Press Bulletin Series

Issued Twice Quarterly

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
A. M. SHELTON, *Director*

DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief, Urbana*

No. 6 **ILLINOIS PETROLEUM** December 4, 1926

THE SORENTO DOME

By Alfred H. Bell

Introduction

All but one of the known oil and gas fields of southwestern and south-central Illinois lie within a rectangle 70 miles long and 18 miles wide, extending in a northwesterly direction from Centralia to Carlinville. (See fig. 1.) Practically without exception they are situated upon, or are closely related to, well-defined anticlinal structures. In order to reduce as much as possible the risk involved in prospecting for oil in this territory, drilling should be preceded by (1) a search for favorable structures hitherto unknown and (2) a reconsideration of the data relating to known favorable structures. This paper gives briefly the results of a restudy of the Sorento dome in parts of Madison, Montgomery and Bond counties.

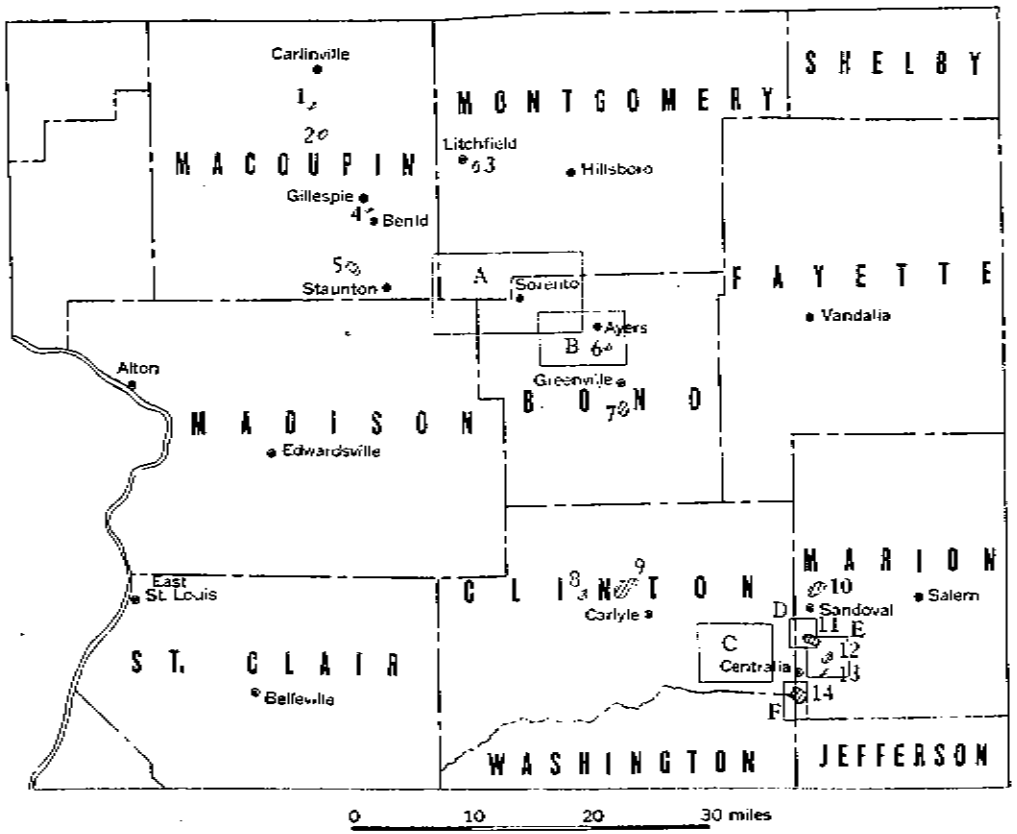
In a former publication[1] the dome was represented by contours indicating the elevation above sea level of Herrin (No. 6) coal and having an interval of 50 feet; it is here represented in greater detail by contours on the same key bed having a 10-foot interval. A restudy of the data has shown that what has been known as the "Sorento dome" really consists of two parts. In this report these will be referred to as the New Douglas dome, which centers about a well in NE. ¼ sec. 10, T. 6 N., R. 5 W., and the Panama anticline which lies about 1 mile west-southwest of Panama.

