OKLAHOMA GEOLOGICAL SURVEY
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C. W. Shannon, Director.

BULLETIN NO. 18.

THE CUSHING OIL AND GAS FIELD, OKLAHOMA.

BY

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NORMAN
December, 1914.

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INTRODUCTION.

General.

The field work for the present report was done during July, August, September, and October, 1913. Unforeseen conditions over which the author had no control have conspired to prevent the publication of the report until the present. The structural map, however, which was one of the prime purposes of the field work, was given to the public during May of the present year. The map accompanying this report showing the development in the Bartlesville sand is the result of subsequent work carried on chiefly during the month of September of this year.

The daily output of oil in Oklahoma now exceeds 300,000 barrels, which represents a value of approximately $215,000. To this sum should be added the value of the gas. It is in part to supply the demand for information concerning the State's present supply of oil and gas that the present report has been prepared, but the primary purpose has been to aid in enlarging the productive areas. Throughout the course of the field operations theoretical aspects of the subject were constantly kept in mind.

ACKNOWLEDGMENTS.

In addition to the data obtained during the course of field operations, the author has drawn freely upon existing publications. Among these are the report of Carl D. Smith* of the United States Geological Survey on the Glenn oil and gas pool and vicinity, and that of D. W. Ohern** on the Ponca City oil and gas field. Other publications have also been used and citations will be made to these as occasion arises.

The writer is deeply indebted to the officers and employees of the different oil and gas companies that operate in this territory for many valuable statistics on production and for numerous well logs, as well as for other courtesies. He was assisted throughout most of the season by George Burress and Frank Gahrtz, and for a short time by Chas. H. Taylor. A large part of the data on the north end of the field was obtained from Messrs. Munn, Newby, and Garrett, who are in the employ of the Gypsy Oil Company. D. W. Ohern gave valuable assistance in the preparation and revision of the original manuscript.

The maps and sections were compiled and drawn by Frank Gahrtz. The work of determining locations and elevations in the

*Smith, Carl D., Bull. U. S. Geol. Survey, No. 541-B, 1913.
**Ohern, D. W., Bull. Okla. Geol. Survey, No. 16, 1912.

area of the Bartlesville wells as indicated in Plate XI was done by Fritz Aurin, Dean Stacy, and J. D. Watson, assistants for the Geological Survey. The statistical tables concerning the wells in the field were compiled by Geo. H. Myers and Dean Stacy from data collected by the writer. All the compilations, drawings, and preparation of special features of the report were done in the office of the Geological Survey by the persons above named, and the clerical force of the Survey under the direction of C. W. Shannon, Director, and L. E. Trout, Field Geologist.

Location and Area.

The area considered in this report lies mostly in the extreme western part of Creek County, 12 miles east of the town of Cushing in Payne County. Some production, however, is obtained in the

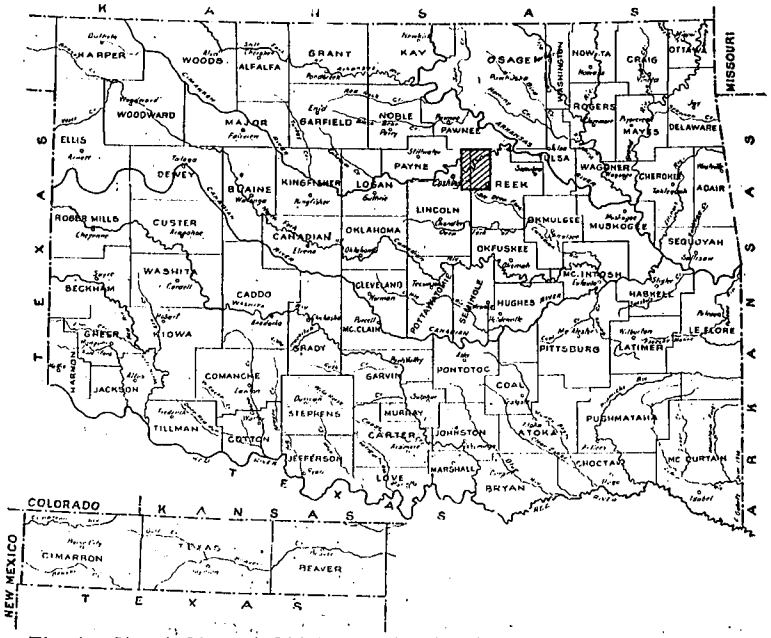

Fig. 1. Sketch Map of Oklahoma, showing location of the Cushing oil field.

contiguous part of the latter county. The territory embraces Tps. 17, 18, and the southern part of 19 N., R. 7 E., and the W. 1-2 of T. 18, the SW. 1-4 of 19, and the northwest corner of T. 17 N., R. 8 E. The productive territory, however, extends westward a short distance beyond the boundaries of the map. The greater part of

the production at the present time is confined to the western part of the area covered by the map. The accompanying sketch map (fig. 1.) shows the location of the area.

History of Development.

The discovery well in the Cushing field was drilled by C. B. Shaffer on the Wheeler lease, sec. 31, T. 18 N., R. 7 E., and was completed in March, 1912. Since that time drilling has been vigorous and constant.

Until December, 1913, production was confined to the Layton and Wheeler sands, which are described in a succeeding section. In December, 1913, however, the Prairie Oil and Gas Company's test in sec. 3, T. 17 N., R. 7 E., penetrated the Bartlesville sand, and since that time attention has been confined almost exclusively to this sand, and at this writing almost all the production comes from this horizon. Development is now progressing at a tremendous rate and there is no sign of cessation.

TOPOGRAPHY.

The Cushing oil and gas field lies in the drainage basins of Cimarron and Canadian rivers. Cimarron River crosses the north end of the field and drains the larger part of the area. Tiger Creek, the principal tributary of the Cimarron, drains the main part of the field, while Buckeye Creek drains a small portion of the northeast corner of the area. Tributaries of Little Deep Fork Creek drain the southeast part of the field into Canadian River.

The valleys of these streams are almost V-shaped, with very narrow flood plains, and the tributaries especially have comparatively steep gradients and deep, narrow valleys. The Pawhuska limestone forms prominent escarpments in the north and east parts of the field, while in the remainder of the territory, especially in the southeast corner, the bluffs and hills are capped with sandstones. In this part of the field sandstone boulders are usually strewn over the surface covering most of the underlying strata, and giving the appearance of massive sandstone formations.

STRATIGRAPHY.

General Features.

The rocks of the area are exclusively sedimentary. With the exception of terrace sands and alluvial deposits, the formations are of Pennsylvanian age. The Pennsylvanian formations exposed at the surface lie near the top of the series. Between the western limit of the field and the upper or western limit of the Pennsylvanian series approximately 400 feet of strata outcrop, J. W. Beede,* draw-

*Beede, J. W., The bearing of the stratigraphic history and invertebrate fossils on the age of the anthracolithic rocks of Kansas and Oklahoma, Journal of Geology, vol. XVII, No. 8, Nov.-Dec., 1909, pp. 710-729.

ing the line between the Permian and Pennsylvanian series at the base of the Elmdale formation which embraces 130 feet of sediments beneath the Neva Limestone of the Kansas Section. This limestone forms the prominent east-facing escarpment just west of the town of Cushing, Okla., and 12 miles west of the old field.

The Pennsylvanian rocks in this area are composed very largely of shales with an abundance of sandstones, and with limestones much less prominent. The composition and thickness of the beds sometimes vary considerably from point to point because of local conditions of deposition. Not infrequently, likewise, similar changes occur in the vertical succession of strata. The rocks exposed at the surface within the confines of the field approximate 225 feet in thickness.

At present all production of oil and gas is from strata of Pennsylvanian age, and so far as the writer knows, no well, with possibly one or two exceptions, has been sunk to the base of the Pennsylvania series.

Surface Formations.

The most prominent stratum outcropping within the Cushing oil field is a bed of limestone, and because of the prominence given thereto in this report special mention is here made. This limestone is prominently exposed in the north and east parts of the field, where it can be seen outcropping near the summit of bluffs and at or near the summit of several hills. In the southwestern part of the field it can be traced from Drumright south to the limits of the area, but in this direction it rapidly thins out and is hence not so prominent as elsewhere. This limestone is used as a key formation for the region, the structural contours of the large map accompanying this report being drawn thereon.

Preliminary field work extending from the northern limit of the Cushing field northeastward toward the Cleveland oil field leads the writer to believe that this limestone is, in part at least, the equivalent of the Pawhuska limestone of Smith.* Hereafter it will be referred to as the Pawhuska limestone, but it is understood that careful and accurate correlation is yet to be made.

FORMATIONS ABOVE PAWHUSKA LIMESTONE.

It has already been observed that the Cushing oil field is located near the western border of the Pennsylvanian series. The following section was made from the Neva limestone (near the base of the Permian series) on the escarpment just west of the town of Cushing, east to the top of the Pawhuska limestone in Drumright.

*Smith, James Perrin, The Arkansas Coal Measures in their relation to the Pacific Carboniferous province: Jour. Geol., vol. II, 1894, p. 199.

	Feet.	In.
Neva limestone massive white	4	
Red shale	30	
White sandstone	3	
Red shale	16	
Reddish sandstone	8	
Red shale	8	
Massive, blue limestone	2	
Red shale	13	
Massive, brown, siliceous limestone	1	
Red shale	3	
Massive, white, friable sandstone	8	
Red shale	16	
Massive, white, friable sandstone	22	
Red shale	5	
Siliceous limestone	1	
Red shale	27	
Massive, white, friable sandstone	5	
Reddish shale	23	
Sandstone	6	
Red nodular limestone	5	
Shale	17	
Soft, massive, sandstone	5	
Shale	20	
Limestone, upper part pure limestone grading into coarse conglomeratic limestone at base	5	
Blotchy, white sandstone	3	
Shale	7	
Soft massive sandstone	57	
White limestone	2	
Shale with two intervening thin layers of limestone	14	
Reddish nodular limestone		6
Reddish shale	5	
Nodular limestone		6
Reddish shale	4	
Brownish, calcareous sandstone	1	
Reddish shale	15	
Very hard fine-grained white sandstone	6	
Reddish sandy shale	10	
Soft sandstone	5	
Shale	14	
Hard sandstone	4	
Shale	6	
Limestone	1	
Shale at top grading downward into sandstone	35	
Shale mostly red	25	
Fine-grained sandstone	7	

	Feet.	In.
Shale mostly red	25	
Gray limestone	1	
Brownish ferruginous limestone	1	
Shale	6	6
Massive, brownish sandstone	19	
Shale	18	
Massive, ferruginous limestone	2	
Shale	3	
Massive sandstone	18	
Pawhuska limestone	top	

According to the above section it is 556.5 feet stratigraphically from the Pawhuska limestone to the top of the Neva limestone.

TERRACE AND ALLUVIAL DEPOSITS.

On both sides of Cimarron River and some of its chief tributaries, the Pennsylvanian formations are more or less completely concealed by terrace sands deposited by the stream when it flowed at a higher level. These sands are thicker and more widely spread on the inside of the curves and loops of the main stream.

The present flood plains of the streams likewise conceal effectually the underlying Pennsylvanian deposits. In a few places where the Cimarron meanders against its banks the stream deposits have been removed, exposing the underlying Pennsylvanian rocks.

FORMATIONS BELOW PAWHUSKA LIMESTONE.

The Pawhuska limestone has been removed by erosion over large areas of the Cushing field. The following section made along the stream in the southwest corner of sec. 10, T. 17 N., R. 7 E., gives the formations underneath the Pawhuska limestone that outcrop in different parts of the Cushing field.

	Feet
Pawhuska limestone	5
Green shale	13
Brown, siliceous lime	1
Sand	4
Green shale	10
Hard, brown sand	5
Shale	5
Sand	6
Shale	12
Massive sand	17
Shale	7
Massive, brownish friable sandstone	44
Shale	10
Elgin sandstone	top

It will be noted that at the base of the above section lies what

is termed the Elgin sandstone. This term is used as a matter of convenience rather than as one of strict accuracy in correlation. The basis of the correlation of what is termed the Pawhuska limestone serves also to correlate this sandstone with the Elgin sandstone of the Kansas section. Further detailed work between the present field and the territory to the northeast is necessary before final correlation can be made.

Subsurface Formations.

For a depth of 1,000 feet or more beneath the Elgin sandstone little is known of the strata, except as their thickness and composition are revealed in the logs of wells. In the Hominy quadrangle which lies to the northeast of the Cushing oil field, and in which these strata outcrop, Robt. H. Wood, of the United States Geological Survey, has made careful detailed study of these formations. This work has been done under cooperative agreement with this Survey, but Wood's results are not yet ready for the public.

FORMATIONS OUTCROPPING IN THE HOMINY QUADRANGLE AND TO THE NORTH.

A general idea of the nature of the formations in the Hominy quadrangle and to the northward is given in Bulletin 16 of this Survey as follows:*

Elgin sandstone.—Associated with the Kanwaka shale in Kansas is a sandstone which has been termed the Elgin. This extends southward across the Pawhuska quadrangle and beyond to Arkansas River where it caps the hills in the vicinity of Cleveland. Just south of the Kansas line near Elgin, Kansas, the Elgin sandstone is 140 feet thick, and is made up of an upper and lower member, separated by shaly sandstone. To the southward the Elgin becomes thinner and consists usually of but a single member which is in most places massive, containing practically no shale. At the southern border of the Pawhuska quadrangle the Elgin is between 50 and 75 feet thick. The probable westward extension of the Elgin beneath the Ponca City region is discussed in the section on Character, Extent, and Correlation of Sands.

Oread limestone.—The Elgin sandstone is succeeded below by the Oread limestone. It seems not to extend more than 10 or 12 miles into Oklahoma although at the Kansas line it is 17 feet thick.

Buxton formation.—The Buxton formation of the Independence quadrangle thickens southward into Oklahoma where in the Pawhuska quadrangle it embraces about 450 feet of sediments. A generalized section follows:

*Ohern, D. W., Ponca City oil and gas field, Bull. Okla. Geol. Survey, No. 16, 1912, pp. 12-14.

	Feet
Shale, sandy shale, and sandstone	140-155
Sandstone, exposed near Nelagony	50
Limestone, lentil	20
Shale, sandy shale, thin sandstones	100
Sandstone, exposed near Bigheart	140
Shale, and sandstone	180
Average total	630

The 50-foot sandstone of the above section is prominently exposed in the vicinity of Nelagony and is known to extend thence in both directions along the strike for a considerable distance. The limestone of the section is a lens and has but limited linear extent.

The sandstone at the base of this section is really composed of several distinctive sandstones separated by shale beds. All the beds, however, are closely associated, especially at Bigheart where they are well developed, several being thick and massive. They are known to extend from the eastern border of Osage County near Bartlesville, southwest across this county and probably into Creek County.

FORMATIONS OUTCROPPING EAST OF OSAGE COUNTY.

The formations below the Buxton formation, liable to be met in deeper drilling in the Ponca City field outcrop in Washington, Nowata, and Craig counties which lie east of Osage County. The senior author has issued a preliminary report on these formations, and a general account of these as known at their outcrops may lead to some conception of what may be expected at depths at Ponca City, although it can hardly be expected that anything more than a broad similarity should be found existing between the formations at this place and at the outcrops, separated as the two are by 55 miles or more.

Wilson formation.—The Wilson formation of the Independence quadrangle, following the general rule, thickens to the southward. In southern Kansas the thickness is 280 feet, but in the southeastern part of the Pawhuska quadrangle it is not much if any less than 400 feet, an approximate section being as follows:

	Feet
Sandstone, exposed near Torpedo	30
Shale thin sandstones and thin limestones	240
Limestone (the Avant)	0-35
Shale, thin sandstones and thin limestones	45-90
Average total	350

The only part of this section that is of special importance in the present discussion is the 30-foot sandstone lying 100 feet below the summit of the formation. This is well developed and prominently exposed at the village

of Torpedo on the Missouri, Kansas & Texas Railroad near the eastern border of Osage County. To the northeast of this place it caps the bluffs just south of Bartlesville while it is shown to extend southwest across the quadrangle and it probably continues beyond Arkansas River.

Dewey limestone.—Succeeding the Wilson formation below is a mass of limestone about 23 feet in thickness to which the senior author in his preliminary paper applied the name Dewey. It is well exposed in Bartlesville, near Dewey, and to the eastward and is prominent on the bluffs west of Ochelata and Ramona. Tentatively it is regarded as the equivalent of the upper part of the Drum limestone of the Kansas section.

Shale and sandstone.—About 75 feet of shale and sandstones intervene between the Dewey limestone above and the Hogshooter limestone below. No distinctive name has been applied to these beds but at present they are regarded as the equivalent of the middle part of the Drum limestone which splits just west of Coffeyville, Kansas. The sandstones of this interval are thin and lenticular.

FORMATIONS OUTCROPPING IN THE VICINITY OF GLENN POOL.

The formations lying at greater depths and outcropping in the vicinity of Glenn Pool and eastward have been described by Carl D. Smith. He gives the following section* as extending from the Lost City limestone, which outcrops on the south side of Arkansas River, about 6 miles west of Tulsa, down to the Boone limestone of the Mississippian series.*

Section showing relation, character, and thickness of formations exposed in and to the east of the Glenn pool area, Oklahoma.

Pennsylvanian series:

	Feet
Limestone, bluish gray; locally known as the "Lost City limestone"	1-40
Shale and sandstone	350
Limestone, bluish, hard; checkerboard lime of the drillers	2½
Shale, with variable beds of sandstone	215
Coal, Dawson	1 2-3-2½
Shale with irregular beds of sandstone	210-350
Limestone, massive gray; big lime of drillers	0-40
Shale, with irregular beds of sandstone	200
Limestone, Fort Scott, Oswego lime of drillers; bluish-gray limestone with 3 to 5 feet of shale near middle	10-30
Shale, sandstone, limestone, and coal; Cherokee formation	1,000

*Smith, Carl D., Bull. U. S. Geol. Survey, No. 541-B, 1913, p. 16.

	Feet
Unconformity.	
Blue to white limestone, with some shale and thin sandstone; Morrow formation	100-120
Unconformity.	
Mississippian series:	
Limestone, blue and brown, locally sandy and shaly; Pitkin	60-
Black shale with thin beds of limestone and sandstone; Fayetteville formation	20-60
Unconfirmity.	
Limestone, Boone; flinty limestone and flint	200-

FORMATIONS SHOWN BY WELL RECORDS.

In order that the reader may have a further general conception of the strata as encountered by the drill, the following logs are given as typical: (Pl. XII).

Magnolia Mikey No. 1, NW. 1-4 33-18-7. Gas.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Soil	4		White slate	705	735
Sandstone	4	13	Sand and water	735	740
Sandstone	65	70	Lime	740	745
White slate	70	98	Sand and water	745	785
Lime	98	110	Black shell	785	915
White slate	110	145	Lime shell	915	920
Red rock	145	150	Black slate	920	1000
White slate	150	180	Sand	1000	1020
White sand	180	183	Black slate	1020	1040
White slate	183	218	Lime	1040	1045
Red rock	218	235	White slate	1045	1090
White slate	235	270	Black slate	1090	1320
Sand	270	278	Lime	1320	1328
Red rock	278	287	Layton sand	1328	1346
White slate	287	297	Slate	1546	1551
Red rock	297	310	Sand and Gas "Big"	1357	1411
White slate	310	350	Slate	1411	1421
Red rock	350	360	Sand—show oil	1421	1470
White slate	360	395	Slate	1470	1550
White sand	395	410	Lime	1550	1553
White slate	410	430	Slate	1553	1632
Red rock	430	444	Jones sand	1632	1650
White sand	444	470	Blue slate	1650	1675
Blue mud	470	509	Lime	1675	1678
Lime	509	530	Blue slate	1678	1738
Sand	530	545	Sand and gas	1738	1760
Blue slate	545	575	Slate	1760	1790
Sand	575	590	Sand and gas	1790	1800
Blue slate	590	604	Slate	1800	2055
slate	604	635	Lime	2055	2060

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Red rock	635	650	Slate	2060	2080
Sand	650	680	Sand	2080	
Sand and water	680	705	Largest gas	2092	

Laura Hutton No. 12, N-2 SW. 1-4 8-17-7.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
No record	0	75	Blue shale	890	900
Sand (water)	75	85	Shale and shells	900	1010
Light shale	85	130	Sand	1010	1020
Sand	130	150	Shale	1020	1030
Light shale	150	200	Sand	1030	1040
Sand	200	210	Blue shale	1040	1070
Red rock	210	240	Lime	1070	1080
Sand	240	255	Sand	1080	1100
Red rock	255	285	Shale	1100	1449
Light shale	285	315	Sand (water, little oil Layton	1449	1509
Sand	315	355	Shale	1509	1600
Red rock and light shale	355	400	Dark shale	1600	1700
Sand	400	415	Light shale	1700	1720
Blue shale	415	420	Jones sand	1720	1760
Sand	420	430	Light shale	1760	1800
Light shale	430	440	Lime	1800	1825
Sand	440	450	Light shale	1825	2040
Red rock	450	500	Little gas sand	2040	2050
Sand	500	520	Light shale	2050	2196
Red rock	520	600	Top of Wheeler sand (little gas)	2196	
Sand	600	645	First gas (5 3-16" casing)	2217	
Light shale	645	670	Strong gas	2225	
Sand	670	680	Through gas	2230	2235
Blue shale	680	710	Wheeler sand	2235	2270
Red rock and sand	710	820			
Sand	820	890			

The Lost City limestone at the top of Smith's section seems to correspond to the limestone at 1,040 to 1,045 feet and 1,070 to 1,080 feet respectively in the logs above cited. The average distance from the Pawhuska limestone in the Cushing field down to the Fort Scott or Oswego limestone (Wheeler sand of the drillers) is 2,340 feet. Deducting the average thickness as given by Smith from the Lost City limestone down to the top of the Fort Scott, the distance from the Pawhuska to the Lost City is about 1,250 feet, which agrees very closely with the two logs above given, considering that the mouth of the first of these wells is 203 feet and that of the second 192 feet below the top of the Pawhuska. This gives, then, the interval from the top of the Pawhuska limestone to the Lost

City limestone as 1,243 feet and 1,262 feet respectively in these wells as compared with 1,250 feet as obtained by deducting Smith's section.

Further discussion of the formations encountered by the drill will be made in a succeeding section on productive horizons, but it should be specifically mentioned here that the so-called Wheeler sand of the driller is believed to be the Fort Scott (Oswego) limestone.

Value of Well Records.

Records were collected from practically all of the wells in the area, but with the exception of the few above cited, all are skeleton logs or simply notations of the depth and thickness of the producing sands. The scarcity of detailed logs is partially due to rapidity of development, but is to be attributed to a lack of appreciation of their importance. Many detailed records are indispensable in a geological study of any area, and it is freely admitted that this report is not nearly as valuable as it would be had the drillers kept an accurate record of each well drilled. In drilling, geologic date of tremendous importance have been uncovered, but through carelessness and ignorance regarding the value of these facts most of them have been destroyed. Usually, too little attention is paid by the driller to the formations above the oil-bearing horizons. These formations often prove to be the key to horizons in other localities and if good well records be kept, such records assist the geologist and driller in correlating the formations in different fields, or in different parts of the same field, and thus also in working out the broader geological problems connected with the oil industry. This knowledge is also of material value to the operators and drillers since it gives them a general idea of the formations to be encountered in new areas which otherwise would be absolute "wild cat" propositions. The misinterpretation of geologic data and the indifference usually manifested by most drillers along this line is illustrated by the following case: A massive, friable sandstone underlies a certain area, and in drilling through this formation the driller recorded only 10 feet of sand. In reality the sand is 57 feet thick as may be ascertained from outcrops in bluffs on three sides of the well. Broad discrepancies in depth, thickness of formations, and interval between given formations are often recorded in close proximity to one another.

Although this state of indifference among the drillers is deplorable, yet the drillers are not in all cases to be censured, since in the first place they do not realize the value of the complete records, and in the second place they are very seldom instructed to take careful notes.

All of the drilling in the Cushing field has been done by the churn drill method, and this does not permit of so close measurements or so detailed descriptions of the beds encountered as would be desirable for both oil men and geologists. In fact, the sole motive of most operators at the present time is to gather only those data which appear to them to be relative to the practical side of the oil business. As a result only notations of the depth and thickness of the producing horizons, the big water sands, and the places for setting the casing are recorded. These data are not sufficient to warrant many definite conclusions on the part of the geologist. In addition to a complete description of the formations encountered, the record kept by the operators should include the initial production, initial closed pressure, initial ratio of oil or gas to water, if any, and the rate of decrease of production in each well. With these data at hand it would be a comparatively easy task for the geologist to formulate some definite laws on the accumulation of oil, and also to estimate within a very small limit of error the total amount of production and the time required to exhaust any given well.

Although a large part of the geologic data uncovered in the field has never been recorded, yet the writer has assembled all of the available data that could be secured in the short time allotted to this work. The report is far from complete but it is believed that sufficient information has been gathered to justify the general conclusions drawn.

STRUCTURE.

General Discussion.

The Pennsylvanian sediments of the Cushing region were laid down in an approximately horizontal position. At the time of the uplift of the Ozark Mountains these Pennsylvanian formations were lifted above sea level and tilted gently away from the mountains. This deformation was very slow and continued during a very long period of time. In the course of this uplift and subsequent movements the beds were slowly raised and depressed alternately and also subjected to lateral pressure and other strains and stresses which have resulted locally in small wrinkles of the nearly level strata into gentle anticlines, synclines and domes. One of the most pronounced of these folded areas known to the writer occurs in the Cushing field.

Before proceeding to the discussion of the several structural features of the Cushing field, it will be in order to say that the average west dip of Pennsylvanian sediments in northeast Oklahoma may be said to vary between 30 and 50 feet per mile; 40 feet to the mile being, perhaps, a fair average. It is impossible to calculate an average west dip of the strata in the Cushing field on account of the many variations from the normal west dip. In the northern part of the field in sec. 7, T. 18 N., R. 7 E., the westward dip has a maximum of 170 feet to the mile. Strong dips also pre-

vail in the southwest part of the field, but these high west dips are exceptional in northeast Oklahoma.

A survey of the surface formations outcropping between the town of Drumright and the gas well of the Fortuna Oil Company in sec. 24, T. 18 N., R. 6 E., gives an average west dip of 54 feet to the mile. This amount of west dip is not at all in harmony with the dip of the Fort Scott limestone (Wheeler sand of the drillers). Taking the depth of the Wheeler sand near the town of Drumright and the depth of the same formation in the Fortuna Company's well we find the west dip to be 104 feet to the mile. This discrepancy of west dip as determined by surface and subsurface formations might be accounted for by a fault somewhere between the town of Drumright and the well mentioned, but no evidence of such fault can be detected. Presumably, therefore, the abnormal west dip is to be accounted for by a rapid westward thickening of the formations. Logs of other wells in the vicinity of the latter bear out this conclusion. While the writer gives this conclusion reluctantly, he sees at present no escape from it. Further surface surveys and additional logs may lead the way to some other explanation of the discrepancy.

The general trend of the folds in the Cushing field is north and south, but they may extend in any direction. Usually the main fold is intersected by one or more minor transverse folds. Although some geologists believe that the major and minor folds in this area were formed at different periods the writer sees no reason to postulate two or more periods of disturbance.

It will be in order here to define certain terms used in the following discussion in order that it may be more easily understood by the driller and practical oil man. Structure is the term used by geologists to indicate the present position or attitude of strata. The angle between the plane of bedding and a horizontal line is called the dip, while the line along which the bed comes to the surface is the outcrop, and the direction of a line at right angles to the dip is called the strike. The upward bending fold or arch is called an anticline; the downward bending trough, a syncline; and the unbroken, regular dip a monocline. Low places in a syncline are sometimes designated as basins or saucer-shaped structures, and the high points along the crests of anticlines, domes. The axis of an anticline is that line which passes through the highest points along its crest, and the line passing through the lowest points along the trough is called the axis of the syncline. A fault is a fissure in the strata along which movement of rocks has taken place. The plane along which such movement occurs is, in the Oklahoma oil fields, vertical, or nearly so.

Method Used for Determining Structure.

The writer found no base map of the area available except the

ordinary county map. This, however, serves fairly well for the purpose of representing the general surface geology and of portraying structure. All surveys, both of the areal geology and of the structure, were plotted on this map.

In order to determine the structure a line of levels was run to the field with a spirit level from the government bench mark located at the southwest corner of sec. 3, T. 17 N., R. 6 E. This primary level line was carried to different parts of the field and temporary bench marks were established. From these temporary bench marks secondary spirit level lines were run to all of the wells in the field, which at that time approximated 700. The elevation and location of each well was determined and plotted. Later the log of each well was obtained, which usually gives the depths to the producing sands, the amount of initial production, the lease name, number and owner of the well.

The principal formations were then mapped and the elevation of a large number of points on the several outcrops was determined. These points and elevations were plotted on the county map as a base. The Pawhuska limestone being easily recognized and outcropping over a large part of the field, was selected as the key rock; the elevations determined were calculated in terms of this limestone, and the structural contours (see map) were drawn upon it. The contour interval is 10 feet.

Method Used for Portraying Structure.

The writer has attempted to portray two phases of structure—that of the surface formations and that of the more productive horizons. For portraying this structure two methods are used—contour lines and cross sections.

CONTOUR LINES.

In determining surface structure the Pawhuska limestone was mapped wherever possible, but in places it has been eroded away. In most such places some outcropping formation having a determinable interval above or below the Pawhuska limestone was usually found and elevations thereon determined. (See Pl. III which shows the outcropping of the different formations that were mapped.) These elevations were later reduced to terms of elevations of Pawhuska limestone at each point by adding or subtracting, as the case might be, the known interval of the bed from the Pawhuska. All elevations were then plotted on the base map at their respective locations. Contour lines with contour intervals of 10 feet were then drawn through points of equal height above sea level.

Inasmuch as the northwest part of T. 17 N., and the southwest part of T. 18 N., R. 7 E., were already in an advanced stage of development at the time the field work was done, it was realized that little aid could be given in extending this part of the field, but

that on the other hand, a vast amount of information could be derived with respect to the relation between accumulation and structure. Therefore, in this part of the field the structure of the Layton and Wheeler "sands" was determined by means of the well records, and calculation made to terms of the Pawhuska limestone. This was done by taking the interval between the top of the Pawhuska limestone and the top of the Layton sand at 1,530 feet, and the interval from the top of the Pawhuska limestone to the top of the Wheeler sand (Fort Scott or Oswego limestone) as 2,340 feet. This gives, therefore, an interval of 810 feet between the Layton and Wheeler "sands."

