MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph. D.
Director

BULLETIN 36

THE JACKSON GAS FIELD
and
THE STATE DEEP TEST WELL

By
WATSON HINER MONROE
and
HENRY NILES TOLER, M. S.

UNIVERSITY, MISSISSIPPI
1937

FRONTISPIECE

Subsurface structure map of the Jackson Gas Field. The contour lines are drawn at 25-foot vertical intervals on top of the Selma chalk, which lies beneath sea level. Accordingly, the greater the numerical value of the contour line, the farther below sea level the top of the chalk is and the farther down on the structure the contour line lies. By Henry Niles Toler.

SYMBOLS

Star-circle indicates gas well
Disc indicates oil well
Circle-diagonal line indicates dry well

MADISON CO.
HINDS CO.
R.2 E.
T. 6 N.
HINDS CO.
RANKIN CO.
JACKSON
U.S. NO 51
U.S. NO 49
U.S. NO 80
CAPITOL ST
BAILEY AVE
HOOKER ST
SOUTH ST
TERRY ROAD
STATE ST
Y. & M. V.
G. M. & N.
I. C.
N. O. & N.
Pearl River
T. 5 N.
T. 4 N.
R. 1 E.
R. 2 E.
Scale
0 2000 4000 6000 8000 FEET

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LETTER OF TRANSMITTAL

Office of the State Geological Survey
University, Mississippi
September 1, 1937

To His Excellency,
Governor Hugh White, Chairman, and
Members of the Geological Commission

Gentlemen:

I have the pleasure of transmitting the manuscript of Bulletin 36, entitled The Jackson gas field and The State deep test well by Watson Hiner Monroe, Assistant Geologist, U. S. Geological Survey, and Henry Niles Toler, Mississippi State Oil and Gas Supervisor. The report contains a full description of the rocks penetrated by the State deep test well, the drilling of which the State Legislature directed the State Mineral Lease Commission to supervise, and a brief summation of the geology and production of the Jackson gas field through June 30, 1937. The information contained therein should be of great value in the further search for oil and gas in Mississippi.

Respectfully submitted,

William Clifford Morse, Director.

NOTE

In the interest of uniformity, the Mississippi Geological Survey follows the divisions of the time scale and of the rock scale adopted by the International Geological Congress:

Time scale
- Era
  - Period
    - Epoch
      - Age

Rock scale
- Group
  - System
    - Series
      - Stage (Formation)

Accordingly, all the third order "group" terms of the authors appear as "series." All the terms "Lower Cretaceous" and "Upper Cretaceous" that refer to time appear respectively as "Early Cretaceous" and "Late Cretaceous."

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THE JACKSON GAS FIELD
AND
THE STATE DEEP TEST WELL*

BY
WATSON HINER MONROE
AND
HENRY NILES TOLER

THE JACKSON GAS FIELD IN GENERAL

LOCATION

The Jackson gas field is partly within and partly without the City of Jackson, Mississippi, which, in turn, is on the east flank of the Mississippi Embayment in the Gulf Coastal Plain.

HISTORICAL REVIEW

The presence of a local uplift at Jackson as an explanation for the reappearance there of the same Tertiary beds that crop out north of Canton, Madison County, 27 miles north of Jackson, was first suggested in 1860 by Hilgard.[1] Many years later it was discovered that oil and natural gas are found on the crest of many anticlines and similar structures that form traps for oil and gas. A study of the Jackson area was made in 1915 by the United States Geological Survey to determine whether the anticlinal folding in that vicinity was of sufficient magnitude to afford such a trap. The results of this investigation[2] stimulated several oil operators to drill wells near Jackson. It is known today that all these wells were drilled too far down the flanks of the anticline to produce gas.

In 1927 a lease on the old State Insane Asylum property in the northern part of Jackson was obtained by Mrs. Ella Rawls Reader, and by 1929 she had had a well drilled into the Selma chalk. The depth in the chalk reached by this well is not known and no tests for gas were made; but it is practically certain that the well was drilled through gas-bearing rock, for the State and other operators have completed producing wells not far away on all sides.

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* Published by permission of the Director, U. S. Geological Survey.

[1] Hilgard, E.W., Geology and agriculture of Mississippi, p. 129, 1860.

[2] Hopkins, O.B., Structure of the Vicksburg-Jackson area, Mississippi: U.S. Geol. Survey Bull. 641, pp. 93-120, 1916.

In December, 1929, the Jackson Oil and Gas Company started a well in section 2, T. 5 N., R. 1 E., which in February, 1930, was brought in as a gas well. It was not considered entirely satisfactory because it had been drilled too deep and yielded much salt water with the gas, but it was still active at the end of June, 1937, and had produced 1,306,816,000 cubic feet of gas.

The drilling of other wells proceeded rapidly and by the end of June, 1937, 137 gas wells had been completed, and more than 65 billion cubic feet of gas had been produced. In the seven years, 1930 to 1937, the rock pressure had declined from 1,010 to 922 pounds per square inch.

The structure and the rock formations of the gas field down to and including the gas-bearing chalk were described in 1932 by Monroe,[3] but the information derived from the drilling of wells after 1932 reveals the structure to be noticeably different from that shown by the structure map accompanying his report.

The rocks below the Selma chalk were described in 1933 by Monroe.[4] Some of these rocks which he then assigned to the Carboniferous are now generally believed to be of Trinity (Early Cretaceous) age, as explained on subsequent pages of the present bulletin.

An excellent summary of the geology and production of the Jackson gas field was published by D. J. Munroe in 1935[5] as one of 38 papers on the geology of natural gas.

By the early part of 1932 the old State Insane Asylum lands, including about 1,320 acres in the northern part of Jackson, were surrounded by producing gas wells and the State Government took steps to lease the land in order to recover for the State the underlying gas. For this purpose a State Mineral Lease Commission, consisting of the Governor, the Attorney General, and the State Land Commissioner was created by the Legislature. In 1936 the State Geologist and the State Oil and Gas Supervisor were added. In March, 1936, the Legislature appropriated $115,000 for gas wells and a deep test for oil on the Asylum property. Drilling of the first gas well began August 26, 1936. On August 29 this well blew out at 1,095 feet where an accumulation of "wild gas" was encountered in the top of the Wilcox series of strata.

[3]Monroe, W. H., The Jackson gas field, Hinds and Rankin counties, Mississippi: U.S. Geol. Survey Bull. 831, pp. 1-17, 1932.

[4]Monroe, W.H., Pre-Tertiary rocks from deep wells at Jackson, Mississippi: Amer. Assoc. Petroleum Geologists Bull., vol. 17, pp. 38-51, 1933.

[5]Munroe, D. J., Jackson gas field, Hinds and Rankin counties, Mississippi; in Ley, H.A., and others, Geology of natural gas, pp. 881-896, 1935.

This well blew wild for 24 hours at an estimated rate of 50 million cubic feet a day, and then the hole bridged over, stopping the flow of gas. A very small amount of gas is still escaping from the crater which was formed while the well was blowing. The well and some equipment were lost, but fortunately no one was injured.

This accumulation of gas in the top of the Wilcox is thought to be the result of leaking casings in near by wells. Two wells in the immediate area were found to be leaking and have been repaired.

The deep test for oil described in this paper and known as the State Fee No. 2 well is in section 25, T. 6 N., R. 1 E. As the State Mineral Lease Commission wanted all possible information about the rocks penetrated and about the oil possibilities of the property, all the oil companies that had shown an interest in the development of the Jackson field were invited to send representatives to watch the drilling and to report on the age and lithologic character of the rocks encountered. At the same time the United States Geological Survey was requested to send an observer to advise the Commission as needed. Watson H. Monroe was thus assigned to the project.

Drilling began on November 7, 1936, and ceased at a depth of 5,530 feet on April 6, 1937. Thirteen and three-eighths-inch casing was set to a depth of 802 feet and 9-inch to a depth of 2,514 feet—45 feet below the top of the chalk rock—sufficient to case off the producing zone at the top of the Selma chalk. Drilling continued without casing from 2,514 to 5,530 feet. An electrical survey of the hole was made by the Schlumberger Corporation on December 14, 1936, from 2,514 to 2,856 feet, and on April 6, 1937, from 2,800 to 5,530 feet. The earlier survey indicated a possibility of gas at depths of 2,842 to 2,856 feet; and, although the later survey did not confirm this possibility, it showed that the sand at that depth was more favorable than any below. In order to test the sand from 2,842 to 2,860 feet, a string of casing was set to 2,910 feet—seven inches in diameter to a depth of 2,046 feet and five inches in diameter from 2,046 to 2,910 feet. The Lane Wells Company then perforated the casing with 12 shots placed at depths between 2,842 and 2,860 feet. Next 1¼-inch tubing was run and the well was tested but it produced only salt water with no indication of oil or gas.

The hole was then plugged back to 2,600 feet and the casings were perforated with 72 shots in the interval between 2,468 and 2,480 feet. The well was completed with an open-flow capacity of 12,000,000 cubic feet of gas a day and some salt water. As the producing formation in this well is several feet above the water level for that part of the field,

it is very likely that the salt water is coming in between the two strings of casing as a result of channeling of the cement, or that it is coming up around the outside of the 9-inch casing through the porous chalk. The well has been connected to the pipe line and is performing satisfactorily at present.

This was the first deep well drilled within the gas-producing area to be located high enough structurally to produce gas. It was a hazardous undertaking as very frequently when the producing zone is drilled into, the drilling fluid fails to return to the surface—"returns are lost" —with the result that the hole caves around the drill stem or that gas starts to blow from the mouth of the well. This well showed some gas between the 13-3/8-inch and the 9-inch casings after the 9-inch casing had been cemented, but did not give any serious trouble.

Considerable difficulty was experienced in drilling this well. Returns were completely lost in the chalk at a depth of 2,790 to 2,800 feet, so it was necessary to put cement in the hole three times before the cavity in the chalk was sealed. There were four fishing jobs. The first was at 745 feet, but the tools were recovered easily. The second was at 4,415 feet where the cones and bearings from the bit were left in the hole; these were fished out with a basket. At 4,775 feet the drill collar and bit twisted off, but they were recovered with little difficulty. A collar washed out 400 feet above the bit while drilling at 4,985 feet and left 400 feet of drill stem in the hole. A "taper tap" was run and caught the lost pipe but it was stuck. Several days were spent in trying to get the pipe loose. It was finally recovered by lubricating and using hydraulic jacks.

Much hard drilling was experienced, particularly in the hard sandstones and in some of the bodies of igneous rock. A few streaks were encountered where rock bits were worn out after drilling less than a foot; and, in all, over a hundred rock bits were used in drilling the well. The contractor, Mr. E. R. Owen, and the drillers, Messrs. Noah Hart and V. V. Ryan, are to be commended for getting the well down to 5,530 feet under some very difficult conditions.

The well cost the State of Mississippi $45,750.51 and, in addition, the fuel for drilling which the State furnished from one of its gas wells.

The authors, representing the State of Mississippi, were in close contact with the well and spent a great part of their time on the location.

Although no oil or gas was found in the deeper rocks, the well is one of the most important thus far drilled in Mississippi, for it tested

the deeper rocks of the Jackson anticline. It seemingly entered rocks of Early Cretaceous age—a system whose sedimentary beds do not crop out in Mississippi—and penetrated these rocks at least 1,500 feet deeper than any well hitherto drilled within the State.

GENERAL GEOLOGY OF THE GAS FIELD

STRATIGRAPHY

The rocks at the surface in the Jackson gas field and those down to and including the producing bed are of sedimentary origin. The top of the cap rock above the producing bed in different parts of the field has been found at depths ranging from approximately 2,060 feet below sea level to 2,330 feet, but no gas has been produced from wells that reached the cap rock at a depth greater than 2,230 feet, and very little gas has been produced below a depth of 2,200 feet below sea level. Underlying the chalk are sandstone, shale, and igneous rock.

The youngest deposits penetrated in wells in the field are loess of Pleistocene age or alluvium of Recent age. These surface deposits are only a few feet thick, and, after penetrating them, wells enter rocks of Tertiary age—first, the Jackson formation, or where that is not present, the Yegua formation of the Claiborne series. The contact of the Jackson and Yegua formations is exposed at the surface in a number of places on top of the dome.

Jackson formation

The Jackson formation, as penetrated in the wells, consists of 50 feet or less of dark greenish-blue very tough calcareous clay underlain by about 25 feet of blue-gray glauconitic fossiliferous fine-grained sand.

Claiborne series

Underneath the Jackson formation is the Claiborne series, about 1,100 feet in thickness, which consists in descending order of the Yegua formation, and the following units as used at Jackson by petroleum geologists: the Minden formation, the Sparta sand, and the Cane River formation. The names of the last three units are all names in general use in Louisiana, and they have replaced the terms Lisbon and Tallahatta formations which are generally applied to this sequence of beds in Mississippi. The Yegua formation consists of about 250 feet of fine-grained sand, clay, and lignite. It is underlain by the upper part (Minden) of the Lisbon formation. This upper part of the Lisbon consists of 250 feet or less of blue-gray glauconitic sand and clay. The Kosciusko sandstone member of the Lisbon formation is equivalent to the Sparta sand of petroleum geologists; it consists of 275 feet or more of light-colored sand and clay. Below the Kosciusko member is the

Winona sand member of the Lisbon formation and next the Tallahatta formation. The Winona and the Tallahatta constitute the *Cane River* formation of the petroleum geologists. The Cane River consists of 300-350 feet of glauconitic sand, clay, and marly or chalky limestone, which form the basal part of the Claiborne series.

Wilcox series

Underlying the Claiborne series is the Wilcox series which consists of 1,250 to 1,300 feet of fine-grained micaceous sand, shale, lignite, and concretionary boulders. The Wilcox seems to grade downward into black shale of the Midway series.

Midway series

The Midway consists of two formations, the Porters Creek clay, called by drillers the "black shale," and the Clayton formation, called the "cap rock." The Porters Creek clay consists of approximately 100 feet of black marine shale that contains numerous fossil shells in its lower part. It merges downward into an impure argillaceous limestone, the Clayton formation—the oldest Tertiary formation—which forms the cap rock above the gas-bearing Selma chalk of Late Cretaceous age. The top of the Clayton is commonly termed the "top of the chalk."

Selma chalk

The Selma chalk contains natural gas in its uppermost part. This part consists of more or less porous earthy limestone which merges downward into very pure soft crystalline limestone. Some parts of the Selma are exceedingly porous and contain cavities lined with crystals of calcite. Near the base of the Selma are several beds of very hard and compact crystalline limestone.

Rocks beneath the Selma chalk

The geology of the rocks underlying the Selma is very imperfectly understood, because only a few wells have penetrated these beds. It was earlier thought that in the Jackson field and near it the rocks underlying the Selma were of Tuscaloosa (Late Cretaceous) age and that underlying the Tuscaloosa were rocks of Carboniferous age,[6] but the facts obtained from the State deep test well have made necessary a reexamination of the cores on which the earlier determination rested. It is now believed that many of these pre-Selma rocks or all of them are of Early Cretaceous (Trinity) age. It is possible that there are rocks of Eutaw or Tuscaloosa age immediately below the Selma, but no break has been found between these rocks and those below, and all, therefore,

[6]Monroe, W.H., Pre-Tertiary rocks from deep wells at Jackson, Mississippi: Bull. Amer. Assoc. Petroleum Geologists, vol. 17, pp. 49-51, January, 1933.

may be of the same age. On the lower flanks of the anticline, several miles from Jackson, rocks of definite Eutaw (Late Cretaceous) age have been penetrated below the Selma, but these rocks either pinch out or change in their lithologic character as they extend up to the higher parts of the structure.