Stratigraphy

An outline of the stratigraphic section for the Sorento dome area is given in table 1. The data have been taken partly from the column given by Wallace Lee[2] and have been partly compiled from a study of well logs. It will be noted that there is considerable disagreement between the pre-Mississippian section as interpreted in this report and the section given by Lee.

[1] Blatchley, R. S., Oil and gas in Bond, Macoupin, and Montgomery counties, Illinois: Illinois State Geol. Survey Bull. 28, Pl. II, 1914.

[2] Lee, Wallace, U. S. Geol. Survey Geol. Atlas, Gillespie-Mount Olive folio (No. 220), p. 3, 1926.



A—Fig. 2, Illinois Petroleum No. 6

B—Fig. 5, Illinois Petroleum No. 5, p. 17

C—Fig. 2, Illinois Petroleum No. 5, p. 9

D—Fig. 1, Illinois Petroleum No. 5, p. 3

E—Fig. 2, Illinois Petroleum No. 4, p. 8

F—Fig. 3, Illinois Petroleum No. 4, p. 11

1—Carlinville oil and gas field
2—Spanish Needle Creek gas field
3—Litchfield oil and gas field
4—Gillespie-Benld gas field
5—Staunton gas field
6—Ayers gas field
7—Lindly gas field
8—Frogtown oil field
9—Carlyle oil field
10—Sandoval oil field
11—Junction City
12—Langewisch-Kuester
13—Brown
14—Wamac
Centralia oil fields

Fig. 1. Index map showing locations of oil and gas fields in part of southwestern Illinois and of the areas mapped in Illinois Petroleum Nos. 4, 5, and 6. (By A. H. Bell, State Geological Survey.)

TABLE 1.—*General stratigraphy of the Sorento dome area*

Era	System	Formation or series	Thickness *Feet*	Estimated depth to top *Feet*	Lithologic character
Cenozoic	Pleistocene and Recent		0 to 150	.....	Alluvium, gumbo, till, and interglacial soil.
	Unconformity				
Paleozoic	Pennsylvanian	McLeansboro.....	200 to 350	.....	Shale and sandstone with thin beds of limestone and coal.
		Carbondale.....	215 to 270	285	Shale and sandstone with thin beds of limestone. Herrin (No. 6) coal at top; Murphysboro (No. 2) coal at bottom.
		Pottsville.....	100 to 150	510	Sandstone and shale with a coal bed in upper part.
	Unconformity				
	Mississippian	Chester.....	80 to 125	610	Limestone, sandstone, and shale red in part.
		Meramec-Osage ("Mississippi lime") { Ste. Genevieve (?) / St. Louis	530 to 680	690	Pure, light gray limestone in part oolitic, sandstone and some shale.
		Kinderhook.....	400 to 520	1230	Chiefly shale, some limestone.
	Mississippian or Devonian	Sweetland Creek.....	40 to 60	1750	Black or chocolate brown shale.
	Devonian-Silurian	.....	490 to 510	1810	Limestone.
	Unconformity				
	Ordovician	Maquoketa.....	180 to 200	2310	Shale.
		Kimmswick-Plattin ("Trenton").....	520	2510	Limestone.
		St. Peter.....	140	3030	Sandstone.
		Shakopee.....	310	3170	Flinty and cherty dolomite and sandstone.

The log of the Mark Flitz well, in sec. 24, T. 8 N., R. 5 W.,[3] was compared with the logs of two other deep wells—the Varner well, sec. 3, T. 8 N., R. 5 W., and the Clint Bliss well, sec. 9, T. 8 N., R. 3 W. The comparison indicates that the strata which Lee correlated as Maquoketa in reality include the Sweetland Creek shale and a portion of the Kinderhook. The St. Peter sandstone was not reached in the Mark Flitz well which finished in the Kimmswick-Plattin limestone, 315 feet below its top.

