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# OIL AND GAS IN OKLAHOMA

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## COTTON COUNTY

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By
W. F. Cloud

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NORMAN
February, 1930

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## ILLUSTRATIONS

## FOREWORD

In 1917 the Oklahoma Geological Survey issued Bulletin 19, Part II, entitled "Petroleum and Natural Gas in Oklahoma." This volume was so popular that the supply was soon exhausted and for several years copies have not been obtainable.

The present Director has seen the need of a revision of this bulletin. On account of the lack of appropriations he has not been able to employ sufficient help to compile the data, and has called on some twenty representative geologists throughout the State to aid in the preparation of reports on separate counties. These gentlemen, all busy men, have contributed freely of their time and information in the preparation of these reports.

It will be understood that the facts as set forth in the various reports represent the observation and opinion of the different men. The Oklahoma Geological Survey has every confidence in the judgment of the various authors, but at the same time the Survey does not stand sponsor for all statements made or for all conclusions drawn. Reports of this kind, are at best, progress reports, representing the best information obtainable as of the date issued, and doubtless new data will cause many changes in our present ideas.

W. F. Cloud, a member on the faculty of the School of Petroleum Engineering has written this report after spending considerable time in the field during the summer of 1929. Mr. Cloud had the cooperation of the companies actively engaged in the oil and gas development of Cotton County at that time, and obtained much pertinent information from them.

Norman, Oklahoma
February, 1930

CHAS. N. GOULD,
Director

# OIL AND GAS IN OKLAMOMA

# COTTON COUNTY

## INTRODUCTION

This report summarizes past and present drilling and production in Cotton County, Oklahoma; describes the surface and subsurface geology as well as it can be ascertained from data available; and gives a general idea of what may be expected as to future development.

This information may be regarded as a composite report of the county. It represents the opinions and conclusions of the writer after spending considerable time in the area, being influenced to a large extent by the written opinions and personal communications of the geologists who have worked in that section of the State.

### Acknowledgments

The writer acknowledges the following individuals who have assisted very much in the compilation of this report: Frank Gouin, Geologist, Duncan, Oklahoma, who furnished pertinent information and suggestions; Dr. Chas. N. Gould and his staff of assistants in the office of the Oklahoma Geological Survey; and numerous geologists, producers, field superintendents, and their assistants who furnished data on production, development, and other miscellaneous information.

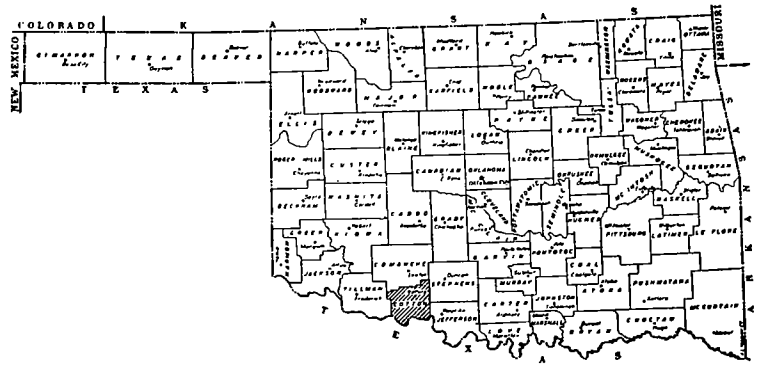


Figure 1.—Index map of Oklahoma showing location of Cotton County.

The geologic and production data compiled in 1920 in the U. S. Bureau of Mines report on the "Underground Conditions in the Walters Oil and Gas Field", by T. W. Swigart has been used to some extent.

Mr. Fred A. Bush, of the Sinclair Oil & Gas Corp., has read the manuscript and offered many helpful suggestions. Dr. Bruce Harlton, of the Amerada, has furnished the report on the Amerada No. 1 Delana well.

### Location

Cotton County is located in southwestern Oklahoma. It includes all or part of the townships included in the area from Tps. 1 to 5 S. inclusive, and from Rs. 9 to 14 W., inclusive. It includes 12 entire townships and parts of 13 others. The total area is approximately 640 square miles. This county is bounded on the north by Comanche County, on the east by Stephens and Jefferson counties, on the west by Tillman County, and on the south by Red River.

### Topography

Cotton County is located in the gently rolling area of the red beds plains. The only native trees in the country are those found along the creeks and streams. Except for several isolated hills capped by resistant sandstone the normal rolling slope is undisturbed throughout the county.

Most of the county is drained toward the south and southeast by tributaries of Red River. The central north-central, western, and most of the southern parts of the county are drained by Cache and Deep Red Run creeks. The northeast part is drained by Beaver Creek which flows southeast through Jefferson County.

## STRATIGRAPHY

### Surface Geology

The surface of the county is composed of Permian sandstones and shales, belonging to the undifferentiated Wichita and Clear Fork formations, which extend northward from north Texas into southern Oklahoma.

The Wichita formation is the oldest of the Permian series. It is probably the equivalent of the Wellington and Garber formations of the Oklahoma section. This formation covers approximately three-fourths of Cotton County. From the Wichita Mountains south it grades from arkosic sandstone through red and chocolate-colored shales and sandstones into blue shale and limestone of the Wichita beds of central west Texas.



