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SUBSURFACE GEOLOGY AND OIL AND GAS RESOURCES OF OSAGE COUNTY, OKLAHOMA

PART 5. Townships 26 and 27 North Ranges 10 and 11 East

BY

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FOREWORD

This report on the subsurface geology of Osage County, Okla., describes the structural features, the character of the oil- and gas-producing beds, and the localities where additional oil and gas may be found. It embodies a part of the results of a subsurface geologic investigation of the Osage Indian Reservation, which coincides in area with Osage County. The investigation was conducted by a field party of the Geological Survey of the United States Department of the Interior in 1934 to 1937 and involved the study of the records of about 17,000 wells that have been drilled in Osage County. Funds for the investigation were allotted to the Geological Survey by the Public Works Administration. The primary purpose of the examination was to obtain geologic data for use in the administration of the Indian lands. The results of the inquiry have shown that many localities in Osage County outside the present producing oil fields are worthy of prospecting for oil and gas and that additional oil and gas can be found also by exploring deeply buried beds in old producing fields.

All townships in Osage County that contain many wells are described; the information furnished by such townships is ample for drawing detailed subsurface structure-contour maps. The descriptions of several contiguous townships are combined in separate reports, which are issued as parts of a single bulletin. No edition of the consolidated volume will be published, but the several parts can be bound together if desired.

The subsurface investigation of Osage County was carried on mainly by L. E. Kennedy, W. R. Dillard, H. B. Goodrich, Charles T. Kirk, J. D. McClure, Otto Leatherock, Constance Leatherock, W. E. Shamblin, J. N. Conley, H. D. Jenkins, J. H. Hengst, G. D. Gibson, and N. W. Bass, geologists. The work of each geologist contributed more or less to the results of the investigation in each township. However, the investigations of the individual townships in Osage County were made mainly by various individuals of the group, and their names appear in the township descriptions. In addition to those whose names appear above, valuable assistance in the compilation of information was given by Lucile Linton, S. B. Thomas, R. C. Beckstrom, B. A. Lilienborg, J. G. Dwen, K. H. Johnson, J. G. Beaulieu, C. R. Viers, E. L. Hitt, Grace Clark, R. A. Payne, and J. C. Rollins.

Oil companies and individuals who contributed information are too numerous to acknowledge all by name. Special mention is made, however, of Laughlin-Simmons & Co. and the Indian Territory Illuminating Oil Co. for supplying most of the well elevations used in Osage County; of the Continental Oil Co., Tidal Oil Co., Sinclair Prairie Oil Co., Indian Territory Illuminating Oil Co., Philips Petroleum Co., W. C. McBride, Inc., The Carter Oil Co., and others for supplying well logs, maps, cuttings, and cores of the producing sands in Osage ounty.

H. D. Miser, geologist in charge of the section of geology of fuels, supervised the work upon which this report is based. Appreciative acknowledgment is here made of many suggestions made by him during the progress of the investigation and during the preparation of the manuscript. Grateful acknowledgment is due the officers of the Osage Indian Agency at Pawhuska and the late John M. Alden and others in the Tulsa office of the Geological Survey for cooperation and assistance; also Hale B. Soyster and H. I. Smith, of the Geological Survey, for sponsorship and interest in the investigation.

N. W. BASS.

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By L. E. KENNEDY, W. E. SHAMBLIN, OTTO LEATHEROCK, and N. W. BASS

ABSTRACT

The four townships—Tps. 26 and 27 N., Rs. 10 and 11 E.—whose subsurface geology and oil and gas resources are described in this report lie in northeastern Osage County, Okla. The east boundary of the area is about 3½ miles west of Bartlesville. This area is on the northwestern margin of a region that contains many oil and gas fields. Oil or gas is produced from 11 zones. Of these, either the Bartlesville sand or the Burgess sand-Mississippi lime zone is the producing zone in most wells. The Siliceous lime, which is a profific oil producer in southern Osage County, yields only gas here.

This area is part of a broad region in northeastern Oklahoma in which the rocks dip west at an average rate of about 40 feet to the mile, but the average rate of dip in these four townships is about 30 feet to the mile. The regional westerly dip is not uniform but is interrupted by domes, anticlines, synclines, and basins, most of which have a structural closure of less than 100 feet on the top of the Oswego lime (Fort Scott limestone). The top of the Oswego lime is the subsurface datum used in drawing the structure contours shown on plate 5.

The occurrence of oil in the Bartlesville and Wayside sands appears to be controlled by the distribution of the reservoir rocks rather than by their structural attitude. In the Burgess sand-Mississippi lime zone and particularly in the Siliceous lime gas is concentrated mainly in domes and anticlines, but the oil in the Burgess sand-Mississippi lime zone occurs mostly low on the flanks of the domes and anticlines and in the synclines.

The investigation has shown that there are a few localities in Tps. 26 and 27 N., Rs. 10 and 11 E., where additional drilling may reveal new oil and gas pools.

INTRODUCTION

The subsurface geologic features, the oil- and gas-producing beds, and the areas that are favorable for the discovery of additional oil and gas in Tps. 26 and 27 N., Rs. 10 and 11 E., Osage County, Okla., are described in this report, which is the fifth of a series of reports covering parts of Osage County. The structure of the buried rocks, the location of producing or abandoned oil and gas wells and dry holes, and the

ownership of leases are shown on the accompanying map (pl. 5). The oil- or gas-bearing beds in producing wells and abandoned producers and the deepest rocks penetrated in dry holes are shown on the map by colors on the well symbols. Wells that produced oil or gas from shallow depths and were drilled deeper to test older rocks are indicated by special symbols.

All the oil- and gas-producing rocks in Tps. 26 and 27 N., Rs. 10 and 11 E., are described briefly; these beds and all other rocks that have been penetrated by the drill are shown graphically in a generalized columnar section on plate 5. The thickness of a formation as shown on the columnar section is not necessarily its thickness in all parts of the area but is representative of the central part of the area. The beds that produce oil and gas are indicated on the columnar section by colors that correspond to the colors on the well symbols on the structure contour map. The oil- and gas-producing beds in each of the four townships are listed also in the following table.

Oil- or gas-producing beds in Tps. 26 and 27 N., Rs. 10 and 11 E., Osage County, Okla.

T. 26 N., R. 10 E.	T. 27 N., R. 10 E.	T. 26 N., R. 11 E.	T. 27 N., R. 11 E.
	Okesa, Torpedo, and Clem Creek sand zone.		
	Mussellem and Peoples sand zone.		Mussellem and Peoples sand zone.
	Layton sand.		Layton sand.
	Wayside sand.	Wayside sand.	Wayside sand.
	Big lime.		
Peru sand.		Peru sand.	
	Oswego lime.		
Skinner sand.			
Bartlesville sand.	Bartlesville sand.	Bartlesville sand.	Bartlesville sand.
Burgess sand-Mississippi lime zone.	Burgess sand-Mississippi lime zone.	Burgess sand-Mississippi lime zone.	Burgess sand-Mississippi lime zone.
Siliceous lime.	Siliceous lime.	Siliceous lime.	Siliceous lime.

The rocks exposed in Tps. 26 and 27 N., Rs. 10 and 11 E. belong to the Ochelata and Nelagoney formations and the Elgin sandstone, all of the Pennsylvanian series. These formations are composed mainly of shale and sandstone but contain some limestone. Their geographic distribution is shown on the geologic map of Oklahoma.[1] The distribution and description of many key beds and the structural attitude of the exposed rocks were set forth many years ago by Clark, Robinson, and Mills,[2] who also prepared structure contour maps. These maps were used extensively in drawing the structure contours on plate 5, particularly in areas for which few or no specific data on the attitude of the buried rocks were available.

[1] Miser, H. D., Geologic map of Oklahoma, U. S. Geol. Survey, 1926.

[2] Clark, F. R. (T. 26 N., Rs. 10 and 11 E.), Robinson, H. M., and Mills, R. V. A. (T. 27 N., Rs. 10 and 11 E.), in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pp. 91–118, 255–277, 303–327, 1922.

OIL- AND GAS-PRODUCING BEDS

Oil or gas has been produced in Tps. 26 and 27 N., Rs. 10 and 11 E., from 11 zones, ranging from the upper part of the Siliceous lime, of Ordovician age, to the Okesa, Torpedo, and Clem Creek sand zone, of Pennsylvanian age. The Siliceous lime yields only gas in these four townships, although it is a prolific oil producer in many localities in southern Osage County. The Burgess sand-Mississippi lime zone yields both oil and gas in many wells. These four townships include a segment of a broad northeastward-trending belt of country in Osage County that contains many oil and gas fields in the Burgess sand-Mississippi lime zone. The townships lie also on the northwest margin of an extensive area in northeastern Oklahoma that contains many oil fields that produce from the Bartlesville sand; but in these townships the Bartlesville sand is thin and lenticular and yields oil in only a few fields of small extent. The Wayside sand is important as an oil reservoir in T. 27 N., R. 10 E., and in a few other places in the four townships. The other zones shown in the table on page 174 are oil- or gas-bearing in only a few wells. Brief descriptions of the oil- and gas-bearing rocks, from the oldest to the youngest, follow.

SILICEOUS LIME

The uppermost beds in the Siliceous lime have yielded gas on or near the crests of several steeply folded domes. This lime has not produced oil in these four townships, although it is a prolific oil producer in southern Osage County. No samples of this lime from wells in these townships were studied, but samples from nearby localities that were examined under the microscope show that the uppermost beds consist of finely crystalline brown to white dolomite that commonly contains chert. It is these beds that yield gas. The gas-bearing beds in different areas, however, are not necessarily equivalent, because the erosion that took place prior to the deposition of the overlying rocks doubtless removed a much thicker column of Siliceous lime on some domes than on others.

Data furnished by the logs of deep wells in Osage County show that on the crests of most steeply folded domes and anticlines peaks of pre-Cambrian rocks lie at shallow depth and that the Siliceous lime, which is commonly about 1,000 feet thick throughout most of the region, is thin or absent.

BURGESS SAND-MISSISSIPPI LIME ZONE

The many fields that produce oil and gas from the Burgess sand-Mississippi lime zone in the northwestern half of Tps. 26 and 27 N., Rs. 10 and 11 E, lie in a belt that extends northeast from T. 23 N.,

R. 8 E., across Osage County. In parts of the county, particularly the southeastern part, a bed of fine to coarse quartz sand, known as the Burgess sand, either lies on the eroded top of the Mississippi lime or is separated from it by a thin bed of shale. The uppermost part of the Mississippi lime consists mainly of weathered chert that is recorded in many logs as sand, because during the process of drilling the chert is broken into fine particles that resemble sand grains. The rocks adjacent to or nearly adjacent to the contact of the Cherokee shale and the Mississippi lime cannot be differentiated in all wells by means of drillers' logs, and they are therefore here designated the Burgess sand-Mississippi lime zone. The logs indicate, however, that in much of Tps. 26 and 27 N., Rs. 10 and 11 E., the Burgess sand is absent and that the oil and gas occur at most places in the upper 25 feet of the Mississippi lime and at a few places as much as 50 feet below the top of the lime.

