

STATE OF ILLINOIS  
 DEPARTMENT OF REGISTRATION AND EDUCATION  
 A. M. SHELTON, *Director*  
 DIVISION OF THE  
 STATE GEOLOGICAL SURVEY  
 M. M. LEIGHTON, *Chief, Urbana*

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CONTENTS

|   | PAGE |
|---|------|
| Recent development on the Ayers anticline.....                                | 1    |
| Recent drilling northwest of St. Francisville, Lawrence County, Illinois..... | 10   |

RECENT DEVELOPMENT ON THE AYERS ANTICLINE

By Alfred H. Bell

INTRODUCTION

Interest in the Ayers area (fig. 1) has been recently revived by the finding of a show of oil during the deepening of one of the wells in the gas field, namely the William Sharp well No. 1 in sec. 28, T. 6 N., R. 3 W. (fig. 4,

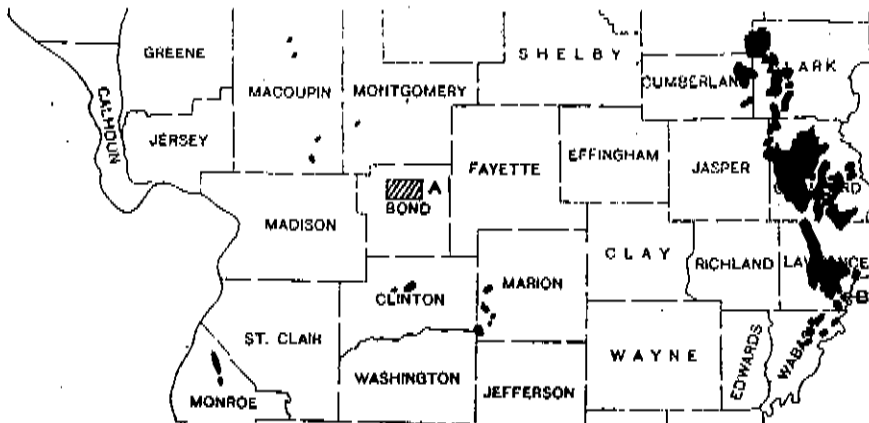


FIG. 1. Index map showing the location of the two areas described in this report, namely the Ayers area (A), and the area northwest of St. Francisville (B). Solid black shows locations of other oil and gas fields.

<sup>1</sup> Blatchley, R. S., Oil and gas in Bond, Macoupin, and Montgomery counties, Illinois: Illinois State Geol. Survey Bull. 28, p. 43, 1914.  
 Bell, A. H., Oil possibilities of the Ayers anticline: Illinois State Geol. Survey Illinois Petroleum No. 5, p. 15, 1926.

map No. 8). In two former publications<sup>1</sup> the Survey has recommended the Ayers anticline as worthy of further testing for oil. The present paper gives the new data from the recent drilling and summarizes what is known of the geological conditions in the area.

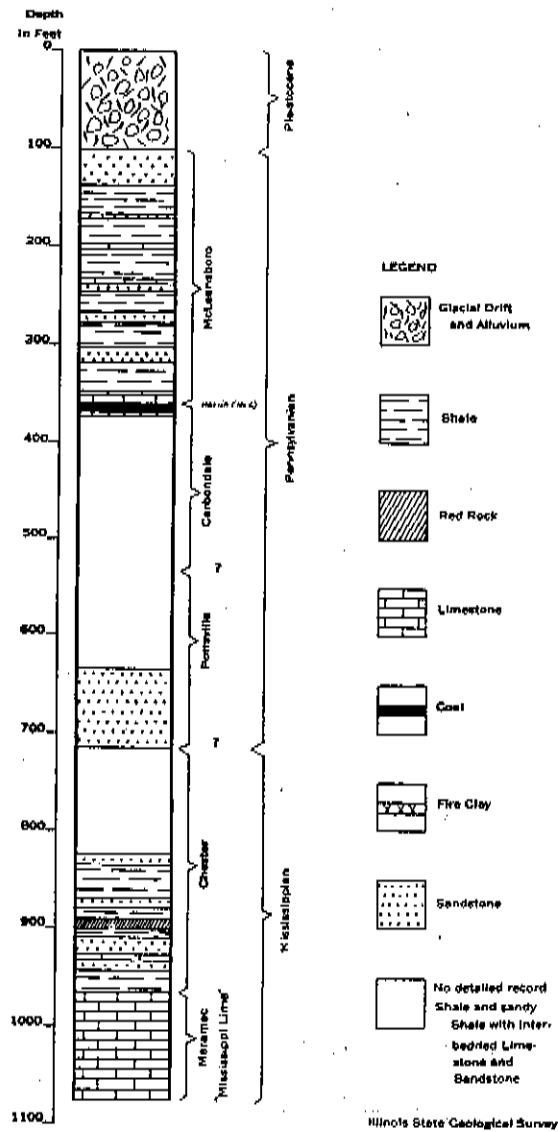


FIG. 2. Generalized columnar section for the Ayers area.

