestone, brown dove, fine rhombic, small dolomite rhombs.
496- 513	Limestone, coarser rhombs and greyer.
513- 518	Limestone, magnesian, dark brown grey, rhombic. vuggy,clay residue.
518- 531	Chalcedony, white to bluish white, vuggy and drusy with small quartz crystals, opaque, some translucent, may be weathered.

531- 560	Limestone, dolomitic, grey, coarse rhombic, virtually a fine grained marble, chalcopyrite, covellite.
560- 570	More chalcedony, with marcasite in cavities.
570- 580	May be cavings, some material like Sioux quartzite.
580- 592	Dolomite, brown grey, rhombic, vuggy, crinoid stem and plicated brachiopod in chalcedony.
592- 610	Dolomite, light grey, fine powdered sugar texture.
610- 655	Sandstone, light grey, cemented, angular coarse etched grains, some of dark chert.
655- 666	Limestone, magnesian, rhombic, quite vuggy, 400' of 12½ in. casing run.
666- 707	Decorah-Platteville (Mid-Ordovician) shale, grey green, bentonitic, silty, with rhombic magnesian limestone.
707- 710	Dolomite, light grey, fine rhombic.
710- 720	Shale, green.
720- 730	Sandstone, buff, very fine grained, virtually a siltstone.
730- 740	Shale, green, some sandy with coarse grains, sandier and siltier below.
750- 755	Siltstone, brown grey, limy cement.
755- 765	Shale, green, flaky, bentonitic, with black phosphatic nodules.
765- 805	St. Peter sandstone, all size grains, etched, round to subround, some light pink grains probably derived from Sioux quartzite.
805- 815	Sandstone, light grey, fine, dolomite cement, glauconite, black phosphate.
815- 825	Largely grey green bentonitic clay.
825- 835	Upper Cambrian, probably, dolomite, light grey, fine rhombic.
835- 860	Dolomite, light grey, rhombic, with subangular dark glauconite particles.
860- 875	Dolomite, light grey, with some fine sand grains.
875- 890	Dolomite, light grey, coarser rhombs.
890- 900	Dolomite, light grey, very glauconitic, some quite coarsely rhombic.
900- 933	Sand, light cream, etched, round to subround, poorly sorted, all sizes of grains, some light pink, likely from Sioux quartzite.
933- 936	Sand with fairly large subrounded pellets of glauconite.

936- 950	Sand with small and sparser glauconite particles.
950- 957	Sand, limy, smaller amount glauconite.
957- 980	Calcareous rhombs of limestone, grey, glauconite, quartz sand.
980-1000	Fine sandy.
1000-1007	Largely lime-cemented fine glauconitic sandstone.
1007-1015	Sandstone, with round concentric limonite pellets, angular to subangular grains, some turgite cement, large grains of Sioux quartzite.
1015-1027	Sandstone, buff, coarse, etched, subangular to subround, some pink and rose grains.
1027-1029	Pre-Cambrian granite with pink feldspar and quartz.
1029-1033	Quartz, pink feldspar, chlorite and biotite fragments.
1033-1035	Biotite granite (granitite), some epidote and plagioclase, probably quartz monzonite.
1039	Granodiorite, mostly white plagioclase.
1043	Considerable black hornblende.
1046	Amphibolite-biotite-quartz schist.
1058-1069	Mostly granodiorite.
1709-1750	Some hornblende.
1757-1766	Light granite with orthoclase, plagioclase and biotite.
1866-1900	Some chlorite schist.
1900-1914	Quartz monzonite.
1932	Drill entered a shear zone, considerable light green chlorite in largely pink granite, sericite, water encountered at 2040, salinity 1777 parts per million, mainly sodium sulphate and chloride.
2090-2140	Shear zone, with quartzite, slickensided, caving, very fine matrix with large angular quartz particles, green and purplish, quite possibly a mylonite (crushed quartz vein), also chunks of chlorite, matrix is fine silicate.
2140-2155	Crushed pegmatite, matrix of fine sericite.
2155-2169	Pegmatite and schist fragments.
2169-2200	Some fine-grained dark grey, somewhat talcose, hornfels-like rock with pyrite.
2200-2206	"Greenstone," fine texture.
2216-2224	Fine chloritic schist, dark green, shattered pegmatite.
2479	Reddish water found, salinity 3720 parts per milli- 7 parts fluoride.

Apparently the drill followed the shear zone to the total depth of 2752 ft.

