GEOLOGY OF THE RANGER OIL FIELD, TEXAS.

By FRANK REEVES.

INTRODUCTION.

Scope of report.—This report describes the geology of an area 12 miles square in Eastland County, Tex. (See fig. 7.) In the northeastern half of this area is the Ranger oil field, one of the most productive oil fields discovered in the United States during the last five years. The aim of the work here reported was to place on record the geologic data that the drilling of several hundred wells had made available, to determine the relation between the structure of the surface rocks and that of the deep-seated rocks, and to ascertain how far the structure could be used as a guide in the development of the oil resources of the region. The area contains the equivalent of four townships of 36 square miles each, but as there are no such magisterial divisions in this part of Texas, the area has been arbitrarily divided into quarters, which for convenience are called the West Ranger, North Eastland, Eastland, and Olden blocks, after the principal towns in them. These blocks have been subdivided into tracts designated by coordinates, as shown on Plate XVII.

Field examinations.—The field work consisted of the mapping of the outcrops and the determination of the altitudes of persistent beds of limestone, the determination of the locations and altitudes of wells drilled in the area, and the collection of well logs, drill cuttings, and data on production. Field work in this area was begun in the fall of 1918 by M. I. Goldman, who mapped the surface structure of the eastern parts of the Olden and West Ranger blocks and an adjoining area on the east. In February, 1919, Mr. Goldman having begun the petrographic study of drill cuttings, the writer took up the field work, which he continued until July, 1919, and completed during the spring of 1920. Efficient assistance was given to the writer in the field work in 1919 by Fred H. Burton and in 1920 by Bruce White and J. M. Vetter.

Acknowledgments.—In the preparation of this report many individuals and oil companies have rendered material assistance by furnishing well logs and information as to production and occurrence of salt water and by aiding in the collection of drill cuttings. Special acknowledgments are due to Mr. J. E. Rea, Mr. John R. Roberts, Mr. Martin, Mr. Cox, and Mr. Gillette Hill, of Eastland; Mr. H. H.

Adams, Mr. M. M. Garrett, and Mr. Witt, of Ranger; Mr. D. D. Carlton, Mr. Well Baker, and Mr. J. T. Kupferstein, of Cisco; Prairie Oil & Gas Co.; Texas & Pacific Coal & Oil Co.; States Oil Corporation; Humble Oil & Refining Co.; Sinclair-Gulf Oil Corporation; Sun Oil

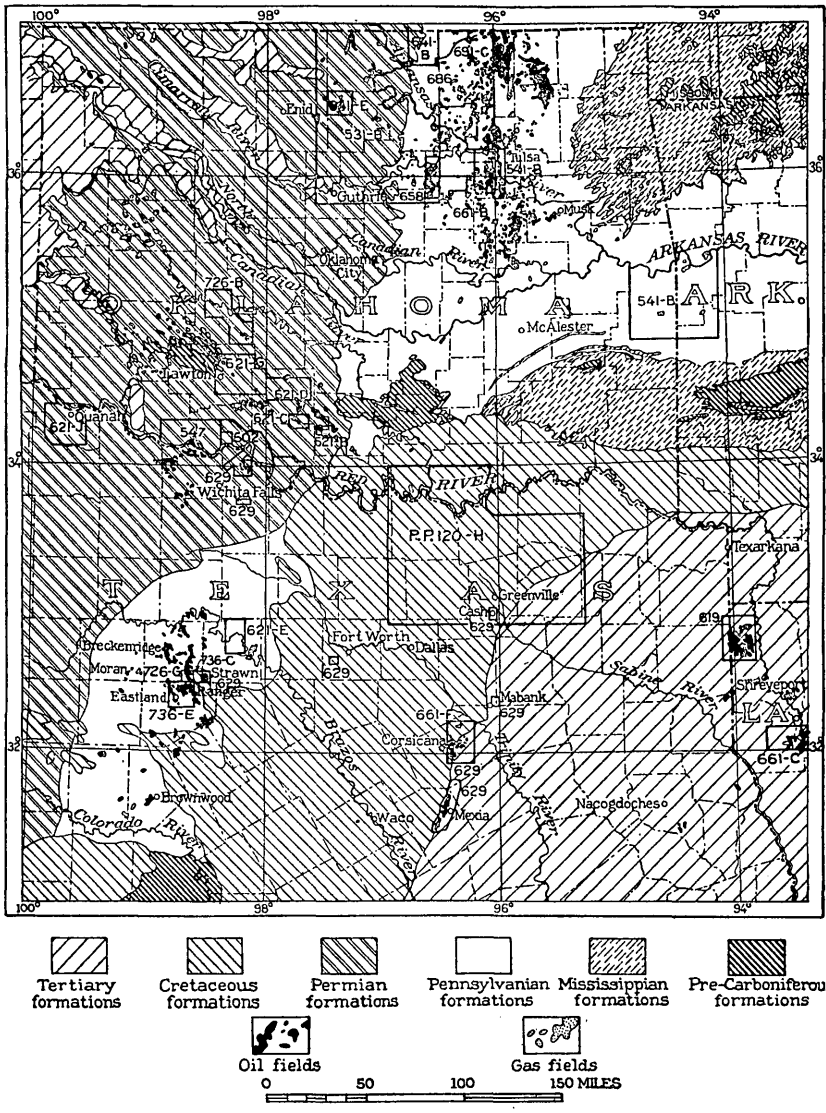

FIGURE 7.—Index map showing oil and gas fields and areal geology in parts of Texas, Oklahoma, Arkansas, and Louisiana. Areas indicated by heavy black lines are described in the bulletins and professional paper of the United States Geological Survey whose numbers are shown.

Co.; Gulf Oil & Refining Co.; Markham & Tidal Oil Co.; Root, Hupp & Duff; Magnolia Petroleum Co.; Hamon & Westheimer Oil Co.; Texas Co.; Mid-Kansas Oil & Gas Co.; Leon Oil Co.; Rickard Texas Oil Co.; Dorsey, Moorman & Gohlson; Arkansas Natural Gas Co.; Southwestern Oil & Development Co.; and Albers Oil Co.

GEOGRAPHY.

Physiographically this area belongs to the Great Plains province. The surface is a plateau, in which streams have eroded broad valleys and the weathered outcrops of gently westward-dipping limestones have produced prominent southeastward-facing escarpments, long ridges, and small round buttes. Along stream divides the plateau is but slightly dissected and the surface of the land is comparatively level. Leon River, which drains the whole area except the northwestern part, the run-off of which flows northward into Salt Fork of Brazos River, flows eastward across the central part of the area in broad alluvium-filled valleys and through narrow rock-walled gorges. Its tributaries are minor streams, which contain no running water except after rains and which have no well-defined valleys in the plateau areas in which they head. The altitude of the surface ranges from about 1,300 feet to about 1,600 feet.

The soil of the region falls into the two general classes sandy and clayey. The sandy soil occurs in the poorly drained upland areas and in the flat bottoms adjoining the larger streams. The clay soil is usually found in the rugged or more eroded parts of the region. The sandy soil supports a native growth of scrubby blackjack and post oaks. About half of the area covered by this soil has been cleared and is farmed, the principal crops being cotton, kafir corn, millo maize, and wheat. A thick growth of mesquite and live oak covers most of the clay soil, little of which is used except for grazing.