In drilling wildcat wells, the efficiency of drilling is limited by a lack of knowledge of the depth and exact character of the beds to be penetrated. Lateral variations in thickness and lithologic character of the strata as well as the dip of the strata are the factors to which this lack of knowledge is due. In order to minimize the difficulty, an estimated depth to the top of each formation which would be encountered in a well drilled near the top of the New Douglas dome is included in the stratigraphic table. The estimated depths are based on the logs of several wells, of which the deeper ones are located farther from the top of the structure than are the shallower ones; consequently they are likely to be more nearly correct for the upper than for the lower formations. Thus the deepest well in the area, which reached approximately the base of the Osage, is located on the Smith farm, sec. 15, T. 7 N., R. 5 W.,[4] 4 miles north of the top of the structure. The nearest well that reached the Kimmswick-Plattin ("Trenton") is 9 miles north; the nearest well that reached the St. Peter sandstone is 16 miles northeast.

Structure

Structure is represented on the accompanying contour map (fig. 2) by contours which give the elevation above sea level of Herrin (No. 6) coal or, in case this coal is absent, of its probable stratigraphic horizon as inferred from the correlation of other beds. Table 2 gives the data on which the contours are based. On account of the superior information given by core drilling, the logs obtained can in most cases be readily correlated with each other and it is believed that considerable reliance can be placed on structure maps which are based on such logs in areas where the wells are relatively closely spaced. The logs of the churn drill wells in this area, on the other hand, are not easily correlated with each other or with the logs of diamond drill coal test wells. They have, therefore, not been considered in the construction of the accompanying map (fig. 2). The elevations of wells in T. 6 N. were determined by stadia survey by the writer's party with the exception of the wells in secs. 23 and 24, T. 6 N., R. 5 W., and sec. 20, T. 6 N., R. 4 W., for which the elevations were determined by aneroid. The elevations of the wells in T. 7 N. and in sec. 2, T. 6 N., R. 4 W., were

[3] Lee, Wallace, op. cit., p. 3.

[4] For the log of this well, see Lee, Wallace, op. cit., p. 3.

taken from various sources and, with very few exceptions, they had been obtained originally by stadia survey.

The map shows the two rather distinct parts of the Sorento dome referred to in the introduction to this report. The top of the New Douglas dome lies approximately in sec. 10, T. 6 N., R. 5 W.; the highest part of the Panama anticline lies west-southwest of Panama (sec. 22, T. 7 N., R. 4 W.). It is probable that a continuous anticlinal axis connects these two structural highs.

The determination of the entire upper part of the structure of the New Douglas dome depends on the interpretation of the log of one well (Map No. 25, Ameling No. 4, sec. 10, T. 6 N., R. 5 W.) and this log shows the absence of Herrin (No. 6) coal, the bed on which the contours of figure 2 are drawn. In order to determine the stratigraphic horizon of this key bed, a cross-section of two wells (Nos. 25 and 19) and one mine shaft (No. 27) was drawn (fig. 3). The evident correlation of the other beds, as shown in the cross-section, places the horizon of the top of the coal very definitely as indicated and there seems to be little room for doubt as to the accuracy of this interpretation.

Figure 3 shows a dip of more than a hundred feet from well No. 25 to the mine and the dips from the center of the structure in all directions except to the northwest (as shown in figure 2) appear to be fairly well authenticated.

Development

Six churn drill wells have been drilled in the area, of which all but two were unfavorably located with respect to structure. Each of the other two was within a mile of the anticlinal axis (sec. 20, T. 7 N., R. 4 W., and sec. 35, T. 7 N., R. 5 W.). Only a very incomplete record of the latter is available. It gives Herrin (No. 6) coal from 325 to 332 feet and sand from 610 to 700 feet; the sand is probably Pottsville. The first well has the following sand record:

	Feet	
Sandy shale	325 to 370	
Sand	660 to 690	(probably Pottsville)
Sandy shale	690 to 710	
Sandy shale	736 to 765	

The St. Louis limestone ("Mississippi lime") was topped at 765 feet. The casing record was as follows:

10-inch	20 feet
8¼-inch	402 feet
6⅝-inch	695 feet

A well in sec. 15, T. 7 N., R. 5 W., had a showing of gas in a sand at 586 feet and a showing of oil lower in the same sand from 584 to 618 feet.

