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DEVELOPMENT IN EASTERN INTERIOR BASIN IN 1940[1]

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Introduction

Drilling activity, both for exploration and for development of existing oil pools, reached a new peak in the Eastern Interior basin during 1940, when 4,680 wells were completed, 3,829 in Illinois, 450 in southwestern Indiana, and 401 in western Kentucky. Total oil production from the basin for the year was approximately 154,796,000 barrels as compared with approximately 99,922,000 barrels in 1939, an increase of 55 per cent.

The 1940 production of oil from the Eastern Interior basin was nearly equivalent to that of Oklahoma (155,952,000 barrels) and amounted to about 11.5 per cent of the United States total, of which nearly 11 per cent was from Illinois alone.

New oil pools discovered in 1940 in the Eastern Interior basin number 36, of which 30 are in Illinois, 5 are in Indiana and one is in Kentucky. Figure 1 is an index map showing the extent of the basin and the areas mapped in Figures 2 and 3.

For further statistical information the reader is referred to the annual Transactions of the A.I.M.E. Petroleum Division for 1941.[2]

The present paper is an attempt to summarize in a preliminary way some of the geologic data revealed by the new drilling.

Exploratory Drilling

During 1940, 523 wells classified as wildcats were drilled in Illinois, of which 48 or 9 per cent were successful in obtaining production, 30 discovering new pools, and 18 discovering extensions to known pools. Wildcat wells were drilled in 64 of the 102 counties of the state. They ranged in location from DeKalb County on the north to Massac County on Ohio River on the south and from Adams County on Mississippi River on the west to the border counties on the Indiana line on the east. More than 90 per cent of the wildcat wells were located in the southern half of the state; 235 or 45 per cent were in the 15 counties[3] located in the deep part of the basin, whereas 189 or 36 per cent were located in 15[4] of the 16 counties immediately adjacent. It is of interest to note that 22 of the 30 new pools and 12 of the 18 extensions were in the 15 deep-basin counties, the remaining 8 new pools and 6 extensions being confined to 7 of the 16 adjacent counties.

Clinton County, one of the counties bordering the west side of the deep-basin area, had the largest number of wildcats—46—but these discovered only one new pool which is of minor importance and one extension. White County, in the deep-

[1] Reprinted from the *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, No. 6, pp. 1114-1124, 1941.

[2] Alfred H. Bell and George V. Cohee, "Oil and Gas Development in 1940", Trans. A.I.M.E., Vol. 142, pp. 274-298, 1941; Illinois Geol. Survey Ill. Pet. No. 37.

[3] Clay, Cumberland, Edwards, Effingham, Fayette, Franklin, Hamilton, Jasper, Jefferson, Marion, Richland, Shelby, Wabash, Wayne, White.

[4] Bond, Christian, Clark, Clinton, Coles, Crawford, Gallatin, Jackson, Lawrence, Macon, Montgomery, Perry, Saline, Washington, Williamson.

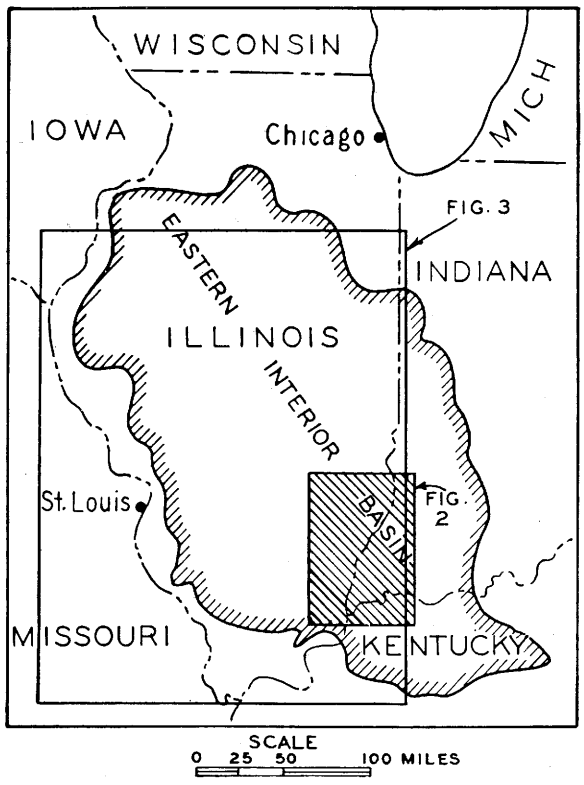


FIG. 1.—Index map of Eastern Interior basin and areas shown in Figures 2 and 3.

basin area, had the second largest number of wildcats—39—and the largest number of new discoveries—6 new pools and 6 extensions.