BARTLESVILLE SAND

The northwestern half of the four townships here described lies northwest and outside of a large area in which the Bartlesville sand is the most prolific producing zone. The Bartlesville sand, which yields oil in the Almeda field in the east-central part of T. 26 N., R. 11 E., is thick and appears to be equivalent to the lenses of oil-bearing Bartlesville sand of Tps. 24 and 25 N., R. 11 E. But the oil-bearing Bartlesville sand lenses in T. 26 N., R. 10 E., the western and northern parts of T. 26 N., R. 11 E., and T. 27 N., Rs. 10 and 11 E., are only 10 to 25 feet thick and lie at the horizon of the upper part of the sand body of the Almeda field and of the sand bodies in Tps. 24 and 25 N., R. 11 E. These thin sand lenses are therefore younger than the Bartlesville sand of the Almeda field. In the southeastern part of the area included in Tps. 26 and 27 N., Rs. 10 and 11 E., the Bartlesville sand is separated from the Mississippi lime by a shale bed about 50 feet thick. This shale bed thins toward the northwest, and progressively younger beds lie in contact with the Mississippi lime.

No samples of the Bartlesville sand from these four townships were examined with the microscope but samples from many places in eastern Osage County examined by Constance Leatherock showed that the Bartlesville sand is composed mainly of fine to medium subangular quartz grains and minor amounts of other minerals, including mica and feldspar. Mica constitutes less than 1 percent of this sand, but is most abundant in the shaly parts. Small concretions of siderite occur commonly in the beds of very fine and silty sand. The Bartlesville sand is similar in composition and physical character to the Burbank (Red Fork) sand, which occurs somewhat higher in

the Cherokee shale and is an important oil producer in western and southern Osage County and in Cowley, Butler, and Greenwood Counties, Kans. The Bartlesville sand is also similar to the Bluejacket sandstone member of the Cherokee, which crops out in northeastern Oklahoma[3] and is equivalent to a part of the Bartlesville.

SKINNER SAND

Several well logs record a bed of sand about 75 feet below the top of the Cherokee shale, which is about the stratigraphic position of the Skinner sand of southeastern Osage County. This bed yielded gas in only one well in these four townships (No. 2 in the SW¼NW¼ NW¼ sec. 31, T. 26 N., R. 10 E.) and is therefore of little importance here as an oil- and gas-producing zone.

OSWEGO LIME (FORT SCOTT LIMESTONE)

The Oswego lime, which is about 80 feet thick in this area, is a persistent unit of limestone and shale. Most well logs record only one shale bed, about 10 feet thick, but some logs record more than one. Only one well, No. 2–224, in the NW¼NE¼ sec. 9, T. 27 N., R. 10 E., yielded gas in valuable amounts from the Oswego lime.

PERU SAND

The Peru sand, which is in the upper part of the Labette shale, is recorded in the well logs in several localities in the area. It yields oil in one well in the NE¼ sec. 2, T. 26 N., R. 10 E.; it yielded oil for a time in two wells in the SE¼ sec. 5, T. 26 N., R. 11 E.; and it has yielded shows of both oil and gas in several wells.

BIG LIME (OOLOGAH LIMESTONE)

The Big lime, which is about 80 feet thick, consists of two beds of limestone separated by shale. In parts of Osage County the Big lime yielded oil in appreciable amounts, but in these four townships it has yielded only a small amount of oil in two wells in the SW¼NE¼ sec. 17, T. 27 N., R. 10 E., on the Brunt anticline, and gas in one well in the SW¼SE¼ sec. 4, T. 27 N., R. 10 E., on the Lynn anticline.

WAYSIDE SAND

The Wayside sand yields oil in a relatively large field in the northeast part of T. 27 N., R. 10 E., and in a few small tracts elsewhere in the four townships. This sand lies about 60 feet above the Big

[3] Miser, H. D., Geologic map of Oklahoma, U. S. Geol. Survey, 1926.

lime and 40 to 50 feet below the Checkerboard limestone. The sequence that includes the Wayside sand includes also limestone and shale in parts of the area. The oil-bearing portion of the sand appears to lie at the horizon that is occupied by limestone in localities outside the oil fields. In many places in Tps. 26 and 27 N., Rs. 10 and 11 E., the Wayside sand is overlain directly by a bed of limestone, but in other places the horizon of this limestone is occupied by sand that forms the upper part of the Wayside sand. It is probable that this limestone bed represents the Lenapah limestone.

LAYTON SAND

Interbedded sand and shale occupy the uppermost part of the Coffeyville formation. The individual beds of sand are lenticular, but most logs record sand in parts of the upper 100 feet of the Coffeyville. This sandy zone is referred to as the Layton sand and is readily identified by its position below the persistent Hogshooter limestone. The Layton sand yields gas in one well in the NW¼ sec. 1, T. 27 N., R. 10 E., on the Blaine dome, and in several wells in sec. 5, T. 27 N., R. 11 E., on the Musgrove dome.

MUSSELLEM AND PEOPLES SAND ZONE

A sequence of lenticular beds of sand, shale, and limestone occurs from about 50 to 200 feet above the Hogshooter limestone. This sequence occupies the stratigraphic position of the upper part of the Nellie Bly formation, the Dewey limestone, the Ochelata formation, and includes beds believed to be equivalent to the Mussellem and Peoples sands. The drawing of the limits of these formations depends on the identification of the Dewey limestone, which is not persistent in these townships. In the attempt to correlate the beds in this sequence several cross sections were prepared by matching logs of closely spaced wells in several selected belts extending westward from the outcrops of the Dewey limestone in the central part of T. 26 N., R. 13 E., and the southeastern part of T. 27 N., R 13 E. These cross sections, which are not reproduced here, show that the Dewey limestone persists westward underground for a distance of only a few miles and that farther west at the horizon of the Dewey limestone there is a zone 50 or more feet thick of lenticular beds of limestone interbedded with sandstone and shale.

One of the cross sections thus prepared passes westward through the southernmost tier of sections in T. 27 N., R. 12 E., into sec. 36, T. 27 N., R. 11 E., and thence northwestward diagonally across T. 27 N., R. 11 E. The Dewey limestone is identifiable in the logs of wells in T. 27 N., R. 12 E., but in sec. 36, T. 27 N., R. 11 E., the logs show several beds of limestone separated by shale and sandstone. Northwest of sec. 36

in T. 27 N., R. 11 E., the horizon of the Dewey limestone is occupied by sandstone. In another cross section taken southwestward through T. 26 N., Rs. 11 and 12 E., the Dewey limestone was identified in logs in T. 26 N., R. 12 E., and farther southwestward through the eastern two-thirds of T. 26 N., R. 11 E., about to sec. 29, where it apparently splits into several beds of limestone, sandstone, and shale.

The sequence of rocks that includes beds believed to be equivalent to the Peoples sand, Dewey limestone, and Mussellem sand is herein referred to as the Mussellem and Peoples sand zone. The upper part of the zone yields gas in several wells in secs. 8, 9, and 17, T. 27 N., R. 11 E., on the Alvin dome, and the lower part of the zone yields gas in one well in the SE¼ sec. 2, T. 27 N., R. 10 E., on the Blaine dome. It appears likely that the lower part of the zone represents the Peoples sand and the upper part the Mussellem sand.

OKESA, TORPEDO, AND CLEM CREEK SAND ZONE

A sequence of sandstone and shale beds 150 feet or more thick occupies the middle part of the Ochelata formation. The sequence includes rocks that are believed to be equivalent to the Okesa, Torpedo, and Clem Creek sands. Although individual beds in the sequence cannot be identified in the logs from well to well, the sequence considered as a unit persists thoughout an extensive area. Gas is produced from this zone in the SE¼ NE¼ sec. 2, T. 27 N., R. 10 E., on the Blaine dome.

T. 26 N., R. 10 E.

T. 26 N., R. 10 E., is in the northeastern part of Osage County, and its eastern boundary is 10 miles west of Bartlesville. Although this township has produced relatively little oil and gas, about 100 wells have been drilled, and oil and gas have been found in six comparatively small areas that are widely separated. The oil is produced mainly from the Bartlesville sand and the Burgess sand-Mississippi lime zone. The gas is found mainly in the Burgess sand-Mississippi lime zone but has been found also in one well in each of two other zones—the Siliceous lime and the Skinner sand.

The subsurface investigation of T. 26 N., R. 10 E., was made mainly in 1935 by L. E. Kennedy. The data on production were compiled in 1938 by Miss Anna L. Weinrich, of the Osage Indian Agency, from records on file at the agency.

STRUCTURE AND DEVELOPMENT

The regional dip of the rocks in T. 26 N., R. 10 E., is westward at an average rate of about 33 feet to the mile, as measured on the top of the Oswego lime. In parts of the township only a few wells

have been drilled, and the meaber data supplied by them are inadequate for the drawing of subsurface structure contours spaced 20 feet apart. Structure contours for much of this township have, therefore, been omitted from plate 5.

SAND CREEK ANTICLINE

The southwestern part of the Sand Creek anticline extends southwestward across secs. 1, 12, and 11 and includes the dome whose crest is in the NE¼ sec. 11. The position of the subsurface structure contours on the Sand Creek anticline as shown on plate 5 is based mainly on Clark's structure-contour map of the exposed rocks,[4] because very few wells that supply datum points on the Oswego lime have been drilled on the anticline.

Three wells, now abandoned, in the NE¼ sec. 1 on the Sand Creek anticline produced oil from the Bartlesville sand, which is from 10 to 20 feet thick and lies at a depth of about 1,850 feet. One well in the northeast corner of sec. 1 produced oil from the Burgess sand-Mississippi lime zone. The initial daily yields of these wells were not learned, but the yields of wells in nearby areas indicate that the initial daily yields were probably less than 100 barrels. The four wells produced a total of 3,687 barrels of oil from 1919 to 1922, after which they were abandoned.

Apparently the Sand Creek anticline has been thoroughly tested for oil and gas. Several wells in addition to the four oil wells described penetrated the upper part of the Burgess sand-Mississippi lime zone, and one well on the small dome in the NE¼ sec. 11 penetrated the uppermost part of the Siliceous lime.

DRY HOLLOW ANTICLINE

The southern part of the large Dry Hollow anticline occupies parts of secs. 1, 2, and 3. The crest of this anticline trends northwestward from the N½NE¼ sec. 2 through secs. 35 and 34, T. 27 N., R. 10 E. Oil is produced in the NW¼ sec. 2 and in the N½ sec. 3 from the Bartlesville sand on the southwest flank, and gas is produced in the NE¼ sec. 2 near the crest of the anticline from the Siliceous lime and the Burgess sand-Mississippi lime zone. The Peru sand has yielded oil in one well in the NE¼ sec. 2. The Bartlesville sand lies at a depth of about 1,840 feet and is about 25 feet thick. The initial daily yields of the oil wells ranged from 10 to 75 barrels. The total yield prior to July 1916 was not learned, but the average yield to the acre from July 1916 to the end of 1937 was about 1,325 barrels. Most

[4] Clark, F. R., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pl. 14, 1922.

of the wells were drilled from 1913 to 1917, and many are still producing.