In this connection it should be noted that the underground structure of the Layton and Wheeler "sands" conforms very closely with each other, and also with that of the outcropping rocks. There is one feature, however, about the underground structure that does not appear so prominently on the surface structure. The underground structure of the chief oil-bearing horizons, based on the well logs, shows in some places a more complex structure than appears on the surface formations. This probably partially accounts for the variation in the initial production of the different wells in close proximity.

CROSS-SECTIONS.

Another method used to portray the structure of the Cushing field in this report is a series of cross-sections. They portray graphically the rise and fall of the oil-bearing horizons and show that they conform closely to the rise and fall of the surface formations. They also show the relation of the structure of one sand to that of another. These cross-sections will be discussed in detail later.

Accuracy of Structural Maps.

The accuracy of the contour structural map and the cross section depends upon four factors. First, the accuracy of the elevations; second, the number and distribution of the elevations determined; third, the variation in the interval between the Pawhuska limestone and the Layton and Wheeler "sands," and fourth, the reliability of well logs. All elevations were obtained with an alidade and the primary level lines were checked closely, so that the limit of error for the first factor is small. The second factor is only to be reckoned with along some of the streams where the outcropping formations cannot be distinguished. The limit of error is small in these localities, because they are never far removed from outcrops of easily recognized formations. Elsewhere the elevations were taken as frequently as desired. The limit of error for the third factor is much larger than for the first two, and at times is as much as from 10 to 15 feet, because the formations sometimes vary in thickness and often it was impossible to determine the exact stratigraphic position of the points determined. As regards the fourth factor

there is considerable variation in the accuracy of the well logs. This is due in part to the carelessness or ignorance of the driller, but probably very largely to the irregularity of the producing strata, and especially of the Layton sand.

The average interval between the top of the Layton and the Wheeler is 810 feet, but sometimes the Layton sand is thin and the Layton lime capping the sand is not reported, so that the apparent interval is considerably less than normal, while if the second or main pay of the Wheeler alone is reported the interval between the base of Layton lime and reported Wheeler is greater than normal. These are exceptions, however, and the sands usually have a fairly uniform interval and thickness.

Discussion of Chief Structural Features.

The dominant structural feature of the Cushing oil field might be defined as an anticline extending from Cimarron River in the west central part of sec. 34, T. 19 N., R. 7 E., southward in a somewhat undulating or sinuous direction to the southern limit of the southeastern corner of sec. 33, T. 17 N., R. 7 E. It is deemed better, however, to regard this anticline as composed of three more or less sharply demarked elongated domes separated by minor transverse synclines, giving thus to the anticline a sort of double saddle-shaped structure. These domes will be described in order, beginning at the north.

DROPRIGHT DOME.

This structure is so named from the oil town of Dropright which has sprung up as a result of remarkable activity on the slope of the dome. This anticline extends from Cimarron River in sec. 34, T. 19 N., R. 7 E., west southwest to the E. 1-2 sec. 17, T. 18 N., R. 7 E., where the dome reaches its maximum development. From this point southward to the southeast corner of sec. 20 it dies out rapidly.

The elongated dome thus described is about 5 miles in length, and the apex or summit is well toward the south end. From the summit northward for a distance of about 2 miles the northward dip is very gentle. The slope is very gentle, but from the middle of sec. 4 northward to Cimarron River the dip is more rapid.

The dip on the west slope also is gentle for about a mile beyond the Cimarron River. However, from this point on to the westward the dip is very steep and reaches a maximum of about 170 feet to the mile, this being the maximum dip in the field so far as is known to the writer. The east side of the dome, too, shows a gentle slope at first. The steepest dip is about the middle of sec. 16. In cross section, therefore, this dome shows a short eastern limit and a much longer, steeper western limit. Likewise in longitudinal section the south end is short and the north is much longer.

DRUMRIGHT DOME.

This dome is so named from the town of Drumright, which is situated on the western slope of the dome. This structure, as above noted, might be regarded as a continuation of the Dropright dome, the two making an anticline, but it is best described separately. It is by no means so well developed as the preceding structure. The axis rises from the southeast corner of sec. 20, T. 18 N., R. 7 E., southeast to the middle of the east side of sec. 33; thence it drops to about the middle of the W. 1-2 of sec. 10, T. 17 N. Both the north and south dips are very gentle, as compared with those of the Dropright dome. The total dip on the north end of the dome is not much in excess of 50 feet, while the south dip is between 30 and 40 feet. The west slope is comparatively gentle, being about 75 feet to the mile. This slope as shown by the structural contours is much more irregular than the corresponding slope of the Dropright dome. The east slope of this dome is somewhat more than a mile in length, and very gentle, the dip being about 50 feet to the mile. As compared with other east dips in northeastern Oklahoma, however, this is rather pronounced. It was on the west slope of this dome in sec. 32, T. 18 N., R. 7 E., that the discovery well was completed in March, 1912.

SHAMROCK DOME.

The southernmost of the three principal domes is termed the Shamrock dome from the Post Office by that name situated some 2 miles to the southwest of the apex of the dome. This dome is seen to be closely related to the Drumright dome. The axis rises from about the middle of the west side of sec. 10, south to the center of sec. 22, thence dropping to the southwest. The southern limit of the dome is beyond the confines of the map, the axis passing out of T. 17 N., in the southeast corner of sec. 33.

The west slope of this dome is long and gradual, being a part of the regular monoclinal structure of the region. The east slope of the dome was not accurately mapped on account of lack of good exposures of formations, and also through want of well logs. It is certain, however, that the east dip continues from the apex of the dome in section 22 approximately to Little Deep Fork Creek in the east 1-2 of sec. 23. This makes one of the best developed domes of the entire area, being surpassed in magnitude only by the Dropright dome.

It will be noted in passing that as this is being written wells of large production are being brought in in the Bartlesville sand on this dome, the well of the Numa Oil Company on the Fife lease in sec. 22, starting off at a reported production approaching 8,000 barrels per day. It is safe to say that the area involved in this dome will be one of the most productive parts of the entire field.

MOUNT PLEASANT DOME.

This structure takes its name from Mount Pleasant church, which is situated on the north slope of the dome. This is one of the few structures that is characterized by east-west elongation. The dome extends from the west 1-2 sec. 10 eastward and somewhat northward through sec. 11 into the northwest part of sec. 12, T. 17 N., R. 7 E. It thus has a length not to exceed 2 miles. Transversely it may be said to extend from about the center of sec. 14, northward to the center of sec. 2, a distance of about 2 miles. The east dip of the dome which, from an economic standpoint is the most important, approximates 65 feet. The great production at the present being obtained from the Bartlesville sand is from the region where this dome comes into contact with the south end of the Drumright and the north end of the Shamrock domes. It will be interesting to follow development toward the apex of this structure.

DROPRIGHT SYNCLINE.

Lying to the eastward of the domes already described is a very pronounced, though somewhat irregular, syncline. Just as the Dropright, Drumright, and Shamrock domes might be considered as so many parts of an anticline characterized by domes, so the syncline is characterized by depressions. The syncline reaches pronounced development just to the eastward of the Dropright anticline. The trough extends from about the southeast corner of sec. 34, T. 19 N., R. 7 E., south and somewhat west to the center of the southeast 1-4 sec. 21, T. 18 N., R. 7 E. The axis of this syncline thus lies about 1 1-2 miles east of that of the Dropright anticline, and is approximately parallel to it. The syncline is characterized by the saucer-shaped depressions; one in the north 1-2 sec. 10, and the other on the southeast 1-4 sec. 21, T. 18 N., R. 7 E. The total maximum dip from the summit of the adjacent dome to the bottom of the first saucer-shaped depression mentioned is approximately 175 feet, which is a very unusual east dip in the oil fields of Oklahoma.

DRUMRIGHT SYNCLINE.

East of the Drumright dome is a broad, rather poorly defined syncline, the axis of which lies in the western part of sec. 35, T. 19 N., R. 7 E. The total dip from the summit of the dome to the bottom of the syncline is about 55 feet.

SHAMROCK SYNCLINE.

East of the Shamrock dome is a very sharply defined syncline which coincides roughly with Little Deep Fork Creek in the eastern parts of secs. 23 and 26, T. 18 N., R. 7 E. This syncline branches to the northward to give rise to the Mount Pleasant dome, one arm of the syncline passing to the southeast and the other to the southwest of the dome. This syncline is comparable in degree of development to that lying eastward of the Dropright dome. The

amount of dip from the summit of Shamrock dome to the bottom of this syncline is approximately 120 feet, the precise amount being difficult to obtain.

MISCELLANEOUS ANTICLINES AND DOMES.

There are several minor anticlines and elongated domes within the area surveyed that deserve special mention, espcially inasmuch as some of these lie beyond the confines of developed territory. In the northwest part of T. 17 N., R. 7 E. these minor structures are especially important, there being no less than seven minor anticlines and elongated domes in comparatively close proximity to each other. These need not be discussed in detail since they are portrayed individually on the contour and structural map. It will be in order here, however, to say that the principal development in the Layton and Wheeler sands is associated with these structures. It should also be noted carefully that some of these structures show no east dip. This is particularly true of those in secs. 5 and 6. As already noted above the contours drawn on the Pawhuska limestone are the results of calculations from the depths of producing sands, and in reality therefore the structure is that of those horizons. Added emphasis should be given to the fact that the calculations are based on casing records rather than logs.

In the southwest part of sec. 6, T. 17 N., R. 8 E., and in sec. 1 to the westward is a small Y-shaped anticline open to the northwest. In the southern part of sec. 1 there is a gentle dip to the southward and also to the northward as far as the middle section. In the northeast 1-4 of the section the dip is to the northeast and southwest. While this structure is mild and not to be compared with domes heretofore described, it will doubtless be tested in the near future. It should be noted, however, that this anticline shows no east dip, properly speaking.

In sec. 13, T. 18 N., R. 7 E., is another broad, rather poorly defined, flat dome. From the center of this section eastward and somewhat northward for a distance of about three-fourths of a mile there is a dip of about 25 feet. In practically every direction from the center of this dome the strata show very mild dips, and it is reasonable to suppose that this region would warrant prospecting.

It remains merely to mention two very small domes: one near the center of section 26, and the other in the SW. 1-4 sec. 23, T. 18 N., R. 7 E. These structures are so small that they need not be discussed in detail, but it should be remarked that they are comparable in area to similar structures south of Drumright.

FAULTS.

The contour structural map shows three faults, each of which merit special consideration in themselves. Their importance is increased in view of the fact that it is not at all improbable that these

may eventually be shown to be associated with the accumulation of oil and gas, as seems to be true in other oil and gas fields in northeastern Oklahoma. The first of these faults extends from near the central part of the SW. 1-4 sec. 14, T. 18 N., R. 7 E., in a general southeast direction to near the southeast corner of sec. 23. It probably extends further into sec. 25, but this is not certain. The maximum displacement in the E 1-2 of sec. 23 is about 123 feet, but this maximum displacement prevails for but a short distance. Throughout the greater length of the fault at its greatest development the dip is between 40 and 50 feet. Development has already been carried on near the north end of the fault.

A short fault was discovered in the N. 1-2 of sec. 12, T. 18 N., R. 7 E. It extends from near the northwest corner of the section, southeast to the southeast corner of the NE. 1-4, probably into sec. 7 to the eastward. The displacement near the center of the fault which shows here to be somewhat greater than 80 feet, with the maximum throw near the middle of the north half of the section.

Another fault extends from the SW. 1-4 of sec. 36, T. 19 N., R. 7 E., southeast to near the center of sec. 7, T. 18 N., R. 8 E. This is not only the longest fault of the area, but shows a greater displacement than either of the others, the maximum throw in the north half of sec. 1 being about 130 feet.

In this connection certain considerations bearing on the relation of faults to anticlines may be of value. The economic value of the anticline as pertaining to the accumulation of oil and gas consists in the fact that if the oil and gas escape they must migrate down the east slope of the anticline and past the syncline which acts as a barrier. This would not be impossible if hydraulic pressure or other force were not acting from the eastward. Other barriers might serve, however, equally well with the syncline. If the fault fissure extends downward through the productive horizons, and if the displacement at those horizons is of such magnitude that the upper surface of the sands on the down throw side passes below the lower surface on the up throw side, then, other things being equal, the fault might perform the function of the syncline.

A further consideration shows that a fault in all probability when followed downward will merge into an anticline. This follows from the fact that any stratum, as the fault dies out downward, must approach gradually the normal, unfaulted position, and in so doing will pass through a stage where rupture has not taken place, but where east dip more or less gentle has taken the place of the downthrow of the fault. It should be constantly kept in mind, however, that a fault can serve the function of a syncline or can merge downward into an anticline in this field only when the downthrow is on

the east side. This could not obviously hold true with the downthrow on the west side.

Relation of Structure to Accumulation of Oil and Gas.

It has already been stated that during the progress of the field work consideration was constantly given to theoretical considerations, with the aim of obtaining all data possible on the relation of structure to accumulation of oil and gas in the hope that a study of this prodigiously productive field might lead to an expansion of the field, and also to the discovery of other fields. There is a wide difference of opinion among geologists and operators as to the value of structure as a guide in drilling. In following or considering the structural theory of the accumulation of oil and gas it should be kept in mind that no theory however sound and orthodox, can be pushed too far, and the structural theory is no exception. There are so many factors entering handicapping the geologist in his work, and so many modifying geologic conditions that only the broadest kind of generalizations should be attempted. The facts obtained in the study of the Cushing field are so full of meaning, however, that the writer is constrained, even at some risk of criticism, to venture a few generalities.

Consideration of the contour structural map as well as of the several cross-sections accompanying this report, shows that the early development of the field in the Layton and Wheeler sands in the general vicinity of the town of Drumright is on the west slope of a general anticline characterized by the three elongated domes above described. This general westward dip has suffered many minor modifications, especially near and south of Drumright. Some of the largest oil wells brought in in these sands are located near the apexes of these minor domes. A close scrutiny of the distribution of gas wells also shows that the gas is found well toward the top of the anticline.

More marked, however, is the case of the north end of the anticline, which has been described as the Dropright dome. It is on the northwest slope of this dome that the marked production in the shallower sands was obtained during 1913. In this case also the general rule is that the gas is found well toward the top or apex of the dome.

The structural map has preceded this report by several months. The first issue of the map showed a marked dome described in this report as the Shamrock dome, centering in sec. 22, T. 17 N., R. 7 E. Acting on the suggestions given in the map, the drill was sunk in sec. 22 to the Bartlesville sand, with the result that phenomenal production is now being obtained in this region. One of the first wells brought in is that of the Numa Oil Company, whose initial production is reported at 8,000 barrels. The writer is lead to believe that this will be one of the richest parts of the entire field.

The first pool opened up in the Bartlesville sand centered around secs. 3, 4, 9, and 10, T. 17 N., R. 7 E. This general region must be regarded both as being at the top of the general anticline, and also on the west slope of the Mount Pleasant dome already described. The small pool centering around SW. 1-4 sec. 14 T. 18 N., R. 7 E., seems to be closely related to the fault in that vicinity, though this is by no means certain.

Turning now to the relation of nonproductive wells to synclines, one finds that one of the earliest wells sunk in the region is in the northeast corner of the NW. 1-4 sec. 28, T. 18 N., R. 7 E. This well is seen to be well toward the bottom of the saucer-shaped depression in the Dropright syncline. This dry hole came very near having a disasterous effect upon this field in its infancy. Further to the northeast in sec. 10 is another dry hole, which lies close to the axis of the syncline. Another is situated in the NW. 1-4 sec. 22, while to the east of this latter well and further away from the syncline some small production is being obtained. In sec. 35 of the same township and range is another dry hole, situated almost exactly on the axis of the syncline. It will be observed also that the dry hole one mile north of Shamrock is far down the western slope of the Shamrock dome; good production being obtained to the eastward of this place, as already remarked.

In the general vicinity with this of Drumright are also several dry holes, some of which are the Bartlesville sand. It is not easy to account for this phenomenon, but it should be noted that these wells are beyond the bounds of the minor synclines and domes which are especially numerous south of Drumright. Whether the failure to obtain production is due to the wells lying beyond the bounds of these folds cannot be determined at present, but the relation is at least interesting.

The production in the earlier developed part of the field decreased westward down the dip and finally failed altogether. Likewise on the northwest slope of the Dropright anticline production is light when in wells far removed from the axis of the dome.

In view of the above considerations one cannot escape the conviction that structure bears a close relation to the accumulation of oil and gas, but that at the same time there are exceptions to the rule, or rather, modifications. Be the modifications or exceptions what they may, several structural features already described in this report must be regarded as promising places for tests. The Shamrock dome has already been tested to the Bartlesville sand, and further comment is unnecessary. The Dropright dome is being tested for the Bartlesville sand and since the structure in this area

is more pronounced than that to the south the production will probably be larger. The Mount Pleasant dome offers excellent acreage. Of less importance and probably also of less commercial value are the low anticlines in sec. 1, T. 17 N., R. 7 E., and in sec. 13, T. 18 N., R. 7 E. While these two structures are not well developed, they doubtless will be tested in the near future.

Too little is yet known regarding the relation of faults to accumulation, but the writer is of the opinion that it is the part of wisdom to test the territory in the vicinity of these faults, especially to the westward of the fault line. If such test should be made perhaps the best locality for the test well is opposite the maximum displacement in each case.

In the section on history of development it was shown that the rich accumulation in the Bartlesville sand was not discovered until December, 1913. This rich sand lying several hundred feet below the Wheeler sand naturally raises the question as to whether there may be still other sand or sands below the Bartlesville. In the Cleveland field and elsewhere in northeastern Oklahoma, producing sands have been found below the Bartlesville sand. It may, therefor, be not unreasonable to suppose that the same may be true in the present area. At any rate the field cannot be regarded as thoroughly tested until deeper tests are made along the axes of the domes described, or a short distance down their western slopes.

PROBABLE ORIGIN AND MODE OF ACCUMULATION OF OIL AND GAS IN THE CUSHING FIELD.

Origin.

The theories that have been brought forward from time to time to account for the origin of petroleum and natural gas divide themselves into two general classes as follows:

A. Inorganic origin

B. Organic origin { Animal origin / Vegetable origin

INORGANIC ORIGIN.

The inorganic theory is essentially a theory formulated by chemists. It holds that oil and gas have been formed by the condensation and isomerization of hydrocarbons and that these commercial reactions are due to the action of water upon certain metallic carbides in the earth's crust. Laboratory experiments tend to show that the inorganic substances from which oil and gas may be formed can exist only at high temperatures and therefore the oil and gas must have had a deep-seated origin or must have been formed near some mass of highly heated rock. But the oil and gas bearing strata in the Cushing field and in fact all the other principal fields in the world with the exception of those of Mexico occur in

sedimentary deposits somewhat removed from such heated rocks. In the Mid-Continent field in particular many observations have been made which prove that the formations in which petroleum and natural gas probably originated have not been subjected to the high temperature required by the inorganic theory. This is particularly true in the Cushing field, because there is no evidence that any of the rocks here at the surface or at depths have ever been highly heated or that the strata in any adjoining area have been subject to such conditions.

ORGANIC ORIGIN.

The generally accepted theory of the origin of oil and gas is that both substances have been formed by slow decay of organic matter buried in the rocks. Inasmuch as the organic matter buried in the rocks at the time of their deposition included both animal and vegetable matter, this phase of the subject will be treated briefly below under these two headlines. The relative importance of animal and vegetable matter as the material from which petroleum and petroleum compounds are formed has been discussed at length in recent publications, but the point will probably not be settled with any degree of certainty within the near future.

Animal origin.—As regards the animal origin of oil and gas, many experiments have been conducted in the laboratory on the destructive distillation of animal matter and these experiments prove that almost any kind of animal matter can be decomposed and separated into various compounds. Some of these when properly treated may be converted into mixtures of oils and gases closely resembling petroleum and gas as found in nature. For this reason it is thought by some geologists that pools of oil and gas owe their origin to the decomposition or destructive distillation of animal matter entombed in the strata at the time of deposition.

The limestone oils of Ohio, Indiana, and parts of Illinois and Canada, often known as "sour oils," are thought by some to be formed from the distillation of the animal matter contained in their respective limestone formations. The oil in these pools is sour and contains a much larger percentage of sulphur and nitrogen than the oil that is found in the sand formations.

There are those, however, who strongly oppose the theory that oil owes its origin to animal matter. The following quotation from Craig* represents the extreme view:

> It is only from fatty parts of animal organisms that the petroleum could be formed, so it is only a portion, and often a very small portion of the soft parts that can be utilized. The elimination of nitrogenous compounds and at the same time the preservation of the fats must be presupposed, and such

*Craig, E. H. Cunningham, Oil finding, p. 9.

an assumption may be said to beg the whole question. The theory is that the animal matter decomposes in such a manner that, before it is entombed, practically all nitrogenous matter has been removed, (since only the merest traces of nitrogen compounds have ever been found in natural petroleum) and the preservation action of salt water has even been adduced to make such a retarded decomposition appear less improbable. But can we find any evidence of such a selective decomposition in nature? Are fats preserved, even in sea-water, while flesh is decomposed and dissipated as gases? Let anyone who has studied formation of guano, or who has been unfortunate enough to have the processes in the decomposition of a dead whale forced upon his senses, answer.

Another difficulty which the animal origin theorists have to encounter is the disposal of the phosphorous contents of the animal matter. This, of course, on the decomposition of the animal organisms naturally takes the form of phosphates. Now, of all salts formed in nature the phosphates, whether of iron or calcium, or double and compound phosphates, are among the most difficult to dissolve and remove in solution. Hence, phosphatic beds or lines of phosphatic nodules may be expected near or among those beds where animal organisms have been most abundant. The phosphates indeed remain chiefly as, or in, the hard parts of the organisms when the softer parts have been decomposed or absorbed into the economy of other living organisms. The proportion of derived phosphates to animal fats is very high in nearly all marine and fresh-water organisms. If, then, we are to contend that the petroleum of our great oil fields is derived from animal matter, vast stores of phosphate must be present somewhere in the vicinity of the place where the oil has been formed. But we know of no great phosphatic deposits associated with oil-rocks or within the confines of oil fields.

The formations in the Cushing field are practically barren of animal remains and nitrogenous or phasphate compounds. Also the oil and gas contain a very small amount of sulphur and nitrogen. These facts tend to show that animal matter is not the source of the large pools of oil in the Cushing field.

Vegetable or plant origin.—In connection with the animal origin of oil and gas the theory of the formation of petroleum and natural gas from vegetable matter has been in existence in one form or another since an early date in the history of oil field discovery and development. At the time the Pennsylvanian rocks in the Mid-Continent field were being laid down, plant life, both terrestrial and marine was very prolific, as is evidenced by the abundance of carbonaceous shales and sandstones and the seams of coal or lignite encountered by the drill. During surface erosion land plants were carried down the streams. These together with the algae and various types of sea-weeds found along the shallow shores were imbedded in the muds and silts of the accumulating deposits of centuries.

The manner in which these plant remains, after having been buried with the rocks as they were deposited, were changed to oil

and gas is not definitely known. Several theories, however, have been advanced to explain the manner in which organic matter is transformed to oil and gas and reference is here made to those that are most generally accepted. There are those who believe that oil and gas are formed by the destructive distillation of the organic remains. The fact that no evidence of any metamorphic condition in the rocks has been found in the Pennsylvanian formation of the Mid-Continent field tends to disprove this theory at least in this particular area. It is thought by still others that the organic remains after being embedded in the rocks and shut off from the oxygen and other destructive agents of the air, have been slowly changed to oil and gas by the effect of low temperatures and high pressures acting through long periods of time.

Dr. Charles B. Morrey of the Ohio State University probably offers the best theory that has been advanced. He believes that bacteria are the agents that cause the transformation from plant remains to oil and gas and summarizes his arguments as follows:

1. Bacteria produce just these decompositions when acting in the absence of air.

2. Bacteria were present in the formations along with other organic matter.

3. Bacteria are the only agents known which can produce such decomposition except heat.

4. The action of heat (in the Ohio field at least) is excluded by geologic evidence.

In conclusion the writer believes that the oil and gas in the Cushing field owe their origin largely to the distillation of the vegetable matter which is found in inexhaustible quantities in the carbonaceous shales. Bacteria, low temperature, and high pressure acting through long periods of time have probably been the principal agents by which the vegetable matter has been transformed into oil and gas.

Causes of Accumulation.

It should be reiterated at this point that the different oil companies operating in the Cushing oil field have made no effort to keep a complete record of the formations encountered by the drill as respects the porosity and thickness of the pay sands, the presence of salt water and its ratio to the oil, together with the initial closed pressure and initial capacity. Because of this incomplete record there is not a sufficient amount of detailed geologic data at hand to jusitfy any definite conclusions on the causes of accumulation and the relation of accumulation to geologic structure. During the field work, however, a large amount of geologic information was obtain-

ed. Now it is necessary to postulate how these pools were probably concentrated and stored.

An important feature to be considered in connection with a discussion on the accumulation of these pools is the question as to whether the oil and gas have originated in or near the rocks in which they now occur or whether they have migrated into them from other rocks at a greater or less distance.

There are a few eminent geologists who maintain that the organic material out of which the oil and gas were formed was buried in the formations in which these products are at present, that is, that the pools originated within the formations where they are now stored. I. C. White, State geologist of West Virginia, is one of those who believe that the oil and gas in the principal pools of the Sewickley quadrangle in Pennsylvania are indigenous in the sands in which they are found. This view is expressed in the introduction to Munn's report.* However, after having made a detailed study of this field he believes that the oil and gas originated in the shales above and below the oil sands. This latter view is prevalent among most geologists at the present time.

The writer has visited many drilling wells in the Cushing field and adjoining territory and has had an opportunity to study samples taken from the different oil-bearing horizons. The samples studied have never given any evidence that the oil-bearing strata contain any large quantity of vegetable matter. On the contrary, however, even in dry "wild-cat" wells where no oil or gas was obtained in any of the sands an examination of practically any of the shales encountered by the drill shows an abundance of vegetable matter. A retort distillation of these shales reveals the presence of oil in small quantities, and in many instances sufficient amounts have accumulated to give small "shows" in the shale. On discussing this proposition Newberry states that as much as 20 gallons of petroleum to the ton have been distilled from certain shales in Ohio. These conditions have led the writer to conclude that the carbonaceous shales are the source of the oil and gas in the Cushing field and therefore they are not indigenous in the present producing strata, but have migrated a greater or less distance from their source or origin.

The thickness and character of the Wheeler limestone tends to substantiate this conclusion. It has every appearance of having been laid down in deep sea and therefore far removed from any vegetable matter. Yet, it is one of the principal producing strata in the field.

Geologists have long since recognized that there is some relation between the accumulation of oil and gas and the structure of rocks.

*M. J. Munn. Report Topographic and geologic survey commission of Pennsylvania. No. 1, p. 16.

The theory of accumulation based on structure has been known as the anticlinal theory. It was advanced as early as 1859, but I. C. White made the first practical application of it in 1882-83. Since that time numerous expansions and modifications of the anticlinal theory have been made by different geologists.* Only a summary is necessary in this report and the following quotation from Griswold** is perhaps the latest and best statement of this theory.

(1) In dry rocks the principal points of accumulation of oil will be at or near the bottom of the synclines or at the lowest point of the porous medium, or at any point where the slope of the rock is not sufficient to overcome the friction, such as structural terraces or benches. (2) In porous rocks completely saturated the accumulation of both oil and gas will be in the anticlines or along level portions of the structure. Where the area of porous rocks is limited the accumulation will occur at the highest point of the porous medium, and where areas of impervious rocks exist in a generally porous stratum the accumulation will take place below such impervious stop, which is really the top limit of the porous rock. (3) In porous rocks that are only partly filled with water the oil accumulates at the upper limit of the saturated area. This limit of saturation traces a level line around the sides of each structural basin, but the height of this line may vary greatly in adjacent basins and in different sands of the same basin.

Partial saturation is the condition most generally found, in which case accumulations of oil may occur anywhere with reference to the geologic structure; it is mast likely, however, to occur upon terraces or levels, as these places are favorable to accumulation in both dry and saturated rocks.

Under all conditions the most probable locations for the accumulation of gas are on the crests of anticlines. Small folds along the side of a syncline may hold a supply of gas, or the rocks may be so dense that gas can not travel to the anticline, but will remain in volume close to the oil.

A study of the general structural map (Pl. I) together with the production map and the sections, shows that the fundamental idea of the anticlinal theory holds good in the Cushing field. In the discussion of the different producing horizons it was proven that the gas in general occurs on the axis of the anticline, while the oil is usually found along the slopes immediately overlying the salt water.

Although the structural idea in the anticlinal theory holds true yet the writer does not agree with Griswold and the many other prominent geologists of this school in regard to the part water plays in the work of accumulating the oil and gas in these anticlinal folds. They believe that water acts as a transporting agent through difference in specific gravity alone. It is entirely probable that this

*See Geology of the oil and gas fields in Sewickley quadrangle, by M. J. Munn for the history of the anticlinal theory.

**Griswold, W. T. and Munn, M. J., Bull. U. S. Geol. Survey, No. 318, 1907, p. 15.

generally accepted process has played a part in the accumulation of the oil and gas, but the evidence is that there are one or more other factors.

It has already been pointed out that the probable source of the oil and gas in the Cushing field is in the carbonaceous shales. A problem of special importance therefore is the migration of the petroleum and natural gas from these shales and their mode of accumulation in the porous rocks on the anticlinal folds. One of the probable factors in directing the circulation to the porous strata is capillarity. Capillary action is the physical phenomenon consequent upon the attraction or repulsion of liquid along sides of very fine passages. The shales contain infinite numbers of minute spaces capable of holding liquids and the oil through capillary action to a small extent probably is drawn along the sides of these fine passages. Hydrostatic pressure, which is the pressure of water in equilibrium may assist this circulation somewhat. The velocity of flow is dependent upon three factors, first, the area and cross-section of the opening; second, its length; and third, the viscosity of the fluid.

Munn* offers the following suggestion to account for the transference of oil from shales to porous sandstones:

> The writer suspects that movement of oil from the mud and shales to sandstones will be considered due principally to currents of moving water upward from the forming shales by differential compression of the shales and the overlying sands, as succeeding strata were laid down on the sea-bottom.

The data at hand are too meagre to form any definite theories, but Munn's suggestions that capillary action and hydrostatic pressure play some part, appear very plausible.

