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OIL AND GAS IN OKLAHOMA

LINCOLN COUNTY

By
Dollie Radler

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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.

The separate on Lincoln County has been prepared by Miss Dollie Radler, administrative geologist of the Amerada Petroleum Corporation of Tulsa. Miss Radler has been in touch with the development of the various fields in this county since their beginning and is eminently qualified to write the present paper.

Norman, Oklahoma
May 1930

CHAS. N. GOULD,
Director

LINCOLN COUNTY

By

Dollie Radler

General Statement

Lincoln County has long been prospected for oil and gas. At the present time there are five producing fields in the county, all but one (Chandler) of which have been thoroughly prospected and their limits defined. Since the discovery of the Oklahoma City and Chandler fields there has been great leasing activity in the western half of the county and there is promise of new fields being opened in the next few years.

This paper summarizes the development to date and tends to show the different structural conditions found in the area.

Location and Area

Lincoln County is situated in the central part of the State. It extends from T. 12 N. to the center of T. 17 N., inclusive, and from R. 2 E. to R. 6 E., inclusive, embracing an area of 990 square miles. Chandler, the county seat, lies in the central part of the county.

Acknowledgments

The writer gratefully acknowledges the assistance of Robert L. Cassingham in the preparation of maps used in this report, B. H. Harlton for sample determinations, W. A. Carruth for drafting of the maps, and Sidney Powers for valuable suggestions and criticisms.

Appreciation is expressed to the Amerada Petroleum Corporation for permission to publish the report.

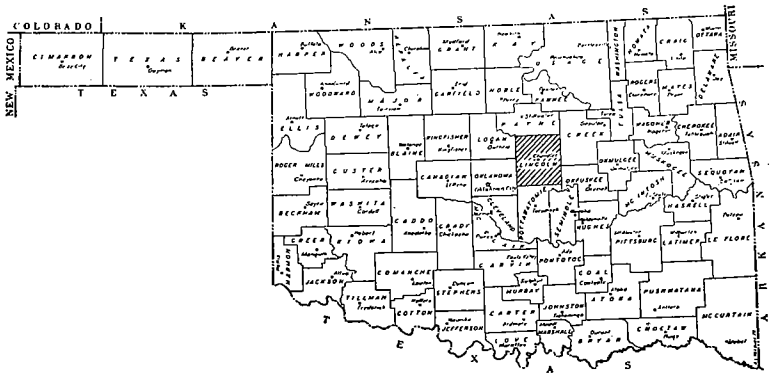

Figure 1. Index map of Oklahoma showing location of Lincoln County.

Topography

Lincoln County is located within the Sandstone Hills Region. The topography is that of a gentle hilly country. The western part of the county is largely prairie with low rolling hills, while the eastern part is timbered and the streams have dissected the surface giving rise to a rough topography. Limestones from escarpments capping the tops of the hills west of Kendrick and Avery. The surface varies in elevation from 1,080 feet above sea level, at the town of Carney in the northwestern part of the County, to 760 feet, where Deep Fork of Canadian River flows out of the county. Deep Fork of Canadian River and its tributaries drain the entire county with the exception of a small portion in the extreme northwestern part of the county which is drained by the Cimarron River.

The County is served by five railroads, the main line of the Frisco, M. K. & T. and Ft. Smith & Western, branch lines of the Rock Island, and Santa Fe. Chandler, Stroud and Davenport are the most important towns.

GEOLOGY

Surface Formations

Shales, sandstones and limestones of upper Pennsylvanian age (Neva to Pawhuska) compose the rocks cropping out in the eastern part of the county, and shales and sandstones of basal Permian age (Stillwater Group) compose the surface rocks in the western part. Gould[1] has shown the approximate Permo-Pennsylvanian contact as an irregular north-south line extending through the center of the County.

The reader is referred to the geologic map of Oklahoma,[2] for the location of the formation boundaries, areas covered by different outcropping formations, and for the location of surface faults.