## STRATIGRAPHY

A generalized columnar section for the area, down to the Meramec series of the Mississippian system (the "Mississippi lime" of the drillers), is given in figure 2. The surface material consists of unconsolidated deposits of Pleistocene age, from 100 to 150 feet or more in thickness, chiefly glacial till and stream deposits. These are underlain by a series of shales and sandy shales with interbedded sandstone, limestone, and coal of Pennsylvanian age. The contact between Pennsylvanian strata and the underlying Chester series of the Mississippian system is not recognizable in the logs of any of the wells in the area, and accordingly estimates of thickness of Pennsylvanian and Chester strata are based on an arbitrarily assumed position for the contact between them. About 550 feet thickness of strata has been assigned to the Pennsylvanian. Herrin (No. 6) coal which occurs at a depth of 370 feet in Hellinger No. 2 well marks the upper limit of the Carboniferous formation. The McLeansboro formation lies above Herrin (No. 6) coal and has a thickness of about 250 feet. The combined thickness of the

TABLE 1.—*Estimate of depths to possible oil and gas horizons on Ayers Anticline*<sup>2</sup>

| Depth Feet | Horizons  | Remarks  |
|------------|---|--|
| 400        | 1. Pennsylvanian sands below Herrin (No. 6) coal                                      | Produce oil at Junction City and Wamac; oil and gas at Carlinville; and gas at Staunton.   |
| 800        | 2. Chester  | Oil at Frogtown, Carlyle, Sandoval and Centralia; gas in Bond County, (1) sec. 28, T. 6 N., R. 3 W., and (2) Lindley pool, sec. 22, T. 5 N., R. 3 W. |
| 900        | 3. Ste. Genevieve (upper part of "Mississippi lime"); correlated with "McClosky sand" | Oil in Lawrence County.  |
| 2000       | 4. Devonian or Silurian   | Showings of oil in wells in Old Ripley Township (south of Ayers anticline).  |
|            | 5. Silurian: "Niagara lime" and Hoing sand  | Gas in Pike County (Pittsfield-Hadley anticline) and oil at Colmar.  |
| 2650       | 6. Ordovician: Kimmswick-Plattin limestone ("Trenton limestone")                      | Oil at Waterloo.   |

<sup>2</sup> Bell, A. H., op. cit., p. 16.

Carbondale and Pottsville formations is about 300 feet. As No. 2 coal, which marks the base of the Carbondale, is not recorded in the logs, these formations have not been separated.

The Chester series consists of about 220 feet of interbedded shale, sandstone, and limestone, and is characterized by a number of beds of "red rock" or red shale. Underlying the Chester is a comparatively great thickness of limestone, probably either the St. Genevieve or St. Louis limestone, or both, of the Meramec series. The Sapp well penetrated 110 feet of limestone but the deeper formations are not penetrated in this or the nearby surrounding territory and consequently their thickness and lithologic character are not well known. Estimates of the depth to each possible producing horizon are given in table 1.

### STRUCTURE

The structure of the area is illustrated by two contour maps, one on Herrin (No. 6) coal, figure 3, and the other on the lower gas sand, figure 4.

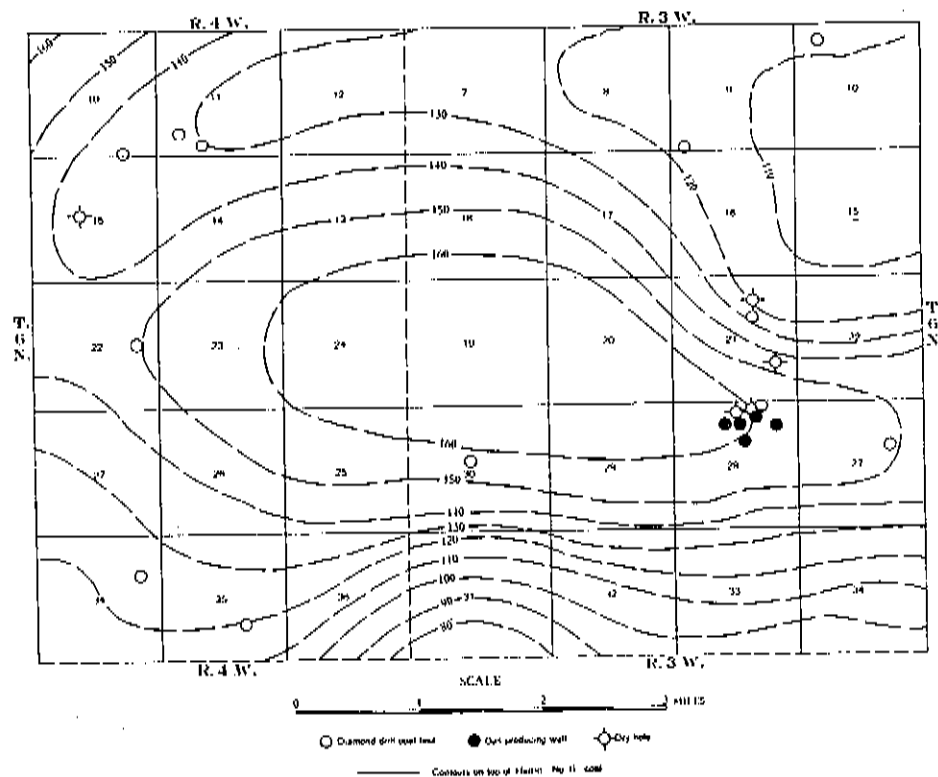
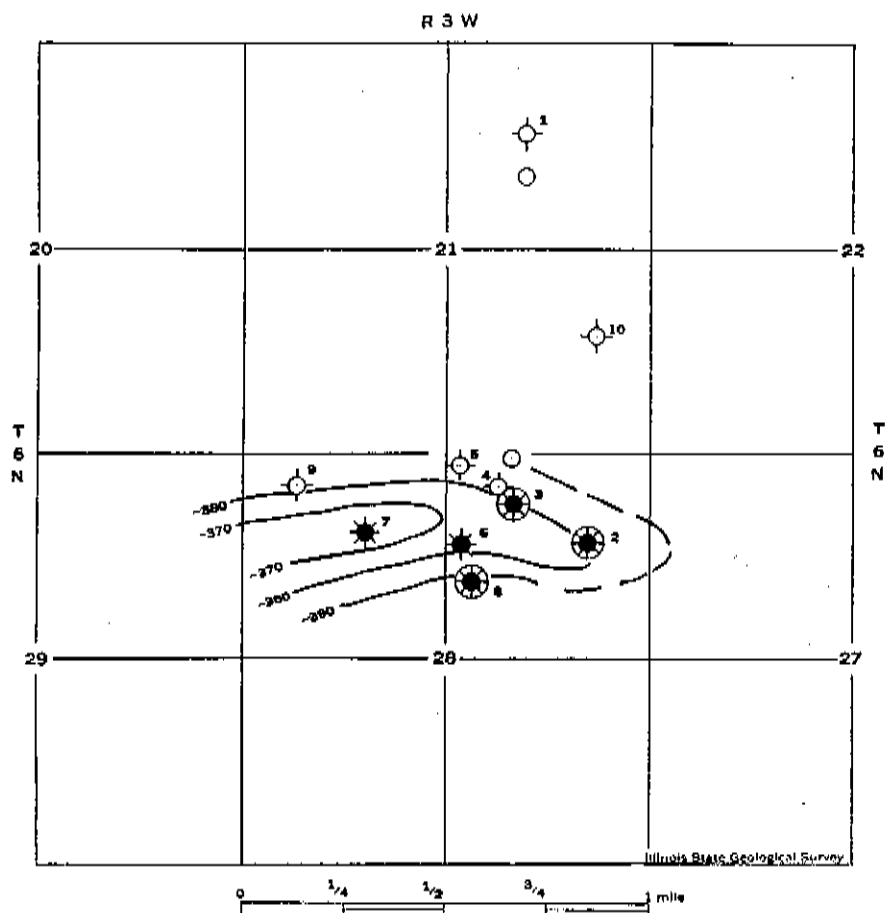