The anticlinal theory as summarized by Griswold assumes that water acts as a transporting agent for the oil and gas in a porous stratum through difference in specific gravity alone. This assumption is the weak "link" in the anticlinal theory. Since the oil and gas are not indigenous in the present producing horizons, they must have reached these strata by traveling a greater or less vertical and lateral distance through rocks that do not have a maximum dip of more than 1 foot in 50 feet. This is 105 feet to the mile—pretty good dip. The writer heartily endorses the view held by Munn when he says:**

> If the close hard sandstone is admittedly sufficiently porous to permit the passage of oil particles through the waterlogged pores at a very small

*Munn, M. J., Geology of the oil and gas fields of the Sewickley quadrangle, Rept. Topographic and Geologic survey of Penn., No. 1, 1910, p. 131.
**Idem, p. 125.

> dip, and with a pressure of less than half the weight of the moving globules of oil, it seems reasonable to suppose that with the enormous pressure under which the oil and water is found either water or oil should be forced out of the sandstone in perceptible quantities throughout its entire thickness. Incidentally, by his statement Griswold can be forced to assume that the great pressure of the oil, water, and gas in the porous streaks comes primarily from the pressure of the gas forming from the petroleum after it has reached the pay streaks. In this instance it is hard to see how these gas pressures can be localized, since if the oil is free to move in at a pressure of less than one-half its weight, the gas should much more easily flow out and dissipate its pressure throughout the whole rock mass as rapidly as it is formed. The initial closed pressure of closely associated pools is rarely the same, and the evidence tends to show that it varies greatly in different pays of a given pool, and even of the same well.

The present data on hand strongly indicates that moving water was the factor competent to accumulate these pools. Blatchley* in discussing this point in connection with the oil deposits of the Trenton limestone in Indiana says that:

> The water when it first passed into the Trenton rock gathered the particles of disseminated oil upon its surface and then pushed them ahead into the higher and limited areas in which the great accumulations are now found.

Similar views are also expressed by Hoeing** as follows:

> The salt water is the direct agent through which accumulations of oil and gas have taken place. With a given rock containing oil scattered through its mass the salt water in the same rock rising up the dip collects the oil as it rises; the latter by its lighter specific gravity then separating from the water and rising ahead of it, in volume increasing in proportion to the distance along the dip through which is rises, finally being caught and held in some structural fold in the rock; but (and this is an important modification of the anticlinal theory) only rising far enough up the dip to keep ahead of the salt water so that the position of the oil with reference to the summit of the fold may be predetermined by the height to which the salt water can rise.

Continuing this line of thought Munn says:

> It may be shown that the hydraulic principle of oil and gas transportation lends itself readily to the explanation of many of the most perplexing phases of the problem, and it is possible that when more is known in a regional way of the age, history and movements of the salt water enclosed in the oil-bearing formations, the solution of the enigmatic question of oil and gas accumulation may be more confidently answered.

*Blatchley, W. S., Twenty-first Ann. Rept. Ind. Dept. of Geol. 1896, p. 45.
**Hoeing, J. B., The oil and gas sands of Kentucky, Bull. Ken. Geol. Survey, No. 1, pp. 22.

He believes that the subsequent movements of oil and gas after passing from the shales into porous strata "were principally due to structural changes that set up slow circulations of the original water of deposition, which may have from time to time been augmented by meteoric waters."

Practically every well that has been drilled in the Cushing field on or near the axis of the anticline has produced large quantities of gas, which exists under high pressure. Several of the wells produce as much as 30,000,000 to 40,000,000 cu. ft. per day. A large part of the gas is piped out of the field, but it is estimated that over 400,000,000 cu. ft. are allowed to escape into the atmosphere every day. These figures give an idea of the vast amount of gas that is stored in the field. The fact that this tremendous volume of gas under high pressure is unable to force itself and the oil back through the porous rocks whence they came, but are prevented from diffusing throughout the producing strata by the resistance offered by water, either hydraulic or interstitial, precludes the idea that they were first forced into this fold in such large quantities by water acting as a transporting agent through difference in specific gravity alone.

In conclusion it is evident that three factors were necessary for the accumulation of the oil and gas in the Cushing field: first, a source for these carbon compounds; second, some transporting agent; and third, a proper reservoir to retain the transported materials. A summary of the theories advocated in this report shows that the source of the petroleum and natural gas is in the carbonaceous shales, and that moving waters as well as capillary and hydraulic pressure act as transporting agents, while porous strata with impervious covers in the folded area form reservoirs sufficient to contain the large quantities of oil and gas that have accumulated.

DISCUSSION OF CHIEF PRODUCTIVE HORIZONS.

General.

Up to the present, commercial quantities of oil and gas have been found in three different horizons, namely: the Layton sand, the Wheeler "sand" (Oswego or Fort Scott limestone), and the Bartlesville sand. A brief discussion of these formations will be given.

The field work for this report was completed before the Bartlesville sand production was discovered, and the cross-sections shown in Plate II in the index map to sections and profiles are based on Layton and Wheeler wells. The profiles shown in this index map, however, are based on the upper Pawhuska limestone and therefore are applicable to the entire area. The maps on the Bartlesville area, which were made later, will be referred to under the discussion on the Bartlesville sand.

Layton Sand.

The Layton sand received its name from the Layton farm in the Cleveland field and the name was applied to the sand in the Cushing field which was supposed to be at the same horizon. In general this sand is a fairly soft, porous, coarse-grained sandstone. It has an average thickness of about 50 feet, but in a few wells scattered over the field the sand is reported to be considerably less and even altogether lacking, while in other portions of the field as much as 100 feet or more has been reported as encountered by the drill. Although the thickness, porosity, and other physical properties of this formation vary somewhat in different localities, yet in a general way they are much the same over the entire field. There is no disposition on the part of the writer to question the fact that the Layton sand is irregular but on the other hand it is very probable that in the wells where extreme irregularity is reported there are several cases where the drillers failed to note closely the changes in the rock formations as the drill passed through them. A study of the well logs, from the different wells in this field, shows that in a number of wells a thin shale or "break" occurs in the Layton sand, while in other wells within close proximity to these the break is not recorded and therefore the sand is reported as being much thicker than ordinary. As an example see Eliza Wacoche Nos. 1 and 2, Plate VII. It is also very likely that at least some of the Layton wells in which the sand is reported to be thin, the drill stopped in the upper sand and did not pass through the shale break into the lower sand.

Notwithstanding the probability that the formations in the Cushing field are more nearly constant than the well logs indicate, yet there are certain variations that appear evident. Plate VIII shows

that the top of the Layton is found at an average depth of 1,530 feet below the top of the upper Pawhuska limestone and 810 feet above the top of the Wheeler lime. The wells from which the records were taken to determine these intervals occur in secs. 30 and 31, T. 18 N., R. 7 E. and secs. 6, 7, and 17, T. 17 N., R. 7 E. When the field work for this report was done, the principal development was in this general area. Since then, however, development has extended to the northward and eastward and covers much larger territory. The records of the new wells to the eastward show that the formations between the Layton and Wheeler sands are thinning in that direction, because the interval between the Layton and Wheeler formations is only about 700 feet in the area around sec. 10, T. 17 N., R 7 E. This thickening of formations from east to west apparently continues westward to the Fortuna Oil Company's well in sec. 24, T. 18 N., R. 5 E., where the Wheeler lime lies at a depth of 300 feet in excess of the westward dip of the formations. There is no evidence of faulting and since the two localities have about the same elevation above sea-level, the increase in depth must be due to a thickening of the formations to the west. Most of the records taken from the wells along the west side of the field show a limestone just above the Layton sand, but only shale is reported in the formation immediately above the sand in the central and eastern areas of the field.

The areal extent of the Layton sand is unknown, but it probably underlies a large area outside of the Cushing field. Robt. H. Wood in Bulletin 531-B of the United States Geological Survey, in speaking of the producing sands in the Cushing field correlates this sand with an upper sand of the Cleveland field which occurs at a depth of about 1300 feet.

Under the discussion on the relation of structure to accumulation of oil and gas it was shown that the oil and gas pools occur on structure, with the gas usually at the top of the fold, the oil area down the slope a short distance, and the salt water still farther down the slope and in the syncline. The data for these general conclusions were based on the production from the different producing horizons taken collectively, and therefore, it will be of interest at this point to study more in detail the production in the Layton sand itself to see if these general conditions obtain.

A detailed study of the well records given in this bulletin, which includes the new development in the Bartlesville sand area, shows that the principal gas production in the Layton occurs on or near the axes of the different anticlines in this field and that the major production of oil occurs a greater or less distance down the slopes below the gas. This arrangement is well illustrated in Plate IX which is a sketch map showing gas areas and areas of initial oil production of 100 barrels and over. This sketch map covers only

the area which had been pretty thoroughly tested at the time the field work for this report was completed, but the same general conditions prevail along Cimarron River in the north end of the field on the Dropright anticline and also on the Mount Pleasant and Shamrock anticlines in the southeast part of the field.

In this connection it should be specially noted that there is one structural feature in the Cushing field that stands out very prominently. A study of the structural map, Plate I, shows that a terrace structure occurs in the general area of Drumright along the west side of the Drumright anticline. On the north end, however, as the terrace structure disappears into the west dipping monocline the formations rise, while on the south end they dip to the southward as the terrace structure disappears. This variation in structure is well shown in Plate III. The effects of this variation in structure on accumulation is very interesting. The gradual rise in the formations to the north from the terrace structure allows the Layton production in this area to connect up with the Layton pool in secs. 5, 6, 7, and 8, T. 18 N., R. 7 E. On the other hand, the small southward dip in the formations on the southern end of the terrace structure shuts off the production and the Layton sand in this area contains salt water.

In addition to the terrace structure which appears to be the important factor in the accumulation of oil and gas in the vicinity of Drumright, there are other structural features of lesser importance that should also be mentioned. The comparatively uniform but very pronounced surface anticlinal structure is well represented in Plate III. In this drawing the structure is graphically portrayed by longitudinal and transverse profiles drawn on the horizon of upper Pawhuska limestone. A study of these profiles shows that the structure is somewhat undulating, but when the magnitude of the folding is taken into consideration, it is rather surprising that the undulation is not more pronounced. The profile A-A running north and south along the axis of the major fold shows an extreme vertical variation of 250 feet between the north end in sec. 27, T. 19 N., R. 7 E., and the crest of the Shamrock anticline in sec. 22, T. 17 N., R. 7 E. The alternating swells and troughs in this profile from north to south represent the crests of the three domes and the small transverse synclines which were described under the discussion of the chief structural features and therefore will not be discussed further at this point. The other structural conditions portrayed in this profile map were also discussed. Suffice it to say, that the location of the oil and gas production as indicated by the wells sketched in this map, shows that, in general, the oil and gas occur as would be expected according to the structural theory.

Since the nature and character of the Layton production, in a general way, conforms closely to the surface structure, the natural

conclusion is that the underground structure of this formation is similar to the surface structure. A series of cross sections of the locations which are given in Plate II proves that this is true over the areas traversed by these cross sections. Section 1 of Plate IV, gives the depth at which production was obtained in the Layton sand in a series of wells beginning on the north in sec. 20, T. 18 N., R. 7 E., with well No. 5 on the Johnson Wacoche lease and continuing southward through secs. 29 and 32, T. 18 N., R. 7 E., and secs. 5 and 8, T. 17 N., R. 7 E., to well No. 10 on the Lucinda Tiger lease in sec. 17, T. 17 N., R. 7 E. Along this section the small minor undulations do not conform altogether with the surface structure but the major underground undulations in sec. 32, T. 18 N., R. 7 E., and secs. 5 and 8, T. 17 N., R. 7 E., are similar to those of the surface structure as shown by the main structural map and also by the surface profiles in Plate III. Later development shows that the undulations in the Layton sand extending north from this section up to the big pool in sec. 8, T. 18 N., R. 7 E., also conform closely in their general features to those of the surface formations.

The problems confronting the writer in obtaining data for the transverse sections were more difficult. In the first place, the Layton production extended only a short distance down the slope, and in the second place, the principal development extended only over to the gas area as there were very few wells along the east slope of the anticlines and even along the axes in the gas area. This latter fact prevented the acquiring of a sufficient amount of data to extend the sections eastward across this area, and consequently the sections in Plate IV cover only the production area along the west slope of the anticlines. Sections IV in Plate IV shows a general west dip, broken only in the east central side of sec. 6, and also the west side of sec. 4. This latter structural effect occurs in the area of the terrace structure which is so pronuonced on the surface. A study of the recent development in the Bartlesville area to the east of this section shows that the Layton sand is fairly level for a short distance, but that in sec. 3 the formation dips slightly to the east. The development along the east slope of the Shamrock anticline also shows that it dips to the east. The Layton sand in the vicinity of the Hill Oil Company's wells in sec. 23, T. 17 N., R. 7 E., is considerably lower than it is at the crest of the anticline in sec. 22 to the west. The other sections of the Layton sand in Plate V are too short to give any comprehensive idea of the underground structure, with the possible exception of section IX. This section shows that the formation rises gradually from the west up to Cimarron River and from this point dips very rapidly to the east for a short distance. The surface structure in this area is not very evident and it may be that the Dropright anticline branches with one prong extending to the northwest where in reality the surface structure which is largely concealed under sand and alluvial deposits may conform to the structure in the Layton formation as shown in this section.

Wheeler Sand.

The second important producing horizon in the Cushing field is known as the Wheeler sand. This formation received its name from the Wheeler farm on which the first producing well in this horizon was obtained. In reality, it is not a sandstone but a formation composed of two members of coarse-grained, light-brown limestone with a thin shale interval between, the three being regarded as the equivalent of the Fort Scott or Oswego limestone, as shown in the section on stratigraphy.

The average thickness of the Wheeler sand in this area is about 75 feet. The shale break usually runs from 5 to 20 feet in thickness and ordinarily occurs just above the center of the formation. In a number of wells the break is not recorded but the writer believes that the drillers simply failed to detect the shale.

The physical characteristics of the Wheeler sand are very constant and since there are no other formations in this area that resemble it, the ordinary driller readily recognizes this formation as soon as the drill penetrates its different members. For this reason there is little danger of confusing the members of the Wheeler horizon with overlying and underlying strata as in the case with the Layton sand. Ordinarily both lime members of the Wheeler formation produce oil or gas or both. The upper member is usually a little thinner and also contains smaller quantities of oil and gas but this is not always true. In the productive areas those members are quite porous, but the dry holes usually find them tight and hard.

The interval between the Wheeler and Layton sands has already been given as ranging from 810 feet along the west side of the field to about 700 feet around sec. 10, T. 17 N., R. 7 E., in the new Bartlesville area. The same records that give these data also show that the interval between the top of the Wheeler and the top of the Bartlesville is variable in different portions of the field, and ranges from 390 to 460 feet with an average interval of about 421 feet.

The Wheeler sand in the Cushing field is probably the equivalent of the Fort Smith or Oswego which is one of the most constant formations underlying practically the entire oil and gas area in northeastern Oklahoma and also a large part of southeastern Kansas.

In a general way the production of the Wheeler sand as related to structure coincides very closely with the production in the Layton sand which has already been discussed, that is, the gas usually occurs on or near the axes of the anticlines and the oil a short dis-

tance down the slope. The oil in the Wheeler sand, however, extends somewhat farther down the slope than production in the Layton sand.

The terrace structure in the general region around Drumright which was briefly referred to above, under the discussion on the Layton sand, also plays an important role in the general accumulation of oil and gas in the Wheeler sand. The surface formations in this area which have a comparatively strong uniform west dip on the west side of the axis flatten out to the eastward in secs. 4, 9, 16, and 17, T. 17 N., R. 7 E., forming a bench or terrace. The surface formations have comparatively uniform dips, and are only slightly undulating, as indicated in Plate III, but the underground structure according to the main structural map and also Plates IV and V is much more irregular and complex. This folding was sufficient to prevent any large quantities of oil from migrating farther up the slope; but it permitted the gas to pass and disseminate itself over the area between the crest of the terrace on the west and a point a short distance beyond the axes of the anticline to the east. As a result of this arrangement the gas territory extends much farther down the west slope of the Drumright and Shamrock anticlines than it usually does along the west slope of the Dropright anticline in the north end of the field.

The behavior of the structure of the Wheeler sand in the Drumright region is very similar to that of the Layton. To the north of Drumright in sec. 20, T. 18 N., R. 7 E., the formations begin to rise and the terrace structure gradually merges into a strong monoclinal dip to the west. Since the formations rise as the terrace structure disappears, there is no prominent barrier and therefore the production is more or less continuous to the north end of the field. On the south end, however, as the terrace structure merges into the monoclinal dip on the west slope of Shamrock anticline, the formations dip slightly to the southward and this south dip shuts off production in the southern part of secs. 19 and 20, T. 17 N., R. 7 E.

It was shown above under the discussion of the Layton sand that in a general way the underground structure of this formation is very similar to the surface structure as shown in the surface profiles in Plate III. A study of the Wheeler sections in Plate IV shows that the main north and south undulations occur in the localities where the surface undulations are more pronounced. The underground structure of the Wheeler sand as shown in Plate V also conforms closely with the surface structure in that area. These sections, however, cover only the west side of the field and therefore show only the general west dip, but later development in the Bartlesville region shows that the Wheeler formation rises toward the axes of the different anticlines, where it is found at a shallower depth than at points down the slope.

Bartlesville Sand.

The most important producing horizon in the Cushing field occurs in a sand known as the Bartlesville sand, so called because it is thought to be a continuation of the principal oil bearing horizon near the town of Bartlesville from which this sand takes its name.

The average thickness of the Bartlesville horizon in the Cushing field is not known because in practically all of the wells the drill was stopped in the sand itself, but the main sand is probably about 100 feet thick. The C. B. Shaffer well in the SE. corner of the NE. 1-4 of sec. 18, T. 18 N., R. 7 E., is reported to have gone 135 feet in the horizon without passing through the sand. It is doubtful, however, if the Bartlesville sand is this thick and the driller probably included in this 135 feet an upper sand and shale such as shown in the well logs below.

The Bartlesville horizon is composed principally of a soft brown, porous, coarse-grained sandstone. The upper portion, however, is usually somewhat broken, ordinarily beginning with a thin sandstone followed by a comparatively thin shale interval, below which the top of the Bartlesville sand proper is found. Quite frequently the top of the main sand is hard and close-grained and only gas occurs in this. In a few wells a thin interval of shale or broken sand occurs in the main producing sand. In most cases these minor changes are not noted by the driller and the strata immediately above the production are recorded as one formation. The three following well logs were chosen as representative wells to give the reader a good idea of the formations encountered by the drill from the surface down. It will also be of interest in this connection to make a study of Plate XII, which gives a section of several Bartlesville wells.

Jemima Richards No. 3, SW. of the N. 2 of sec. 3, T. 17 N., R. 7 E. Completed July 18, 1914.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Sand	0	54	Lime	720	729
Slate	54	100	Lime	729	732
Lime	100	105	Sand	732	749
Slate	105	120	Lime	749	753
Red rock	120	168	Sand	753	760
Slate	168	180	Slate	760	776
Sand	180	205	Sand	776	800
Slate	205	234	Slate	800	803
Sand	234	257	Sand	803	810
Lime	157	262	Lime	810	812
Sand	262	284	Sand	812	818
Lime	284	294	Slate	818	880
Sand	294	300	Lime	880	885
Slate	300	305	Sand (water)	885	898
Red rock	305	314	Slate	898	912

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Slate	314	335	Sand	912	953
Lime	335	339	Slate	953	969
Slate	339	368	Lime	969	973
Red rock	368	390	Sand	973	1012
Sand	390	410	Slate	1012	1125
Slate	410	415	Slate	1128	1326
Sand	415	435	Lime	1326	1332
Slate	437	461	Slate	1332	1347
Sand	461	474	Sand (Layton)	1347	1387
Slate	474	489	Shale	1387	1392
Lime	489	510	Slate	1392	1561
Sand	510	530	Lime	1561	1565
Slate	530	534	Sand (Cleveland)	1565	1577
Sand	534	546	Slate	1577	2021
Slate	546	568	Wheeler sand	2021	2035
Lime	568	576	Break	2035	2047
Slate	576	590	Lime (2nd gas)	2047	2090
Lime	590	620	Slate	2090	2196
Sand	620	627	Lime	2196	2199
Slate	627	635	Slate	2199	2300
Lime	635	647	Sand (water)	2300	2301
Slate	647	657	Slate	2301	2396
Sand	657	690	Sand (gas)	2396	2411
Slate	690	710	Slate	2411	2431
Lime	710	720	Bartlesville sand	2431	2485*

Sandy Fox No. 4, NE. cor. NW. 1-4 sec. 10, T. 17 N., R. 7 E. Completed Sept. 3, 1914. Elevation 945.5.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Sand		20	Blue shale	938	945
Limy shells	20	30	Shell	945	1260
Blue shale	30	70	Shelly (gas)	1260	1280
Soft sand	70	120	Lime	1280	1290
Shale	120	160	Blue shale	1290	1319
Shell	160	164	Lime shell	1219	1321
Shale	164	200	Blue shale	1321	1339
Sand (water)	200	232	Lime shell	1339	1341
Blue shale	232	280	Layton gas sand	1341	1350
Lime shell	280	284	Slate	1350	1360
Sand	284	290	Sand	1360	1375
Yellow mud vein	290	302	Slate	1375	1500
Light blue shale	302	342	Black shale	1500	1550
Red mud	342	355	White slate	1550	1583
Blue mud	355	361	Jones sand (gas)	1583	1633
Red mud	361	365	Slate	1633	1670
Shell and sand	365	371	Lime (gas)	1670	1675
Red mud	371	400	Blue shale	1675	1880
Blue shale	400	470	Sand (secon s)	1880	1905
Sand and gravel	470	480	Blue shale	1905	2023
Light blue shale (Blue mud vein)	480	492	Lime shell Lime shell op of	2023	2036

*Entire production 110 bbls. per hour.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Sandy shale	492	502	Wheeler	2035	2094
Blue mud	502	520	Slate	2095	2135
Sand and shell—hard	520	532	Sand (gas)	2035	2170
Blue shale	532	560	Shale	2170	2195
Water, sand and shell —water	560	580	Lime	2195	2200
Blue shale	580	595	Blue shale	2200	2245
Shell and sand	595	607	Sand (second gas)	2245	2265
Blue mud vein (cave)	607	619	Slate	2265	2345
Sandy shale	619	623	Lime	2345	2350
Sand	623	652	Slate	2350	2360
Blue mud	652	672	Lime	2360	2365
Lime	672	680	Slate	2365	2405
Blue mud or shale	680	855	Shell	2405	2410
Shell	855	860	Shale (black)	2410	2462
Slate	860	865	White, hard, gas sand. Top of Bartlesville	2462	2467
Shell	865	870	Gray sand	2467	2483½
Slate	870	875	Gray sand, fine	2483½	2489
Shell	875	880	More gas, first flow	2489	2502
Slate	880	900	Broken sand	2502	2512
Sand	900	905	Big pay	2512	2518*
Black shale	905	935			
Water gravel	935	938			

*First 24 hrs. 964 bbls. Tools in hole. Entire production 1,000 bbls.

Susanna Dacon, sec. 16, T. 17 N., R. 7 E. Completed Sept. 9, 1914.

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Mud	1	40	Sand	750	810
Slate	40	100	Slate	810	860
Sand	100	120	Sand	860	900
Slate	120	140	Shale	900	930
Sand	140	185	Lime	930	945
Slate	185	240	Slate	945	995
Slate	240	300	Sand	995	1050
Lime	300	320	Shale	1050	1100
Slate	320	340	Lime	1100	1120
Lime	340	350	Shale	1120	1445
Sand	350	390	Layton shell	1445	1460
Slate	390	400	Gas	1460	1490
Sand	400	415	1st oil (200 bbls.)	1490	1515
Slate	415	425	Lime	1515	1520
Sand	425	440	Shale	1520	1575
Slate	440	460	Jones sand (Big gas)	1725	1760
Lime	460	470	Shale	1760	2220
Red rock	470	490	Wheeler sand	2220	2250
Lime	490	500	Shale	2250	2257
Red rock	500	510	Sand, Wheeler (big gas)	2257	2285
Slate	510	520	Shale	2285	2325
Sand	520	540	Penn. sand (big gas)	2325	2420
Slate	540	550	Slate	2420	2610
Lime	550	575	Sand	2610	2630
Slate	575	580			

Character of rock.	Depth in feet.		Character of rock.	Depth in feet.	
	From.	To.		From.	To.
Sand	580	615	Slate	2630	2653
Slate	615	665	Bartlesville sand	2653	2665
Red rock	665	675	Show oil at	2665	
Slate	680	690	*Sand	2665	2683
Lime	690	700	Hard mud	2683	2694
Shale	700	750	Good oil sand	2694	**2735

*Produced 120 bbls. over night in this sand.
**Entire production 250 bbls.

The Bartlesville sand is the most interesting and most important formation in the Pennsylvania series. This is due to the fact that it is more constant in its physical characteristics and has a larger areal extent and also produces much more oil than any other oil-bearing horizon in the Mid-Continent field. In the different oil fields of northeast Oklahoma, this sand has probably produced as much oil as all of the other oil bearing horizons put together.

The stratigraphic position of the Bartlesville sand with respect to the overlying strata is well known in this field, but its relation to the formations occuring underneath is largely a matter of conjecture since there are no wells in the Cushing field that have been drilled down to the Mississippi lime. Carl D. Smith estimates that in the famous Glenn pool area, the Mississippi lime occurs at a depth of about 1300 feet below the Wheeler sand or Oswego lime. The names and approximate thickness of the formations which make up this interval beginning at the top and going down according to Smith are as follows:

	Feet
Cherokee formation Shale, sandstone, limestone, and coal.	1,000
Morrow formation Blue to white limestone, with some shale and thin sandstone.	100-120
Pitkin formation Limestone, blue and brown, locally sandy and shaly.	50
Fayetteville formation Black shale with thin beds of limestone and sandstone.	275

In general the formation in the Pennsylavania series in northeastern Oklahoma thicken to the south and to the west and therefore the interval between the Wheeler sand and the Mississippi lime in the Cushing field is probably somewhat in excess of 1300 feet. Since the well records in the Cushing field show that the top of the Bartlesville occurs at an average depth of 421 feet below the top of the Wheeler, it is evident that the Mississippi lime lies at a depth of at least 880 feet below the top of the Bartlesville sand.

*The Glenn oil and gas pool and vicinity: Bull. U. S. Geol. Survey, No. 541-B. 1913 p. 20.

The areal extent of the Bartlesville sand is probably as great if not greater than that of the other producing horizons in the Pennsylvania series. Correlations show this sand in every producing field in northeast Oklahoma, and that it also underlies a large part of southeast Kansas.

The first discovery well in the Bartlesville sand was not finished until December, 1913. Since the completion of this well in sec. 3, T. 17 N., R. 7 E. by the Prairie Oil and Gas Company, a large number of wells as shown in Plate X have been drilled into this formation with the result that the greatest oil pool in the Mid-Continent field and in fact, one of the greatest in the history of the oil industry has been opened up. The limits of this pool which lie principally to the west of the Mount Pleasant anticline and along the Drumright anticline have been pretty well defined, but only a few wells have been drilled on the Shamrock and Dropright anticlines where the writer believes that other important pools will be opened up.

At the time of the author's field work for this report was finished there was not any Bartlesville production, and therefore, only a general structural map showing the surface structure of this area could be made. Later development, however, rendered this possible and Fritz Aurin and Dean Stacy were sent into the field to determine the location and elevation of the mouth of each Bartlesville well in this pool. With these data, which are given in Plate X, a structural map, Plate XI, showing the underground structure of the Bartlesville sand was constructed in the same way as the other structural maps which have already been described.

A study of the Bartlesville production in the Cushing field shows that it is limited to a comparatively narrow strip extending in a general north and south direction along the axis of the major fold. The Bartlesville production east of Drumright is very unlike the Layton and Wheeler in two respects. In the first place, the west dip in the Bartlesville is much more rapid than it is above in the Layton and Wheeler horizons, and therefore, the production does not extend as far to the west. In the second place, there is no distinct area as in the Layton and Wheeler sands. There is more gas along the crests of the folds, but this is accompanied with oil. A brief discussion of the relation of accumulation in the Bartlesville to structure will be made at this time.

The terrace structure which plays an important role in the accumulation of oil and gas in the Layton and Wheeler sands is not a very important factor in the accumulation in the Bartlesville sand. In fact, Plate XI based on the well records in the Bartlesville sand shows that there is no terrace structure in the Bartlesville, but rather the terrace structure above has given place to a small anticline below. This anticline apparently forms in the east central part of the SE. 1-4 of sec. 5, T. 17 N., R. 7 E., and extends southward along the east line of sec. 8, T. 17 N., R. 7 E., almost to the SE. corner of this same section and then swings rather abruptly to the east and continues to the central part of the NE. ¼ of sec. 16, T. 17 N., R. 7 E. It is very probable that the anticline continues to the southeast and connects up with the main fold of the Shamrock anticline. The production in sec 8 is apparently due to this fold, because to the north and west down in the synclines there is no production. The area along this fold extending to the southeast and joining up with the Shamrock fold in sec. 15, T. 17 N., R 7 E. and thence southward through secs. 22 and 27, T. 17 N., R. 7 E., should be very favorable territory. A few wells have been drilled in this general area and they are yielding a good production. The territory lying east of this fold in the southern part of sec. 10 and connecting up with the syncline extending to the southeast and passing between the Shamrock anticline and the Mount Pleasant anticline is not favorable territory.

The principal Bartlesville production at the present time occurs along the prominent anticlinal structure extending from the south side of sec. 33, T. 17 N., R. 7 E. southeast sec. 3, T. 17 N., R. 7 E. as shown in Plate XI. This fold undoubtedly continues to the southeast connecting up with the Mount Pleasant anticline in sec. 11, T. 17 N., R. 7 E., but there has not been enough drilling to prove this. On the northwest, near the center of sec. 33, T. 17 N., R. 7 E., the Bartlesville sand dips off very rapidly to the north and west which is also true to a less extent of the surface structure and therefore the territory between this area and the southern end of the Dropright anticline should be unproductive territory. The dry hole in the NE. corner of the SE. ¼ of sec. 29; also the one in the NE. corner of the NW. ¼ of sec. 28; and still another in SE. corner of the SW. ¼ of sec. 20, T. 18 N., R. 7 E., all in the Bartlesville sand seems to prove this. A short distance to the north, however, where the formations begin to rise toward the Dropright anticline Bartlesville production is obtained and all of the territory near the crest of this anticline should be favorable. The underground structure of the Bartlesville sand in the Dropright area is not known, since there is very little development in this horizon along the Dropright anticline. There is very little doubt, however, that the main folding will conform in a general way to the north and south fold in the surface structure, yet there may also be some minor

folding that does not show up on the surface structure. In fact the underground structure in the different producing horizons over the developed areas, as has already been shown, although conforming very closely in the main features is much more irregular and pronounced than it is on the surface. This is especially true of the Bartlesville sand the structure of which is shown in Plate XI. There is some evidence that the production in the northwest part of the Dropright area occurs along an anticlinal fold which probably branches off from the main Dropright anticline near the southeast corner of sec. 8, T. 18 N., R. 7 E. and extends northwest through sec. 5 into sec. 6. The surface structure in this area along Cimarron River and some distance to the west is covered up with river sand and alluvial deposits and therefore is probably not mapped very accurately since the contour lines connecting known structural points on the north and south were only drawn in roughly.

