

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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RECENT DEVELOPMENT IN THE VICINITY OF
JACKSONVILLE

By Alfred H. Bell

INTRODUCTION

Gas was discovered about 6 miles east of Jacksonville as early as 1890, and oil in 1910. Since that time numerous attempts have been made to develop a commercial oil field, but until this year the oil production has been of little importance except for local use. During the fall of 1926 the attention of oil operators was attracted to the Jacksonville area by the completion of a well estimated at 10 barrels by P. C. Irwin and others on the Conklin farm in sec. 18, T. 15 N., R. 9 W. Attempts to extend this production have so far not been successful although a little oil has been found in some of the adjacent wells. In the meantime Timberlake and Higgins of Centralia, and Benoist Brothers and others of Mt. Vernon obtained leases and began operations in the vicinity. As a result of the efforts of Timberlake and Higgins, commercial quantities of oil, as well as gas, have been found. The new drilling has added to previous knowledge of geological conditions in the area, and a brief presentation of the newly acquired data will undoubtedly be of assistance both in the development of the production already discovered and in the search for new oil production in the surrounding territory. The area to which this paper refers is part of that described in a former Survey publication¹.

FIELD WORK

Because of the close spacing of some of the wells, a new plane table survey of the area was made on a scale of 1,000 feet to one inch which is a larger scale than that formerly used. Levels to the oil and gas wells and to as many of the dry holes and abandoned wells as could be located were run from Strawn's Crossing on the Chicago and Alton Railroad. The instrument work was done by Leslie A. Holmes.

¹Collingwood, D. M., Oil and gas development in the vicinity of Jacksonville; Illinois State Geol. Survey Bull. 44B, 1923.

The surface material of the area is glacial drift and stream deposits, and the topography gives no indication of the subsurface structure. Accordingly the physiographic features are not described in this paper.

STRATIGRAPHY

Beneath the Pleistocene deposits of unconsolidated materials, which vary in thickness from 30 to 100 feet, lie rocks of Pennsylvanian age, largely shale with some interbedded limestone, sandstone, and coal. As the Pennsylvanian strata are bounded both above and below by irregular erosional surfaces, their thickness is variable; it is roughly 200 feet. In the area mapped only two of the wells of which records are available were deep enough to pass through Mississippian strata, and consequently data concerning the older rocks are very limited. One of the wells, Rhodes and Moorehead's Cleary No. 2, went 140 feet into the Kimmawick-Plattin or "Trenton" limestone. A study of cuttings from this well and correlation with the logs of other deep wells in the general region indicate the following probable thicknesses for the formations drilled:

*Thickness of Formations Penetrated in Rhodes and Moorehead's
Cleary No. 2.*

	Thickness Feet	Kind of rock
Mississippian	640	Chiefly limestone and shale
Devonian	150	Chiefly limestone
Ordovician		
Maquoketa	200	Shale
Kimmawick-Plattin	140	Limestone

STRUCTURE

The stratified rocks of the area are essentially flat-lying and have a gentle regional dip to the east. Owing to the inadequate character of the majority of the well logs available, it was not found practicable to use a Pennsylvanian stratum as the key horizon for a structure contour map. However, the majority of the older logs give the depth to the top of "rock" which presumably represents the top of the Mississippian limestone in most places, and accordingly this was chosen as the key horizon in figure 1. It has the disadvantage of being a surface of unconformity, and therefore the map cannot be considered a structure map in the ordinary sense. The contours represent the topography of the pre-Pennsylvanian erosional surface, modified perhaps by later deformational movements. It is possible, as has

been pointed out², that the form of this erosional surface may to some extent have been controlled by the folding of the Mississippian rock strata beneath. Insofar as the upper surface of the porous oil- and gas-bearing zone in the Mississippian conforms with the pre-Pennsylvanian erosional surface, the oil and gas pools in this horizon should have a definite relation to the features shown by the contours. Collingwood's conclusion³ that the oil and gas of this area "have been found mostly in certain lenses or horizons in the Salem, and are associated with the highest parts of its old eroded surface" must be somewhat modified in the light of the new data here presented.