Igneous rocks

Interbedded with them and cutting across the bedding of the pre-Selma rocks, many bodies of igneous material have been reached in wells below a depth of 2,900 feet. In some of the wells the igneous material consists of ash that was blasted from the mouths of active volcanoes during pre-Selma time. In other wells only intrusive rocks are found; that is, rocks that solidified without reaching the surface of the ground. In a few wells both ash and intrusive rock have been found. The State deep test well proves conclusively that there were at least two periods of igneous activity, for beds intruded by igneous rocks lie above beds of lava or tuff which at one time occupied a position at the surface of the ground. The intrusive rocks underlying the Jackson field include lamprophyre, a dark-colored granular dike rock having abundant mafic minerals; tinguaite, a fine-grained generally lighter-colored dike rock of the nepheline-syenite family; nepheline syenite; aplite; and sanidine-calcite rock. The ash found in some wells contains abundant small lapilli, spherical glassy pellets composed of radiating crystals.

Structure

In 1916 Hopkins,[7] using the top of the Glendon limestone of the Vicksburg series as a key horizon, showed that the formations dip away from Jackson in a broad anticline, which he called the Jackson anticline. He was unable to contour the top of the anticline, for he did not have the stratigraphic information derived from wells that is available today. In 1930 and 1931, a field investigation by Monroe, in which he used the well data then available, showed that the top of the anticline, really an elongate dome, is in the northeastern part of Jackson in section 35, T. 6 N., R. 1 E., and that the top is about 400 feet higher structurally than Hopkins' highest contour line.

The structure of the top of the chalk—strictly speaking the top of the Clayton formation—agrees only in a general way with the structure of the rocks exposed at the surface. The crest of the upwarped area is in general dome-shaped and extends 6 miles north and south and 4 miles east and west. The center of the dome is in the eastern part of

[7]Hopkins, O.B., Structure of the Vicksburg-Jackson area, Mississippi, with special reference to oil and gas: U. S. Geol. Survey Bull. 641, pp. 108-112, 1917.

section 2, T. 5 N., R. 1 E. The top of the dome consists of two large anticlines separated by a southwest-trending syncline that forms a low saddle in section 36, T. 6 N., R. 1 E., and a deep trough southwest of section 36. The northwestern anticline has two areas somewhat higher than the rest, one in section 25, T. 6 N., R. 1 E., on the old Asylum property, and the other in sections 34 and 35, T. 6 N., R. 1 E. The top of the southeastern anticline is somewhat more complex, having a crest in section 1, T. 5 N., R. 1 E., (the highest point on top of the chalk in the field), another in section 11, a third in section 15, T. 5 N., R. 1 E., and possibly a fourth in sections 7 and 18, T. 5 N., R. 2 E. It is significant that the rock pressure of the gas in the wells on the small domes in section 11 and in sections 7 and 18 is higher than in wells in the rest of the field. This suggests that these two domes are isolated from the rest of the anticline. In addition there is a flattening of the dip to the south away from the crest in sections 13 and 14. This flattening may be caused by a small upwarping in the southern part of these sections or may be caused by faulting in the northern part.

No faulting in the anticline has been proved, but there is a strong suggestion of an eastward-trending fault in the northern part of sections 13 and 14, T. 5 N., R. 1 E. D. J. Munroe[8] has mapped a small fault that he states "may or may not exist" in section 2, T. 5 N., R. 1 E.

The surface of the Selmá chalk is irregular, having been eroded before the deposition of the sediments of the Clayton. Consequently much of the apparent structure may really be the topography of the top of the Selma chalk. The cause of the origin of the anticline is in dispute among geologists, but it was probably caused in part by upwarping and in part by differential compaction of sediments above and around the igneous plug. Munroe[9] suggests that the smaller irregularities of the top of the cap rock may have been caused by collapse during Wilcox time of caverns in the Selma chalk.

GAS PRODUCTION

The first gas sold in the Jackson field for use other than drilling was from the Mendoza Well No. 1 of the Love Petroleum Company. This gas was connected to the power plant of the Mississippi Power and Light Company on June 11, 1930. Gas was first turned into the distribution system of the City of Jackson on October 30, 1930. On January 27,

[8]Munroe, D. J., Jackson gas field, Hinds and Rankin counties, Mississippi: in Ley, H.A., and others, Geology of natural gas, pp. 886, 887, 1935.

[9]Op. cit. pp. 885, 887.

1931, gas was first put in the pipe line for delivery outside the City of Jackson by the United Gas System.

Since discovery the gas production from the field by years has been as follows:

1930	586,634,000	cubic feet
1931	6,164,370,000	cubic feet
1932	9,674,653,000	cubic feet
1933	9,405,972,000	cubic feet
1934	9,001,229,000	cubic feet
1935	10,290,923,000	cubic feet
1936	12,968,571,000	cubic feet
1937	7,304,293,000	cubic feet (Through June, 1937)
Total	65,396,645,000	cubic feet

Early production came from just a few wells, but during the year 1934, when a peak in the number of producing wells was reached, the production came from 113 wells. Since 1934 there has been a gradual decline in the number of producing wells, and on June 30, 1937, 94 wells were connected to the pipe lines.

The productive area as outlined has now practically all been drilled. The only drilling during the year 1936-1937 was by the State on its own property. At present, the State has four producing gas wells connected to the pipe line and a contract let for the drilling of two more gas wells. It now seems that this will probably conclude the active drilling of gas wells in the field.

Three wells were completed on the southeast edge of the Jackson gas field in 1932 and 1933 that produced a heavy oil along with much salt water. These wells have been producing at irregular intervals and the total aggregate production for them up to July, 1937, is approximately 15,000 barrels of oil.

Data on the Jackson gas field as of June 30, 1937, are as follows:

Proved area, in acres	7,500
Approximate open-flow capacity in million cubic feet of gas per day	3,500
Approximate initial rock pressure in pounds per square inch	1,010
Present rock pressure	922
Total number of wells drilled on the Jackson structure	195
Number of productive wells	140

Number of wells which were drilled to the producing horizon (Selma chalk) but which did not produce..	44
Number of abandoned locations and wells that did not reach the Selma chalk.....	11
Number of wells now connected to pipe lines.....	94
Number of producing wells not yet connected to pipe lines	2
Number of wells that once produced and were connected to pipe lines but are now dead due to encroachment of salt water.....	35
Number of wells which made some gas and oil or gas or oil and salt water but were never connected to pipe lines, and which are now dead.....	6
Number of wells producing some oil at present.....	3
Number of wells now yielding salt water with the gas....	15

TOTAL PRODUCTION BY WELLS THROUGH JUNE 30, 1937

Operator	Farm—Well No.	Date Connected to Pipe Line	Date of Last Production	Total Production in Thous.
Alexander, Tr	Casey 1	2/22/32		561,769
Alexander, Tr	Fitzhugh 1	7/26/32		834,470
Alexander, Tr	Fitzhugh 2	7/27/32		989,859
Alexander, Tr	Hewitt-Simpson 1	10/31/34		320,494
Alexander, Tr	Hurst 1	5/9/32		526,540
Alexander, Tr	Hurst 2	1/16/33	9/18/36	555,809
Alexander, Tr	Independent Realty 1	5/23/32		653,752
Alexander, Tr	Love Petroleum Co. 1	11/8/33		667,952
Alexander, Tr	Love Petroleum Co. 2	11/22/33		680,551
Alexander, Tr	Mayes 1	10/1/34		492,577
Alexander, Tr	McLaurin 1	11/29/35		138,692
Alexander, Tr	Ridgway-McGehee 1	5/30/32		522,966
Alexander, Tr	Woodland Hills 1	7/8/32		541,705
Alexander, Tr	Wright 1	12/21/31	11/4/35	271,641
Julian Alexander	Rice 1	8/5/33	2/13/37	276,240
Atkins & Hightower	Community Lease 1	8/17/34		245,467
Atkins & Hightower	Woodland Hills 1	12/1/33		212,771
Attkisson & Dyer	Downing Rehfeldt 1	1932	3/12/36	15,000
Attkisson & Dyer	Valentour 1	8/30/32	10/31/33	183,742
Attkisson & Dyer	Wiggins 1	11/6/31	12/22/36	164,214
J. A. Baker et al	Hudson 1	9/7/32	6/16/37	502,734
J. A. Baker et al	Permanent Invest. 1	7/2/32	10/26/35	99,868
J. A. Baker et al	Rankinside Dev. Co. 1	6/4/32		824,629
J. A. Baker et al	Rankinside Dev. Co. 2	4/8/33		547,333
J. A. Baker et al	Rankinside Dev. Co. 3	6/10/33		489,448
Baker & Owen	Gulf States Creo. Co. 1	4/23/32		648,033
Baker & Owen	Swearingen 1	9/29/31		455,125
J. R. Buford, Tr	Sanders 1	2/21/35		346,167
J. R. Buford, Tr	Sanders 2	7/15/35	12/12/36	108,381
Cane River O. & G	Lutkin 1	8/1/31	11/28/31	30,064
Capitol Oil & Gas	Brown 1	7/3/31	1/1/36	68,624
City of Canton	Belhaven College 1	1/1/33		258,415
City of Canton	Belhaven College 2	7/31/35		93,749
Feazel Oil & Gas	Garrett 1	5/1/31		229,824
Feazel Oil & Gas	Millstein 1	2/17/31		462,295
Ferguson & Fuller	Cruise 1	8/10/32		631,409
Ferguson & Fuller	Ivy 1	11/18/32		345,869
Ferguson & Fuller	Montgomery 1	1933	10/20/36	5,000
Ferguson & Fuller	Sours 1	3/18/32		437,619
Grandstaff et al	East et al 1	1/29/32		481,131
Hawkeye Oil & Gas	Webster 1	3/7/31	10/31/31	144,965
Henslee et al	G. M. & N. R. R. 1	12/21/34		346,460
Henslee et al	Tanner 1	6/4/32		557,125
Henslee & Tanner	Hudson 1	1/19/34	12/15/36	366,368
Henslee & Tanner	Sloan 1	7/7/34	3/26/36	97,732
L. M. Holmes	Security Lease 1	5/9/33		559,313
L. M. Holmes	Security Lease 2	5/26/33		346,928
Hope Oil & Gas	Crane-Lawrence 1	8/15/33	4/8/37	236,995
Hopkins Gas Co	Ridgway-McGehee 1	10/6/31		401,264
Howie & Howie	Fee 1	3/7/32		327,698
Ind. Gas & Elec. Co	I. C. R. R. 1	11/30/31	11/9/34	180,807
Jackson Oil & Gas	Mayes 1	12/10/30		1,296,816
Jackson Oil & Gas	Mayes 4	4/27/34		251,368
Jackson Royalties	Pate 1	5/19/31		554,442
LeFleur Oil & Gas	Carr 1	7/29/31		553,853
LeFleur Oil & Gas	Chadwick-Brown 1	6/17/31		595,789
LeFleur Oil & Gas	Ellis 1	6/2/31		257,173

TOTAL PRODUCTION BY WELLS THROUGH JUNE 30, *1937—Con't.*

Operator	Farm—Well No.	Date Connected to Pipe Line	Date of Last Production	Total Production in Thous.
Cleve Love et al	Brown 1	4/14/32		549,531
Love Petroleum Co	Cobb 1	7/14/33		525,504
Love Petroleum Co	Cox 1	8/1/33		249,388
Love Petroleum Co	Fee 1	10/9/33		1,010,662
Love Petroleum Co	Fee 2	10/15/34		610,768
Love Petroleum Co	Gulf States Creo. Co. 1	3/16/34		1,007,204
Love Petroleum Co	Hartfield 1	11/7/32	4/5/36	336,622
Love Petroleum Co	Homestead 1	5/29/31		504,828
Love Petroleum Co	Hutton 1	10/30/30		1,434,710
Love Petroleum Co	Interior Lbr. Co. A-1	7/7/33		636,397
Love Petroleum Co	Interior Lbr. Co. 2	7/1/32		608,834
Love Petroleum Co	Maley 2	5/23/31	12/6/33	383,401
Love Petroleum Co	Maley 3	9/25/31	1/5/32	70,059
Love Petroleum Co	Mendoza 1	6/11/30		3,452,835
Love Petroleum Co	Mendoza 2	2/15/31		1,534,333
Love Petroleum Co	Morton Lumber Co. 1	3/28/31		929,475
Love Petroleum Co	Pate 1	7/20/33		332,728
Love Petroleum Co	Bob Taylor 1	5/2/31		510,703
Love Petroleum Co	Red Taylor 1	1/26/32	2/26/32	19,679
Love Petroleum Co	Spann 1	1/31/33	2/24/35	185,727
Love Production Co	Crisler 1	2/18/31		251,205
Love Production Co	Gordon 1	2/17/31		443,416
Millsaps College	Fee 1	2/9/32		1,098,770
Meredith et al	Allen 1	12/16/31		355,704
Meredith & Smith	Strawder 1	5/30/32		564,229
Meredith & Smith	Strawder 2	7/19/32		565,529
Meredith & Smith	Strawder 3	9/12/32		555,215
Meredith & Smith	Strawder 4	11/4/32		455,598
Meredith Trading Co	Nelson 1	7/20/34		224,184
Millstein Oil & Gas	Hartfield 1	7/18/31		421,744
Miss. Petroleum Co	Baptist Orphanage 1	7/26/31	2/9/37	692,042
Miss. Petroleum Co	Baptist Orphanage 2	8/12/31	9/15/36	643,472
Miss.-Texas Co	Col. Mens' Bus. Assn. 1	4/8/31	May, 1933	92,250
Muse & Muse, Tr	Bradley 1	8/16/32	1/10/33	36,146
Muse & Muse, Tr	Cotten 1	6/12/32	10/17/32	50,996
Muse & Muse, Tr	Pate 1	6/26/32		520,113
Muse & Muse, Tr	Seaney 1	4/3/32		436,854
Muse & Muse, Tr	Webb 1	12/10/31		462,391
Muse & Muse, Tr	Wright 1	1/26/32		527,056
Orr & Anderson	Burr Brown 1	4/21/32		298,503
Orr & Anderson	Casey-Wellons 1	5/4/32		1,036,478
Orr & Redmond	Casey 1	12/31/31		442,343
Pearl River O. & G	Littlefield 1	10/23/31		491,789
Pearl River O. & G	Mack 1	4/8/32		447,697
Pearl River O. & G	Pate 1	10/14/31	4/7/36	432,819
Pearl River O. & G	Pate 2	10/14/31	2/12/35	301,212
Pearl River O. & G	Pate 3	10/10/31		592,908
Pioneer Oil & Gas	Greaves 1	7/2/31		487,106
Pioneer Oil & Gas	Green 1	2/17/32	11/2/36	573,494
Pioneer Oil & Gas	Moter 1	3/10/32		503,766
Pioneer Oil & Gas	Ragland 1	7/21/31		522,770
Ridgway-McGehee, Inc	Mosal 1	5/27/32		450,814
Ridgway-McGehee, Inc	Mosal 2	10/3/32		473,918
Roell Oil & Gas	Dreyfus 1	6/26/32	1/9/35	188,764
Rhea J. Smith	Crane-Lawrence 1	12/20/33	10/21/36	279,694
Southern Petroleum Co	Ivy 1	5/11/32		974,461
Southern Petroleum Co	Negro Invest. Assn. 1	11/12/31		999,427

TOTAL PRODUCTION BY WELLS THROUGH JUNE 30, 1937—Con't.

