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  
April, 1948

1950 Reprint
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<td>U.S. Indian Service, Red Scaffold School</td>
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<td>Spink</td>
<td>Budlong</td>
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<td>C.M.St.P. &amp; P.RR.</td>
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<td>City of Canton</td>
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<td>Daniel Bierwagon #1</td>
<td>Haakon</td>
<td>Bierwagon et al</td>
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<td>Haakon</td>
<td>John Stroppel</td>
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<td>&amp; Refining Co.</td>
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<td>Charles Mix</td>
<td>Palensky et al</td>
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<tr>
<td>Wildcat Oil Test</td>
<td>Lincoln</td>
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INDEX MAP
OF
BORINGS IN SOUTHWESTERN S. DAK.
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 onehundredth 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 Fuszon 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'

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
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<tbody>
<tr>
<td>0-90</td>
<td>Sand, etc-Lake Dakota beds.</td>
</tr>
<tr>
<td>90-100</td>
<td>Pierre clay, bentonitic, slate grey.</td>
</tr>
<tr>
<td>225-250</td>
<td>Niobrara, chalk pellet marl.</td>
</tr>
<tr>
<td>260-310</td>
<td>Codell sandstone, much pyrite and marcasite at top. Sand grains light and dark grey, angular to round, polished, mostly fine grained, poorly cemented.</td>
</tr>
<tr>
<td>310-320</td>
<td>Marcasite cemented sandstone.</td>
</tr>
<tr>
<td>320-370</td>
<td>Sandstone, light grey, fine angular.</td>
</tr>
<tr>
<td>370-390</td>
<td>Carlile clay, slate grey.</td>
</tr>
<tr>
<td>390-410</td>
<td>Sand, as higher up.</td>
</tr>
<tr>
<td>410-420</td>
<td>Marcasite cemented sand.</td>
</tr>
<tr>
<td>420-470</td>
<td>Clay, slate grey, with marcasite.</td>
</tr>
<tr>
<td>470-500</td>
<td>Greenhorn limestone, grey sandy, INOCERAMUS PRISMS and GLOBIGERINA, chalk pellet marl appears to pass downwards into coarse sand, angular to rounded.</td>
</tr>
<tr>
<td>500-540</td>
<td>Graneros clay, slate grey.</td>
</tr>
<tr>
<td>540-550</td>
<td>Largely sand, grey, firm, rounded to angular.</td>
</tr>
<tr>
<td>550-560</td>
<td>Largely sand, with Greenhorn cavings.</td>
</tr>
<tr>
<td>560-570</td>
<td>Largely marcasite.</td>
</tr>
<tr>
<td>570-580</td>
<td>Largely marcasite, green, abundant fish remains.</td>
</tr>
<tr>
<td>580-590</td>
<td>Clay, slate grey, micaceous.</td>
</tr>
<tr>
<td>590-600</td>
<td>Marcasite and Greenhorn cavings.</td>
</tr>
<tr>
<td>600-720</td>
<td>Clay, slate grey, shaly.</td>
</tr>
<tr>
<td>720-730</td>
<td>Some fine grey sandstone.</td>
</tr>
<tr>
<td>730-750</td>
<td>Shale, slate grey, micaceous.</td>
</tr>
<tr>
<td>750-760</td>
<td>Dakota (?) sandstone, dark grey.</td>
</tr>
<tr>
<td>760-800</td>
<td>Shale, slate grey, micaceous.</td>
</tr>
</tbody>
</table>
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?).
796  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.
1191-1227  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.
Lakota sand, buff, coarse, poorly sorted, etched, round to angular grains, some marmesite cemented, Greenhorn limestone fragments, lignite, manganese-bearing Fuson pellets.

Sioux quartzite, pink.
Some small pebble-sized grains.
Phyllite.
Pink and purplish quartzite with sericite and biotite.
Phyllitic pipestone.
Quartzite with sericite and specularite.
Pipestone, purple, silty argillite to fine sandstone, greasy grey pyrophyllite.
Mainly pyrophyllite, pearly, translucent, honey color, beeswax lustre.
Pyrophyllite, fine grain dark maroon sandstone, pipestone.
Pyrophyllite, and translucent quartz.
Pyrophyllite, brown-grey, pearly, with quartz grains.
Quartzite and aluminum silicate, sericite or muscovite.
Some light-colored argillite.
Somewhat schistose purplish quartzite and pipestone, mica, pyrophyllite.
Some white kaolin or bauxite.
Some white kaolin or bauxite, brown-buff and pink.
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, CLOBIGFRINA,
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 ben-
tonite, 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:

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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>(Ca)</td>
<td>17.0</td>
<td>Sulphate $(SO_4)$</td>
</tr>
<tr>
<td>Magnesium</td>
<td>(Mg)</td>
<td>6.0</td>
<td>Chloride $(Cl)$</td>
</tr>
<tr>
<td>Alkalies as Sodium</td>
<td>(Na)</td>
<td>516.0</td>
<td>Nitrate $(NO_3)$</td>
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<tr>
<td>Iron</td>
<td>(Fe)</td>
<td>0.08</td>
<td>Bicarbonate $(HCO_3)$</td>
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<tr>
<td>Aluminum</td>
<td>(Al)</td>
<td>2.0</td>
<td>Silica $(SiO_2)$</td>
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<tr>
<td>Fluoride</td>
<td>(F )</td>
<td>3.1</td>
<td>Total Solids</td>
</tr>
</tbody>
</table>

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:

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<tr>
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<tbody>
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<td>Calcium</td>
<td>(Ca)</td>
<td>285.0</td>
<td>Sulphate $(SO_4)$</td>
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<tr>
<td>Magnesium</td>
<td>(Mg)</td>
<td>52.0</td>
<td>Chloride $(Cl)$</td>
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<tr>
<td>Alkalies as Sodium</td>
<td>(Na)</td>
<td>46.0</td>
<td>Nitrate $(NO_3)$</td>
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<tr>
<td>Iron</td>
<td>(Fe)</td>
<td>0.09</td>
<td>Bicarbonate $(HCO_3)$</td>
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<tr>
<td>Aluminum</td>
<td>(Al)</td>
<td>3.0</td>
<td>Silica $(SiO_2)$</td>
</tr>
<tr>
<td>Fluoride</td>
<td>(F )</td>
<td>2.7</td>
<td>Total Solids</td>
</tr>
</tbody>
</table>

-9-
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.

30-30  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. 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.

-10-
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 Minnewasté limestone, light cream, very fine grained, dense.
1380-1424 Bentonite, lavender and light drab, some chert and limestone fragments, casing set at 1291'.
1442      Large amount fine sand.
1445-1443 Limestone, as at 1360-1380'.
1458-1460 Largely fine sand.
1462      Base Minnewasté (?)
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.
<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-200</td>
<td>Graneros shale, dark blue grey. Shale, dark blue grey flaky, bentonitic, with very small sericite flakes.</td>
</tr>
<tr>
<td>220</td>
<td>Dakota sandstone, with thin beds of grey carbonaceous sandstone interbedded with shale.</td>
</tr>
<tr>
<td>230</td>
<td>Sandstone, light grey, muscovitic, fine angular with shale laminae.</td>
</tr>
<tr>
<td>240-290</td>
<td>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.</td>
</tr>
<tr>
<td>290-300</td>
<td>Marcasite cement.</td>
</tr>
<tr>
<td>355</td>
<td>Base Dakota sandstone.</td>
</tr>
<tr>
<td>355-360</td>
<td>Fuson sandstone, grey etched, angular grains, a few rounded fine to medium, with muscovite and manganese-bearing pellets.</td>
</tr>
<tr>
<td>360-370</td>
<td>Same partly cemented by pyrite and marcasite.</td>
</tr>
<tr>
<td>370-380</td>
<td>With light green grey bentonite.</td>
</tr>
<tr>
<td>380-390</td>
<td>Bentonite, hard, grey white.</td>
</tr>
<tr>
<td>390-410</td>
<td>Bentonite, hard, grey drab and light green grey.</td>
</tr>
<tr>
<td>410-420</td>
<td>Clay, dark blue grey, bentonitic.</td>
</tr>
<tr>
<td>420-430</td>
<td>Clay, lavender, bentonitic.</td>
</tr>
<tr>
<td>430-450</td>
<td>Clay, lavender and light green grey, bentonitic.</td>
</tr>
<tr>
<td>450-460</td>
<td>Lakota sandstone, light grey, fine angular grains. Sandstone, poorly sorted, finer to coarse, some pyrite and marcasite cement, grey, with white bentonite matrix and some has limy cement (Minnewastè equivalent); larger grains are the more rounded.</td>
</tr>
<tr>
<td>470-680</td>
<td>Morrison clay, light grey, bentonitic, pyrite and marcasite nodules, small dark &quot;greenstone&quot; pebbles.</td>
</tr>
<tr>
<td>680-690</td>
<td>Clay, dark grey, with small balls of light grey bentonite, some carbonized wood.</td>
</tr>
<tr>
<td>690-720</td>
<td>Clay, light grey.</td>
</tr>
<tr>
<td>720-750</td>
<td>Some sand, light brown.</td>
</tr>
<tr>
<td>750-760</td>
<td>Bentonite, white, sandy and limy.</td>
</tr>
</tbody>
</table>
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- 875  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- 990  Clay, bentonitic, drab and greenish.