The more obvious features of the contoured pre-Pennsylvanian surface in T. 15 N., R. 9 W. as shown in figure 1 are enumerated below: Mississippian "highs" occur (1) along the S. line of the SE. $\frac{1}{4}$ sec. 8, extending eastward into secs. 9 and 16 and S. into sec. 17, (2) in the E. $\frac{1}{4}$ of sec. 5 and adjacent part of sec. 4, (3) NW. $\frac{1}{4}$ sec. 18, and (4) E. part of sec. 4 and the whole of sec. 3. A synclinal belt trending east-west lies about in the center of secs. 8, 9, and 10. The oil production in both secs. 8 and 18 is situated not on the highest parts of the erosional surfaces, but on the saddles between the highs. The Harris-Conklin gas field in secs. 3 and 2 is associated with a Mississippian high. As would be expected, gas occurs higher on the slopes than oil, but there are exceptions, and the probable explanation is that the upper surface of the porous reservoir rock does not entirely conform with the erosional surface mapped. Some of the gas also comes from producing horizons other than the Salem limestone and would not be expected to be related as is this formation to the features of the pre-Pennsylvanian erosional surface.

Table 1 contains in outline form the material treated in the pages following and when used with the map (fig. 1), gives a summary of the information gained from the wells drilled in the last eight months.

PRODUCING HORIZONS

Pennsylvanian: Gas from sandstone beds in the Pennsylvanian has been reported in a number of the wells, but at present the only commercial well producing from the Pennsylvanian seems to be Timberlake and Higgins' Cleary No. 2 (map No. 16). This well was drilled into the Salem limestone, but gas having a pressure of 45 pounds was found in a sand from 239 to 247 feet, or about 60 feet above the top of the Salem, which was found at 299 feet.

Salem: Most of the gas and all of the oil so far produced in the area occurs in a Mississippian limestone which has been correlated as the Salem

²Collingwood, D. M., Oil and gas development in the vicinity of Jacksonville: Illinois State Geol. Survey Bull. 44B, p. 13, 1923.

³Idem., p. 14.