TABLE 2.—*Well data from Sorento Dome area*

[a] Map No.	Company	Well No.	Surface Elevation *Feet*	No. 6 coal	
				Depth *Feet*	Elevation *Feet*
1	Whitebreast Fuel	I	611	458	153
2	Whitebreast Fuel	M	519	360	159
3			591	377	214
4	Whitebreast Fuel	E	527	295	232
5	Whitebreast Fuel	F	525	353	172
6	Shoal Creek Coal		538	374	164
7	Whitebreast Fuel	1	563	446	117
8	Whitebreast Fuel	L	609	459	150
9	Lumaghi Coal	10	593	387	206
10	A. W. Crawford	20	522	294	228
11	Sorento Coal		585	384	201
12	Lumaghi Coal	7	584	400	184
13	Lumaghi Coal	26	595	415	180
14			650	390	260
15			640	395	245
16	Lumaghi Coal	1	600	364	236
17	Lumaghi Coal	5	582	373	209
18	Lumaghi Coal	4	589	373	216
19	Sorento Options	22	589	351	238
20	Lumaghi Coal		590	340	250
21	Wilmington Star Coal		585	342	243
22	H. R. Ameling	6	592	357	235
23	H. R. Ameling	9	591	334	257
24	H. R. Ameling	15	613	356	257
25	H. R. Ameling	4	580	285	295
26	H. R. Ameling	1	577	374	203
27	Big Mound Coal		605	415	190
28	H. R. Ameling	16	609	372	237
29	New Staunton Coal	10	609	370	239
30	H. R. Ameling	7	572	347	225
31	New Staunton Coal	13	566	332	234
32	New Staunton Coal	11	600	396	204
33	H. R. Ameling	20	596	400	196
34	H. R. Ameling	8	591	397	194
35	Schallenberg		614	437	177
36	H. R. Ameling	3	565	370	195
37	Whitebreast Fuel	H	511	362	149
38	Duncan	3	577	441	136
39	Sullivan Machinery	1	576	444	132
40	Shoal Creek Coal	2	574	443	131
41	Consolidated Coal	2	506	363	143
42	Consolidated Coal	1	528	378	150

[a] See figure 2 for locations.