STILLWATER FORMATION

The Stillwater formation as described by Aurin, Officer, and Gould[3] includes a series of red and gray sandstones, red shales and occasional limestones. Its base is the base of the Cottonwood limestone which has been traced across western Pawnee County south to the Payne County line, but cannot be followed into Lincoln County. The highest of the persistent members found in the area is the Fort Riley limestone which has been traced south to the Cimarron River in the extreme northwestern corner of the county. Other members of this formation are not differentiated in the county.

ESKRIDGE SHALE

Following Gould's[4] classification the Eskridge is the highest Pennsylvanian formation lying just below the Cottonwood limestone. In its type locality it consists of brown, green and yellow shales but in this area it merges with the undifferentiated red beds.

1. Gould, Chas. N., and Wilson, Roy A., the upper Paleozoic rocks of Oklahoma: Oklahoma Geol. Survey Bull. 41, pl. I, 1927.
2. Miser, H. D., Geologic map of Oklahoma: U. S. Geol. Survey, 1926.
3. Aurin, F. L., Officer, H. G., and Gould, Chas. N., The Subdivision of the Enid formation: Bull. Am. Assoc. Pet. Geol. vol. 10, pp. 793-794, 1926.
4. Gould, Chas. N., Index to the stratigraphy of Oklahoma: Oklahoma Geol. Survey Bull. 35, pp. 78-81, 1925.

NEVA LIMESTONE

The Neva limestone lies immediately below the Eskridge shales. This formation in Lincoln County is a series of thin limestones and limy shales, red to gray in color. It can be traced a short distance into the county, but farther south changes from limestone and shale to sandstone and shale and merges with the other undifferentiated red beds.

ELMDALE FORMATION

The Elmdale formation is composed of variegated shales with thin limestones, the most persistent member being the Cushing limestone exposed near Cushing. It can be followed south from Cushing across Lincoln County, passing near Chandler, Sparks and Prague, and finally disappears in northeastern Pottawatomie County.

SAND CREEK FORMATION

The Sand Creek formation consists of two prominent limestone members, the Foraker, 60 to 110 feet thick at the top, and the Grayhorse, 4 feet thick at the base, with intervening shales and thin limestones. In Lincoln County the limestones change to limy shales and sandstones.

BUCK CREEK FORMATION

The Buck Creek formation consists of a series of shales and limestones with two sandy zones near the top. Its aggregate thickness is 175 feet. This formation is exposed in the northeastern part of the County.

PAWHUSKA FORMATION

The Pawhuska formation consists of three beds of heavy gray limestone with intervening shales and sandstones. It is exposed in the extreme eastern part of Lincoln County near Stroud and is the oldest formation exposed in the county.

Subsurface Formations

PENNSYLVANIAN ROCKS

Rocks of Pennsylvanian age extend below the surface to depths varying from 3,800 feet in the Stroud field, to 4,500 feet at Chandler and to 5,600 feet in sec. 13, T. 13 N., R. 1 W., six miles west of the county line. They consist of alternating shales, sands and thin limestones.

The Pennsylvanian is of commercial importance at Davenport where production is obtained from two sands, the Peru or Upper sand at an approximate depth of 2,600 feet, and the Prue sand which is the main producing horizon of the field at depths of 3,250 to 3,400 feet. The production in the Peru sand has been limited to a very small area in section 3, T. 14 N., R. 5 E. Initial production ranges from 50 to 425 barrels per day of 51° oil. This sand varies between 18 and 25 feet in thickness, is very lenticular and contains lime and shale partings.

The Prue sand is a micaceous lenticular sandstone and varies in thickness from 30 to 110 feet in the field and grades into a sandy shale and limestone or pinches out entirely on the edges of the field. Initial production ranges from 15 to 1,100 barrels. Oil and gas is also found in both the Layton and Prue sands at Chandler in section 7, T. 14 N., R. 4 E.

The Bartlesville sand produces oil and gas in commercial quantities in the Shaffer pool, section 31, T. 17 N., R. 5 E., and is of minor importance in other areas. Nearly all wells on structure have shows of oil or gas in the Bartlesville horizon but in many areas sand conditions are poor and production is not found in commercial quantities.