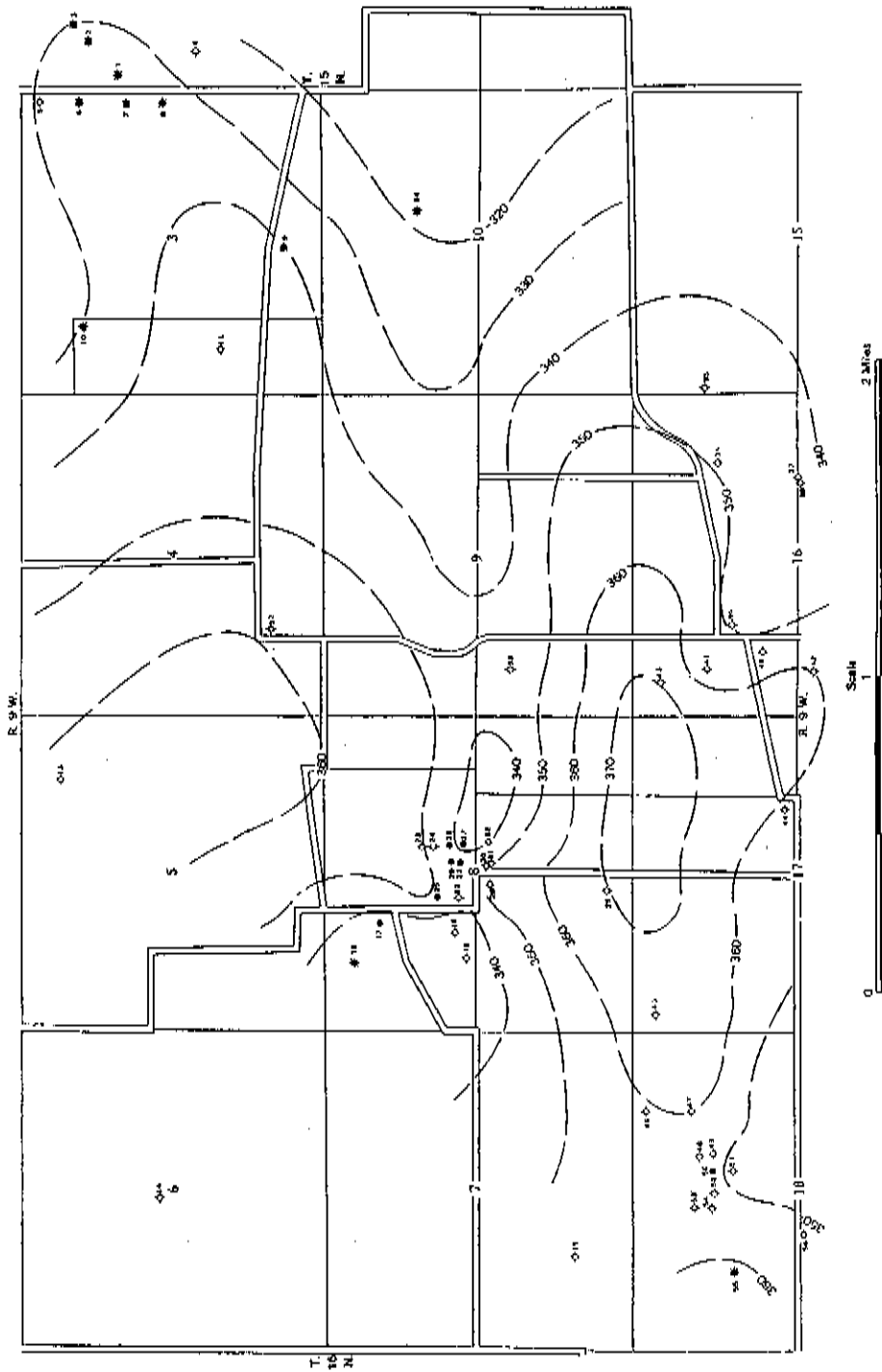


Fig. 1. Structure map of Jacksonvillle area. Contours represent elevation above sea level of the pre-Pennsylvanian erosional surface. See Table I, pp. 4 and 5 for well data. (By A. H. Bell, Illinois State Geological Survey.)

TABLE I.—Tabulated data on borings in the vicinity of Jacksonville.

Map No.	Location		Company	Farm and Well No.	Elevation			Remarks
	Section	Part of Section			Curb	Coal	Top of Miss.	
1	2	SW	P. C. Irwin et al.	Conklin No. 1	644		334	Gas well
2	2	SW	P. C. Irwin et al.	Conklin No. 2	646		331	Gas well
3	2	SW	P. C. Irwin et al.	Conklin No. 3	646		?	Small gas well
4	2	NW	P. C. Irwin et al.	A. J. Harris	544		?	Dry hole
5	3	NE	P. C. Irwin et al.	A. J. Harris No. 5	643		?	Dry hole
6	3	SE	P. C. Irwin et al.	A. J. Harris No. 1	644		325?	Gas well
7	3	SE	P. C. Irwin et al.	A. J. Harris No. 3	644		333	Gas well
8	3	NE	P. C. Irwin et al.	A. J. Harris No. 3	644		340	Gas well
9	3	SE	P. C. Irwin et al.	A. J. Harris No. 4	630		330	Gas well
10	3	SW	P. C. Irwin et al.	L. Trotter No. 2	636		?	Gas well, abandoned
11	3	SW	P. C. Irwin et al.	L. Trotter No. 1	636		?	Gas, Burlington test
12	4	SE	P. C. Irwin et al.	Rayburn No. 1	638		358	Gas well, abandoned
13	5	NE	W. Kennedy	D. I. Green No. 1	637		361	Gas well, abandoned
14	6	NE	W. Kennedy	O. Cully No. 1	612		?	Dry hole
15	7	SE	W. Kennedy	E. O. Green No. 1	588		?	
16	8	NW	Timberlake & Higgins	Cleary No. 2	635	427	336	Gas well
17	8	SW	Timberlake & Higgins	Cleary No. 1	634	434	335	Oil well
18	8	NW	Rhodes & Moorehead	Cleary No. 2	586	418	332	Dry hole, Trenton test
19	8	SE	W. Kennedy	Cleary No. 1	587		?	Gas well, abandoned
20	8	SW	Rhodes & Moorehead	Mahon No. 1	589	432	344	Oil well
21	8	SW	Rhodes & Moorehead	Mahon No. 2	588	431	343	Oil well
22	8	SE	Leeper & Curtis	Mahon	587		?	Show oil
23	8	SW	Five Star Petroleum	Mahon No. 4	597	426	350	Show oil
24	8	SW	?	Mahon	589		?	Abandoned
25	8	SE	Timberlake & Higgins	Mahon No. 7	593	434	?	Oil well
26	8	SW	Timberlake & Higgins	Mahon No. 8	589	426	346	Oil well
27	8	SW	Timberlake & Higgins	Mahon No. 9	595	426	338	Oil well
28	8	NW	Five Star Petroleum	Coons No. 1	613	480	353	Gas well, abandoned
29	8	SE	?	Coons	618		369	Gas, abandoned