GEOLOGIC AGE OF PRODUCING FORMATIONS

In spite of the rapid development of Devonian limestone production during the first half of 1940, the Mississippian system continues to be by far the most important source of oil in the Eastern Interior basin. It is estimated that the Devonian limestone produced about 26 per cent of Illinois' production in 1940. The total from the Pennsylvanian and Ordovician systems was probably less than 2 per cent so that 72 per cent of the total was from the Mississippian.

No new areas of Devonian limestone production were discovered in 1940 and the proved areas in the five Devonian pools in western Illinois were almost completely drilled up during the first half of the year. Planimeter measurements indicate the following productive areas in the Devonian as of December 31, 1940.

Pools	*Acres*
Sandoval	380
Salem	5,000
Tonti	21
Centralia	2,200
Bartelso	230
Total	7,831

It is of interest to note that the actual productive acreage found for the Devonian in the Salem pool is identical with that estimated a year ago.[5]

Only one of the 48 discovery wells in Illinois found production in the Devonian; this was an extension of the Bartelso pool. The McClosky oölitic limestone (in the Fredonia member of the Ste. Genevieve formation, lower Mississippian series) was the producing formation in 27 of the 48 discovery wells, 16 new pools and 11 extensions. Most of these new McClosky pools are in counties bordering Wabash River. One new pool, the Inman pool in Gallatin County, produces from the Rosiclare sandstone, which is also in the Ste. Geneveive formation, just above the Fredonia.

Various Chester sandstones produced oil in 10 new pools and 4 extensions, that is, the Aux Vases (basal Chester), 2 extensions; Bethel sandstone, 5 new pools, all west of the deep-basin area; Cypress sandstone, 2 new pools and 1 extension; Hardinsburg, 1 new pool; Tar Springs, 1 new pool and 1 extension; Palestine, 1 new pool. Pennsylvanian sandstone produced oil in 3 new pools and 1 extension.

A multiplicity of producing formations is especially noteworthy in the region bordering Wabash River, both in Illinois and in Indiana. This is illustrated in Figure 2. In this region the distribution of the productive areas appears to be controlled by sand conditions to a greater degree than by structure. Much work remains to be done to interpret the geologic history and occurrence of oil in this area.

[5] Alfred H. Bell., "Developments in the Eastern Interior Basin 1939 and First Quarter of 1940," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 24, No. 6 (June, 1940), p. 967.