The Clear Fork formation is obscurely exposed over part of the northern and northwestern parts of the county. It is composed of red and gray shales and isolated ledges of lenticular red and light gray sandstones. It contains dolomitic beds locally. The Clear Fork has been correlated with the Hennessey of southwest Oklahoma.[1]

Both the Wichita and the Clear Fork grade from red to brown and gray and from shale to limestone westward in the subsurface beds as well as southward where exposed.

The Wichita-Clear Fork contact can not be definitely traced across the entire county, but from the northwest corner of T. 1 S., R. 11 W. it can be traced more or less accurately in a generally southwest direction across approximately two townships. The relationship of the two formations then becomes obscure. But the outcrop of the Clear Fork beds evidently still trends toward the southwest, since the two formations can again be differentiated in southeast Tillman County.

### Surface Structure

While the dip of the surface rocks may vary frequently locally, the general direction of dip is toward the west and southwest.

In the southwest part of the county local variation of dip is discernible. In secs. 30, 31, 32, T. 5 S., R. 12 W., about one mile southeast of the Red River bridge at Burkburnett, the Permian rocks forming the river bluff have a pronounced northeast dip. This is probably an extension of the Burkburnett anticline. Reverse dips are traceable in sections 28, 29, and 32 also. It is possible that the northwest and southeast dips visible in sections 1, 2, 10, and 15 mark the trend of the axis of the Burkburnett structure.

The writer has noted east and west dips in a thin sandstone ledge along the ravines in the Keys gas field, which is located in sections 22, 23, 24, 25, 26, and 27, T. 1 S., R. 10 W. The reverse dips in this area do not exceed twelve degrees.

Gouin[2] has mapped a surface structure in the Ahpeatone area which extends over the major parts of T. 1 S., R. 13 W., and Tps. 2 and 3 S., Rs. 12 and 13 W. A check of this reconnaissance work shows the surface "high" to lie in sec. 31, T. 2 S., R. 12 W.

Munn[3] has mapped a dome in the Permian in sec. 6, 7, 8, 9, and 16, T. 4 S., R. 13 W. This is separated from the dome at Grandfield by a flat saddle in the northern part of sec. 2, T. 4 S., R. 14 W.

His report shows also a smaller dome in secs. 25, 26, and 27, T. 4 S., R. 13 W., but owing to lack of outcrops south of this location

1. Willis, Robin, Preliminary correlation of the Texas and New Mexico Permian. Amer. Assn. Pet. Geol., vol. 13, no. 8, p. 1001, 1929.
2. Gouin, Frank, personal communication.
3. Munn, M. J., Reconnaissance of the Grandfield District, Oklahoma: U. S. Geol. Survey Bull. 547, 1914.

the outline can not be definitely determined. From the center of this dome eastward the rocks appear to pitch gradually along the axis of the fold to some point near the center of sec. 26, T. 4 S., R. 12 W., from which they rise slightly to a small dome in secs. 24 and 25, T. 4 S., R. 12 W.

### Subsurface Geology

A correct interpretation of the subsurface geology of Cotton County is difficult because of the scarcity of reliable horizon markers and the lack of descriptions of the strata as to color and texture as recorded in rotary well logs. The problem is made still more difficult because to date only a few deep wells have been drilled in this county. Also, only recently have the operators paid very much attention to a systematic microscopic and paleontologic examination of well cutting and cores.

When the writer undertook the compilation of this report he had thought of preparing a northeast-southwest cross-section through Cotton County across Red River and into north Texas, thus correlating the southern Oklahoma geologic section with that area. But, owing to the time allotted for this report and to the scarcity of correlative information as to the subsurface strata of these two areas, this idea had to be abandoned. However, the correlation on the Amerada No. 1 Delana well gives a comprehensive idea of the subsurface section of the county. (See fig. 2). The Sholem Alechem limestone horizon is probably the equivalent of the lower limestone body of the Hoxbar and the limestone of the upper Deese.

### CAMBRIAN AND PRE-CAMBRIAN

It is reasonable to believe that igneous rocks might be encountered at comparatively shallow depths in the north-central part of the county, although to the writer's knowledge no well log to date records having drilled to pre-Cambrian rocks. Since the Reagan sandstone outcrops north and northeast of the Wichita Mountains, and has been found as far east as the Arbuckle Mountains, it is quite possible that it underlies the northern and northeastern parts of Cotton County. This assumption can be proved only by deeper drilling, however, as no well log submitted to date can be interpreted as having drilled into the Reagan.

As was previously mentioned, the Amerada-Delana well in the NW.¼ sec. 31, T. 4 S., R. 9 W., encountered considerable limestone of Cambrian age above granite wash at 3,275 feet, and pre-Cambrian granite at 3,350 feet.