TABLE 1.—Tabulated data on borings in the vicinity of Jacksonville—Concluded.

Map No.	Location		Company	Farm and Well No.	Elevation			Remarks
	T. 15 N., R. 9 W.	Part of Section			Curb	Coal	Top of Miss.	
30	NW	SE	Benoist Brothers	Travis No. 1	625	?	Oil show, abandoned	
31	NW	SE	(Old well) ?	Travis	619	?	Oil show, abandoned	
32	NW	SE	Timberlake & Higgins	Travis No. 10	627	344	Drilling	
33	NW	SE	W. Kennedy	Masters No. 2	633	345	Gas, oil show, abandon'd	
34	NW	SW	P. C. Irwin	O'Rear No. 1	598	418	Gas well	
35	SW	NE	?	N. O'Rear No. 1	637	313	Gas, abandoned	
36	NW	NW	W. Kennedy	I. Tindall No. 2	634	349	Show gas, abandoned	
37	SE	NE	Leeper & Curtis	I. Tindall No. 1	644	344	Gas, abandoned	
38	NE	SE	?	I. Tindall	634	349	Gas, abandoned	
39	SE	NW	W. Kennedy	I. Tindall No. 3	629	?	Gas, abandoned	
40	SW	NW	W. Kennedy	Green	631	?	Gas, abandoned	
41	NW	NW	W. Kennedy	I. Tindall No. 4 ?	637	358	Gas, abandoned	
42	NW	SW	W. Kennedy	Hemphill	626	?	Gas, abandoned	
43	NW	NW	W. Kennedy	Masters No. 1	629	?	Gas, abandoned	
44	SW	NE	W. Kennedy	Travis	619	?	Gas, oil, abandoned	
45	NW	NW	?	Dunlap	610	?	Show oil, abandoned	
46	NE	NE	W. Cody et al.	Conklin No. 2	613	?	Show gas, oil, abandon'd	
47	NE	NE	W. Cody et al.	Conklin No. 1	614	361	Show oil, abandoned	
48	NW	NE	P. C. Irwin et al.	Conklin No. 4	617	?	Show oil, abandoned	
49	SW	NE	P. C. Irwin et al.	Conklin No. 5	617	357	Dry hole	
50	SW	NE	P. C. Irwin et al.	Conklin No. 1	617	356	Oil well	
51	SW	NE	P. C. Irwin et al.	Conklin No. 2	610	341	Dry hole	
52	SW	NE	P. C. Irwin et al.	Conklin No. 3	600	?	Show oil, abandoned	
53	NE	NW	Frank Byrns et al.	Willerton	599	?	Show oil, abandoned	
54	SW	NW	Frank Byrns et al.	Willerton	585	?	Oil abandon'd, Keokuk test	
55	SW	NW	Timberlake & Higgins	Willerton No. 1	582	363	Gas well	
56	NE	SW	P. C. Irwin et al.	Arnold No. 1	594	455	Gas abandoned	

(Spergen)⁴. There seems to be little doubt that it belongs in the Meramec group and that it is either St. Louis or Salem. The oil-bearing strata vary considerably in lithologic character within relatively short distances. In the two recently drilled wells, Mahon Nos. 8 and 9 (map Nos. 26 and 27), the oil rock is a relatively pure limestone and seems to be entirely lacking in silicious material. On the other hand, the same horizon to the southwest in the Five Star Petroleum Company's Coons No. 1 (map No. 28), to the northwest in the Timberlake and Higgins' Mahon No. 7 (map No. 5), and to the north in the Five Star Petroleum Company's Mahon No. 4 (map No. 23) is represented by a sandy limestone⁵. The same condition was found in a study of the samples from Timberlake and Higgins' Mahon No. 7.