FIG. 3. Structure map of Ayers anticline, Bond County. Key horizon Herrin (No. 6) coal. (Illinois State Geological Survey.)

The former is reprinted from Illinois Petroleum No. 5. As the new drilling has not given additional information on the structure of the Pennsylvanian beds, this map still represents our most up-to-date interpretation. The structure map of the gas sand (fig. 4) is here presented for the first time. It shows a narrow, elongated anticline with axis trending cast-west and



- Diamond Drill Coal Test
  - Gas Well
  - Abandoned Gas Well
- Dry Hole
  - Contours on Lower Gas Sand

FIG. 4. Structure map of part of the area shown in figure 3. The key horizon is a sand in the lower part of the Chester series. Contour interval, 10 feet. Datum plane, sea-level.

TABLE 2.—Well data

| Map No. | Sec. | Company      | Farm and No. | Surface elevation above sea-level | Upper sand |               |                |
|---------|------|--------------|--------------|-----------------------------------|------------|---------------|----------------|
|         |      |              |              |                                   | Depth Feet | Altitude Feet | Thickness Feet |
| 1       | 21   | Ohio         | Sapp 1       | 542                               |            |               | 0              |
| 2       | 28   | Bond Co. Gas | Wharton      | 546                               |            |               | 0              |
| 3       | 28   | Bond Co. Gas | Alderman     | 518                               |            |               | 0              |
| 4       | 28   | Ohio         | Alderman     | 518                               |            |               | 0              |
| 5       | 28   | Bond Co. Gas | Stowe        | 551                               |            |               | 0              |
| 6       | 28   | Bond Co. Gas | Hellinger 1  | 553                               | 894        | —341          | 6              |
| 7       | 28   | Bond Co. Gas | Hellinger 2  | 528                               | 867        | —339          | 9              |
| 8       | 28   | Bond Co. Gas | Sharp 1      | 551                               | 907        | —356          | 10             |
| 9       | 28   | Bond Co. Gas | Warlick 1    | 532                               |            |               | 0              |
| 10      | 21   | Ohio         | F. V. Cary   |                                   |            |               |                |

apparently coinciding with the axis of the anticline shown in figure 3. The dips shown in figure 4 are, however, considerably steeper than are those of the coal (fig. 3) in the surrounding territory. In this respect structural conditions are similar to those in the Lindley gas field five and a half miles south. The data on which the structure map of the gas sand was based are given in table 2.

#### DEVELOPMENT

##### OHIO OIL COMPANY

Three test wells were drilled by the Ohio Oil Company in the area in 1917: (1) The H. E. Sapp well in the SE. corner NW.  $\frac{1}{4}$  NE.  $\frac{1}{4}$  sec. 21, T. 6 N., R. 3 W. (fig. 4, map No. 1); (2) the Alderman well in the NW.  $\frac{1}{4}$  NE.  $\frac{1}{4}$  sec. 28 (map No. 4), and; (3) the F. V. Cary well in the NE.  $\frac{1}{4}$  SE.  $\frac{1}{4}$  sec. 21 (map No. 10). The first of these had a show of oil from 952 to 956 feet in a sand which may be the producing sand of the gas field; the second had gas in sand from 901 to 911 feet and water from 911 to 936 feet; the third had no showing of oil or gas. All three of the wells penetrated about 100 feet of "Mississippi lime."

*of the Ayers gas field*

| Lower sand    |                  |                                  | Total<br>depth<br>feet | Remarks   |
|---------------|------------------|----------------------------------|------------------------|---|
| Depth<br>feet | Altitude<br>feet | Thickness drilled<br>feet        |                        |   |
| 952           | —410             | 4                                | 1100                   | Show of live oil  |
| 926           | —380             | 2                                | 926                    | Gas well, abandoned   |
| 898           | —380             | 6                                | 1060                   | Gas well, abandoned   |
| 901           | —383             | 10 gas-bearing; 25 water-bearing | 1150                   | Gas found but not used; drilled to "Mississippi lime"           |
| 934           | —383             | 13 show gas; 4 water-bearing     | 951                    | Gas show—dry hole   |
| .....         | .....            | .....                            | 900                    | Gas producer  |
| 890           | —362             | 5 gas                            | 895                    | Gas producer; formerly from upper sand, now from lower sand     |
| 944           | —393             | 3 oil-bearing; 20 water-bearing  | 1004                   | Gas producer from upper sand; oil show in lower sand; abandoned |
| 913           | —381             | 10 show gas; 7 water-bearing     | 930                    | Gas show—dry hole   |
| ?             | ?                |                                  | 1090                   | Dry   |

## BOND COUNTY GAS COMPANY

Several years later the Bond County Gas Company began operations in the territory. Their first well was the Wharton, located in the NE.  $\frac{1}{4}$  NE.  $\frac{1}{4}$  sec. 28 (fig. 4, map No. 2). Gas at a pressure of 350 pounds per square inch was found in a sand from 926 to 928 feet. Later several more gas wells were drilled in the adjacent territory to the west. During 1923 and 1924 six gas wells and one dry hole, the Stowe No. 1 (map No. 5), were drilled. The gas produced was used to supply the town of Greenville. The encroachment of water in the gas sand gave trouble, however, and the natural gas had to be supplemented by manufactured gas. It is reported that the Wharton and Alderman wells still had gas pressures of approximately 150 pounds per square inch at the time they were abandoned.