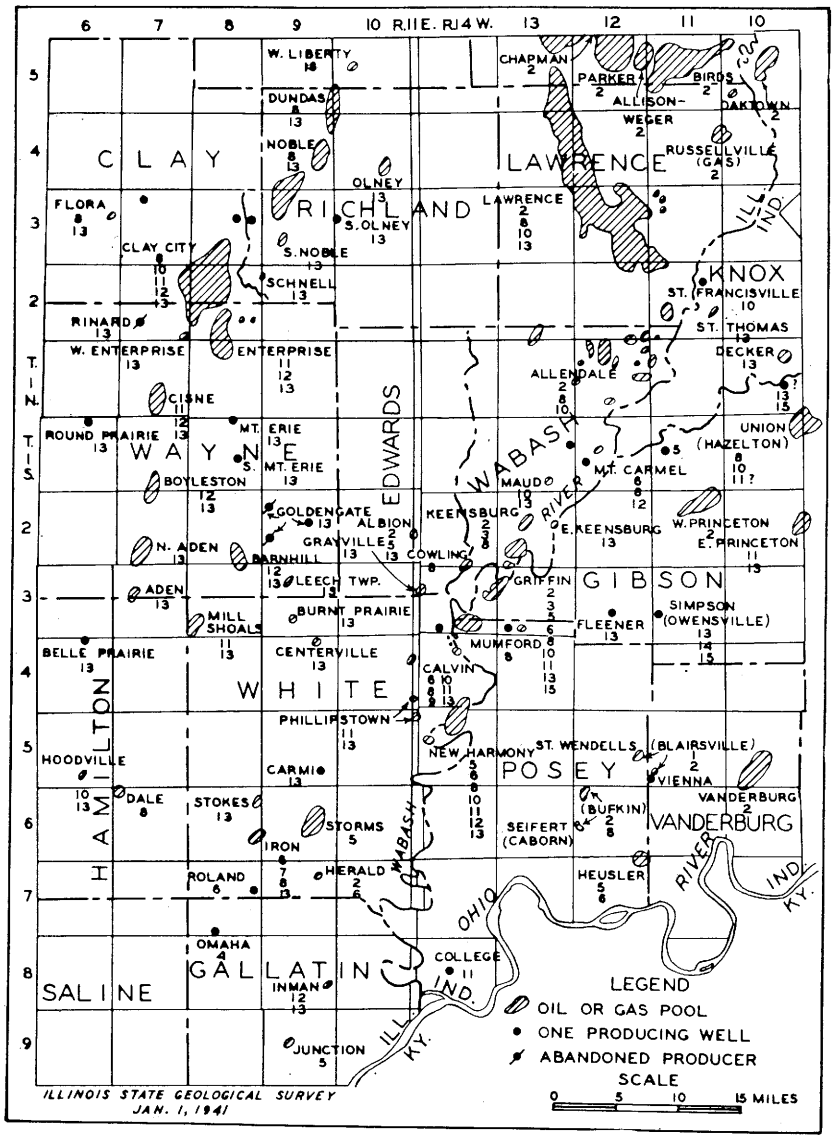


FIG. 2.—Lower Wabash River area, Illinois and Indiana, showing oil and gas pools and producing formations in each pool indicated by numbers under pool name (see table for key). Information on Indiana pools furnished by G. F. Fix, State gas supervisor, Indianapolis, J. B. Robertson, Evansville, Indiana, P. S. McClure, Shell Oil Company, Evansville, and S. G. Elder, Sun Oil Company, Evansville.

Producing Strata:	*Map No.*
Pennsylvanian system	
McLeansboro group	1
Tradewater group	2
Caseyville group	
Mississippian system	
Chester series	
Clore formation	3
Palestine formation	4
Waltersburg formation	5
Tar Springs formation	6
Hardinsburg formation	7
Mississippian System	
Chester Series (Con't.)	
Cypress formation	8
Paint Creek formation	9
Bethel formation	10
Aux Vases formation	11
Iowa series	
Rosiclare member	12
Fredonia member	13
St. Louis formation	14
Salem formation	15

Devonian Structure Map

In order to provide the latest interpretation of regional structure for Illinois for the tectonic map of the United States the writer was called on to revise the subsurface contour map of the Illinois basin on the base of the Kinderhook-New Albany shale as of January 1, 1941 (Figure 3). Some noteworthy differences between this map and that presented a year ago are: (1) three areas of closure, (a) in northern Champaign County, (b) southwestern Coles County (Mattoon area), and (c) the Louden pool area, Fayette County; (2) many more bends in the southern part of the −4,500-foot contour; and (3) much greater complication in extreme southern Illinois where the contours have been revised in accordance with the findings of J. M. Weller.[6]