MISSISSIPPIAN ROCKS

"MISSISSIPPI" LIMESTONE

The Mississippian in this area consists of about 250 feet of dark fine grained argillaceous limestone, which is called locally "Mississippi lime" in the Stroud field and the "Mayes" limestone member of the Caney formation farther west in the county. The Magnolia Petroleum Corporation Benedict No. 2, SW.¼ SE.¼ sec. 8, T. 14 N., R. 4 E., was completed for an initial of 5,000 barrels per day from what is believed to be the top of this formation.

CHATTANOOGA SHALE

The "Mississippi" limestone is underlain by approximately 45 feet of Chattanooga shale which is a black, non-calcareous fine grained shale. Fossils found in this formation comprise *Sporongites huronensis* and Conodonts. The Chattanooga shale is equivalent to the Woodford chert of the Arbuckle Mountains.

DEVONIAN-SILURIAN ROCKS

HUNTON LIMESTONE

The Hunton limestone consists of a white crystalline limestone varying in thickness up to 110 feet. This formation contains characteristic micro fossils which distinguish it from the older limestones. The contact between the Chattanooga and Hunton is an erosional unconformity. The Hunton lies conformably on the Sylvan shale.

Oil in commercial quantities has been found in the Hunton in the Skellyville Pool, secs. 5, 6, 7, and 8, T. 15 N., R. 6 E. It occurs in the erosional zone at the top of the formation.

ORDOVICIAN ROCKS

SYLVAN SHALE

The Sylvan shale is a gray to light green fine textured shale about 50 feet thick. It is considered in this report as belonging to the Ordovician although there is considerable discussion as to its age. A few Graptolities occur in the lowermost portion.

VIOLA LIMESTONE

Underlying the Sylvan shale is the Viola limestone which is a buff colored, fine grained to coarsely crystalline limestone about 30 feet thick. The upper portion is milky white and flaky which has lead to the local name of "buttermilk lime". The remainder is more dense and much harder. The Viola contains few micro fossils. Its presence is usually determined by lithology and by stratigraphic position in the section. The Sylvan shale lies conformably on the Viola.

SIMPSON FORMATION

Lying conformably below the Viola limestone is the Simpson formation. The upper part consists of brown dolomite about 10 feet thick and is probably the reservoir for the heavy oil produced at Stroud, although it was called Viola at the time the field was drilled. Below this Simpson dolomite is the Wilcox sand which is of commercial importance in the Stroud field where it is found at approximately 4,000 feet and at Chandler where Magnolia Petroleum Corporation's discovery well, sec. 8, T. 14 N., R. 4 E., was completed for an initial of 600 barrels in this horizon at a depth of 4,970 feet. A dry hole drilled by Slick in sec. 5, T. 14 N., R. 4 E., had 107 feet of this sand underlain by 70 feet of green, fine grained shale with sandstone partings and then drilled 270 feet of what is locally known as "Second Wilcox" sand. The first sand is believed to be the main producing horizon at Seminole and the second the "Wilcox" sand as originally named. The complete section of the Simpson formation has not been penetrated by the drill in this county.

Surface Structure

The strata of Lincoln County have a northwest-southeast strike and a southwest dip of 35 feet per mile. The normal structure is interrupted to form local anticlines and terraces. There is considerable surface faulting through the west line of R. 5 E. The extent of this faulting in the subsurface strata is unknown because of lack of data. Surface anticlines that have been thoroughly prospected reveal that the structure is reflected in the subsurface strata.

DEVELOPMENT

Owing to the proximity of Lincoln County to the Cushing field it has long received the attention of oil producers. Many wildcat tests having been drilled which had excellent showings of oil and gas before commercial production was found. Development of commercial production in the county began early in the fall of 1923 with the discovery of the Stroud field by the Union Petroleum and Supply Company. A development map of the county is shown (Plate I).