The Burgess sand-Mississippi lime zone, which lies at a depth of about 1,950 feet in the NE¼ sec. 2 near the crest of the anticline, appears from the logs to be represented there by only the Mississippi lime. The gas occurs in the uppermost 10 to 20 feet of the lime. The initial daily yields of the wells ranged from 3 to 28 million cubic feet. Well 14–256 in the northwest corner of the NE¼ sec. 2 produced initially 19 million cubic feet a day from the Siliceous lime, which was encountered at a depth of 2,200 feet. Well 1–89 in the northeast corner of sec. 2 is reported to have produced initially 9 million cubic feet a day from a sand that lies at the stratigraphic position of the Squirrel sand, but this well was later deepened to the Burgess sand-Mississippi lime zone, from which it produced 6 million cubic feet a day. It appears probable that a few additional producing wells drilled to the Burgess sand-Mississippi lime zone and the Siliceous lime in the N½ sec. 2 would produce gas.

The total amount of oil produced is shown in the following table:

Oil produced from the Dry Hollow anticline in secs 2 and 3, T. 26 N., R. 10 E.

Tract	Date of first production	Production to end of 1937 (barrels)
NE ¼ sec. 2	1923	16,016
NW ¼ sec. 2	Prior to July 1916	[1] 119,478
NE ¼ sec. 3	do	[1] 206,931
NW ¼ sec. 3	do	[1] [2] 71,364
		413,789

[1] Does not include amount produced prior to July 1916.
[2] Abandoned in 1930.

WHITETAIL DOME

The southern part of the Whitetail dome occupies part of sec. 6. Five wells in the N½ sec. 6 on the dome produce oil from the Burgess sand-Mississippi lime zone, which lies at a depth of about 1,930 feet. The initial daily yields of the wells ranged from 10 to 70 barrels, and the total yield from all wells to the end of 1937 was 69,816 barrels.

MIZER DOME

The position of the subsurface structure contours on the Mizer dome in secs. 7 and 18 as shown on plate 5, are speculative, because only two datum points on the Oswego lime are available. The dome is a relatively pronounced upfold in the exposed rocks.[5] Two wells on the dome tested the Burgess sand-Mississippi lime zone, and one

[5] Clark, F. R., op. cit., pl. 14.

of these tested the Siliceous lime. Each well produced a very small amount of oil from the Burgess sand-Mississippi lime zone.

STRIKEAXE ANTICLINE

The Strikeaxe anticline, whose crest is in the NE¼ sec. 30, is a pronounced upfold in both the buried (pl. 5) and the exposed rocks.[6] Relatively small amounts of oil and gas have been produced on the anticline from the Burgess sand-Mississippi lime zone, which lies at a depth of about 2,050 feet. The logs indicate that no Burgess sand is present and that the oil and gas occur in the uppermost 50 feet of the Mississippi lime. The initial daily yields of the oil wells ranged from 10 to 30 barrels, and the yields of the gas wells ranged from 1½ to 5 million cubic feet. The oil wells yielded a total of 30,312 barrels from 1920 to 1926, when the last well was abandoned. The total yield of the gas wells was not learned.

Shows of oil or gas were encountered in the wells in the Mussellem sand, the Big lime, and the Peru sand. Three wells tested the Siliceous lime, but none of these are on the crest of the anticline. It is not improbable that gas could be obtained from the Siliceous lime in the center of the N½NE¼ sec. 30.

SEC. 31

The eastern part of the Lookout anticline, which lies mainly in T. 26 N., R. 9 E., occupies the western part of sec. 31, T. 26 N., R. 10 E. Well 1 in the northwest corner of sec. 31 yielded gas and oil from the Burgess sand-Mississippi lime zone. The initial daily yield of gas was reported to be 10 million cubic feet. The total yield of oil from this well amounted to 10,952 barrels, but was spread over a period of 15 years. Well 2 in the NW¼NW¼ sec. 31 was reported to have yielded initially 7½ million cubic feet of gas a day from sand that lies at the stratigraphic horizon of the Skinner sand.

REVARD ANTICLINE

The Revard anticline is a relatively large fold that lies mainly in secs. 13 and 24. Gas is produced on the anticline from the Burgess sand-Mississippi lime zone, and a small amount of oil is produced in one well from the Bartlesville sand. The initial daily yields of the gas wells ranged from 2 to 4½ million cubic feet. The initial daily yield of the oil well was 25 barrels, and its total yield to the end of 1937 was 2,311 barrels. It is not unlikely that a well drilled in the southeast corner of the NW¼SW¼ sec. 13 would produce gas from the Siliceous lime, which would be encountered at a depth of about 2,250 feet.

[6] Clark, F. R., op. cit., pl. 14.

T. 27 N., R. 10 E.

T. 27 N., R. 10 E., is in northeastern Osage County. Its southeast corner is 1 mile north and 9½ miles west of Bartlesville, and Bigheart is in the NW¼ sec. 3. The township lies on the northwestern margin of a large region in eastern Osage County that contains many oil and gas fields.

Nine zones yield oil or gas in T. 27 N., R. 10 E. These include the uppermost part of the Siliceous lime, which yields only gas; the Burgess sand-Mississippi lime zone, which yields oil and gas in many places in the township; the Bartlesville sand, which yields oil in the southeastern part of the township; the Oswego lime, which yields gas in one well in the NW¼NE¼ sec. 9; the Big lime, which has yielded gas in one well in the NW¼ sec. 4 and oil in two wells in the SW¼NE¼ sec. 17; the Wayside sand, which yields oil and gas, mainly in a large area in the northeast quarter of the township; the Layton sand and the Mussellem and Peoples sand zone, each of which has yielded gas in one well in the NW¼ sec. 1; and the Okesa, Torpedo, and Clem Creek sand zone, which yields gas in one well in sec 2.

The drilling for oil and gas began early in T. 27 N., R. 10 E. A few wells in sec. 36 were drilled in 1905 and 1906; one well was drilled in the southeast corner of sec. 27 in 1907; wells in secs. 34 and 35 in 1913 to 1919; most of the wells in secs. 13, 24, 25, 14, and 15 in 1914 to 1917; most of the wells in secs. 1, 2, 10, 11, and 12 from 1917 to 1921; those in secs. 4 and 5, from 1918 to 1920; those in sec. 17, from 1918 to 1923; and those in sec. 31, from 1919 to 1922.

The subsurface investigation of T. 27 N., R. 10 E. was conducted in 1935, mainly by W. E. Shamblin. The data on production were compiled in 1938 by Miss Anna L. Weinrich, of the Osage Indian Agency, from records on file at the agency.

STRUCTURE AND DEVELOPMENT

The regional dip of the rocks in T. 27 N., R. 10 E., is westward at an average rate of about 25 feet to the mile, as measured on the top of the Oswego lime. This regional dip is interrupted, however, by several domes, anticlines, synclines, and structural basins. Of these the most prominent are the Herridge anticline and the domes associated with it, the Dry Hollow anticline, the Bellieu and Blaine domes, the Lynn and Brunt anticlines, the deep syncline in the southwest quarter of the township, and the structural basin in secs. 13 and 14.

The main structural features in the buried rocks are reflected in the attitude of the exposed rocks as shown by Robinson and Mills'

structure contour map.[7] Locally, however, the structural features in the buried rocks differ considerably from those in the exposed rocks. The differences are particularly marked in the SW¼ sec. 24 and the NW¼ sec. 25 and in the W½ sec. 10.

Several faults cut the exposed rocks on the Lynn and Brunt anticlines and on the Whitetail dome. The faults all trend northwest and lie within a narrow belt of faults that extends northeastward for many miles through Oklahoma.[8] The maximum vertical displacement of the exposed rocks along the faults in T. 27 N., R. 10 E., is 60 feet, but along most of the faults it is less than 25 feet. The available data are inadequate to determine whether the deeply buried rocks also are displaced by the faults.

BLAINE DOME

The Blaine dome is a pronounced upfold that lies mainly in secs. 1 and 2. Its structural closure is about 75 feet on the Oswego lime (see pl. 5) and about 40 feet in the exposed rocks.[9] The dome lies on an anticlinal fold that extends northeastward and forms the East Mission Creek anticline in T. 28 N., Rs. 10 and 11 E. Gas is produced in one well in the SW¼SE¼NE¼ sec. 2, near the crest of the dome, from a sand that lies near the stratigraphic position of the Clem Creek sand, which in this report is included in the Okesa, Torpedo, and Clem Creek sand zone. The initial yield of this well was 1¾ million cubic feet a day. Well 3–225, in the SW¼NE¼SE¼ sec. 2, on the south flank of the dome, yields gas from the Mussellem and Peoples sand zone, and well 26–43, in the center of the west line of the NW¼ sec. 1 had an initial yield of 2 million cubic feet a day from the Layton sand. A few wells have yielded from 1 to 2½ million cubic feet a day from the Burgess sand-Mississippi lime zone; and a large number of wells low on the south flank of the dome, in and just southwest of the syncline that borders the dome on the southwest, yield oil from the Wayside sand at a depth of about 1,275 feet. The initial daily yields of the wells ranged from 10 to 240 barrels, but most wells yielded initially less than 100 barrels a day. The total yield to the end of 1937 was about 2,500 barrels to the acre.

The distribution of the wells producing from the Wayside sand suggests that the producing area in sec. 11 could be extended south-

[7] Robinson, H. M., and Mills, R. V. A., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pl. 46, 1922.

[8] Fath, A. E., The origin of the faults, anticlines, and buried "granite ridge" of the northern part of the Mid-Continent oil and gas field: U. S. Geol. Survey Prof. Paper 128, pl. 12, 1920. Miser, H. D., Geologic map of Oklahoma, U. S. Geol. Survey, 1926.

[9] Robinson, H. M., and Mills, R. V. A., idem, pl. 46.

ward, possibly to the producing area in the southeastern part of that section and the northern part of sec. 14. The Siliceous lime probably would yield gas on the crest of the Blaine dome, where it would be reached at a depth of about 2,200 feet.

LYNN ANTICLINE

The Lynn anticline is a large upfold whose axis trends southeast through parts of secs. 5 and 9 and thence east through the southern parts of secs. 10 and 11 and the northern part of secs. 15 and 14. The fold is terminated on the east by a deep structural basin in secs. 14, 13, and 12. (See pl. 5.) Three small domes are superposed on the crest of the anticline. The main part of the anticline in secs. 4, 5, and 9 on the Oswego lime is similar to that in the exposed rocks,[10] except that the exposed rocks are cut by several northwestward-trending faults. The maximum vertical displacement of the exposed rocks along the faults is 60 feet, but the data were inadequate to determine whether the deeply buried rocks are similarly displaced.

A short distance northeast of the Lynn anticline the exposed rocks form a second anticline, the axis of which is parallel to that of the Lynn anticline and extends northwestward from the S½ sec. 15 through secs. 15, 10, 3 and 4.[11] This second anticline is not represented on plate 5 because the well logs do not indicate that it is present in the deeply buried rocks. However, the positions of the structure contour lines in this part of plate 5 are necessarily speculative because they are based on few data.

Gas is produced on the Lynn anticline from the Burgess sand-Mississippi lime zone in several wells, from the Siliceous lime in a few wells, from the Oswego lime in one well, from the Big lime in one well, and from the Wayside sand in one well. The initial daily yields of the wells producing from the Burgess sand-Mississippi lime zone ranged from 2 to 15 million cubic feet, and the initial daily yields of a few of the wells producing from the Siliceous lime ranged from 3½ to 5 million cubic feet. The initial daily yield of the well producing from the Oswego lime was 1¼ million cubic feet, and that of the well producing from the Big lime was 3¼ million cubic feet.