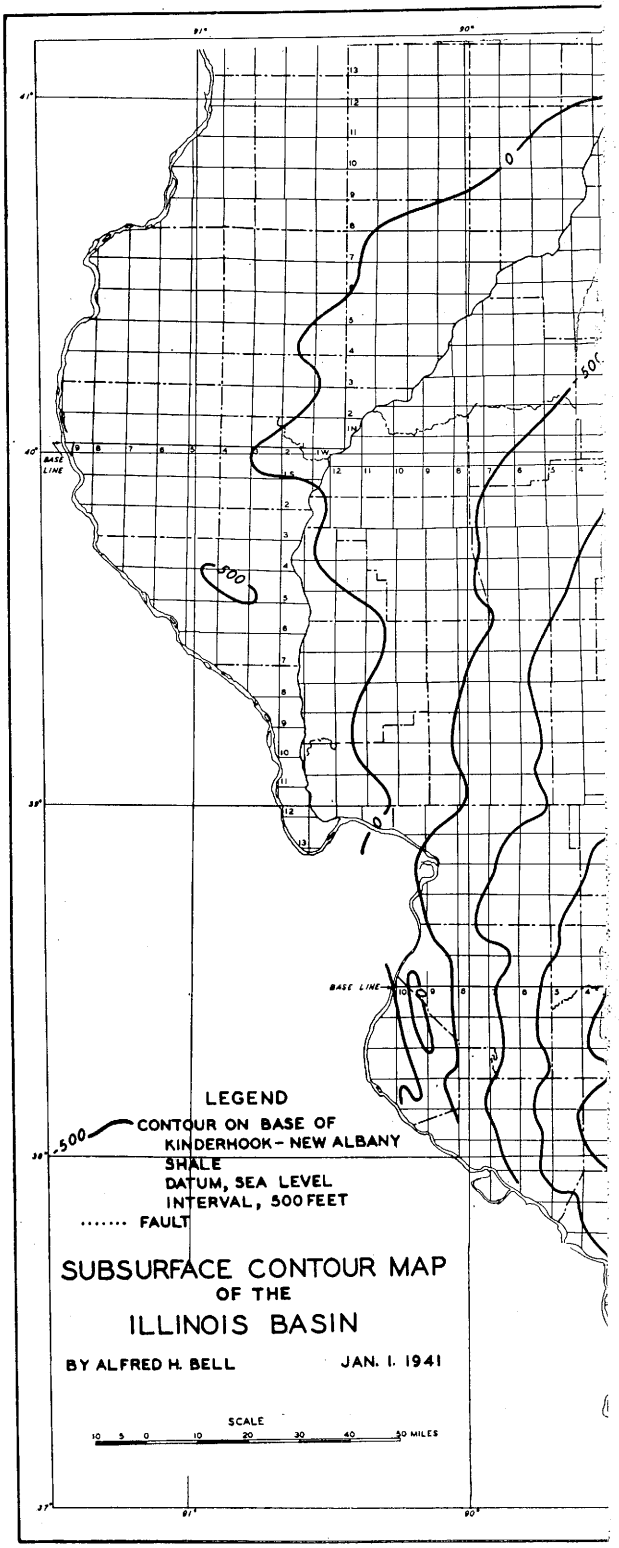
Results of Deep Testing in 1940

Oil production was discovered in the Kimmswick ("Trenton") limestone of Ordovician age in the Centralia and Salem pools in 1940, but only small initial productions were obtained in the discovery wells—100 and 130 barrels, respectively. A second Trenton well in the Centralia pool had an initial production of 74 barrels. By the end of the year production of both Trenton wells in the Centralia pool had declined greatly.

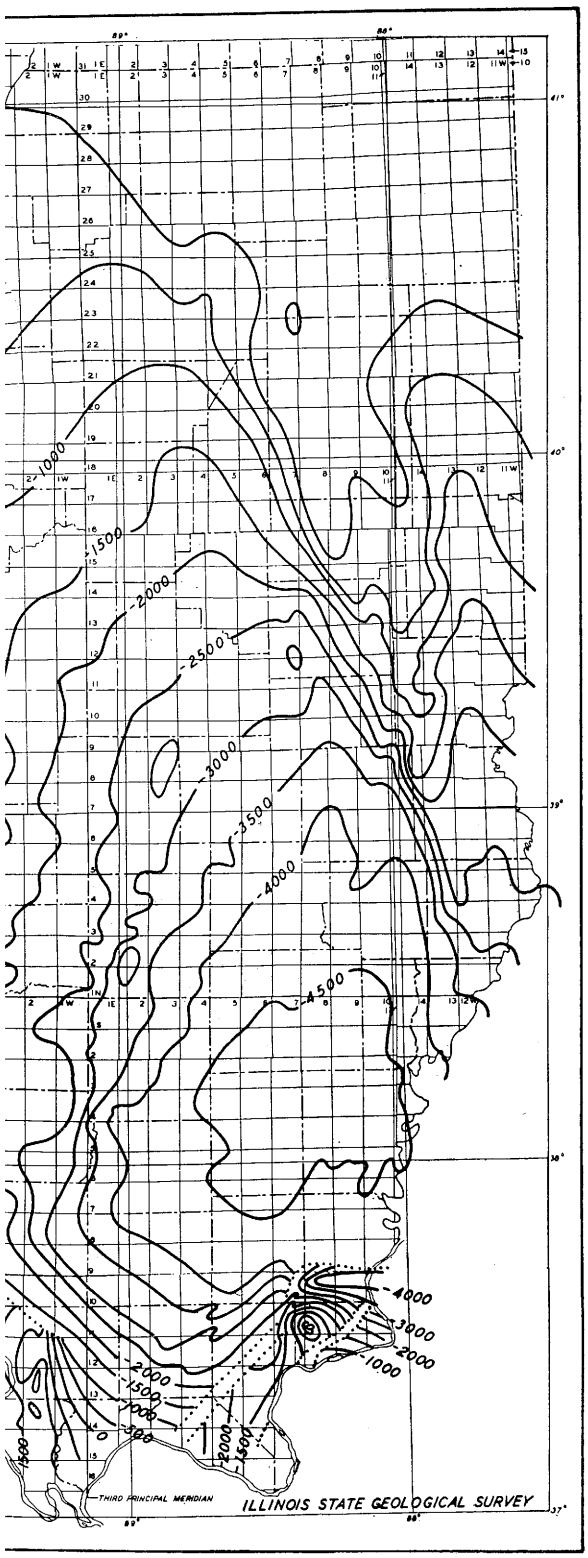
The small initial production of the Trenton discovery well in the Salem pool is not a good index to the formation's capacity to produce because at first, trouble was experienced in pumping the well at the considerable depth of 4,500 feet. Production was later brought up to about 200 barrels per day. A number of Trenton wells have been brought in in the Salem pool since January 1, 1941, but a description of them is outside the scope of this article.