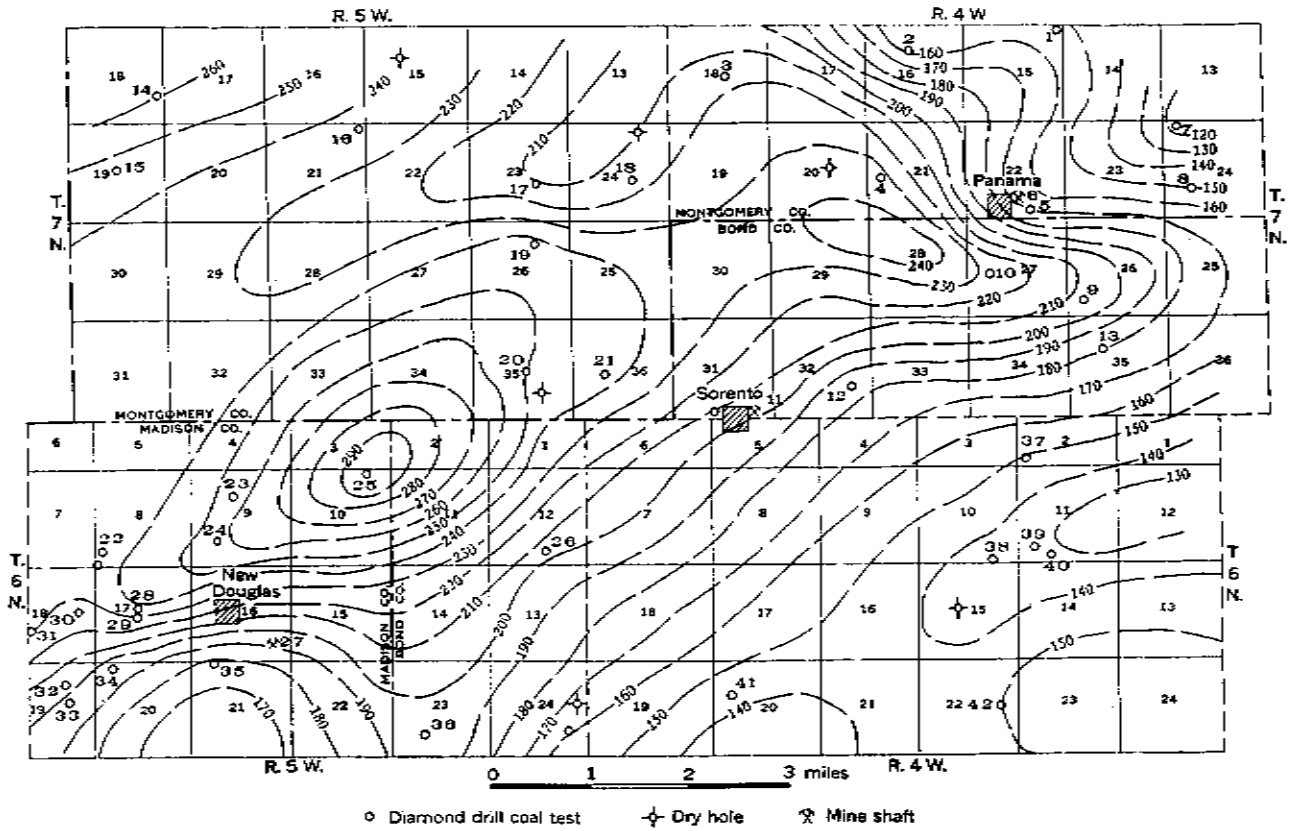


Fig. 2. Structure map of Sorento dome area with contours drawn on top of Herrin (No. 6) coal. See table 2, p. 6, for well data. (By A. H. Bell, Illinois State Geological Survey.)