In 1927 and 1928 a program of cleaning out and deepening some of the wells was undertaken by the Bond County Gas Company. As a result, a supply of gas adequate for the town of Greenville is now being obtained from two wells, Hellinger Nos. 1 and 2 (fig. 4, map Nos. 6 and 7). These two wells and the Sharp No. 1 (map No. 8) originally produced gas from an upper sand, a few feet higher in the stratigraphic section than the producing sand of the Wharton and Alderman wells. This upper sand is not reported

present in the logs of any of the wells other than the three mentioned above, and on account of its restricted lateral occurrence it has been called a stray sand. Hellinger No. 1 was not deepened but was cleaned out in the upper sand and it is now producing gas at a pressure of 150 pounds per square inch. Hellinger No. 2 was deepened and gas at a pressure of 350 pounds per square inch was found in the lower sand. In deepening the Sharp well the interval from the upper to the lower sand was found to be 37 feet as compared with 23 feet in Hellinger No. 2 well. This sand was drilled in on April 20, 1928, from 944 to 951 feet, and the well filled up about two-thirds full of fluid, mainly brackish water. It was bailed down a number of times in the next few days and several gallons of oil settled out. The oil has a gravity of 32.5 degrees Baumé. The well was drilled to 1004 feet and the project of drilling to the "Mississippi lime" had to be abandoned because the hole was crooked.

One dry hole was drilled in 1927-28, the P. L. Warlick No. 1 (fig. 4, map No. 9). A show of gas was found in sand from 913 to 923 feet, and salt water in sand from 923 to 930 feet. The well was plugged and abandoned at this depth.

#### PRODUCING SANDS

The gas in the Ayers gas field comes from two sands in the Chester series. The lower sand is present in all of the wells in the area and lies 66 feet above the top of the "Mississippi lime" in the Bond County Gas Company's Alderman well (fig. 4, map No. 3). The upper sand, as mentioned above, was found in only three of the wells in the area.

Samples of the producing sand from most of the Bond County Gas Company's wells were studied. It is a fine to very fine-grained, well-bedded sand, light greenish-gray in color, sometimes brown. It is partly calcareous and partly noncalcareous, but the calcite content is not high. Some clayey material is present and pyrite, limonite, mica, and glauconite occur as accessory minerals. Porosity determinations were not attempted on account of the small size of the pieces available, and variations in porosity were not detected by examination under the binocular microscope. The fact that there are considerable differences in the gas pressures in the same sand in nearby wells shows that there are variations in the permeability of the sand. Parts of it appear to be virtually sealed off from other parts by impervious streaks. No differences in lithologic character were noted between the upper and lower sands.

#### RECOMMENDATIONS

There still remains a considerable untested area on the Ayers anticline. Formerly the presence of oil on or near the top of the structure had not been demonstrated; the nearest showing of oil was that found in the Sapp well



in sec. 21, T. 6 N., R. 3 W. (fig. 4, map No. 1), down on the north flank of the anticline. Moreover, the gas obtained from the field was apparently "dry" gas for no condensation of gasoline was found in the pipe line in cold weather. The recent finding of the show of oil in the Sharp well suggests the possibility that oil may exist in commercial quantities in the same sand somewhere else on the anticline. As no tests deeper than the Ste. Genevieve or St. Louis limestone have been drilled on the structure the possible deeper producing beds remain untested.

The structure, especially the west part in secs. 20 and 19, T. 6 N., R. 3 W., and sec. 24, T. 6 N., R. 4 W., is known only in general outline and the details are largely unknown. It is believed that the most efficient way in which the anticline may be thoroughly tested is first to determine structure in greater detail by means of a number of shallow tests to Herrin (No. 6) coal and then to make the location for one or more deep tests on the basis of the more complete knowledge of structure so obtained. The advantage of such procedure over the more ordinary one of locating deep tests without knowledge of structural details has been well demonstrated in the mid-continent oil fields but so far the structure drilling plan has not been adopted to any extent by Illinois oil operators. A discussion of the question and a tabular comparison of costs are given in a former publication.<sup>2</sup> In view of the success of structure testing by shallow drilling in bringing in new pools and extending old ones in the mid-continent field, it is believed that its possibilities for success in Illinois would justify its adoption.

<sup>2</sup> Moulton, Gail F., Proper testing for oil structures in Illinois and some areas deserving such testing: Illinois State Geol. Survey Report of Investigations No. 6, pp. 6-9, 1925.

RECENT DRILLING NORTHWEST OF ST. FRANCISVILLE,  
LAWRENCE COUNTY, ILLINOIS

By Alfred H. Bell

GENERAL STATEMENT

The success of recent drilling in sec. 7, T. 2 N., R. 11 W., suggests that some of the territory in secs. 7 and 8, formerly considered condemned, in reality has good possibilities of commercial oil production. This area is located in southeastern Lawrence County southwest of the Murphy pool and northwest of St. Francisville. It was the scene of great drilling activity after the discovery, on April 6, 1914, of a 3100 barrel well on the M. J. Murphy farm in sec. 5, T. 2 N., R. 11 W. at a depth of 1835 feet in the McClosky sand. On account of the large initial production of several of the wells in the Murphy pool, and the expectation of similar large production in the adjacent territory to the south and southwest, a number of wells in secs. 7 and 8 were abandoned, although, according to current reports, most of them had enough oil in the Kirkwood sand to give production on a commercial scale. The index map (fig. 1, p. 1) shows the location of the area (B) described in this report and its relation to adjacent oil and gas fields.