The typical oil-bearing rock from Mahon No. 9 (map No. 27) is a light brown limestone, rather soft, having a finely mottled texture. On examination with the hand lens it is seen to consist of numerous small fragments resembling oolites but more irregular in shape. The interstitial space is partly filled with calcium carbonate; and the remaining open space appears ample to contain oil in commercially extractable quantities.

The impervious rock which confines the oil to certain zones in the Salem limestone appears to be dense non-porous parts of the Salem itself. In Mahon well No. 9 (map No. 27) a bed of sandstone 2 feet thick, containing no gas, oil, or water, lies directly on top of the Salem limestone. A thickness of 18 feet of limestone was drilled through before the first show of oil was encountered. Evidently at least part of this upper 18 feet of the Salem is impervious in this location. The drill cuttings from this "cap rock" are very fine grained in texture and light gray or almost white in color.

As illustrated in the Mahon wells Nos. 8 and 9 (map Nos. 26 and 27), the succession of oil-bearing and barren strata in the Salem varies within comparatively short distances. The porosity of a given bed may vary from place to place, and the oil-bearing zones may to some extent lie across the bedding planes.

Keokuk-Burlington: Gas from a deeper producing horizon was discovered in Timberlake and Higgins' Willerton No. 1 (map No. 55). A small quantity of gas was found in the Salem in this well, and drilling was continued. After passing through 90 feet of Salem limestone and 110 feet of Warsaw formation, chiefly sandy shale, the top of the Keokuk-Burlington was reached at a depth of 421 feet. The 5 3/16-inch casing was set at this depth, and drilling was continued in hard limestone to a depth of 135 feet at which point gas with a pressure of 45 pounds and a slight "rainbow"

⁴Collingwood D. M., Oil and gas development in the vicinity of Jacksonville: Illinois State Geol. Survey Bull. 44B, pp. 12 and 13, 1923.

⁵Idem, pp. 9 to 12 for logs based on sample studies from the two wells of the Five Star Petroleum Company.

of oil were found. Production was estimated at 2,000,000 cubic feet per day.

Figure 2 is designed to show the oil-bearing horizons in relation to the barren strata, and the two logs detailed below example the character of the formations penetrated.

Driller's log from Timberlake and Higgins' well No. 10 (map No. 32) on Travis farm in NW. $\frac{1}{4}$ SE. $\frac{1}{4}$ Sec. 8, T. 15 N., R. 9 W.

Elevation—627 Feet

No.	Thickness Feet	Depth Feet
Pleistocene system		
1. Clay, yellow	18	18
2. Gravel, clay, sand.....	22	40
Unconformity		
Pennsylvanian system		
3. Shale, blue	24	64
4. Lime	1	65
5. Shale	3	68
6. Gravel and water (coal).....	3	71
7. Slate, dark	9	80
8. Slate, white	15	95
9. Lime	1	96
10. Slate, white	24	120
11. Shale, gray	54	174
12. Sandstone	5	179
13. Shale, dark	23	202
14. Lime (?)	1	203
15. Slate, black	3	206
16. Coal	6	212
17. Fire clay	12	224
18. Lime	5	229
19. Slate, white	16	245
20. Sand; gas and show of oil.....	6	251
21. Sand	6	257
22. Coal	3	260
23. Fire clay	6	266
24. Slate, dark	17	283
Unconformity		
Mississippian system		
25. Lime, white	30	313
26. Lime; first oil show in limestone.....	13	326
27. Lime and green shale.....	4	330
Unconformity		
Mississippian system		
19. Lime, hard	18	275
20. Lime, brown; oil show.....	4	279
21. Lime, light brown.....	4	283
22. Lime, brown	4	289
23. Lime, white	2	291

*Driller's log from Timberlake and Higgins' well No. 9 (map No. 27) on Mahon farm
in SW. ¼ NW. ¼ Sec. 8, T. 15 N., R. 9 W.*