A few wells in secs. 10, 15, and 14, on the eastward-trending prong of the anticline, yield oil from the Burgess sand-Mississippi lime zone; others yield gas from this zone; and many yield oil from the Wayside sand. One well in sec. 15 yields gas from the Siliceous lime. The initial daily yields of the wells producing oil from the Burgess sand-Mississippi lime zone ranged from 8 to 35 barrels, and those of the

[10] Robinson, H. M., and Mills, R. V. A., op. cit., pl. 46.
[11] Idem.

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wells producing from the Wayside sand ranged from 10 to 150 barrels. The wells producing from the Wayside sand were drilled in 1915 to 1918, and most of them are still producing. The amount of oil produced prior to July 1916 was not learned, but the average yield to the acre of the wells producing from the Wayside sand from July 1916 to the end of 1937 was about 3,100 barrels. It is believed that this average would be increased only slightly by including the oil produced prior to July 1916, for only a few wells had been drilled prior to that time.

It appears probable that the area producing from the Wayside sand could be extended northward through the undrilled part of sec. 11. Additional gas probably could be found in the Burgess sand-Mississippi lime zone and in the Siliceous lime on the crest of the dome in the SW¼ SE¼ sec. 4, and in the Siliceous lime on the crest of the dome in the NW¼SW¼ sec. 4.

BRUNT ANTICLINE

The Brunt anticline is a low fold whose crest is in the SE¼NE¼ sec. 17. It appears to be a southwestward projecting prong of the Lynn anticline. The structural closure on the top of the Oswego lime is only a little more than 20 feet, and the crest of the anticline is about 80 feet lower structurally than the crests of the two main domes on the Lynn anticline. (See pl. 5.) Only small amounts of oil and gas have been produced on the Brunt anticline. A total of 10,500 barrels of oil was produced in the NE¼ sec. 17, most of which came from one well that produced from the Big lime. A second well produced small amounts of oil for a few months from the Big lime, and a third had a show of oil in the Peru sand. A well in the northwest corner of the SE¼ sec. 17 appears to have produced a small amount of oil from the Layton sand, but no record of the amount could be found at the Osage Agency. One well produced gas at an initial daily rate of 3 million cubic feet from the Burgess sand-Mississippi lime zone. Several wells penetrated the upper part of the Siliceous lime, which yielded water.

DOMES IN SECS. 24 AND 25 AND THE WESTERN PARTS OF THE HERRIDGE ANTICLINE AND THE BACON RIND DOME

A complex group of upfolds in the east-central part of T. 27 N., R. 10 E., and the west-central part of T. 27 N., R. 11 E., includes the Herridge anticline, the Bacon Rind dome, the domes in the W½ sec. 24 and the NW¼ sec. 25, T. 27 N., R. 10 E. The Herridge anticline and the Bacon Rind dome lie mainly in T. 27 N., R. 11 E., but they extend westward into secs. 13, 24,, and 25, T. 27 N., R. 10 E. The folding in the deeply buried rocks (see pl. 5) is much more

complicated than in the exposed rocks.[12] The domes in the W½ sec. 24 and the NW¼ sec. 25 are expressed in the exposed rocks as a narrow structural terrace, and the crest of the Herridge anticline in the exposed rocks lies a short distance southeast of its crest in the buried rocks.

Many wells in the area containing the group of domes in sec. 13, the SE¼ sec. 23, secs. 24, 25, and 26 produce oil from the Burgess sand-Mississippi lime zone at a depth of about 1,900 feet, and a few produce gas from this zone. The logs of most of the wells indicate that the oil occurs in the upper part of the Mississippi lime rather than in the Burgess sand, but some logs record the oil-bearing rock as sand. The initial daily yields of most of the wells were not large, but the wells are long-lived. Many wells were drilled from 1914 to 1916 and are still producing. The amount of oil produced prior to July 1916 was not learned, but the average yield to the acre from July 1916 to the end of 1937 was slightly more than 1,500 barrels.

One dry hole in the NW¼SE¼ sec. 24 penetrated the upper part of the Siliceous lime but found it barren of oil or gas. A better locality in which to test this lime is the northwest corner of the NE¼SW¼ sec. 24, on the crest of the dome, where the Siliceous lime may produce gas. The lime would be encountered here at a depth of about 2,100 feet.

BELLIEU DOME

The Bellieu dome is a relatively small upfold whose axis trends northeast through secs. 27, 22, and 23. It forms a part of a larger anticlinal fold that trends southward and joins the Dry Hollow anticline in the E½ sec. 34. A few wells on the northern part of the Bellieu dome produced oil for 11 years from the Wayside sand. Several wells in widely separated places on the dome produced gas, and several other wells produced oil from the Burgess sand-Mississippi lime zone. The Siliceous lime yielded gas in a few wells.

WHITETAIL DOME

The Whitetail dome lies mainly in sec. 31 but extends southward into sec. 6, T. 26 N., R. 10 E. The deeply buried rocks dip much more steeply (see pl. 5) than the exposed rocks,[13] and the crest of the dome in the Oswego lime lies about a quarter of a mile southwest of the crest in the exposed rocks. One well on the west flank of the dome yields oil from the Bartlesville sand, and many wells on the dome yield oil from the Burgess sand-Mississippi lime zone,

[12] Robinson, H. M., and Mills, R. V. A., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pl. 46, 1922.

[13] Idem.

which lies at a depth of about 1,930 feet. Most of the logs record the main oil-producing zone as sand, and a few logs record it as lime. It could not be determined from the logs, however, whether the oil occurs in the upper cherty part of the Mississippi lime or in the Burgess sand.

The wells were drilled in 1919 to 1923, and their initial daily yields ranged from 10 to 80 barrels. Although these yields are small, most of the wells are still producing. The average yield to the acre in sec. 31 was about 1,775 barrels to the end of 1937.

Two wells on the dome penetrated the upper part of the Siliceous lime but found it barren of oil and gas.

The distribution of the wells indicates that by the drilling of additional wells the producing area in sec. 31 might be extended northwestward in the SW¼ and eastward in the SE¼. Wells with small yields, however, should be expected.

DRY HOLLOW ANTICLINE

The Dry Hollow anticline extends northwestward from sec. 2, T. 26 N., R. 10 E., through sec. 35 and part of sec. 34, T. 27 N., R. 10 E., and thence swings northeastward through the NE¼ sec. 34, the SE¼ sec. 27, and the SW¼ sec. 26. A local dome is superposed on the anticline in the NE¼ sec. 34. The anticline on the Oswego lime extends farther northwestward than the fold in the exposed rocks. The northeastern part of the anticline in the NE¼ sec. 34 is represented in the exposed rocks by an anticlinal nose and terrace.

A broad area in which oil is produced from the Bartlesville sand extends across the southwest flank of the anticline in secs. 2 and 3, T. 26 N., R. 10 E., and sec. 34, T. 27 N., R. 10 E., and across the axis of the anticline and down its northeast flank in secs. 34 and 35. This position on the anticline of the oil-bearing area in the Bartlesville sand indicates that the anticline is not the controlling factor in the distribution of the oil in the Bartlesville sand. The initial yields of the wells ranged from 10 to 125 barrels. One well was drilled in the southeast corner of sec. 27 in 1907, but most of the wells in the field were drilled from 1914 to 1919; many of them are still producing. The amount of oil produced prior to July 1916 was not learned, but the amount produced from July 1916 to the end of 1937 was about 1,375 barrels to the acre. The amount of oil produced on the anticline, by tracts, is included in the table on page 189.

Several wells on the anticline produced gas from the Burgess sand-Mississippi lime zone, and a few tested the Siliceous lime.

SEC. 36

A few wells in the SE¼ sec. 36, low on the west flank of the Sand Creek anticline, produce oil from the Bartlesville sand. Two of these

wells were drilled in 1905, one in 1906, one in 1913, and one in 1918. The initial daily yields of the wells ranged from 10 to 40 barrels. The amount of oil produced from 1905 to July 1916 was not learned, but the amount produced from July 1916 to the end of 1937 is 52,994 barrels.

YIELDS

The total amount of oil produced in T. 27 N., R. 10 E., from July 1916 to the end of 1937, as compiled from records of the Osage Indian Agency, is shown in the table following. Records of oil produced prior to July 1916 are not available.

Oil produced in T. 27 N., R. 10 E.

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
NE¼ sec. 1	June 1920	1,520	Abandoned in 1925.
SW¼ sec. 2	December 1919	22,976	
SE¼ sec. 3	August 1920	4,545	Abandoned in 1926.
SE¼ sec. 9	July 1921	683	Abandoned in 1922.
NE¼ sec. 10	February 1919	50,540	
SW¼ sec. 10	December 1923	36,653	
SE¼ sec. 10	February 1919	22,928	
NE¼ sec. 11	July 1920	262,349	
NW¼ sec. 11	July 1919	438,926	
SW¼ sec. 11	February 1917	24,135	
SE¼ sec. 11	October 1917	124,189	
NW¼ sec. 12	October 1916	35,257	
SW¼ sec. 12	Prior to July 1916	[1] 11,938	Abandoned in 1934.
NE¼ sec. 13	May 1917	78,391	
NW¼ sec. 13	Prior to July 1916	[1] 39,404	
SW¼ sec. 13	August 1917	539	Abandoned in 1919.
SE¼ sec. 13	Prior to 1916	[1] 74,740	
NE¼ sec. 14	do	[1] 294,783	
NW¼ sec. 14	Prior to July 1916	[1] 361,015	
SW¼ sec. 14	do	[1] 126,453	
SE¼ sec. 14	do	[1] 28,174	
NE¼ sec. 15	May 1917	51,909	
NW¼ sec. 15	December 1920	22,280	
SW¼ sec. 15	March 1919	24,023	
SE¼ sec. 15	June 1917	11,373	Abandoned in 1929.
NE¼ sec. 17	March 1923	10,499	Abandoned in 1930.
NE¼ sec. 22	April 1917	21,790	Abandoned in 1929.
NE¼ sec. 23	October 1918	7,060	Abandoned in 1928.
NW¼ sec. 23	May 1917	85,001	Do.
SW¼ sec. 23	October 1916	4,989	Abandoned in 1919.
SE¼ sec. 23	Prior to July 1916	[1] 69,015	
NE¼ sec. 24	October 1916	70,934	
NW¼ sec. 24	Prior to July 1916	[1] 82,796	
SW¼ sec. 24	do	[1] 287,729	
SE¼ sec. 24	do	[1] 73,577	
NE¼ sec. 25	Prior to July 1916	[1] 67,820	
NW¼ sec. 25	do	[1] 59,827	
SW¼ sec. 25	July 1919	13,683	Abandoned in 1934.
NE¼ sec. 26	Prior to July 1916	[1] 10,031	Abandoned in 1929.
SE¼ sec. 26	May 1919	3,686	Abandoned in 1921.
NE¼ sec. 27	March 1921	29,736	Abandoned in 1932.
NW¼ sec. 27	October 1921	7,825	Do.
SW¼ sec. 27	March 1921	27,859	Do.
SE¼ sec. 27	October 1921	22,939	Do.
SW¼ sec. 31	August 1920	82,823	
SE¼ sec. 31	February 1920	75,074	
NE¼ sec. 34	Prior to July 1916	[1] 36,221	
NW¼ sec. 34	October 1920	10,892	Abandoned in 1931.
SW¼ sec. 34	Prior to July 1916	[1] 21,318	
SE¼ sec. 34	do	[1] 146,931	
NW¼ sec. 35	do	[1] 37,674	
SW¼ sec. 35	do	[1] 76,996	
SE¼ sec. 35	October 1920	11,933	
SE¼ sec. 36	Prior to July 1916	[1] 52,994	
		3,659,375	

[1] Does not include amount produced prior to July 1916.