The results of the few tests drilled to the St. Peter sandstone are not encouraging. The deepest of these is The Pure Oil Company's Billington well No. 3 in the Cisne pool, Wayne County, in the deep-basin area (Fig. 4, map No. 19).

[6] J. M. Weller, "Geology and Oil Possibilities of Extreme Southern Illinois," *Illinois Geol. Survey Rept. Inv.* 71 (1941).



Fig



3.

Total depth was 7,207 feet and the top of the St. Peter was at 7,114 feet. The St. Peter formation here is fine-grained compact well-cemented sandstone, with but slight porosity. In the Carter Oil Company's Seaman well No. 1, near Mattoon (total depth 4,908 feet, top of St. Peter 4,689 feet), the St. Peter is medium-grained friable porous sandstone like that found in water wells in northern Illinois. The Glenwood formation, consisting of fine-grained sandstone beds, lying just above the St. Peter, had a slight showing of oil.

Data on important deep tests completed in Illinois in 1940 are given in Table I and Figure 4.

Southwestern Indiana

The following information on developments in southwestern Indiana was furnished by G. F. Fix, State gas supervisor, Indianapolis, Indiana.

Oil and gas prospecting and drilling reached a higher peak in Indiana during 1940 than for any like period in the past decade. The amount of wildcat activity was not appreciably greater than for 1939, however, with most of the increase due to inside drilling in already proved areas, for example, the Griffin and Rockport fields. Only one new field of commercial importance was discovered during the year. This was the College pool, located in southwestern Posey County. Production is found in the Aux Vases sandstone at depths of approximately 2,600 feet, although some saturation has been found in higher Chester sandstones. Other areas discovered during the year include the following: (1) Bufkin, in central Posey County, produces chiefly from lower Pennsylvanian sands, including the basal Pennsylvanian Mansfield sandstone, and from the Cypress sandstone of Chester age. A total of 16 oil and gas wells had been completed in this field at the end of the year. (2) The St. Thomas field, in southwestern Knox County, primarily in secs. 24 and 25, T. 2, N., R. 11 W., was discovered late in the summer. Production is from the McClosky formation of the Ste. Genevieve limestone at depths of approximately 1,800 feet. Initial production from wells in this field varied from 100

TABLE 1.—IMPORTANT DEEP TESTS IN ILLINOIS IN 1940
(See Figure 4 for locations)