The Survey published geological reports on the Lawrence County oil fields in 1913<sup>1</sup> and 1916.<sup>2</sup> The present paper gives a summary of the data on the old and new drilling in an area of five sections in the northwest part of ~~Dennison Township~~ (T. 2 N., R. 11 W.), Lawrence County, and discusses the geological conditions in their bearing on prospects for new production.

STRUCTURE

The structure of the area is illustrated in figure 5 by contours, with a 20-foot interval, showing the elevation of the top of the Kirkwood sand. In the north part of secs. 7 and 8 the contours are taken from plate VIII, Bulletin 33, but have been renumbered with reference to sea-level instead of to a datum plane 1500 feet below sea-level. The data on which the map is based are given in table 3. On account of the lack of detailed logs of any of the wells except the three in the north part of sec. 18 the correlation of the Kirkwood sand is in some places uncertain. All of the datum points except two were based on sand records in which the sands were identified by the drillers. Over most of the area the map (fig. 5) shows a general

<sup>1</sup>Blatchley, R. S., Oil fields of Crawford and Lawrence counties: Illinois State Geol. Survey Bull. 22, 1913.  
<sup>2</sup>Rich, J. L., Oil and gas in the Vincennes quadrangle: Illinois State Geol. Survey Bull. 33, pp. 147-180, 1916.

dip to the south, which is in accordance with the known regional dip in the surrounding area. The features of special interest are: (1) an anticlinal nose in the S.  $\frac{1}{2}$  NE.  $\frac{1}{4}$  sec. 7 and adjacent part of sec. 8; and (2) a flat or terrace in the SW.  $\frac{1}{4}$  sec. 7 and N.  $\frac{1}{2}$  sec. 18.

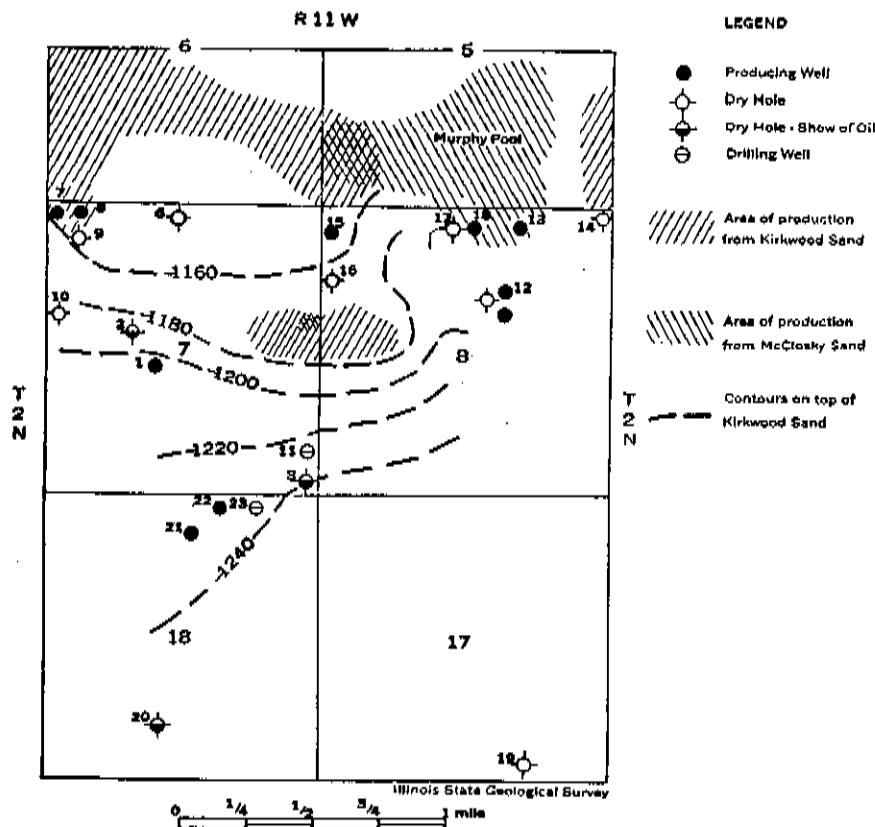


FIG. 5. Structure map of area southwest of Murphy pool; key horizon top of Kirkwood sand. Contour interval 20 feet. Datum sea-level.

On account of the meagre information available on the McClosky sand it was not found possible to make a satisfactory structure contour map using it as key bed. Its structure seems to be similar to that of the Kirkwood sand in at least part of the area, as it rises to the north from the Hunt et al., Des Boeuf well No. 1 (fig. 5, map No. 21) to the George L. Barnett wells (table of well data, Nos. 4 and 5) in the NE.  $\frac{1}{4}$  sec. 7.

#### OIL SANDS

Oil is produced in the area from two horizons, the Kirkwood sand in the lower part of the Chester series, and the McClosky sand in the Ste.

Genevieve limestone of the Meramec series. Other sands, notably the Tracy and certain Pennsylvanian sands, have given shows of oil.

## MC CLOSKY SAND

The McClosky sand is said to have yielded the largest initial productions of any of the producing sands in Illinois.<sup>8</sup> In discussing the McClosky

<sup>8</sup>Blatchley, R. S., op. cit., p. 113.