T. 26 N., R. 11 E.

T. 26 N., R. 11 E., is in the northeastern part of Osage County, and its east boundary is 3½ miles west of Bartlesville. About 270 wells have been drilled in the township and oil or gas has been found in several widely separated localities. Oil or gas has been produced from five zones. Of these, the Bartlesville sand is the producing zone in most wells but the Burgess sand-Mississippi lime zone is the producing zone in many wells. The Wayside sand has yielded oil in several wells in the northeastern part of the township, the Peru sand yielded oil for a time in two wells in sec. 5, and the Siliceous lime yielded gas in one well in sec. 28.

Oil was first produced in 1904 from one or two wells in secs. 4 and 29. In 1905 and 1906 a few additional wells were drilled in these two sections, and several oil and gas wells were completed in secs. 15, 16, and 33. The major development in the Almeda field, in the east-central part of the township, took place in 1913 and 1914. A few additional wells were drilled here in 1915 to 1919, but there has been no further drilling in recent years. Nearly all the wells in the southern part of the field in secs. 1, 2, and 12, were drilled in 1919 and 1920. A few wells were drilled between 1922 and 1926 in sec. 2, but there has been no recent development in this part of the township. A few of the wells in secs. 16, 17, 20, and 28 were drilled from 1907 to 1913, but most of them were drilled in 1919 and 1920. Between 1922 and 1927 eight oil or gas wells were completed in sec. 3. Since 1927 only a few wells have been drilled in the township. Of these, one gas well was drilled recently in sec. 29, and another in sec. 32; a gas well in sec. 8 was deepened and a dry hole was drilled in sec. 29.

The oil recovery to the acre in T. 26 N., R. 11 E., has not been large. The data on production from 1916 to 1937, inclusive, indicate that the total production from the Bartlesville sand ranges from 100 to 120,000 barrels to the quarter section, which is an average yield of about 7,000 barrels to the well. Available data for wells producing from the Burgess sand-Mississippi lime zone in the central part of the township show that the average recovery of oil to the well is about 9,000 barrels. The oil wells producing from the Wayside sand in the SE¼ sec. 1 yielded a total of about 11,000 barrels from 1919, when the wells were drilled, to 1925, when the lease was abandoned.

The subsurface investigation of T. 26 N., R. 11 E., was made in 1935 by L. E. Kennedy. The data on production were compiled in 1938 by Miss Anna L. Weinrich of the Osage Indian Agency, from records on file at the agency.

STRUCTURE AND DEVELOPMENT

T. 26 N., R. 11 E., is in the north-central part of a belt of country 10 to 15 miles wide that extends northward along the eastern margin of Osage County and is characterized by pronounced folds.[14] The top of the Oswego lime, which is the datum used for drawing the subsurface structure contours on plate 5, has a regional dip westward across the township of about 35 feet to the mile. The regional dip is interrupted, however, by several pronounced anticlines and synclines, the most prominent of which are the Panther Creek, Lost Creek, Buck Creek, and Jones anticlines and the Okesa and Whisky Hollow domes. A pronounced syncline extends in an irregular northeasterly course from the west-central part across the township, and another syncline extends northeastward from the middle of the south boundary into sec. 12.

The main structural features of the buried rocks are reflected in the attitude of the exposed rocks, as shown by Clark's structure contour map.[15] In most localities the dips in the buried rocks are steeper than those in the exposed rocks, and the crests of the folds in the buried rocks are offset short distances from the crests in the exposed rocks. Two faults in sec. 17, each with a small displacement, cut the exposed rocks, but the data are insufficient to determine the depth to which the buried rocks are affected.

SECS. 1 AND 2 AND N½ SEC. 12

Relatively small amounts of oil have been produced from the Wayside sand in secs. 1 and 2 and the N½ sec. 12; a few wells yielded small amounts of oil from the Bartlesville sand; and one well yielded oil and one gas from the Burgess sand-Mississippi lime zone. The depth to the Wayside sand is about 800 feet, to the Bartlesville sand about 1,500 feet, and to the Burgess sand-Mississippi lime zone about 1,700 feet.

The initial yields of the wells producing from the Wayside sand ranged from 2 to 100 barrels of oil a day and averaged about 15 barrels. The wells in sec. 1 producing from the Wayside sand were drilled in 1919 and 1920 and abandoned in 1925; their total yield was 10,907 barrels, which is an average of about 1,000 barrels to the well. Wells 1 and 2, in the NW¼ sec. 12, were drilled in 1921, and their total yield to the end of 1937 was 7,509 barrels. Well 4, in

[14] Bass, N. W., Kennedy, L. E., Dillard, W. R., and Leatherock, Constance, Subsurface geology of Osage County, Okla.: United States Department of the Interior Press Memorandum 105368, pls. 1 and 2, 1936.

[15] Clark, F. R., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pl. 15, 1922.

the NW¼ sec. 12, was drilled in 1938 and had an initial yield of 4 barrels a day. Well 1 was deepened into the Bartlesville sand but failed to find oil there.

Of the wells producing from the Bartlesville sand, the two in the NW¼ sec. 2 were drilled in 1924 and 1926 and by the end of 1937 had produced a total of 19,365 barrels of oil. The two wells in the NE¼ sec. 2 were drilled in 1922 and were abandoned within a few months, after they had yielded a total of 127 barrels of oil.

The initial yield of the oil well in sec. 1 that produced from the Burgess sand-Mississippi lime zone was only 3 to 5 barrels a day, and the initial yield of the gas well in the NE¼NW¼ sec. 1, was 1½ million cubic feet a day. Most of the wells are low on the south flank of the Bachius anticline, the crest of which is near the east quarter corner of sec. 36, T. 27 N., R. 11 E. The few wells in sec. 2 are in or near the syncline that lies between the Bachius and Doe Creek anticlines, and the three wells in the NW¼ sec. 12 are a short distance southwest of the axis of the syncline that bounds the Bachius anticline on the southwest. The distribution of the producing wells in secs. 1 and 2 and the N½ sec. 12 and the wells in the southeastern part of T. 27 N., R. 11 E., indicate that the occurrence of oil in this area is not controlled by the structural attitude of the rocks. It appears probable that additional wells might produce from the Wayside sand in sec. 12, and from the Bartlesville sand in the NW¼ sec. 2, but the small yields of the old wells indicate that the yields of new wells also would be small.

DOE CREEK ANTICLINE

Much of the southeastern part of the Doe Creek anticline lies in secs. 2, 3, and 4 of T. 26 N., R. 11 E. The anticline bulges into a local dome in the N½ sec. 3 of this township, and the S½ sec. 34, T. 27 N., R. 11 E. The crest of the dome on the Oswego lime (see pl. 5) lies about a quarter of a mile north of the crest in the exposed rocks.[16]

The Bartlesville sand yields oil in six wells in sec. 3 on the south flank of the dome at depths of 1,480 to 1,560 feet. The initial daily yields of the wells ranged from 8 to 50 barrels.

The Burgess sand-Mississippi lime zone yields gas in three wells in the N½ sec. 3 at a depth of about 1,850 feet. The gas occurs in the upper 25 to 45 feet of the Mississippi lime. The initial daily yields of the wells ranged from 2¼ to 4½ million cubic feet. The Burgess sand-Mississippi lime zone is reported also to have yielded a show of gas—2 million cubic feet—in the dry hole near the center of the SE¼ sec. 3, where the rocks are structurally about 70 feet lower than on the crest of the dome.

[16] Clark, F. R., op. cit., pl. 15.

The oil wells producing from the Bartlesville sand were drilled from 1922 to 1925, and by the end of 1937 they had produced a total of 43,192 barrels. The dry hole (No. 2) in the center of the north line of the SW¼ NE¼ sec 3, which was completed in 1938, and the dry hole near the center of the SE¼ of the same section appear to establish the boundary of the producing area on the northwest and southeast, but it is probable that the oil-producing area in sec. 3 could be extended northeast and southwest by additional drilling. The small yields of the old wells indicate that the yields of new wells probably would be small.

SAND CREEK ANTICLINE

A part of the Sand Creek anticline is in sec. 6. One well was drilled in the E½NW¼ sec. 6, on the southeast flank of the anticline. The well produced a show of oil from the Bartlesville sand, which was only 10 feet thick, and about five barrels a day from the Burgess sand-Mississippi lime zone. The well was completed in September 1920 and was abandoned about a year later, after it had produced a total of only 320 barrels. It appears probable that wells drilled in the N½NW¼ sec. 6 would produce oil from the Bartlesville sand because wells north, northwest, and west of this tract produce oil from this sand. The well yields are expected to be relatively small.

SYCAMORE DOME

The Sycamore dome, whose crest is in the SW¼ sec. 7, covers a small area and has only a small structural closure. The positions of the structure contour lines representing this dome on plate 5 are based almost entirely on the structure contour map of the exposed rocks.[17] One well on the northwest flank of the dome has been drilled into the Siliceous lime; the log records no show of oil or gas. The dome is not particularly attractive as a site for prospecting because it appears to be only a very small structural feature low on the west flank of the large Buck Creek anticline.

BUCK CREEK ANTICLINE

A large, complex fold whose axis trends northeastward across parts of secs. 18, 17, 8, 9, and 10 is known as the Buck Creek anticline. In addition to the Sycamore dome, which lies low on its west flank, it has two subsidiary domes on its crest, one in the SE¼ sec. 8 and the other near the west quarter corner of sec. 10. The anticline as shown on the Oswego lime (pl. 5) is similar in its main features to the anticline in the exposed rocks, except that the dips on the Oswego lime are much steeper than the dips in the exposed rocks.

[17] Clark, F. R., op. cit., pl. 15.