In the north Texas area, to the south and southwest of Cotton County, igneous rocks have been encountered in several wells. The Fain-McGaha No. 1 Mathews, completed in February, 1928, in Foard County, Texas, encountered detrital chlorite and phyllite schist from 2,205 to 2,390 feet, and solid granite from 2,390 to a total depth of 2,585 feet. The Barkley and Meadows No. 1 Stephens in Wilbarger

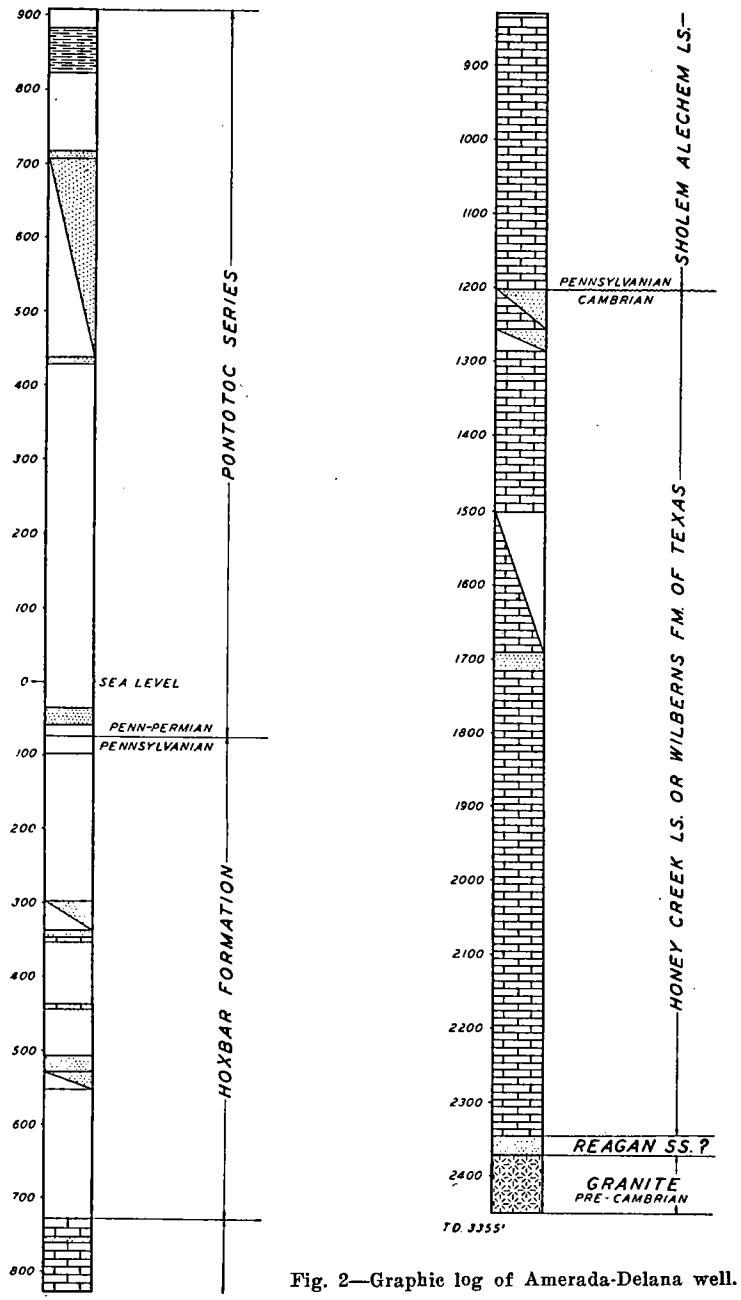


Fig. 2—Graphic log of Amerada-Delana well.

County, Texas drilled into red and black granite at 2,950 feet. The Continental-Magnolia No. 1 Beach, drilled five miles south of Burkburnett, Texas, encountered black arkose and diorite gneiss at 3,020 feet.

The evidence supplied by these three wells, together with that of the Amerada-Delana well in sec. 31, T. 4 S., R. 9 W., provided it did strike solid granite at 3,350 feet, points toward the existence of a buried granite high extending approximately east and west along the southern boundary of Tillman, Cotton, and Jefferson counties.

### CAMBRO-ORDOVICIAN

As has been stated, most of the deep tests drilled in this county have encountered the Arbuckle limestone.

The Magnolia Petroleum Company drilled in to the Arbuckle lime at 3,017 feet in a well in the NE.¼, SW.¼ sec. 25, T. 1 S., R. 9 W., in Stephens County about 12 miles northeast of the Walters field.

Other wells wherein the Arbuckle limestone is reported to have been encountered in Cotton County are listed below:

| LOCATION | DEPTH TO ARBUCKLE |
|---|---|
| NE.¼ sec. 5, T. 2 S., R. 12 W. | 2,150 |
| SE.¼ sec. 21, T. 4 S., R. 9 W. | 3,155 |
| SW.¼ sec. 29, T. 4 S., R. 11 W. | 2,970 |
| NW.¼ sec. 31, T. 2 S., R. 12 W. | 2,680 |
| NW.¼ sec. 31, T. 4 S., R. 9 W. | 3,275(?) |
| NE.¼ sec. 33, T. 2 S., R. 9 W. | 3,340 |
| SE.¼ sec. 32, T. 1 S., R. 10 W. | 4,336 |
| SW.¼ sec. 23, T. 2 S., R. 12 W. | 2,600 |

### ORDOVICIAN

With the possible exception of the northeastern part of the county, the Simpson formation is probably absent in most of Cotton County, the Pennsylvanian strata being directly above the Arbuckle lime. This may be attributed to two causes: (1) block faulting in the region adjacent to the Wichita Mountains; and (2), this area may be presumed to have been a positive element during these periods. So, there possibly was no deposition upon the eroding Arbuckle lime until Pennsylvanian time. To the best of the writer's knowledge only two wells previously referred to have encountered strata younger than the Arbuckle limestone beneath rocks of Pennsylvanian age. If any post-Arbuckle deposits were made in this area they must have been thin and were eroded off and carried away before the encroachment of the Pennsylvanian seas.