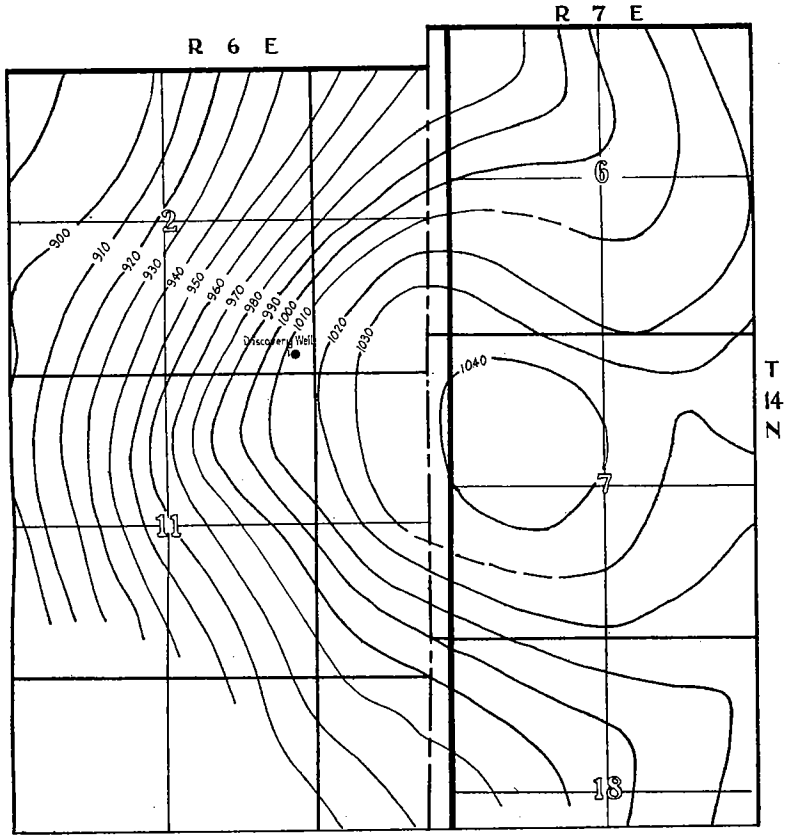

Figure 2. Surface map of Stroud pool. Contour interval, 10 feet.

STROUD POOL

The Stroud Pool is located in secs. 2, 11, and 12, T. 14 N., R. 6 E., in Lincoln County, and sec. 7, T. 14 N., R. 7 E., of Creek County, three miles southeast of the town of Stroud.

The discovery well was drilled by the Union Petroleum and Supply Company in the SE. cor. sec. 2, T. 14 N., R. 6 E., located on the west side of a closed surface anticline (fig. 2). This well encountered Wilcox sand from 4,086 to 4,088 feet and was completed for an initial of 560 barrels of 42 gravity oil, September 1, 1923. This well started a campaign of drilling and for the first time rotary drilling was used in this part of Oklahoma.