990- 995  Siltstone, light salmon.

995- 995  Fine conglomerate, or grit and sandstone, with subangular grains of varicolored chert, bentonite matrix, some pyrite cement.

990- 1000  Mostly bentonite.

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 satin-spar, 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, sub-round to subangular, Converse.
1781-1810 Sandstone, orange, fine to medium, etched, sub-round 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.
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.
<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2245-2250</td>
<td>Limestone, buff (?)</td>
</tr>
<tr>
<td>2250-2260</td>
<td>Anhydrite, limy</td>
</tr>
<tr>
<td>2260-2265</td>
<td>Claystone, dark salmon, mottled, containing small spots of anhydrite</td>
</tr>
<tr>
<td>2265-2270</td>
<td>Limestone, light brown grey, fine textured, fossiliferous</td>
</tr>
<tr>
<td>2270-2275</td>
<td>Sandstone, unsorted, cream anhydrite cement</td>
</tr>
<tr>
<td>2275-2285</td>
<td>Anhydrite, grey to cream</td>
</tr>
<tr>
<td>2285-2300</td>
<td>Limestone, magnesian, dark grey, very fine granular, some black bituminous shale, possible sandstone near base, oil show</td>
</tr>
<tr>
<td>2302-2312</td>
<td>Sandstone, white, all sizes of grains, etched, sub-round to angular, very large subangular to subround quartz grit grains</td>
</tr>
<tr>
<td>2321-2326</td>
<td>Shale, dark grey, bituminous</td>
</tr>
<tr>
<td>2316-2335</td>
<td>Sandstone, white (?), films of black oxide or bitumen</td>
</tr>
<tr>
<td>2335-2340</td>
<td>Probably grey, finely granular limestone</td>
</tr>
<tr>
<td>2340-2370</td>
<td>Limestone, magnesian, grey, and dolomite, clayey, fine granular, intermixed with anhydrite, some sandy</td>
</tr>
<tr>
<td>2370-2400</td>
<td>Limestone, light brown grey, finely granular, with milky chert, silty</td>
</tr>
<tr>
<td>2400-2410</td>
<td>Anhydrite, with salmon and grey claystone</td>
</tr>
<tr>
<td>2410-2425</td>
<td>Limestone, magnesian, dove, with spots of anhydrite</td>
</tr>
<tr>
<td>2425-2435</td>
<td>Limestone, light brown, magnesian, silty, with black bituminous shale, mixed with anhydrite</td>
</tr>
<tr>
<td>2435-2445</td>
<td>Limestone, light brown, magnesian, small rhombs in finer matrix, brown chert, black bituminous chert</td>
</tr>
<tr>
<td>2445-2450</td>
<td>Same with anhydrite and sandy</td>
</tr>
<tr>
<td>2450-2456</td>
<td>Anhydrite and milky chert</td>
</tr>
<tr>
<td>2456-2470</td>
<td>Limestone, dark brown, bituminous, FUSILINIDS, spicules, brown chert</td>
</tr>
<tr>
<td>2470-2484</td>
<td>Limestone light brown, with very small sand grains (&quot;Whetstone rock&quot;)</td>
</tr>
<tr>
<td>2487</td>
<td>Fine brown sandstone reported</td>
</tr>
<tr>
<td>2537</td>
<td>Total depth (?)</td>
</tr>
</tbody>
</table>
FALL RIVER COUNTY