Operator	Farm—Well No.	Date Connected to Pipe Line	Date of Last Production	Total Production in Thous.
State of Mississippi	Fee 3	12/22/36		132,605
State of Mississippi	Fee 4	1/16/37		148,503
State of Mississippi	Fee 5	1/21/37		176,765
Stirling et al	Buford 1	3/26/32	8/18/34	191,141
United Gas Public Serv.	City of Jackson 1	1/29/31	2/4/33	474,203
United Gas Public Serv.	Crane-Lawrence 1	3/28/31		2,377,090
United Gas Public Serv.	Fondren 1	2/14/33	9/11/36	354,393
United Gas Public Serv.	Hartfield 1	1/27/31		1,262,143
United Gas Public Serv.	Moter 1	5/13/31	12/21/36	342,481
United Gas Public Serv.	Payne 1	11/1/31		576,324
United Gas Public Serv.	Toole 1	11/10/30	12/25/35	617,491
Bob Weaver	Gordon-Mayes 1	7/10/35		208,479
Bob Weaver	O'Parka 1	8/27/35		151,460
Bob Weaver	Sellers 1	8/28/34		205,194
W. E. Willis et al	Applewhite-Holden 1	12/4/31		768,680
W. E. Willis et al	Wilson 1	5/24/34	1/17/36	59,462
Willmut Gas & Oil	Boehle 1	7/12/35		332,576
Total gas metered				64,230,927
Total gas wasted and used in drilling				1,165,718
Grand Total				65,396,645

WELL DATA

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
1	Atlas Oil Co	Garber 1	18-6-1E	342.5	2158	2242	3079	Abd.	6/17/17
2	Benedum & Trees	Swearingen 2	14-6-1E	334	2146	2269	3043	Abd.	10/1/17
3	Mrs. Reader et al	State Land 1	25-6-1E	299			2905 +-	Abd.	4/27/31
4	Lion Oil & Refining Co	Misterfeldt 1	2-4-1E	275	2715	2789	4075	Abd.	6/2/29
5	Home Oil Producing Co	Rainey 1	13-5-1E	268	2145?	2241?	2512	Abd.	10/29/29
6	Jackson O. & G. Co	Mayes 1	2-5-1E	273	2087	2187	2466	15M	10/27/30
7	Love Petroleum Co	Mendoza 1	11-5-1E	268	2079	2172	2447	32M	5/2/30
8	Gulf Refining Co	Rainey 1	13-5-1E	268	2131	2232	3607	10-15M Abd.	7/13/30
9	La. Gas & Fuel Co	Harris 1	35-6-1E	282	2122	2225	3239	Abd.	5/17/30
10	Jackson O. & G. Co	Taylor 1	35-6-1E	290	2142	2255	3232	Abd.	6/23/30
11	Love Petroleum Co	Hutton 1	11-5-1E	266	2091	2181	2453	22M	7/9/30
12	United Gas	Toole 1	28-6-1E	304	2128	2196	2502	20.993M	7/10/30
13	Ohio Oil Co	School Land 1	16-5-1E	279	2141	2227	2511	Abd.	7/12/30
14	Pearl River O. & G. Co	Littlefield 1	12-5-1E	270	2034	2119	2393	43½M	7/13/30
15	Cane River O. & G. Co	Lufkin 1	15-5-1E	267	2108	2198	2468	16.667M	7/24/30
16	Jackson O. & G. Co	Cap. Ld. & Inv. Co. 1	29-6-1E	318	2194	2250	2605	Abd.	7/25/30
17	Love Production Co	Gordon 1	2-5-1E	282		2184	2482	17.857M	8/1/30
18	Love Petroleum Co	Mendoza 2	12-5-1E	269	2076	2174	2442	43M	8/2/30
19	United Gas	Moter 1	12-5-1E	262	2039	2208	2478	10M	8/6/30
20	Jackson O. & G. Co	Patton 1	17-5-2E	294	2185	2255	2549	Abd.	8/11/30
21	Dome O. & G. Co	Elton Plantation 1	5-4-1E	263			2805	Abd.	8/13/30
22	Marine O. & G. Co	Country Club 1	31-6-1E	318		2406	3063	Abd.	8/16/30
23	Capital O. & G. Co	Brown 1	28-6-1E	302	2108	2197	2503	8M	8/18/30
24	Capital O. & G. Co	Clarke 1	10-5-1E	266	2162	2234	2628	Abd.	8/18/30
25	Jackson O. & G. Co	Mayes 2	2-5-1E	268	2214	2313	2713	Abd.	8/24/30
26	Love Petroleum Co	Dreyfus 1	10-5-1E	264	2212	2330	2597	Abd.	8/25/30
27	United Gas	Payne 1	12-5-1E	269	2033	2122	2394	50M	8/25/30
28	Love Production Co	Crisler 1	2-5-1E	270	2103	2198	2485	2-5M	9/3/30
29	United Gas	Hartfield 1	7-5-2E	271	2029?	2125	2398	50M	9/10/30
30	Feazel O. & G. Co	Millstein 1	2-5-1E	274	2069	2160	2441	35.283M	9/16/30

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
31	Pearl River O. & G. Co.	Pate 1	12-5-1E	269	2062	2144	2418	54.359M	9/20/30
32	United Gas	City of Jackson 1	10-5-1E	259	2102	2192	2459	35M	9/21/30
33	United Gas	Crane-Lawrence 1	26-6-1E	297	2103	2156	2457	18M	9/23/30
34	Cleve Love et al	Ridgeway-McGehee 1	2-5-1E	271	2096?	2217	2503	Abd.	9/24/30
35	Southern Petroleum Co.	Investment 1	12-5-1E	270	2046	2115	2390	45-50M	10/4/30
36	LeFleur O. & G. Co.	Chadwick-Brown 1	11-5-1E	260	2084	2176	2449	40M	10/9/30
37	Millstein O. & G. Co.	Hartfield 1	12-5-1E	269	2029	2118	2392	40M	10/16/30
38	Jackson Royalties Inc.	Pate 1	12-5-1E	269	2025	2114	2387	45-50M	10/30/30
39	Cleve Love et. al.	Brown 1	12-5-1E	269	2039	2133	2407	45M	10/30/30
40	Pearl River O. & G. Co.	Pate 2	12-5-1E	270	2076?	2165	2439	47.853M	11/2/30
41	Hawkeye O. & G. Co.	Webster 1	15-5-1E	270	2105	2204	2478	27.144M	11/15/30
42	Pioneer O. & G. Co.	Graves 1	12-5-1E	269	2036	2122	2402	53M	11/18/30
43	Universal Gas Co.	Holliday-Ross 1	8-6-2E	291			2653	Abd.	11/23/30
44	Mississippi Petroleum Co	Baptist Orphanage 1	28-6-1E	319	2103	2165	2489	39M	11/25/30
45	Love Petroleum Co.	Cobb 1	12-5-1E	270	2020	2105	2378	48.552M	11/30/30
46	Universal Gas Co.	Sharbrough 1	28-6-1E	309			88'	Abd.	12/1/30
47	Love Petroleum Co.	Morton Lbr. Co. 1	34-6-1E	306	2013	2088	2402	52M	12/3/30
48	Southern Petroleum Co.	Ivy 1	12-5-1E	270	2055	2116	2393	51M	12/13/30
49	Sabine O. & G. Co.	Rankinside 1	6-5-2E	273	2165	2276	2549	Abd.	12/18/30
50	Love Petroleum Co.	Cox 1	12-5-1E	270	2027	2117	2391	40.768M	12/23/30
51	Pirtle & Flint	Negro Fair Ass'n. 1	28-6-1E	307	2113	2207	2519	7-10M	1/4/31
52	Pearl River O. & G. Co.	Pate 3	12-5-1E	270		2101	2375	50M	1/11/31
53	Iowa Gas Co.	Payne 1	15-5-1E	268	2123	2232	2504	3-5M	1/17/31
54	Attkisson & Dyer	Wiggins 1	33-6-1E	308	2084	2183	2495	7-10M	1/17/31
55	Gulf Refining Co.	Hamilton 1	4-5-2E	284	2193	2278	4027	Abd.	1/17/31
56	Love Petroleum Co.	Homestead 1	34-6-1E	314	2028	2136	2455	25M	1/22/31
57	Ganzil et. al.	Stallings 1	25-5-1E	272	2308?	2357	3071	Junked	2/8/31
58	Feazel O. & G. Co.	Garrett 1	2-5-1E	274	2073	2164	2443	15-20M	2/8/31
59	Love Petroleum Co.	Bob Taylor 1	34-6-1E	311	2014	2107	2423	35M	2/17/31
60	Mississippi Pet. Co.	Baptist Orphanage 2	28-6-1E	331	2053	2151	2487	42M	2/30/31

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
61	Love Petroleum Co	Maley 2	15-5-1E	265	2087	2180	2449	40M	3/18/31
62	Gulf Refining Co	McLaurin 1	30-6-2E	276	2116	2209	2950	Abd.	3/18/31
63	Millstein O. & G. Corp	Gammill-Hartfield 1	6-5-2E	274	2135	2223	2501	Abd.	3/21/31
64	Pioneer O. & G. Co	Ragland 1	12-5-1E	270	2029	2115	2393	52M	3/22/31
65	E. B. Love et. al	Payne 1	27-6-1E	309		2222	2550	Abd.	3/31/31
66	LeFleur Oil & Gas Co	Ellis 1	12-5-1E	270	2029?	2120	2398	19M	4/21/31
67	Pirtle & Flint	Frank Payne 1	27-6-1E	314	2111?	2229	2558	Abd.	5/4/31
68	Industrial Gas & Ele. Co	I. C. R. R. 1	4-5-1E	280	2080	2190	2473	25-30M	5/25/31
69	LeFleur Oil & Gas Co	Carr 1	12-5-1E	270	2034	2119	2397	57M	6/2/31
70	United Gas P. S. Corp	Hartfield 1-A	7-5-2E	272	2158	2254	2538	Abd.	7/11/31
71	Love Petroleum Co	Pate 1	12-5-1E	268	2029?	2119	2388	49.528M	7/20/31
72	Hopkins Gas Co	Ridgeway-McGehee 1	2-5-1E	274	2083	2187	2474	10–12M	7/26/31
73	Love Petroleum Co	Maley 3	15-5-1E	255	2094	2185	2444	35–40M	7/28/31
74	Baker-Owen et. al	Swearingen 1	34-6-1E	356	2022	2127	2486	41.424M	8/13/31
75	Muse & Muse	Webb 1	12-5-1E	270	2039	2121	2396	40.763M	9/20/31
76	Mississippi Petroleum Co	Solvent Inv. 1	14-5-1W	388	2567	2681	3075	Abd.	10/16/30
77	Love Petroleum Co	Maley 1	15-5-1E	268	2120	2220	2494	50 bb. H. Oil	3/19/32
78	Cane River O. & G. Co	Kabbes 1	15-5-1E	262	2173?	2279	3268	Abd. Temp	1/12/32
79	Love Petroleum Co	Interior Lbr. Co. 1	28-6-2E	275	2286	2380	3712	Abd.	9/14/33
80	Gulf Refining Co	Hanna 1	23-5-1E	265	2206	2299	2815	Junked	9/30/31
81	Meredith Drilling Co	Allen 1	12-5-1E	269	2037	2101	2374	31M	10/11/31
82	Jackson O. & G. Co	Mayes 3	2-5-1E	277	2117	2235	2518	Abd.	10/6/31
83	James A. Alexander	Wright 1	13-5-1E	270	2050	2193	2473	40M	10/20/31
84	Hilgard Gas Co	Mississippi Co. 2	4-5-1E	296		2229	2551	Abd.	10/24/31
85	W. E. Willis et. al	Applewhite-Holden 1	12-5-1E	268	2059?	2109?	2381	3–5M	10/26/31
86	Gulf Ref. Co. (United Gas)	Hinds Co. 1	16-6-1E	331	2344		2707	Abd.	2/20/31
87	James A. Alexander	Casey 1	12-5-1E	265	2052	2113	2388	35M	11/10/31
88	Orr. et. al	Casey 1	12-5-1E	268	2040	2102	2378	35M	11/2/31
89	Attkisson & Dyer	Downing-Rehfeldt 1	27-6-1E	348	2095	2200	2555	1–2M	1/30/32
90	Attkisson & Co	Valentour 1	18-5-2E	269		2193	2470	30M	4/3/32

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
91	Howard Oil Co	Jackson College 1	9-5-1E	321				Abd.	
92	Southern Petroleum Co	Wilson 1	23-6-1E	314	2087	2183	2503	4½M	3/28/32
93	Square Deal O. & G. Co.	Spann 1	13-5-1E	268	2152?	2230?	2500	5M?	11/17/31
94	United Gas P. S. Corp	McLaurin 1	8-5-2E	284		2229	3296	Abd.	11/18/31
95	J. E. Grandstaff et. al	Buford 1	11-5-1E	257	2090	2187	2454	38M	9/30/31
96	J. E. Grandstaff et. al	East et. al. 1	12-5-1E	266	2030?	2112	2385	51M	11/22/31
97	Wilson McGuire et. al	Moter (Mack) 1	12-5-1E	267	2041	2095?	2367	48M	11/24/31
98	Muse & Muse	Wright 1	12-5-1E	268	2041	2106	2380	53M	11/25/31
99	Ferguson & Fuller	Soures et. al. 1	34-6-1E	294		2138	2437	43M	12/20/31
100	Howie & Howie	Howie et. al. 1	34-6-1E	288		2155	2448	18M	12/1/31
101	Love Petroleum Co.	Red Taylor 1	15-5-1E	268?	2094	2181	2454	42M	10/15/31
102	United Gas P. S. Co	Millsaps College 1	34-6-1E	351	2067	2148	2503	35M	1/9/32
103	Orr & Anderson	Brown 1	12-5-1E	270		2127	2403	25M	12/21/31
104	Cummins & Montgomery	Ivy 1	13-5-1E	269	Same as	No. 138	(+—)	Abd.	
105	Pioneer O. & G. Co	Moter 1	12-5-1E	268		2147	2422	43M	12/19/31
106	Hope Oil & Gas Co	Crane-Lawrence 1	23-6-1E	307	2076	2176	2491	18.781M	9/23/32
107	F. E. Stewart	Miss. Cottonseed 1	4-5-1E	283				Abd.	
108	Pioneer O. & G. Co	Green 1	12-5-1E	267		2138	2413	45.431M	12/29/31
109	Ridgeway & McGehee	Mosal 1	24-6-1E	303	2044	2151	2460	15M	12/29/31
110	Muse & Muse	Seaney 1	12-5-1E	269	2021	2117	2391	35M	12/21/31
111	Baker & Owen	Permanent Inv. Co. 1	33-6-1E	287		2191	2484	10M	12/9/31
112	Roell O. & G. Co	Dreyfus et. al. 1	4-5-1E	277	2081	2205	2487	20–25M	1/26/32
113	Love Petroleum Co.	Interior Lumber Co. 2	2-5-1E	267	2077	2167	2439	17M	3/26/32
114	Baker & Owen	Creosote Co. 1	12-5-1E	268	2046	2115	2387	53M	12/31/31
115	Meredith & Smith	Strawder 1	12-5-1E	269		2110	2384	38M	3/17/32
116	Love Petroleum Co.	Interior Lbr. Co. 1-A	1-5-1E	270	2047	2135	2411	35M	1/25/32
117	Alexander, Tr	Hurst 1	12-5-1E	269		2081	2350	52½M	1/16/32
118	Alexander, Tr	Taylor-Watkins 1	1-5-1E	270		2072	2346	49M	2/17/32
119	Ferguson-Fuller	Cruise 1	34-6-1E	303	2046	2156	2461	43M	3/20/32
120	Alexander Trustee	Woodland Hills 1	26-6-1E	281	2042?	2166	2452	36M	4/16/32