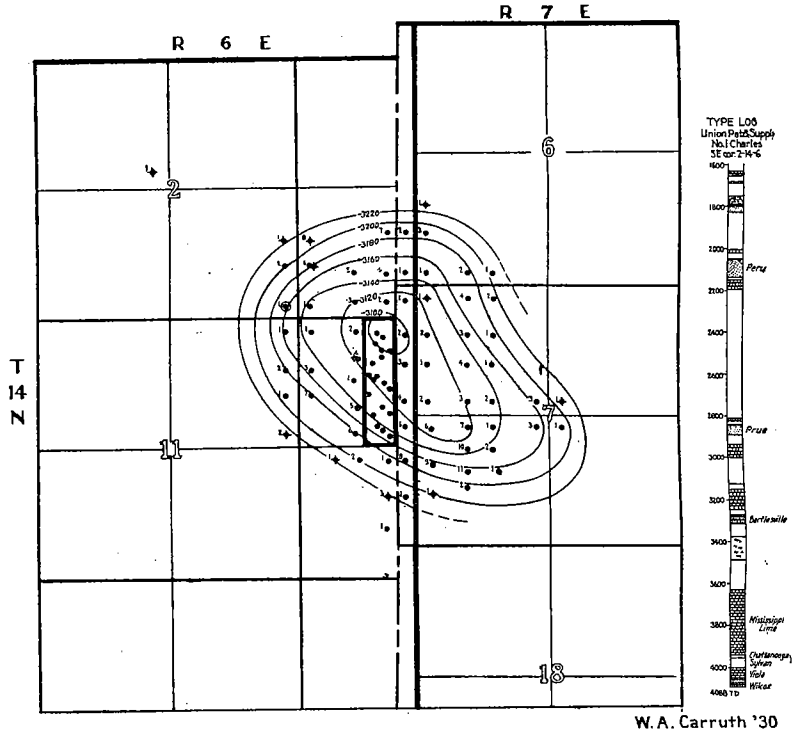

Figure 3. Subsurface structure map of Stroud pool. Contour interval, 20 feet. Contours on top of Wilcox sand.

The townsite of Key West is just east of the discovery well near the top of the surface anticline. Companies paid large sums for leases on town lots and many wells were started in the townsite. Very few of these wells showed any profit because of too close spacing of wells.

Initial production of wells ranged from 50 to 2,500 barrels per day. The field covers an area of approximately 400 acres of which half is in Creek County. The limits of the field are well defined as shown by the subsurface map, figure 3.

The field will yield ultimately an estimated figure of 18,000 barrels per acre.

DAVENPORT FIELD

The Davenport field is located in secs. 34 and 35, T. 15 N., R. 5 E., and secs. 2, 3, 4, 10 and 11, T. 14 N., R. 5 E., just east of the town of Davenport. The field was discovered by Morgan and Flynn in Sep-

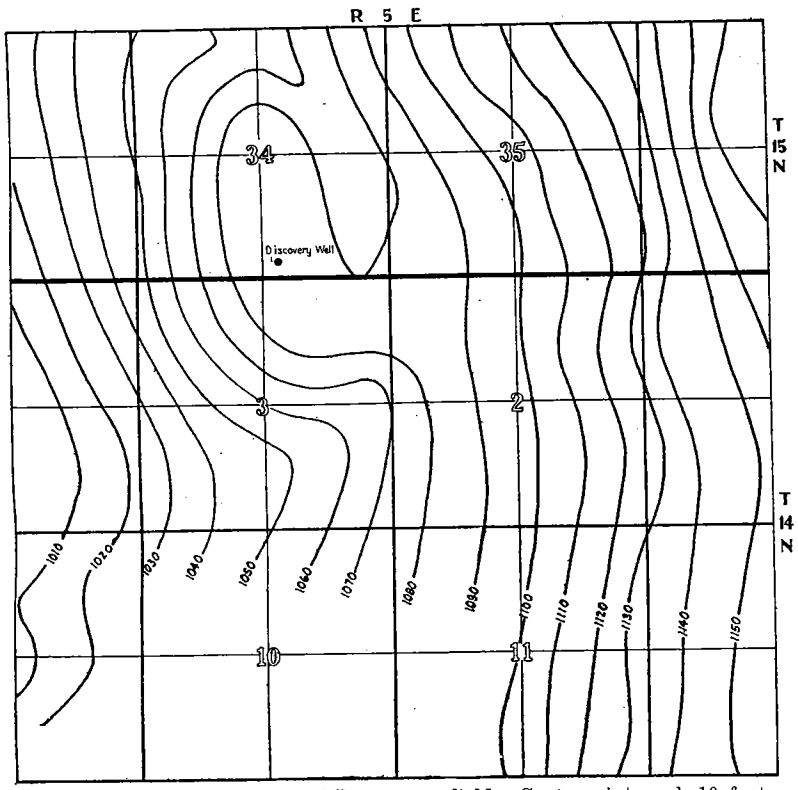

Figure 4. Surface map of Davenport field. Contour interval, 10 feet.

tember, 1924, by the completion of their No. 1 Smith in the SW. cor. SE.¼ sec. 34, T. 15 N., R. 5 E. This well had an initial of 220 barrels of oil from the Prue sand, 3,416 to 3,445 feet. It is located near the top of a surface anticline. (fig. 4). However, the producing horizon is very lenticular and the production covers a much larger area than the area covered by the surface anticline as shown by the subsurface map, figure 5.