SHILOH WELL
Lakota Development Company
Contractor: H.L. Hollingsworth
S.E. 1/4 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- 135 Grey shale.
135- 365 Black shale.
365- 373 Grey shale.
373- 407 Black shale.
407- 416 Grey shale. \} Mixed log
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- 603 Red shale.
603- 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.
<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>825-850</td>
<td>Sand.</td>
</tr>
<tr>
<td>850-870</td>
<td>Coal.</td>
</tr>
<tr>
<td>870-885</td>
<td>Sand.</td>
</tr>
<tr>
<td>885-900</td>
<td>Sand and grey shale.</td>
</tr>
<tr>
<td>900-922</td>
<td>Fused, sandy shale.</td>
</tr>
<tr>
<td>922-965</td>
<td>Shale and lime.</td>
</tr>
<tr>
<td>965-1000</td>
<td>Sandy lime.</td>
</tr>
<tr>
<td>1000-1026</td>
<td>Lakota, hard sand (water).</td>
</tr>
<tr>
<td>1026-1056</td>
<td>Grey shale.</td>
</tr>
<tr>
<td>1056-1080</td>
<td>Hard grey shale.</td>
</tr>
<tr>
<td>1080-1110</td>
<td>Hard grey sand.</td>
</tr>
<tr>
<td>1110-1130</td>
<td>Hard grey lime.</td>
</tr>
<tr>
<td>1130-1150</td>
<td>Morrison, black shale.</td>
</tr>
<tr>
<td>1150-1180</td>
<td>Red shale.</td>
</tr>
<tr>
<td>1180-1190</td>
<td>Hard shells (layers).</td>
</tr>
<tr>
<td>1190-1275</td>
<td>Sundance, red shale.</td>
</tr>
<tr>
<td>1275-1285</td>
<td>Blue shale.</td>
</tr>
<tr>
<td>1285-1350</td>
<td>Black shale.</td>
</tr>
<tr>
<td>1350-1355</td>
<td>Black sandy shale.</td>
</tr>
<tr>
<td>1355-1425</td>
<td>Sand and shale (water).</td>
</tr>
<tr>
<td>1425-1560</td>
<td>Spearfish, red beds.</td>
</tr>
<tr>
<td>1560-1569</td>
<td>Sand (water).</td>
</tr>
<tr>
<td>1568-1572</td>
<td>Red beds.</td>
</tr>
<tr>
<td>1573-1590</td>
<td>Shells and sand.</td>
</tr>
<tr>
<td>1590-1690</td>
<td>Red beds.</td>
</tr>
<tr>
<td>1690-1725</td>
<td>Minnekahta, pink lime etc.</td>
</tr>
<tr>
<td>1725-1800</td>
<td>Opeche, red sandy clay.</td>
</tr>
<tr>
<td>1800-1810</td>
<td>Minnelusa, sand Converse.</td>
</tr>
<tr>
<td>1810-1830</td>
<td>Lime and sand.</td>
</tr>
<tr>
<td>1830-1950</td>
<td>Red sandy shale.</td>
</tr>
<tr>
<td>2025-2030</td>
<td>Sand.</td>
</tr>
<tr>
<td>2030-2073</td>
<td>Lime.</td>
</tr>
<tr>
<td>2073-2075</td>
<td>Red white sand (water).</td>
</tr>
<tr>
<td>Depth Range</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>2075-2080</td>
<td>White sand and lime.</td>
</tr>
<tr>
<td>2080-2095</td>
<td>Brown sandy lime.</td>
</tr>
<tr>
<td>2095-2125</td>
<td>Lime.</td>
</tr>
<tr>
<td>2125-2130</td>
<td>Sand (water).</td>
</tr>
<tr>
<td>2130-2140</td>
<td>Red sand</td>
</tr>
<tr>
<td>2140-2170</td>
<td>White lime.</td>
</tr>
<tr>
<td>2170-2230</td>
<td>Grey lime.</td>
</tr>
<tr>
<td>2230-2235</td>
<td>Brown shale.</td>
</tr>
<tr>
<td>2235-2240</td>
<td>Purple lime.</td>
</tr>
<tr>
<td>2240-2265</td>
<td>White lime.</td>
</tr>
<tr>
<td>2265-2290</td>
<td>Red shale.</td>
</tr>
<tr>
<td>2290-2305</td>
<td>Brown and black shale with lime.</td>
</tr>
<tr>
<td>2305-2337</td>
<td>Brown shale.</td>
</tr>
<tr>
<td>2337-2350</td>
<td>Hard sand shell.</td>
</tr>
<tr>
<td>2350-2365</td>
<td>Red shale.</td>
</tr>
<tr>
<td>2365-2404</td>
<td>Brown shale</td>
</tr>
<tr>
<td>2404-2435</td>
<td>Sand.</td>
</tr>
<tr>
<td>2435-2440</td>
<td>Lime.</td>
</tr>
<tr>
<td>2440-2485</td>
<td>Lime.</td>
</tr>
<tr>
<td>2485-2540</td>
<td>Lime.</td>
</tr>
<tr>