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
121	Fred Henslee et. al	Tanner 1	14-5-1E	268	2028	2125	2401	43M	3/6/32
122	Muse & Muse Trustee	Cotton 1	14-5-1E	265		2204	2472	42M	3/8/32
123	Alexander Trustee	Ridgeway-McGehee 1	1-5-1E	273		2056	2330	36.754M	2/25/32
124	Baker et. al	Rankinside 1	6-5-2E	271	1990	2089	2365	47M	3/30/32
125	Belhaven College	Belhaven College 1	35-6-1E	299	2004	2091	2394	45M	4/11/32
129	McGuire et. al	Springlake 1	11-5-1E	258	2182		2483	Abd.	5/21/32
126	Muse & Muse Tr	Pate 1	12-5-1E	269	2065?	2141	2417	48M	4/18/32
127	M. L. Meredith	Strawder 2	12-5-1E	268		2102	2373	35M	5/8/32
128	D. L. Adams	Hanna 1	14-5-1E	267		2209	2476	Abd.	6/14/32
130	Muse & Muse Tr	Bradley 1	11-5-1E	265		2205	2475	34M	6/2/32
132	M. L. Meredith	Strawder 3	12-5-1E	266	2037	2096	2370	41M	8/7/32
131	Alexander, Tr	Fitzhugh 1	1-5-1E	270		2124	2396	21M	5/2/32
133	Alexander, Tr	Fitzhugh 2	1-5-1E	270		2096	2370	45M	6/17/32
134	J. A. Baker et. al	Hudson 1	11-5-1E	268		2205	2481	13M	7/17/32
135	Alexander, Tr	Holmes 1	31-6-2E	272	2165	2265	2539	Abd.	7/22/32
136	Henslee et. al	Warner 1	14-5-1E	270		2218	2491	Oil	8/3/32
137	I. M. Holmes	Security Realty 1	1-5-1E	260	2043	2128	2400	44M	8/4/32
138	Ferguson & Fuller	Ivy 1	13-5-1E	269	2011	2100	2377	39M	8/11/32
139	Ridgeway & McGehee	Mosal 2	24-6-1E	327	2061	2159	2498	31M	8/16/32
140	Meredith & Smith	Strawder 4	12-5-1E	268	2012	2107	2384	37½M	9/7/32
141	Jackson Oil & Gas Co	Mayes 4	1-5-1E	260	2049	2144	2415	10M	10/8/32
142	Home Oil Prod. Co	S. Jackson Land Co. 1	23-5-1E	260		2234	2502	Abd.	9/29/32
143	Love Petroleum Co	Hartfield 1	6-5-2E	271	2055	2148	2423	43M	10/9/32
144	W. E. Willis et. al	Warner 1	14-5-1E	266		2223	2497	200 bbls.	2/10/33
145	Alexander, Trustee	Hurst 2	7-5-2E	270	2036	2137	2408	45M	11/27/32
146	Natural Gas Co	Holder 1	13-6-1E					Abd.	
147	Cleve Love, et. al	Security Realty 2	36-6-1E	265		2182	2460	30M	1/18/33
148	Love Petroleum Co	Spann 1	13-5-1E	270	2080	2177	2454	34M	11/13/32
149	J. A. Baker, et. al	Rankinside 2	6-5-2E	273	2000	2087	2370	50M	1/20/33
150	United Gas	Fondren 1	24-6-1E	366	2093	2174	2544	28M	1/7/33

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
151	Ferguson & Fuller	Montgomery 1	26-6-1E	311		2204	2524	9M	5/25/33
152	J. A. Baker, et. al	Rankinside 3	6-5-2E	272	1985	2081	2361	48M	4/30/33
153	Julian Alexander	Rice 1	6-6-2E	272	2008	2135	2413	33½M	6/12/33
154	Love Petroleum	Fee 1	1-5-1E	270	2006	2090	2373	44M	6/28/33
155	Meredith Trading Co.	Crane Lawrence 1	23-6-1E	288	2080	2183	2478	21M	7/14/33
156	Muse & Muse	Carlton 1	13-5-1E	268		2194?	2467?	25M	7/25/33
157	Cleve Love, et. al	Childress 1	24-5-1E	270	2106	2211	2483	Abd.	7/26/33
158	J. A. Alexander	Love Petroleum 1	1-5-1E	265	2000	2106	2376	37M	8/3/33
159	Atkins & Hightower	Woodland Hills 1	26-6-1E	285	2068?	2170	2467	27½M	7/31/33
160	Alexander Trustee	Love Petroleum 2	36-6-1E	265	2041	2138	2410	40M	9/20/33
161	J. A. Baker et. al	Hawkins 1	31-6-2E	272			2382	Abd.	9/8/33
162	Atkins & Hightower	Community 1	26-6-1E	332		2137	2485	27½M	9/22/33
163	Roger G. James	Warner 1	13-5-1E	267	2122	2205	2472		1/21/35
164	Love Petroleum Co.	Creosote Co. 1	31-6-2E	272	1997	2072	2363	42M	11/2/33
165	United Gas	McLaurin C-1	19-6-2E	314	2172	2278	2747	Abd.	10/19/33
166	Henslee & Tanner	Hudson 1	11-5-1E	265	2055	2160	2432	36M	10/13/33
167	Meredith Trading Co.	Nelson et. al. 1	24-6-1E	347	2084	2160	2515	25M	12/12/33
168	Orr & Anderson	Casey-Wellons 1	11-5-1E	270	2051	2125	2403	46M	1/18/32
169	B. B. Jones	J. A. Stone 1	18-5-3E	258	3497	3995	5511	Abd.	1/27/34
170	Weaver Drilling Co	Sellers 1	26-6-1E	315	2081	2150	2474	28.8M	12/19/33
171	Alexander, Tr	Mayes 1	25-6-1E	264	2065	2153	2426	45+-M	4/9/34
172	Henslee Tanner	Sloan 1	7-5-2E	270	2064	2145	2419?	38½M	3/28/34
173	J. R. Buford, Trustee	Sanders 1	30-6-2E	280	2039	2145	2431	40.591M	8/27/34
174	Alexander, Trustee	Simpson 1	25-6-1E	265		2143	2416	38.445	6/2/34
175	Love Petroleum Co.	Fee 2	1-5-1E	261	2046	2135	2407	39.014	6/27/34
176	Love Petroleum Co.	Pearl River Int. 1	15-6-2E	276	2606	2784	4267	Abd.	9/8/34
177	Weaver Drilling Co	Garden-Mayes 1	36-6-1E	266		2160	2435	15M	10/8/34
178	Henslee et. al	G. M. & N. R. R. 1	36-6-1E	270	2060	2148	2432	20M	10/1/34
179	City of Canton	Belhaven 2	35-6-1E	291	2060	2160	2457	27M	11/23/34
180	Atkins & Hightower	Sanders 1	30-6-2E	270		2180	2456	13½M	1/7/35

WELL DATA—Continued

Key No.	OPERATOR	FARM—WELL No.	Location	Surf. Elev.	Black Shale Sub-Sea	Chalk Sub-Sea	Total Depth	Initial Production	Date of Comp.
181	Bob Weaver	O'Parka 1	26-6-1E	320		2150	2475	30M+-	4/8/35
182	T. H. Robinson	Martin Heirs 1	26-6-1E	322		2150	2479	50M	5/23/35
183	Jas. A. Alexander	Walthall 1	25-6-1E	275		2190	2474	Abd.	5/27/35
184	V. V. Ryan	Boehle 1	18-5-2E	277		2167	2448	35½M	5/13/35
185	V. V. Ryan	Ascher 1	18-5-2E	275		2202	2479	Abd.	7/22/35
186	J. C. Satterfield	Walthall 1	25-6-1E	277		2167	2450	Abd.	8/10/35
187	V. V. Ryan	Mills 1	7-5-2E	272		2191	2466	Abd.	9/1/35
188	Jas. A. Alexander	McLaurin 1	30-6-2E	310		2155	2471	12.255M	9/6/35
189	V. V. Ryan	Mills 2	7-5-2E	279		2189	2695	Abd.	6/22/36
190	T. H. Robinson	Harvey 1	27-6-1E	327	2057	2161	2494	Abd.	3/24/36
191	Wilmut Gas & Oil Co.	Sloan 1	8-5-2E	276		2243	2520	Abd.	4/3/36
192	Cleve Love et. al	Valentour 1	18-5-2E	272		2196	2687	Abd.	8/15/36
193	State of Miss.	Fee 1	25-6-1E	273			1095	Lost	8/30/36
194	State of Miss.	Fee 2	25-6-1E	328	2054	2141	5529	12M	4/6/37
195	State of Miss.	Fee 3	25-6-1E	272		2150	2427	50M	6/2/37
196	State of Miss.	Fee 4	35-6-1E	338	2074	2165	2509	12½M	10/8/36
197	State of Miss.	Fee 5	25-6-1E	341	2059	2147	2492½	40M	10/30/36
198	State of Miss.	Fee 6	26-6-1E	330	2085	2192	2523	Abd.	8/7/37
199	State of Miss.	Fee 7	26-6-1E	341					

THE STATE DEEP TEST WELL

LOCATION

The location for the State Fee No. 2 deep test well on the Old Insane Asylum property in Hinds County—the drilling of which by the State was started on November 7, 1936—was made 590 feet east and 364 feet south of the northwest corner of section 25, T. 6 N., R. 1 E. This location was selected for two reasons, (1) to be as great a distance as possible from the center of the core of igneous rock underlying the Jackson anticline, and (2) to reach as great a height as possible on the anticline. Magnetic surveys had indicated that the main body of igneous rock might be in the northern part of section 13, T. 5 N., R. 1 E., where the Gulf Refining Company had drilled through more than 600 feet of igneous rock in the bottom of their Rainey No. 1 well, but gravity surveys with a torsion balance had indicated that the center might be in section 2, T. 5 N., R. 1 E., near the Louisiana Gas and Fuel Company's Harris No. 1 well in section 35, T. 6 N., R. 1 E., which penetrated 250 feet of volcanic ash. The location selected for the deep test well is, therefore, four miles north of the center of the magnetic anomaly and 2½ miles north of the center of the gravity anomaly. The second condition—location of the well on a high position of the anticline—was very gratifyingly fulfilled when the well reached the top of the cap rock at a depth of 2,469 feet (2,141 feet below sea level), a shallower depth than any other well thus far drilled on the State-owned Asylum property.

TYPES OF INFORMATION OBTAINED

The information given below is derived from a study of the drillers' log and of cores and cuttings taken at various depths while the well was being drilled, from observation of drilling conditions, and from a study of resistivity and porosity measurements made by the Schlumberger Corporation. The drillers' log and the ages of the rocks penetrated in the well are shown graphically in Plate 1. The depths given on the plotted logs of the lower part of the hole do not agree with those given in the text, for it was found on completion that the well was about 15 feet deeper than shown by the log. Study of the Schlumberger Electrical Log has indicated that this error was introduced when the well was being drilled at a depth of approximately 3,150 feet. This error has not been corrected in the detailed descriptions of samples, because it seems desirable for the descriptions of the samples to bear the same depths as those marked on the cores and cuttings that have been deposited for study with more than ten different organizations. It has, however, been necessary to correct the error on the plotted log for the purpose of making a comparison of the drillers' log and the samples with the Schlumberger log.

SEDIMENTARY ROCKS

BEDS ABOVE 2,843 FEET

The rocks penetrated in the deep test well down to the Selma chalk are essentially the same as those penetrated in other wells in the field, so the previous description in this report is probably adequate. The top of the Claiborne was reached at 50 feet, the top of the Wilcox at 1,130 feet, and the top of the Midway at 2,360 feet. The cap rock was reached at a depth of 2,469 feet (2,141 feet below sea level). It consists of dark-gray fossiliferous very pure limestone and contains, according to Dr. Julia Gardner who examined the rock, *Tubulostium* sp. Although the species is not determinable, she cannot separate it from a species of *Tubulostium* that is locally abundant at the base of the Midway in Alabama.

A core from 2,815 to 2,822 feet consisted of hard limestone containing pellets of sandy clay. In this material, Dr. L. W. Stephenson found an echinoid fragment, *Gryphaea* sp., *Pecten* sp., *Anomia* ? sp., and a crab claw. These specimens are not diagnostic of the age of the rock, but there is little doubt in the minds of the authors that the rock is Cretaceous, probably Selma chalk. The base of the Selma was reached at a depth of approximately 2,843 feet (2,515 feet below sea level); the Selma and Clayton thus have a combined thickness of about 374 feet.

BEDS BELOW 2,843 FEET—GENERAL COMPARISONS

The geologic relations of the rocks below 2,843 feet are very imperfectly understood. Similar rocks were found in the Gulf Refining Company's Hamilton No. 1 well in section 4, T. 5 N., R. 2 E.; in the Gulf Refining Company's Hanna No. 2 well in section 23, T. 5 N., R. 1 E.; and in the Love Petroleum Company's Interior Lumber Company No. 1 well in section 28, T. 6 N., R. 2 E. The rocks below the Selma in all these wells consist of more or less consolidated gray and red, massive and thin-bedded, quartz sandstone, some of which is micaceous; of red, gray, and black shale; and in the Hamilton well of a few beds of conglomerate. The only organic remains found below the Selma chalk are small pieces of carbonized wood and coal in the sandstones. The rocks from the bottom 600 feet of the Hamilton well were at one time correlated by Monroe[10] with the Pottsville formation of the Pennsylvanian system, but comparison of similar cores from the State Fee No. 2 deep test well with cores from the Trinity series (Lower Cretaceous) in wells in Louisiana suggests that these rocks in Mississippi are of Early Cretaceous age. Lower Cretaceous fossils have been found

[10]Monroe, W.H., Pre-Tertiary rocks from deep wells at Jackson, Mississippi: Amer. Assoc. Petroleum Geologists Bull., vol. 17, pp. 49-51, 1933.

both above and below these rocks in Louisiana, and, although no fossil shells have been found in the rocks in Mississippi, the correlation solely on the basis of lithologic character is probably correct.

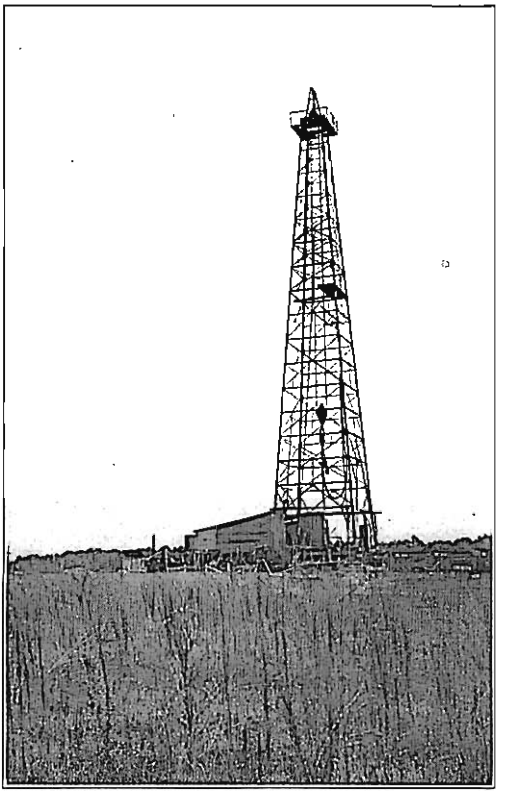

Figure 1.—The State deep test well.

BEDS BELOW 2,843 FEET—STATE DEEP TEST WELL

From 2,843 feet to approximately 2,915 feet the State deep test well was drilled through hard angular-grained, fine-grained quartz sandstone and thin interbedded strata of greenish-gray shale. From 2,915 feet to about 2,944 feet the well penetrated very hard, dense quartzite. The age of this rock is in doubt, but the cuttings from the interval of 2,957 to 2,975 feet contain a piece of red shale that cannot be distinguished from red shale in the Trinity rocks below. As the drill entered intrusive igneous rock at 2,944 feet and was still in igneous rock at 2,975 feet, the red shale must have come from the rocks between 2,843 feet and 2,944 feet. Intrusive igneous rock was penetrated from

2,944 feet to 3,005 feet, where quartzite and shale were entered again. The well penetrated intrusive igneous rock from 3,024 feet to about 3,045 feet, where a bed of quartzite about 7 feet thick was entered. At 3,052 feet extrusive igneous rock was encountered which continued for several feet, but its exact thickness is not known. The extrusive rock is seemingly underlain by intrusive igneous rock at 3,075 feet more or less, and this intrusive rock continues to a depth of 3,220 feet (This is a corrected figure and is 15 feet greater than the depth given for cores and cuttings on deposit at the Mississippi Geological Survey, the Mississippi

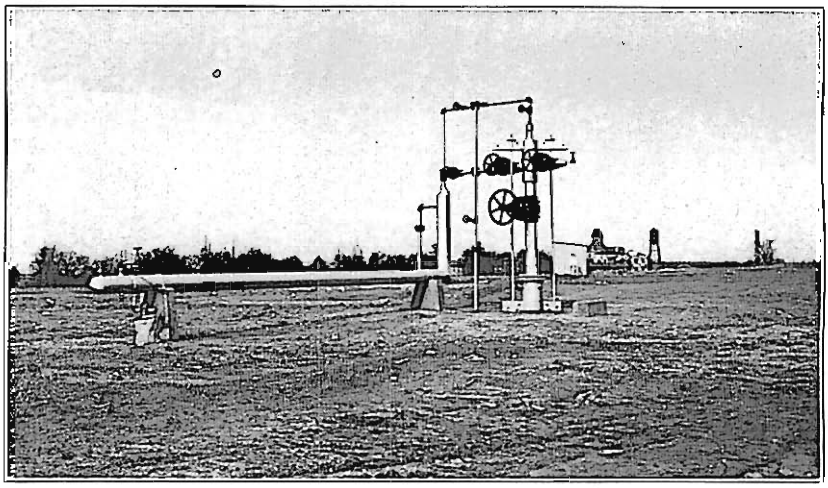

Figure 2.—State Fee No. 4 gas well.