Development progressed rapidly in the field. Wells were completed for initial productions ranging from 15 to 1,100 barrels per day from the Prue sand. On January 2, 1926, the Prairie Oil and Gas Company completed their No. 6 Stout, SW.¼ NE.¼ NW.¼ sec. 13, T. 14 N., R. 5 E., for an initial of 300 barrels of 51 gravity oil from the Peru sand, 2,630 to 3,638 feet. Only a very small area in section 3 produced from this horizon. The wells having initials ranging from 15 to 300 barrels.

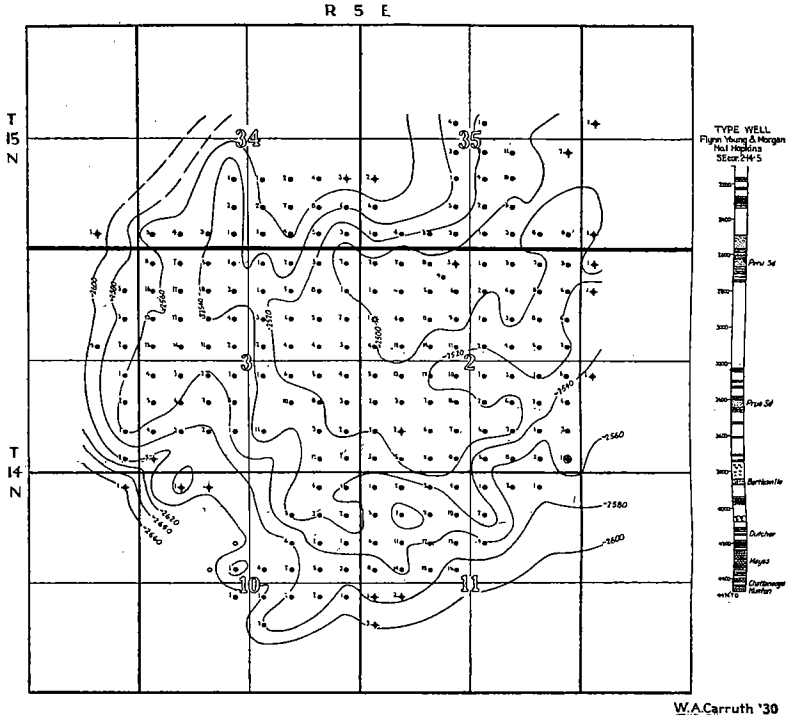

Figure 5. Subsurface map of Davenport field. Contour interval, 20 feet. Contours on top of Prue sand.

Several wells in the field have been carried to the Wilcox sand. These encountered shows of oil in the Pennsylvanian sands below the Prue but only water in the Wilcox. The meager control indicates that the structure is not reflected in the older rocks.

The Davenport oil field covers an area of 2,000 acres with an ultimate estimate per acre yield of 5,000 barrels.

The development of the Davenport field has been ably described by Brandenthaler, Schlater, and Kent[5] and the reader is referred to their report for more detailed information on the field.

5. Brandenthaler, R. R., Schlater, K. C., Kent, H. M. Engineering report on the Davenport oil field, Lincoln Co., Okla.: Dept. of Com. Bureau of Mines Report in cooperation with the State of Okla. & Bville. Ch. of Com. (The writer believes that the sand described in this report as Layton is Peru sand.)