<td>2540-2550</td>
<td>Limy sand and black shale (shale particles when pulverized and wet will leave black smear on the hand. Carbonaceous).</td>
</tr>
<tr>
<td>2550-2570</td>
<td>Grey lime (water).</td>
</tr>
<tr>
<td>2570-2600</td>
<td>Grey sandy lime.</td>
</tr>
<tr>
<td>2600-2610</td>
<td>Pink lime.</td>
</tr>
<tr>
<td>2610-2635</td>
<td>Red shale.</td>
</tr>
<tr>
<td>2635-2642</td>
<td>Grey lime.</td>
</tr>
<tr>
<td>2642-2695</td>
<td>Red shale, caving.</td>
</tr>
<tr>
<td>2695-2698</td>
<td>Lime and shells, caving.</td>
</tr>
<tr>
<td>2698-2703</td>
<td>Purple and grey lime, caving.</td>
</tr>
<tr>
<td>2703-2720</td>
<td>Pink and white lime, caving.</td>
</tr>
<tr>
<td>2720-2785</td>
<td>Red shale and brown shale, caving, basal laterite.</td>
</tr>
<tr>
<td>2785-2800</td>
<td>Madison, pink lime and white talc.</td>
</tr>
<tr>
<td>2800-2820</td>
<td>Grey lime and sand--very hard.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2550-2580</td>
<td>Streaks of red grey limestone.</td>
</tr>
<tr>
<td>2580-2610</td>
<td>White sand (water).</td>
</tr>
<tr>
<td>2610-2623</td>
<td>Talc and red shale.</td>
</tr>
<tr>
<td>2623-2743</td>
<td>Bad caves, broken lime shells and shale.</td>
</tr>
<tr>
<td>2743-2780</td>
<td>Red sandy shale.</td>
</tr>
<tr>
<td>2780-2815</td>
<td>Hard grey limestone.</td>
</tr>
<tr>
<td>2815-2820</td>
<td>White sand and gas.</td>
</tr>
<tr>
<td>Depth Range</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>2820-2930</td>
<td>Grey limestone.</td>
</tr>
<tr>
<td>2830-2842</td>
<td>Pink limestone.</td>
</tr>
<tr>
<td>2842-2854</td>
<td>Hard grey limestone.</td>
</tr>
<tr>
<td>2854-2865</td>
<td>Pink limestone.</td>
</tr>
<tr>
<td>2865-2875</td>
<td>Grey and pink limestone.</td>
</tr>
<tr>
<td>2875-2890</td>
<td>Red water sand.</td>
</tr>
<tr>
<td>2890-2895</td>
<td>Grey sandy limestone.</td>
</tr>
<tr>
<td>2895-2905</td>
<td>Grey limestone.</td>
</tr>
<tr>
<td>2905-2935</td>
<td>Pinkish limestone.</td>
</tr>
<tr>
<td>2935-2950</td>
<td>Pink limestone.</td>
</tr>
<tr>
<td>2950-2960</td>
<td>Reddish lime.</td>
</tr>
<tr>
<td>2960-2964</td>
<td>Grey limestone.</td>
</tr>
<tr>
<td>2964-2970</td>
<td>Coarse pink limestone.</td>
</tr>
<tr>
<td>2970-2985</td>
<td>Reddish limestone.</td>
</tr>
<tr>
<td>2985-2995</td>
<td>Reddish limestone.</td>
</tr>
<tr>
<td>2995-3003</td>
<td>Grey limestone.</td>
</tr>
<tr>
<td>3003-3012</td>
<td>Dark grey lime.</td>
</tr>
<tr>
<td>3012-3030</td>
<td>Grey lime.</td>
</tr>
<tr>
<td>3030-3050</td>
<td>Pink lime.</td>
</tr>
<tr>
<td>3050-3070</td>
<td>Grey lime.</td>
</tr>
<tr>
<td>3070-3082</td>
<td>Pink lime.</td>
</tr>
<tr>
<td>3082-3109</td>
<td>Red shale.</td>
</tr>
<tr>
<td>3109-3135</td>
<td>Blue shale.</td>
</tr>
<tr>
<td>3135-3195</td>
<td>Red lime.</td>
</tr>
<tr>
<td>3195-3210</td>
<td>Red sandy lime.</td>
</tr>
<tr>
<td>3210-3213</td>
<td>Grey sandy lime with brown specks.</td>
</tr>
<tr>
<td>3218-3220</td>
<td>Pink sandy lime. (Englewood?)</td>
</tr>
<tr>
<td>3220-3231</td>
<td>Dark grey sandy lime.</td>
</tr>
<tr>
<td>3231-3238</td>
<td>Grey sandy lime with red specks.</td>
</tr>
<tr>
<td>3238-3240</td>
<td>Sand contains quartz-mica-feldspar.</td>
</tr>
<tr>
<td>3240-3250</td>
<td>Pre-Cambrian biotite granite.</td>
</tr>
</tbody>
</table>
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 an-
       gular.