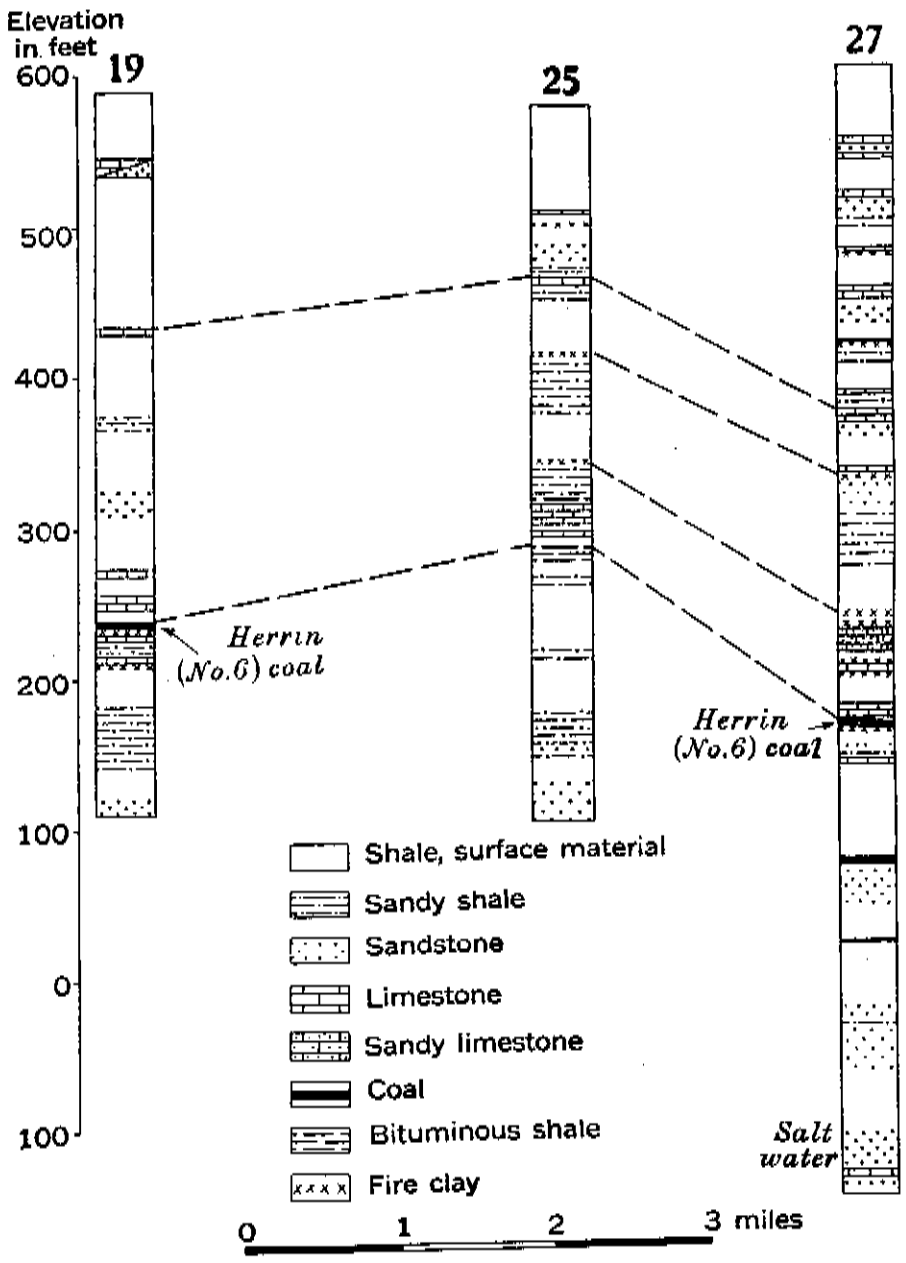


Fig. 3. Cross-section through New Douglas dome. See fig. 2 for locations of wells and mine shaft. (By A. H. Bell, Illinois State Geological Survey.)

This sand probably belongs in the Pottsville and may be contemporaneous with the producing sand of the Staunton gas field.

RECOMMENDATIONS

The most important oil production in southwestern Illinois is from sands of Chester age, and the probability of the presence of Chester sands over the New Douglas dome is a favorable feature from the point of view of the oil prospector.

A study of the logs shows that Chester rocks are present in all the wells shown on the map that have been drilled to a sufficient depth and it is therefore highly probable that the Chester is present on top of the New Douglas dome. The following table lists these wells with the thickness of Chester found in each:

TABLE 3.—*Wells in Sorento Dome area penetrating the Chester*

Location			Thickness of Chester *Feet*
Section	Township N.	Range W.	
15	7	5	80
24	7	5	80
20	7	4	80
24	6	5	125
15	6	4	record incomplete

It should be added, however, that from general studies of the surrounding region, the Chester is known to thin out to the west and to thicken to the east. The Chester is definitely absent in the Staunton gas field, so that the western boundary of the area in which Chester rocks are present lies somewhere between the westernmost wells listed above, and the Staunton dome area—its precise location is not known. Although it is not absolutely certain, yet it is very probable that Chester rocks occur on top of the New Douglas dome.

Besides the Chester there are several other possible producing horizons. (See table 4, which lists the producing horizons in other oil and gas fields of central and western Illinois.[5]) Of these perhaps the most important is the Pottsville, since to it belong the gas sands of the Staunton and other fields to the north.