The rural districts of the region are but sparsely settled except in the oil fields, where there has been in the last few years a great increase in the number of inhabitants. Most of the newcomers live in hastily built houses and in tents. The two chief towns are Ranger and Eastland, both of which have increased in population many hundred per cent since oil was discovered in the area in 1917. Ranger, which according to the 1910 census had a population of 586, in 1920 had 16,205; Eastland, with a population of 855 in 1910, increased to 9,368 in 1920. Olden is a small oil town of about 1,000 inhabitants halfway between Ranger and Eastland.

There are three railroads in the area—the Texas & Pacific, the Wichita Falls, Ranger & Fort Worth, and the Missouri, Kansas & Texas.

The climate of the region approaches the semiarid. The annual rainfall, which averages 32 inches for a period of several years, is variable, some years having much more and others much less than this. The greater part of the rainfall occurs in the winter and spring, and consequently the region suffers more from seasonal aridity than from a scarcity of rainfall. The winters are mild, there being but little snowfall and infrequent freezes. The summers are very hot, but because of the lack of moisture in the air and the prevalence of winds the heat usually causes no great discomfort. Sand storms occur in the winter and early spring.

STRATIGRAPHY.

GENERAL FEATURES.

The rocks that may be studied in this area consist of about 4,900 feet of sedimentary strata of Lower Cretaceous, Pennsylvanian, Mississippian, Ordovician, and Cambrian age. These are subdivided into a number of formations, as shown in the subjoined table. Approximately the upper 1,000 feet of these beds crop out at the surface. Knowledge of the remaining beds has been obtained from the logs and drill cuttings of wells.

Rock formations in the Ranger oil field, Tex.

System or series.	Group or formation.		Character.
Lower Cretaceous, 0–50 feet.	Trinity sand, 0–50 feet.		Coarse conglomerate, sandstone, and sand.
	Unconformity		
Pennsylvanian, 4,200+ feet.	Cisco group, 500 feet, exposed.		Gray and blue clay and shale, brown and gray cross-bedded sandstone, and blue to gray thin-bedded fossiliferous limestone.
	Canyon group, 800–1,000 feet.		Gray multiple-bedded and yellow thin-bedded fossiliferous limestone, brown cross-bedded ferruginous and gray even-bedded calcareous sandstone, and gray and blue shale and clay.
	Strawn formation, 1,750–2,000 feet.		Fine-grained thin-bedded and coarse-grained heavy-bedded gray sandstone, blue and black shale, and siliceous thin-bedded limestone.
	Unconformity		
	"Bend series," 1,000–1,280 feet. Smithwick shale, 230–330 feet.		Black shale and black thick-bedded limestone.
	"Bend series," 1,000–1,280 feet. Marble Falls limestone, 600–650 feet.		Black shale, black and gray limestone, and gray lenticular sandstone.
Mississippian, 150± feet.	"Bend series," 1,000–1,280 feet. "Lower Bend" limestone.	150 ± feet.	Black limestone.
	"Bend series," 1,000–1,280 feet. "Lower Bend" shale.	150 ± feet.	Black shale.
	Unconformity		
Ordovician and Cambrian, 545+ feet.	Ellenburger limestone, 545+ feet.		White dolomite, crystalline limestone and sandstone.

The rocks that crop out at the surface (see fig. 8) belong to the Lower Cretaceous and Pennsylvanian series and are weathered into two distinct types of soils. The Cretaceous rocks occur only as a thin layer overlying the Pennsylvanian strata along stream divides, having been removed by erosion in other areas. They form the upland sandy areas of the region. The Pennsylvanian rocks, where not exposed, underlie the Cretaceous rocks at depths of 10 to 50 feet. At their outcrop they commonly form clay soils and constitute the areas known by the farmers as "tight land." A brief statement

of the geologic history of the region will explain the occurrence of these two classes of rocks.

During the middle epoch of the Carboniferous period, when the sediments accumulated in which occur many of the richest coal and oil bearing beds in the world, the Pennsylvanian rocks of the Ranger region were laid down as sediments in the sea or as flood-plain deposits along a slowly subsiding coastal plain. During the long time in which the Pennsylvanian sediments were accumulating the region temporarily emerged from the sea at one or more periods, but at the end of the Pennsylvanian epoch earth stresses finally elevated the region and converted it into a permanent land area. The sediments originally laid down as horizontal beds of sand, clay, and marl were converted into sandstone, shale, and limestone and tilted so that the surface strata in the region dip toward the northwest. Through the Triassic and Jurassic periods the region was subjected to erosion and at length reduced to a low-lying plain, on which in Lower Cretaceous time, when the sea invaded the area of the present Gulf Coastal Plain of the southeastern United States, rivers deposited coarse sand and conglomerate. Still later earth forces again elevated the land but effected only slight folding and consolidation of the sediments. Thus it is that in the Ranger region there are flat-lying beds of Cretaceous age overlying folded beds of consolidated Pennsylvanian rocks.

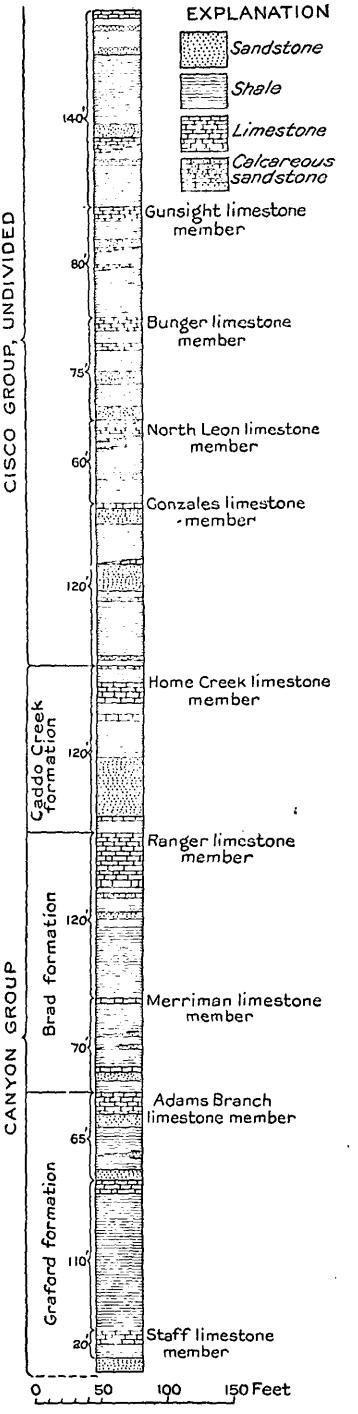

FIGURE 8.—Stratigraphic section of rocks exposed in the Ranger oil field, Tex.

LOWER CRETACEOUS ROCKS.