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.
360-920 No cuttings.

930-980 Dakota sand, buff, fine, angular.
930-1000 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-rossette 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 Mober-ridge 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 1413½-20½.
1453
1473
1480-1512
1500-1553
1600-1620
1670
1680
1700
1721
1740&1760
1815-1835
1873
1935
2013
2020
2050
2070
2090

Much marcasite.
Shale, dark grey, minute flattened disks of chalk.
Marcasite.
Marcasite.
INOERAMUS prisms.
Bentonite, light blue grey.
Marcasite, pyrite and shale.
Marcasite, pyrite and shale with selenite.
Largely marcasite.
Shale somewhat chalky with marcasite and selenite.
Greenhorn limestone, composed of GLOBIGERINA and INOCERAMUS prisms, dark grey chalky shale.
Graneros shale, dark grey, considerable white bentonite.
TEXTULARIA, GLOBIGERINA, INOCERAMUS prisms.
Some angular sand, mostly black shale.
Sand angular, fine, light grey.
Black shale, a little fine sandstone.
Sand, grey, fine angular, partly recrystallized.
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:

<table>
<thead>
<tr>
<th>Element</th>
<th>Parts per Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na)</td>
<td>2512.0</td>
</tr>
<tr>
<td>Ammonia (NH₃)</td>
<td>3.4</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>69.6</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>22.8</td>
</tr>
<tr>
<td>Sulphate (SO₄)</td>
<td>4554.0</td>
</tr>
<tr>
<td>Chlorine (Cl)</td>
<td>632.0</td>
</tr>
<tr>
<td>Carbonate (CO₃)</td>
<td>0.0</td>
</tr>
<tr>
<td>Bicarbonate (HCO₃)</td>
<td>126.9</td>
</tr>
<tr>
<td>Sili ca (SiO₂)</td>
<td>11.3</td>
</tr>
<tr>
<td>Iron and Alumina (Fe₂O₃)</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Total solids 7933.6
HAAKON COUNTY

JOHN STROPEL, 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
1555-1560 Graneros shale.
1615 Abundant forams.
1630 A little fine sandstone.
1735 Siltstone.
1765-1770 Dakota sandstone, grey, fine, angular.
1770-1780 Sandstone, fine, carbonaceous.

1870-1880 Fuson manganese-bearing pellet horizon.

Last sample is sandstone and drillers log shows flowing water sands at 1786-87', 1809-10', 1326-28', and 1878-1880'.
The water has the following mineral composition, analysed by the State Chemist; in parts per million:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica (SiO₂)</td>
<td>23.0</td>
<td>Magnesium (Mg)</td>
<td>1.5</td>
</tr>
<tr>
<td>Sulphate (SO₄)</td>
<td>2.0</td>
<td>Iron (Fe)</td>
<td>1.0</td>
</tr>
<tr>
<td>Chloride (Cl⁻)</td>
<td>850.0</td>
<td>Fluoride (F⁻)</td>
<td>2.5</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 (Na₂CO₃).
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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>16.0</td>
</tr>
<tr>
<td>Sulphate</td>
<td>1214.0</td>
</tr>
<tr>
<td>Chloride</td>
<td>99.0</td>
</tr>
<tr>
<td>Fluoride</td>
<td>2.4</td>
</tr>
<tr>
<td>Calcium</td>
<td>192.0</td>
</tr>
<tr>
<td>Magnesium</td>
<td>58.0</td>
</tr>
<tr>
<td>Iron</td>
<td>1.0</td>
</tr>
<tr>
<td>Hardness as</td>
<td>721.0</td>
</tr>
<tr>
<td>CaCO3</td>
<td></td>
</tr>
</tbody>
</table>

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

$SW_4$, 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'