General Conclusions.

The discussions above based on actual development and structural maps reveal the fact that there is a general stratigraphical arrangement of gas, oil, and salt water in the Cushing field, and that the accumulation of these is dependent largely on the folding in this area. This relation of accumulation to structure is evident because the general gas pools occur along the crests of the different anticlines just above the general oil territory, and the wells drilled into the producing horizons down the slopes below the area of oil production almost invariably get large quantities of salt water.

Although folding has been the principal factor in the accumulation of the oil and gas pools in the Cushing field, yet the variations in the physical characteristics of the receiving sand have also played an important part. The irregularity in thickness, porosity, and other physical characteristics of the individual producing horizons are the principal factors which prevent the oil, gas, and salt water from arranging themselves in the respective horizons in such a way as to have a constant ratio of production in areas occurring on similar structure. At the time of deposition the physical properties of the Layton, Wheeler, and Bartlesville sands were probably much more uniform than they are at present, because the individual deposits along the shores of the ocean in horizons similar to these are usually comparatively regular in thickness, porosity, and other physical characteristics. After these formations were laid down, however, they were covered up with succeeding formations and subjected to erosion by circulating underground waters. This erosion undoubtedly formed porous channels through which these percolating waters could pass. The ordinary processes of erosion, solution, and redeposition, have altered considerably the original character of the sands, with the result that in some places the sands are very soft and porous; while in other places, sometimes within

close proximity, redeposition has rendered the formation so hard and close grained that oil and gas could hardly penetrate these locally hardened areas. The occurence of small producing wells and even a few dry holes in different producing sands over the Cushing field in areas of good production is due, in the opinion of the writer, to these irregularities in the individual sands. The variation in the initial production, closed rock pressure, proportion of oil to gas or salt water or both, and also the variation of the life of individual wells on the same structural horizons in the same community is also due to this irregularity in the physical properties of the sands.

In addition to this folding and variation in the physical properties of the producing sands which are the principal factors in the accumulation of the oil and gas pools in the Cushing field, there are other factors which play a minor part in this general process. The large quantities of oil and gas in this field have very likely been under process of accumulation since the first folding took place. Within this long period of time many changes have probably occurred, such as the changes in the places at which the oil and gas were forced into this folded area and also the variation in the force or power of the transporting agents.

LIFE OF PRODUCING WELLS.

It is impossible to estimate with any degree of certainty the life of any well, for the simple reason that there are too many unknown factors that may play an important part. In order to give even a conservative estimate on the life of any well, the porosity of the oil bearing stratum, its thickness, drainage area, initial production, initial closed pressure, and rate of decrease must be known. Heretofore the development records in the different oil fields in the world show that the factors given above are never the same even in wells within close proximity to one another and the wells in the Cushing field are no exception to this general rule. Therefore, any predictions on the life of a well or the total amount of oil or gas it will yield can only be mere approximations. Inasmuch, therefore, as these factors vary widely, individual wells have not been studied and only the decline of the total production it noted.

The table of development shows that 161 Layton and Wheeler wells gave an average daily production of 23,079 barrels in February, 1913. Notwithstanding the fact that new wells were being completed daily, the production gradually declined. At the close of May 301 wells were giving an average daily production of 18,574 barrels. These figures show that during this period 140 more wells with an average initial production of about 97 barrels were completed and still the daily production declined 4,505 barrels, which proves conclusively that within three months the production from 161 original wells decreased approximately one-half.

The table shows an increase in the daily production during the the following six months. This increase was due in part to the opening up of the new Layton pool on the north end of the field but principally to the increased drilling activities over the entire field which brought in a larger number of wells than had usually been completed in previous months. The maximum production from the Layton and Wheeler sands was obtained during the month of November, 1913. Since the Bartlesville production was discovered in December, 1913, however, there has been little new development in the Layton and Wheeler formations. As a result of this comparative inactivity the production has declined rapidly and at present is not more than 9,000 barrels. If the production in these two formations continues to decline at its present rate within another year they will be producing only about 3,000 barrels a day. At the present price of oil this amount of production will not pay for the operating expenses of the 650 Layton and Wheeler wells.

It should be noted at this point that in general the initial production of the Layton wells, especially those east of Drumright and those near Dropright, was larger than the initial production of the Wheeler wells. On the other hand the production in the Layton wells usually declined much more rapidly, and the Wheeler sand has proved more productive.

The Bartlesville pool is comparatively new and more time and development is necessary to give it a thorough test. The general behavior of the wells in the Bartlesville sand is shown by the following group of wells which have been selected from one of the principal leases in this area:

No. 1, initial production 2,200 barrels, completed May 12, 1914.
No. 2, initial production 1,104 barrels, completed June 26, 1914.
No. 3, initial production 2,640 barrels, completed July 18, 1914.
No. 4, initial production 432 barrels, completed September 15, 1914.
No. 5, initial production 1,100 barrels, completed September 28, 1914.

The total initial production of these 5 Bartlesville wells was 7,476 barrels. On October 1, 1914, just 3 days after the last well was brought in with an initial production of 1100 barrrels; the 5 wells were making a total production of only 2,000 barrels per day, which is an extremely rapid decline in production. Although the production in the Bartlesville sand is much greater than that of the Layton and Wheeler sands, yet the rapid rate of decrease in production as shown in these wells indicate that the Bartlesville pool when

developed as thoroughly as the other pools, will also decline as rapidly.

CHARACTER OF OILS IN CUSHING FIELD

In spite of the fact that Oklahoma is one of the principal oil producing areas in the world, very little work has been done in the way of investigating the character of its oils. David T. Day, working under the auspices of the United States Geological Survey is the only one, until recently, who has done any extensive work. His samples were collected in the spring of 1908, and therefore do not include the Cushing oils. Recently, however, the Corporation Commission of this State decided that, in view of the rapid reduction of the market value of crude oil by the Prairie Oil and Gas Company and other corporations, it should among other things attempt to regulate the price of this commodity. In order to carry out their plans intelligently, the Commission asked I. C. Allen, an expert oil chemist for the United States Bureau of Mines, to analyze samples of oils from the different fields in the State and to make a report on same.

In order that the reader may know the character of the oils in the Cushing field, and also that of the oils in the other fields in the State, the analyses by Allen are here given.

Average analyses of Oklahoma oils, by fractional distillation.

Location.	Specific gravity. (at 15° C.)	Degrees Baume (60° F.)	Calories per gram.	B. t. u. per pound.	Viscosity at 20° C. (Engler scale.)	Water. (per cent.)	Sulphur. (per cent.)
Composite of 6 samples from Cushing Field. Taken by O. U. Bradley, May 28, 1914	.8190	40.94	10,975	19,755	1.3	*	0.22
Composite of 5 samples from Boston Pool. Taken by O. U. Bradley, May 30, 1914	.8330	38.07	10,924	19,661	1.5	0.1	0.15

*Trace.

Average analyses showing commercial values of Oklahoma oils.

Location.	Specific gravity. (at 15° C.)	Degrees Baume. (60° F.)	Calories per gram.	B. t. u. per pound.	Viscosity at 20°C. (Engler scale.)	Water. (per cent.)	Sulphur. (per cent.)
Avant	0.8617	32.49	10,828	19,490	2.3	*	0.17
Bald Hill	.8465	35.40	10,905	19,629	2.3	0.1	0.17
Bartlesville	.8604	32.71	10,883	19,585	2.3	*	0.14
Bigheart	.8547	35.58	10,904	19,589	2.3	0.0	0.16
Checotah	.8610	32.60	10,910	19,638	3.5	*	0.11
Cleveland	.8388	36.94	10,921	19,658	1.7	0.0	0.21
Collinsville-Claremore	.8585	33.10	10,846	19,524	2.6	0.0	0.20
Cushing	.8389	37.00	10,911	19,639	2.0	0.0	0.27
Flat Rock	.8635	32.14	10,804	19,448	3.0	0.0	0.26
Glenn Pool	.8445	35.83	10,879	19,582	1.8	0.2	0.28
Gotebo	.8595	32.89	10,925	19,665	2.9	*	0.25
Hamilton Switch	.8439	35.92	10,907	19,633	2.0	0.0	0.18
Henryetta	.8720	30.55	10,761	19,370	3.3	*	0.35
Hominy Creek	.8585	33.09	10,838	19,508	2.7	0.1	0.20
Madill	.8504	34.64	10,893	19,608	3.7	0.0	0.16
Mounds	.8635	32.14	10,826	19,488	3.5	0.0	0.22
Muskogee	.8304	38.60	11,009	19,817	1.5	0.0	0.10
Nelagony	.8615	32.51	10,827	19,489	2.4	*	0.19
Nowata	.8525	34.22	10,920	19,656	1.8	*	0.14
Okmulgee	.8530	34.13	10,850	19,531	2.6	0.1	0.20
Oresa	.8665	31.58	10,836	19,506	3.0	0.3	0.18
Osage City	.8472	35.30	10,879	19,506	2.0	0.0	0.24
Pawhuska	.8710	30.73	10,807	19,453	6.6	0.1	0.23
Ponca City	.8144	41.91	10,998	19,797	1.2	0.0	0.10
Red Fork	.8457	35.57	10,928	19,670	1.9	0.0	0.24
Salt Creek	.8511	34.52	10,881	19,585	2.6	0.0	0.17
Sapulpa	.8635	32.14	10,826	19,486	2.7	0.0	0.25
Schulter	.8600	32.84	10,840	19,513	2.8	0.0	0.23
Turley	.8772	29.67	10,790	19,422	7.2	0.0	0.23
Wheeler	.9166	22.76	10,554	18,998	40.2	0.6	1.20
Grand average	.8544	33.96	10,870	19,567	3.9	0.0	0.23

*Trace.

Comparative analysis of Oklahoma oils.

	(1) Oklahoma Pools. Average of 139, excluding (2), (3), and (4).	(2) Cushing Pool. (Bartlesville sand only). Composite of 6 samples.	(3) Boston Pool. Composite of 5 samples.	(4) Healdton Pool. Average of 20 samples.
Specific gravity at 15° C.	.8544	.8190	.8330	.8666
Corresponding gravity. Baume	33.96	46.94	38.07	31.57
Calories per gram	10870.	10975.	10927.	10785.
B. t. u. per pound	19567.	19755.	19661.	19414.
Viscosity at 20 degrees C. (Engler)	3.9	1.3	1.5	3.0
Water, per cent	0.0	trace	0.1	trace
Sulphur, per cent	0.23	0.22	0.15	0.70
Gasoline, per cent—				
By weight	8.1 (59.6°B.)	25.8 (58.5°B*)	18.7 (58.6°B*)	6.0 (57.7°B)
By volume	9.4			7.0
or				
By weight	13.8 (56.3°B.)	32.9 (55.4°B*)	26.5 (55.4°B*)	11.2 (54.4°B)
By volume	----------			
Kerosene, per cent—				
By weight	38.5 (42.2°B.)	32.0 (42.2°B*)	32.8 (42.2°B*)	28.8 (42.2°B)
By volume	40.5			30.7
or				
By weight	40.5			
By volume	24.2 (42.1°B.)	20.4 (41.7°B*)	22.1 (41.7°B*)	20.2 (41.3°B)
Lubricants, per cent—				
By weight	26.1 (29.1°B.)	23.2 (29.5°B*)	29.5 (29.5°B*)	29.7 (29.9°B)
By volume	25.3			29.4
or				
By weight	34.7 (30.0°B.)	27.7 (31.7°B*)	32.4 (31.7°B*)	33.1 (33.4°B)
By volume	----------			
Residue, per cent—				
By weight	25.6	17.5	16.8	34.4
Loss—				
By weight	0.8	1.5	2.2	1.1
Total	100.0	100.0	100.0	100.0

*Estimated.

Average analyses of Oklahoma oils, by fractional distillation.

Location.	Number of samples analyzed.	Pressure of mercury.	Lubricants. Up to 150° C.	150°-175° C.	175°-200° C.	200°-225° C.	225°-250° C.	250°-275° C.	275°-300° C.	300°-325° C.	Unrefined.	Residue.	Residue. Distilling loss.
		mm.	(per. cent.)										
Avant	11	6	0.5	1.8	4.4	5.7	6.7	7.2	6.7	8.4	52.9	23.5	0.5
Bald Hill	8	7	0.1	0.5	3.3	4.8	5.9	6.7	6.4	8.1	44.7	24.6	1.4
Bartlesville	8	7	------	0.1	3.5	5.9	6.7	6.9	6.2	8.4	47.4	29.9	0.6
Bigheart	12	6	0.2	0.8	3.8	5.6	6.3	6.7	6.1	7.7	47.0	18.0	1.0
Checotah	1	8	1.1	2.2	3.4	5.0	6.4	7.5	8.2	9.9	58.8	28.1	0.0
Cleveland	16	13	------	1.9	3.6	4.6	5.2	5.4	5.7	6.9	40.6	23.7	0.9
Collinsville-Claremore	2	12	------	2.1	4.3	5.2	5.8	6.0	6.4	6.8	44.7	28.8	0.5
Cushing	7	14	------	0.7	2.9	3.3	4.2	4.4	4.4	5.5	32.2	25.7	0.9
Flat Rock	2	12	------	1.6	3.9	5.4	6.2	6.2	6.6	7.5	44.8	29.6	0.4
Glenn Pool	3	12	------	2.0	3.6	4.4	4.9	4.9	5.3	6.5	38.3	28.2	1.2
Gotebo	1	6	------	------	3.0	4.9	5.3	5.8	6.2	7.0	42.1	37.6	0.5
Hamilton Switch	5	12	------	1.2	3.2	4.7	5.0	5.9	5.6	7.5	41.0	28.2	0.8
Henryetta	1	6	------	------	2.5	5.4	6.4	6.6	6.6	8.9	45.3	30.6	1.1
Hominy Creek	2	6	3.0	2.6	3.1	4.8	5.9	7.0	6.5	8.1	51.5	26.2	0.3
Madill	2	6	------	0.8	3.3	4.3	4.4	4.6	4.9	5.8	36.8	13.6	1.5
Morris	4	8	------	0.5	3.3	5.4	6.8	7.4	7.1	9.4	49.3	28.0	1.0
Mounds	2	12	------	1.8	3.6	5.0	5.4	5.5	6.0	7.9	42.6	34.6	0.9
Muskogee	6	7	------	0.9	3.3	4.9	5.5	6.1	5.9	7.2	42.5	18.6	1.6
Nelagony	1	5	------	------	6.4	7.1	7.7	7.2	6.8	7.4	52.6	18.3	0.5
Nowata	4	7	------	------	4.0	5.2	5.8	6.2	5.8	7.9	44.1	23.6	0.8
Okmulgee	4	7	------	1.1	3.3	4.9	6.2	6.7	6.9	9.3	47.6	26.2	0.9
Oresa	4	8	------	0.4	3.5	4.5	6.8	7.7	7.0	8.3	49.3	28.6	0.4
Osage City	4	12	------	2.3	3.7	5.0	5.6	5.6	6.0	6.4	42.4	24.8	0.5
Pawhuska	1	6	------	------	3.5	6.3	7.0	7.3	7.0	8.2	51.7	29.2	0.3
Ponca City	4	8	------	0.4	3.4	4.4	4.8	5.1	4.7	5.6	37.2	12.6	1.6
Red Fork	3	12	------	0.9	3.5	4.0	4.7	4.9	5.3	6.3	36.7	29.3	0.8
Salt Creek	5	8	------	0.7	2.6	4.9	5.9	6.5	6.6	9.1	45.9	23.9	0.9
Sapulpa	4	12	------	2.1	3.5	4.8	5.7	5.6	6.2	6.8	42.0	33.4	0.4
Schulter	4	7	------	0.3	3.4	5.5	6.2	6.4	6.5	8.5	45.6	26.8	0.9
Turley	5	12	------	1.6	4.6	5.9	6.8	6.7	7.2	8.5	48.6	34.3	0.3
Wheeler	2	6	2.4	2.2	3.0	4.5	5.5	6.3	6.7	10.9	48.8	48.2	0.8
Total number of samples	139												
Grand average		9	0.2	1.1	3.6	5.0	5.9	6.2	6.2	7.8	45.0	26.5	0.8
Specific gravities of fractions at		15° C.	.8301	.8335	.8415	.8515	.8625	.8725	.8900	.9070	------	------	------
Corresponding degrees													

Average analyses of Oklahoma oils, by fractional distillation.

Samples.	Naptha.						Lamp oils.					
	Pressure of mercury.	Water.	Up to 150° C.	Unrefined.	150°-175° C.	175°-200° C.	200°-225° C.	225°-250° C.	250°-275° C.	275°-300° C.	Unrefined.	300°-325° C.
	mm.	(per cent.)										
Composite of 6 samples from Cushing Field. Taken by O. U. Bradley, May 28, 1914	744	*	3.4	3.4	7.9	7.5	7.0	7.1	7.0	5.2	41.8	5.1
Composite of 5 samples from Boston Pool. Taken by O. U. Bradley, May 30, 1914	744	2.1	1.4	1.4	4.6	6.3	6.4	7.8	7.0	6.6	38.7	8.5

*Trace.

Samples.	Lubricants.									
	Pressure of mercury.	175°-200° C.	200°-225° C.	225°-250° C.	250°-275° C.	275°-300° C.	300°-325° C.	Unrefined.	Residue.	Distilling loss.
	mm.	(per cent.)								
Composite of 6 samples from Cushing Field. Taken by O. U. Bradley, May 28, 1914	13	4.5	4.5	4.5	4.5	4.2	5.5	35.8	17.1	1.6
Composite of 5 samples from Boston Pool. Taken by O. U. Bradley, May 30, 1914	8	2.9	5.0	6.0	3.8	5.7	7.0	40.9	16.8	2.1

Average analyses of Oklahoma oils, by fractional distillation.

Location.	Number of samples analyzed.	Pressure of mercury.	Napthas.					Lamp Oils.					
			Water	Up to 150° C.	Unrefined.	150°-175° C.	175°-200° C.	200°-225° C.	225°-250° C.	250°-275° C.	275°-300° C.	Unrefined.	300°-325° C.
		mm.	(per. cent.)										
Avant	11	747	*	------	------	0.0	0.4	2.8	5.2	6.6	8.1	23.1	11.5
Bald Hill	8	742	0.1	0.1	0.1	0.5	1.7	4.4	6.8	7.6	7.9	28.9	8.9
Bartlesville	8	741	*	------	------	0.1	1.0	5.4	6.5	7.3	7.8	28.1	9.7
Bigheart	12	746	0.0	------	------	0.8	4.3	6.4	7.0	7.5	8.0	34.0	9.8
Checotah	1	755	*	------	------	------	------	------	------	0.5	12.6	13.1	15.1
Cleveland	16	745	0.0	1.7	1.7	4.0	5.6	5.9	5.8	5.7	6.1	33.1	7.3
Collinsville-Claremore	2	742	0.0	------	------	0.3	3.0	3.4	5.9	6.7	6.7	26.0	8.1
Cushing	7	751	0.0	3.3	3.3	5.1	5.5	7.5	7.1	6.7	6.0	37.9	6.8
Flat Rock	2	748	0.0	------	------	------	2.4	5.7	5.4	5.6	6.1	25.2	7.4
Glenn Pool	3	742	0.2	1.7	1.7	3.2	5.3	5.6	5.5	5.3	5.5	30.4	6.7
Gotebo	1	738	*	------	------	------	------	------	10.3	10.9	8.6	29.8	9.9
Hamilton Switch	5	746	*	------	------	1.6	4.2	5.1	6.9	5.9	6.3	30.0	7.3
Henryetta	1	747	*	------	------	------	0.0	3.3	5.0	6.2	7.2	23.0	8.9
Hominy Creek	2	755	0.1	------	------	------	------	1.8	4.9	6.4	8.8	21.9	10.5
Madill	2	750	0.0	2.2	2.2	4.3	4.6	9.6	9.9	9.1	8.8	46.3	8.7
Morris	4	747	*	------	------	0.1	0.4	2.0	4.6	5.6	8.0	21.7	9.4
Mounds	2	750	0.0	0.2	0.2	0.2	1.0	3.8	4.8	5.5	6.4	21.7	7.4
Muskogee	6	749	0.0	0.1	0.1	0.8	4.4	7.9	7.8	8.4	7.9	37.2	8.7
Nelagony	1	749	*	------	------	------	------	0.6	9.2	9.0	9.8	28.6	10.0
Nowata	4	742	*	0.1	0.1	0.9	3.0	6.2	6.4	6.9	8.0	31.4	9.2
Okmulgee	4	747	0.1	------	------	0.2	1.2	3.4	5.2	7.2	8.0	25.2	9.2
Oresa	4	743	0.2	------	------	------	0.4	0.2	5.0	7.6	8.2	21.4	11.1
Osage City	4	742	0.0	0.9	0.9	2.9	5.2	5.9	6.0	5.5	5.9	31.4	7.8
Pawhuska	1	742	0.1	------	------	------	------	------	------	7.8	10.9	18.7	12.4
Ponca City	4	740	0.0	1.8	1.8	5.4	8.4	8.2	8.3	8.6	7.9	46.8	8.8
Red Fork	3	746	0.0	1.1	1.1	3.2	5.7	6.1	5.6	5.8	5.7	32.1	7.1
Salt Creek	5	745	0.0	------	------	0.2	2.3	4.8	6.4	6.7	8.9	29.3	9.6
Sapulpa	4	743	0.0	------	------	0.1	2.1	5.4	5.6	5.8	5.8	24.2	7.3
Schulter	4	747	0.0	------	------	0.1	0.6	5.3	6.4	6.8	7.5	26.7	8.8
Turley	5	747	0.0	------	------	------	2.1	3.2	3.1	3.3	5.1	16.8	7.2
Wheeler	2	742	0.6	------	------	------	------	------	------	------	1.6	1.6	7.3
Total Number of samples	139												
Grand Average		744	*	0.4	0.4	1.1	2.4	4.2	5.7	6.4	7.5	27.3	9.0
Specific gravities of fractions	------	------	15°C.	.7045	------	.7160	.7334	.7506	.7705	.7916	.8082	------	.8265
Corresponding degrees Baume	------	------	------	68.72	------	65.53	60.89	56.52	50.68	46.86	42.22	------	39.39

Harry Willock, Secretary of the Waverly Oil Works makes the following report to the Corporation Commission on the values of the Cushing crude as compared to those of the Pennsylvania crude.

As near as I could figure the value of the products from Pennsylvania and Cushing crude based on the comparative run made by the Wells Refining Oil Process Company figures would be as follows:

Pennsylvania Oil.

	Degrees Gr.			
Gasoline	66.2,	25 gal. at	.12	$3.00
Turp. Subt.	51.9,	15 gal. at	08½	1.28
Kerosene	45.7,	15 gal. at	.05	.75
300 oil	40.3,	15 gal. at	.05	.75
Non vis. Neut.	35.5,	12 gal. at	.04½	.54
Vis. Neut.	31.0,	8 gal. at	.12	.96
S. R. Cyl. Stock	25.0,	8 gal. at	.12	.96
Ref. Parf. Wax		2 gal. at	.25	.50
Total		100		$8.74
5 per cent gallonage loss in manufacture				.44
Total value of products				$8.30

Cushing Oil

	Degrees Gr.			
Gasoline	65.7,	30 gal. at	.12	$3.60
Turp. Subt.	48.2,	20 gal. at	.08½	1.70
Kerosene	40.1,	15 gal. at	.03	.45
Gas oil	34.6,	15 gal. at	.02	.30
Vis. Neut.	28.0,	10 gal. at	.10	1.00
S. R. Cyl. Stock	24.0,	6 gal. at	.08	.48
Ref. Parf. Wax		½gal. at	.25	.13
Asphalt		3½gal. at	.06	.21
Total		100		$7.87
5 per cent gallonage loss in manufacture				.39
Total value of products				$7.48

You will note from the above figures that the products from 100 gallons of Pennsylvania oil only exceeds in value the products of a like number of gallons of Cushing crude oil by 82 cents, or in other words that Pennsylvania oil, from a refining standpoint is worth only approximately 10 per cent more than the Cushing oil, although at the present time with Cushing oil selling at 75 cents and Pennsylvania oil at $1.90 at the wells, price of Pennsylvania oil is over two and one-half times that of Cushing oil.

The following tests made on Cushing crude oil by the Cosden Refining Company at Tulsa will also give an idea of the character of the Cushing oil.

Result of a test run on 30,000 gallons of 40.9° Baume Cushing crude, from Bartlesville, Wheeler, and Layton sands.

Crude benzine	36
80 per cent of this if re-run would be finished 60 per cent gasoline.	
Kerosene	20
Gas oil	10
Wax distillate	21
Residium	9
Layton crude with 43.5° Baume.	
Gasoline 60° to 61° gravity	50
Water white 40° to 41° gravity	12.5
Residium or road base	33.5
Loss	4

Test of 580 bbls. of Cushing crude 40° Baume from Bartlesville, Wheeler, and Layton sands.

207.54 bbls. crude benzine, or 35.78 per cent.
96.66 bbls. water white distillate, or 16.67 per cent.
177.68 bbls. wax distillate, or 30.64 per cent.
70.37 bbls. residium, or 13.51 per cent.
19.7 bbls. loss, or 3.4 per cent.

Wheeler crude 41.2° Baume.	
Gasoline 60° to 61° gravity	37.5
Water white 40° to 41° gravity	21.0
Wax distillate	26.0
Tar, or heavy residium	12.0
Loss	5.5

Records obtained from the Superintendent of the Cosden Refining Company, Tulsa, Oklahoma.

J. E. Ellis, Superintendent of the Cushing Refining Company at Cushing, in discussing the crude oils of the Cushing fields says that the average specific gravity of the Layton, Bartlesville, and Wheeler crudes received at his refinery is about 41°, 40.5°, and 38° to 39° Baume respectively. The tests at his plant also show that the Layton crude is slightly better than Bartlesville crude inasmuch as it yields about 5 per cent more benzine, but since this is really the only difference, they have practically the same value. In general the Wheeler crude proves to be of a slightly lower grade of oil than the Layton and Bartlesville crudes. Again the Layton and the Bartlesville oils are usually of a light green color while the Wheeler usually has a darker shade of green than that of the other two oils.

While discussing the character of the Cushing oils it may be of interest to note that during the transportation of the crude oils

from the field to the refineries at Cushing about 2 per cent of the volatile matter in the oil escapes. This percentage of loss is increased still more during the refining process when an additional 4 to 6 per cent escapes.

DEVELOPMENT.

The discovery well in the Cushing field was completed in March, 1912. During the first twelve months of the history of this field the principal development was within the vicinity of Drumright, in the Layton sand and Wheeler limestone. After this period, however, development spread rapidly in the Layton and Wheeler horizons and soon test wells were drilled in almost every part of the present productive area. At the time the pools appeared to be isolated but later development shows that they are all more or less connected with the possible exception of the area in sections 14, 15, 22, and 23, T. 18 N., R. 7 E. The north end of the field along the Cimarron River which caused considerable excitement at the time was not discovered until the summer of 1913. Rapid development continued, but there was no new pool opened up until in December of that year, on the completion of the Prairie Oil and Gas Company's well on the Tucker farm in sec. 3, T. 17 N., R. 7 E., which started off at 500 barrels a day in the Bartlesville sand. Development in the Bartlesville sand is just in its infancy, yet the production has increased to such an extent that the pipe lines are unable to handle all of the oil.

Data gathered from drilling records in the Bartlesville, Layton, and Wheeler sands, seem to warrant the following general conclusions. The Bartlesville which is essentially an oil sand, contains little gas. As a result of the absence of gas and the extreme porosity of the rock, the oil extends up the slopes and over the crests of the anticlines. The oil of the Wheeler sand is found farther down the slope than that of the Layton or Bartlesville. The porosity of the Wheeler seems to be less than in either of the other sands. The fineness of the sand combined with the pressure exerted by the gas, serve to keep the oil of the Wheeler at a lower level on the structure. Of the wells drilled to the three sands, those to the Bartlesville are highest structurally, while those to the Wheeler are lowest. The Layton wells hold the intermediate position.

The following tables give a summary of the development in the field up to the present time.

*Bartlesville Sand Production—Cushing Field.**

Date.	Actual runs, in barrels.			Total runs, in barrels.	Per cent. of Total Prod. run.	Estimated Total Production, in barrels.	Number of producing wells.	Average daily production, in barrels.
	Prairie.	Gulf.	Texas.					
May 19-June 18, 1914	951,165	228,536	258,818	1,438,519	35.9	3,728,465	---	120,273
June 19-July 18, 1914	683,253	237,149	182,061	1,102,463	23.9	4,789,018	189	159,634
July 19-August 18, 1914	441,788	144,972	120,545	707,305	15.3	4,619,283	251	149,009
August 19-September 18, 1914	471,625	163,468	79,884	714,977	14.2	5,045,784	319	162,767
September 19-October 18, 1914	387,519	186,574	122,542	696,635	12.7	5,473,448	348	182,448
October 19-November 18, 1914	630,849	222,208	287,168	1,140,225	19.6	5,822,384	387	187,819
Total for 6 months	3,566,199	1,182,907	1,051,018	5,800,124	19.6	29,478,382		

In the above table it will be noted that an average of 19.6 per cent of the total estimated production for the past 6 months is run by 3 pipe-line companies: The Prairie Oil and Gas Co., The Gulf Pipe Line Co., and The Texas Co. The remainder of the production is either used by local refineries or shipped in tank cars to market or put in storage tanks.

*This table is compiled from reports of umpire A. E. Watts to the Corporation Commission.

Table of Development.