The Lower Cretaceous rocks consist of coarse conglomerate, sandstone, and unconsolidated sand which belong to the Trinity division of the Lower Cre-

taceous. Their thickness ranges from a few feet to 50 feet. The conglomerate consists of a complex of pebbles of quartz, chert, schist, shale, and limestone, all considerably silicified. The pebbles are of various sizes and range in shape from well rounded to angular. The pebbles of limestone and shale are usually the less rounded and apparently have been derived from the Pennsylvanian rocks through weathering. In some places the limestone conglomerate is but a reconsolidation of weathered fragments of the older limestone and occupies approximately the former position of the parent rock. The sandstone and sands consist of fairly well sorted siliceous material, of gray to white color. They contain large fragments of fossil wood. Many of the thinner layers of sand represent outwash or wind-drifted material that has been carried down over the Pennsylvanian rocks from the outcrops of Cretaceous rocks. The amount of folding of the Cretaceous sediments is slight, but there apparently have been minor crustal movements in the region since their deposition. The Cretaceous rocks are confined to the level and uneroded higher lands and occupy about half the surface of the region.

CARBONIFEROUS ROCKS.

The Cretaceous rocks of the Ranger region are underlain by about 4,350 feet of strata of Carboniferous age. About 1,000 feet of these strata crop out across the area mapped; the remainder have been penetrated in the drilling of wells. The upper three-fourths of the strata consist of light-colored shale, clay, sandstone, and thin limestone; the lower fourth consists almost entirely of black shale and black and gray limestone. Most of the sediments are of marine origin. About 4,200 feet of these strata are of Pennsylvanian age and belong to the five units into which the Pennsylvanian of central Texas has been divided, namely, the Cisco and Canyon groups, the Strawn formation, the Smithwick shale, and the Marble Falls limestone. The Cisco, Canyon, and Strawn were named by Cummins[1] and the Smithwick shale and Marble Falls limestone were named by Paige.[2] The basal 150 feet of the Carboniferous strata are of Mississippian age. These strata have not yet received a distinctive name and are here referred to as the "Lower Bend" rocks.

CISCO GROUP.

The Cisco group consists of blue and gray clay and shale interbedded with conglomeratic gray and brown cross-bedded sand-stones and thin beds of blue and gray fossiliferous impure limestone. The Cisco in central Texas is reported to have a thickness of 800 feet.

[1] Cummins, W. F., Geology of northwestern Texas: Texas Geol. Survey Second Ann. Rept., 1891.
[2] Paige, Sidney, U. S. Geol. Survey Geol. Atlas, Llano-Burnet folio (No. 183), p. 9, 1912.

In the area mapped only the lower 500 feet of the group is present, but owing to the northwest dip of the strata, the total thickness of this portion of the group is exposed in the western half of the area. The most persistent limestone beds of the Cisco and Canyon groups were used as key beds in determining the structure of the surface strata of the area. Their outcrops are shown on Plate XVII, and their relative position and thickness are indicated in figure 8. The principal key beds of the Cisco group are described below.

Gunsight limestone member.—In tract 1-A of the North Eastland block there is a soft gray limestone about 10 feet in thickness which is probably the Gunsight limestone of Plummer.[3] The main bed of this limestone weathers into chalky fragments and produces at its outcrop a slight terrace. A lower bed a few feet below the main bed is yellow on the weathered surface and about 1 foot in thickness. The Gunsight limestone is about 450 feet above the Ranger limestone, a prominent limestone of the Canyon group, which has been used in the area mapped as a datum plane in determining the elevation of all the key beds and the intervals to oil sands and deep-seated rocks.

Bunger limestone member.—At 80 feet below the top of the Gunsight limestone and 370 feet above the Ranger limestone there is a persistent multiple-bedded limestone about 10 feet thick, which forms prominent outcrops along the headwaters of the Middle Fork of Gonzales Creek in the northern part of the North Eastland block. This is probably the Bunger limestone described by Plummer.[4] It is a hard, compact blue limestone which usually weathers into thin yellow slabs. The top part is less massive and consists in some areas of a pinkish granular very fossiliferous limestone that weathers into shelly fragments. About 15 feet below the limestone there is a calcareous sandstone a few feet thick which weathers into reddish concretionary lumps. At 40 to 50 feet above the Bunger limestone is a lens of multiple-bedded pink limestone composed almost entirely of fossil *Fusulina* and brachiopods.

North Leon limestone member.—The North Leon limestone is a blue fine-textured siliceous limestone about 4 feet thick, stained pink in spots, which weathers into thin yellow plates and shelly fragments. It usually contains abundant brachiopods, crinoid stems, and *Fusulina*. In many localities a brown sandstone overlies this limestone and a white argillaceous ripple-marked sandstone lies from 5 to 10 feet beneath it. This limestone crops out in the western part of the Eastland block and in the southern part of the North Eastland block. Good exposures of it occur in tracts 1–A, 1–B, 2–A, and 2–B of the Eastland block, along the North Fork of Leon River. As North

[3] Plummer, F. B., Preliminary paper on the stratigraphy of Pennsylvanian formations of north-central Texas: Am. Assoc. Petroleum Geologists Bull., vol. 3, p. 44, 1919.

[4] Op. cit., pp. 143–144.

Fork and Leon have both been used as geologic names, and as there is no other geographic feature in the vicinity of the outcrop of this limestone, it is here named North Leon limestone. It lies about 75 feet below the Bunger limestone and about 295 feet above the Ranger limestone.

Gonzales limestone member.—Near the town of Eastland there is a hard resistant limestone about 4 feet thick which is probably equivalent to the Gonzales limestone mapped by Ross [5] in the Lacasa area, north of the West Ranger block. It is one of the most persistent limestones in the lower part of the Cisco group. The interval between it and the top of the Ranger limestone is 235 feet.

CANYON GROUP.

In the Ranger oil field the Canyon group underlies the Cisco group without any apparent unconformity or marked change in the character of the strata except for the appearance of thicker and purer beds of limestone. The group ranges in thickness from 800 to 1,000 feet, but only the upper 500 feet is exposed in this area. The group consists of multiple-bedded gray fossiliferous limestones, brown cross-bedded and grayish-white even-bedded calcareous sandstones, and light-gray clays and shales, with one or two beds of red shale near the base. The limestones, though making up only one-fifth of the group, exercise, like those of the Cisco, a strong influence on the topography of the region, producing at their outcrops prominent eastward-facing escarpments, canyons, and in places dip slopes. As a rule they preserve their thickness and characteristics for many miles, and consequently make excellent key beds. The more persistent and prominent of the limestones exposed in the area are described below. The Canyon group in this region has been divided by Plummer, as explained by Dobbin,[6] into the three formations shown in the columnar section on page 115 (fig. 8).

Home Creek limestone member.—A persistent bed of limestone that forms prominent outcrops in the Ranger and Caddo oil fields and is generally known among oil geologists as the "Caddo limestone," has been correlated by Plummer [7] with Drake's Home Creek limestone of the Colorado River section. The top of this limestone Drake [8] used as the boundary line between the Cisco and Canyon rocks. The limestone was named the "Eastland limestone" by Plummer. Ross [9]

[5] Ross, C. S., The Lacasa area, Ranger district, north-central Texas: U. S. Geol. Survey Bull. 726, pp. 307-308, pl. 53, 1921.

[6] Dobbin, C. E., Geology of the Wiles area, Ranger district, Tex.: U. S. Geol. Survey Bull. 736, pp. 57-58, 1922.

[7] Plummer, F. B., Preliminary paper on the stratigraphy of the Pennsylvanian formation of north-central Texas: Am. Assoc. Petroleum Geologists Bull., vol. 3, p. 140, 1919.