TABLE 3.—Well data on area

| Map No. | Year drilled | No. Sec. | Company           | Farm and No.      | Elevation Feet |
|---------|--------------|----------|-------------------|-------------------|----------------|
| 1       | 1914         | 7        | T. L. Hartman     | W. V. Griggs 2    | 421 (?)        |
| 2       | ?            | 7        | Borough           | W. V. Griggs 2    | 421            |
| 3       | 1912         | 7        | Titus et al.      | J. Des Boeuf 1    | 502            |
| 4       | 1915         | 7        | Ohio Oil          | Geo. L. Barnett 5 | 458            |
| 5       | 1915         | 7        | Ohio Oil          | Geo. L. Barnett 6 | 461            |
| 6       | 1909         | 7        | Ohio Oil          | Nancy Buchanan 1  | 416            |
| 7       | 1914         | 7        | ?                 | Nancy Buchanan 1  | 466            |
| 8       | 1914         | 7        | ?                 | Nancy Buchanan 2  | 443            |
| 9       | 1914         | 7        | ?                 | Nancy Buchanan 3  | 467            |
| 10      | 1915         | 7        | ?                 | Nancy Buchanan 4  | ?              |
| 11      | 1928         | 7        | Bolton et al.     | J. Des Boeuf      | 501            |
| 12      | 1914         | 8        | Octo              | Chas. Garvey 1    | 455            |
| 13      | 1914         | 8        | Octo              | Chas. Garvey 2    | 426            |
| 14      | 1914         | 8        | Octo              | Chas. Garvey 3    | 409            |
| 15      | 1909         | 8        | Ohio Oil          | Geo. L. Barnett 2 | 442            |
| 16      | 1909         | 8        | Ohio Oil          | A. B. Jordan 1    | 440            |
| 17      | 1914         | 8        | Ohio Oil          | A. B. Jordan 3    | 454            |
| 18      | 1914         | 8        | Ohio Oil          | A. B. Jordan 14   | 451            |
| 19      | 1914         | 17       | Lewis Oil & Gas   | M. A. Morris 1    | 453            |
| 20      | 1915         | 18       | ?                 | Tobias Ramsey 1   | 444            |
| 21      | 1922         | 18       | Hunt et al.       | J. J. Des Boeuf 1 | 462            |
| 22      | 1928         | 18       | Shelton Oil & Gas | J. J. Des Boeuf 1 | 483            |
| 23      | 1928         | 18       | Shelton Oil & Gas | J. J. Des Boeuf 2 | 502            |

<sup>a</sup>As the exact location of the two wells on the Geo. L. Barnett farm is not known

horizon, Rich says<sup>4</sup>: "The McClosky oil comes from a thin sandstone, or in places, apparently from a soft, oolitic limestone in the upper part of the Ste. Genevieve formation. The productive horizon is commonly thin, ranging from 2 to 10 feet in the Murphy pool and averaging not more than 10

<sup>4</sup>Rich, J. L., op. cit., pp. 158, 159.

northwest of St. Francisville

| Kirkwood sand         |                  |                               | McClosky sand   |                               | Remarks   |
|-----------------------|------------------|-------------------------------|-----------------|-------------------------------|---|
| Depth<br>Feet         | Altitude<br>Feet | Thickness<br>recorded<br>Feet | Depth<br>Feet   | Thickness<br>recorded<br>Feet |   |
| 1624                  | —1203            | 5                             | 1862            | 10                            | Oil production from McClosky  |
| not recorded          |                  | 80                            | 1866            | 2                             | Oil show from McClosky. Small show of oil at two places in Kirkwood   |
| 1742                  | —1240            | 2                             | not drilled (?) |                               | "Rich black oil in Kirkwood." Smell of oil in Tracy (?). Not producing well   |
| 1621                  | —1163            | 64                            | 1818            | 6                             | Show of oil in McClosky   |
| 1631                  | —1170            | 29                            | 1840            | 3                             | Show of gas in McClosky   |
| 1565                  | —1149            | 65                            | not drilled     |                               | Dry hole  |
| 1624                  | —1158            | 39                            | not drilled     |                               | Production from Kirkwood  |
| 1601                  | —1158            | 23                            | not drilled     |                               | Production from Kirkwood—oil show in Ridgley at 1230-51 feet  |
| 1625                  | —1158            | 20                            | not drilled     |                               | Dry hole  |
| no record             |                  |                               | no record       |                               | Dry hole—no shows of oil  |
| drilling (June, 1928) |                  |                               |                 |                               |   |
| 1636                  | —1181            | 18                            | 1879            | 3                             | Oil production from Kirkwood; small show of oil in McClosky. T. D. 2010 feet  |
| 1610                  | —1184            | 20                            | 1829            | ?                             |   |
| 1584                  | —1175            | 10                            | no record       |                               | Dry hole  |
| 1600                  | —1158            | 38                            | not drilled     |                               | Oil production from Kirkwood; best oil at 1630 feet   |
| 1605                  | —1166            | 35                            | not drilled     |                               | Dry hole. T. D. 1641 feet   |
| absent (?)            |                  |                               | 1860            | 10                            | Dry hole. Show of gas 1860-1862 feet; salt water 1862-1870 feet. T. D. 1900 feet  |
| absent (?)            |                  |                               | 1842            | 4                             | Oil production from McClosky  |
| no record             |                  |                               | no record       | 20                            | Dry hole. No water in Kirkwood. T. D. 1990 feet   |
| absent (?)            |                  |                               | 1852            | 12                            | Dry hole: sand logged as Kirkwood at 1730 is probably Tracy; water and show of oil; McClosky sand dry, good texture. T. D. 1913 feet. |
| 1693                  | —1231            | 67                            | 1905            | 74                            | Oil production from McClosky  |
| 1719                  | —1236            | 23                            | not drilled     |                               | Oil production from Kirkwood  |
| not yet drilled       |                  |                               | not drilled     |                               | Show of oil in Bridgeport—drilling  |

they have been omitted from the map. The Barnett farm is in the NE.  $\frac{1}{4}$  of sec. 7.

feet over the entire field. It is clearly not a single bed everywhere. It is rather a zone in the upper part of the Ste. Genevieve formation, in which here one, there another, bed carries the oil, the porosity of the rock being evidently the controlling factor. Within this zone, which has a maximum observed thickness of 80 feet, one to three oil-bearing horizons are reported. In nearby wells it is not uncommonly found that in one well the upper porous zone is productive; in another the lower. . . . The McClosky oil is green, with a large sulphur content, and its gas has a rank odor."