Date.	Producing wells.	Gas.	Dry and abandoned.	Drilling.	Rigs.	Average daily production.	Average per well.	Total per month.	Daily production of wells completed.
October, 1912	23	7	2	41	39	2670	116	82,739	------
November, 1912	41	8	2	48	53	5540	135	166,200	4250
December, 1912	72	10	2	76	47	9681	134.5	300,111	6015
January, 1913	118	13	3	91	61	14925	126	462,675	4575
February, 1913	161	15	4	99	60	23079	143	646,212	7500
March, 1913	204	17	4	118	58	22259	109	694,023	7600
April, 1913	260	20	6	90	51	18829	73	564,870	5875
May, 1913	301	25	7	176	75	18574	62	575,794	7615
June, 1913	377	29	8	169	31	19822	53	594,660	9587
July, 1913	439	32	11	171	40	21992	50	681,572	11070
August, 1913	507	33	11	172	31	25040	49	776,240	12661
September, 1913	552	36	14	120	20	26351	48	790,520	8657
October, 1914	601	38	15	116	25	27561	46	854,391	9718
November, 1913	627	39	15	84	28	27561	44	826,830	8493
December, 1913	656	41	17	53	18	23028	35	713,868	8630
January, 1914	686	43	18	51	10	19504	28	604,624	3631
February, 1914	713	43	20	75	26	26160	36	732,480	13688
March, 1914	730	46	23	79	24	52308	72	1,621,543	24364
April, 1914	764	48	25	141	42	------	------	------	24218
May, 1914	819	51	33	156	60	------	------	------	60135
June, 1914	893	53	40	162	53	------	------	------	82459
July, 1914	959	53	41	155	30	------	------	------	60480
August, 1914	1031	55	44	162	29	------	------	------	63960
September, 1914	1098	57	54	173	60	------	------	------	76480
October, 1914	1154	58	56	117	55	------	------	------	72975

Production previous to October, 1912, 250,000 barrels.

MARKETS.

Pipe Lines

There are three main pipe line companies, the Prairie Oil and Gas Company, the Texas Company, and the Gulf Pipe Line Company, operating in the Cushing field. All three companies entered the field soon after production was found there and have since carried most of the crude to refineries in different parts of the country. The crude carried by the Prairie lines is taken to the Standard plants at Neodesha, Kans.; Sugar Creek, Mo.; Wood River, Ill.; and Whiting, Indiana. The Texas Company transfers the crude to its own refineries at Dallas, Port Arthur, and Port Neches, Texas. The Gulf lines carry the crude to the refineries of that company at Fort Worth and Port Arthur, Texas.

In addition to the three main pipe lines mentioned above, the five refineries located in Cushing have their own pipe line connections for transporting the crude oil from the field to their respective refineries. The J. S. Cosden & Company's plant at West Tulsa, the plant of the Milliken Refining Company at Vinita, and the Pierce Oil Corporation's plant at Sand Springs are also connected with the field by their own lines.

According to the data obtained in the field and at the office of the Geological Survey the pipe line runs from the Cushing field at this writing amount to approximately 60,000 barrels a day. The Prairie Oil and Gas Company runs in the neighborhood of 25,000 barrels; the Texas Company, 9,000 barrels; Gulf Refining Company, 8,500 barrels; Chanute Refining Company, 8,000 barrels; Pierce Oil Corporation, 3,400 barrels; Consumers Refining Company, 1,600 barrels; Cushing Refining Company, 1,500 barrels; and the Cosden Refining Company, 10,000 barrels. The amount of crude oil consumed from the Cushing field by the Milliken Refining Company and other refineries is not known but at present it is only a small amount.

Some of the production is transported from the field to the railroad in small lines and loaded into tank cars by means of loading racks, and shipped to market. The amount of crude oil transported in this manner is very small when compared to the amount piped away.

At the present time the transporting facilities in the Cushing field are not adequate to carry away the total production. The lighter compounds in the Cushing crude volatilize rapidly when allowed to stand in the open and therefore the oil depreciates in value. In order to care properly for the over-production practically all of the producing companies owning Bartlesville productions have acquired one or more farms on which they are constructing storage

tanks. A large number of these tanks have already been completed, and within the neighborhood of 100 more are under construction. It will give the reader an idea of the amount of construction work along this line that is going on in the Cushing field at this writing, to say that one company has sent orders to the supply houses for for a sufficient amount of material to increase their present number up to at least 100 tanks, each with a capacity of 55,000 barrels. It is estimated that there are something like 11,000,000 barrels of crude oil in storage at the present time in these tanks on the tank farms in and near the Cushing field.

Refineries

There are at the present time five refineries in Cushing using the Cushing crude oil exclusively. There are also several outside the field that secure large quantities of their crude from this field. The refineries located in Cushing are: Chanute Refining Company, capacity 4,000 barrels; Consumer's Refining Company, capacity 3,000 barrels; Cushing Refining Company, capacity 2,600 barrels; and Cosden and Company, capacity 2,600 barrels. The New State Refining Company is not completed but when finished will have a capacity of 1,000 barrels.

The Cushing Refining Company is now doubling the capacity of its plant, and the International Refining Company is building a refinery with a capacity of 3,000 barrels.

The refineries outside of the Cushing field that use Cushing crude are as follows: those to which the Prarie Oil and Gas Company, The Gulf Pipe Line Company, and the Texas Company lines transport crude, as mentioned above in dealing with those lines; J. S. Cosden & Company's plant at West Tulsa; the plant of the Milliken Refining Company at Vinita; and the Pierce Oil Corporation's plant at Sand Springs. All of these plants are connected with the field by their lines. The Milliken plant is at present using Cushing crude entirely and the plants of J. S. Cosden & Company, and Pierce Oil Corporation get most of their crude from this field.

The chief refined products secured from Cushing crude are: gasoline, naptha, kerosene, machine oils, and fuel oil. They are marketed throughout the middle states and large quantities are exported.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Sec. 3 T. 17 N., R. 7 E.										
SW. cor. SW. ¼ SW. ¼	Prairie Oil & Gas Co.	Geo. Tucker No. 1	892	Wheeler	2202	13	1310		2305	320
SW. cor. N. ½ SW. ¼	Producers Oil Co.	Anna L. McIntosh No. 1	880	do	2187	55	1307		2242	dry
SW. cor. SE. ¼ SW. ¼	Prairie Oil & Gas Co.	F. Tucker No. 1	892	do	2185	23	1299		2208	dry
Sec. 4, T. 17 N., R. 7 E.										
NW. cor. NE. ¼	Quaker Oil & Gas Co.	Jeanetta Richards No. 1	812	Layton[1]	1380	25	488		1405	
NW. cor. W. ½ SW. ¼	Kathleel Oil Co.	Samuel Richards No. 1	897	do	1389	66	492		1455	200
Sec. 5, T. 17 N., R. 7 E.										
NE ¼										
NE. cor. NE. ¼	Gypsy Oil Co.	Eastman Richard No. 3	883	Layton	1393	87	510	1441	1480	150
Center N. Line E. ½ NE. ¼	do	do No. 2	857	do	1388	73	531		1461	364
NW. cor. E. ½ NE. ¼	do	do No. 1	871	do	1390	73	519	1420	1463	300
Center W. Line NE. ¼ NE. ¼	do	do No. 7		do	1420	95		1450	1515	600
SW. cor. NE. ¼ NE. ¼	do	do No. 5	866	do	1411	79	545	1420	1490	800
NW. cor. SE. ¼ NE. ¼	do	do No. 6	866	do	1415	83	549	1432	1498	700
Center W. Line SE. ¼ NE. ¼	do	do No. 8	857	do	1402	105	545	1427	1507	500
SW. cor. E. ½ NE. ¼	do	do No. 4	901	do	1428	72	527		1500	800
Center Line E. ½ NE. ¼	do	do No. 9		do	1434	66		1454	1500	800
SE. cor. E. ½ NE. ¼	do	do No. 10		do	1403	106		1439	1509	250
NE. cor. W. ½ NE. ¼	Gunsberg & Forman	Eastman Richard No. 1	862	Layton	1410	57	548	1430	1467	1350
Center N. Line W. ½ NE. ¼	do	do No. 8	889	do	1451	51	562	1470	1502	250
NW. cor. W. ½ NE. ¼	do	do No. 2	874	"1000" foot	998	17	124		1015	100
NW. cor. W. ½ NE. ¼	do	do No. 14		Wheeler[2]	2190	66			2256	*
SW. cor. NW. ¼ NE. ¼	do	do No. 5	860	Layton	1425	53	565	1450	1478	60
NW. cor. SW. ¼ NE. ¼	do	do No. 4	842	do	1392	66	550	1431	1458	200
Center W. Line SW. ¼ NE. ¼	do	do No. 6	848	do	1406	57	558	1425	1463	200
SW. cor. NE. ¼	do	do No. 3		do	1395	67			1462	150
Center S. Line W. ½ NE. ¼	do	do No. 9		do	1424	42			1466	800
SE. cor. W. ½ NE. ¼	do	do No. 7	867	do	1406	66	539	1422	1472	750
Center E. Line SW. ¼ NE. ¼	do	do No. 13	850	do	1400	59	550		1459	600
NE. cor. SW. ¼ NE. ¼	do	do No. 10	860	do	1412	40	552		1452	500
SE. cor. NW. ¼ NE. ¼	do	do No. 11	868	do	1406	64	538		1470	250
Center E. Line NW. ¼ NE. ¼	do	do No. 12		do	1420	82		1454	1502	750
NW. ¼										
NE. cor. NW. ¼	C. B. Shaffer	J. W. Fulkerson No. 3	860	Layton	1447	42	587		1489	100
Center N. Line NW. ¼	do	do No. 1	822	Wheeler	2166	6	1344		2172	400
NW. cor. NW. ¼	do	do No. 9		do	2169	40			2209	400
SE. cor. NE. ¼ NW. ¼	do	do No. 2	838	Layton	1428	37	590		1465	
One Loc. E. No. 8 N. ½ NW. ¼	do	do No. 16		Wheeler	2181	60			2241	100
SW. cor. NW. ¼ NW. ¼	do	do No. 8		do	2217	60			2277	150
NE. cor. W. ½ SE. ¼ NW. ¼	do	do No. 7	949	do	2206	69	1357	2250	2275	500
One Loc. N. No. 14 in NW. ¼	do	do No. 15		do	2200	48		2221	2248	85
NW. cor. SW. ¼ NW. ¼	do	do No. 10		do	2215	53			2268	200
Cen. E. Line W. ½ SE. ¼ NW. ¼	do	do No. 6	836	Layton	1421	45	585	1426	1466	55
One Loc. S. No. 15 in NW. ¼	do	do No. 14		Wheeler	2190	64		2233	2254	75
SW. cor. NW. ¼	do	do No. 13		do	2223	57			2280	250
SE. cor. W. ½ E. ½ NW. ¼	do	do No. 5	830	Layton	1407	16	577		1423	300
Center E. ½ SE. ¼ NW. ¼	do	do No. 4	846	do	1407	41	561	1425	1448	

*Gas. [1]Later drilled to Bartlesville sand, [2]Two million gas and some oil.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SW. ¼										
Cen. N.Line NE.¼ NE.¼ SW.¼	Prairie Oil & Gas Co.	J. W. Fulkerson No. 3	871	Layton	1414	40	543	1436	1454	
Cen. S. Line NE.¼ NE.¼ SW¼	do	do No. 2	871	do	1392	66	550	1431	1458	200
NE. cor. SE. ¼ NE. ¼ SW. ¼	do	Ella Jones No. 3	866	do	1425	43	559		1468	280
SE. cor. NW. ¼ NE. ¼ SW. ¼	C. B. Shaffer	J. W. Fulkerson No. 4	831	Jones	1700	17	839		1717	*
SE. cor. N. ½ NW. ¼ SW. ¼	do	do No. 12		Wheeler	2184	46			2230	300
Cen. W. Line N.½ N.½ SW.¼	do	do No. 11		do	2235	52			2287	150
NW. cor. S. ½ N. ½ SW. ¼	Prairie Oil & Gas Co.	Ella Jones No. 11		Wheeler	2184	56			2240	225
SE. cor. W. ½ S. ½ N.½ SW.¼	do	do No. 12	824	do	2216	50	1392		2266	450
Cen. N. L. E.½ S.½ N.½SW.¼	do	do No. 6	824	Layton	1394	53	570	1423	1447	100
SW. S.½ NW. ¼ SW. ¼	do	do No. 13		Wheeler	2217	41			2258	100
Center E. Line SW. ¼	do	do No. 4	890	Layton	1405	36	615	1430	1441	700
Center E. Line SE. ¼ SW. ¼	do	do No. 5	885	do	1390	53	505	1421	1443	500
SE. cor. SW ¼	do	do No. 1	855	do	1395	17	540		1412	450
SE. cor. SE. ¼ SW. ¼	do	do No. 9	852?	Wheeler	2100		1248		2100	*
Center S. Line SE. ¼ SW. ¼	do	do No. 2	842	Layton	1380	42	538		1422	720
SW. cor. SE. ¼ SW. ¼	do	do No. 7	846	do	1402	42	556		1444	150
Center W. Line SE. ¼ SW. ¼	do	do No. 10	836	do	1415	23	579		1438	150
NW. cor. SE. ¼ SW. ¼	do	do No. 8	832	do	1406	34	574		1440	150
SE. cor. SW. ¼ SW. ¼	Waters-Pierce Oil Co.	do No. 1	874	Wheeler	2295	30	1421		2325	*
NE. cor. SW. ¼ SW. ¼	do	do No. 2	841	Layton	1483	60	642		1543	300
NW. cor. SW. ¼ SW. ¼	do	do No. 3		Wheeler	2229	62		2229	2291	600
SW. cor. SW. ¼ SW. ¼	do	do No. 4	906	do	2288	33	1382		2321	850
Center SW. ¼ SW. ¼	do	do No. 5	908	do	2256	60	1348	2264	2316	70
SE. ¼										
NE. cor. SE. ¼	Cushing Gas & P. Co.	Jackson Barnett No. 12	904	Layton(3)	1398	89	494		1487	250
Center N. Line NE. ¼ SE. ¼	do	do No. 11	905	Layton	1404	97	499		1501	200
NW. cor. NE. ¼ SE. ¼	do	do No. 2	902	do	1418	55	516	1445	1473	530
NE. cor. NW. ¼ SE. ¼	do	do No. 6	873	Layton	1395	70	522		1465	800
Center N. Line NW. ¼ SE. ¼	do	do No. 5	852	do	1381	72	529		1453	400
NW. cor. NW. ¼ NE. ¼	do	do No. 1	875	do	1420	44	545		1464	
Center W. Line N. 60 a. SE. ¼	do	do No. 4	885	do	1417	63	532	1424	1480	250
SW. cor. N. 60 a. SE. ¼	do	do No. 3	889	do	1417	63	578	1423	1442	500
One Loc. E. No. 3 SE. ¼	do	do No. 8	896	do	1412	61	516		1473	250
SE. cor. W. ½ N. 60 a. SE. ¼	do	do No. 7	897	do	1398	74	501		1472	60
SW. cor. E. ½ N. 60 a. SE. ¼	do	do No. 9	904	do (4)	1395	93	491		1488	100
Cen. S. Line E. ½ N. 60 a. SE.¼	do	do No. 10	913	do (5)	1400	77	487		1477	40
Cen. E. Line E. ½ N. 60 a. SE.¼	do	do No. 13	926	Layton(6)	1431	75	505	1484	1506	40
Cen. N. Line E. ½ S. 100a. SE.¼	Gypsy Oil Co.	do No. 8		do	1425	127			1552	*
NW. cor. E. ½ S. 100a. SE. ¼	do	do No. 7		do	1397	93			1490	15
NE. cor. W. ½ S. 100a. SE. ¼	do	do No. 5		do	1427	80			1507	200
NW. cor. W. ½ S. 100a. SE. ¼	do	do No. 3	890	do	1404	32	514	1420	1436	260
NW. cor. SW. ¼ SE. ¼	do	do No. 4		do	1396	80			1476	100
Cen. N. L. W. ½ S. 100a. SE. ¼	do	do No. 6		do	1426	64			1490	250
Cen. W. Line S. 100a. SE. ¼	do	do No. 2	889	do	1415	70	526	1455	1485	350
SW. cor. SW. ¼ SE. ¼	do	do No. 1	891	do	1365	79	474		1444	310
Center S. Line SW. ¼ SE. ¼	do	do No. 9		do	1355	95		1419	1450	10

*Gas. (3) (4) (5) (6) Later drilled to Bartlesville sand.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Sec. 6, T 17 N., R. 7 E.										
NE. ¼										
NE. cor. N. ½ NW. ¼ NE. ¼	T. B. Slick	Sarah Deerisaw No. 3	922	Wheeler	2326	72	1404		2398	160
Cen. E. Line SE. ¼ NE. ¼ NE. ¼	B. B. Jones	do No. 1	886	Jones (?)	1540	30	654		1570	50
Cen. W. L. SW. ¼ NE. ¼ NE. ¼	do	do No. 2	906	Wheeler	2300	59	1394		2359	120
NW. cor. SE. ¼ NE. ¼	C. B. Shaffer	do No. 9	---	do	2315	62			2377	175
SE. cor. NE. ¼	do	do No. 5	874	do	2244	62	1370	2250	2306	210
Cen. S. Line SE. ¼ NE. ¼	do	do No. 6	908	do	2287	62	1379	2341	2349	100
Center S. Line S. ¼ NE. ¼	do	do No. 7	950	do	2328	58	1378		2386	200
Center S. Line SW. ¼ NE. ¼	do	do No. 8	---	do				2337	2396	75
NW. ¼										
NE. cor. SE. ¼ NW. ¼	C. B. Shaffer	Fannie Deerisaw No. 12	---	Wheeler	2337	58		2366	2395	100
SE. cor. NW. ¼	do	do No. 3	919	do	2333	57	1414	2358	2390	200
Center S. Line SE. ¼ NW. ¼	do	do No. 4	---	do	2362	28			2390	40
SW. ¼										
NE. cor. E. ½ SW. ¼	Kathleen Oil Co.	Beeley Deerisaw No. 4	921	Wheeler	2320	57	1399	2357	2377	200
Center N. Line E. ½ SW. ¼	do	do No. 11	902	do	2319	43	1417		2362	150
NW. cor. E. ½ SW. ¼	do	do No. 10	906	do	2321	42	1415		2363	100
Center W. Line NE. ¼ SW. ¼	do	do No. 9	869	do	2310	52	1441		2362	150
SW. cor. NE. ¼ SW. ¼	Kathleen Oil Co.	Beeley Deerisaw No. 3	904	Wheeler	2355	50	1451	2358	2405	200
NW. cor. SE. ¼ SW. ¼	do	do No. 5	901	do	2335	129	1432		2441	150
Center W. Line SE. ¼ SW. ¼	do	do No. 6	890	do	2313	43	1423	2318	2356	100
SW. cor. E. ½ SW. ¼	do	do No. 7	902	do	2332	32	1430		2364	250
Center S. Line E. ½ SW. ¼	do	do No. 13	911	do	2325	33	1414		2358	60
Center E. Line NE. ¼ SW. ¼	do	do No. 2	931	do	2362	33	1431	2376	2395	125
Center E. Line SE. ¼ SW. ¼	do	do No. 12	915	do	2323	45	1408		2368	115
NE. cor. NW. ¼ SW. ¼	McMann Oil Co.	do No. 4	898	do	2318	61	1420	2330	2379	50
Center E. Line NW. ¼ SW. ¼	do	do No. 2	---	do	2322	40			2362	100
SE. cor. NW. ¼ SW. ¼	do	do No. 1	889	do	2335	37	1446	2338	2372	100
Center S. Line NW. ¼ SW. ¼	do	do No. 5	864	do	2320	33	1456		2353	60
SW. cor. NW. ¼ SW. ¼	do	Beeley Deerisaw No. 3	889	do	2351	34	1462		2385	60
NE. cor. SW. ¼ SW. ¼	Producers Oil Co.	do No. 4	880	do	2812	129	1432		2441	150
NW. cor. SW. ¼ SW. ¼	do	do No. 7	894	do	2359	36	1465	2362	2395	50
Center W. Line SW. ¼ SW. ¼	do	do No. 2	889	do	2359	44	1470		2403	50
SE. cor. SW. ¼ SW. ¼	do	do No. 5	898	do	2335	31	1437		2366	65
SW. cor. SW. ¼	do	do No. 1	899	do	2359	35	1460		2390	1800
SE ¼										
NE. cor. SE. ¼	T. B. Slick	Salo Fulsom No. 1	875	do	2257	63	1382	2288	2320	250
Center N. Line NE. ¼ SE. ¼	do	do No. 15	---	do	2321	44			2365	75
Center N. Line W. ½ SE. ¼	do	do No. 17	941	do	2368	35	1427		2303	100
NW. cor. SE. ¼	do	do No. 3	934	do	2360	43	1426	2362	2403	150
Center W. Line NW. ¼ SE. ¼	do	do No. 4	935	do	2362	39	1427	2362	2401	150
SW. cor. NW. ¼ SE. ¼	do	do No. 5	923	do	2352	35	1429		2387	75
Center W. Line SW. ¼ SE. ¼	do	do No. 6	938	do	2367	33	1429		2400	60
SW. cor. SE. ¼	do	do No. 7	936	do	2364	45	1428		2409	125
Center S. Line SE. ¼	do	do No. 13	940	do	2345	45	1405		2390	75
SE. cor. SE. ¼	do	do No. 11	881	do	2265	71	1384		2336	25
Center S. Line SW. ¼ SE. ¼	do	do No. 14	936	Wheeler	2341	75	1405		2416	40
Center NW. ¼ NE. ¼	do	do No. 18	950	do	2368	12	1418		2380	50

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Cener S. Line SE. ¼ SE. ¼	T. B. Slick	Salo Fulsom No. 12	902	Wheeler	2300	80	1398		2380	100
SE. cor. NE. ¼ SE. ¼	do	do No. 8	874	do	2290	29	1416		2319	75
NE. cor. SE. ¼ NE. ¼ SE. ¼	do	do No. 2	859	do	2260	60	1401		2320	75
SW. cor. NE. ¼	C. B. Shaffer	Sarah Deerisaw No. 2	923	do	2340	60	1417	2345	2400	50
NW. cor. SW. ¼ NE. ¼	do	do No. 11		do	2375	29			2405	50
NE. cor. SW. ¼ NE. ¼	do	do No. 10		do	2320			2350	2370	50
NE. cor. S. ½ NE. ¼	do	do No. 1		do						150
Center N. Line SE. ¼ NW. ¼	do	Fanne Deerisaw No. 13		Wheeler	2337	58		2367	2395	150
Center E. Line N. ½ N. ½ NE. ¼	T. B. Slick	Sarah Deerisaw No. 1	904	do	2226	84	1322		2310	250
SE. cor. NE. ¼ SW. ¼	Kathleen Oil Co.	Beeley Deerisaw No. 1	916	do	2340	50	1424		2390	90
SE. cor. SW. ¼	do	do No. 8	913	do	2333	57	1420		2390	200
Center N. Line SW. ¼ SW. ¼	Producers Oil Co.	do No. 8	867	do	2307	53	1440		2360	50
Center S. Line SW. ¼ SW. ¼	do	do No. 3	861	do	2302	8	1441		2310	84
Sec. 7 T. 17 N., R. 7 E.										
NE ¼										
NE. cor. NE. ¼	Prairie Oil & Gas Co.	Kogee Washington No. 1	894	Wheeler	2317	44	1423	2327	2361	50
Center N. Line NE. ¼ NE. ¼	do	do No. 4	911	do	2338	24	1427		2362	75
Center N. Line NE. ¼	do	do No. 5	945	do	2380	32	1435		2412	100
Center N. Line NW. ¼ NE. ¼	do	do No. 6	941	do	2386	39	1445		2425	50
Center W. Line NW. ¼ NE. ¼	do	do No. 8		do	2342	24			2366	30
Center W. Line NE. ¼	do	do No. 9	915	do	2339	25	1424		2364	35
SE. cor. W. ½ NE. ¼	do	do No. 12		do	2387	37			2424	100
Center W. Line SW. ¼ NE. ¼	do	do No. 10	923	do	2357	26	1434		2383	40
Center S. Line SW. ¼ SE. ¼	do	do No. 15		do	2341	51		2381	2392	20
SW. cor. E. ½ NE. ¼	do	do No. 11		do	2348	48			2396	150
SE. cor. NE. ¼	do	do No. 2	963	do	2348	39	1385	2350	2387	90
NW. cor. NE. ¼	do	do No. 7	937	do	2367	37	1430		2404	50
Center E. Line SE. ¼ NE. ¼	do	do No. 13	947	do	2382	49	1378	2337	2377	75
Center E. Line NE. ¼ NE. ¼	do	do No. 14	917	do	2302	50	1385	2340	2352	100
NW ¼										
NE. cor. NW. ¼	Gypsy Oil Co.	Sarah Deere No. 9	922	do	1530	60	608		1590	*
NW. cor. NE. ¼ NW. ¼	do	do No. 8	907	Wheeler	2330	36	1423		2366	100
NE. cor. NW. ¼ NW. ¼	do	do No. 12	883	do	2310	27	1427		2337	35
Center N. Line NW. ¼ NW. ¼	do	do No. 6	854	do	1530	92	676		1612	*
NW. cor. NW. ¼	do	do No. 4	907	Wheeler	2316	64	1409		2380	100
Center W. Line NW. ¼ NW. ¼	do	do No. 3	916	do	2323	65	1407		2388	75
Center W. Line NW. ¼	do	do No. 1	892	do	1500	105	608		1605	250
Center W. Line SW. ¼ NW. ¼	do	do No. 2			1540	60			1600	150
SW. cor NW. ¼	do	do No. 7		Wheeler	2342	44			2386	
Center S. Line NW. ¼	do	do No. 10		do	2319	35			2354	
SE. cor. NW. ¼	do	do No. 5	931	do	2378	37	1447		2415	
Center E. Line NE. ¼ NW. ¼	do	do No. 13	909	do	2331	47	1422		2378	50
SW. ¼										
NE. cor. N. ½ SW. ¼	Kathleen Oil Co.	Newman Deere No. 1	959	Wheeler	2376	52	1417		2428	300
Center N. Line N. ½ SW. ¼	do	do No. 11	936	do	2389	37	1453		2426	170
Center N. Line NW. ¼ SW. ¼	do	do No. 10	920	do	2384	41	1464	2385	2425	75
Center S. Line S. ½ SW. ¼	do	do No. 6	943	Wheeler	2401	38	1558		2339	60

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Center W. Line N. ½ SW. ¼--	Kathleen Oil Co.---	Newman Deere No. 9--	---	Wheeler ---	2390	35	----	----	2425	150
Center S. Line NW. ¼ SW. ¼-	---do ---	---do --- No. 7--	921	---do ---	2391	44	1470	----	2435	150
Center S. Line NE. ¼ SW. ¼--	---do ---	---do --- No. 3--	958	---do ---	2410	40	1452	2415	2450	225
SE. cor. N. ½ SW. ¼---	---do ---	---do --- No. 2--	977	---do ---	2424	38	1447	2428	2462	300
Center E. Line NE. ¼ SW. ¼--	---do ---	---do --- No. 4--	967	---do ---	2438	50	1471	2438	2488	100
NW. cor. N. ½ SW. ¼---	---do ---	---do --- No. 5--	---	---do ---	2460	39	----	----	2499	100
NE. cor S. ½ SW. ¼----	McMann Oil Co. ---	---do --- No. 1--	933	---do ---	2421	40	1488	----	2461	120
Center N. Line SE. ¼ SW. ¼--	---do ---	---do --- No. 2--	931	---do ---	2412	42	1481	2414	2454	200
Center N. Line S. ½ SW. ¼---	---do ---	---do --- No. 6--	941	---do ---	2405	36	1464	----	2441	50
Center N. Line SW. ¼ SW. ¼-	---do ---	---do --- No. 7--	928	---do ---	2378	44	1450	----	2422	100
NW. cor. S. ½ SW. ¼----	---do ---	---do --- No. 8--	938	---do ---	2405	42	1472	----	2447	100
Center W. Line SW. ¼ SW. ¼	---do ---	---do --- No. 10--	936	---do ---	2418	35	1482	----	2453	60
SW. cor. S. ½ SW. ¼----	---do ---	---do --- No. 11-	945	---do ---	2420	41	1475	----	2461	100
Center S. Line SW. ¼----	---do ---	---do --- No. 9--	941	---do ---	2398	49	1457	2415	2447	120
Center S. Line SE. ¼ SW. ¼--	---do ---	---do --- No. 5--	---	---do ---	2375	54	----	----	2429	100
SE. cor. S. ½ SW. ¼-----	---do ---	---do --- No. 3--	952	---do ---	2404	39	1452	----	2443	250
Center E. Line S. ½ SW. ¼----	---do ---	---do --- No. 4--	966	Wheeler ---	2407	36	1441	----	2443	100
SE. ¼ ----------										
NE. cor. E. ½ SE. ¼----	Quaker Oil & Gas Co.	Minnie Washingon No. 1-	974	Wheeler ---	2360	48	1386	----	2408	380
Center W. Line NE. ¼ SE. ¼-	---do ---	---do --- No. 10-	965	---do ---	2357	50	1392	2578	2407	50
Center W. Line SE. ¼ SE. ¼--	---do ---	---do --- No. 5--	963	---do ---	2489	31	1526	----	2420	120
SW. cor. E. ½ SE. ¼----	---do ---	---do --- No. 3--	---	---do ---	2386	61	----	----	2447	50
SE. cor. SE. ¼----------	---do ---	---do --- No. 4--	990	---do ---	2380	64	1390	----	2444	25
NW. cor. E. ½ SE. ¼----	---do ---	---do --- No. 2--	966	---do ---	2347	54	1381	2382	2401	400
Center E. Line SE. ¼----	---do ---	---do --- No. 9--	962	---do ---	2396	28	1434	----	2424	50
Center E. Line NE. ¼ SE. ¼--	---do ---	---do --- No. 7--	965	---do ---	2331	68	1366	2345	2399	150
NE. cor. W. ½ SE. ¼----	Producers Oil Co. ---	---do --- No. 5--	957	---do ---	2390	52	1433	2400	2442	60
NW. cor. SE. ¼----------	---do ---	---do --- No. 1--	940	---do ---	2371	50	1431	2375	2421	200
Center W. Line NW. ¼ SE. ¼-	---do ---	---do --- No. 8--	946	---do ---	2380	37	1434	2385	2417	75
Center N. Line W. ½ SE. ¼---	---do ---	---do --- No. 13-	947	---do ---	2382	49	1435	2389	2431	25
NW. cor. SW. ¼ SE. ¼------	---do ---	---do --- No. 2--	974?	---do ---	2417	27	1443	2427	2444	100
Center W. Line SW. ¼ SE. ¼-	---do ---	---do --- No. 7--	971	---do ---	2415	48	1444	2425	2463	90
SW. cor. SE. ¼----------	---do ---	---do --- No. 6--	960?	---do ---	2410	50	1450	----	2460	150
Center S. Line W. ½ SE. ¼---	---do ---	---do --- No. 12-	967	Wheeler ---	2415	39	1448	----	2454	75
SE. cor. W. ½ SE. ¼----	---do ---	---do --- No. 4--	974	---do ---	2415	31	1441	----	2446	75
Center E. Line SW. ¼ SE. ¼--	---do ---	---do --- No. 9--	---	---do ---	2329	101	----	----	2430	120
Center E. Line W. ½ SE. ¼---	---do ---	---do --- No. 10-	---	---do ---	2495	34	----	----	2429	100
Center E. Line NW. ¼ SE. ¼--	---do ---	---do --- No. 11-	---	---do ---	2385	38	----	----	2423	70
Sec. 8, T. 17 N., R. 7 E.----										
NE. ¼ ----------										
Center N. Line NE. ¼----	Devonian Oil Co.----	Maley Yarhola No. 4--	830?	Layton ----	1423	40	593	----	----	----
Center N. Line NW. ¼ NE. ¼-	---do ---	---do --- No. 2--	869	---do ---	1350	104	481	----	1454	*
NW. cor. NE. ¼----------	---do ---	---do --- No. 1--	852?	---do ---	1372	63	520	1400	1435	500
One Loc. S. No. 1 W.Line NE.¼	---do ---	---do --- No. 3--	---	---do ---	1372	74	----	1405	1446	470
Center W. Line NE. ¼----	---do ---	---do --- No. 5--	---	---do ---	1400	26	----	1402	1426	400
Center W. Line SW. ¼ NE. ¼-	---do ---	---do --- No. 6--	839	---do ---	1393	34	554	----	1427	600
SW. cor. NE. ¼----------	---do ---	---do --- No. 7--	835	---do ---	1366	49	531	----	----	----
Center S. Line SW. ¼ NE. ¼--	---do ---	---do --- No. 8--	827	---do ---	1389	45	562	----	----	----