### PENNSYLVANIAN

After consulting various geologists who have done work in southern Oklahoma and northern Texas, the writer has concluded that very little exact data are available as to just what part of the Pennsylvanian section is present north of Red River in the area occupied by Cotton County.

According to Dott[4] the southeast part of Cotton County was submerged during upper Caney and Wapanucka time. An examination of several well logs obtained from this area causes the writer to believe that the Cup Coral, Deese, and Hoxbar members of the Glenn formation are present, also. The Amerada-De Lana well in sec. 31, T. 4 S., R. 9 W. shows Hoxbar from 1,005 to 1,346 feet, and Deese from 1,346 to 2,360 feet, with Ordovician strata to the top of the granite wash at 3,275 feet. However, the opinion of geologists is divided as to the age of the strata penetrated in this well. Several hold the opinion that the entire section to 3,275 feet is Permo-Pennsylvanian, and that it was lower Arbuckle lime instead of granite encountered at 3,275 feet.

The total thickness of the Permo-Pennsylvanian section in the area of the Walters field is approximately 3,910 feet. A well drilled in 1927 by the Garvin Drilling Company in sec. 32, T. 1 S., R. 10 W. encountered the Simpson formation from 3,910 to 4,336 feet, and drilled into the Arbuckle lime to a total depth of 4,338 feet. The log of this well is as follows:

*Log of Garvin Drilling Co.'s well, Fink No. 1, SEi¼ SE.¼ SE.¼ sec. 32, T. 1 S., R. 10 W.*

| Formation | Top | Bottom |
|---|---|---|
| Red beds and shale | 0 | 34 |
| Sand | 34 | 51 |
| Red beds | 51 | 83 |
| Pack sand | 83 | 155 |
| Red beds and shale | 155 | 339 |
| Pack sand and red beds | 339 | 368 |
| Pack sand, red beds | 368 | 634 |
| Red sandy shale | 634 | 902 |
| Sand | 902 | 908 |
| Shale | 908 | 1041 |
| Sand and shale | 1041 | 1092 |
| Sandy lime-cored | 1092 | 1097 |
| Brown sand and shale | 1097 | 1230 |
| Lime | 1230 | 1232 |
| Hard brown sand and shale | 1232 | 1375 |
| Broken lime | 1375 | 1389 |
| Shale-brown, cored at 1574′ | 1389 | 1575 |
| Lime | 1575 | 1576 |
| Pack sand-cored | 1576 | 1577 |
| Brown sandy shale | 1577 | 1601 |
| Broken lime-cored | 1603 | 1601 | 1605 |
| Broken sandy shale-cored | 1608 | 1605 | 1649 |
| Broken lime | 1649 | 1654 |
| Brown shale-cored | 1679 | 1654 | 1687 |
| Lime-cored | 1687 | 1694 |
| Red and brown shale | 1694 | 1757 |
| Lime | 1757 | 1759 |
| Shale and boulders | 1758 | 1785 |
| Broken hard lime | 1785 | 1796 |
| Brown shale | 1796 | 1851 |
| Hard broken lime | 1851 | 1868 |
| Blue sticky shale and boulders | 1868 | 1934 |
| Cored 1899′ broken lime | 1934 | 1978 |
| Red, blue sandy shale | 1978 | 1968 |
| Cored 1940,-48,-49,-56,-57 | | |
| Sand oil-cored | 1968 | 1978 |

(Continued on page 12).

4. Dott, Robert H., Pennsylvanian paleogeography: Oklahoma Geol. Survey Bull. 40-J, p. 12, 1927.

| Formation | Top | Bottom |
|---|---|---|
| Cored 1969 and 71 blue shale | 1978 | 1986 |
| Broken lime and boulders | 1986 | 2019 |
| Broken shale | 2019 | 2030 |
| Brown and blue shale with lime | 2030 | 2069 |
| Shale and boulders | 2069 | 2100 |
| Oil sand | 2100 | 2112 |
| Sandy shale | 2112 | 2165 |
| Hard lime | 2165 | 2180 |
| Lime | 2180 | 2191 |
| Red shale | 3568 | 3575 |
| Blue sandy lime and red beds | 3575 | 3578 |
| Gray lime | 3578 | 3581 |
| Red | 3581 | 3615 |
| Gray lime shells | 3615 | 3618 |
| Red lime | 3618 | 3622 |
| Gray lime and red rock | 3622 | 8634 |
| Gray lime | 3634 | 3647 |
| Water sand | 3647 | 3664 |
| Hard gray sandy lime | 3664 | 3667 |
| Water sand | 3667 | 3675 |
| Gray sand and sandy lime | 3675 | 3684 |
| Water sand | 3684 | 3712 |
| Red beds and gray lime | 3712 | 3717 |
| Red, gray and white mixtures | 3717 | 3722 |
| Blue shale | 3722 | 3728 |
| Pink shale | 3728 | 3744 |
| Brown shale | 3744 | 3767 |
| Broken lime | 3767 | 3775 |
| Blue shale | 3775 | 3795 |
| Red, blue and brown shale | 3795 | 3840 |
| Broken lime | 3840 | 3843 |
| Brown and blue shale | 3843 | 3866 |
| Lime | 3866 | 3870 |
| Brown shale and lime shells | 3870 | 3900 |
| Lime | 3900 | 3910 |
| Hard water sand | 3910 | 3935 |
| Blue shale | 3935 | 3941 |
| Hard sand | 3941 | 3945 |
| Brown shale and gravel | 3945 | 3948 |
| Brown blue and red sticky shale | 3948 | 3974 |
| Gray lime | 3974 | 4236 |
| Water sand | 4236 | 4237 |
| Lime | 4237 | 4241 |
| Black slate | 4241 | 4245 |
| Sandy lime | 4245 | 4247 |
| Water sand | 4247 | 4250 |
| Black and gray lime | 4250 | 4255 |
| Lime | 4255 | 4269 |
| Lime gray sandy | 4269 | 4275 |
| Black slate | 4275 | 4277 |
| Gray lime | 4277 | 4292 |
| Shale brake | 4292 | 4294 |
| Lime | 4294 | 4299 |
| Sandy lime | 4299 | 4303 |
| Sandy lime carrying water | 4303 | 4314 |
| Black shale | 4314 | 4336 |
| Gray lime | 4336 | 4338 |