YANKTON COUNTY

CHICAGO, MILWAUKEE, ST. PAUL and PACIFIC RY. YANKTON
Altitude 1210'

0- 74	Alluvial and glacial.
74- 90	Carlile shale, medium grey.
90- 110	Shale, dark grey.
110- 130	Greenhorn limestone (?).
130- 330	Graneros shale, at least in lower part.
330- 370	Dakota sand, grey, fine, angular, a little glauconite.
390- 410	Shale, bentonitic, grey.
410- 450	Fuson sandy bentonite, light grey, with manganese bearing pellets.
450- 525	Lakota, sand, fine, poorly sorted, angular grains.

ZIEBACH COUNTY

U.S. INDIAN SERVICE, RED SCAFFOLD SCHOOL
SE¼, Sec. 6, T 9 N, R 19 E, Altitude 1996 (2007.7?)

25	Gravel of quartz, chert, chalcedony, iron oxide, aragonite, igneous and metamorphic rocks.
50	Sand.
75	Pierre bentonitic clay, and gravel, dark grey, considerable biotite.
100	Mainly sand, various sizes, and gravel.
125	Clay, dark ashy grey.
150	Clay, dark ashy grey and bentonite, light grey.
175	Clay, dark ashy grey.
200	Clay, grey.
225	Clay, lighter grey and more bentonitic.
250	Bit sample, chalk, light grey, clay ironstone and clay, grey.
250	Bit sample, mostly light drab bentonite with large amount biotite, and small particles of angular clastic volcanic quartz.
275	Clay, dark grey.
300	Clay, dark grey, shell fragments, biotite and light bentonite.
325	Same with INOCERAMUS prisms.
350	Same with iron carbonate concretions, no biotite.
400- 640	Same clay with fish fragments.
775	Iron carbonate concretions.
840	Hauerite (manganese sulphide).
900	Iron carbonate concretions.
920	Brown iron carbonate concretions, hauerite and pyrite.
940	Clay, denser, flakier and darker grey.
960	Sharon Springs shale, dark grey bituminous.
1000	Same with iron carbonate concretions and pyrite.
1150	Same with some light grey marl, ashy, to 1225'.
1225	Niobrara marl, grey, chalk-spotted.
1250	Clay.
1275&1300	Chalky marl.
1325&1340	Higher percent chalk, light grey, some bituminous.
1360	Clay, dark grey.
1400 ?	Shale, dark grey, bentonitic, bituminous.

1420	Codell sand, fine to silty, limy cement, GLOBIGERINA, chalk speckled marl.
1440	Shale, dark grey, INOCERAMUS prisms, to 1520'
1540	Some fine sand and silt.
1560	Same with drab flaky bentonite.
1600	Considerable fine sand and silt, light grey.
1720&1740	Shale, dark blue grey, finely flaky, small muscovite flakes.
1760	Possibly Greenhorn, limestone, fine, silty, light grey, INOCERAMUS prisms.
1780	Shale, dark dull grey, slaking.
1790-1800	Greenhorn limestone, GLOBIGERINA, INOCERAMUS prisms, fish remains.
1820-1840	Marl, spotted with small lighter grey limy pellets, thin interbedded limy films.
1860-1880	Same with more limestone, GLOBIGERINA.
1900-1920	Large amount Greenhorn limestone (caving?), marly shale, limy sandstone and siltstone.
1390-1940	Shale, dark slate grey, minute lime spots, thinly laminated. All Graneros, probably bituminous.
1950	Same with GLOBIGERINA, ORBULINA, INOCERAMUS prisms, some thin limestone layers.
2100	Shale, dark slate grey.
2140	A little sandstone, light grey, fine grained, some medium angular grains in interbeds with shale, dark slate grey, splintery. Sand has bentonitic matrix.
2190	Shale, dark slate grey, bentonitic, flaky, some sandstone.
2250&2270	Dakota sandstone, stained by red iron oxide, partly recrystallized, mostly coarse angular.
2290	Sandstone.
2300	Sandstone, light grey, fine to coarse.
2315-2320	Fuson sandstone, carbonaceous, numerous manganese-bearing pellets.
2360	Shale light grey.
2370	Lakota (?) sandstone, fine grained.

Water flow of 500 gallons per minute from 2330 ft. downwards. The following is the analysis, in parts per million, by Wilcox and Nelson, U. S. Department of Agriculture:

Calcium	(Ca)	9.6	Chlorine	(Cl)	2417.0
Magnesium	(Mg)	4.5	Fluorine	(F)	2.8
Sodium	(Na)	2197.0	Nitrate	(NO_3)	1.9
Bicarbonate	(HCO_3)	1696.0	Boron	(B)	7.7
Sulphate	(SO_4)	1.4			

Total solids (Added) 6337.9