*Gas.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Center S. Line NE. ¼	Devonian Oil Co.	Maley Yarhola No. 11	833	Wheeler	2100	85	1267		2185	*
Center SW. ¼ NE. ¼	do	do No. 9	848	Layton	1385	59	537		1444	400
Center E. Line W. ½ NE. ¼	do	do No. 10		Layton	1390	54			1444	250
Center NW. ¼ NE. ¼	do	do No. 12							2226	dry
NW. ¼										
NE. cor. NW. ¼	Prairie Oil & Gas Co.	Nancy Yarhola No. 1	853	Layton	1385	35	532	1416	1420	500
Center E. Line NE.¼ NW.¼	do	do No. 2	849	do	1351	67	502		1418	400
Center E. Line NW. ¼	do	do No. 3	853	do	1380	40	527		1420	850
Center E. Line SE. ¼ NW. ¼	do	do No. 4		do	1378	66			1444	350
SE. cor. NW. ¼	do	do No. 5	849	do	1423	53	574		1476	2500
Center S. Line SE. ¼ NW. ¼	do	do No. 6	830	do	1440	44	610		1484	1500
SW. cor. E. ½ NW. ¼	do	do No. 7		Wheeler	2196	40		2203	2236	500
SE. cor. W. ½ NW. ¼	do	do No. 8	846	Wheeler	2243	40	1397	2253	2283	500
SW. cor. NW. ¼	do	do No. 10		do	2328	47			2375	200
NW. cor. NW. ¼	do	do No. 14	926	do	2295	41	1369		2336	450
NE. cor. W. ½ NW. ¼	do	do No. 16	852	do	2211	40	1359		2251	700
Center N. Line NE. ¼ NW. ¼	do	do No. 18		Layton	1395	35			1430	500
Cen. E. Line W.½ E.½ NW.¼	do	do No. 20	883	Layton	1401	46	518		1447	90
Center SE. ¼ NW. ¼	do	do No. 21		do	1402	60			1462	375
SW. ¼										
Center N. Line E. ½ SW. ¼	Waters-Pierce Oil Co.	Laura Hutton No. 2	884	Layton	1451	44	567		1495	1470
NW. cor. E. ½ SW. ¼	do	do No. 3	863	do	1440	59	577		1499	300
Center E. Line NE. ¼ SW. ¼	do	do No. 4		do	1420	75			1495	1200
NE. cor. SE. ¼ SW. ¼	do	do No. 8	879	do	1449	42	570	1473	1491	150
SE. cor. NE. ¼ SW. ¼	do	do No. 9		do	1465	67		1485	1532	500
Center E. ½ SW. ¼	do	do No. 10	916	do	1479	49	563		1528	250
Center S. Line E. ½ SW. ¼	do	do No. 11	931	do	2283	25	1352		2308	1000
Center E. Line SE. ¼ SW. ¼	do	do No. 12	868	Wheeler	2196	58	1328		2254	*
SW. cor. NE. ¼ SW. ¼	do	do No. 13	966	Layton	1498	50	532		1548	250
NW. cor. SE. ¼ SW. ¼	do	do No. 14	967	Wheeler	2320	61	1353	2325	2381	75
Center W. Line SE. ¼ SW. ¼	do	do No. 15	968	Wheeler	2336	46	1468		2382	100
SW. cor. E. ½ SW. ¼	do	do No. 16	965	do	2322	48	1357		2370	250
NE. cor. W. ½ SW. ¼	do	Hut-te-che Lewis No. 1½								300
NE. cor. NW. ¼ SW. ¼	do	do No. 1		Layton	1423	62			1485	
Center E. Line NW. ¼ SW. ¼	do	do No. 2		do	1473	71			1544	
Center E. Line NW. ¼ SW. ¼	do	do No. 2½	902	Wheeler	2269	63	1376		2332	400
SE. cor. NW. ¼ SW. ¼	do	do No. 3	924	Layton	1513	32	589		1545	100
Center E. Line W. ½ SW. ¼	do	do No. 3½	924	Wheeler	2375	59	1451		2434	150
NE. cor. SW. ¼ SW. ¼	do	do No. 4			1517	34			1551	75
Center E. Line SW. ¼ SW. ¼	do	do No. 5	960	Wheeler	2320	69	1360		2389	800
SE. cor. W. ½ SW. ¼	do	do No. 6	966	do	2324	51	1358		2375	1350
SW. cor. W. ½ SW. ¼	do	do No. 7	980	do	2364	58	1384		2422	300
Center W. Line SW. ¼ SW. ¼	do	do No. 8	971	do	2354	59	1383		2413	100
Center W. Line SW. ¼	do	do No. 9	975	do	2319	57	1344		2376	400
Center W. Line NW. ¼ SW. ¼	do	do No. 10	908	do	2287	58	1379		2345	300
NW. cor. W. ½ SW. ¼	do	do No. 11		do	2324	62			2386	480
NE. cor. E. ½ SW. ¼	Waters-Pierce Oil Co.	Laura Hutton No. 1		Layton	1412	37		1426	1449	620
SE. cor. E. ½ SW. ¼	do	do No. 5	893	Wheeler	2206	82	1313		2288	100

*Gas.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet.			
Center W. Line NE. ¼ SW. ¼	Waters-Pierce Oil Co.	Laura Hutton No. 6	---	Layton	1487	54	----	1492	1541	300
Center NE. ¼ SW. ¼	---do	---do No. 7	898	---do	1441	75	543	1467	1516	300
SE. ¼										
NW. cor. SE. ¼	Oil Production Co.	Lessey Yarhola No. 1	---	Layton	1382	20	----	----	1402	900
Center W. Line N. ½ SE. ¼	---do	---do No. 2	849	---do	1390	76	541	----	1466	750
Center N. Line NW. ¼ SE. ¼	---do	---do No. 3	846	---do	1382	84	536	----	1466	350
SW. cor. N. ½ SE. ¼	---do	---do No. 4	---	---do	1415	66	----	----	1481	250
Center NW. ¼ SE. ¼	---do	---do No. 5	945	---do	1436	48	591	----	1484	75
Center S. Line NW. ¼ SE. ¼	---do	---do No. 6	848	---do	1392	86	544	----	1478	50
NW. cor. S. ½ SE. ¼	Greis et al	Lessey Yarhola No. 1	886	Wheeler	2170	60	1284	----	2230	85
SW. cor. S. ½ SE. ¼	---do	---do No. 2	879	Wheeler	2195	80	1316	----	2275	225
Sec. 9, T. 17 N., R. 7 E.										
NW. cor. NE. ¼	Steele et al	Lizzie Brown No. 1	---	Wheeler	2180	14	----	----	2194	*
NW. cor. SW. ¼ NE. ¼	Kathleen Oil Co.	---do No. 1	884	---[7]	----	----	----	----	2490	*
NW. cor. N. ½ SW. ¼	Gunsberg & Duffer	Katie Brown No. 1	966	Jones [8]	1792	826	----	----	----	*
Sec. 10, T. 17 N., R. 7 E.										
SW. cor. NE. ¼	Cortez Oil Co.	Sandy For No. 1	1000	Wheeler[9]	2330	74	1330	2335	2404	75
SE. cor. E. ½ NW. ¼	Prairie Oil & Gas Co.	Dan Tucker No. 1	984	---do	2304	48	1330	----	2352	10
Sec. 17, T. 17 N., R. 7 E.										
NE. cor. NE. ¼ NE. ¼	Only Oil Co.	Jessie Tiger No. 1	886	Layton[10]	----	---	----	----	----	dry
NW. cor. NE. ¼	---do	---do No. 2	892	Wheeler[11]	2192	82	1300	----	2274	60
NW. ¼										
NE. cor. N. ½ NW. ¼	Layton Oil Co.	Lucinda Tiger No. 1	907	Wheeler[12]	2200	86	1293	----	2286	280
Center N. Line NE. ¼ NW. ¼	---do	---do No. 2	934	Wheeler	2284	61	1350	2298	2345	100
Sec. 15, T. 17 N., R. 7 E.										
SE. cor. SE. ¼	Hill Oil & Gas Co.	Lillie Jackson No. 1	976	Wheeler[13]	2275	10	1299	----	2285	*
NW. cor. N. ½ NW. ¼	Layton Oil Co.	Lucinda Tiger No. 3	948	Wheeler	2337	35	1389	----	2372	500
SE. cor. NW. ¼ NW. ¼	---do	---do No. 4	---	---do	2259	56	----	2286	2315	----
NE. cor. NW. ¼ NW. ¼	---do	---do No. 5	959	---do	2316	54	1357	----	2370	346
NW. cor. NE. ¼ NW. ¼	---do	---do No. 6	930	Layton	1540	20	510	----	1560	100
SW. cor. N. ½ NW. ¼	---do	---do No. 7	908	Wheeler	2300	39	1392	----	2339	500
Center S. Line NW. ¼ NW. ¼	---do	---do No. 8	904	---do	2265	50	1361	----	2315	300
Center S. Line NE. ¼ NW. ¼	---do	---do No. 9	886	---do	2238	40	1352	----	2278	150
SE. cor. N. ½ NW. ¼	---do	---do No. 10	882	---do	2218	56	1336	----	2274	50
Center S. Line NW. ¼ NW. ¼	---do	---do No. 11	904	Layton	1484	30	580	1490	1514	100
Center W. Line NW. ¼ NW. ¼	---do	---do No. 12	---	Wheeler	2322	56	----	2325	2378	100
Center S. Line N. ½ NW. ¼	---do	---do No. 13	---	Layton	1498	35	----	----	1533	100
NE. cor. SW. ¼ NW. ¼	C. B. Shaffer	---do No. 1	889	Wheeler	2247	55	1358	2247	2302	100
Center N. Line SW. ¼ NW. ¼	---do	---do No. 2	917	---do	2268	51	1351	----	2319	500
NW. cor. S. ½ NW. ¼	---do	---do No. 3	927	---do	2307	40	1380	----	2347	1000
SW. cor. E. ½ NW. ¼	---do	---do No. 4	---	---	1605	23	----	----	1628	200
Center S. Line SW. ¼ NW. ¼	---do	---do No. 5	---	Wheeler	2298	33	----	----	2331	2560
Cener S. Line S. ½ NW. ¼	---do	---do No. 6	932	---do	2271	51	1339	----	2322	400
SE. cor. S. ½ NW. ¼	---do	---do No. 8	---	---do	2236	49	----	----	2285	*
Center N. Line SE. ¼ NW. ¼	---do	---do No. 10	---	Wheeler	2230	71	----	----	2301	15
Center SW. ¼ NW. ¼	---do	---do No. 11	934	---do	2336	36	1402	----	2372	125
Center S. ½ NW. ¼	---do	---do No. 12	898	---do	2248	64	1350	----	2312	20

*Gas. [7] [8] [9] [10] [11] [12] Later drilled to Bartlesville sand. [13]To Layton.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SW. cor. S. ½ NW. ¼	C. B. Shaffer	Lucinda Tiger No. 13	---	Layton	1593	24	----	1602	1617	100
Center N. Line SW. ¼ NW. ¼	---do	---do No. 14	917	---do	1505	33	588	1529	1538	300
SW. ¼										
SW. cor. SW. ¼	T. B. Slick	Miller Tiger No. 1	---	Wheeler	2304	88	----	2390	2392	100
NW. cor. SW. ¼ SW. ¼	---do	---do No. 2	---	---do	2287	77	----	2290	2364	100
Cen. W. L. SW. ¼ NW. ¼ SW. ¼	---do	---do No. 3	---	---do [14]	2331	45	----	----	2376	----
NW. cor. SW. ¼	---do	---do No. 4	---	---do	2354	52	----	----	2406	50
Center N. Line NW. ¼ SW. ¼	---do	---do No. 5	---	---do	2320	53	----	----	2373	900
Center N. Line SW. ¼	---do	---do No. 6	960	---do	2291	69	1331	----	2360	200
Center N. Line NE. ¼ SW. ¼	---do	---do No. 7	932	---do	2271	51	1339	----	2322	400
NE. cor. SW. ¼	---do	---do No. 8	---	---do	2242	36	----	----	2278	50
SE. cor. NW. ¼ SW. ¼	---do	---do No. 10	---	---do	2250	71	----	----	2321	120
Center S. Line NE. ¼ SW. ¼	---do	---do No. 11	---	---do	2238	145	----	----	2383	300
Center S. Line SW. ¼ SW. ¼	---do	---do No. 14	---	---do	2324	82	----	2471	2406	100
Center NW ¼ SW. ¼	---do	---do No. 12	---	---do	2288	62	----	2323	2350	1200
NW. cor. SE. ¼	McMann Oil Co.	Hettie Tiger No. 1	---	---do	2189	70	----	----	2259	45
Sec. 18, T. 17 N., R. 7 E.										
E. ½										
NW. cor. E. ½ NE. ¼	Gunsberg-Foreman	Bettie Cain No. 1	988	Wheeler	2385	69	1397	----	2454	150
NE. cor. E. ½ NE. ¼	---do	---do No. 2	---	---do	2349	65	----	----	2414	150
Center W. Line NE. ¼ NE. ¼	---do	---do No. 3	989	---do	2423	30	1434	----	2453	150
SE. cor. E. ½ NE. ¼	---do	---do No. 4	1012	---do	2413	60	1401	----	2473	200
NE. cor. SE. ¼ NE. ¼	---do	---do No. 5	---	---	---	---	---	---	---	1500
NE. cor. E. ½ SE. ¼	---do	---do No. 6	---	Wheeler	2398	65	----	----	2463	200
SE. cor. NE. ¼ NE. ¼	---do	---do No. 7	916	---do	2340	46	1424	----	2386	300
SW. cor. E. ½ NE. ¼	---do	---do No. 9	996	---do	2425	44	1429	----	2469	60
SE. cor. NE. ¼ SE. ¼	---do	---do No. 10	---	---do	2332	74	----	----	2406	50
Center E. Line NE. ¼ NE. ¼	---do	---do No. 11	950	---do	2332	74	1482	2340	2406	150
SE. cor. SE. ¼	---do	---do No. 13	---	---do	2356	50	----	2382	2406	50
Center W. Line SE. ¼ SE. ¼	---do	---do No. 15	---	---do	2455	40	----	2465	2495	50
NW. cor. SE. ¼ NE. ¼	---do	---do No. 8	969	---do	2415	38	1446	----	2453	10
NW. cor. SW. ¼ SE. ¼	---do	Perry Bowers No. 1	---	---do	2410	92	----	2426	2502	425
SE. cor. NW. ¼ SE. ¼	---do	---do No. 3	---	---do	2438	59	----	2465	2497	75
SW. cor. SW. ¼ SE. ¼	---do	---do No. 4	---	---do	2482	110	----	2492	2592	85
NE. cor. SW. ¼ SE. ¼	Southwestern Pet. Co.	---do No. 2	---	---do	2478	30	----	----	2508	130
SE. cor. SW. ¼ SE. ¼	---do	---do No. 3	---	---do	2457	40	----	----	2497	120
NE. cor. W. ½ NE. ¼	Kathleen Oil Co.	Dewey Bruner No. 1	973	Wheeler	2403	47	1430	2403	2450	150
NW. cor. W. ½ NE. ¼	---do	---do No. 2	962	---do	2415	45	1453	----	2460	110
Center N. Line NW. ¼ NE. ¼	---do	---do No. 3	957	---do	2368	107	1411	2412	2475	120
Center E. Line NW. ¼ NE. ¼	---do	---do No. 4	988	---do	2420	52	1432	2428	2472	120
Center W. Line NW. ¼ NE. ¼	---do	---do No. 5	983	---do	2432	48	1449	2445	2480	140
Center W. Line NE. ¼	---do	---do No. 6	995	---do	2447	44	1452	----	2491	75
Center W. Line SW. ¼ NE. ¼	---do	---do No. 7	994	---do	2449	41	1455	----	2490	90
SW. cor. W. ½ NE. ¼	---do	---do No. 8	995	---do	2448	43	1453	----	2491	100
NW. cor. SE. ¼	---do	---do No. 9	990	---do	2450	42	1460	----	2492	50
SW. cor. N. ½ S. ½ NW. ¼ SE. ¼	---do	---do No. 10	994	---do	2460	35	1466	----	2495	130
SE. cor. N. ½ S. ½ NW. ¼ SE. ¼	---do	---do No. 11	1012	---do	2475	28	1463	----	2503	60
NE. cor. NW. ¼ SE. ¼	---do	---do No. 12	1014	---do	2444	59	1430	----	2503	175

[14] Light showing of oil.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Center E. Line W. ½ NE. ¼	Kathleen Oil Co.	Dewey Bruner No. 14	996	Wheeler	2432	43	1436		2475	75
NW. ¼										
NE. cor. NW. ¼	C. B. Shaffer	Bessie Cobb No. 1		do	2379	44		2379	2423	150
Center N. Line E. ½ NW. ¼	do	do No. 2		do	2413	38			2451	200
Center E. Line NE. ¼ NW. ¼	do	do No. 3	992	do	2410	74	1418		2484	60
NE. cor. W. ½ NW. ¼	do	do No. 4	960	do	2430	34	1470		2464	185
Center E. Line NW. ¼	do	do No. 5	993	do	2417	77	1424	2457	2494	60
Center E. Line SE. ¼ NW. ¼	do	do No. 6	995	do	2417	76	1422		2493	50
SE. cor. NW. ¼	do	do No. 7	993	Wheeler	2418	75	1425		2493	90
Center S. Line SE. ¼ NW. ¼	do	do No. 8	988	do	2408	90	1420		2498	100
SW. cor. SE. ¼ NW. ¼	do	do No. 9		do	2412	78		2460	2490	90
SE. cor. SW. ¼ NW. ¼	do	do No. 10	977	do	2336	71	1359		2407	60
Center S. Line NE. ¼ NW. ¼	do	do No. 12		do	2411	77		2457	2488	60
NW. cor. NW. ¼	do	do No. 13		do	2400	72		2441	2472	50
SW. ¼										
NE. cor. SW. ¼	B. B. Jones	Hutton No. 1	981	Wheeler	2455	30	1474		2485	150
Sec. 19, T. 17 N., R. 7 E.										
NE. ¼										
NE. cor. E. ½ NE. ¼	Munice Oil Co.	David Barnett No. 1		Wheeler	2369	8			2377	1000
NW. cor. E. ½ NE. ¼	do	do No. 2	1014	do	2456	32	1442		2488	75
SE. cor. NE. ¼ NE. ¼	do	do No. 3		do	2442	33			2475	50
NE. cor. NW. ¼ NE. ¼	Gunsberg & Foreman	do No. 2		do	2411	97			2508	125
Sec. 20, T. 17 N., R. 7 E.										
NW. cor. NW. ¼	Prairie Oil & Gas Co.	Mattie Coachman No. 1	952	do	2390	28	1338		2418	75
Sec. 21, T .17 N., R. 7 E.										
NW. cor. NW. ¼	Prairie Oil & Gas Co.	Litchfield No. 1		do	2310	30			2340	*
Sec. 23, T. 17 N., R. 7 E.										
SW. cor. NW. ¼ SE. ¼	Hill Oil & Gas Co.	Ora Carlisle No. 1	926	Layton	1533	18	607		1551	dry
NW. cor. SW. ¼ SE. ¼	do	Donavon No. 1	941	do	1544	36	603		1580	20
NE. cor. SW. ¼ SE. ¼	do	W. N. Scott No. 1	962	do	1532	47	570		1579	30
Center S. Line SE. ¼ SW. ¼	do	do No 2	1017							100
SE. cor. NE. ¼ SW. ¼	do	L. Bruner No. 1	932	Layton	1527	48	595		1575	35
Sec. 28, T. 17 N., R. 7 E.										
SW. cor. N. ½ NE. ¼	Kathleen Oil Co.	Semor Keys No. 1		Layton	1492	10			1602	150
Center S. Line N. ½ NE. ¼	do	do No. 2	1014	do	1523	42	509		1565	15
Center E. Line NE. ¼	do	do No. 3		do	1470	90			1560	dry
Sec. 5, T. 18 N., R. 7 E.										
SW. cor. SW. ¼ SE. ¼	Gem Oil Company	O. Hawkins No. 1		Layton	1366	34			1400	1200
Center S. Line SW. ¼ SE. ¼	do	do No. 2		do	1403	35		1415	1438	100
NW. cor. SW. ¼ SE. ¼	do	do No. 7(?)		do					1497	dry
SW. cor. E. ½ SE. ¼	Quaker Oil & Gas Co.	Sina Crow No. 1		Wheeler[15]	2150	59			2209	*
SW. cor. NE. ¼ SW. ¼	McMann Oil Co.	Mollie Jones No. 1		Layton	1372	28			1400	40
SE. cor. NE. ¼ SW. ¼	do	do No. 2		do					1457	dry
SE. cor. NW. ¼ SW. ¼	Producers Oil Co.	Dale No. 1		do	1434	35			1469	80
SE. cor. SE. ¼ SW. ¼	B. B. Jones	S. Rector No. 1		do	1367	42			1409	2930
NE. cor. SW. ¼ SW. ¼	do	do No. 2		do	1398	42		1425	1440	1800
NE. cor. SE. ¼ SW. ¼	do	do No. 4		do	1398	32		1420	1440	40
Center S. Line SW. ¼ SW. ¼	do	do No. 9		do	1290	56		1329	1346	1000

*Gas; [15]Dry in Layton.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet	Thickness penetrated—feet.	Altitude below sea level—feet			
Sec. 6, T. 18 N., R. 7 E.										
SW. cor. SE. ¼ SE. ¼	McMann Oil Co.	Samuel E. Vance No. 5	---	Layton	1320	69	----	1335	1389	1180
Sec. 7, T. 18 N., R. 7 E.										
Center N. Line NE. ¼	McMann Oil Co.	Benj. Vance No. 1	---	Layton	1335	56	----	1357	1391	960
NE. cor. NE. ¼	---do	---do --- No. 2	---	---do	1290	83	----	1330	1373	150
Sec. 8, T. 18 N., R. 7 E.										
NW. cor. E. ½ NE. ¼	McMann Oil Co.	Thomas Conne No. 2	---	Layton	1440	50	----	----	1490	600
NE. cor. NW. ¼	---do	---do --- No. 3	---	---do	1347	47	----	----	1394	1500
Center E. Line NE. ¼	---do	---do --- No. 4	---	---do [16]	1328	40	----	----	1368	*
NW. cor. W. ½ NE. ¼	---do	Mussleman No. 5	---	---do	1317	43	----	----	1360	2200
One Loc. S. of No. 5	---do	---do --- No. 7	---	Layton	1295	45	----	----	1340	2200
Center N. Line W. ½ NE. ¼	---do	---do --- No. 10	---	---do	1333	60	----	----	1393	700
NW. cor. W. ½ NE. ¼	---do	---do --- No. 11	---	---do	1416	55	----	----	1471	650
One Loc. S. of No. 7	---do	---do --- No. 2	---	---	1322	25	----	1347	2347	1600
Center E. Line NW. ¼	J. H. Markham	Eliza Yarhola No. 1	---	Wheeler	1945	35	----	----	1980	*
Center Loc. NE. ¼ NW. ¼	---do	---do --- No. 2	---	Layton	1295	26	----	----	1321	150
Center NE. ¼ NW. ¼	---do	---do --- No. 3	---	---do	1287	65	----	1310	1352	720
NE. cor. NW. ¼ NW. ¼	---do	---do --- No. 4	---	---do	1295	10	----	----	1305	2400
SW. cor. E. ½ SE. ¼	Silurian Oil Co.	Amy No. 11	---	---do	1305	54	----	----	1359	*
Sec. 10, T. 18 N., R. 7 E.										
SE. cor. SW. ¼	B. B. Jones	Monday Bean No. 1	---	--- [17]	----	---	----	----	3010	dry
Sec. 12, T. 18 N., R. 7 E.										
SW. cor. N. ½ SE. ¼	Pocahontas Oil Co.	Reuben Morrison No. 1	873	Bartlesville	2612	38	1739	----	2650	40
Sec. 14, T. 18 N., R. 7 E.										
SW. cor. N. ½ SW. ¼	B. B. Jones	Joseph Jackson No. 1	---	Layton	1522	12	----	----	1534	200
NW. cor. SW. ¼	---do	---do --- No. 2	---	---do	1556	31	----	----	1587	100
SE. cor. NW. ¼ NW. ¼	---do	---do --- No. 3	---	---do	1566	22	----	----	1588	120
SW. cor. NW. ¼	McMann Oil Co.	Selvina No. 1	---	---do	----	---	----	----	1570	dry
NW. cor. S. ½ SW. ¼	Pocahontas Oil Co.	Joseph Jackson No. 1	---	Layton	1584	32	----	----	1616	250
SW. cor. SW. ¼	---do	---do --- No. 2	---	---do	1616	23	----	----	1639	120
NE. cor. SW. ¼ SW. ¼	---do	---do --- No. 3	---	---do	1572	15	----	----	1587	200
Sec. 15, T. 18 N., R. 7 E.										
SE. cor. E. ½ NE. ¼	T. B. Slick	Geo. Clifton No. 1	-----	---	----	---	----	----	1620	dry
SE. cor. SE. ¼	B. B. Jones	Johnny Jones No. 2	---	---	1629	34	----	----	1663	60
NE. cor. SE. ¼ SE. ¼	---do	---do --- No. 1	---	---	1624	26	----	----	1650	75
Sec. 17, T. 18 N., R. 7 E.										
SW. cor. SE. ¼	T. B. Slick	Jno. Powell No. 1	---	---	----	---	----	----	720	*
Sec. 18, T. 18 N., R. 7 E.										
SW. cor. NW. ¼ SE. ¼	C. B. Shaffer	B. Wilson No. 1	770	Wheeler	2082	35	1312	----	2117	100
SE. cor. NW. ¼ SE. ¼	---do	---do --- No. 2	---	---	----	---	----	----	2062	*
Sec. 19, T. 18 N., R. 7 E.										
NE. cor. SE. ¼ NE. ¼	Carpathia Oil Co.	Joseph Brown No. 2	851	Wheeler	2152	25	1301	----	2177	60
Center E. Line SE. ¼ SE. ¼	---do	Blanche Fixico No. 2	---	---do	2144	18	----	----	2162	----
SE. cor. N. ½ SE. ¼	---do	Blanche Fixico No. 1	---	Wheeler [18]	2235	40	----	----	2275	----
SE. cor. SE. ¼ SE. ¼	---do	---do --- No. 1	769	Wheeler	2141	46	1472	----	2187	100
SE. cor. SW. ¼	McBride et al	L. E. Morgan No. 1	---	--- [19]	----	---	----	----	2817	dry
Sec. 22, T. 18 N., R. 7 E.										