[8] Drake, N. F., Report on the Colorado coal field: Texas Geol. Survey Fourth Ann. Rept., 1892.

[9] Ross, C. S., op. cit., pp. 306-307.

has identified it with the Home Creek limestone of Drake, and the United States Geological Survey has adopted Drake's name for it. The Home Creek limestone where exposed in this area consists of two beds of limestone separated by 10 feet of shale. The upper bed of limestone, which is 3 to 5 feet thick, weathers into light-gray massive slabs and usually forms outcrops some distance back from the lower bed. The lower bed is about 15 feet thick and includes at the top 5 feet of thin layers of soft grayish-white limestone which weathers into chalky fragments or smooth white slabs, underlain by 10 feet of massive rock that forms prominent cliffs along the banks of streams. This limestone crops out along Leon River immediately south and east of Eastland. To the north it disappears near Olden, under the cover of the Cretaceous sands, but it reappears near Pleasant Grove Church, from which it is exposed almost continuously in a northeasterly direction to Caddo. The base of the Home Creek limestone is 90 feet above the Ranger limestone and 150 feet below the top of the Gonzales limestone.

Ranger limestone member.—About 120 feet below the top of the Canyon group there is a limestone about 40 feet thick which, due to its prominent outcrop near Ranger, is widely known as the Ranger limestone. The rock is gray on its weathered surfaces and bluish gray on fresh fracture. It is a hard, resistant limestone and forms at its outcrops prominent escarpments and cliffs. Along Leon River south of Eastland it is exposed in vertical cliffs 40 feet high. From this locality the outcrop extends northward and forms a canyon along Colony Creek 1 mile south of Colony School and a prominent escarpment immediately west and north of Ranger. About 12 feet above the top of the Ranger limestone there is a thin layer of shelly yellow, very fossiliferous limestone which usually forms a separate outcrop a short distance from the Ranger.[10] The intervening belt, which is made up of shale and marked by a broad terrace, is in many places a grassy slope free from the thick growth of mesquite that usually covers the rest of the outcrop. From 5 to 10 feet below the base of the Ranger, in most localities, there is a second layer of hard brown to yellow limestone that weathers into large rounded boulders. This limestone in some localities is replaced by a calcareous grayish-white sandstone from 3 to 5 feet thick.

Because of its thickness and persistency, the Ranger limestone has been made the datum plane in determining the structure of the surface rocks and in computing intervals between surface and deep-seated strata. The interval between it and the "Black lime," the datum plane on which the structure of the deep-seated strata has been mapped, ranges from 3,020 feet in the southern part of the

[10] In the Lacasa report, already cited, Ross includes the limestone and the underlying shale in the Ranger limestone.

Eastland block to 3,350 feet in the northeastern part of the West Ranger block, as a result of a regional increase in the thickness of the strata toward the northeast, amounting to 25 feet to the mile. There are also local variations in the interval due to the fact that the deeper strata are folded more intensely than the surface strata. As a result the interval in adjacent anticlinal and synclinal areas varies as much as 50 to 150 feet, the difference depending on the size of the folds. The amount of this interval is shown for a number of localities in the series of plotted logs in Plates XV and XVI.

Merriman limestone member.—About 84 feet below the base of the Ranger limestone there is a persistent bed of fine-textured yellow limestone about 4 feet thick, which is very hard and usually weathers into large rectangular blocks. This bed is a good horizon marker and can be easily identified by its yellow color and massive character and the fact that no other limestones are close to it in the stratigraphic column. The limestone is here named the Merriman limestone member of the Brad formation, from Merriman Church, south of Ranger, near which it crops out.

Adams Branch limestone member.—The base of the Adams Branch limestone, so named by Drake,[11] is 206 feet below the top of the Ranger limestone. The member consists of 16 feet of hard gray limestone that forms prominent outcrops. The top 5 feet weathers yellow and crops out back from the remainder of the bed, forming a terrace. The limestone is prominently exposed along Colony Creek south of Merriman Church, 4 miles south of Ranger. Immediately underlying it is a white calcareous sandstone about 10 feet thick.

Staff limestone member.—About 160 feet below the base of the Adams Branch limestone there is a limestone 10 feet thick, here named the Staff limestone member of the Graford formation, because it crops out near Staff, in the southern part of the Olden block. The upper half of the limestone weathers into gray fragments; the lower part is massive, hard, and yellow. A sandstone 20 feet below this stratum forms prominent outcrops along Leon River. At 110 feet above the Staff limestone is a thin limestone, the outcrop of which is obscured by an overlying sandstone.

STRAWN FORMATION.

The Strawn formation consists of 1,750 to 2,000 feet of grayish-white and blue shale, sandstone, and sandy shale, with a few thin beds of limestone and black shale. Near the top of the formation there are two rather persistent beds of red shale. The beds of sandstone, which constitute about one-third of the strata, range in thickness from a few feet to 400 feet or more. The thicker beds, which

[11] Op. cit., p. 142.

are found in the basal part of the formation, consist of gray to white fine-grained sandstone and usually contain salt water, although in some localities oil and gas are found in them. Coal is apparently not reported in wells that have passed through the formation, though 20 miles to the northeast, at its outcrop, valuable beds of coal are mined. It is difficult to determine the boundary between the Canyon and Strawn in the well logs of the Ranger field, because it is not easy to recognize the Palo Pinto limestone, the top of which Plummer has used as the boundary between the Canyon and Strawn rocks. An attempt has been made to define this boundary in the series of plotted logs on Plates XV and XVI, but owing to its indefiniteness the writer can not confirm Matteson's statement [12] that there is an erosional unconformity at this horizon. In view, however, of the constancy in the thickness of the two divisions, as shown in the plotted logs, it is thought that this unconformity is not pronounced in the Ranger field. The combined thickness of the Canyon and Strawn ranges from 2,700 to 2,800 feet, the variation being chiefly due to a regional increase in thickness of the strata toward the northeast.

It was originally thought by Cummins [13] that there was between the Strawn formation and the "Bend series" a group of rocks consisting mostly of blue and black clays, with a few beds of sandstone, hard limestone, and sandy shale. To these rocks he gave the name "Millsap division." Later, however, he decided that the rocks belong to the Strawn, and the name "Millsap" was dropped by the Texas Geological Survey. Plummer [14] revived the use of the term and applied it to a group of massive dark-blue shales, with lenticular, unevenly bedded limestones, which crop out in Parker County. Goldman [15] distinguished a series of sandy shales overlying the Smithwick shale, which he states is approximately equivalent to Cummins's "Millsap division." In the Ranger field some of the logs show a blue shale above the Smithwick shale and a thick sandstone in the Strawn formation that may belong to this group of rocks, but wherever it occurs it is here included in the Strawn formation.

"BEND SERIES."

The Texas Geological Survey formerly grouped all the Carboniferous strata in central Texas lying below the Strawn formation into one unit called the "Bend series" and recognized three subdivisions—

[12] Matteson, W. G., A review of the development in the new central Texas oil fields during 1918: Am. Assoc. Petroleum Geologists Bull., vol. 3, p. 172, 1919.

[13] Cummins, W. F., Geology of northwestern Texas: Texas Geol. Survey Second Ann. Rept., pp. 372–374, pl. 6, p. 361, 1891.