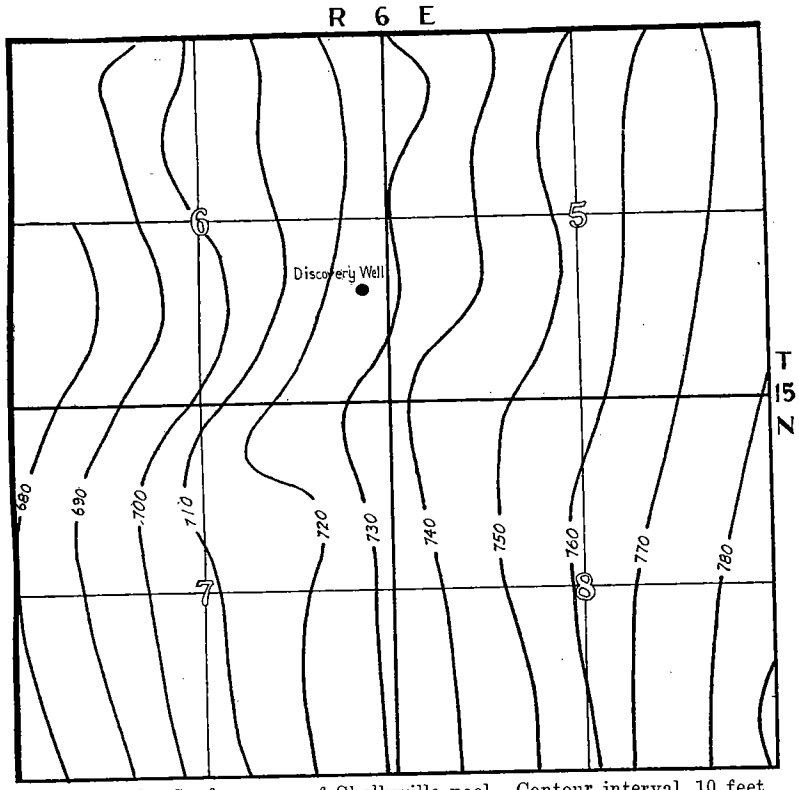

Figure 6. Surface map of Skellyville pool. Contour interval, 10 feet.

SKELLYVILLE POOL

The Skellyville Pool is located in secs. 5, 6, 7, and 8, T. 15 N., R. 6 E., three miles northwest of the town of Stroud. The discovery well cated in the SE.¼ NE.¼ SE.¼ sec. 6, T. 15 N., R. 6 E. This well was completed October 13, 1924, for an initial of 150 barrels in the was drilled by the Independent Oil and Gas Company, No. 1 Erp, lo-Dutcher sand, 3,770 to 3,777 feet, later deepened January, 1926, to 4,304 feet, encountering a hole full of water in the Wilcox sand, 4,170 to 4,190 feet. It was then plugged back to 4,030 feet and was completed in the Hunton limestone for an initial of 75 barrels after shot. This field is small and very erratic. The production is from the Hunton limestone and accumulation is in a porous zone at the contact between the Chattanooga and Hunton.

Initial productions ranged from 15 to 1,000 barrels per day. There were no wells of any importance completed in the Dutcher sand.

There is very little structure on either the surface (fig. 6) or subsurface (fig. 7) and accumulation seems to be at the erosional uncon-

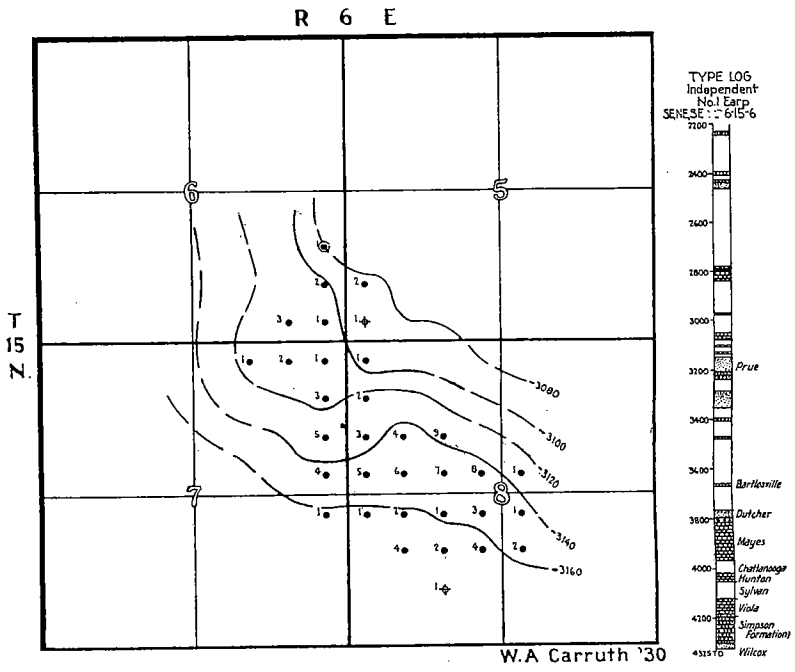

Figure 7. Subsurface map of Skellyville pool. Contour interval, 20 feet. Contours on base of Chattanooga shale.

formity near the northern limit of the Hunton formation in this part of the county.