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Cenozoic sand, fine bentonite light brown.</td>
</tr>
<tr>
<td>60</td>
<td>Silt, yellow green.</td>
</tr>
<tr>
<td>70-100</td>
<td>Silt with bentonite matrix and volcanic glass shards, cream colored.</td>
</tr>
<tr>
<td>115-120</td>
<td>Clay, blue grey, bentonitic.</td>
</tr>
<tr>
<td>120-123</td>
<td>Clay, silty, cream.</td>
</tr>
<tr>
<td>135</td>
<td>Clay, bentonitic, with coarse sand, cuttings below to 370' have glass shards.</td>
</tr>
<tr>
<td>180</td>
<td>Silt, bentonitic, cream.</td>
</tr>
<tr>
<td>260</td>
<td>Largely light cream bentonite.</td>
</tr>
<tr>
<td>290</td>
<td>Sandy, drab.</td>
</tr>
<tr>
<td>320</td>
<td>Ash, mostly bentonite, light grey drab.</td>
</tr>
<tr>
<td>340</td>
<td>Same, with angular sand.</td>
</tr>
<tr>
<td>350</td>
<td>Bentonite, faint lavender.</td>
</tr>
<tr>
<td>360</td>
<td>Bentonite and sand, cream.</td>
</tr>
<tr>
<td>370</td>
<td>Bentonite and sand, light drab or ashy grey.</td>
</tr>
<tr>
<td>370</td>
<td><strong>Pierre (top) clay, blue grey, bentonitic.</strong></td>
</tr>
<tr>
<td>390</td>
<td>Clay, grey, bentonitic.</td>
</tr>
<tr>
<td>400</td>
<td>Clay, grey, bentonitic with altered GLOBIGERINA.</td>
</tr>
<tr>
<td>430</td>
<td>Clay, ash, with biotite.</td>
</tr>
<tr>
<td>440</td>
<td>Clay with GLOBIGERINA and fish remains.</td>
</tr>
<tr>
<td>480</td>
<td>Clay spotted with flattened chalk pellets.</td>
</tr>
<tr>
<td>500-520</td>
<td>Bentonite, white.</td>
</tr>
<tr>
<td>520</td>
<td>Large amount marcasite, hauerite.</td>
</tr>
<tr>
<td>540</td>
<td>OSTRACODS and CRISTELLARIA.</td>
</tr>
<tr>
<td>550</td>
<td>Chalk, medium grey.</td>
</tr>
<tr>
<td>590</td>
<td>Clay, grey.</td>
</tr>
<tr>
<td>611-620</td>
<td>Angular fine sand, bentonite, light grey, very small buckshot concretions insoluble in hydrochloric acid.</td>
</tr>
<tr>
<td>620</td>
<td>INOCERAMUS prisms.</td>
</tr>
<tr>
<td>640</td>
<td>GLOBIGERINA, some light grey bentonite.</td>
</tr>
<tr>
<td>690</td>
<td>Bentonite, cream.</td>
</tr>
<tr>
<td>760</td>
<td>Siltstone, brown.</td>
</tr>
<tr>
<td>350</td>
<td>Bentonite, blue grey, flaky.</td>
</tr>
<tr>
<td>860 &amp; 880</td>
<td>Bentonite, light grey, large flakes biotite.</td>
</tr>
</tbody>
</table>
890  Clay, bentonitic, darker grey.
950 & 970  Some fine brown sandstone.
980  AMMODISCUS.
1000  Clay, bentonitic, darker grey.
1150  GLOMOSPIRA, grey biotitic bentonite.
1275  Hauermite 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  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.

-31-
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.
2225  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.
2500  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.
Fine gravel, chalk and clay particles.

20- 40

40- 90 Upper Niobrara chalky, grey, ashy, GLOBIGERINA.
90- 120 Many loose forams, INOCERAMUS prisms, OSTRERA
CONGESTA.

120- 130 Chalk, cream colored, fairly pure.
140- 160 Some chalk but largely black bituminous chalky
marl, biotite, coccoliths, TEXTULARIA, GLOBIGER-
INA.

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.

-33-
UNION COUNTY

LA FLUEB NO. 1
Sioux Valley Oil and Refining Co.
northwest part of town of Jefferson
Sec. 13, T 90 N, R 48 W, Altitude about 1112-15'

60 or 70  Sand, alluvial, light brown, with black chert
          particles, fairly coarse, subrounded.
70-125  Alluvial gravel and sand, with dolomite, amethyst
          and Pre-Cambrian rock fragments.
125-128  Grit.
242-352  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.