In the northern part of Cotton County, sec. 5, T. 2 S., R. 12 W., the drill passed out of Pennsylvanian strata into the Arbuckle lime at 2,150 feet. The thickness of the Pennsylvanian in this section of the county is estimated at 1,200 to 1,350 feet.

In the Randlett area the Pennsylvanian strata are approximately 1,250 feet thick. The section here is very similar to the Cisco and Canyon sections of north Texas.

### PERMIAN

Thickness of the Permian red beds in Cotton County as revealed by well logs is very indefinite, as most of the wells were drilled with rotary tools, and very little attention was paid to proper collection of the cuttings. After examining the logs of most of the wells drilled in the county, the writer has found no formation in the Permian series which may be used as a definite horizon marker.



The Permo-Pennsylvanian contact can not be definitely located in the well logs available. However, there are probably 850 to 1,000 feet of Permian overlying the Pennsylvanian in the Walters field. These beds thicken toward the west and southwest. They are apparently 1,300 feet thick in sec. 15, T. 2 S., R. 11 W. The log of a well drilled one-half mile northeast of Emerson shows approximately 1,350 feet of sandy red shale and gumbo. A well drilled in the NW.¼ sec. 31, T. 2 S., R. 12 W. encountered coarse arkosic sand and gravel from 1,425 to 1,483 feet. This is probably the base of the Permian in this area. Farther west the red beds seem to thin out, as a thickness of only 1,240 feet was logged in a well drilled in the SW.¼ sec. 35, T. 2 S., R. 14 W.

The Amerada-De Lana well, drilled to 3,353 feet in the NW.¼ sec. 31, T. 4 S., R. 9 W., the southeast corner of Cotton County, encountered only 940 feet of strata which are considered Permian.

In the Randlett area the Permian red beds are approximately 1,600 feet thick; whereas, farther west in sec. 36, T. 4 S., R. 13 W., 1,400-1,450 feet seems to be the average thickness.

A well in the NE.¼ sec. 32, T. 4 S., R. 13 W., one and one-half miles southeast of Devol, drilled through only 1,200 feet of what is apparently Permian strata.

The Permian red beds thin toward the north in the general direction of the Wichita Mountains, being 1,250 feet thick in sec. 34, T. 1 S., R. 11 W. Northwest of this location, in sec. 9, T. 1 S., R. 12 W., Comanche County, the log of the Carmichael well shows only 1,040 feet of probable Permian sediment.

After examining approximately 250 well logs from widespread areas of Cotton County, the writer has concluded that there are possibly 1,025 to 1,850 feet of Permian non-marine and Pennsylvanian sediments (mostly marine maroon arkosic shales) underlying that area of Oklahoma. This section is thinnest in the southeast corner of the county and along the central-northern part, included in the south half of T. 1 S., Rs. 11 and 12 W.

Across Red River to the south in Wichita County, Texas, the Permian becomes thin toward the southeast. The Continental-Magnolia No. 1 Beach, drilled five miles south of Burkburnett, encountered only 870 feet of Wichita strata. Whereas, the Fair McGaha-Shell No. 1 Mathews well in Foard County, Texas, drilled through 360 feet of Clear Fork, and drilled into the Cisco at 1,150 feet. This indicates that the Wichita is approximately 800 feet thick in that area, becoming thinner toward the southwest.

## STRUCTURAL RELATIONSHIP

### Wichita Uplift

The earliest known period of folding which might have effected the subsurface structure of Cotton as well as adjoining counties is that associated with the formation of the Wichita Mountains of Comanche County.

The general trend of this uplift is toward the southeast. It is quite possible that the folding associated with it was responsible for the structures favorable for the accumulation of the oil and gas produced in Caddo, Comanche, Stephens, and northeast Cotton counties.

### Arbuckle Uplift

The other major uplift that has evidently aided in molding the subsurface structure of Cotton County is that associated with the formation of the Arbuckle Mountains. This movement evidently occurred in post-Glenn time. Possibly the area previously effected by the Wichita uplift was again subjected to movement when the Arbuckle uplift occurred, although perhaps not as intensively.