[14] Plummer, F. B., Preliminary paper on the stratigraphy of the Pennsylvanian formations of north-central Texas: Am. Assoc. Petroleum Geologists Bull., vol. 3, p. 140, 1919.

[15] Goldman, M. I., Lithologic subsurface correlation in the "Bend series" of north-central Texas: U. S. Geol. Survey Prof. Paper 129, pp. 15–16, 1921.

an upper black shale, a middle black and gray limestone, and a lower black shale. Paige [16] named the upper division the Smithwick shale and the middle division the Marble Falls limestone. The lower division, which consists of both black shale and black limestone, will be referred to here as the "Lower Bend." Some geologists in the past have thought that all of the "Bend series" is of Pennsylvanian age, but Girty [17] states that the Smithwick shale and Marble Falls limestone are of early Pennsylvanian (Pottsville) age and that the "Lower Bend" limestone and shale are of Mississippian age. In fact, it is now generally believed that there is a sharp break between the fauna of the Marble Falls limestone and that of the "Lower Bend," and that the "Lower Bend" fauna is closely related to the Moorefield fauna of Arkansas, described by Girty,[18] which is undoubtedly of Mississippian age. The "Bend series" crops out in the central mineral region of Texas, where according to Paige[19] it has a thickness of 600 to 800 feet. In the Ranger field, 90 miles north of its outcrop, the three divisions of the "Bend" can be tentatively recognized from a study of well logs and have a combined thickness of 1,000 to 1,280 feet.

SMITHWICK SHALE.

In the area mapped the Strawn formation is underlain by 230 to 330 feet of strata, consisting usually of an upper and a lower black shale separated by a black limestone, which have generally been assumed to be the equivalent of the Smithwick shale of the central mineral region. Goldman,[20] however, as a result of his correlation of the "Bend series" of the Ranger field with that of the Seaman and Rudd wells, about 20 miles respectively north and south of the Ranger field, thinks that the lower shale member, with the exception of a sandy layer at its top, is equivalent to the top of the Marble Falls limestone of the central mineral region. This conclusion is corroborated by a comparison of the thickness of the Smithwick shale and Marble Falls limestone of the Ranger field with those of the Seaman and Rudd wells. For these reasons the top of the drillers' "Black lime," which has been generally regarded as the boundary between the Smithwick shale and Marble Falls limestone, apparently because it marks the dividing line between a series of overlying shales and a series of underlying limestones, is not so regarded here, the boundary being placed instead at the top of the shale member that overlies the "Black lime." From the drillers' logs of wells in the Ranger field it is impossible to draw the boundary within this shale member, as

[16] Paige, Sidney, U. S. Geol. Survey Geol. Atlas, Llano-Burnet folio (No. 183) p. 8, 1912.

[17] Girty, G. H., The Bend formation and its correlation: Am. Assoc. Petroleum Geologists Bull., vol. 3, pp. 71-78, 1919.

[18] Girty, G. H., The fauna of the Moorefield shale of Arkansas: U. S. Geol. Survey Bull. 439, 1911.

[19] Paige, Sidney, op. cit., p. 8.

[20] Goldman, M. I., op. cit., p. 16.

Goldman places it, but as his boundary is near the top of the shale, the boundary as here drawn corresponds approximately to Goldman's boundary. The Smithwick shale is therefore here considered to include an upper black shale and a lower black limestone. The thickness of the upper black shale ranges from 100 to 200 feet. The black limestone, generally known as the "Smithwick lime" by the geologists working in the region and as the Caddo lime, Breckenridge lime, and "False Black lime" by the oil men, is 50 to 150 feet thick. The top of this limestone is usually 300 feet above the top of the "Black lime." The "Smithwick lime" thickens and becomes sandy toward the north and is the chief source of the oil obtained in Stephens County. It yields oil in the northwestern part of the Ranger field also.

The variation in thickness of the upper shale member of the Smithwick is probably due to the erosional unconformity described by Matteson.[21] This unconformity marks the removal in some areas of about 100 feet of beds. The north-south series of plotted logs given in Plate XV show a constant thinning of the member southward to well 276, south from which there is a slight increase in thickness. In the northwest-southeast series of logs given in Plate XVI the upper member shows no increase in any direction, but the position of the boundary line varies more than in the other series. However, this may be due partly to inaccuracies in the logs of the strata at these depths, where the absence of oil sands made it seem unnecessary for the drillers to keep good logs. The writer has corrected some of these inaccuracies and changed some logs to agree with the logs of a number of adjoining wells. The logs that have been changed are marked with an asterisk (*).

MARBLE FALLS LIMESTONE.

For reasons given above the shale between the "Smithwick lime" and the "Black lime" is for convenience here included with the Marble Falls limestone. That formation therefore consists of 600 to 650 feet of black shale, black and gray limestone, and gray lenticular sandstone. At the top there is a black shale member about 200 feet thick, with a lens of sandstone occurring in the middle in some localities, which yields oil in a few wells. Toward the base of this top member there are usually one or two limestone lenses. Beneath this shale there is 50 to 75 feet of multiple-bedded black shaly limestone, which contains sandy layers bearing oil and gas. These beds constitute what the drillers call the "Black lime." Under the "Black lime" there is about 100 feet of black shale interbedded with lenses of black limestone, beneath which there is a gray limestone.

[21] Op. cit., p. 173.

Immediately under this limestone, except in the eastern part of the Ranger field, where a few feet of black shale intervenes, there is a lens of sandstone which in the producing part of the field has a thickness of 10 to 50 feet. This sandstone is known among the oil men as the McClesky sand. It is the chief oil and gas producing bed of the Ranger field. The portion of the Marble Falls limestone below the McClesky sand consists principally of gray limestone and black shale.

"LOWER BEND" ROCKS (MISSISSIPPIAN).

It is difficult to distinguish the Mississippian strata from the Pennsylvanian in the logs of the few wells that have penetrated these rocks, for the boundary is marked by no definite change in the character of the sediments. It is probable, however, that the black shale shown in the logs of many wells above the Ellenburger limestone is equivalent to the "Lower Bend" shale, which according to Girty is of Mississippian age. The thickness of this shale in the area mapped is generally recorded as about 100 feet. Probably some of the limestone overlying this shale is also of Mississippian age and belongs to the "Lower Bend," for at the outcrop of the beds in the central mineral region limestone occurs in the upper part of the "Lower Bend" succession. Goldman also includes from 20 to 50 feet of limestone in the top of the "Lower Bend" in his study of the drill cuttings from the Seaman and Rudd wells.

ORDOVICIAN AND CAMBRIAN ROCKS.

ELLENBURGER LIMESTONE.

The deepest wells drilled in the area penetrate at the base of the Mississippian black shale a hard grayish-white crystalline limestone which crops out in the central mineral region of Texas, and has been called by Paige [22] the Ellenburger limestone. This limestone can be readily recognized in the logs of wells drilled in the Ranger area, as it is usually recorded as a hard white limestone underlying a black shale or black limestone at about 600 feet below the top of the "Black lime." Its microscopic character is described by Udden and Waite.[23] This limestone contains strata of Cambrian and Ordovician age; but the boundary line between the two systems has not yet been established. At its outcrop, 90 miles south of Ranger, it is about 1,000 feet thick. Its thickness in the area mapped is not known, as the deepest well in the area, the States Oil Corporation's Barber No. 2 (No. 182 on the map), has penetrated only 545 feet into the limestone.