Elevation—595 Feet

No.		Thickness Feet	Depth Feet
Pleistocene system			
1.	Mud, brown	15	15
2.	Hardpan, gravel, water.....	21	36
3.	Clay, blue; and gravel.....	29	65
4.	Gravel	12	77

Unconformity

No.		Thickness Feet	Depth Feet
Pennsylvanian system			
5.	Shale	58	135
6.	Lime, dark	9	144
7.	Shale, dark	21	165
8.	Lime	1	166
9.	Shale, black	3	169
10.	Coal	5	174
11.	Lime, gray	7	181
12.	Lime, white	6	187
13.	Shale, gray	41	228
14.	Coal	6	234
15.	Fire clay	4	238
16.	Slate, gray	7	245
17.	Slate, dark	10	255
18.	Sand, hard	2	257

RECENT DEVELOPMENT

An account of the history of development up to 1922 has already been published^a. Within the last eight months 13 wells have been drilled in secs. 8 and 18, T. 15 N., R. 9 W. of which 2 are gas producers, 5 oil producers, and 6 dry holes. Among the best of the oil wells are the last two drilled; namely, Timberlake and Higgins' Mahon Nos. 8 and 9 (map Nos. 26 and 27). The character of the oil-bearing rock is such that shooting with nitroglycerin is particularly successful. The showing of oil in Mahon No. 8 before the shot was so small that most operators would not have considered

^aCollingwood, D. M., Oil and gas development in the vicinity of Jacksonville; Illinois State Geol. Survey Bull., 44B, 1923.