### Permian Folding

Surface folds adjacent to the Wichita Mountains indicate that they were subjected to a second disturbance since the deposition of the Wichita-Clear Fork formations. However, an appreciable amount of the folding noted in the surface Permian may be due to faulting, differential settling, and compaction of load in the thick mass of red shales that are present.

The discordance of dip between the Duncan sandstone and the overlying Permian rocks is also suggestive of some degree of disturbance during Permian time.

## OIL AND GAS DEVELOPMENT

A large number of wells have been drilled in Cotton County within the last fifteen years. However, the only commercial production to date was obtained in the Walters field. A little gas and a very small amount of oil were obtained in a few wells drilled in the vicinity west of the city of Walters; however, the sand was very thin in this area, and the wells were soon abandoned.

### The Walters Field

#### LOCATION

This oil and gas field is located northeast of Walters, Oklahoma in secs. 29, 31, 32, 33, 34, and 35, T. 1 S., R. 10 W., and secs. 1, 2, 3, 4, 5, 6, 9, and 10, T. 2 S., R. 10 W. A northeast extension of the field, known as the Keys gas field, includes the SW.¼ sec. 19 and the NW.¼ sec. 30, T. 1 S., R. 9 W., and all or parts of secs. 14, 22, 23, 24, 25, 26, and 27, T. 1 S., R. 10 W.



#### HISTORY

The first well drilled was completed as a gas well in February, 1917. It is located in the SE. cor. sec. 22, T. 1 S., R. 10 W. This well flowed about 20 million cubic feet of gas daily from a depth of 2,176 feet. The initial casing-head pressure was 875 pounds per square inch. Within two months this pressure had declined to 385 pounds, due partly to the immediate drilling of offset wells. This well is still producing a small amount of gas at 35 pounds pressure.

The largest gas well in the field was completed across the highway south of the discovery well, in the NE. cor. section 27. The initial gas volume of this well was approximately 40 million cubic feet daily at 880 pounds pressure.

The wells in the Keys area declined rapidly as drilling progressed. In the spring of 1920 the average shut-in pressure was 200 pounds. Since then the pressure decline has been slow. The average pressure in 1925 was 70 to 75 pounds. The average open-flow pressure for the entire gas area at the present time is 35 to 40 pounds. The writer witnessed a shut-in pressure text of 102 pounds made on a well in the SW.¼ SE.¼ sec. 14, T. 1 S., R. 10 W.

It is impossible to estimate how much gas this section of the field has produced to date. There has been very little water produced with the gas in this part of the field.

#### STRUCTURE

The surface structure cannot be mapped satisfactorily in this area. However, in the gas area of the northeast extension of the field the surface high is partially traceable. It is somewhat comparable to the subsurface structure of the Keys gas sand. This is the only part of the field in which any appreciable amount of surface closure can be mapped from the outcrops available.

The subsurface contour map drawn by Swigart[5] on the Priddy sand portrays a low, flat structure composed of small domes and irregular noses. Due to recent development in secs. 34 and 35, T. 1 S., R. 10 W. and in secs. 2 and 3, T. 2 S., R. 10 W., this map can now be extended to show closure on the east side of the field proper. The structure is so flat and spreads out over such a large area that the oil and water have never appeared to have undergone complete gravitational separation in parts of the field. This, in the writer's opinion, accounts for the fact that many of the wells have always produced some water, but have never been troubled much with rapid water encroachment, although the field has been producing for more than ten years.

5. Swigart, T. E., Underground conditions in the Walters oil and gas field: Bull. U. S. Bur. Mines, 1920.

### STRATIGRAPHY

There are a very few isolated outcrops over the range of the entire field. In a few places reddish lenticular sandstones and red shales are exposed along the streams and highways. The surface terrain is largely a red sandy loam belonging to a part of the Wichita formation which is Permian in age.

Well logs show the base of the Permian to be from 850 to 1,000 feet below the surface over the ridge which is responsible for the structure of the Walters field. This estimate is based solely on stratigraphic analyses of well logs and well cuttings, and is therefore debatable. The exact thickness of the Permian is made still more obscure because of the absence of fossils in the well cuttings and cores obtainable.

The only deep test ever drilled in the productive area of Cotton County was the well in the SE.¼ SE.¼ SE.¼ sec. 32, T. 1 S., R. 10 W., by the Garvin Drilling Company in 1926 and 1927. In this well red beds were logged as deep as 3,717 feet. Geologists and paleontologists are not agreed as to how much Permian, Hoxbar, Deese, and Springer sediments were encountered. However, it is quite probable that drilling stopped in the top of the Arbuckle lime.

### PRODUCING SANDS

Past and present productive areas of the entire Walters field comprise approximately 3,000 acres. A few wells flowed 1,000 barrels daily for a very short time but most of them averaged from 100 to 250 barrels and declined rapidly.

The Priddy sand has produced most of the oil in the field. It was encountered at an average depth of 2,100 feet. This sand is loose, coarse, and friable, and contains an appreciable amount of lime fragments locally. It is muddy gray in color, and is about 20 feet thick in section 3, increasing to approximately 30 feet in section 5, where it is very porous.