Between 60 and 70 wells have been drilled on the Buck Creek anticline, of which a few more than 50 produced oil or gas from the Bartlesville sand, 5 produced gas from the Burgess sand-Mississippi lime zone, 2 in the SE¼ sec. 5 produced oil for a time from the Peru sand, and one in the NW¼ sec. 16 produced oil from the Wayside sand. The main tracts producing from the Bartlesville sand are on the south flank of the anticline and in the syncline and the structural basins that lie between the Buck Creek anticline and the Okesa dome. The area that contains the wells with the largest initial daily yields and the largest total yields lies in the N½ sec. 20, in the bottom of the syncline and the structural basin. The depths to the Bartlesville sand in this area range from 1,560 to 1,795 feet. The initial daily yields of the oil wells ranged from 3 to 600 barrels. The initial daily yields of most of the wells in the NE¼ sec. 20 exceeded 100 barrels, but the yields of most other wells were less than 50 barrels. The total amount of oil produced from the Buck Creek anticline is shown in the following table:

Oil produced from the Buck Creek anticline

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
SW¼ sec. 4	Prior to July 1916	[1] 15,250	
SE¼ sec. 5	do	[1] 16,694	
SW¼ sec. 9	do	Unknown	
NW¼ sec. 16	do	[1] 37,577	
SW¼ sec. 16	1919	10,165	Abandoned in 1935.
NE¼ sec. 17	Prior to July 1916	[1] 7,985	
SE¼ sec. 17	1920	44,184	Abandoned in 1938.
NW¼ sec. 17	1918	42,126	
SW¼ sec. 17	1919	3,235	
NE¼ sec. 18	1921	2,062	Abandoned in 1928.
NE¼ sec. 20	1920	69,082	
NW¼ sec. 20	1919	45,833	
		294,193	

[1] Does not include amount produced prior to July 1916.

Most of the area of the Buck Creek anticline has been tested for oil and gas. It is probable, however, that additional wells that would produce from the Bartlesville sand could be drilled in the NW¼ sec. 17, the SE¼NE¼ sec. 18, and the SE¼SW¼ sec. 8. It is doubtful whether the undertaking would be profitable, however, because the small yields of the old wells in the NW¼ sec. 17 indicate that the yields of new wells also would be small. The dome whose crest is near the west quarter corner of sec. 10 might yield gas from the Siliceous lime at a depth of about 2,100 feet. It is not improbable that the oil-bearing lens of Bartlesville sand in the NW¼ sec. 16 and the SW¼ sec. 9 may extend northeastward into the NE¼ sec. 9, because most lenses of Bartlesville sand in this part of Osage County trend northeast and lie in northeastward-trending belts.

BUCK POINT DOME

The Buck Point dome is an irregular-shaped fold whose crest is in the NE¼ sec. 14. This dome and the Whisky Hollow and Okesa domes together form a prominent anticline that extends southwest for several miles. The Buck Point dome has a broad, nearly flat top. Its structural closure on the top of the Oswego lime (pl. 5) appears to be no greater than its closure in the exposed rocks,[18] but the amount of closure on the Oswego lime could not be determined precisely because of the lack of datum points on the southeast flank of the dome.

Several wells on the Buck Point dome produced gas and a few wells produced small amounts of oil from the Burgess sand-Mississippi lime zone. The initial daily yield of gas wells 206 and 218 in the SE¼ sec. 11 was 4 million cubic feet a day each, but the initial yields of the other gas wells were not learned. The initial daily yields of the three oil wells in the NE¼ sec. 15 ranged from 10 to 40 barrels. The wells in the NW¼ sec. 12 that produce oil from the Wayside sand are on the northeast flank of the dome but are not included here because they were described with the field in sec. 1. (See p. 191.) It is not improbable that a few wells that would yield gas in small amounts could be drilled in the SW¼ sec. 11 and the S½N½ sec. 14, but it is questionable whether the undertaking would be profitable. The Siliceous lime was tested in well 218, on the crest of the dome, but was found barren of oil and gas.

ALMEDA FIELD

The western part of the Almeda oil and gas field lies mainly on the west flank of the Panther Creek anticline, whose crest is in the western part of T. 26 N., R. 12 E. Most of the wells in the field were drilled in 1913 and 1914. Nearly all the gas wells have been abandoned but most of the oil wells are still producing. The oil is found in the Bartlesville sand at depths ranging from 1,485 to 1,600 feet. The initial yields of the wells ranged from 5 to 420 barrels a day. Four wells had an initial daily yield of more than 200 barrels each, but the initial yield of most wells was less than 75 barrels. The data on production for the period prior to July 1916 were available for only the SE¼ sec. 24. This tract began producing in 1913 and by the end of 1937 had produced a total of 240,724 barrels of oil, which is a yield to the acre of about 2,200 barrels. The total production from July 1916 to the end of 1937 was 42,811 barrels from the SE¼ sec. 13 and 91,155 barrels from the NE¼ sec. 24.

The gas is found in the Burgess sand-Mississippi lime zone at depths ranging from 1,585 to 1,845 feet and in an area in which these rocks are from 20 to 140 feet lower structurally than on the

[18] Clark, F. R., op. cit., pl. 15.

crest of the anticline. The well logs indicate that no Burgess sand is present here and that the gas occurs in the uppermost part of the Mississippi lime. The initial yields of the gas wells ranged from 2 to 10 million cubic feet a day. Additional wells drilled on the higher part of the anticline in the E½E½ sec. 24 and in the NE¼ sec. 25 would probably yield gas.

WHISKY HOLLOW DOME

The Whisky Hollow dome, whose crest is in the NE¼ sec. 22, is the middle one of three domes that lie along the crest of an anticline that extends southwestward from sec. 12 nearly across T. 26 N., R. 11 E. The crest of the Whisky Hollow dome on the Oswego lime is in about the same position as its crest in the exposed rocks,[19] but the dips in the Oswego lime on the flanks of the fold are steeper than the dips in the exposed rocks. For a time gas was produced in several wells from the Burgess sand-Mississippi lime zone near the crest and on the northwest flank of the dome. Oil is produced from the Burgess sand-Mississippi lime zone in several wells and from the Bartlesville sand in two wells low on the northwest flank of the dome. The depth to the Burgess sand-Mississippi lime zone is about 1,650 feet. The initial yields of the gas wells ranged from 2 to 3 million cubic feet a day. The initial yields of the oil wells, some of which were drilled as early as 1905 and 1906, were not learned. The total yield of the oil wells in the SW¼ sec. 15 from July 1916 to the end of 1937 was 51,618 barrels. The amount of oil produced prior to July 1916 was not learned.

It is probable that additional wells drilled in the SE¼ sec. 15 and the NE¼ sec. 22 would produce gas from the Burgess sand-Mississippi lime zone. A well should be drilled also on the crest of the dome to test the Siliceous lime, which would be encountered at a depth of about 1,950 to 2,000 feet. The Siliceous lime commonly yields gas in this part of Osage county.

OKESA DOME

The Okesa dome is a prominent upfold on a major anticline that extends southwestward from sec. 12 nearly across the township. The structural closure of this dome is about 50 feet on the top of the Oswego lime (pl. 5) and about 30 feet in the exposed rocks.[20]

The Bartlesville sand yielded small amounts of oil in several wells low on the northwest flank of the dome and in other wells low on the south flank and in the syncline between the dome and the Jones anti-

[19] Clark, F. R., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey, Bull. 686, pl. 15, 1922.
[20] Idem.

cline. The initial daily yields of most of the wells ranged from only 10 to 30 barrels, and all but a few of the wells have been abandoned. The oil wells producing from the Bartlesville sand in the N½ sec. 20 in the syncline between this dome and the Buck Creek anticline are described on page 194 in connection with the Buck Creek anticline. A few wells yielded gas and a few others yielded small amounts of oil from the Burgess sand-Mississippi lime zone. One well near the crest of the dome yielded initially 2 million cubic feet of gas a day from the Siliceous lime, at a depth of 2,028 feet. The wells in the SE¼ sec. 20 produced a total of 13,565 barrels from July 1916 to the end of 1937, and the single well in the SW¼ sec. 20 produced a total of 1,736 barrels from March 1921 to November 1929, when it was abandoned. The amount of oil produced prior to July 1916 from the SE¼ sec. 20 was not learned.

The small yields of the many wells drilled on the Okesa dome afford little encouragement for drilling additional wells.

LOST CREEK ANTICLINE

The Lost Creek anticline, which is in secs. 29, 30, and 31, has a dome on its crest in secs. 29 and 30. Little confidence can be placed in the position of the structure contours for this area as shown on plate 5, however, because they are based on too few control points. Nevertheless, Clark's structure contour map of the exposed rocks [21] shows a fairly prominent anticline whose crest is a few hundred feet north of the center of the SE¼NE¼ sec. 31. Two wells were drilled in sec. 31 into the Mississippi lime, but they found no oil or gas. Two wells on the dome in secs. 29 and 30, however, produced gas from the Burgess sand-Mississippi lime zone. The well in the northeast corner of the SE¼ sec. 30, produced initially 2½ million cubic feet a day, and the well in the SW¼ sec. 29, produced initially 1½ million cubic feet a day. The well in the SW¼ sec. 29, tested the Siliceous lime also, but found it to be water-bearing.

JONES ANTICLINE

The Jones anticline, whose crest is in the NE¼ sec. 33, is one of the most pronounced upfolds in the township. It has a structural closure of about 100 feet on the Oswego lime (see pl. 5) and about 30 feet in the exposed rocks.[22] The anticline, nevertheless, has been disappointing as a site for an oil and gas field. A few wells produced gas from the Burgess sand-Mississippi lime zone, which lies at a depth of about 1,840 feet. The initial daily yield of one of these wells was 3,300,000 cubic

[21] Clark, F. R., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey, Bull. 686, pl. 15, 1922.

[22] Idem.

feet, but the yields of the others were not learned. The Bartlesville sand yielded oil in several wells low on the northwest flank, in the syncline between this anticline and the Okesa dome, and in one well low on the west flank. All the wells have been abandoned except well 1 in the northeast corner of the SE¼ sec. 32, which has produced a total of 12,203 barrels of oil, but only 442 barrels in 1937. The initial daily yields of most of the wells were less than 50 barrels and their total yields were also small.

The total amount of oil produced from the Jones anticline is shown in the following table.

Oil produced from the Jones anticline

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
SE¼ sec. 28	May 1920	38,040	Abandoned in 1930.
SW¼ sec. 28	September 1920	5,676	Abandoned in 1929.
SE¼ sec. 32	September 1919	12,203	
NE¼ sec. 33	October 1921	721	Abandoned in 1924.
NW¼ sec. 33	November 1930	18,231	Abandoned in 1930.
		74,851	

The fact that the Siliceous lime yields gas on many domes and anticlines in this part of Osage County suggests that this lime should be tested for gas on the crest of the Jones anticline. The test well probably would encounter gas in the Burgess sand-Mississippi lime zone also. Moreover oil might be found in the Bartlesville sand north and south of well 1 in the northeast corner of the SE¼ sec. 32, but the small yields to be expected may not justify the expense of drilling the wells.

PHILLIPS ANTICLINE

The northern part of the Phillips anticline extends from the northeastern part of T. 25 N., R. 11 E., northward into secs. 35 and 36, T. 26 N., R. 11 E. The anticline is a large fold both on the Oswego lime and in the exposed rocks. Gas is produced on the anticline in secs. 35 and 36 from the Bartlesville sand and from the Burgess sand-Mississippi lime zone. The initial yield of the gas well in the SW¼ sec. 36, producing from the Bartlesville sand, was 5½ million cubic feet a day. The well was drilled in 1920 and is still producing. The initial yield of the well in the NW¼SE¼ sec. 35, producing from the Burgess sand-Mississippi lime zone, was 4½ million cubic feet a day. This well was drilled in 1927 and is still producing. It appears probable that additional wells drilled in the SE¼ sec. 35 and the SW¼ sec. 36 would also produce gas from the Bartlesville sand and the Burgess sand-Mississippi lime zone, and it is not

unlikely that the Siliceous lime would yield gas on the crest of the anticline in the SW¼SW¼ sec. 36.