State Oil and Gas Board, and the United States Geological Survey; the depths given in the detailed descriptions of cores and cuttings below correspond with those on the cuttings and are about 15 feet too small from approximately 3,150 feet to 5,514 feet; on the vertical sections, Plate 1, the corrected depths are used).

From 3,220 feet to 3,245 feet the well penetrated quartzite and crumpled shale—material whose attitude and lithologic character were probably highly altered by the adjacent igneous activity. Some of the shale had bedding parallel to the edges of the core, indicating, if the hole is vertical, that the shale is standing vertically at that depth.

From approximately 3,245 feet to the bottom of the hole at 5,530 feet the sedimentary rocks consist of red shale, gray shale, red and gray mottled shale, dark shale, gray thin-bedded and massive more or less

micaceous sandstone, much of which contains carbonaceous matter, and thin beds of quartzite. Cutting these sedimentary rocks are several small sills or dikes, or both, of intrusive igneous rock.

AGE OF BEDS BELOW 2,843 FEET

It seems likely that all the sedimentary rocks below 3,245 feet belong to the same geologic formation, probably the Trinity (Lower Cretaceous) formation, because they closely resemble the Trinity as it is developed in Louisiana. The rocks between the base of the Selma chalk

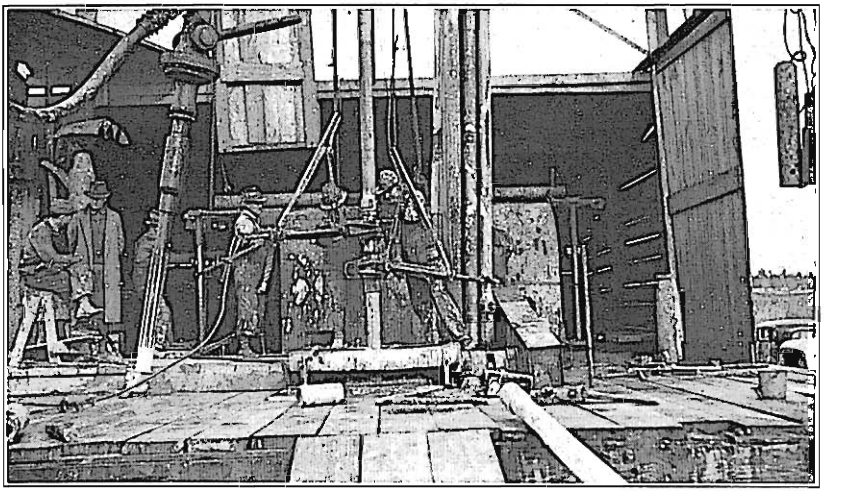

Figure 3.—Connecting a joint while lowering drill stem into hole.

(2,843 feet) and 3,245 feet are very much like those below 3,245 feet, so the authors do not feel certain that these rocks should be placed in a separate formation. Included within them is a body of extrusive igneous rock. It is generally believed that the major period of igneous activity in Louisiana and Arkansas and, by inference, in Mississippi, was in early Late Cretaceous time. The presence of bentonite, a decomposed volcanic ash, in the Upper Cretaceous rocks in northeastern Mississippi strengthens this belief. It is, of course, entirely possible that the igneous activity started in the Early Cretaceous and continued intermittently into Late Cretaceous time. In the State Fee No. 2 well the extrusive rock is overlain by sedimentary rocks into which younger igneous rocks have been intruded, a relationship which proves conclusively that igneous activity here took place during two different times. At present the age of the beds between the Selma chalk and the shales and sand-

stones of definite Trinity age cannot be stated certainly. *Nearly* all petroleum geologists familiar with the geology of the Jackson area agree that the rocks encountered near the bottom of this well are of Early Cretaceous age, but there has been no agreement as to the depth to the contact between the Upper and Lower Cretaceous. Some have placed this contact as deep as 4,400 feet, and some have placed it about 3,400 feet. The present authors are decidedly uncertain as to the depth of the top of the Lower Cretaceous.

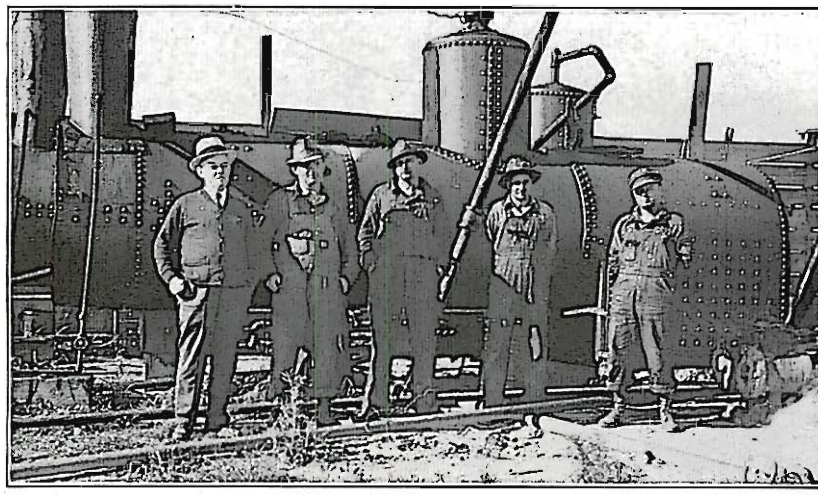

Figure 4.—Day drilling crew: E. R. Owen, Contractor, at left; Noah Hart, Driller, second from left.

IGNEOUS ROCKS

NATURE AND DISTRIBUTION

The igneous rock encountered in the well consists of volcanic rock, that reached the surface as a lava flow or as an ash fall, and of intrusive igneous rock, that did not reach the surface. The intrusive rock is of two types, lamprophyre above 4,400 feet and tinguaite below. It is possible that there is tinguaite above 4,400 feet, but it was not recognized. The presence of a body of lamprophyre above the volcanic rock proves conclusively that there were two distinct *periods of* igneous activity, for after the volcanic rock had solidified it was covered by many feet, possibly many hundreds of feet, of sand and clay before the second period of igneous activity during which the lamprophyre was forced into the sandstone. It is impossible to determine whether the intrusion of the tinguaite preceded or followed that of the lamprophyre,

or whether they are offshoots of the same magna at the same time; but it is definitely established that at least the upper body of lamprophyre followed the activity that produced the volcanic rock.

RELATIONS TO MAIN INTRUSION

The igneous rocks in this well seem to be offshoots from the main plug of igneous rock at Jackson and seem to lie north of the main body of igneous rock. It was not possible to determine from the cores or cuttings whether the bodies of igneous rock were dikes extending across

Figure 5.—Night drilling crew. V. V. Ryan, Driller, at right.

the bedding of the sedimentary rocks or were sills forced between the beds. In the lower part of the hole cores of shale were obtained that showed streaks of altered shale cutting diagonally across the bedding in such a manner as to suggest that gases or solutions from the igneous rock had worked their way along joint planes in the shale. This suggests further that many of the bodies of tinguaite may be dikes.

As discussed in the section on sedimentary rocks penetrated in the well, the time of igneous activity is not known definitely except that it began in Trinity time or later. As igneous rocks of Late Cretaceous age are known in Arkansas[11] it may be that some of the igneous activity at Jackson took place at the same time, possibly during the Tuscaloosa and Eutaw epochs.

[11]Miser, H.D., and Purdue, A.H., Geology of the DeQueen and Caddo Gap Quadrangles, Arkansas: U. S. Geol. Survey Bull. 808, p. 115, 1929.

DEPTHS AND TYPES OF IGNEOUS ROCKS

The first igneous rock in the deep test well was cored from 2,951 feet to 2,957 feet. The rock is of lamprophyric type, highly altered by hydrothermal activity. Rock similar to this was drilled to a depth of 3,005 feet where sedimentary rock was again entered. At 3,024 feet igneous rock was again entered; this is a mixture of altered lamprophyre and a fine-grained volcanic rock. Sandstone metamorphosed to quartzite was drilled from approximately 3,045 feet to 3,052 feet where volcanic (extrusive) rock, altered almost entirely to clay, was entered. The thickness of this volcanic rock is not known definitely, but probably does not exceed 25 feet. At 3,150 feet the well was being drilled in highly altered lamprophyric rock again, and continued in rock of the same type to approximately 3,220 feet, where it again entered sedimentary rock. The next body of igneous rock was encountered near 3,944 feet. A core taken at this depth (labeled 3,906 to 3,910 feet) consists of white kaolin speckled with a black clay mineral, both probably highly altered products of igneous rock, and sedimentary sandstone. Igneous rock was again encountered from 4,415 feet to 4,421 feet and from 4,435 feet to 4,452 feet. This rock is black and light green and is reported by Dr. Charles Milton to be a tinguaite. Similar igneous rock was penetrated from 4,565 to 4,567 feet. White feldspathic igneous rock, partly replaced by calcite, was drilled between 4,627 feet and 4,632 feet. Thin dikes or sills of tinguaite were penetrated at approximately the following depths: from 4,682 feet to 4,690 feet, from 4,710 to 4,717 feet, from 4,732 to 4,736 feet, several places between 4,765 and 4,820 feet, from 4,920 to 4,930 feet, several places between 5,060 and 5,130 feet, from 5,145 to 5,156 feet, from 5,177 to 5,183 feet, from 5,202 to 5,205 feet, from 5,217 to 5,242 feet, from 5,320 to 5,335 feet, from 5,370 to 5,390 feet, from 5,487 to 5,492 feet, and from 5,512 to 5,524 feet.

METHODS OF STUDYING CUTTINGS

Cores and cuttings from the State Fee No. 2 deep test well were examined at the well and in the laboratory by the authors and were further examined in the laboratory of the United States Geological Survey by Charles Milton, H. D. Miser, C. S. Ross, L. W. Stephenson, and Julia Gardner, whose reports to the authors are freely quoted in the following descriptions.

Each sample of cuttings from depths below 2,900 feet was separated into groups of the different kinds of rocks included; and, in the descriptions, approximate figures are given to indicate the relative abundance of each type of rock. It should be emphasized that the percentage figures are only approximate.

INTERPRETATION FROM ROTARY CUTTINGS

In this well, drilled by rotary tools, the part of the hole below 2,514 feet was not cased during drilling. As a result there was some mixture of cuttings caused by pieces of rock being scraped from the wall of the well by the bit as it entered and left the hole, by cuttings sticking to the wall for a time and later being carried to the surface by the drilling mud, and by recirculation of cuttings in the drilling mud. An attempt has been made by Monroe to determine what material in the cuttings is from the rock at the bottom of the hole at the time the cuttings were collected, in order to obtain a clearer conception of the rocks in this well and their relationship to rocks found in other deep wells in the field.

CONCLUSIONS

The Jackson gas field is in Hinds and Rankin counties, Mississippi, within and about the City of Jackson. The original producing area that has been proved for the field is approximately 7,500 acres. The discovery well was completed in 1930, and since then 195 wells have been drilled, of which 137 produced gas, 3 produced oil, and 55 were dry. Of those wells which produced gas 41 have been drowned out by encroaching salt water.

The various estimates of the reserves of the Jackson Gas Field have varied widely. Some of the early estimates indicated less gas than has already been produced to June 30, 1937. Present estimates of the original reserves vary from approximately 100 billion to more than 200 billion cubic feet of gas. As 65 billion cubic feet have been withdrawn to date, the field may be expected to last from four to eight years longer at the present rate of withdrawal.

The gas and also the small quantity of oil produced are found in the top of the Selma (Upper Cretaceous) chalk. The gas is produced from depths of 2,060 to 2,230 feet below sea level. Most of the production, however, has been from depths above 2,200 feet below sea level. Structure contours drawn on the top of the cap rock (Eocene-Clayton formation) above the top of the producing beds show that the structure is exceedingly irregular, consisting of at least two separate highs, each of which has subsidiary domes superimposed on it. The uplift has been caused not by compressional forces from the sides, but rather by a relatively upward movement during and after the intrusion of an igneous plug.

The rocks penetrated down to and including the producing bed are the Jackson formation which is exposed at the surface; the Claiborne series, which crops out at a few places within the field and which aggre-

gates 1,050 feet in thickness; the Wilcox series, which is 1,300 feet thick; the Midway series, which averages 100 feet in thickness; and the Selma chalk, which is 345 to 450 feet thick.

The rocks underlying the Selma are not well known, for only a few wells have entered them. Several miles away from the crest of the anticline, wells have extended from the Selma into the Eutaw formation, which consists, in general, of dark fossiliferous shale, but near the crest of the anticline wells have extended from the chalk into red and gray shale, sandstone, quartzite, and igneous rock of several kinds. The sedimentary rocks may represent, in the upper part, the Eutaw and Tuscaloosa formations; in the lower part, and perhaps in all this series, the Trinity (Early Cretaceous age). These lower rocks were formerly believed to be Pennsylvanian in age, but comparison with cores from Louisiana of definite Trinity age leads to the belief that they are Trinity.

A deep test for oil was drilled by the State from November, 1936, to April, 1937, to a total depth of 5,530 feet. In it the cap rock above the Selma was reached at 2,469 feet; the base of the Selma, at approximately 2,840 feet; and red and gray shale and sandstone, gray quartzite, and bodies of igneous rock, mainly lamprophyre and tinguaite, but including some extrusive rock, sanidine-calcite rock, and white felspathic rock, to 5,530 feet. All the sedimentary rocks below approximately 3,400 feet and possibly all those below the base of the Selma appear to be of Early Cretaceous age. The igneous action took place at least two times, but whether late or early in Cretaceous time is not known.

The well was unsuccessful in finding oil or gas below the present producing horizon, but it was plugged back to 2,480 feet and completed as a gas well in the top of the Selma chalk.

Although the results of this deep test and of the few other wells drilled below the Selma chalk in the area were not encouraging, they have not condemned the possibilities of finding oil around the Jackson structure. This structure is the result of great vertical movement that affected a rather large area. Because of its extent and the fact that the stratigraphic and structural conditions below the Selma chalk are very complex, it is hazardous to predict what the result of future exploration will be.

DETAILED DESCRIPTION OF CORES
AND CUTTINGS OF THE STATE
FEE NO. 2 WELL*

Cut. indicates Cuttings. B. S. indicates Bit Samples.
C. 1 indicates Core 1. F. B. S. indicates Fishing Bit Sample.

530 Cut.—Light-gray silty micaceous fine-grained sand. A little glauconite; fragments of fossil shells.

800- 824 Cut.—Light-gray and brown silty micaceous very fine-grained sand. A few shell fragments from above.

824- 855 Cut.—Light-gray micaceous very fine-grained angular quartz sand. A few grains of glauconite. A few shell fragments and foraminifera.

855- 915 Cut.—Light brownish-gray very fine-grained sandy, silty micaceous clay containing a little carbonaceous matter.

915- 975 Cut.—Light grayish-brown calcareous, micaceous fossiliferous silty clay. Foraminifera and fragments of larger fossils.