*Gas. [16]Twelve million cubic feet of gas and 50 barrels of oil. [17]Layton and Bartlesville sands absent. [18]Great amount water [19]Dry in all sands.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet.			
NE. cor. NE. ¼	C. J. Wrightsman	David Holen No. 1	977	---	---	---	---	---	1616	10
SW. cor. NW. ¼ SE. ¼	---do	---do No. 2	---	Layton	1520	53	---	---	1573	---
NW. cor. NE. ¼ NW. ¼	B. B. Jones	Anne Roberts No. 1	---	Stray[20]	---	---	---	---	2945	*
Sec. 23, T. 18 N., R. 7 E.										
NW. cor. NW. ¼ NW. ¼	B. B. Jones	Lee Jackson No. 1	---	---	1619	---	---	---	1664	60
Sec. 27, T. 18 N., R. 7 E.										
SE. cor. NW. ¼	T. B. Slick	London No. 1	---	---	---	---	---	---	3170	dry
SW. cor. SW. ¼	McMann Oil Co.	Albert Wildcat No. 1	952	Layton	1466	21	514	---	1487	1000
Center S. Line SW. ¼ SW. ¼	---do	---do No. 2	999	---do	1566	18	567	---	1584	130
Center W. Line SW. ¼ SW. ¼	---do	---do No. 3	937	---do	1424	86	487	---	1510	*
Center SW. ¼ SW. ¼	---do	---do No. 4	941	---do	1490	37	549	---	1527	250
Sec. 28, T. 18 N., R. 7 E.										
NE. cor. SE. ¼ SE. ¼	Prairie Oil & Gas Co.	Emma Billy No. 1	914	Layton	1399	10	485	---	1409	*
SE. cor. SE. ¼	---do	---do No. 2	936	---do	1494	11	558	---	1505	60
SW. cor. SE. ¼	---do	---do No. 4	---	---	---	---	---	---	1795	*
SW. cor. NW. ¼	Slick and Jones	Mamie Blackwell No. 2	---	Layton	1434	16	---	---	1515	*
SW. cor. SW. ¼	Pulaski Oil Co.	Waitie Moffer No. 1	---	---	---	---	---	---	---	*
SE. cor. SW. ¼	---do	---do No. 2	---	Layton	1363	80	---	---	1443	75
Center S. Line SE. ¼ SW. ¼	---do	---do No. 3	---	---do	1425	30	---	---	1475	100
Center E. Line SE. ¼ SW. ¼	---do	---do No. 4	---	---do	1417	22	---	---	1439	25
Sec. 29, T. 18 N., R. 7 E.										
NE. ¼										
SW. cor. NE. ¼	Gypsy Oil Co.	Aggie Wacoche No. 1	785	Wheeler	2126	60	1341	---	2186	75
NW. cor. SW. ¼NE. ¼	---do	---do No. 2	807	---do	2174	22	1367	---	2196	50
SW. cor. NW. ¼NE. ¼	---do	---do No. 3	822	---do	2153	52	1331	---	2205	40
NW. cor. NE. ¼	---do	---do No. 4	832	---do	2149	53	1317	2184	2202	50
SW. cor. NE. ¼	---do	---do No. 5	---	---do	2126	51	---	---	2177	50
Center N. Line NW. ¼ NE. ¼	---do	---do No. 6	818	Layton	1358	113	540	---	1471	50
SE. ¼										
SW. cor. SE. ¼	C. B. Shaffer	Eliza Wacoche No. 1	805	Wheeler	2156	24	1351	2162	2180	960
NW. cor. SW. ¼ SE. ¼	---do	---do No. 2	809	---do	2144	60	1335	2154	2204	130
SW. cor. NW. ¼ SE. ¼	---do	---do No. 3	793	Layton	1365	86	572	---	1451	50
NW. cor. SE. ¼	---do	---do No. 4	778	---do	1352	81	574	---	1433	50
NW. cor. SE. ¼	---do	---do No. 5	778	Wheeler	2128	38	1450	---	2166	150
W. ½										
SE. cor. E. ½ SW. ¼	Prairie Oil & Gas Co.	Polly Deerisaw No. 1	795	Layton	1373	60	578	---	1433	---
SE. cor. E. ½ SW. ¼	---do	---do No. 1	795	Cleveland	1793	19	898	---	1812	*
SE. cor. E. ½ SW. ¼	---do	---do No. 1	795	Wheeler	2135	54	1340	---	2189	465
SW. cor. E. ½ SW. ¼	---do	---do No. 2	791	---do	2164	41	1373	---	2166	430
NE. cor. SE. ¼ SW. ¼	Prairie Oil & Gas Co.	---do No. 3	799	---do	2157	42	1358	2160	2199	300
NW. cor. SE. ¼ SW. ¼	---do	---do No. 4	873	---do	2159	45	1286	---	2204	---
SE. cor. NE. ¼ SW. ¼	---do	---do No. 5	785	---do	2147	40	1362	---	2187	750
SW. cor. NE. ¼ SW. ¼	Prairie Oil & Gas Co	---do No. 6	---	---do	2159	45	---	---	2204	500
NW. cor. E. ½ SW. ¼	Prairie Oil & Gas Co.	---do No. 7	---	---do	2159	42	---	---	2201	400
NE. cor. E. ½ SW. ¼	---do	---do No. 8	810	---do	2164	37	1354	---	2201	800
SE. cor. E. ½ NW. ¼	---do	---do No. 9	809	---do	2162	18	1353	---	2180	1000
SW. cor. E. ½ NW. ¼	---do	---do No. 10	---	---do	2162	40	---	---	2202	960
NW. cor. SE. ¼ NW. ¼	---do	---do No. 11	821	---do	2190	33	1369	---	2223	300

*Gas. [20]Layton and Bartlesville sands absent.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SW. cor. NE. ¼ NW. ¼	Prairie Oil & Gas Co.	Polly Deerisaw No. 12	819	Wheeler	2165	40	1346	2170	2205	150
NW. cor. E. ½ NW. ¼	do	do No. 13	809	do	2159	40	1350		2199	300
NE. cor. E. ½ N. ¼	do	do No. 14	827	do	2177	35	1350		2212	500
SE. cor. NE. ¼ NW. ¼	do	do No. 15	820	do	2167	35	1347		2202	450
NE. cor. SE. ¼ NW. ¼	do	do No. 16	830	do	2164	40	1334		2204	500
SW. cor. W. ½ NW. ¼	Prairie Oil & Gas Co.	Jessie Bruner No. 1		Wheeler	2148	40			2188	275
Center W. Line SW. ¼ NW. ¼	Prairie Oil & Gas Co.	do No. 2	776	do	2154	48	1378		2202	250
SE. cor. E. ½ W. ½ NW. ¼	do	do No. 3		do	2145	39			2184	200
NE. cor. W. ½ NW. ¼	do	do No. 4	788	do	2137	40	1349	2140	2177	680
NE. cor. SW. ¼ NW. ¼	do	do No. 5	801	do	2165	42	1364		2207	225
SE. cor. NW. ¼ NW. ¼	do	do No. 6		do	2159	38			2197	60
NW. cor. W. ½ NW. ¼	do	do No. 7	773	do	2127	37	1354		2164	300
SW. cor. NW. ¼ NW. ¼	do	do No. 8	774	do	2132	44	1358	2135	2176	100
SE. cor. W. ½ SW. ¼	Prairie Oil & Gas Co.	Jessie Bruner (?) No. 1	854	do	2225	39	1371		2264	200
NE. cor. SW. ¼ SW. ¼	Prairie Oil & Gas Co.	do No. 2		do	2154	48			2202	250
Center N. Line E.½ W.½ SW.¼	do	do No. 3	777	do	2217	41	1440		2258	200
Cen. N. Line W.½ W.½ SW.¼	T. B. Slick	do No. 2	809	do	2211	54	1402		2265	150
Cen. S. Line W.½ NW.¼ SW.¼	do	do No. 3		do	2212	40			2252	50
Sec. 30, T. 18 N., R. 7 E.										
NE. ¼										
SE. cor. NE. ¼ NE. ¼	T. B. Slick	Sallie Casey No. 1	830	Wheeler	2176	65	1346		2241	235
NE. cor. NE. ¼	do	do No. 2		do	2153	42			2195	50
Center E. Line NE. ¼ NE. ¼	do	do No. 3		do	2144	61			2205	240
NE. cor. NW. ¼ NE. ¼ NE. ¼	do	do No. 4		Layton	1380	52		1422	1432	100
SE. cor. SE. ¼ NE. ¼	McBride et al	Sallie Casey No. 1		Wheeler	2202	45			2252	150
Center E. ½ SE. ¼ NE. ¼	do	do No. 2	847	do	2207	45	1460		2247	250
NE. cor. SE. ¼ NE. ¼	do	do No. 3	843	do	2184	47	1341		2230	125
SE. cor. SW. ¼	Producers Oil Co.	Nat. Adkins No. 1		do					2358	dry
SE. cor. SE. ¼	Gypsy Oil Co.	Chas. Kernal No. 1	907	do	2300	26	1393		2326	40
Sec. 31, T. 18 N., R. 7 E.										
NE. ¼										
SW. cor. E. ½ NE. ¼ NE. ¼	C. B. Shaffer	Sulloly Jones No. 1	899	Wheeler	2294	53	1395	2319	2347	400
NE. cor. NE. ¼	do	do No. 2	873	do	2273	52	1400		2325	40
NE. cor. SE. ¼ NE. ¼	do	do No. 3	871	do	2280	70	1409		2350	100
SE. cor. NE. ¼	do	do No. 4	910	do	2280	70	1370		2350	250
SE. ¼										
NE. cor. SE. ¼	C. B. Shaffer	Nellie Jones No. 1	907	Wheeler	2281	44	1380		2331	200
SE. cor. SE. ¼	do	do No. 2		do	2228	42			2270	200
SW. cor. SE. ¼ SE. ¼	do	do No. 3	875	do	2265	63	1390		2328	120
SE. cor. SW. ¼ SE. ¼	do	do No. 4	919	do	2328	60	1409		2388	125
SW. cor. SE. ¼	do	do No. 5		do	2348	73			2421	45
NE. cor. SE. ¼ SE. ¼	do	do No. 6	847	do	2226	58	1379		2284	200
Center NW. ¼ SE. ¼ SE. ¼	do	do No. 7		do	2252	70		2290	2322	100
Sec. 32, T. 18 N., R. 7 E.										
NE. ¼										
NW. cor. NE. ¼	C. B. Shaffer	George Jones No. 1	798	Wheeler	2115	81	1317		2196	125
Cen. Loc. W. Line NW.¼ NE¼	do	do No. 2	792	Layton	1371	29	579		1400	85
SW. cor. NE. ¼	do	do No. 3	802	do	1381	55	579		1436	50

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SE. cor. SW. ¼ NE. ¼	C. B. Shaffer	George Jones No. 4	---	Wheeler ---	1389	8	----	----	1397	1200
SW. cor. SE. ¼ NE. ¼	---do	---do No. 5	817	---do ---	1415	85	598	----	1500	20
SE. cor. NE. ¼	---do	---do No. 6	819	---do ---	1365	75	546	----	1440	100
NE. cor. SE. ¼ NE. ¼	---do	---do No. 7	798	---do ---	1377	18	579	----	1395	500
NW. cor. SE. ¼ NE. ¼	---do	---do No. 8	---	---do ---	1361	67	----	----	1428	50
NE. cor. SW. ¼ NE. ¼	---do	---do No. 9	820	---do ---	1371	65	551	----	1436	500
NW. cor. SW. ¼ NE. ¼	---do	---do No. 10	---	---do ---	1390	80	----	----	1470	100
NW. ¼										
SW. cor. NW. ¼ NW. ¼	C. B. Shaffer	Annie Jones No. 1	830	Wheeler ---	2200	24	1370	----	2224	120
NE. cor. NW. ¼	---do	---do No. 2	788	Layton ---	1365	82	577	----	1447	432
NW. cor. SW. ¼ NW. ¼	---do	---do No. 3	866	Wheeler ---	2245	55	1379	2246	2300	250
SW. cor. NW. ¼	---do	---do No. 4	871	---do ---	2239	51	1368	2245	2290	350
NW. cor. NE. ¼ NW. ¼	---do	---do No. 5	805	---do ---	2155	25	1350	----	2180	10
SE. cor. NE. ¼ NW. ¼	---do	---do No. 6	---	---do ---	2131	61	----	----	2192	175
Cen. N. Line E.½ W.½ NW.¼	C. B. Shaffer	Annie Jones No. 7	818	Wheeler ---	2186	4	1368	----	2190	450
NW. cor. NW. ¼	---do	---do No. 8	873	---do ---	2200	24	1327	----	2224	166
SE. cor. NW. ¼ NW. ¼	---do	---do No. 10	---	---do ---	2174	43	----	----	2217	100
SE. cor. NW. ¼	---do	---do No. 11	---	Layton ---	1363	59	----	----	1422	90
NE. cor. SE. ¼ NW. ¼	---do	---do No. 12	734	---do ---	1369	43	635	----	1412	50
NE. cor. SW. ¼ NW. ¼	---do	---do No. 13	851	Wheeler ---	2211	57	1360	----	2268	125
SE. cor. SW. ¼ NW. ¼	---do	---do No. 14	840	---do ---	2230	34	1390	----	2264	60
SW. ¼										
NW. cor. SW. ¼	C. B. Shaffer	Hannah Powell No. 1	---	Wheeler ---	2228	50	----	----	2278	480
NW. cor. E. ½ SW. ¼ SW. ¼	---do	---do No. 2	---	---do ---	2162	60	----	----	2222	200
NE. cor. SW. ¼	---do	---do No. 4	788	Layton ---	1369	35	581	----	1404	125
Center E. Line SE. ¼ SW. ¼	---do	---do No. 6	---	---do ---	1383	57	----	----	1440	90
Cen. N. Line W.½ SW.¼ SW.¼	---do	---do No. 7	843	Wheeler ---	2196	60	1353	----	2256	600
NE. cor. NW. ¼ SW. ¼	---do	---do No. 8	---	---do ---	2188	54	----	2218	2242	120
SW. cor. E. ½ SW. ¼ SW. ¼	C. B. Shaffer	---do No. 1	---	---do ---	2171	55	----	----	2226	530
SE. ¼										
Center NW. ¼ NW. ¼ SE. ¼	T. B. Slick	Emma Deerisaw No. 1	809	Wheeler ---	2131	84	1322	----	2215	10
NE. cor. NW. ¼ SE. ¼	---do	---do No. 2	826	Layton ---	1378	69	552	----	1447	200
NW. cor. NE. ¼ SE. ¼	---do	---do No. 3	841	---do ---	1386	67	545	----	1453	1200
Center E. Line N. ½ N. ½ SE.¼	---do	---do No. 4	---	---do ---	1387	66	----	----	1453	200
Cen. W. Line S. ½ N. ½ SE. ¼	Prairie Oil & Gas Co.	Emma Deerisaw No. 1	860	Layton ---	1334	104	574	----	1438	*
Cen. W. Li. E.½ S.½ N.½ SE.¼	---do	---do No. 2	836	---do ---	1380	66	544	----	1446	120
Cen. E. Li. W.½ S.½ N.½ SE.¼	---do	---do No. 3	817	---do ---	1382	38	565	----	1420	300
Cen. S. ½ NE. ¼ SE. ¼	Prairie Oil & Gas Co.	---do No. 4	850	---do ---	1416	46	566	----	1462	210
Center S. ½ NW. ¼ SE. ¼	---do	---do No. 5	804	---do ---	1402	46	598	----	1448	90
Cen. S. Line S. ½ N. ½ SE. ¼	---do	---do No. 6	---	---do ---	1392	61	----	----	1453	100
SW. cor. SE. ¼ SE. ¼	McMann Oil Co.	---do No. 1	858	---do ---	1378	70	520	1400	1448	720
Cen. W. Line SE. ¼ SE. ¼	McMann Oil Co.	Emma Deerisaw No. 2	838	Layton ---	1362	73	524	----	1435	480
Center S. Line SE. ¼ SE. ¼	---do	---do No. 3	857	---do ---	1370	89	513	----	1459	240
NW. cor. SE. ¼ SE. ¼	---do	---do No. 4	843	---do ---	1390	51	547	----	1441	150
SE. cor. SE. ¼ SE. ¼	---do	---do No. 5	890	---do ---	1400	78	510	----	1478	250
Center N. Line SE. ¼ SE. ¼	---do	---do No. 6	860	---do ---	1400	52	540	----	1452	800
Center E. Line SE. ¼ SE. ¼	---do	---do No. 7	901	---do ---	1415	79	514	----	1494	400
NE. cor. SE. ¼ SE. ¼	---do	---do No. 8	872	---do ---	1420	40	548	----	1460	1200

*Gas.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SE. cor. SW. ¼ SE. ¼	Chapman Oil Co.	Emma Deerisaw No. 1	852	Layton	1390	68	438		1458	200
SW. cor. SW. ¼ SE. ¼	do	do No. 2	857	do	1410	65	553		1475	250
Center E. Line SW. ¼ SE. ¼	do	do No. 3	840	do	1387	63	547		1450	200
NE. cor. SW. ¼ SE. ¼	do	do No. 4	821	do	1380	65	459		1440	600
NW. cor. SW. ¼ SE. ¼	do	do No. 5	827	do	1385	80	558		1465	150
Center S. Line SW. ¼ SE. ¼	do	Emma Deerisaw No. 6	892	Layton	1450	57	558		1507	200
Center N. Line SW. ¼ SE. ¼	do	do No. 7	883	do	1410	50	577		1460	1200
Center W. Line SW. ¼ SE. ¼	do	do No. 8	842	do	1409	62	567		1471	75
Sec. 33, T. 18 N., R. 7 E.										
NE. ¼										
SE. cor. N. ½ SE. ¼	Prairie Oil & Gas Co.	Rhoda Freeman No. 1	797	Layton	1450	30	653		1480	125
NE. cor. NE. ¼	Prairie Oil & Gas Co.	do No. 2	908	do	1419	58	511		1477	200
Center N. Line NE. ¼ NE. ¼	do	do No. 3	894	do	1419	48	525		1467	250
NW. ¼										
SE. cor. NW. ¼	C. B. Shaffer	Manolia Mikey No. 1	839	Cleveland	2000	92	1161		2092	*
SW. cor. NW. ¼	do	do No. 2	799	Layton	1356	53	557		1409	50
Center N. Line NE. ¼ NW. ¼	do	do No. 5	861	do	1375	72	514		1447	25
NE. cor. NW. ¼	do	do No. 4	850	do	1393	87	543		1480	15
Center N. Line NW. ¼	do	do No. 6	---	do	1370	67		1418	1437	30
SE. ¼										
SW. cor. S. ½ SW. ¼	T. B. Slick	Robinson Mikey No. 1	857	Layton	1394	33	537		1427	15M
NW. cor. S. ½ SW. ¼	do	do No. 2	856	do	1372	83	516		1455	75
SW. cor. N. ½ SW. ¼	C. B. Shaffer	do No. 1	---	do	1340	76			1416	500
NW. cor. N. ½ SW. ¼	do	do No. 2	809	do	1345	48	536		1393	200
NW. cor. NE. ¼ SE. ¼	Prairie Oil & Gas Co.	John Kochel No. 1	---	Stray	2063	50			2113	15M
Sec. 34, T. 18 N., R. 7 E.										
NW. cor. W. ½ NW. ¼	Prairie Oil & Gas Co.	Albert E. Barney No. 2	947	Layton	1478	69	531		1547	60
Center E. Line W. ½ W. ½	Prairie Oil & Gas Co.	do No. 1	987	Wheeler	2194	118	1207		2312	*
Sec. 35, T. 18 N., R. 7 E.										
SW. cor NW. ¼	Prairie Oil & Gas Co.	Chas. Jones No. 1	---	---					3110	dry
Sec. 1, T. 17 N., R. 6 E.										
Center S. Line	B. B. Jones et al	Joseph Harriot No. 1	---	Wheeler	2376	42		2376	2418	100
One Loc. North of No. 2	Dunn Bros.	do (?)No.3	---	do	2354	70		2354	2424	100
Cener N. Line	do	do (?)No.5	---	do	2387	15			2402	60
Sec. 2, T. 17 N., R. 6 E.										
SE. cor. NE. ¼ SW. ¼	Darby&Doolin Oil Co.	G. Minor No. 1	---	---					2611	dry
Sec. 12, T. 17 N., R. 6 E.										
One Loc. S. of No. 1	T. B. Slick	J. Arnold No. 2	---	Wheeler	2375	40		2375	2415	20
One Loc. S. of No. 2	do	do No. 3	---	do	2370	48			2418	200
One Loc. S. of No. 3	do	do No. 4	---	do	2389	35			2424	25
One Loc. S. of No. 4	do	do No. 5	---	do	2400	88			2488	100
One Loc. S. of No. 5	do	do No. 6	---	do	2400	42			2442	50
One Loc. S. of No. 1	C. B. Shaffer	Louisa Harriott No. 2	---	do	2324	6			2330	80
One Loc. S. of No. 2	do	do No. 3	---	do	2335	105			2400	135
One Loc. S. of No. 3	C. B. Shaffer	do No. 4	---	Wheeler	2363	43			2406	140
One Loc. S. of No. 4	do	do No. 5	---	do	2353	59			2412	50
One Loc. S. of No. 5	do	do No. 6	---	do	2354	88			2442	75
One Loc. S. of No. 6	do	do No. 7	---	do	2372	69		2412	2441	60

*Gas.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
One Loc. S. of No. 7	C. B. Shaffer	Louisa Harriott No. 8	---	Wheeler	2380	65	----	2416	2445	50
One Loc. S. of No. 8	do	do No. 9	922	do	2383	74	1461	2427	2457	75
One Loc. N. of No. 3	Dunn Bros.	do No. 4(?)	---	do	2387	43	----	----	2430	75
Sec. 2. T. 17 N., R. 7 E.										
SW. cor. NW. ¼	Gypsy Oil Co.	Doche Simmons No. 1	882	Bartlesville[21]	2477	93	1595	----	2570	----
Cen. W. Line SW.¼ of NW.¼	do	do No. 5	867	---	----	---	----	----	----	----
SW. cor. NW. ¼ of SW. ¼	Kathleen Oil Co.	Q. V. Jackson No. 2	976	Bartlesville	2456	150	1480	----	2606	600
SW. cor SW. ¼	do	do No. 6	918	do	2394	76	1476	----	2470	1750
NW. cor. SE. ¼ of SW. ¼	do	do No. 8	965	do	2484	92	1519	----	2576	750
SE. cor. NW. ¼ of SW. ¼	do	do No. 9	939	do	2474	21	1535	----	2494	----
SE. cor. SW. ¼	do	do No. 10	947	do	2630	54	1683	----	2684	480
NW. cor SW. ¼	do	do No. 11	951	do	2486	99	1535	2512	2585	828
NE. cor. NW. ¼ of SW. ¼	do	do No. 12	887	do	----	---	----	----	----	750
NE. cor. SE. ¼ of SW. ¼	do	do No. 13	908	do	2675	40	1767	----	2715	1100
Cen. S. Line SE. ¼ of SW. ¼	do	do No. 14	984	do	2659	59	1775	----	2718	750
Cen S. Line SW. ¼ of SW. ¼	do	do No. 16	947	do	2445	47	1498	----	2492	600
SW. cor. NE. ¼ of SW. ¼	McMann Oil Co.	Russel Thompson No. 1	919	do	2555	49	1636	----	2604	----
SE. cor. NE. ¼ of SW. ¼	do	do No. 2	885	do	2658	18	1773	----	2676	2000
SW. cor. N. ½ of SE. ¼	T. B. Slick	Bessie Carlile No. 1	880	do [22]	2626	105	1746	----	2731	----
Sec. 3, T. 17 N., R. 7 E.										
SW. cor SW. ¼ of NE. ¼	Gypsy Oil Co.	Jemima Richards No. 1	867	Bartlesville	2450	39	1583	----	2489	2200
SE. cor. SW. ¼ of NE. ¼	do	do No. 2	915	do	2552	58	1637	----	2610	1100
NW. cor. SW. ¼ of NE. ¼	do	do No. 3	849	do	2431	54	1582	----	2485	2640
NE. cor. SW. ¼ of NE. ¼	do	do No. 4	845	do	2466	---	1621	----	----	1440
SW cor. NW. ¼ of NE. ¼	Kathleen Oil Co.	do No. 1	866	do	2495	64	1629	----	2559	2300
SW. cor. SE. ¼ of NE. ¼	do	do No. 2	879	do	2451	147	1572	2459	2598	335
SE. cor. NW. ¼ of NE. ¼	do	do No. 3	861	do	2521	65	1660	----	2586	1000
NW. cor. SE. ¼ of NE. ¼	do	do No. 5	854	do	2530	72	1676	----	2602	1000
SE. cor NE. ¼	do	do No. 6	901	do	2522	45	1621	----	2567	350
Cen. E. Line SE. ¼ of NE. ¼	do	do No. 7	857	do	2510	44	----	----	2554	----
Cen. N. Line NE. ¼ of NE. ¼	do	do No. 11	868	do	2630	51	1762	----	2681	114
Cen. N. Line NE. ¼	do	do No. 12	884	do	2605	65	1721	----	2670	1000
NW. cor NE. ¼	do	do No. 14	875	do	2547	65	1672	2568	2612	1800
Cen. NE. ¼ of SE. ¼	do	Q. V. Jackson No. 18	930	do	2398	45	1468	----	2443	350
Cen. N. Line NW. ¼ of NE. ¼	do	Jemima Richards No. 13	874	do	2595	34	1721	----	2629	600
Cen. NW. ¼ of NE. ¼	do	do No. 15	878	do	2568	27	1690	----	2595	dry
Cen. S. Line NW ¼ of NW. ¼	McMann Oil Co.	Thomas Long No. 1	823	do [23]	2435	43	1612	----	2478	1680
SW. cor. NW. ¼ of NW. ¼	do	do No. 2	818	do	2425	70	1607	----	2498	1600
NW. cor. NW. ¼ of NW. ¼	do	do No. 3	828	do	2423	70	1595	----	2493	3950
SE. cor. N. ½ of NW ¼	do	do No. 4	849	do	2459	65	1610	----	2524	2700
Cen. S. Line N. ½ of NW. ¼	do	do No. 5	834	do	2448	64	1614	----	2512	1800
Cen. S. Line NE. ¼ of NW. ¼	do	do No. 6	838	do	2437	63	1599	----	2500	2500
NE. cor. NW. ¼ of NW. ¼	do	do No. 7	851	do	2468	66	1617	----	2534	1600
NE. cor. NE. ¼ of NW. ¼	do	do No. 8	855	do	2504	68	1649	----	2572	1980
SW. cor. SW. ¼ of NW. ¼	Prairie O. and G. Co.	Ella Jones No. 14	881	do	2490	53	1609	----	2543	900
Cen. S. Line SW. ¼ of NW. ¼	do	do No. 15	907	do	2511	37	1604	----	2548	2000
Cen. S. Line NW. ¼	do	do No. 16	912	do	2523	52	1611	----	2575	1000
Cen. S. Line SE. ¼ of NW. ¼	do	do No. 17	832	do	2436	47	1604	----	2483	1300

[21]Oil and gas at 2,477 feet to 2,488 feet. [22]Some oil at 2,626 feet to 2,646 feet. [23]Twenty million cubic feet gas in Wheeler sand.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SE. cor. NW. ¼	Prairie O. and G. Co.	Ella Jones No. 18	850	Bartlesville	2432	38	1582		2470	2000
NW. cor. SW. ¼ of NW. ¼	do	do No. 19	868	do	2446	38	1578		2484	2400
Cen. N. Line SW. ¼ of NW. ¼	do	Ella Jones No. 20	862	do[24]	2458	52	1596		2510	
NE. cor. SW. ¼ of NW. ¼	do	do No. 21	838	Squirrel[25]	2280	34	1442	2300	2438	1400
Cen. N. Line SE. ¼ of NW. ¼	do	do No. 22	834	Bartlesville	2432	50	1598		2482	1350
NE. cor. SE. ¼ of NW. ¼	do	do No. 23	843	do	2452	35	1609		2487	1100
SW. cor. SE. ¼ of SW. ¼	do	C. B. Shaffer No. 1	892	do	2645	2	1753		2647	700
NW. cor. SE. ¼ of SW. ¼	do	do No. 2	874	do	2535	60	1661		2595	2180
NE. cor. SE. ¼ of SW. ¼	do	do No. 3	971	do	2536	36	1565		2572	1700
SE. cor. SE. ¼ of SW. ¼	do	do No. 4	941	do	2600		1659			
SW. cor. SW. ¼ of SW. ¼	do	T. B. Slick No. 1	892	Wheeler[26]	2204		1312			560
NW. cor. SW. ¼ of SW. ¼	do	do No. 2	913	Bartlesville	2665	55	1751		2720	1025
SE. cor. SW. ¼ of SW. ¼	do	do No. 3	872	do	2635	50	1763		2685	2700
NE. cor. SW. ¼ of SW. ¼	do	do No. 4	868	do	2579	41	1651		2620	1600
Cen. N. Line SW. ¼ of SW. ¼	do	do No. 5	886	do	2631	51	1745		2682	1750
SW. cor. SW. ¼ of SW. ¼	do	do No. 6	901	do	2645	40	1744		2685	560
SW. cor. W. ½ of SE. ¼	do	Dan Tucker No. 8	955	do	2571	64	1616		2635	700
NW. cor. SW. ¼ of SE. ¼	do	do No. 9	974	do	2569	52	1595		2621	1200
NW. cor. W. ½ of SE. ¼	do	do No. 11	844	do	2420	55	1576		2475	1100
NE. cor. W. ½ of SE. ¼	do	do No. 12	884	Tucker	2534	31	1650		2565	540
SE. cor. NW. ¼ of SE. ¼	do	do No. 13	861	?[27]	2275	111	1414		2386	1000
NE. cor. SW. ¼ of SE. ¼	do	do No. 14	864	Bartlesville	2337	46	1473		2383	450
SE. cor. SW. ¼ of SE. ¼	do	do No. 15	924	do	2392	48	1468		2440	800
Cen. S. Line N. ½ of SW. ¼	Producers Oil Co.	Anna L. McIntosh No. 2	877	do	2590	63	1713		2653	3000
Cen. S. Line NW. ¼ of SW. ¼	do	do No. 3	890	do	2534	73	1644		2607	750
NW. cor. NW. ¼ of SW. ¼	do	do No. 4	881	do	2513	38	1632	2553	2566	2400
Cen. S. Line NE. ¼ of SW. ¼	do	do No. 5	864	do	2497	52	1633	2497	2552	2000
Cen. N. Line NW. ¼ of SW. ¼	do	do No. 6	898	do	2535	45	1637		2580	2400
Cen. N. Line N. ½ of SW. ¼	do	do No. 7	892	do	2530	50	1638	2521	2571	3120
Cen. E. Line W. ½ of SW. ¼	do	do No. 8	904	do	2475	145	1571	2580	2620	1900
Cen. N. Line NE. ¼ of SW. ¼	do	do No. 11	847	do[28]	2543		1696			
NE. cor. NE. ¼ of SW. ¼	do	do No. 12	852	do	2445	6	1593		2451	
SE. cor. NE. ¼ of SW. ¼	do	do No. 13	935	do	2482	54	1547		2536	2640
Cen. E. ½ NE. ¼ of SW. ¼	do	do No. 14	875	do	2470	60	1595		2530	2400
Sec. 4, T. 17 N., R. 7 E.										
SE. cor. SE. ¼	Gunsberg & Forman	Jemima Richards No. 1	950	Bartlesville[29]	2696	29	1746		2779	528
NE. cor. SE. ¼ of SE. ¼	do	do No. 2	893	do[30]	2637	30	1744		2667	480
SE. cor. NE. ¼ of SE. ¼	do	do No. 3	881	do	2612	65	1731		2677	2400
NE. cor. SE. ¼	do	do No. 4	888	do[31]	2510	65	1622		2575	2900
NW. cor. SE. ¼ of SE. ¼	do	do No. 5	883	do	2626	65	1743		2691	1440
SW. cor. SE. ¼ of SE. ¼	do	do No. 6	891	do	2626	68	1735		2694	1200
NW. cor. NE. ¼ of SE. ¼	do	do No. 7	857	do	2510	65	1653		2575	1200
NE. cor. NW. ¼ of SE. ¼	do	do No. 8	854	do	2534	65	1680		2599	2360
SE. cor. NW. ¼ of SE. ¼	do	do No. 9	845	do	2591	66	1746		2657	1500
NW. cor. SE. ¼	do	do No. 10	873	do	2598	61	1725		2659	4000