T. 27 N., R. 11 E.

T. 27 N., R. 11 E., is in northeastern Osage County, and its southeast corner is about 4 miles northwest of Bartlesville. About 365 wells have been drilled in the township, and oil and gas have been found in many widely distributed localities. Oil or gas occurs in six stratigraphic zones. Of these, the Burgess sand-Mississippi lime is the reservoir rock in more wells than any of the others. The Bartlesville sand ranks second in importance as a producer of oil, but it has yielded very little gas, and all the areas that produce from it are in the south half of the township.

Oil was first produced in 1905 and 1906 from wells in secs. 33 and 34, on the north flank of the Doe Creek anticline, and a few wells that produced gas were drilled in the western part of the township during these two years. Most of the wells on the Mathews dome were drilled in 1922 to 1925; those on the Musgrove dome were drilled in 1926 and 1927; those on the Alvin dome in 1919 to 1927; those in sec. 18 in 1914 to 1921; those in sec. 30 in 1914 to 1921; those in sec. 31 in 1919; those on the Elkins anticline in 1914 to 1919, except one gas well which was drilled in 1905; those on the Bighorse anticline in 1928 to 1930; and those in secs. 35 and 36 in 1919 to 1927.

About 2 million barrels of oil was produced from T. 27 N., R. 11 E., between July 1916 and the end of 1937. About a dozen tracts produced oil prior to July 1916, but the amount produced up to that time was not learned. The total yield of oil to the acre in most tracts has been small. The largest total yield to the acre was obtained from the Burgess sand-Mississippi lime zone in the NW¼ sec. 18, where the total yield to the acre to December 31, 1937, had been a little less than 3,500 barrels. The average yield to the acre from the Bartlesville sand to the end of 1937, was about 1,400 barrels in secs. 22 and 27, and a little less than 1,100 barrels in the S½ sec. 36. The few data available indicate that the average total yield to the acre from the Wayside sand is less than 1,000 barrels. The total yields of the gas-bearing areas were not learned. The investigation indicates that there are a few localities that should be tested for gas in the Siliceous lime and that some of the areas producing gas from the Burgess sand-Mississippi lime zone might be extended.

The subsurface investigation of T. 27 N., R. 11 E., was made in 1935, mainly by Otto Leatherock, although part of it was conducted by L. E. Kennedy. The data on production were compiled in 1938 by Miss Anna L. Weinrich of the Osage Indian Agency, from records on file at the agency.

STRUCTURE AND DEVELOPMENT

The rocks in T. 27 N., R. 11 E. have a regional dip westward of about 28 feet to the mile along the south boundary and about 22 feet to the mile along the north boundary, as measured on the top of the Oswego lime. This regional dip is interrupted by several domes, anticlines, structural basins, and synclines. Most of the upfolds have a structural closure of less than 80 feet and occupy an area of about a square mile. The most prominent upfolds are the Musgrove, Mathews, Alvin, and Bacon Rind domes, in the northwestern part of the township, the Bighorse and Elkins anticlines in the central part, and the Herridge, Sand Creek, Doe Creek, and Bachius anticlines in the southern part. The township contains several uncommonly deep structural basins, including those in secs. 4 and 9, 14, 27 and 34, 28 and 33.

The main structural features of the buried rocks, as shown on plate 5, are evident also in the exposed rocks, as shown on the structure contour map of the exposed rocks by Robinson and Mills.[23] The dips are steeper in the buried rocks than in the exposed rocks, and the crests of the upfolds in the buried rocks are offset with respect to the crests in the exposed rocks, the offset in most folds being less than a quarter of a mile to the west, northwest, or southwest.

MUSGROVE DOME

The Musgrove dome, whose crest is in sec. 5 (see pl. 5) was recommended by Robinson and Mills[24] as a favorable site for oil and gas. Several years after the publication of Robinson and Mills' report, gas was found on this dome in the Layton sand at a depth of about 825 feet and in the Burgess sand-Mississippi lime zone at a depth of about 1,830 feet. The initial daily yields of the wells producing from the Layton sand ranged from 750,000 to 1,000,000 cubic feet, and the initial daily yields of the wells producing from the deeper beds ranged from 1½ million to 3 million cubic feet. The logs indicate that no Burgess sand is present here and that the gas occurs in the uppermost 25 feet of the Mississippi lime. None of the wells on the Musgrove dome have tested the Siliceous lime, though it is probably a reservoir for gas in this part of Osage County. A well near the crest of the dome would encounter the lime at a depth of about 2,175 feet. One well on the southeast flank of the dome produced about 10 barrels of oil a day from the Bartlesville sand but was abandoned after producing a total of 183 barrels.

[23] Robinson, H. M., and Mills, R. V. A., in White, David, and others, Structure and oil and gas resources of the Osage Reservation, Okla.: U. S. Geol. Survey Bull. 686, pl. 41, 1922.

[24] Idem., pp. 276–277.

RUTTER ANTICLINE

The northwestern part of the Rutter anticline extends from the western part of T. 27 N., R. 12 E., northwestward into secs. 13 and 12, T. 27 N., R. 11 E. The structure contour lines on the anticline as shown on plate 5 are speculative and are based largely on the structure contour map of the exposed rocks. Nevertheless, the anticline should be investigated as a site favorable for the production of gas and possibly oil. The Burgess sand-Mississippi lime is the zone most likely to yield gas, but other zones, too, may be gas-bearing.

MATHEWS DOME

The Mathews dome in secs. 10, 11, and 15, has a structural closure on the top of the Oswego lime of 50 feet or more (pl. 5). The crest of the dome is in the NE¼SE¼ sec. 10, about 2,000 feet southwest of the crest in the exposed rocks. An unusually deep structural basin lies southeast of the dome. Several wells on the dome yield gas from the Burgess sand-Mississippi lime zone at a depth of about 1,875 feet. The logs indicate that no Burgess sand is present here and that the gas occurs in the uppermost 30 feet of the Mississippi lime. The initial daily yields of the wells ranged from 225,000 to 2,225,000 cubic feet, but their total yields were not learned. Many of the wells were completed about 12 years ago and are still producing some gas. One well in the southwest corner of the NE¼ sec. 10 yielded a total of 300 barrels of oil during 1925 but was then abandoned. Shows of oil and gas were found in the Wayside sand in several wells, but four wells drilled to test this sand in the SW¼ sec. 10 and NE¼ sec 15 failed to produce. None of the wells on the Mathews dome have tested the Siliceous lime, and inasmuch as this lime yields gas on many domes in northeastern Osage County, it should be tested here. A well on the crest of the dome would encounter the Siliceous lime at a depth of about 2,200 to 2,250 feet.

ALVIN DOME

The Alvin dome is a pronounced upfold in secs. 7, 8, 9, and 17. Its crest is near the center of the S½SE¼ sec. 8, about 1,000 feet northwest of the crest in the exposed rocks. The structural closure is about 50 feet on the Oswego lime (see pl. 5) and about 20 feet in the exposed rocks.[25]

Many wells on the Alvin dome produce gas from the Mussellem and Peoples sand zone, which is encountered at a depth of about

[25] Robinson, H. M., and Mills, R. V. A., op. cit., pl. 41.

725 feet. Other wells produce gas and two wells have produced oil from the Burgess sand-Mississippi lime zone, which is encountered at a depth of about 1,900 feet. Several of the oil wells in the NW¼NE¼ and N½NW¼ sec. 18 are low on the southwestward plunging nose or prong of the Alvin dome. They are not included here, however, as they are described for convenience below with the other wells in sec. 18, which are on the Bacon Rind dome. The initial daily yields of the wells on the Alvin dome that produce gas from the Musellem and Peoples sand zone ranged from 1 million to 8½ million cubic feet, and the initial daily yields of the wells that produce from the Burgess sand-Mississippi lime zone ranged from less than 1 million to 4¼ million cubic feet. The total yields of these gas wells were not learned. The oil well in the southeast corner of sec. 7 began producing in 1919 and by the end of 1937 had produced 14,276 barrels. The wells in the SW¼ sec. 17 produced a total of 1,726 barrels of oil from 1918 to 1922, and those in the SE¼ sec. 17 produced a total of 5,647 barrels from July 1916 to the end of 1921, when they were abandoned. The amount of oil produced prior to July 1916 from the SE¼ sec. 17 was not learned.

The Siliceous lime yields gas in the SW¼ sec. 18 on the Bacon Rind dome, which is only 1¾ miles southwest of the crest of the Alvin dome. Therefore, the Siliceous lime should be tested for oil and gas on the crest of the Alvin dome, where it would be reached at a depth not greater than 2,250 feet. It is not unlikely that additional wells drilled in the NE¼ sec. 18 would produce oil.

BACON RIND DOME

The Bacon Rind dome is a broad-crested dome in secs. 18 and 19, T. 27 N., R. 11 E., and secs. 13 and 24, T. 27 N., R. 10 E. In sec. 19 it is closely associated with the Herridge anticline from which it is separated by a low saddle in the N½ of the section. The Bacon Rind dome is separated from the Alvin dome by a deep syncline, whose axis has an irregular northwestward course from the N½ sec. 20 through the SW¼ sec. 17 and the SE¼ and N½ sec. 18.

Gas is produced from the Burgess sand-Mississippi lime zone and from the Siliceous lime on the higher parts of the dome. Oil is produced from the Burgess sand-Mississippi lime zone on the north flank of the dome, in the syncline that borders the dome on the north, and in the area lying north of the syncline. The logs indicate that no Burgess sand is present on the dome and that the oil and gas of the Burgess sand-Mississippi lime zone occur in the uppermost 50 feet of the lime. The depth to the Mississippi lime is about 1,950

feet, and the depth to the Siliceous lime about 2,150 feet. One well in the NE¼ sec. 18 is reported to be producing oil from the Mussellem and Peoples sand zone. The initial daily yields of the two gas wells producing from the Siliceous lime were 5 and 7 million cubic feet, respectively, and the initial daily yields of the gas wells producing from the Mississippi lime ranged from 2 to 4 million cubic feet. The total yields of the gas wells were not learned, but the oil wells had produced about 3,500 barrels to the acre by the end of 1937. The total amount of oil produced in sec. 18 from 1917 to the end of 1937 was 698,850 barrels; of this total, 128,506 barrels was produced from the NE¼, 554,584 barrels from the NW¼, and 15,860 barrels from the SE¼.

It is probable that a few additional wells would produce gas from the Siliceous lime on the higher parts of the dome and that a few additional wells in the Mississippi lime in the NE¼ sec. 18 would produce oil.

HERRIDGE ANTICLINE

Of the group of closely associated domes and anticlines in the western part of this township and the eastern part of T. 27 N., R. 10 E., the Herridge anticline has the fewest wells. This anticline is irregular in shape, as shown on plate 5, and is separated from the Elkins anticline on the east and the Bacon Rind dome on the north by shallow structural saddles. Several wells on the south flank and one well on the northwest flank, all of which have been abandoned, yielded small amounts of oil from the Burgess sand-Mississippi lime zone. The initial daily yields of these wells ranged from 5 to 25 barrels. A few wells yielded small amounts of gas from the Burgess sand-Mississippi lime zone. The logs indicate that no Burgess sand is present on the anticline and that the oil and gas occur in the uppermost 50 feet of the Mississippi lime.