975-1005 Cut.—Medium grayish-brown silty micaceous, calcareous clay. Foraminifera, pyrite.

1005-1036 Cut.—Grayish-brown calcareous clay, and glauconitic, micaceous silty fine-grained subangular quartz sand. Foraminifera.

1036-1066 Cut.—Brownish-gray calcareous, glauconitic, micaceous silty argillaceous subangular fine-grained sand. Foraminifera.

1066-1097 Cut.—Brown clay and coarsely glauconitic chalk. Foraminifera.

1097-1130 Cut.—Gray slightly glauconitic, micaceous angular-grained quartz sand.

1130-1158 Cut.—Gray sparingly glauconitic, micaceous angular to rounded fine-grained quartz sand.

1158-1188 Cut.—Micaceous angular fine-grained quartz sand.

1188-1218 Cut.—Similar.

1218-1247 Cut.—Similar, less glauconite.

1247-1278 Cut.—Similar, little glauconite, some pyrite.

1278-1307 Cut.—Similar, silty.

1307-1337 Cut.—Similar.

1337-1368 Cut.—Light-brown silty clay.

1368-1398 Cut.—Micaceous, glauconitic silty subangular fine-grained quartz sand.

1398-1428 Cut.—Light brownish-gray micaceous silty calcareous clay.

1428-1468 Cut.—Similar.

1520-1550 Cut.—Micaceous fine-grained angular to rounded quartz sand. Some glauconite.

1550-1588 Cut.—Similar.

1588-1630 Cut.—Light-brown silty micaceous clay.

1590 B. S.—Light-brown silty micaceous clay.

1630-1660 Cut.—Light-brown silty argillaceous, micaceous sand.

*Bold face type indicates cuttings believed to be derived from depths indicated --and cores.

1660-1691 Cut.—Micaceous silty argillaceous angular fine-grained quartz sand.

1691-1722 Cut.—Angular fine-grained quartz sand. Mica; some glauconite.

1722-1732 Cut.—Similar, some pink quartz.

1732-1763 Cut.—Similar, a few pieces of lignite.

1763-1793 Cut.—Micaceous angular fine-grained quartz sand; glauconite, pyrite.

1793-1824 Cut.—Similar.

1824-1851 Cut.—Similar.

1851-1882 Cut.—Similar, grains of lignite.

1882-1913 Cut.—Similar to last.

1913-1943 Cut.—Similar to 1763-1793.

1943-1972 Cut.—Similar, silty.

1972-2002 Cut.—Light-gray silty micaceous, argillaceous angular fine to very fine-grained sand and sandy clay.

2002-2032 Cut.—Micaceous silty angular fine-grained sand; a few grains of glauconite, a few pieces of lignite.

2032-2063 Cut.—Light-brown silty micaceous clay.

2063-2094 Cut.—Similar.

2094-2124 Cut.—Angular to subrounded fine-grained quartz sand; a little muscovite, glauconite, lignite, and pyrite.

2129 B. S.—Light-brown silty clay; muscovite.

2129-2135 C. 1 —**Micaceous silty thinly bedded very fine-grained sand.**

2184-2190 C. 2 —**Highly micaceous light-gray very fine-grained sandy and silty clay; many small grains of lignite.**

2186-2216 Cut.—Sparingly micaceous angular fine-grained quartz sand; a few grains of glauconite and lignite.

2216-2247 Cut.—Light-brown silty micaceous very fine-grained sandy clay and silty sand; a few grains of glauconite.

2247-2277 Cut.—Similar.

2277-2308 Cut.—Similar to 2186-2216.

2308-2346 Cut.—Similar to 2186-2216.

2346-2367 Cut.—Light-brown silty very fine-grained sandy micaceous clay. (Cuttings in part from above).

2367-2398 Cut.—Similar.

2398-2429 Cut.—Micaceous angular very fine-grained quartz sand; a few grains of glauconite and lignite. (Cuttings from above).

2429-2462 Cut.—Angular fine-grained quartz sand; a few flakes of muscovite, a few grains of glauconite and lignite. (Cuttings from above).

2469-2472 C. 4 —**Dark-gray fossiliferous limestone. Cap rock of gas rock. Julia Gardner states: "The samples submitted are a dense gray limestone, containing a large amount of crystalline calcite, at least one large pellet of glauconite, small angular flakes of disseminated mica, and abundant Tubulostium. The species is not determinable but there are no characters retained by which it can be separated from the species of Tubulostium which is locally abundant at the base of Midway in Alabama."**

2470-2490 Cut.—**Hard white chalky and crystalline limestone.**

2507-2537 Cut.—Hard porous chalk; quartz sand from above.

2537-2567 Cut.—Hard chalky and crystalline limestone.

2567-2598 Cut.—Similar.

2598-2628 Cut.—Similar.

2628-2658 Cut.—Similar.

2658-2690 Cut.—Similar.

2690-2751 Cut.—Similar, a number of iron stains.

2751-2782 Cut.—Similar, considerable calcite.

2782-2813 Cut.—Similar.

2815-2822 C. 5 —Hard limestone containing pellets of sandy clay. L. W. Stephenson states: "I have had the material broken up and am able to recognize the few organisms listed below: Echinoid (fragment), Gryphaea sp. (small, smooth), Pecten sp. (small, smooth), Anomia ? (ribbed), Crab claw (small). Although the material from the paleontologic viewpoint is not strictly diagnostic, it may be of Cretaceous age. Small smooth Pectens are fairly common in the Upper Cretaceous but so far as I know are not known from the Eocene, except those belonging to the subgenus Amusium which is characterized by internal ribs. I can see no evidence of internal ribs on these specimens. C. S. Ross examined two thin sections. The rock appears to be a coquina composed of fragments of shells and calcareous hard parts of organisms, many of which appear to be waterworn. Ross states that the mineral pyrites is scattered through the rock and some of it was recognized in the large dark spots."

2846-2852 C. 6 —Top: Remarkably clean, slightly calcareous, angular fine-grained quartz sandstone. Middle: Similar, but less clean. Thin films and balls up to ½ inch diameter of greenish-gray shale. Contains a 45° fracture plane containing foreign material. Bottom: Similar to top; a little interstitial pyrite. P. G. Nutting states: "Following is report of porosity tests. The samples are of cemented pure quartz sand with infiltrated white clay.

	Top	Middle	Bottom	
Mean rock density	2.085	2.287	2.128	gram/cc.
Mean grain density	2.590	2.582	2.576	gram/cc.
Percent voids	19.50	11.43	17.39	gram/cc.
Ignition loss (%)	0.32	0.52	0.36	gram/cc.

This is an excellent reservoir sand, firm, clean, and above average capacity."

2852-2858 Cut.—Mostly chalk from above.

2858-2865 Cut.—Similar; fossils: oyster and crab claw.

2858-2863 C. 7 —Fine-grained angular quartz sandstone, cemented by silica, slightly calcareous, slightly pyritic.

2863-2869 C. 8 —Tightly cemented quartzitic sandstone, rounded quartz grains.

2865-2874 Cut.—Mostly chalk from above.

2874-2881 C. 9 —Very fine-grained greenish-gray tightly cemented quartzitic sandstone. Fracture dips 36°. C. S. Ross states: "The specimens are dominantly sandstones with a large proportion of mica flakes and a mica-like interstitial mineral. The green shale is very similar, being composed of quartz grains and a much larger proportion of the interstitial mineral."

2881-2888 C.10 —Tightly cemented angular fine-grained quartz sandstone and light-greenish-gray silty shale.

2888-2896 Cut.—Porous and tightly cemented angular fine-grained quartz sandstone and greenish-gray shale. Similar to cores above.

2896-2903 Cut.—Same as last cuttings.

2903-2906 C.11 —Charles Milton reports: "Sample is a sandstone consisting of subrounded quartz grains, with interstitial clayey material. A thin veinlet of calcite and pyrite traverses the core; along the contact of veinlet and sandstone is microbrecciation."

2906-2918 Cut.—A few pieces of dark-gray quartzite, much porous and non-porous sandstone, greenish-gray shale, and chalk.

2918-2928 Cut.—Ten percent dark-gray to black hard slightly calcareous, micaceous sandstone; (Milton reports: "Hard gray fine-grained slightly calcareous sandy shale. Microscopically, consists of angular quartz particles in a clay matrix, showing segregation of fine and coarse particles in sedimentational bands. Veinlets of carbonate. No igneous material observable."); 30% light and dark-gray shale; 60% porous and non-porous sandstone.

2928-2933 Cut.—One piece of slightly calcareous quartzite cut by a vein of pink calcite. Ross examined cuttings from 2929-2931 and states: "The specimens are quartzite with closely interlocking grains of quartz. The interstitial material is a carbonate (probably calcite) and a very little sericitic mica. The darker specimen contains a little more dark-colored pigmenting material." 33% porous and non-porous sandstone; 33% greenish-gray shale; 33% chalk.

2931- B. S.—Light-greenish-gray soft shale.

2931-2931½ C.12—Tightly cemented angular-grained quartzite, dark interstitial mineral. Milton states: "Sample is sandstone with dark dolomitic (?) areas, suggestive of magmatic derivation."

2932-2937 Cut.—Similar to 2928-2933.

2937-2947 Cut.—Two pieces of gray quartzite; rest chalk.

2947-2957 Cut.—One piece pink igneous rock containing feldspar, pyrite, and calcite; one piece quartzite cut by vein of calcite and pyrite; rest mostly chalk.

2951-2957 C.13 —Ross states: "The samples from 2951-57 are nearly all a highly altered igneous rock of lampropyhric type. Alteration for both the light-colored material and the dark fragment has gone so far that the exact character cannot be determined. Only a little feldspar and a large proportion of apatite remain fresh. One sample of this group was a fine-grained limestone with grains of igneous rock. The alteration products of the igneous rock are calcite, a little magnetite, a large proportion of a leucoxene-like mineral, and a material that resembles dickite. This suggests hydrothermal alteration, rather than weathering."

2957-2975 Cut.—A few pieces of black, green, salmon-pink highly altered igneous rock; much tightly cemented sandstone and greenish-gray shale. One piece each of red shale and black shale.

2975-2985 Cut.—Twenty-five percent igneous rock; 25% slightly porous sandstone; 25% very hard non-porous quartzite; 25% shale and chalk.

2988-2994 C.14 —Igneous rock. Milton states: "Sample is (a) highly altered fine-grained lamprophyre, with brown calcite veinlets. The originally abundant augite is replaced with calcite, the outlines of the crystals replaced by leucoxene. The groundmass is fairly fresh alkali feldspar, with calcite. Apatites are prominent. (b) Coarse sanidine-calcite igneous rock."

2985-2995 Cut.—Igneous rock and considerable vein material, probably dolomite; quartzite; shale.

2995-3005 Cut.—Similar to last. Ross reports: "The large piece is essentially similar to the igneous rock (from 2951-2957). The small grains are dominantly potash feldspar of the sanidine type. Biotite, apatite, and alteration products are also present. The rock appears to be aplitic. Thus the pink mineral is all potash feldspar."

3005-3007 Cut.—About equal parts of tightly cemented quartzite and quartzitic sandstone and of igneous rock.

3007-3011 Cut.—Fifty percent quartzite and quartzitic sandstone; 30% light-gray and greenish-gray shale with pyrite veins; 10% igneous; 10% black and dark-gray shale.

3011-3015 Cut.—Seventy-five percent quartzite and quartzitic sandstone, some veins of calcite and pyrite; 15% igneous rock; 10% light and dark-gray and greenish-gray shale.

3015-3019 Cut.—Seventy percent hard quartzite and quartzitic sandstone, some shot with veins of pyrite; 20% light and dark-gray shale; 10% igneous.

3019-3024 Cut.—Forty-five percent quartzitic sandstone, mostly fine-grained as above, but containing some very fine-grained thin-bedded pieces; 45% light-gray to black shale and a few pieces of gray shale containing thin films or spots of red shale; 10% igneous rock of several kinds.

3024-3028 Cut.—One-third hard fine-grained quartzite and thin-bedded very fine-grained quartzitic sandstone; 1/3 some gray and much black shale; 1/3 igneous rock of several kinds (highly altered lamprophyric igneous rock).

3028-3036 C.16 —Igneous rock. Milton states: "Mixture of altered lamprophyre with a fine-grained volcanic rock containing much brown biotite. Also some sanidine-calcite rock."

3036-3044 Cut.—Fifty percent igneous rock of several kinds; 25% quartzite; 25% shale, light-gray and greenish-gray, black, and a couple pieces of red.

3044-3057 Cut.—Seventy percent quartzite, some cut by veins of pyrite; 10% red shale streaked with light-gray and black shale; 20% altered igneous material.

3058-3061 C.17 —Milton states: "Extremely altered volcanic rock, now almost completely clay of several types. A few grains of quartz and microcline are present."

3058-3074 Cut.—Thirty-five percent like core 3058-3061; 35% other altered igneous rock, some very hard. Ross states: "Mixture of highly altered lamprophyric igneous material, shale, sandstone, and kaolinized igneous material: one grain of calcareous oolite observed." Twenty percent red shale; 10% quartzite.

3074-3138 Cut.—Ross states: "Some shale, highly altered lamprophyric igneous material, and sandstone. Most abundant material is an igneous rock composed of fresh sanidine, aegirite-augite, and some nepheline, in a highly altered groundmass."

From this depth to the bottom of the hole the measurements given are about 15 feet too small. The depths given on the large-scale plotted logs on Plate I are corrected. The depths given in the following detailed description agree with the sample labels.

3136-3138 C.18—Ross states: "Highly altered lamprophyric igneous rock, with a fragment of quartzite. Cut by numerous veins of calcite."

3138-3160 Cut.—Ross reports: "Igneous material similar to last, together with a nearly pure feldspar rock. Contains fragments of quartzite, shale, and masses of halloysite."

3160-3173 Cut.—Ross reports: "Shale, altered lamprophyric rock, and feldspar rock. A brown shaly material is ferruginous clay material and angular quartz but may contain volcanic ash. It is so altered that its character is in doubt. One fragment contained abundant glauconite and a few Globigerina [chalk from above.]."

3173-3205 Cut.—Ross reports: "Largely dark igneous rock, somewhat similar to 3118-38. Contains abundant feldspar phenocrysts of sanidine type, aegirite-augite, and altered nepheline. Minor minerals are apatite and titanite. With them are fragments resembling marble, halloysite, shale, and some quartzite." He summarized igneous rocks from 3026-3205 as follows: "The material is so heterogenous that it is probable that some materials have escaped identification. The freshest igneous rock is that encountered at 3118-38 and 3173-3205. Here, there is less mixture of types and admixed material that may have come from above. This may represent a dike or sill, or perhaps a volcanic flow, but this seems less probable. Some of the igneous material seems to be of a deep-seated type and some of the quartzite, and possibly the marble-like material, indicates metamorphic rock. This suggests strongly that explosive volcanic action has brought up material from deeper horizons. Material of this type could occur either on the flanks of a crater or from its throat. The shale encountered below indicates material from the flank. This, however, is slickensided, squeezed, and contains at least some volcanic material. Nearly all specimens are partly altered to calcite, and are cut by numerous calcite veinlets. Much of the igneous material contains abundant pyrite."

3215-3219 C.19—Light-gray shale and a little igneous rock.

3219-3225 C.20—Light and dark-gray shale, some with interstitial pyrite; large fragments of the highly altered lamprophyric igneous rock. Bottom: Very fine-grained thin-bedded quartzitic sandstone containing on one of the bedding planes a spray of barite crystals and a crystal of pyrite.

3225-3230 C.21—Crumpled dark-gray shale standing vertically and dark-gray quartzitic sandstone.

3230-3235 Cut.—Twenty percent fine-grained quartzite containing elongated black grains, resembles gneiss; 20% red shale streaked with gray shale; 20% dark-gray shale; 20% like core 3058-61; 20% igneous rock.

3235-3236½ C.22—Ross reports: "A very compact quartzite enclosed in a matrix of granulated and cemented material that has evidently been derived from the same quartzite. Almost all of material from 3219 to 3277 feet shows a fragmental character and evidence of intense brecciation and granulation."