Map No.	*County*	*Pool*	*Location*	*Company*	*Farm No.*	*Depth, Feet*	*Deepest Formation*	*Top Feet*	*Initial Production (Bbls.)*	*Date Completed*
1	Clinton	Centralia	NW NE NE 13- 1N- 1W	Borton	Storer 1	4,120 PB 4,070	"Trenton"	4,012	100	12- 3-40
2	Clinton	Carlyle	SE NE SE 3- 2N- 3W	Schwarz	Schlafly 1	4,120	St. Peter	4,106	Dry	1- 7-41
3	Clinton	Centralia	SW NE SE 12- 1N- 1W	Ames	Hicks 2	4,068	"Trenton"	4,018	74	7- 2-40
4	Clinton	(Wildcat)	NE NE SW 17- 3N- 4W	Tatum	Schrage 1	3,549	St. Peter	3,516	Dry	7-16-40
5	Clinton	(Wildcat)	SW SE SE 33- 2N- 4W	Trumbell	Peters 1	3,305	"Trenton"	3,210	Dry	7-23-40
6	Coles	Mattoon	NW NE SW 35-12N- 7E	Carter	Seaman 1	4,908	St. Peter	4,689	Dry	5-14-40
7	Edwards	Albion	NW NE SW 19- 2S -11E	Superior Oil	Green 1	5,185	Devonian	4,907	Dry	7- 9-40
8	Edwards	(Wildcat)	SE SE NE 36- 2S -10E	Superior Oil	Scott 1	5,196	Devonian	4,951	Dry	8-27-40
9	Jackson	(Wildcat)	SW SE SE 35- 8S - 5W	Trumbell	Bennett 1	2,950	"Trenton"	2,755	Dry	9-24-40
10	Jackson	(Wildcat)	SW SW SW 32-10S - 3W	Manellin	Baysinger 1	2,294	St. Peter	2,288	Dry	9-20-40
11	Jackson	(Wildcat)	SE SE NE 9- 8S - 3W	Magnolia Pet.	Smith 1	3,893	"Trenton"	3,705	Dry	12-31-40
12	Jasper	West Liberty	C E ½ NW NW 16- 5N-10E	Pure Oil	Redman 1	4,584	Devonian	4,316	Dry	7- 9-40
13	Marion	Sandoval	SW SE SW 4- 2N- 1E	Martin	Robinson 1	5,023	St. Peter	4,978	Dry	1-14-41
14	Marion	Salem	SW NE SW 29- 2N- 2E	P. Rossi	Brooks 8	4,618	"Trenton"	4,505	130	2- 4-41
15	Marion	Fairman	C E ½ NE NW 18- 3N- 1E	Shell Oil	Ververs 6-C	4,100	"Trenton"	3,927	Dry	10-29-40
16	Marion	Patoka	NE NE SW 28- 4N- 1E	Jones et al.	Majonnier 2	2,956	Devonian	2,886	Dry	3- 5-40
17	Monroe	(Wildcat)	SE SW SE 19- 1S -10W	Hoffer	Boyer 2	2,270	Cambrian	2,200	Dry	8-13-40
18	Randolph	(Wildcat)	SW NW SW 16- 7S - 7W	Anderson	Cassoutt 1	1,698	"Trenton"	1,555	Dry	8-13-40
19	Wayne	Cisne	C E ½ SE NE 27- 1N- 7E	Pure Oil	Billington 3	7,207	St. Peter	7,114	Dry	5-14-40
20	Wayne	N. Aden	SW NW SW 33- 2S - 7E	Rockhill	Twist A-7	5,393	Devonian	5,135	Dry	8- 6-40
21	White	Phillipstown	C W ½ NW NW 31- 4S -11E	Phillips Pet.	Garr 1	5,349	Devonian	4,885	Dry	5-14-40
22	White	(Wildcat)	NW SW NE 13- 7S - 8E	Kingwood	Martin	5,225	Devonian	4,888	Dry	7- 2-40

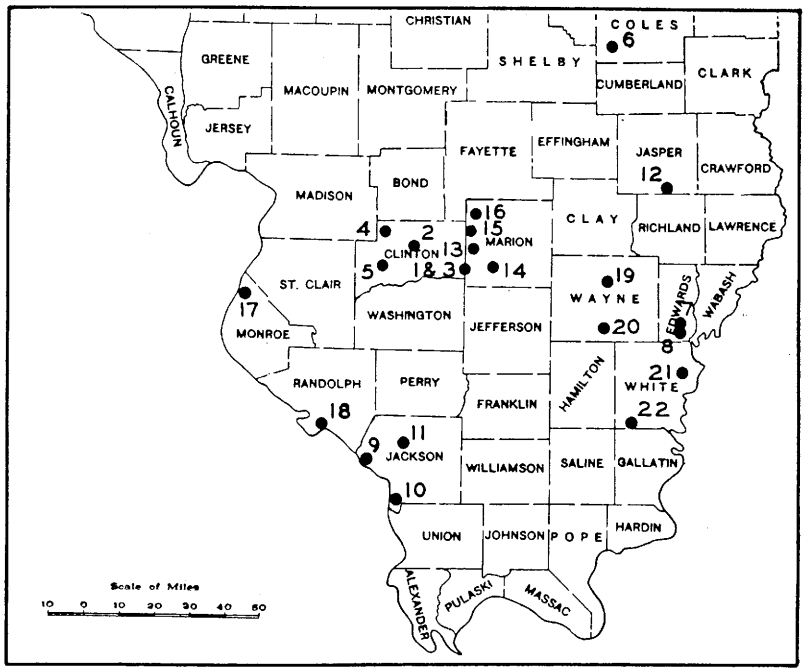


FIG. 4.—Map showing important deep tests in Illinois completed or nearly completed in 1940. See table 1 for list.