Some oil was produced in the SW¼ sec. 19 and the NW¼ sec. 30 prior to July 1916, but the amount was not learned. Subsequent to July 1916, a total of 16,075 barrels was produced in the SW¼ sec. 19 and 97,246 barrels in the NW¼ sec. 30 before the leases were abandoned in 1930. An oil well in the NE¼ sec. 30, now abandoned, produced a total of 2,033 barrels from 1919 to 1924.

It is not unlikely that gas could be obtained by drilling additional wells into the Mississippi lime in the S½ sec. 19 on and near the crest of the dome. At least one well should be drilled on the crest of the dome to test the Siliceous lime, inasmuch as this lime yields gas on the Bacon Rind dome, only a mile to the northwest. The Mississippi lime would be encountered at a depth of about 1,800 feet, and the Siliceous lime at a depth of about 2,150 feet.

ELKINS ANTICLINE

The Elkins anticline is a pronounced fold that extends northeast from the northeast corner of sec. 31 through parts of secs. 29, 28, and 21 and into sec. 16. (See pl. 5.) The anticline includes a prominent dome in the SW¼ sec. 21 and one less steep in secs. 28 and 29. The dome in sec. 21 is unusual in that its crest on the Oswego lime lies directly beneath the crest in the exposed rocks.[26] The dome in the W½ sec. 28 and the E½ sec. 29 is not revealed in the attitude of the exposed rocks.

The Elkins anticline has yielded both oil and gas, but mainly gas from the Burgess sand-Mississippi lime zone. Recently well 446 was drilled into the Siliceous lime on the crest of the dome in the SW¼ sec. 21 and produced gas at the rate of 4 million cubic feet a day. Three wells in the SW¼ sec. 21 yielded a small amount of oil from the Bartlesville sand but were abandoned in 1931. The logs of the gas wells in the Burgess sand-Mississippi lime zone indicate that the gas occurs in the uppermost part of the lime below the horizon of the Burgess sand. The initial daily yields of only a few of the gas wells are known; these ranged from 1½ to 3 million cubic feet. One of the gas wells was drilled in 1905; others were drilled during the period 1913 to 1916, and a few of these are still producing. Most of the oil wells in sec. 20, on the northwest flank of the anticline, had initial daily yields of less than 30 barrels. These wells were drilled from 1913 to 1918, and all were abandoned before the end of 1922.

The total amount of oil produced from the Elkins anticline, from July 1916 to the end of 1937 is shown in the following table:

Oil produced from the Elkins anticline

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
NE¼ sec. 20	Prior to July 1916	[1] 20,572	Abandoned in 1922.
NW¼ sec. 20	1917	2,581	Abandoned in 1919.
SE¼ sec. 20	Prior to July 1916	8,483	Abandoned in 1922.
SW¼ sec. 21	1918	19,180	Abandoned in 1934.
SW¼ sec. 29	1920	150	Abandoned in 1920.
SE¼ sec. 29	Prior to July 1916	[1] 4,509	Abandoned in 1922.
NE¼ sec. 32	1917	313	Abandoned in 1921.
NW¼ sec. 33	Prior to July 1916	[1] [2] 1,600	Do.
		57,388	

[1] Does not include amount produced prior to July 1916.

[2] It appears probable that the oil in this tract was produced by well 74, which is shown on plate 5 as an abandoned gas well.

[26] Robinnson, H. M., and Mills, R. V. A., op. cit., pl. 41.

The success of well 446 in obtaining gas from the Siliceous lime on the dome in the SW¼ sec. 21 indicates that more wells should be drilled to the lime on this dome and that a well should be drilled to the Siliceous lime on the dome whose crest is a short distance north of the east quarter corner of sec. 29.

BIGHORSE ANTICLINE

The Bighorse anticline is a pronounced upfold whose axis trends northwest through secs. 26 and 22. Two domes occupy the crest of the fold. The crest of the main dome is in the SW¼ sec. 22, and the crest of the small dome in the NW¼ sec. 26, is about 50 feet lower than that of the main dome. (See pl. 5.) The structural closure of the anticline is about 75 feet on the top of the Oswego lime and about half as much in the exposed rocks. The crest of the main dome on the Oswego lime is about 1,000 feet west of the crest in the exposed rocks.

The Bighorse anticline was recommended many years ago by Robinson and Mills [27] as a promising site for drilling, but it was not prospected successfully until 1927. The main oil pool is found in the Bartlesville sand at a depth of about 1,700 feet and gas is found in the Burgess sand-Mississippi lime zone at a depth of about 1,900 feet. In the SW¼ sec. 26, a few wells have been completed recently in the Wayside sand at a depth of about 1,050 feet, but the yields have been very small. The initial daily yields of the oil wells producing from the Bartlesville sand ranged from 5 to 250 barrels; the initial daily yields of the gas wells producing from the Burgess sand-Mississippi lime zone ranged from 1 million to 3½ million cubic feet; and the initial daily yields of the oil wells producing from the Wayside sand ranged from 2 to 15 barrels. The total yields of gas were not learned but the total yields of oil to the end of 1937 are shown in the following table:

Oil produced from the Bighorse anticline

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
SW¼ sec. 22	1929	95,300	
SE¼ sec. 22	1927	135,307	
SW¼ sec. 23	1927	10,507	Abandoned in 1935.
NW¼ sec. 26	1933	69	Abandoned in 1933.
SW¼ sec. 26	1932	1,628	
NE¼ sec. 27	1929	30,386	
NW¼ sec. 27	1929	55,931	
		329,128	

[27] Robinson, H. M., and Mills, R. V. A., op. cit., p. 274.

The distribution of the wells indicates that the area producing from the Bartlesville sand could be extended to the south and southwest by drilling additional wells in the N½ sec. 27. Only small yields should be expected, however.

The dry hole in the northwest corner of the SE¼ sec. 22 penetrated the uppermost few feet of the Siliceous lime but found no oil or gas. This does not prove that no oil or gas occurs in the Siliceous lime on the dome, because the hole is not on the crest of the dome. A well drilled in the NW¼NE¼SW¼ sec. 22 might produce gas from the Siliceous lime.

SHAW DOME

A small, low fold, known as the Shaw dome, extends westward from the western part of sec. 24 into the SW¼ sec. 23. It lies in a region in which the rocks are structurally low, and its crest, which is only a few feet high, forms an east-west structural ridge between two structural basins.

A few wells on the Shaw dome have produced small amounts of oil from the Wayside sand, which lies at a depth of about 1,075 feet. One well penetrated the uppermost 50 feet of the Mississippi lime. The wells in the NE¼ sec. 23 were drilled in 1921 and had produced a total of 650 barrels before they were abandoned, in 1925. The wells in the SE¼ sec. 23 were drilled in 1926 and had produced a total of 6,896 barrels before they were abandoned, in 1931.

SEC. 25, SE¼ SEC. 26, AND SECS. 35 AND 36

In secs. 25, 26, 35, and 36 the Wayside and Bartlesville sands yield oil in several wells. The Burgess sand-Mississippi lime zone yields mainly gas, but has yielded a small amount of oil in one well. The oil wells producing from the Wayside sand and several of those producing from the Bartlesville sand lie in a relatively narrow belt that extends northeast through sec. 35 into sec. 25. Most of the wells producing from the Bartlesville sand lie in a narrow northward-trending belt in sec. 36, on the west flank of the Bachius anticline, and the gas wells producing from the Burgess sand-Mississippi lime zone are also in sec. 36, on the flanks of the anticline. One well in the southwest corner of the NE¼ sec. 25 produced a small amount of oil from the Burgess sand-Mississippi lime zone. The initial yields of the oil wells producing from the Wayside sand and of those producing from the Bartlesville sand ranged from 5 to 125 barrels a day, but the initial yields of most wells were less than 50 barrels. The initial yields of the two gas wells in the E½ sec. 36 were 1¼ million and 2 million cubic feet a day, respectively, but the initial yields of the other gas wells were not learned.

The total amount of oil produced in sec. 25, the SE¼ sec. 26, and secs. 35 and 36 to the end of 1937 is given in the following table:

Oil produced in secs. 25, 26, 35, and 36, T. 25 N., R. 11 E.

Tract	Date of first production	Production to end of 1937 (barrels)	Remarks
NE¼ sec. 25	1921	1,307	Abandoned in 1925.
SW¼ sec. 25	1919	15,042	
SE¼ sec. 26	1920	5,714	
NE¼ sec. 35	1918	148,846	
NW¼ sec. 35	1921	10,637	
SW¼ sec. 35	1920	31,597	
SE¼ sec. 35	1918	84,472	
NW¼ sec. 36	1918	44,689	
SW¼ sec. 36	1920	47,120	
SE¼ sec. 36	1920	49,739	Abandoned 1934.
		439,163	

It is probable that by drilling more wells in secs. 35, 36, and 25 the area producing from the Bartlesville sand and those producing from the Wayside sand could be extended southwestward and northeastward and that the area producing from the Bartlesville sand in sec. 36 could be extended southwestward. Only wells with small yields should be expected. The Siliceous lime might yield gas in the southeast corner of the NE¼ sec. 36.

DOE CREEK ANTICLINE

Much of the Doe Creek anticline lies in secs. 33 and 34, and its crest is near the south quarter corner of sec. 34. Oil has been produced since 1906 from the Bartlesville sand on the north flank of the anticline, and 7 of the 17 producing wells are still active. Gas has been produced from the Burgess sand-Mississippi lime zone in a well near the crest of the anticline (well 382) and another low on the north flank. The initial daily yield of well 382 was 4,152,000 cubic feet. After producing from the Burgess sand-Mississippi lime zone for several years, this well was deepened into the Siliceous lime, from which it produced gas at an initial rate of 3½ million cubic feet a day.

The total yield of oil from the NE¼ sec. 33 and the SW¼ sec. 34 from 1906 to the end of 1937 was 147,840 barrels. The total yield from the SE¼ sec. 33 from July 1916 to the end of 1937 was 25,303 barrels, but the amount produced from this tract prior to July 1916 was not learned. The total yield from the NW¼ sec. 34 was not learned.

SAND CREEK ANTICLINE

The Sand Creek anticline is a broad fold that lies mainly in sec. 31. Three wells on the anticline produce oil from the Bartlesville sand,

which lies at a depth of about 1,775 feet. The initial daily yield of well 3 in the SW¼ sec. 31 is reported to have been 100 barrels and that of each of the other two producing wells in the S½ sec. 31 is reported as 15 barrels. The total yield from the SW¼ sec. 31 from July 1916 to the end of 1937 was 23,414 barrels, and that from the SE¼ sec. 31 was 35,949 barrels. Two wells on the anticline tested the Burgess sand-Mississippi lime zone but failed to produce oil or gas. Additional wells that would probably produce from the Bartlesville sand might be drilled near the present producing wells in the S½ sec. 31, particularly in the SE¼ sec. 31.