#### TRACY SAND

The Tracy sand is intermediate in position between the McClosky and the Kirkwood sands. It has been defined as "a soft, calcareous sandstone, in the lower part of the Chester group, which lies on the average from 100 to 118 feet above the upper productive horizon of the McClosky sand."<sup>5</sup> The Tracy sand has not been reported in any of the wells in the area, but a comparison of the sand record of the Titus et al., Des Boeuf No. 1 well (SE. corner sec. 7) (fig. 5, map No. 3) with the log of the Hunt et al., Des Boeuf No. 1 well in sec. 18 (fig. 5, map No. 21) strongly suggests that the sand called McClosky in the former well is in reality the Tracy sand, and that the McClosky sand has not yet been tested in the SE. corner sec. 7. A smell of oil was reported in the (probable) Tracy sand. The Tobias Ramsey No. 1 well in the south part of sec. 18 (fig. 5, map No. 20) had a show of oil in a sand which has the approximate stratigraphic position of the Tracy.

#### KIRKWOOD SAND

The Kirkwood is the most prolific sand in the Lawrence County field. It lies on the average 200 to 230 feet above the upper lens of the McClosky sand. Rich says:<sup>6</sup>

"In several localities within the (Vincennes) quadrangle the Kirkwood sand is lenticular, having in many places two and even three lenses. In some places the lower, in others the upper, beds are developed. The thickness of the sand also varies greatly, ranging from 0 to 100 feet. The average thickness has been computed by Blatchley to be 33 feet. Owing to irregular thickening and thinning both the top and the bottom of the sand bed or beds are irregular. On account of this irregularity and of the replacing of one lens here and there by another higher or lower in the series, contours drawn on the top of the Kirkwood sand show many irregularities which should not be interpreted as structural features of the rock formations as a whole. The contours do, however, represent with the greatest attainable accuracy the

<sup>5</sup> Rich, J. L., op. cit., p. 160.

<sup>6</sup> Rich, J. L., op. cit., p. 160.

elevation at the various localities of the upper sand of the Kirkwood horizon."

"The Kirkwood sand is a medium, fine-grained sand often called the 'sugar' sand because it resembles brown sugar in the churn-drill samples. . . . The . . . oil is generally considered sweet oil which is more free from sulphur than is the oil from the lower sand."

Several of the wells in the area (table 3, well No. 4 and fig. 5, map Nos. 6 and 21) had about 65 feet of Kirkwood sand, divided approximately in the middle by a "break" of 4 to 12 feet of shale. In southeastern Lawrence County the part above the shale is generally oil-bearing and the part below is water-bearing.

#### PENNSYLVANIAN SANDS

The Buchanan sand which lies at the base of the Pottsville formation is invariably water-bearing in the area. The Bridgeport sand, also in the Pottsville formation but about 250 feet above the Buchanan, is generally water-bearing, but in at least one well in the area, the Shelton Oil and Gas Company, Des Boeuf No. 2 in sec. 18 (fig. 5, map No. 23), it had a considerable show of oil.

#### RECENT DEVELOPMENT

The Shelton Oil and Gas Company drilled two wells on the Des Boeuf farm in sec. 18 in 1928. The first of these (fig. 5, map No. 22) had a show of oil in a sand from 905 to 920 feet and had an initial production of 35 barrels per day natural in the Kirkwood sand from 1719 to 1742 feet. It was shot with 40 quarts of nitroglycerin and apparently the shot penetrated the lower, water-bearing part of the Kirkwood sand for water came in in considerable quantity and the well produced only 3 or 4 barrels of oil a day. After being cleaned out the well produced a steadily increasing amount of oil. The second well (fig. 5, No. 23) produced at an initial rate of 24 barrels per day from the Bridgeport sand, from 1012 to 1025 feet. After shooting with 40 quarts of nitroglycerin water came in and oil production stopped. The well is to be deepened to the Kirkwood or possibly to the McClosky sand.

A well drilled in 1922 on the Des Boeuf farm in sec. 18 (fig. 5, map No. 21) had an initial production of 9 barrels a day from the McClosky sand. Since then it has produced steadily and is now making 5 barrels a day. The following is the driller's log of this well:

<sup>1</sup> Blatchley, R. S., Unpublished data, quoted by Rich, J. L., *op. cit.*, p. 161.

Log of Hunt et al. Des Boeuf well No. 1, sec. 18, T. 2 N., R. 11 W.

(Elevation 462 feet)