No production from rocks older than the Chester has been obtained within a radius of 50 miles. A showing of oil, variously reported from 10 to 75 barrels, was obtained in Brown No. 1, sec. 9, T. 5 N., R. 4 W., six

[5] See figure 1 for the locations of most of these fields.

miles south of Sorento. This oil was from a sand of Devonian or Silurian age at a depth of 2000 feet. The well did not make a commercial producer and a number of dry holes were drilled in the vicinity.

It seems probable that once the top of the St. Louis limestone is reached the most likely oil-bearing strata have been penetrated. The advisability of deeper drilling is open to question. If it is desired to test the structure very thoroughly, drilling might be continued to the top of the Kimmswick-Plattin

TABLE 4.—*Producing horizons in central and western Illinois oil and gas fields*

Depth *Feet*	Horizons	Remarks
285	1. Pennsylvanian sands below Herrin (No. 6) coal	Produce oil at Junction City and Wamac; oil and gas at Carlinville; gas at Staunton.
610	2. Chester	Oil at Frogtown, Carlyle, Sandoval and Centralia; gas in Bond County, (1) Ayers, and (2) Lindly.
690	3. Ste. Genevieve (upper part of "Mississippi lime"); correlated with "McClosky sand"	Oil in Lawrence County.
1810	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.
2510	6. Ordovician: Kimmswick-Plattin limestone ("Trenton limestone")	Oil at Waterloo.

("Trenton"). The possibility of oil in commercial quantities at still greater depth is decidedly remote.

On the whole it seems a better procedure to drill only into the St. Louis ("Mississippi lime") and if the first test to this depth is unsuccessful to drill the structure in another place in the hope of finding more favorable sand conditions. Further testing would be especially desirable if encouraging showings are found in the first test.

Assuming that an oil sand exists in the region having a structure similar to that shown for Herrin (No. 6) coal, the most probable location of oil pools therein is in the upper parts of the New Douglas dome and the Panama anticline. On account of the lack of proof for any reverse dip the Panama anticline does not seem to be as favorable a structure for oil accumulation as the New Douglas dome, but at the same time it should be noted that because of the lack of drilling, the structure in the area to the west of the Panama anticline is not well known. If production is secured from the New Douglas dome it would be desirable to test the Panama anticline as well, making a location not far from its summit as shown in figure 2 (sec. 28, T. 7 N., R. 4 W.).

If, however, oil sands exist in the region in those lower strata which are separated from Herrin (No. 6) coal by one or more important unconformities, the relations of the possible oil pools to the structure of Herrin (No. 6) coal are not likely to be so simple. This was found to be true for the Langewisch-Kuester and Brown pools east of Centralia where the production, coming from a sand in the lower part of the Chester, is found on the slopes of the anticlinal structures in Herrin (No. 6) coal.[6] Hence, the possibilities of production in a region cannot be said to be exhausted even when the upper parts of the anticlines in Herrin (No. 6) coal have been tested.

At the present time definite recommendations based on adequate knowledge of the structure of pre-Pennsylvanian strata in southwestern Illinois in general and in the Sorento dome area in particular cannot be made. In the future, as knowledge of these deeper strata gradually accumulates, and as more accurate data are obtained from more carefully kept logs, the geological guidance of oil prospecting will be of greater service than is at present possible.

Conclusions

The New Douglas dome is a structure with more than the usual amount of closure, situated in a region in which oil and gas have been produced from structures having less closure. The upper part of the structure has not yet been tested for oil. The presence of a number of sands of Pennsylvanian age upon the dome has been demonstrated, and it is probable that Mississippian sands are also present. In view of (1) the unusually favorable structure, and (2) the presence of possible reservoir sands, it is recommended that one or more test wells be drilled in this area.

[6] Bell, A. H., Oil investigations in the Centralia area—preliminary report: Illinois State Geol. Survey Press Bulletin Series, Illinois Petroleum No. 4, pp. 6-10, August 28, 1926.