3235-3241 Cut.—**Thinly laminated very fine-grained sandstone, interbedded light and dark laminae.** Also a little red shale, considerable igneous, and other rocks from above.

3241-3247 C.23—**Light-greenish-gray shale containing abundant small grains of red material. Some of the shale is streaked discontinuously with red.**

3250-3259 Cut.—**About ¼ red shale streaked with gray;** some igneous, light-gray shale and sandstone from above.

3259-3271 Cut.—Similar to last.

3271-3277 C.24—**Medium-gray slickensided shale streaked with red.**

3277-3288 Cut.—Similar to 3250-3259.

3288-3295 Cut.—Similar.

3295-3304 Cut.—**Hard very fine-grained sandstone, red shale streaked with gray;** and igneous from above.

3304-3310 C.25—**Light-gray very fine-grained quartz sandstone containing thin black horizontal films of carbonaceous matter.**

3304-3315 Cut.—**Gray sandstone,** and red and gray sandy shale.

3310-3315½ C.26—**Dark-gray silty very fine-grained quartz sandstone, and light-gray fine-grained sandstone containing thin black carbonaceous films.**

3315-3323 Cut.—**Sixty-five percent quartzitic sandstone, some consisting of a matrix of fine-grained sandstone containing scattered well-rounded coarse quartz grains; one fragment contains piece of coal with the vessels or tracheids filled with cylinders of pyrite;** 35% red and gray shale.

3323-3327 Cut.—**Almost entirely light-gray quartzitic sandstone.** A little red and gray shale and igneous from above.

3327-3337 Cut.—Similar.

3337-3349 Cut.—Similar.

3349-3361 Cut.—Similar, but contains more shale and some coalified (?) carbonaceous matter.

3361-3373 Cut.—Mostly light-gray fine-grained sandstone; some red and gray shale.

3373-3382 Cut.—Similar, but somewhat more **red and gray shale.**

3382-3390 Cut.—**Red and gray shale,** fine-grained sandstone, and several pieces of very fine-grained dark-gray thin-bedded quartz sandstone containing thin films of carbonaceous matter.

3390-3402 Cut.—**Mostly red and gray mottled and dark-gray shale;** some sandstone.

3401-3407 C.27—**Massive red shale streaked with light-gray.**

3407-3412 Cut.—**Red shale** and sandstone.

3412-3420 Cut.—**Mostly red shale;** a little sandstone.

3420-3430 Cut.—**Red shale and gray shale.**

3430-3440 Cut.—**One-third gray fine-grained sandstone;** red and gray shale.

3440-3445 Cut.—Similar.

3445-3449 Cut.—Red and gray shale.

3449-3453 Cut.—Similar.

3453-3457 Cut.—Red and gray shale; **a few pieces of gray fine-grained sandstone.**

3457-3463 C.28 —(1) Very fine-grained red micaceous sandstone, and (2) gray fine-grained calcareous quartzitic sandstone cut by veins of calcite and contains seams of carbonaceous matter.

3463-3469 C.29 —Top: Micaceous silty gray very fine-grained sandstone, mottled with red.
Middle and bottom: Micaceous red very fine-grained sandstone.

3469-3474 Cut.—Mostly red and gray shale, some thin-bedded very fine-grained gray sandstone.

3474-3484 Cut.—Red and gray shale and red sandstone.

3484-3490 Cut.—Similar, gray shale contains small round concretions.

3490-3500 Cut.—Gray thin-bedded very fine-grained sandstone, containing thin films of carbonaceous matter. Red and gray shale and red sandstone.

3500-3504 Cut.—One-third red fine-grained sandy shale partly streaked with gray; 1/3 micaceous thin-bedded fine-grained sandstone, with films of carbonaceous matter; 1/3 gray shale, gray massive fine-grained sandstone, shale containing small spherical concretions and well-rounded cuttings of igneous rock, all probably from above.

3504-3508 Cut.—Forty-five percent light-gray massive fine-grained sandstone with thin films of carbonaceous matter; 45% red and gray very fine-grained sandy shale; 10% light-gray thin-bedded sandstone cut by thin films of carbonaceous matter.

3508-3512 Cut.—About 80% red and greenish-gray silty shale, some fine-grained sandy.

3512-3520 Cut.—Fifty percent red and gray shale; 40% light and dark-gray fine and very fine-grained sandstone; 10% igneous.

3520-3524 Cut.—About equal parts of gray fine-grained sandstone streaked with carbonaceous matter, and of red and gray slightly sandy shale.

3524-3530 Cut.—Mostly red and gray shale.

3530-3539 Cut.—Similar.

3547-3555 Cut.—Mostly red and gray shale, some thin-bedded micaceous very fine-grained sandstone, and a little igneous.

3555-3560 Cut.—Mostly red and gray shale.

3560-3570 Cut.—Mostly red and gray shale; about 1/4 igneous rocks of several kinds; a few pieces of light-gray sandstone.

3570 B. S.—Red very fine-grained sandy micaceous shale.

3570-3583 Cut.—Similar to 3560-3570.

3583-3610 Cut.—Fifty percent red and gray slightly sandy shale; 50% angular fine-grained slightly porous quartz sandstone; a little igneous.

3591-3597 C.30 —Very fine-grained light-gray sandstone.

3597-3604 C.31 —Similar, some of sand unconsolidated.

3604-3610 C.32 —Light-gray slightly calcareous very fine-grained quartzitic sandstone.

3610-3625 Cut.—Light gray calcareous slightly porous fine-grained sandstone, some containing crystals of calcite; some gray and red shale.

3625-3638 Cut.—Equal parts of fine-grained sandstone and gray and red shale.

3638-3650 Cut.—Mostly gray and red shale; a little fine-grained gray sandstone.

3650-3663 Cut.—Mostly gray and red shale and very fine-grained sandy shale.

3663-3675 Cut.—Mostly fine-grained non-calcareous or sparingly calcareous sandstone.

3675-3685 Cut.—Similar, but contains a little more **red and gray shale** and a few more pieces of black igneous rock, probably from above.

3685-3695 Cut.—**About 2/3 red and gray shale, about 1/3 fine and very fine-grained sandstone;** a few pieces of green igneous rock, probably from above.

3695-3703 Cut.—**About 2/3 light-gray non-calcareous fine-grained sandstone containing a little carbonaceous matter; rest is gray and red shale.**

3703-3709 C.33—**Very fine-grained non-calcareous cross-bedded sandstone containing thin films of carbonaceous matter.**

3709-3715 C.34—**Gray sandstone containing plant material.**

3715-3720 Cut.—**Gray and red shale.**

3720-3727 Cut.—**Red and gray shale.**

3727-3733 Cut.—**Some fine-grained gray sandstone;** red and gray shale.

3733-3739 Cut.—**Light-gray tightly cemented fine-grained quartz sandstone.**

3739-3743 Cut.—**Mostly gray and red shale and sandy shale;** a little gray fine-grained sandstone.

3743-3748 Cut.—**Red and gray shale.**

3748-3752 Cut.—**Red and gray shale;** a few pieces of soft green igneous rock from above.

3752-3757 Cut.—**Red and gray shale.**

3757-3769 Cut.—**Mostly red and gray slightly sandy shale;** some fine-grained sandstone.

3769-3779 Cut.—Mostly **red shale;** some gray shale; some soft white clay, mostly kaolin, that may be derived from a highly altered igneous rock similar to core at 3058-3061.

3779-3790 Cut.—**Two-thirds gray, thin-bedded and massive carbonaceous fine and very fine-grained sandstone;** 1/3 red and gray shale and igneous rock.

3790-3800 Cut.—Same.

3800-3809 Cut.—Same.

3809-3822 Cut.—Light-gray massive slightly porous fine-grained quartz sandstone.

3822-3836 Cut.—**Fifty percent light-gray slightly carbonaceous angular fine-grained quartz sandstone; and 50% red and gray shale.**

3836-3848 Cut.—**Seventy-five percent light-gray angular fine-grained quartz sandstone;** 25% gray and red shale.

3848-3857 Cut.—**Fifty percent gray and red shale;** 50% light-gray fine-grained sandstone; a few pieces of igneous rock.

3867-3887 Cut.—**One-third fine-grained light-gray quartz sandstone; 1/3 gray and red shale;** 1/3 well-rounded pieces of white clay and green igneous rock, two pieces of fossiliferous chalky limestone, probably from above.

3887-3895 Cut.—**One-half red and gray shale;** 1/8 gray sandstone; 1/8 white clay; 1/8 igneous; 1/8 other miscellaneous material from above.

3895-3905 Cut.—Ten percent fine-grained sandstone; 40% red and gray shale; 30% white kaolin like that above; 10% green and black igneous rock; 10% miscellaneous material.

3906-3910 C.35 —Light-gray very slightly calcareous, carbonaceous angular fine and very fine-grained quartz sandstone, and white kaolin speckled with a black clay mineral probably a highly altered igneous rock.

3906-3928 Cut.—Fifty percent angular fine-grained quartz sandstone; 50% gray and red shale; a few pieces of igneous rock.

3928-3937 Cut.—Fifty percent gray and red shale; 50% fine-grained sandstone.

3937-3950 Cut.—Fifty percent gray and red shale; 50% fine-grained sandstone.

3950-3965 Cut.—Forty percent gray and red shale; 50% fine-grained sandstone; 10% kaolin and igneous rock.

3965-3980 Cut.—Seventy-five percent red and gray shale; 25% fine-grained sandstone and igneous rock.

3980-4007 Cut.—Fifty percent very light-gray massive angular very fine-grained sandstone; 50% gray and red shale, a little igneous and kaolin.

4007-4014 C.36 —Red silty micaceous very fine-grained sandy shale; splits with bedding which is inclined 20°.

4018-4032 Cut.—Light-gray tightly cemented angular very fine-grained sandstone.

4032-4048 Cut.—Same; a few pieces of red and gray shale and a piece of fossiliferous chalk.

4055-4068 Cut.—Fifty percent gray angular fine-grained sand; 50% red and gray very fine-grained sandy shale.

4068-4078 Cut.—Seventy-five percent gray and red shale, some fine-grained, sandy; 25% micaceous angular fine-grained sandstone.

4078-4085 Cut.—Fifty percent red very fine-grained sandy shale; 50% gray fine-grained sandstone; considerable loose fine-grained sand and some igneous rock in sample.

4085-4095 Cut.—Same.

4095-4105 Cut.—Gray sand and sandstone and pyrite, some of which has replaced plant material (wood?).

4105-4125 Cut.—Red and gray shale; gray sand and sandstone.

4130-4136 C.37 —Micaceous dark-red very fine-grained earthy sandstone or sandy shale. Bedding of core dips 35°.

4136-4146 Cut.—Two-thirds light-gray angular fine-grained quartz sandstone; 1/3 red and gray shale.

4146-4160 Cut.—Sixty percent red and gray shale and very fine-grained sandy shale; 30% fine-grained sandstone; 10% igneous rock and clay, possibly highly altered igneous rock.

4160-4170 Cut.—Fifty percent red and gray shale and sandy shale; 25% fine-grained sandstone; 25% green igneous rock.

4170-4185 Cut.—Fifty percent red and gray shale and sandy shale; 20% green igneous rock; 10% kaolin, possibly derived from decomposed igneous rock; 20% light-gray fine-grained sandstone.

4185-4200 Cut.—Seventy percent red and gray shale; 20% fine-grained sandstone; 10% green igneous rock.

4200-4212 Cut.—Fifty-five percent red and gray shale; 45% gray fine and very fine-grained sandstone.

4212-4225 Cut.—**Forty percent red very fine-grained sandstone;** 40% red and gray shale; 20% light-gray sandstone; a few pieces of green igneous rock.

4225-4235 Cut.—**Micaceous red very fine-grained sandstone.**

4235-4245 Cut.—**Same; a few pieces of red and gray shale.**

4245-4255 Cut.—**Fifty percent gray and red shale:** 50% red very fine-grained sandstone; a little igneous rock and gray sandstone from above.

4255-4267 Cut.—**Fifty percent light-gray fine-grained quartz sandstone;** 50% red and gray shale; a little red sandstone from above.

4267-4274 C.38—**White slightly calcareous fine-grained quartzitic sandstone. A coating of salty clay or salt on outside of core. One piece of white clay and sand.**

4274-4286 Cut.—**Seventy-five percent tightly cemented angular fine-grained quartzitic sandstone;** 25% red shale, red sandstone, chalk, and igneous rock, probably all from above.

4286-4302 Cut.—**Forty percent red shale and slightly sandy shale and some dark-gray shale;** 50% tightly cemented fine-grained sandstone; 10% chalk, igneous rock, and light-gray sandy shale, from above.

4302-4314 Cut.—**Seventy percent gray and red shale;** 10% fine-grained light-gray sandstone; 10% igneous rock including one large cutting of pyrite; 10% chalk.

4314-4320 Cut.—**One-third gray shale;** 1/3 red shale; 1/3 calcareous and dolomitic (?) very fine-grained sandstone.

4324-4346 Cut.—**Fifty percent red and gray shale, some of gray containing small spherical concretions: 50% gray very fine-grained sandstone; red fine-grained sandstone, gray fine-grained sandstone.**

4346-4356 Cut.—**Forty-five percent light-gray angular fine-grained quartz sandstone;** 45% red and gray shale; 10% red sandstone, chalk, kaolin, and green igneous rock.

4356-4373 Cut.—**Forty-five percent fine-grained light-gray sandstone; 45% red and gray shale;** 10% light and dark-green igneous rock, a little red sandstone.

4373-4380 Cut.—**Thirty percent fine-grained sandstone;** 60% red and gray shale; 10% light-green igneous rock.

4383-4392 Cut.—**Seventy percent red and gray shale;** 30% light-green igneous rock, light-gray sandstone, and chalk.

4392-4400 Cut.—**Forty percent light-gray angular fine-grained sandstone;** 50% red and gray shale; 10% light-green igneous rock.

4400-4407 Cut.—**Ten percent light-green igneous rock;** 60% red and gray shale; 15% light-gray sandstone; 5% kaolin.

4407-4415 Cut.—**Sixty percent red and gray shale and sandy shale;** 20% light and dark-green igneous rock (Ross reports that rock is syenite resembling aplite); 20% fine-grained sandstone.

4415-4416½ Cut.—Fifty percent red and gray shale; 25% fine-grained tightly cemented sandstone; 25% igneous rock, chalk, and gray sandy shale.

4416 F.B.S.—**Greenish-gray soft clayey shale.**

4416½-4417 F.B.S.—**Micaceous gray silty very fine-grained sandstone.**

4417-4425 Cut.—**Twenty percent light-green igneous rock;** 60 % red and a little gray shale; 20% fine and very fine-grained sandstone.

4423-4425 Cut.—Selected cuttings of green and black igneous rock. Milton reports: "Fine-grained greenish rock with *porphyritic* feldspars. No thin section was made but from inspection the rock is a tinguaite."

4425-4435 Cut.—Igneous rock, gray sandstone and shale.

4435-4438 Cut.—One-third igneous rock, 1/3 kaolin-like rock, 1/3 red shale.

4438 F.B.S.—Very hard gray tightly cemented very fine-grained quartzite.

4438-4446 Cut.—Forty percent red and gray shale; 40% light-gray very fine-grained sandy shale; 10% green igneous rock; 10% kaolin.

4455-4462 C.41—Tightly cemented thinly laminated micaceous cross-bedded sparingly calcareous sandstone containing thin films of carbonaceous matter. Laminae dip 30°, but this may all be cross-bedding. Strong salt taste on outside of core.

4462-4478 Cut.—Thirty percent fine-grained quartzitic sandstone; 40% light and dark-green igneous rock; 30% red shale.

4478-4485-Cut.—Forty-five percent light-gray angular fine-grained carbonaceous quartzitic sandstone; 45% green igneous rock; 10% red and gray shale.