-34-
<table>
<thead>
<tr>
<th>Page</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>531-560</td>
<td>Limestone, dolomitic, grey, coarse rhombic, virtually a fine grained marble, chalcopyrite, covellite.</td>
</tr>
<tr>
<td>560-570</td>
<td>More chalcedony, with marcasite in cavities.</td>
</tr>
<tr>
<td>570-580</td>
<td>May be cavings, some material like Sioux quartzite.</td>
</tr>
<tr>
<td>580-592</td>
<td>Dolomite, brown grey, rhombic, vuggy, crinoid stem and plicated brachiopod in chalcedony.</td>
</tr>
<tr>
<td>592-610</td>
<td>Dolomite, light grey, fine powdered sugar texture.</td>
</tr>
<tr>
<td>610-655</td>
<td>Sandstone, light grey, cemented, angular coarse etched grains, some of dark chert.</td>
</tr>
<tr>
<td>655-666</td>
<td>Limestone, magnesian, rhombic, quite vuggy, 400' of 12 1/2 in. casing run.</td>
</tr>
<tr>
<td>666-707</td>
<td>Decorah-Platteville (Mid-Ordovician) shale, grey green, bentonitic, silty, with rhombic magnesian limestone.</td>
</tr>
<tr>
<td>707-710</td>
<td>Dolomite, light grey, fine rhombic.</td>
</tr>
<tr>
<td>710-720</td>
<td>Shale, green.</td>
</tr>
<tr>
<td>720-730</td>
<td>Sandstone, buff, very fine grained, virtually a siltstone.</td>
</tr>
<tr>
<td>730-740</td>
<td>Shale, green, some sandy with coarse grains, sandier and siltier below.</td>
</tr>
<tr>
<td>750-755</td>
<td>Siltstone, brown grey, limy cement.</td>
</tr>
<tr>
<td>755-765</td>
<td>Shale, green, flaky, bentonitic, with black phosphatic nodules.</td>
</tr>
<tr>
<td>765-805</td>
<td>St. Peter sandstone, all size grains, etched, round to subround, some light pink grains probably derived from Sioux quartzite.</td>
</tr>
<tr>
<td>805-815</td>
<td>Sandstone, light grey, fine, dolomite cement, glauconite, black phosphate.</td>
</tr>
<tr>
<td>815-825</td>
<td>Largely grey green bentonitic clay.</td>
</tr>
<tr>
<td>825-835</td>
<td>Upper Cambrian, probably, dolomite, light grey, fine rhombic.</td>
</tr>
<tr>
<td>835-860</td>
<td>Dolomite, light grey, rhombic, with subangular dark glauconite particles.</td>
</tr>
<tr>
<td>860-875</td>
<td>Dolomite, light grey, with some fine sand grains.</td>
</tr>
<tr>
<td>875-890</td>
<td>Dolomite, light grey, coarser rhombs.</td>
</tr>
<tr>
<td>890-900</td>
<td>Dolomite, light grey, very glauconitic, some quite coarsely rhombic.</td>
</tr>
<tr>
<td>900-933</td>
<td>Sand, light cream, etched, round to subround, poorly sorted, all sizes of grains, some light pink, likely from Sioux quartzite.</td>
</tr>
<tr>
<td>933-936</td>
<td>Sand with fairly large subrounded pellets of glauconite.</td>
</tr>
</tbody>
</table>
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 million 7 parts fluoride.

Apparently the drill followed the shear zone to the total depth of 2752 ft.
<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-74</td>
<td>Alluvial and glacial.</td>
</tr>
<tr>
<td>74-90</td>
<td>Carlile shale, medium grey.</td>
</tr>
<tr>
<td>90-110</td>
<td>Shale, dark grey.</td>
</tr>
<tr>
<td>110-130</td>
<td>Greenhorn limestone (?)</td>
</tr>
<tr>
<td>130-330</td>
<td>Graneros shale, at least in lower part.</td>
</tr>
<tr>
<td>330-370</td>
<td>Dakota sand, grey, fine, angular, a little glauconite.</td>
</tr>
<tr>
<td>390-410</td>
<td>Shale, bentonitic, grey.</td>
</tr>
<tr>
<td>410-450</td>
<td>Fuson sandy bentonite, light grey, with manganese bearing pellets.</td>
</tr>
<tr>
<td>450-525</td>
<td>Lakota, sand, fine, poorly sorted, angular grains.</td>
</tr>
</tbody>
</table>
ZIEBACH COUNTY

U.S. INDIAN SERVICE, RED SCAFFOLD SCHOOL
SE 1/4, 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, GLOBI-
GERINA, 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.
1790-1300  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-
ese-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:
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (Ca)</td>
<td>9.6</td>
<td>Chlorine (Cl)</td>
<td>2417.0</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>4.5</td>
<td>Fluorine (F)</td>
<td>2.3</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>2197.0</td>
<td>Nitrate (NO₃)</td>
<td>1.9</td>
</tr>
<tr>
<td>Bicarbonate (HCO₃)</td>
<td>1696.0</td>
<td>Boron (B)</td>
<td>7.7</td>
</tr>
<tr>
<td>Sulphate (SO₄)</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total solids (Added) 6337.9