[22] Paige, Sidney, U. S. Geol. Survey Geol. Atlas, Llano-Burnet folio (No. 183), p. 7, 1912.

[23] Udden, J. A., and Waite, V. V., Microscopic characteristics of the Bend and the Ellenburger limestones. 26 pp., mimeographed and illustrated by photographic prints, Austin, Texas Bur. Econ. Geology and Technology, 1919.

The boundary between the "Lower Bend" shale and the Ellenburger limestone is represented by a great unconformity in central Texas. It is not known definitely whether the absence of strata of Silurian and Devonian age is a result of erosion after their deposition or of an emergence at the end of Ellenburger time, but it is probable that the latter explanation is the true one, for nowhere in central Texas are intervening strata known.

The following is a list of the wells drilled to the Ellenburger limestone in the area mapped:

Wells drilled to Ellenburger limestone in Ranger field.

Map No.	Farm.	Well No.	Company.	Depth of Ellenburger limestone (feet).	Interval between "Black lime" and Ellenburger limestone (feet).
29	J. E. Barnes	1	Prairie	4,080	687
36	L. M. Cooke	1	Texas and Pacific	4,060	674
62	G. T. Parrock	1	States	4,078	578
182	B. D. Barber	2	do	3,960	610
219	W. T. Pitcock	1	Texas and Pacific	3,775	636
232	E. S. Davis	1	Magnolia	3,934	674
294	J. M. Rush	1	Mid-Kansas	3,720	632
298	J. T. Falls	1	Prairie	3,620	580
297	do	2	do	3,645	605
300	C. C. Holcomb	1	Cosden	3,877	680
309	C. U. Connellee	3	Arkansas National	3,725	599
311	do	1	do	3,735	620
312	W. S. Barber	1	Cosden		
313a	J. H. Bransford	1	Prairie	3,717	579
314	Doctor Johnson	1	Sammies	3,615	579
315	H. Brashear	1	Leon	3,630	595
321	M. Sibley	1	Wichita-Ranger	3,555	613
322	S. Parker	1	Leon	3,565	615

STRUCTURE.

METHOD OF DETERMINING STRUCTURE.

In an area like the Ranger field, where the inclination or dip of the beds is very slight, it is necessary, in order to determine the structure of the beds, to ascertain the elevation above sea level of a certain bed at many points well distributed over the area. As no single bed is exposed except along the narrow belt of its outcrop, however, it becomes necessary, in order to determine the structure of the surface beds for the whole area, to obtain elevations on many beds. These elevations are reduced to terms of the elevation of a single bed by subtracting or adding the vertical distances at which the several beds occur above or below the bed that is to be considered the datum plane. The figures thus obtained show the elevation of a certain single bed for the whole area and consequently indicate the amount of folding of this bed and all the other beds, both above and below it, which were subjected to the same movements of tilting or

buckling during the same period of time. Plates XVII, XVIII, and XIX show the structure of the Ranger field by means of lines passing through points of equal elevation, or contour lines.

These lines are drawn at 10-foot vertical intervals—that is, the surface strata have a dip of 10 feet across the area included between any two adjacent lines. Where the lines are closest together the strata have the steepest dip. The direction of the contour lines indicates the strike of the strata.

The terms most used in describing the structure of oil fields are "anticline" and "syncline." An anticline is an upward fold or warp of the strata; a syncline, a downward fold. At times the enormous stresses that produce folding cause fractures in the rocks of the earth's crust, accompanied by a displacement of the beds on one side of the fracture with respect to those on the other. These breaks, called faults, are shown on the structure map by short, heavy lines running at angles to the contour lines.

The mapping of the structure of the rock beds is the chief means by which the oil geologist determines the probabilities of oil being found in certain localities. In the development of the oil fields of the world it has been discovered that the largest oil pools have a certain relation to definite structural features. In most oil fields the oil occurs in the anticlinal areas or on domes; in some it accumulates in synclines; and in others the oil is found on structural terraces. With a knowledge of these relations the geologist works out the structure of the surface beds of an undrilled area and determines the most favorable areas in which to test the beds for oil.

In some regions the structure of the deeper-seated strata, in which the oil occurs, is not revealed by the structure of the surface rocks; but it is rare that the structure of the deep-seated strata does not have some expression in the surface structure. It was one of the purposes of the investigation whose results are set forth in this report to determine what relation exists between the structure of the "Bend" strata—the principal oil-bearing series—and the accumulation of oil in the Ranger area, and to discover to what extent this structure is revealed by the structure of the surface beds. Accordingly the structure of the surface strata was determined for the whole area and that of the "Bend" strata for the portion of the area that has been drilled.

STRUCTURE OF SURFACE STRATA.

GENERAL FEATURES.

The structure of the surface strata is represented on Plate XVII by means of contour lines showing the elevation above sea level of the top of the Ranger limestone, which crops out in the southeastern half of the area mapped. The main structural feature is a monocline

with a regional northeasterly strike and a low northwest dip. The strata, besides being tilted northwestward, have been arched into low plunging anticlines that pitch in northwest and southwest directions. Some of these folds are continuous for several miles, though the amount of folding is very slight, the vertical uplift of the strata being rarely more than 15 feet.

FAULTS.

In the southern part of the area mapped a number of faults cut the surface strata. All these faults except three lie in a belt of steeply dipping strata along the south side of a syncline that extends across the Olden block. The faults strike about N. 70° W., at an angle of 35° with the axis of the syncline. All but one are normal faults, and in all, so far as known, the displacement is vertical. The fault dip ranges from 60° to 90°, and the downthrow ranges from a few feet to 45 feet and is usually on the southwest side. Some of the faults, including the two major ones, near the Union and Lone Cedar schools, are scissors faults, the ends having opposite directions of throw. The fault near the Union School has a maximum throw of 35 feet; that near the Lone Cedar School has a maximum throw of 45 feet. The proximity of a fault is indicated by veining and jointing in the rocks. At the outcrop of the fault the rocks are strongly fissured and contain numerous veins, which are parallel to the fault plane and range from a fraction of an inch to 1 inch in width. The vein materials are calcite, quartz, pyrite, and hematite. At many places large crystals of martite are found in the limestone near the fault. On the faulted belt the rocks are also strongly jointed, and the joint planes, like the veins, are parallel to the faults. The topographic expression of a fault is rarely visible except where it crosses a limestone bed. Slickensides occur, but gouge and breccia were not seen.

STRUCTURE OF DEEP-SEATED ("BEND") STRATA.

BEDS USED IN DETERMINING THE STRUCTURE.

In determining the structure of the "Bend" strata the top of the "Black lime" has been used as a key horizon, for this stratum is the most persistent and widely recognized bed of the "Bend series," and its depth is usually recorded rather accurately by the drillers, who generally set the 6⅝-inch casing on it. In some localities, however, a lentil of limestone a few feet above the "Black lime" is at times mistaken for the "Black lime" itself. In the northeastern part of the field the so-called "lower Smithwick shale" and "Black lime" are so sandy that it is impossible from the well logs to recognize a definite boundary between them, and it becomes necessary to rely on other beds, such as oil sands or the so-called "Smithwick lime", to determine at what depth the "Black lime" should occur.