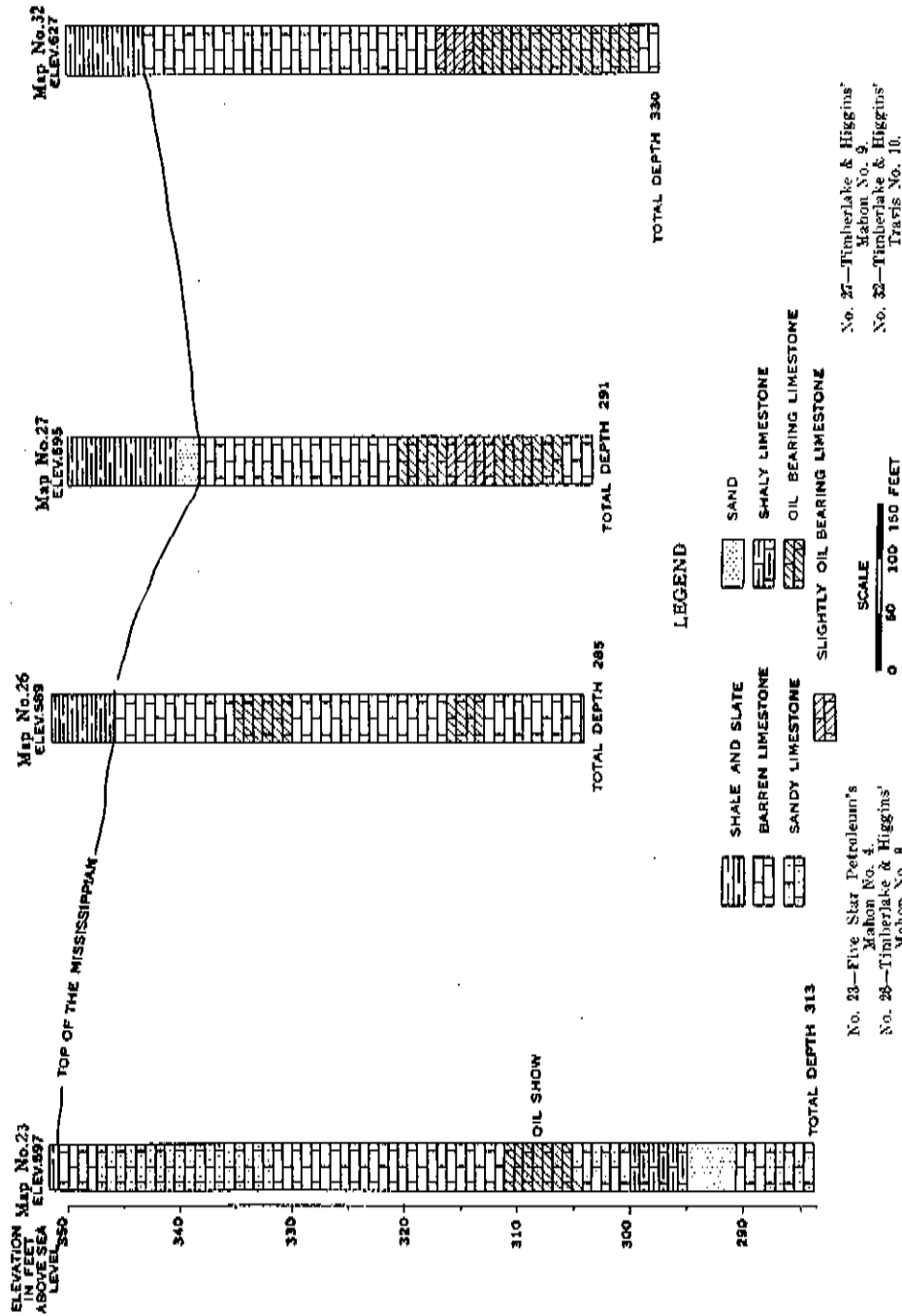


FIG. 2. North-south cross-section through Mahon and Travis farms, sec. 8, T. 15 N., R. 9 W., to show the relation of the oil-bearing horizons to the barren strata.

shooting. However, Mr. Timberlake decided to shoot with 80 quarts of nitroglycerin, and the performance of the well afterwards shows this expenditure to have been justified. Within 3 hours after the shot the oil was standing 75 feet above the bottom. By the time the well was ready to be pumped there was 150 feet of oil in the well. In a 12-hour pumping test it produced 17 barrels of oil of 34° A. P. I. gravity (American Petroleum Institute). Mahon No. 9 had a somewhat better showing of oil before the shot than had No. 8, and it also was shot with 80 quarts. On account of trouble with tubing and valves the well was not pumped continuously for 12 hours, but in a total of 8 hours pumping on two successive days it made 19 barrels of oil.

The most recent well drilled in the area, Timberlake and Higgins' Travis No 10 (map No. 32) was completed on August 17th, total depth 330 feet. It had a show of gas and oil in a Pennsylvanian sand from 245 to 257 feet and a show of oil in the Mississippian from 310 to 328 feet in limestone. At the time of writing it has not yet been shot, but it will probably make a commercial well for the amount of oil showing in the Mississippian is about the same as in Mahon No. 9.

The group of six gas wells on the Harris and Conklin farms in secs. 2 and 3, T. 15 N., R. 9 W. were drilled by P. C. Irwin and his associates in 1923. The best well, Harris No. 3 (map No. 3) gauged 9.3 million cubic feet per 24 hours. All the rest except Conklin No. 3 which was considerably lighter gauged in the neighborhood of 2,000,000 cubic feet. The owners of these wells have recently completed the construction of five miles of 6-inch and four miles of 8-inch pipe line to the city of Jacksonville. About August 1st natural gas was turned on in Jacksonville and is being used mixed with artificial gas to the extent of a quarter of a million cubic feet per day. At present only two wells are being used; namely, Conklin Nos. 1 and 2 (map Nos. 1 and 2). The pressure in the main is 55 pounds, and this is reduced to seven pounds at the city limits.

RECOMMENDATIONS

It seems probable that oil production will be found to extend some distance south, southeast, and east of the present productive area on the Mahon lease. It will probably be found most advantageous to "feel out" this acreage by moving outwards, one location at a time, in these directions.

The occurrence of gas at a number of localities in the surrounding region and the association of oil with gas in secs. 8 and 18, T. 15 N., R. 9 W. suggest the possibility of the occurrence of oil in commercial quantities in the

same geologic horizon in other localities than those in which it is already known. At present the lack of adequate knowledge of structural conditions prevents the making of any very specific recommendations as to territory worthy of wildcat testing. Much of this lack of geological data must be attributed to the fact that only meager records were kept of the great majority of the earlier wells drilled. Those who have been operating more recently in the region are to be congratulated on the way in which they have cooperated in the geological study of the area by keeping detailed logs and samples of cuttings. These data will be an invaluable aid in future development in the area.