In a few isolated areas in the field production was obtained from what has been called the "second layer" of the Priddy sand. This is evidently a sand lens in the shale between the Priddy and the Keys sands. It lies approximately 60 feet below the top of the Priddy sand, and where found has an average thickness of 8 to 10 feet. This sand is rather fine-grained and contains more shale than the Priddy sand.

The Keys sand has been encountered at 95 to 100 feet below the top of the Priddy sand. In wells where it has been penetrated the thickness averages 15 to 20 feet. This is a tight sand. It has been logged as containing much lime in many of the wells. This is the sand that has produced most of the dry gas obtained from the northeast part of the Walters field. However, it is probable that it might produce both oil and gas in the central part of the field if the wells were deepened to it, as it has produced an appreciable amount of gas in five or six wells in the SE. ¼ sec. 31, T. 1 S., R. 10 W., which is on the west edge of the field. It is to be noted that the oil produced south and west of these gas wells is coming from the upper layer of the Priddy sand.



The Zypsie sand is located 205 to 230 feet below the top of the Priddy sand. It has produced and is still producing some oil of low gravity in the S. ½ of section 29 and the NE. ¼ of section 32. This sand is probably 20 feet thick, although it has been found in only a few wells. It is harder and contains more quartz than the other sands mentioned above, yet the gravity of the oil is lower, being only 28° A. P. I. corrected to 60° F.

### WELL SPACING

The wells drilled in the Walters field were usually uniformly spaced with four wells on each 40-acre tract. On a few leases as many as six wells were drilled on 40 acres. In a few instances wells were spaced as far as 850 to 900 feet apart at first, then later wells were drilled between these locations.

The gas wells were not so closely spaced as the oil wells. They averaged one well to each 40-acre tract except where immediate lease offsets were drilled.

The wells that have been drilled recently, as well as those drilling at the present time, have been located promiscuously, usually about 300 to 400 feet apart in any direction adaptable to best surface conditions for economic operation.

### DRILLING AND COMPLETION

Practically all of the wells in the Walters field and more than four-fifths of the wildcat wells in Cotton County have been drilled with rotary tools, as cable tools are much slower in the thick shales encountered in this section of the State.

Many of the wells were drilled-in with cable tools and spudding machines. However, the general practice in this field has been to drill-in and complete the well with rotary tools. The companies usually cemented 6 5/8-inch casing above the sand, then "rat-holed" and cored ahead until the sand was encountered. If 8-inch casing was to be cemented above the sand, one or two points of 12½-inch surface pipe were cemented. However, in most of the wells 10-inch surface pipe was used. The tendency at the present time is to use only one joint of conductor pipe, since there is no danger of gas blow-outs.

The last water sand usually encountered lies approximately 125 feet above the top of the Priddy sand. This permits the operators to easily choose a suitable place to land and cement the "oil string" in the

shales above the oil sand. Many of the wells were completed with a 5 3/16-inch perforated liner.

The wells in this field were often drilled and completed within six to eight drilling days. The contract price was usually $2.50 per foot. It costs approximately $9,500.00 to $10,000.00 to drill and complete a well and install pumping equipment.

Most of the old wells are pumped by jacks and power plants. The recently drilled wells and the old wells which are still producing more than the average, as well as the isolated wells, are hooked directly to the beam and are pumped-off once a day.

The writer believes that the inefficient use of rotary tools while drilling-in the wells has been largely responsible for the spotted and erratic production during the early development of the field, as well as at the present time. An example: recently a rotary-drilled well, offsetting a 17-barrel pumping well only 300 feet distant, failed to get production in the Priddy sand which is producing on all four locations surrounding this dry hole. The rock pressure is very low in this area, yet this well was drilled-in with the hole full of mud fluid.

On another lease in sec. 2, T. 2 S., R. 10 W., the recent extension of the field to the east, a rotary-drilled well failed to get production 250 feet from a recently completed well which is pumping 37 barrels of oil daily. The pumper on the lease informed the writer that while the offset was drilling through the "sand" the pumping well gauged five barrels increased production daily. The drillers claimed that they encountered no sand at all in this test, although it was drilled approximately 100 feet deeper than the producing offset well.

It is quite probable that inefficient use of rotary tools may account for the apparent absence of the Priddy sand in the SE. ¼ sec. 31, T. 1 S., R. 10 W., where commercial gas wells were completed in the Keys sand; yet the oil production on the east, south, and west is coming from the Priddy sand. Judging from the logs of the wells in section 31 the upper pay streaks were logged as limestones.

### PRODUCTION DATA

Swigart's report[5] shows approximately 290 producing wells, drilling wells, and locations in the Walters field in March, 1920. This does not include the 19 or 20 wells drilled west and northwest of the city of Walters, only one of which is still producing. Of this total of 290 wells only 145 produced oil in commercial quantities. There were 32 producing gas wells in the field. About 23 of these still produce commercial gas.

Since March, 1920, approximately 70 wells have been drilled in the field. These later wells were drilled in secs. 27, 29, 32, 33, 34,

5. Swigart, T. E., op. cit.



and 35, T. 1 S., R. 10 W., and in secs. 2, 3, 5, and 8 T. 2 S., R. 10 W. Most of these wells are producing small quantities of oil although the wells drilled in section 8 were dry.