4485-4489 Cut.—Ten percent fine-grained sandstone and sandy shale; 50% green igneous rock; 40% red and gray-streaked shale.

4489-4495 C.42—H. D. Miser reports: "Two fragments of core of gray sandstone. Larger one is 2 1/2 inches long; laminae marked by carbonized macerated plant material; dip about 25 degrees from plane normal to sides of core. Small core is a jumbled mass of hard sandstone and carbonized plant debris; no bedding or lamination present."

4495-4500 Cut.—Thirty percent light-gray sandy shale all in well-rounded pieces; 50% green igneous rock; 20% red shale.

4500-4507 Cut.—Thirty-five percent red shale; 35% green igneous rock; 25% gray shale and sandy shale; 5% gray sandstone.

4507-4517 Cut.—Sixty percent red and gray shale; 30% green igneous rock; 10% fine-grained sandstone.

4517-4528 Cut.—Sixty percent red and gray shale and sandy shale; 15% green igneous rock; 15% kaolin; 10% fine-grained gray sandstone.

4528-4537 Cut.—Twenty-five percent red shale; 15% fine-grained sandstone; 25% green igneous rock; 20% kaolin; 15% gray shale.

4537-4548 Cut.—Twenty percent red shale; 20% green igneous rock; 20% sandstone; 20% dark-gray shale and very light-gray sandy shale; 20% kaolin.

4548-4554 Cut.—Twenty-five percent red shale; 25% gray shale and light-gray sandy shale; 25% kaolin; 20% green and red igneous rock; 5% sandstone

4554-4562 Cut.—Thirty-five percent gray shale; 15% red shale; 30% igneous rock; 15% gray sandstone; 5% kaolin.

4562-4575 Cut.—Twenty percent gray shale; 20% red shale; 20% gray very fine-grained sandstone and sandy shale; 20% green igneous rock; 20% kaolin.

4575-4587 Cut.—Twenty percent gray sandstone and sandy shale; 40% green and red igneous rock; 20% kaolin; 20% red and gray shale.

4587-4614 Cut.—Thirty percent light-gray very fine-grained sandy shale' red shale, and gray shale; 40% green igneous rock; 30% kaolin.

4614-4617 Cut.—**Thirty-five percent igneous rock (some of the igneous rock is white and feldspathic and has been partly replaced by calcite);** 30% sandstone; 35% gray and red shale and sandy shale.

4617-4619 Cut.—**Twenty-five percent gray and red shale, gray sandy shale;** 60% green igneous rock; 15% gray sandstone.

4619-4627 C.43—**Micaceous dark-red very fine-grained sandy shale. Strong salt taste on exterior of core; faint salt taste in interior. Massive, but suggestion of horizontal bedding.**

4627-4638 Cut.—Same as 4617-4619.

4638-4646 Cut.—**One-third gray sandstone;** 1/3 green igneous rock; 1/3 red and gray shale.

4646-4658 Cut.—Similar.

4658-4665 Cut.—Similar.

4668-4680 Cut.—**Sixty percent green and black igneous rock; 40% red and gray shale and sandstone.**

4680-4695 Cut.—**Twenty percent gray and red shale;** 60% green and black igneous rock; 20% kaolin.

4695-4702 Cut.—**Thirty-five percent green and black igneous rock and calcite veins;** 35% kaolin; 30% gray sandstone and shale.

4703-4711 C.44—**Dark-gray sparingly calcareous silty finely micaceous, sandy shale. Bedding plane dips about 48°.**

4711-4726 Cut.—**Forty percent green and light-gray igneous rock; 20% red shale; 10% dark-gray shale;** 20% sandstone; 10% light-gray sandy shale.

4726-4739 Cut.—Similar.

4739-4756 Cut.—**Fifty percent igneous rock; rest red and gray sandstone and shale.**

4756-4770 Cut.—Similar.

4770-4792 Cut.—**Forty-five percent green igneous rock, much of it cut by veins of calcite; 40% gray shale and sandy shale;** 5% red shale; 5% gray sandstone; 5% sandstone and kaolin.

4792-4803 Cut.—**Forty percent green igneous rock; 40% gray sandy shale, gray shale, and kaolin; 10% red shale;** 10% gray sandstone and quartzite.

4803-4821 Cut.—**Fifty percent red and gray shale** and sandstone; 50% green igneous rock.

4821-4838 Cut.—Similar.

4839-4846 C.45—**Red silty highly micaceous shale cut by a vein of light-gray non-calcareous material. No salt taste.**

4846-4860 Cut.—**Shale;** green igneous rock, and gray sandstone.

4860-4885 Cut.—**A few pieces of red shale; gray sandstone;** green igneous rock.

4885-4900 Cut.—**Gray sandstone** and red shale.

4900-4915 Cut.—**Forty-five percent green igneous rock; 15% quartzitic sandstone;** 40% red and a little gray shale.

4915-4940 Cut.—Fifty percent green igneous rock; 50% red and gray shale.

4940-4957 Cut.—Similar.

4957-4972 Cut.—**Forty-five percent red shale and sandy shale;** 45% light-gray sandstone and sandy shale; 5% igneous rock; 5% dark-gray shale.

4972-4982 Cut.—**Thirty percent red shale;** 30% green igneous rock; 30% light-gray sandstone; 10% dark-gray shale.

4985-4991 Cut.—**Twenty percent very hard and tightly cemented light-gray quartzitic sandstone, many small dark areas in the quartzite;** 60% red shale; 20% dark-gray shale.

5001-5019 Cut.—**Fifty-five percent red shale;** 20% dark-gray shale; 20% light-gray quartzitic sandstone; 5% green igneous rock.

5019-5040 Cut.—Similar.

5040-5052 Cut.—**Thirty-five percent red shale;** 30% green igneous rock; 15% gray quartzitic sandstone; 15% gray shale; 5% miscellaneous material from above.

5052-5058 Cut.—**Forty percent green igneous rock;** 40% **red shale;** 20% gray shale and sandstone.

5058-5073 Cut.—**Fifty percent green igneous rock;** 30% **red shale;** 10% **gray shale and sandy shale;** 10% light-gray very fine-grained sandstone.

5074-5081 C.46 —**Red finely micaceous silty shale cut by a lenticular bed 1/8 inch thick of greenish-gray shale. Apparent dip of bedding planes is about 20°.**

5081-5093 Cut.—**Forty percent green igneous rock;** 20% **dark-gray shale;** 20% **red shale;** 20% quartzitic sandstone.

5093-5110 Cut.—**Sixty percent angular fine-grained quartzitic sandstone like that far above;** 25% **green igneous rock;** 15% **red shale.**

5110-5118 Cut.—**Mostly red shale, some quartzitic sandstone containing carbonaceous matter,** and a little igneous rock.

5118-5129 Cut.—**Forty percent slightly calcareous fine and very fine-grained quartzitic sandstone and quartzite;** 30% red shale; 20% igneous rock; 10% gray shale.

5129-5141 Cut.—**Twenty percent green igneous rock;** 5% **pink igneous rock;** 5% **green and pink igneous rock;** 35% red shale; 30% quartzitic sandstone; 5% gray shale.

5141-5148 Cut.—**Forty percent red shale;** 40% gray sandstone and gray sandy shale; 10% green igneous rock; 10% gray shale.

5148-5160 Cut.—**Thirty percent red shale;** 30% green igneous rock; 30% gray sandstone; 10% gray shale.

5160-5168 Cut.—**Forty percent light-green igneous rock;** 40% red shale; 10% gray shale and kaolin and other materials from above; 10% gray quartzite.

5168-5174 Cut.—**Sixty percent red shale;** 15% **gray shale;** 15% quartzitic sandstone; 10% pink and green types of igneous rock.

5174-5181 Cut.—**Fifty percent red shale;** 50% gray sandstone and shale.

5181-5192 Cut.—**Seventy percent red shale;** 5% **igneous rock;** 25% gray sandstone and quartzite.

5192-5194 Cut.—**Twenty-five percent gray sandstone;** 60% red shale; 10% green and dark-gray igneous rock; 5% gray shale.

5194-5195 Cut.—**Twenty-five percent quartzitic gray sandstone;** 60% red shale; 10% pink igneous rock; 5% gray shale.

5195-5196 Cut.—Similar.

5196 Cut.—Forty percent dark-green igneous rock; 60% red shale.

5196-5208 Cut.—Mostly red shale and igneous rock; some gray shale.

5208-5214 C.48 —No recovery. Broken up pieces of core, recovered in cuttings on reaming out the hole, consist of light-green and salmon-pink igneous rock--syenite containing much aegirite-augite. Milton reports: "A more or less altered tinguaite. In a fine-grained groundmass, consisting largely of densely strewn aegirine-augite needles, are large orthoclase crystals (Carlsbad twinned), nephelines now altered to aggregates of cancrinite and isotropic crystals probably of the hauynite-sodalite group."

5214-5218 Cut.—Twenty-five percent igneous rock like core; 75% red shale.

5218-5227 Cut.—50% white and light-brown igneous rock; Milton reports: "Consists of (a) light-colored material, and (b) fine-grained dark material. Under the microscope (a) is seen to be a dike rock essentially similar to that described above, and (b) is a sandstone showing strong evidence of contact-metamorphism, presumably from the intrusion of the tinguaite rock." 50% red and gray shale and sandstone.

5227-5233 Cut.—Mostly red shale; a little quartzite and igneous.

5233-5235 Cut.—Similar.

5235-5240 Cut.—Fifty percent red shale; 20% light-gray quartzitic sandstone; 15% gray shale; 15% light-brown igneous rock.

5240-5245 Cut.—Forty-five percent red shale; 30% quartzite; 15% gray shale; 10% igneous.

5245-5257 Cut.—Forty-five percent dark-gray carbonaceous fine-grained quartzitic sandstone; 45% red shale; 10% gray shale and igneous.

5257-5268 Cut.—Seventy percent red shale; 10% sandstone; 10% igneous rock; 10% gray shale.

5268-5274 C.49 —Micaceous dark-red very fine-grained sandy shale dipping about 20°. Strong salt taste on outside of core, faint on inside.

5274-5284 Cut.—Sixty percent red shale; 20% gray shale; 10% quartzitic sandstone; 10% igneous rock.

5284-5300 Cut.—Seventy percent red shale; 10% gray shale; 10% igneous; 10% quartzitic sandstone.

5300-5305 Cut.—Similar.

5305-5317 Cut.—Sixty-five percent white igneous rock. Milton reports: "Practically all the sample as (a) of the sample from 5218-27 feet, with occasionally a piece of (b). Microscopically, the characters are the same, insofar as the inherent variation of this type of igneous rock permits; and the single fragment of sandstone sectioned shows very little metamorphism." 30% red shale; 5% quartzite and gray shale.

5317-5325 Cut.—Ten percent igneous rock like above; 20% sandstone; 60% red shale; 10% gray shale and sandy shale.

5325 B. S.—(On side of bit) Dark-gray shale.

5325-5333 Cut.—Sixty percent red shale; 30% light and dark-gray quartzitic sandstone; 10% gray shale and a few pieces of igneous rock like that at 5317-5325.

5333-5344 Cut.—Seventy percent red shale; 25% gray sandstone; 5% gray shale.

5344-5354 Cut.—Similar.

5354-5365 Cut.—Twenty percent white igneous rock; 60% red shale; 10% red sandstone; 10% gray shale.

5365-5376 Cut.—Fifteen percent white igneous rock; 55% red shale; 15% gray sandstone; 15% gray shale.

5376-5387 Cut.—Thirty-five percent red and a little gray fine-grained quartzitic sandstone; 50% red shale; 10% gray shale; 5% white igneous rock.

5387-5397 Cut.—Ten percent red quartzitic sandstone; 70% red shale; 10% gray shale; 10% light-colored igneous rock.

5397-5408 Cut.—Twenty percent gray and red quartzitic sandstone; 60% red shale; 15% gray shale; 5% igneous rock.

5408-5418 Cut.—Similar, red shale predominates.

5418-5420 Cut.—Similar.

5420-5425 Cut.—Sixty-five percent red shale; 15% gray sandstone; 15% gray shale; 5% green igneous rock.

5425-5432 Cut.—Fifty percent red shale; 20% gray shale; 20% gray sandstone; 10% green igneous rock.

5432-5438 Cut.—Seventy percent red and gray shale (mostly red, some mottled red and gray); 25% gray sandstone; 5% green igneous rock and vein calcite.

5438-5442 C.51—Micaceous dark-red very fine-grained sandy shale, cut by vein of dolomite. Strong salt taste on one bedding plane; faint salt taste on interior of core. Bedding dips 30°.

5442-5447 Cut.—Twenty percent green and black igneous rock; 40% red shale; 20% gray shale; 20% sandstone.

5447-5455 Cut.—Thirty percent gray fine and very fine-grained sandstone; 50% red and some gray and mottled shale; 20% green igneous rock.

5455-5459 Cut.—Fifteen percent gray sandstone; 75% red shale; 10% gray shale.

5459-5463 Cut.—Thirty percent light-gray fine-grained quartzitic sandstone; 60% red shale; 10% gray shale.

5463-5465 Cut.—Twenty percent fine-grained dark and light-gray very hard quartzite; 75% red shale; 5% gray shale and a little igneous.

5465-5468 Cut.—Forty percent very hard slightly calcareous light-gray quartzite; 60% red shale.

5468-5475 Cut.—Similar, some igneous rock and one large crystal of biotite mica.

5475-5478 Cut.—Ten percent green igneous rock; 60% red shale; 30% quartzitic sandstone.

5478-5482 Cut.—Thirty percent gray sandstone; 40% green igneous rock, a little white and some pink igneous rock, vein calcite cuttings; 30% red and gray-mottled and red shale.

5482-5489 Cut.—Twenty percent gray sandstone; 50% red and gray shale; 30% green igneous rock.

5489-5499 Cut.—Sixty percent red and gray shale; 25% gray sandstone; 15% green igneous rock.

5499-5509 Cut.—Twenty-five percent green and brown igneous rock; 50% red and gray shale; 25% gray sandstone.

5509-5514 C.52—Dark-red non-calcareous massive fine-grained argillaceous sandstone. Strong salt taste on exterior of core none on interior.

5514 Total depth of well according to log.

5522 Total depth of well by steel line measurement of pipe.

5530 Total depth of well according to Schlumberger Corp.

5196 Cut.—Forty percent dark-green igneous rock; 60% red shale.

5196-5208 Cut.—Mostly red shale and igneous rock; some gray shale.

5208-5214 C.48—No recovery. Broken up pieces of core, recovered in cuttings on reaming out the hole, consist of light-green and salmon-pink igneous rock--syenite containing much aegirite-augite. Milton reports: "A more or less altered tinguaite. In a fine-grained groundmass, consisting largely of densely strewn aegirine-augite needles, are large orthoclase crystals (Carlsbad twinned), nephelines now altered to aggregates of cancrinite and isotropic crystals probably of the hauynite-sodalite group."

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5240-5245 Cut.—Forty-five percent red shale; 30% quartzite; 15% gray shale; 10% igneous.

5245-5257 Cut.—Forty-five percent dark-gray carbonaceous fine-grained quartzitic sandstone; 45% red shale; 10% gray shale and igneous.

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5325 B. S.—(On side of bit) Dark-gray shale.

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5387-5397 Cut.—Ten percent red quartzitic sandstone; 70% red shale; 10% gray shale; 10% light-colored igneous rock.

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5408-5418 Cut.—Similar, red shale predominates.

5418-5420 Cut.—Similar.

5420-5425 Cut.—Sixty-five percent red shale; 15% gray sandstone; 15% gray shale; 5% green igneous rock.

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VERTICAL SECTION AT STATE FEE WELL NO. 2

(NW¼ NW¼ NW¼ OF SECTION 25, T.6 N., R.1E., HINDS COUNTY, MISS.)

AGE — DRILLERS' LOG (0 – 2800')

AGE — DRILLERS' LOG (2800' – 5530')

SCHLUMBERGER ELECTRICAL LOG (2800' – 5530')

INFERRED LOG (2800' – 5530')