The McClesky sand was also used as a key bed. In fact, because it is the most persistent sandstone and the most productive oil bed in the "Bend series," it is more easily recognized in well logs than the "Black lime", but as not all the wells were drilled deep enough to reach this sandstone, it can not be used throughout the area as a key bed. However, a sufficient number of wells were drilled to the McClesky sand to indicate with certainty the position of the "Black lime" in wells drilled in intervening areas. In areas outside of the oil field where the McClesky sand is absent most of the wells have been drilled through the "Bend series" to the Ellenburger limestone, which is also an easily recognizable rock, and as it underlies the "Black lime" at a rather constant interval in this region the position of the "Black lime" in such areas can also be determined with fair certainty.

In the work on the identification of unexposed beds the drillers' logs have been almost the only source of the data used. If time for the collection and study of drill cuttings had been available it would of course have been easier to identify the beds and more information could have been obtained as to the character of the strata and the changes occurring in them from place to place, but in a field covering 144 square miles, where a thousand wells have been drilled, the time required for the collection of well logs and data on production, and for the field work of locating and determining the elevation of the wells and mapping the surface structure made it impossible to collect and study more than a few drill samples. It is thought, however, that the structure of the "Bend series" has been pretty accurately determined. In most parts of the field enough well logs were available to check up inaccuracies of recorded depths. The "Bend" strata, being chiefly marine sediments, show but slight variation from place to place, and the drillers, though making some mistakes and showing some carelessness, have preserved in their logs a fairly accurate and consistent record of the rocks encountered.

The structure of the "Bend" strata was determined from the attitude of the top of the "Black lime." As this bed lies below sea level, however, 3,000 feet has been added to the figures representing its elevation, so that the structure could be expressed in terms of elevation above sea level. To determine the true position of the "Black lime" with reference to sea level 3,000 must be subtracted from the figures indicated by the structure contours on the maps. To determine the depth of the "Black lime" at any point represented on the subsurface structure map, it is necessary to add 3,000 feet to the elevation of the surface at that point and from the sum subtract the elevation shown on the subsurface structure map for the "Black lime." In the table on pages 144–151 the elevation of the well mouth and the depth to the "Black lime" are given for about 330 wells.

GENERAL FEATURES.

The folding of the deep-seated strata, as shown by the representation of the structure of the "Black lime" on Plate XIX, is pronounced and varied. The dip of the strata ranges from $\frac{1}{2}°$ to $2\frac{3}{4}°$, or from about 50 to 250 feet to the mile. The main features of the folding are elliptical domes and basins and long plunging anticlines. The domes lie along anticlinal axes that trend northeast. Spurs extend from these folds in a westerly to northwesterly direction. The regional structure of the "Bend series" as shown by Cheney[24] and Hager,[25] is that of a broad plunging anticline which extends slightly east of north from the central mineral region across the northern part of Texas. The Ranger field is supposed to lie along the crest of this arch.

LOCAL FEATURES.

In the area where sufficient wells have been drilled to determine the attitude of the "Bend" strata four anticlinal folds have been mapped. These are called the New Hope, Ranger, Merriman, and Olden anticlines. The position of the synclines in the "Bend" strata is shown on the structure maps.

New Hope anticline.—The New Hope anticline, so named because its axis lies near New Hope Church, is the most pronounced anticlinal fold of the area mapped. It is 3 miles long and 1 mile wide. The strata dip from its crest at the rate of about 250 feet to the mile, and the closure of the fold as mapped is about 90 feet. As only a few wells have been drilled on this fold, its outline and the exact position of its crest can not be definitely determined.

Ranger anticline.—About a mile west of Ranger the strata of the "Bend series" are folded into an anticline whose axis has a trend generally parallel to that of the New Hope anticline. This fold is relatively flat, the dips being only about 75 feet to the mile. The closure is about 20 feet. From the crest of the fold a spur trends northwestward and dies out near the Colony School. The Ranger anticline is separated from the New Hope anticline by a pronounced syncline. Synclines also lie to the south and east of it.

Merriman anticline.—In the northeastern part of the Olden block, at the south end of the Ranger field, there is a fold which can not be entirely mapped because sufficient wells have not been drilled to reveal its exact form and extent. A broad spur of this fold extends northward into the southeast corner of the West Ranger block. The dips in the Merriman fold are from 40 to 100 feet to the mile.

[24] Cheney, M. G., Structural map of "Bend series" in north-central Texas: Oil Trade Jour., vol. 9, No. 5, p. 75, May, 1918.

[25] Hager, Dorsey, Geology of the oil fields of north-central Texas: Am. Inst. Min. Eng. Bull. 138, pp. 1115-1116, June, 1918.

Olden anticline.—A narrow plunging anticline extends from tract 1–B of the Olden block northwestward to and beyond Pleasant Grove Church. This fold is of the nature of a narrow anticlinal spur, the axis of which bends twice from a northerly to a northwesterly direction. The strata dip away from its crest at 50 to 80 feet to the mile.

RELATION BETWEEN THE STRUCTURE OF THE DEEP-SEATED STRATA AND THAT OF THE SURFACE STRATA.

A comparison of the structure of the Ranger limestone and the "Black lime" (see Pl. XVIII) will show to what extent the folding of the deep-seated rocks is revealed by the folding of the surface rocks. It is apparent at a glance that the folding of the "Black lime" is more intense than that of the Ranger limestone. In the deep-seated strata there are pronounced domes, plunging anticlines, and synclinal basins in which the strata show uplifts of 80 to 100 feet, with dips ranging from 50 to 250 feet to the mile. The surface strata, on the contrary, show but a slight buckling of the strata and a regional dip to the northwest of about 50 feet to the mile.

The axes of the folds of both the deep-seated strata and the surface strata, however, conform rather closely in position and direction. This is especially true of the New Hope and Merriman anticlines. The Olden plunging anticline is represented by a fold in the surface strata, but the axis of the surface fold lies a short distance to the east of the axis of the deep-seated fold. The northwestern extension of this anticline is not so closely represented in the surface structure. The Ranger anticline is approximately overlain by a broad fold in the surface beds. The synclinal axes in the two groups of rocks show a similar conformity in position and trend. The one south of the New Hope anticline has about the same position in both the surface and the deep-seated strata. The other synclines do not exactly correspond in position, because the surface folds are smaller than the deep-seated folds and the anticlinal and synclinal axes therefore lie closer together in the former than in the latter.

The structure of the deep-seated strata is thus revealed to a slight extent by the structure of the surface strata, but in the small area where it is possible to draw a comparison the facts do not warrant any more definite statement except that plunging anticlines in the exposed rocks of Carboniferous age conform closely in position and trend with more pronounced folds in the deep-seated Carboniferous rocks. The other general inferences on the relation between the folding of the surface and deep-seated strata in this region drawn by Pratt[26] and Adams[27] are not clearly supported in the area here considered.

[26] Pratt, W. E., Geologic structure and producing areas in north Texas petroleum fields: Am. Assoc. Petroleum Geologists Bull., vol. 3, pp. 44–54, 1919.