[24]Oil at 2,300 feet to 2,330 feet. [25]Very hard sand at 2,438 feet, probably Bartlesville. [26]Initial production in Wheeler 560 barrels. Drilled to Bartlesville later. [27]Initial production 1,000 barrels at 2,293 feet to 2,308 feet. [28]Forty million cubic feet gas at 2,543 feet. [29]Production at 2,696 feet to 2,725 feet. [30]Production at 2,639 feet to 2,667 feet. [31]Four million cubic feet gas at 2,145 feet.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SW. cor. NW. ¼ of SE. ¼	Gunsberg & Forman	Jemima Richards No. 11	874	Bartlesville	2612	66	1738	----	2678	2500
SW. cor. NE. ¼ of SE. ¼	---do	---do No. 12	871	---do	2811	66	1940	----	2877	600
Cen. NE. ¼ of SE. ¼	---do	---do No. 13	878	---do	2538	65	1660	----	2603	2000
Cen. SE. ¼ of SE. ¼	---do	---do No. 15	---	---do	2600	65	----	----	2665	1200
NW. cor. NW. ¼ of NW. ¼	Gypsy Oil Co.	Yarna Richards No. 1	875	---do	2518	92	1643	----	2610	300
NE. cor. NW. ¼ of NW. ¼	---do	---do No. 2	833	---do	2470	72	1637	2530	2542	3648
SW. cor. NW. ¼ of NW. ¼	---do	---do No. 3	915	---do	2572	70	1657	----	2642	1632
SE. cor. NW. ¼ of NW. ¼	---do	---do No. 4	878	---do	2490	65	1612	2506	2555	1520
SW. cor. SW. ¼ of NW. ¼	Prairie O. & G. Co.	B. B. Jones No. 2	935	---do	2420	55	1485	----	2475	500
NW. cor. SW. ¼ of NW. ¼	---do	---do No. 1	915	---do	2579	60	1664	----	2639	----
SE. cor. SW. ¼ of NW. ¼	---do	---do No. 4	935	---do	2650	40	1715	----	2690	120
NE. cor. SW. ¼ of NW. ¼	---do	---do No. 5	887	---do	2526	92	1639	----	2618	1600
NE. cor SE. ¼ of NW. ¼	---do	Yarna Ricards No. 4	876	---do	2520	42	1644	----	2562	952
SW. cor. SE. ¼ of NW. ¼	---do	---do No. 6	880	---do	2580	39	1700	----	2619	----
NW. cor. SE. ¼ of NW. ¼	---do	---do No. 7	874	---do	2487	65	1613	----	2552	----
SW. cor. NE. ¼ of NW. ¼	---do	---do No. 8	865	---do	2534	64	1669	----	2598	700
NW. cor. NE. ¼	Quaker O. & G. Co.	Jeanetta Richards No. 1	812	---do	2475	62	1663	2485	2550	1440
SW. cor. NE. ¼	---do	---do No. 2	875	---do	2559	65	1684	2624	2624	4000
SE. cor. NE. ¼	---do	---do No. 3	859	Wheeler[32]	2045	125	1186	----	2170	----
SW. cor. SE. ¼ of NE. ¼	---do	---do No. 4	847	Bartlesville	2482	65	1635	2482	2547	2400
SE. cor. SW. ¼ of NE. ¼	---do	---do No. 5	853	---do	2522	64	1663	2522	2586	1806
NE. cor. SE. ¼ of NE. ¼	---do	---do No. 6	878	---do	?	---	----	----	2454	250
SE. cor. SE. ¼ of NE. ¼	---do	---do No. 7	855	---do	2465	65	1610	2455	2530	1950
SE. cor. NE. ¼ of NE. ¼	---do	---do No. 9	856	---do	?	---	----	----	2450	----
NE. cor. NE. ¼ of NE. ¼	---do	---do No. 9	824	---do	2400	9	1576	----	2409	----
NW. cor. NE. ¼ of NE. ¼	---do	---do No. 10	820	---do	2420	65	1600	----	2485	2784
NE. cor. NW. ¼ of NE. ¼	---do	---do No. 11	820	---do	?	---	----	----	2400	----
NW. cor. S. ½ NW. ¼ of NE. ¼	---do	---do No. 12	883	---do	?	---	----	----	2472	----
NW. cor. SW. ¼ of NE. ¼	---do	---do No. 13	890	---do	2505	73	1615	----	2578	1200
Cen. SE. ¼ of NE. ¼	---do	---do No. 14	845	---do	2455	72	1610	2500	2527	960
NW. cor. SE. ¼ of NE. ¼	---do	---do No. 15	832	---do	?	---	----	----	2423	----
Cen. NE. ¼ of NE. ¼	---do	---do No. 16	---	---do	2475	73	----	----	2548	720
Cen. NW. ¼ of NE. ¼	---do	---do No. 17	---	---do	2442	75	----	----	2517	480
Sec. 5, T. 17 N., R. 7 E.										
NW. cor. NE. ¼ of SE. ¼	Cushing G. & P. Co.	Jackson Burnett No. 16	890	Bartlesville	2566	81	1670	----	2647	----
SE. cor. W. ½ of NE. ¼	Gunsberg & Forman	Eastman Richards No. 15	853	---do	2587	77	1734	----	2664	900
NE. cor. E. ½ of NE. ¼	Gypsy Oil Co.	---do No. 3	882	---do	2550	72	1668	----	2622	3600
SE. cor. NE. ¼	---do	---do No. 10	869	---do	2560	59	1691	----	2619	4032
NE. cor. SE. ¼ of NE. ¼	---do	---do No. 11	904	---do	(?)	---	1667	----	----	----
SE. cor. NE. ¼ of NE. ¼	---do	---do No. 12	914	---do	2565	---	1651	----	----	5184
Cen. E. Line SE. ¼	---do	Jackson Barnett No. 12	834	---do	2608	79	1774	----	2687	1689
Cen. E. Line SE. ¼ of SE. ¼	---do	---do No. 13	895	---do [33]	2588	75	1693	----	2663	----
Cen. E. Line SE. ¼ of SW. ¼	Prairie O. & G. Co.	Ella Jones No. 5	---	---do	2599	91	----	----	2860	----
Cen. W. Line NW. ¼ of SW. ¼	---do	---do No. 11	---	Wheeler	2216	50	----	2216	2266	500
Sec. 8, T. 17 N., R. 7 E.										
SW. cor. NE. ¼	Devonian Oil Co.	Maley Yarhola No. 13	835	Bartlesville	2534	41	1699	----	2575	----
SE. cor. NE. ¼	---do	---do No. 14	906	---do	2572	72	1666	----	2644	----

[32] Twenty-five million cubic feet gas at 2,045 feet to 2,135 feet. [33] Oil at 2,588 feet to 2,665 feet.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
SE. cor. SW. ¼ of NE. ¼	Devonian Oil Co.	Maley Yarhola No. 15	847	Bartlesville	2538	12	1691	----	2550	----
Cen. S. Line SE. ¼ of NE. ¼	---do	---do No. 16	868	---do	2538	72	1670	----	2610	----
NE. cor. NE. ¼	---do	---do No. 17	921	---do	2588	80	1667	2600	2668	----
NE. cor. SE. ¼ of NE. ¼	---do	---do No. 18	891	---do	2565	---	1674	----	----	----
NW. cor. S. ½ of SE. ¼	Greis Oil Co.	Lessey Yarhola No. 1	---	---do	2590	50	----	----	2640	230
SW. cor. S. ½ of SE. ¼	---do	---do No. 2	---	---do	2645	52	----	----	2697	150
NE. cor. SW. ¼ of SE. ¼	---do	---do No. 3	847	---do	2575	67	1728	----	2652	740
NE. cor. SE. ¼ of SE. ¼	---do	---do No. 4	885	---do	2590	82	1705	----	2672	720
SE. cor. SE. ¼ of SE. ¼	---do	---do No. 5	861	---do	2563	80	1702	----	2643	500
Cen. N. Line SE. ¼ of SE. ¼	---do	---do No. 6	889	---do	2605	73	1816	----	2678	600
NW. cor. SE. ¼ of SE. ¼	---do	---do No. 7	885	---do	2603	68	1818	----	2671	700
Cen. S. Line SE. ¼ of SE. ¼	---do	---do No. 8	854	---do	2565	77	1711	----	2642	400
Cen. S. Line S. ½ of SE. ¼	---do	---do No. 9	846	---do	2566	37	1720	----	2603	800
Cen. S. Line SW. ¼ of SE. ¼	---do	---do No. 10	835	---do	2569	75	1734	----	2644	250
Cen. N. Line NW. ¼ of SE. ¼	Oil Production Co.	---do No. 3	846	---do	2549	61	1703	----	2610	700
Cen. NW. ¼ of SE. ¼	---do	---do No. 5	946	---do	2587	65	1741	----	2652	700
SE. cor. NE. ¼ of SE. ¼	---do	---do No. 9	889	---do	2600	68	1711	----	2668	1500
Cen. N. Line SE. ¼	---do	---do No. 10	854	---do	2547	70	1693	----	2617	500
Cen. E. Line NE. ¼ of SE. ¼	---do	---do No. 12	929	---do	2628	63	1699	----	2691	1500
Cen. S. Line N. ½ of SE. ¼	---do	---do No. 15	871	---do	2591	54	1720	2599	2645	500
NE. cor. SW. ¼ of NW. ¼	Prairie O. & G. Co.	Nancy Yarhola No. 13	---	---do	2584	40	----	----	2624	190
SE. cor. SW. ¼	Waters-Pierce Oil Co.	Laura Hutton No. 5	---	---do	2686	26	----	----	2712	200
NE. cor. SE. ¼ of SW. ¼	---do	---do No. 9	---	---do	2630	42	----	----	2672	----
NW. cor. NE. ¼ of SW. ¼	---do	---do No. 17	---	---do	2556	128	----	----	2684	96
Cen. W. ½ NE. ¼ of SW. ¼	---do	---do No. 18	---	---do	2735	6	----	----	2741	----
NE. cor. NE. ¼ of SW. ¼	---do	---do No. 20	---	---do	2604	29	----	----	2633	75
Cen. SE. ¼ of NE. ¼ of SW. ¼	---do	---do No. 22	882	---do	2648	33	1766	----	2681	----
Sec. 9, T. 17 N., R. 7 E.										
NE. cor. NW. ¼	Devonian Oil Co.	Linda Yarhola No. 1	919	Bartlesville	2639	54	1720	----	2693	1250
SE. cor. NE. ¼ of NW. ¼	---do	---do No. 2	922	---do	2629	42	1707	2641	2671	----
NE. cor. NW. ¼ of NW. ¼	---do	---do No. 4	1011	---do	2716	70	1705	----	2786	----
NE. cor. SE. ¼ of NW. ¼	---do	---do No. 5	931	---do	2630	70	1699	2630	2700	----
SE. cor. NW. ¼	---do	---do No. 6	934	---do	2630	83	1696	----	2713	----
NW. cor. NW. ¼	---do	---do No. 7	912	---do	2587	---	1675	----	----	----
SW. cor. NW. ¼	---do	---do No. 8	927	---do	2627	52	1700	2667	2679	----
SE. cor. SW. ¼ of NW. ¼	Devonian Oil Co.	---do No. 9	955	---do	2667	---	1712	----	----	----
SW. cor. SE. ¼ of NW. ¼	---do	---do No. 10	997	---do [34]	2708	---	1711	----	----	----
SW. cor. NE. ¼ of NW. ¼	---do	---do No. 11	940	---do	2671	---	1731	----	----	----
SE. cor. NW. ¼ of NW. ¼	---do	---do No 12	939	---do	2641	---	1702	----	----	----
NE. cor. NE. ¼	Elwood Oil Co.	Lizzie Brown No 2	951	---do	2699	50	1748	----	2749	----
Cen. E. Line NE. ¼ of NE. ¼	---do	---do No. 3	914	---do	2649	---	1735	----	----	----
NW. cor. SE. ¼ of NE. ¼	---do	---do No. 6	923	---do	2562	38	1639	----	2600	----
NE. cor. SE. ¼ of NE. ¼	---do	---do No. 7	897	---do	2623	40	1726	----	2663	----
SW. cor. SE. ¼ of NE. ¼	---do	---do No. 10	915	---do	2617	40	1702	----	2657	----
SE. cor. NW. ¼ of NE. ¼	---do	---do No 11	893	---do	2588	50	1695	----	2638	----
NE. cor. SW. ¼	Gunsberg & Forman	Katie Brown No. 1	958	---do	2677	67	1719	----	2744	1800
NW. cor. NE. ¼ of SW. ¼	---do	---do No 2	937	---do	2619	78	1682	----	2697	2000
SE. cor. NE. ¼ of SW. ¼	---do	---do No. 3	903	---do	2675	54	1772	----	2729	1200

[34] Gas at 2,241 feet in Wheeler sand.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
NW. cor. NE. ¼ of SE. ¼	McMann Oil Co.	Mose Wiley No. 2	940	---do	2650	65	1710	----	2715	1100
NE. cor. NW. ¼ of SE. ¼	---do	---do No. 3	957	---do	2670	72	1713	2682	2742	1200
NW. cor. NW. ¼ of SE. ¼	---do	---do No. 4	963	---do	2678	78	1715	2690	2756	1300
SW. cor. SE. ¼ of SE. ¼	---do	---do No. 5	968	---do	2666	67	1698	2675	2733	800
SW. cor. NW. ¼ of SE. ¼	---do	---do No. 6	923	---do	2660	68	1737	----	2728	1000
NW. cor. SW. ¼ of SE. ¼	---do	---do No. 7	---	---do	2654	72	----	----	2726	1900
SW. cor. SW. ¼	Producers Oil Co.	Katy Brown No. 1	870	---do [35]	2566	56	1696	----	2622	----
NW. cor. S. ½ of SW. ¼	---do	---do No. 2	916	---do	2631	62	1715	----	2693	1100
Cen. S. Line SW. ¼ of SW. ¼	---do	---do No. 5	873	---do	2558	90	1685	2586	2648	2800
Cen. E. Line SE. ¼	Southwestern-McMann	Mose Wiley No. 2	931	---do	2644	66	1713	----	2710	1000
One location S. No. 2	---do	---do No. 3	945	---do	2683	69	1738	----	2752	1050
One loction N. No. 2	---do	---do No. 4	925	---do	2647	68	1722	----	2715	----
Sec. 10, T. 17 N., R. 7 E.										
SW. cor. NE. ¼	Cortez Oil Co.	Sandy Fox No. 1	1000	Bartlesville [36]	2691	22	----	----	2850	dry
NW. cor. NE. ¼	---do	---do No. 2	999	---do	2692	53	1693	----	2745	400
NW. cor. NE. ¼ of NE. ¼	---do	---do No. 3	902	---do	2383	42	1481	----	2425	----
NE. cor. NW. ¼ of NE. ¼	---do	---do No. 4	975.5	---do	2462	56	1486	2512	2518	1000
NE. cor. NE. ¼	---do	---do No. 5	898	---do	2399	---	1501	2450	2464	1800
Cen. E. Line NE. ¼ of NE. ¼	---do	---do No. 8	906	---do	2413	---	1507	----	----	----
NW. cor. NW. ¼	B. B. Jones	Eliza Lowe No. 1	931	---do	2685	65	1754	----	2750	450
Cen. W. Line NW. ¼ of NW. ¼	---do	---do No. 2	942	---do	2684	58	1742	----	2782	650
One location E. No. 1	---do	---do No. 3	938	---do	2676	54	1738	----	2740	600
SW. cor. NW. ¼ of NW. ¼	---do	---do No. 4	883	---do	2683	58	1800	----	2741	----
Cen. W. Line SW. ¼ of NW. ¼	---do	---do No. 5	900	---do	2663	73	1763	----	2736	800
SW. cor. SW. ¼ of NW. ¼	---do	---do No. 6	914	---do	2655	59	1741	----	2714	800
NW. cor. NW. ¼ of SW. ¼	---do	---do No. 8	901	---do	2660	53	1759	----	2713	----
SW. cor. NW. ¼ of SW. ¼	---do	---do No. 9	933	---do	2662	50	1729	----	2712	----
SE. cor. NW. ¼	Prairie O. & G. Co.	Dan Tucker No. 1	---	---do	2304	48	----	----	2352	15
NW. cor. E. ½ NW. ¼	---do	---do No. 2	893	---do	2663	49	1770	----	2715	2600
SW. cor. NE. ¼ of NW. ¼	---do	---do No. 3	901	---do	2670	39	1769	----	2722	1750
NW. cor. SE. ¼ of NW. ¼	---do	---do No. 4	925	---do	2695	---	1770	----	----	----
Cen. W. Line SE. ¼ of NW. ¼	---do	---do No. 5	927	---do	2709	---	1782	----	----	----
NE. cor. E. ½ of NW. ¼	---do	---do No. 7	936	---do	2621	---	1685	----	----	----
Cen. E. Line NW. ¼ of NW. ¼	T. B. Slick	Eliza Lowe No. 2	958	---do	2661	70	1703	----	2731	1800
SE. cor. NW. ¼ of NW. ¼	---do	---do No. 3	894	---do	2670	57	1776	2700	2727	1912
NE. cor. NW. ¼ of NW. ¼	---do	---do No. 4	---	---do	2650	56	----	2651	2786	2160
Cen. E. Line SW. ¼ of NW. ¼	---do	---do No. 5	904	---do	2675	25	1771	----	2700	800
SE. cor. NW. ¼ of SW. ¼	---do	---do No. 7	915	---do	2678	46	1763	2683	2724	----
NE. cor. NW. ¼ of SW. ¼	---do	---do No. 8	927	---do	2698	53	1771	2730	2751	----
SE. cor. NW. ¼ of SW. ¼	---do	---do No. 10	961	---do	2756	48	1795	----	2804	----
Sec. 16, T. 17 N., R. 7 E.										
NW. cor. NW. ¼	Only Oil Co.	Jeannetta Tiger No. 1	880	Bartlesville	2573	76	1693	----	2649	750
SW. cor. NW. ¼	---do	---do No. 2	896	---do	2654	56	1758	----	2710	300
SE. cor. SW. ¼	Prarie O. & G. Co.	Cogee West No. 3	---	---do	2702	2	----	----	2704	500
NE. cor. W. ½ of NE. ¼	Producers Oil Co.	Mary Gooden No. 1	975	---do	2647	66	1672	2657	2713	600
NW. cor. NE. ¼	---do	---do No. 2	940	---do [37]	2614	71	1674	----	2685	----

[35] Fifty million feet gas at 2,125 feet to 2,206 feet. [36] Production of 50 barrels in Wheeler, but only a showing in Bartlesville at 2,850 feet. [37] Twenty million cubic feet gas at 2,614 feet.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Sec. 17, T. 17 N., R. 7 E.										
Cen. N. Line NE. ¼ of NE. ¼	Only Oil Co.	Jessie Tiger No. 5	879	Bartlesville	2595	72	1716	----	2667	400
Cen. N. Line NE. ¼	---do	---do No. 6	855	---do	2575	60	1720	----	2635	300
Cen. N. Line SW. ¼ of NE. ¼	---do	---do No. 7	837	---do	2577	52	1740	----	2629	100
Sec. 21, T. 17 N., R. 7 E.										
SE. cor. NE. ¼	Prairie O. & G. Co.	R. S. Litchfield No. 1	---	Bartlesville[38]	2735	45	----	----	2915	1560
Cen. W. Line NE. ¼	---do	---do No. 2	---	---do	2242	44	----	----	2786	----
SE. cor. NE. ¼ of NW. ¼	---do	---do No. 20	---	---do	2752	38	----	----	2790	300
NE. cor. SE. ¼ of NW. ¼	---do	---do No. 1	---	---	2718	74	----	2786	2792	----
Sec. 22, T. 17 N., R. 7 E.										
SW. cor. E. ½ NW. ¼	Gypsy Oil Co.	Lena Fife No. 1	---	Bartlesville	2730	56	----	----	2786	6000
NW. cor. NE. ¼ of SW. ¼	Hill Oil & Gas Co.	Thomas Cain No. 1	---	---do	2759	52	----	----	2801	----
Sec. 28, T. 17 N., R. 7 E.										
Cen. E. Line NE. ¼	Kathleen Oil Co.	S. Keys No. 3	---	Skinner	2385	55	----	----	2440	dry
Cen. W. Line NE. ¼	---do	---do No. 1	970	Bartlesville	2435	10	1465	----	2445	30
Sec. 33, T. 17 N., R. 7 E.										
NE. cor. NW. ¼ of NW. ¼	Gunsberg & Forman	Francis Brown No. 1	---	--- (?)	----	---	----	----	2732	dry
Sec. 7, T. 18 N., R. 7 E.										
NE. cor. SE. ¼	C. B. Shaffer	B. Wilson No. 9	808	Bartlesville	2360	118	1552	----	2478	1800
SE. cor. SW. ¼ of SE. ¼	---do	---do No. 5	776	---do	2324	124	1548	2432	2448	----
SW. cor. SE. ¼ of SE. ¼	Twin State Oil Co.	Vida M. Way No. 1	752	---do	2312	64	1560	----	2376	----
Sec. 8, T. 18 N., R. 7 E.										
NW. cor. SE. ¼	J. H. Markham Jr.	Eliza Yarhola No. 11	757	Skinner	2160	60	1403	----	2220	----
NE. cor. SW. ¼ of NE. ¼	McMann Oil Co.	S. S. Mussellam No. 8	---	Bartlesville	2400	31	----	2431	----	4000
NE. cor. SW. ¼	Silurian Oil Co.	Amy No. 2	753	---do	2304	54	1551	----	2358	----
NW. cor. SW. ¼	---do	---do No. 3	814	---do	2379	---	1565	----	----	----
Sec. 10, T. 18 N., R. 7 E.										
SE. cor. SE. ¼ of SW. ¼	B. B. Jones	Oleson No. 1	---	Bartlesville[39]	2720	20	----	----	3097	dry
Sec. 12, T. 18 N., R. 7 E.										
SW. cor. N. ½ of SE. ¼	B. B. Jones	Reuben Morse No. 1	---	Tucker	2910	42	----	----	2952	----
Sec. 13, T. 18 N., R. 7 E.										
NW. cor. NE. ¼	Prairie O. & G. Co.	Diana Morrison No. 1	---	Bartlesville	2697	66	----	----	2763	dry
Sec. 16, T. 18 N., R. 7 E.										
NW. cor. NW. ¼	McMann Oil Co.	Emma Coker No. 1	840	Bartlesville	2390	87	1550	2460	2477	2400
Sec. 18, T. 18 N., R. 7 E.										
Cen. E. Line NE. ¼ of NW. ¼	C. B. Shaffer	G. W. Fisher No. 5	---	Bartlesville	2295	110	----	2397	2405	7500
SE. cor. NE. ¼	---do	---do No. 1	---	---do	2320	136	----	----	2456	----
SW. cor. NW. ¼ of SE. ¼	---do	B. Wilson No. 1	849	Bartlesville	2500	50	1651	----	2550	140
Sec. 19, T. 18 N., R. 7 E.										
Cen. E. Line NE. ¼ of NE. ¼	C. B. Shaffer	Jos. Abraham No. 1	844	Bartlesville	2559	20	1715	----	2579	530
Sec. 20, T. 18 N., R. 7 E.										
NE. cor. W. ½ of SW. ¼	Gunsberg & Forman	Johnson Wocoche No 4	785	Bartlesville	2595	35	1810	----	2630	----
Sec. 22, T. 18 N., R. 7 E.										
NW. cor. NE. ¼	J. W. Wrightsman	David Holen No. 3	---	---	2778	6	----	----	3027	----
Sec. 25, T. 18 N., R. 7 E.										
NW. cor. SW. ¼	B. B. Jones	Polly Stidham No. 1	---	Tucker	3035	25	----	----	3060	dry
Sec. 29, T. 18 N., R. 7 E.										
NE. cor. SE. ¼	C. B. Shaffer	E. Wocoche No. 6	---	Bartlesville	2668	83	----	2690	2751	----

[38]Twenty million cubic feet gas in Wheeler sand. [39]Struck Mississippi lime (?) at 3,097 feet.

Location.	Name of oil company.	Number and name of well.	Surface elevation.	Sand.				Oil depth—feet.	Total depth—feet.	Initial production—barrels.
				Name.	Depth to top—feet.	Thickness penetrated—feet.	Altitude below sea level—feet			
Sec. 32, T. 18 N., R. 7 E.										
NW. cor. SW. ¼ of NE. ¼	C. B. Shaffer	Geo. Jones No. 10	---	Bartlesville	2579	6	----	----	3000	----
Sec. 33, T. 18 N., R. 7 E.										
SE. cor. SE. ¼ of SE. ¼	Gypsy Oil Co.	Jno. Kochel No. 1	825	Bartlesville	2383	85	1558	2396	2468	----
SW. cor. SE. ¼ of SE. ¼	---do	---do No. 2	819	---do	2360	135	1541	----	2495	----
NE. cor. SE. ¼ of SE. ¼	---do	---do No. 4	847	---do	2391	92	1544	2461	2483	----
SW. cor. NE. ¼ of SE. ¼	Prairie O. & G. Co.	---do No. 2	844	---do	2403	64	1559	----	2467	----
SE. cor. NE. ¼ of SE. ¼	---do	---do No. 3	852	---do	2424	105	1582	----	2539	----
SW. cor. NW. ¼ of SE. ¼	---do	Armanda Curry No. 1	841	Tucker[40]	2566	33	1725	----	2599	190
SW. cor. NE. ¼ of SE. ¼	---do	---do No. 2	827	---do [41]	2540	31	1713	----	2591	220
SE. cor. NW. ¼	C. B. Shaffer	Magnolia Mikey No. 10	836	Bartlesville	2560	79	1714	----	2639	----
NW. cor. NW. ¼	---do	---do No. 11	---	---do	2665	76	----	----	2757	----
SE. cor. NW. ¼	---do	---do No. 12	827	---do	2571	44	1744	----	2615	----
Cen. S. Line E. ½ of NW. ¼	---do	---do No. 13	819	---do	2578	20	1759	----	2598	15
SE. cor. NW. ¼ of SW. ¼	---do	R. Mikey No. 3	---	---do	2560	55	----	----	2615	dry
NE. cor. S. ½ NW. ¼ of SW. ¼	---do	---do No. 4	800	---do	2545	55	1745	----	2600	140
SW. cor. SE. ¼ of SW. ¼	---do	---do No. 5	814	Bartlesville	2570	15	1756	2573	2585	----
SW. cor. SW. ¼	T. B. Slick	---do No. 1	869	---do	2518	63	1649	2560	2681	----
NW. cor. SW. ¼ of SW. ¼	---do	---do No. 2	854	---do	2636	74	1782	----	2712	dry
SE. cor. SW. ¼ of SW. ¼	---do	---do No. 4	817	---do	2467	97	1650	2502	2564	----
SW. cor. SE. ¼ of SW. ¼	---do	---do No. 5	814	---do	2427	75	1613	2447	2502	888
SE. cor. SW. ¼	---do	---do No. 6	834	---do	2385	85	1550	2580	2580	----
SE. cor. NE. ¼ of SW. ¼	---do	---do No. 8	822	---do	2552	46	1730	2585	2598	----
NE. cor. SW. ¼	---do	---do No. 9	841	---do	2550	113	1709	----	2663	----
NW. cor. NE. ¼ of SW. ¼	---do	---do No. 10	803	---do	2551	41	1748	----	2592	----
SW. cor. NE. ¼ of SW. ¼	---do	---do No. 11	804	---do	2490	14	1686	----	2504	5520
Cen. NE. ¼ of SW. ¼	---do	---do No. 14	805	---do	2561	51	1756	----	2612	----
One location W. No. 9	---do	---do No. 15	828	---do	2561	39	1733	----	2600	----
One loction S. No. 10	---do	---do No. 17	802	---do	2524	58	1722	----	2582	----
Cen. N. Line NE. ¼ of SW. ¼	---do	---do No. 16	---	---do	2572	32	----	----	2604	----
Sec. 34, T. 18 N., R. 7 E.										
SW. cor. SE. ¼	Prairie O. & G. Co.	Winey Shwinogee No. 1	867	Bartlesville	2571	49	1704	----	2620	544
SE. cor. SW. ¼	---do	Kizzie Hutkey No. 2	870	---do	2540	74	1670	----	2614	1150
SW. cor. E. ½ of SW. ¼	---do	---do No. 1	874	---do	2513	70	1639	----	2583	650
Cen. N. Line W. ½ of NW. ¼	---do	Albert Barney No. 3	---	Wheeler	2275	64	----	----	2339	----
Cen. W. Line NW. ¼ of NW. ¼	---do	---do No. 4	---	Bartlesville	2670	120	----	----	2790	dry
SW. cor. SW. ¼	---do	---do No. 5	837	---do	2395	76	1558	----	2471	190
SE. cor. SW. ¼ of SW. ¼	---do	---do No. 6	863	---do	2477	70	1614	----	2547	600
NW. cor. SW. ¼ of SW. ¼	---do	---do No. 7	840	---do	2455	74	1615	----	2529	520
Sec. 35, T. 18 N., R. 7 E.										
SW. cor. SE. ¼	Gunsberg & Forman	Wm. Jones No. 1	---	Bartlesville	2845	15	----	----	2860	dry
SW. cor. NW. ¼	Prairie O. & G. Co.	Charley Jones No. 1	---	---do [42]	2800	60	----	----	3010	dry
Sec. 32, T. 19 N., R. 7 E.										
SW. cor SE. ¼	Gunsberg & Forman	Raymond-Offutt No. 1	---	Bartlesville[43]	2655	35	----	----	2693	----
SE. cor. SW. ¼	McMann Oil Co.	Ester Richards	---	---do	2599	38	----	----	2637	150

[40]Initial production in Bartlesville 25 barrels; in Tucker 190 barrels. [41]Initial production in Bartlesville 20 barrels; in Tucker 220 barrels. [42]Struck Mississippi lime (?) at 3,010. [43]Pumped 360 barrels first 24 hours.