The field covers an area of 320 acres with an ultimate estimated yield of 5,000 barrels per acre.

SHAFFER POOL

The Shaffer Pool, located in sec. 31, T. 17 N., R. 5 E., and sec. 6, T. 16 N., R. 5 E., became of commercial importance owing to the discovery of "Wilcox" sand production in the Shaffer Oil Company's No. 1 Connell, SE.¼ SW.¼ sec. 31, completed August 23, 1927, for an initial of 1,942 barrels in the "Wilcox" sand. This well is located on top of a surface anticline. Several tests had previously been drilled on this structure before the completion of this well. The first was a gas well drilled by the Cosden Oil and Gas Company, SE.¼ SW.¼ SE.¼ sec. 31, T. 17 N., R. 5 E., which was completed June 21, 1919, for 21 million cubic feet of gas in the Cleveland sand 2,060 to 2,081 feet. This well was later abandoned. On May 4, 1921, Cosden completed their No. 1 Cook, NW.¼ SW.¼ sec. 31, T. 17 N., R. 5 E., for 40 barrels in the Bartlesville sand 3,755 to 3,765 feet. At the present time there

are nine oil wells and one gas well on this structure. The structure is very small and is completely drilled up. Initial productions ranged from 50 to 1,900 barrels per day.

CHANDLER POOL

The Chandler Pool is located in secs. 7, 8 and 17, T. 14 N., R. 4 E. This area has been prospected for several years. A gas well was completed by Green and Hines, Norton No. 1, SW.¼ NE.¼ sec. 7, T. 14 N., R. 4 E., February 25, 1924, for an initial production of six million cubic feet of gas in sand found at a depth of 3,305 to 3,307 feet believed to be the Peru sand which produces at Davenport. This well was offset to the west by Magnolia in their No. 1 Benedict, SE.¼ NW.¼ sec. 7, T. 14 N., R. 4 E., completed February 26, 1927, for 85 barrels in the same sand. This led to the completion of two more wells in this sand in section 7.

Further drilling led to the completion of Magnolia's No. 1 Gilliam, SW. cor. section 8, for an initial production of 35 barrels in the Prue sand, 3,952 to 3,990 feet. Their No. 2 Gilliam, NE.¼ SE.¼ SW.¼ sec. 8, was completed for 105 barrels in what is believed to be Simpson dolomite after encountering a hole full of water in the "Wilcox" sand 5,055 to 5,077 feet.

The discovery well in the "Wilcox" sand, which gives promise of being a very prolific producing horizon, was completed July 28, 1929 by Magnolia in their No. 1 Decker, SE.¼ SW.¼ SE.¼ sec. 8, a depth 4,950 to 4,973 feet with an initial production of 1,400 barrels. The completion of this well started an active drilling campaign which has resulted in the completion of numerous wells in the "Wilcox" sand and has led to the discovery of a new producing horizon believed to be Burgess sand which had been passed by in other wells drilled. This well is Magnolia's No. 2 Decker, SW.¼ SE.¼ section 8, which blew in for 5,000 barrels at a depth of 4,675 to 4,690 feet while drilling with rotary tools. This is believed to be a freak well and production from this horizon will probably not be of great commercial importance.

The number of producing horizons found in the field, together with the area now covered by production, gives promise that the field will be one of the largest found in the County. Structurally the field is located on a surface nose. Subsurface data to date indicate a closed anticline covering two sections.

SUMMARY

All fields in the county except the Chandler Pool have been thoroughly prospected. The discovery of prolific production in this field has led to increased activity in the west half of the county. The surface geology has been thoroughly mapped and parts have been core drilled. Correlations are difficult in both surface and core drill work. On account of the existence of many producing sands in the stratigraphic section of this area it is believed that other oil fields will be found.