|                                | Thickness<br>Feet | Depth<br>Feet |
|--------------------------------|-------------------|---------------|
| Soil .....                     | 6                 | 6             |
| "Slate", blue .....            | 14                | 20            |
| Gravel .....                   | 1                 | 21            |
| "Slate", blue .....            | 21                | 42            |
| Sand .....                     | 53                | 95            |
| "Slate" and coal (water).....  | 5                 | 100           |
| Sand .....                     | 63                | 163           |
| "Slate", blue .....            | 77                | 240           |
| Lime, soft .....               | 10                | 250           |
| "Slate", black, soft.....      | 9                 | 259           |
| Lime, hard .....               | 13                | 272           |
| "Slate", blue, soft.....       | 12                | 284           |
| Lime, hard .....               | 6                 | 290           |
| "Slate", white .....           | 4                 | 294           |
| Lime, soft .....               | 14                | 308           |
| "Slate", black .....           | 28                | 336           |
| Lime .....                     | 10                | 346           |
| "Slate", light .....           | 62                | 408           |
| Coal .....                     | 2                 | 410           |
| Lime .....                     | 2                 | 412           |
| "Slate", light .....           | 13                | 425           |
| "Slate", dark .....            | 10                | 435           |
| Sand .....                     | 34                | 469           |
| "Slate", black .....           | 38                | 608           |
| "Slate", white .....           | 7                 | 615           |
| Lime .....                     | 20                | 635           |
| "Slate", light .....           | 75                | 710           |
| "Slate", black .....           | 15                | 725           |
| "Slate", light .....           | 10                | 735           |
| "Slate", dark .....            | 35                | 770           |
| Sand .....                     | 30                | 800           |
| "Slate", black .....           | 5                 | 805           |
| Lime .....                     | 10                | 815           |
| "Slate", light .....           | 55                | 870           |
| Sand, white, soft (water)..... | 20                | 890           |
| "Slate" .....                  | 8                 | 898           |
| Sand .....                     | 28                | 926           |
| "Slate", white .....           | 4                 | 930           |
| "Slate", black .....           | 13                | 943           |
| Lime .....                     | 6                 | 949           |
| Sand (oil) .....               | 11                | 960           |
| Lime .....                     | 12                | 972           |
| Sand (water) .....             | 45                | 1017          |
| "Slate" .....                  | 5                 | 1022          |
| Lime .....                     | 2                 | 1024          |
| Sand .....                     | 15                | 1039          |



*Log of Hunt et al. Des Boeuf well No. 1, sec. 18, T. 2 N., R. 11 W.—Concluded*

|                        | Thickness   | Depth       |
|------------------------|-------------|-------------|
|                        | <i>Feet</i> | <i>Feet</i> |
| "Slate" .....          | 16          | 1055        |
| Sand (water) .....     | 28          | 1083        |
| "Slate" .....          | 2           | 1085        |
| Sand (water) .....     | 27          | 1112        |
| "Slate" .....          | 12          | 1124        |
| Lime .....             | 3           | 1127        |
| "Slate" .....          | 38          | 1165        |
| Sand (water) .....     | 15          | 1180        |
| "Slate", black .....   | 80          | 1260        |
| "Slate", light .....   | 10          | 1270        |
| Lime, light .....      | 3           | 1273        |
| "Slate" .....          | 22          | 1295        |
| Lime .....             | 3           | 1298        |
| Sand (water) .....     | 24          | 1322        |
| "Slate", dark .....    | 5           | 1327        |
| Lime .....             | 13          | 1340        |
| "Slate" .....          | 8           | 1348        |
| Lime and sand.....     | 27          | 1375        |
| Sand (water) .....     | 23          | 1398        |
| "Slate" .....          | 10          | 1408        |
| Sand .....             | 67          | 1475        |
| Lime, brown, hard..... | 15          | 1490        |
| Lime, blue .....       | 68          | 1558        |
| Sand .....             | 65          | 1623        |
| "Slate" .....          | 24          | 1647        |
| Lime, hard .....       | 14          | 1661        |
| "Slate" .....          | 19          | 1680        |
| Lime .....             | 13          | 1693        |
| Kirkwood Sand .....    | 29          | 1722        |
| "Slate" .....          | 2           | 1724        |
| Sand (water) .....     | 36          | 1760        |
| "Slate" .....          | 6           | 1766        |
| Sand, broken .....     | 6           | 1772        |
| Lime .....             | 21          | 1793        |
| Sand .....             | 40          | 1833        |
| "Slate" .....          | 9           | 1842        |
| Lime, hard .....       | 8           | 1850        |
| Shale, red .....       | 3           | 1853        |
| Lime .....             | 5           | 1858        |
| "Slate" .....          | 3           | 1861        |
| Lime .....             | 5           | 1866        |
| "Slate" .....          | 2           | 1868        |
| Lime .....             | 17          | 1885        |
| Small show oil.....    |             | 1856-1881   |
| "Slate" .....          | 4           | 1889        |
| Lime .....             | 16          | 1905        |
| McClosky Sand .....    | 74          | 1979        |

**Correlation:** The base of the Pennsylvanian system is probably at 1475 feet; the base of the Chester series is somewhere between 1853 and 1905 feet. Identification of sands was made by driller.

A new well is being drilled by Bolton and others on the Des Boeuf farm 100 feet west and 770 feet north of the SE. corner sec. 7 (fig. 5, map No. 11).

#### PROSPECTS FOR NEW PRODUCTION

In view of the steady production for six years from the McClosky sand in the Hunt et al. Des. Boeuf well in sec. 18 (fig. 5, map No. 21), and of the probable rise of this formation to the north, prospects for McClosky production in most of the SE.  $\frac{1}{4}$  sec. 7 appear to be good if the sand continues porous. As it is probable that the McClosky sand was not tested in the Titus et al. Des Boeuf well (fig. 5, map No. 3) there is a possibility that McClosky production may be extended eastward into the SW.  $\frac{1}{4}$  sec. 8.

As commercial production from the Kirkwood sand was found in the Shelton Oil and Gas Company Des Boeuf No. 1. (fig. 5, map No. 22), and "rich black oil" was reported in this sand in the Titus et al. Des Boeuf No. 1 (fig. 5, map No. 3), there appear to be good prospects for Kirkwood production in the same territory (SE.  $\frac{1}{4}$  sec. 7 and SW.  $\frac{1}{4}$  sec. 8) where the Kirkwood sand rises to the north.

The presence of the terrace in the SW.  $\frac{1}{4}$  sec. 7 and the NW.  $\frac{1}{4}$  sec. 18 suggests the possibility that Kirkwood or McClosky production or both might be extended westward from the producing wells in sec. 18.

In developing Kirkwood production in this area care should be taken not to penetrate the water-bearing sand below the shale break. Because of the risk of breaking into the water sand it is not considered advisable to shoot the upper part of the sand if commercial production can be obtained without shooting.