Within the last two years wells have been drilled in secs. 34 and 35, T. 1 S., R. 10 W., and in secs. 2 and 3, T. 2 S., R. 10 W. This is the eastern extension of the field. Eight wells are being drilled in this area at the present time. These recently drilled wells when properly and carefully completed initial productions of 33 to 65 barrels daily.

Out of a total of approximately 175 producing oil and gas wells in 1920, approximately 45 or 50 have been abandoned, some of them prematurely, however. All of the old wells are being pumped, as there are no flowing wells in the field. Their average production is 5.5 barrels per well per day. Several of the gas wells are still capable of producing from 2 to 6 million cubic feet per day. The wells recently completed in the eastern extension of the field average 42.6 barrels daily.

Most of the oil is being produced from the Priddy sand. There are 14 wells in the SE. ¼, sec. 29, T. 1 S., R. 10 W., producing 107 barrels daily from the Zypsie sand. According to Swigart's report and available field information this is the only area that ever produced from the Zypsie sand. Apparently the Priddy sand thinned out into shale and limestone in the northwest part of the field.

The peak of average daily production per well was reached in June, 1919. It was 54 barrels at that time. The entire field reached its peak of production, 3,400 barrels per day, in September, 1919. The largest wells in the field produced between 250 and 300 barrels initial, but declined rapidly. Most of the wells had initial production ranging from 100 to 225 barrels per day.

Through the courtesy of several of the companies producing oil in the Walters field the writer has compiled the table showing the production summary of the major leases. (See page 20).

### POSSIBILITY OF FUTURE PRODUCTION

#### The Walters Field

It is quite possible that many commercial wells can be drilled east, north, and northeast of the old wells in this area, if properly completed.

Recently wells have been completed in secs. 33, 34, and 35, T. 1 S., R. 10 W., and in secs. 2 and 3, T. 2 S., T. 10 W.

The writer believes that commercial wells can be obtained by drilling to sands below the Priddy and Zypsie sands in this area.

*Production summary major leases in Walters field.*

| COMPANY | LOCATION | LESSOR | SIZE OF LEASE (ACRES) | TOT. BBLS. PRODUCED TO 7/1/29 | BARRELS PER ACRE | PRODUCING SAND |
|---|---|---|---|---|---|---|
| Gypsy | NE SE 29-1S-10W | Pruett | 40 | 458,433 | 11,461 | Zypsie |
| Gypsy | SW NW 4-2S-10W | Wilkinson | 40 | 72,462 | 1,812 | Priddy |
| Carter | W½ NE 5-2S-10W | ? | 80 | 167,680 | 2,096 | Priddy |
| Pure | SE NW 29-1S-10W | Kelly | 10 | 13,204 | 1,320 | Zypsie |
| Pure | SE SW 29-1S-10W | McMahon | 40 | 92,509 | 2,313 | Zypsie |
| Pure | W½ SE 29-1S-10W | Zypsie | 60 | 284,175 | 4,736 | Zypsie |
| Pure | NW NE 32-1S-10W | Fink | 40 | 29,893 | 747 | Priddy |
| Pure | SE NW 32-1S-10W | Kassl | 40 | 27,734 | 693 | Priddy |
| Pure | NW SE 32-1S-10W | McQuown | 30 | 46,360 | 1,545 | Priddy |
| Prairie | N½ SW 5-2S-10W | Howell | 80 | 270,320 | 3,379 | Priddy |
| Texas | N½ NW 4-2S-10W | ? | 80 | 214,970 | 2,687 | Priddy |
| McMan | SE 4-2S-10W | B. F. Priddy | 160 | 436,324 | 2,721 | Priddy |
| McMan | S½ SW 3-2S-10W | G. G. Priddy | 120 | 600,462 | 5,004 | Priddy |
| McMan | SW SE 3-2S-10W | G. G. Priddy | 120 | 600,462 | 5,004 | Priddy |
| McMan | NW NE 10-2S-10W | W. D. Priddy | 40 | 55,323 | 1,383 | Priddy |
| McMan | N½ NW 10-2S-10W | Chapman | 80 | 219,823 | 2,748 | Priddy |
| McMan | W½ NE 4-2S-10W | Patterson | 80 | 116,400 | 1,455 | Priddy |
| McMan | E½ NE 6-2S-10W | Maize | 80 | 112,370 | 1,405 | Keys & Priddy |
| McMan | E½ NW 6-2S-10W | Carr | 80 | 94,103 | 1,103 | Priddy |



**Other Parts of The County**

Reference to the oil and gas map in the pocket of this report will cause one to believe that Cotton County has been fairly well tested for commercial production. Many wildcat tests have been drilled in this county, but to date the results have been disappointing. However, in most of these wells the complete Pennsylvanian section has not been penetrated.

Due to the existence of the Wichita Mountains to the north of the county, the Arbuckle Mountains to the east, and the buried granite ridge to the south extending east and west in the vicinity of Red River, it is apparent that the central portion of Cotton County is occupied by a basin, the axis of which trends approximately east and west. In such an area, therefore, it is not probable that oil and gas exist in commercial quantities.

However, the existence of this basin, viewed in the light of present subsurface information, does not entirely condemn this central area. Minor folds and other petroliferous traps, as well as stratigraphic overlaps from the south, may exist which heretofore have not been located.