to 300 barrels a day, but the saturation is very spotty, and at the end of the year more dry holes had been completed than oil wells. Five oil wells were pumping and flowing at the end of the year. There was also some new activity in the old Gentryville pool in northern Spencer County, with one or two small wells completed.

The Griffin field received the bulk of drilling during the year, with 173 completions, of which 10 were dry holes. This makes a total of 253 producing wells in the field which was considerably extended during the year. The New Harmony field, located on Ribeyre Island in western Posey County, had 5 completed oil wells for a total of 24 producers. The Rockport Gas field, in southern Spencer County, had 50 completions, of which 27 were gas, 9 were oil and 14 were dry holes. The 9 completed oil wells in this field represent the first oil production from Rockport, no commercial oil wells having been completed previous to 1940. Most of the older Indiana fields had one or more completions each, for small oil and gas wells.

The total number of completions in Indiana for 1940 was 521, of which about 450 were in the southwestern part of the state, or that part included in the Eastern Interior coal basin. This number is considerably greater than the 377 completed in the state in 1939. Of the total number of completions, 248 were oil wells, 77 were gas wells, and 196 were dry.

Oil production in Indiana in 1940 was slightly more than 5 million barrels, as compared with about 1¾ million barrels for the previous year. Gas production also was increased considerably, due to the flush production from the Rockport field. Pipe-line proration, which has been effective in reducing the output from older fields for the past 3 years, was removed late in 1940. This proration has varied considerably in allowable, but never was more than ⅔ the daily potential of the well.

Although southwestern Indiana is expected to receive at least as great and possibly greater development during the coming year, the scene of active leasing and exploration was shifting to the north

and northwestern parts of the state at the end of the year. Several seismograph, magnetometer, and soil-analysis crews are busy in this area, as well as geologists working surface and subsurface geology. Many major companies as well as a large number of independent companies are interested and many large blocks of leases have been assembled, although little actual drilling has taken place.

Western Kentucky

The following information on developments in western Kentucky was furnished by D. J. Jones, State geologist, Lexington, Kentucky.

Oil and gas production maintained normal levels throughout the year. Altogether, 175 oil wells, 10 gas wells, and 216 dry holes were recorded.

Production for the year 1940 was 5,178,814 barrels as compared with 5,518,449 barrels for 1939. That part of the state, west of the axis of the Cincinnati arch, produced 3,164,673 barrels.

The Chester sands have accounted for a greater part of the new production.

A new pool has been developed near Handyville in southwestern Daviess County.

Several old producers in the Utica and Grindstone Hill areas have been deepened to the McClosky with encouraging results.

The sands of the Chester group in much of the area of the Western coal basin are found at a very shallow depth. Production in general ranges from 250 to 1,500 feet. The small company, and particularly the individual operator, can prospect and develop production at a low cost.

Completions were reported from 22 counties, testing beds from Pennsylvanian to Lower Ordovician. Several blocks are under lease in the western part of the state (Jackson Purchase). Ballard, McCracken, Carlisle, and Graves counties are in line to receive Ordovician tests.

The area west of the Cincinnati arch and east of the Western coal basin has reported the usual drilling activity. Most of these were Devonian tests in the area of the Mississippian. A few shallow Ordovician tests resulting in a very small amount of production were reported from Cumberland County.

Throughout Kentucky there seems to be considerable interest in the possibility of production from the St. Peter sand and Knox dolomite. A Knox completion in the Gainesville pool of Allen County was dry. This was the deepest stratigraphic test during 1940 for western Kentucky. Scattered tests to these horizons in western Kentucky have not furnished conclusive information. Some of them were not drilled on favorable surface structure and with few exceptions no consideration was given to the probability of favorable subsurface conditions. There are porous zones in the Knox that under proper conditions of structure should be reservoirs for oil and gas.