[27] Adams, H. H., Geologic structure of Eastland and Stephens counties, Tex.: Am. Assoc. Petroleum Geologists Bull., vol. 4, pp. 159–167, 1920.

PERIODS AT WHICH FOLDING OCCURRED.

FOLDING OF GREATEST INTENSITY.

The crustal movements that produced the folding of the "Bend" strata probably reached their greatest intensity toward the end of "Bend" time, for then, as indicated by the unconformity at the top of the Smithwick shale, there was an emergence followed by erosion of the strata. At this time also widespread diastrophic movements affected the whole region and the Wichita, Arbuckle, and Ouachita mountains of Oklahoma and Arkansas were formed.[28] The two trends in the folding of the "Bend" strata in the area mapped parallel approximately the regional trends of the folding in these mountains.

EARLIER FOLDING.

Although the folding of the "Bend" strata probably reached its greatest intensity at the end of the "Bend" epoch, it had been in progress during the deposition of the upper part of the Marble Falls limestone, which contains a considerable amount of sandy material that indicates a shallowing of the water and glauconite beds that, according to Goldman,[29] indicate breaks in sedimentation. That folding was going on during the deposition of these beds is also indicated by their greater thickness in synclinal than in anticlinal areas. For example, the interval between the McClesky sand and the top of the "Black lime," which is approximately 200 feet in the central part of the Ranger field, is from 15 to 30 feet more in synclines than in adjacent anticlines. There is also a regional increase in the thickness of the strata toward the north. Thus for anticlinal and synclinal areas the interval mentioned ranges from 170 to 185 feet in the southern part of the field and from 200 to 230 feet in the northern part of the field.

This folding of the beds at the time of the deposition of the sediments affords an explanation of the relation that appears to exist between the thickness of the McClesky sand and the structure of the "Bend" strata as shown on Plate XIX. From this map it will be seen that there is an area west of Ranger in which the sandstone is over 40 feet thick. Away from this area the sandstone thins. Toward the southwest, south, and southeast it pinches out entirely, but farther southwest and probably in the other directions it reappears. There is also an area to the northeast where it is absent. Toward the north it apparently decreases in thickness for a short distance and then increases in thickness. The area in which the sandstone is

[28] Moore, R. C., The relation of mountain folding to the oil and gas fields of northern Oklahoma: Am. Assoc. Petroleum Geologists Bull., vol. 5, pp. 34–48, 1921.

[29] Goldman, M. I., Lithologic subsurface correlation in the "Bend series" of north-central Texas: U. S. Geol. Survey Prof. Paper 129, pp. 11–12, 1921.

thickest coincides approximately with anticlinal areas in the "Bend" strata. This relation might appear more marked if more data were available on the thickness of the McClesky sand. At present the data are fragmental and somewhat unreliable. In the drilled-up portion of the field only a part of the wells have gone through the McClesky sand, and it is possible that the relation above noted is due to the fact that in producing areas the drillers have included with the sand the part of the overlying gray limestone that yields oil or gas and that in nonproducing areas they have not recorded any sand, though sand was present. The sandstone would thus be recorded as attaining its greatest thickness in the producing anticlinal areas and being absent in the nonproductive synclinal areas. However, it is thought that these possible inaccuracies in the logs have not produced the apparent relation between the areas of uplift and thickness, but that, on the other hand, they make the relation appear less consistent. An explanation of this relation follows. If folding were taking place in the floor of the shallow sea in which the calcareous muds and sandy material of the "Bend" were accumulating, it is probable that where the sea bed was elevated, although materials of the same kind and amount were being deposited there as elsewhere, wave action would at certain stages tend to remove from the shallow part of the sea the finer argillaceous and calcareous material and transport it to the deeper areas, leaving only the sandy material in place. As a result there might be formed over an area of uplift a sand which toward synclinal areas would thin and grade into a sandy shale or sandy limestone. Evidence that movements in the sea floor actually take place during the deposition of sediments is presented by the recent crustal movements in the East Indian Sea, where, as Molengraf [30] points out, the submarine topography shows a highly folded surface with deep-sea basins occurring along synclinal troughs and islands along anticlinal folds. It is probable, moreover, that all the major orogenic movements that have produced mountains out of geosynclines of deposition have been preceded by slight crustal movements of the sea bed. In fact, many geologists now think that the folding of mountains precedes their uplift.

The above explanation of the origin of the McClesky sand thus not only accounts for the relation of its thickness to the folding of the strata, but also accounts for the increase in thickness of the associated strata in the synclines. It also explains what is otherwise hard to account for—how at one horizon lentils of marine sandstone could form at more than one place offshore.

The relation between the amount of oil that the McClesky sand yields and its thickness, as described on pages 139–140, is also ex-

[30] Molengraf, G. A. F., Recent crustal movements in the island of Timor and their bearing on its geological history: Royal Acad. Sci. Amsterdam Proc., June-Sept., 1912 (report in English).

plained by this hypothesis, which postulates a removal of the finer argillaceous and calcareous materials from the sand in the areas of uplift. The action that would result in the development of a greater thickness of sand would also tend to increase its effective porosity.

LATER FOLDING.

As illustrated by Plate XVIII, there has been movement along the older lines of folding since "Bend" time. This movement, however, represents but a slight rejuvenation of the older crustal movements—a process which Suess has called "posthumous folding." The date of this later folding is not known, but it probably occurred at the end of Carboniferous time, when the region was elevated above the sea.

The slight amount of folding has apparently occurred in the region since Lower Cretaceous time, for the Cretaceous conglomerates that overlie the Pennsylvanian beds west of Strawn are reported by E. S. Bleecker [31] to be fractured by faults that apparently lie in the same zone of faulting as those described on page 127, which are associated with the folding of the underlying Pennsylvanian rocks. Some of the smallest streams in the area also appear to occupy synclines in the surface rocks.

OIL AND GAS DEVELOPMENT.

HISTORY OF THE DISCOVERY OF THE RANGER FIELD.

Prior to 1917 a few shallow wells were drilled in the vicinity of Ranger and Eastland in a search for the sand in which oil had been obtained at Strawn, in Palo Pinto County. These wells, however, were not drilled deep enough to reach the "Black lime," and as no oil was encountered in overlying formations, the possibility that the area might produce oil was considered to be very slight. On October 30, 1916, however, the Texas Co. discovered oil in the so-called "Smithwick lime" on the Park lease, near Breckenridge, Stephens County. This discovery induced the Texas Pacific Coal Co. to drill a well on the Walker farm, just north of Ranger, Eastland County, and in August, 1917, this well reached the "Black lime," from which considerable gas was obtained. A second well was drilled on the J. H. McClesky farm, 1 mile southwest of Ranger, which on October 11, 1917, penetrated at a depth of 3,431 feet a sandstone about 200 feet below the top of the "Black lime," from which oil began to flow at the rate of 1,200 barrels a day. After this strike development progressed rapidly, resulting in the extension of the Ranger field over several square miles of territory, with a maximum average daily production in July, 1919, of 80,000 barrels, and in the discovery of other important fields in central and northern Texas. In fact, the

[31] Unpublished report of the U. S. Geological Survey on the Round Mountain area.

opening of the Ranger field marked the beginning of probably the most intense activity that has ever occurred in the oil industry in the United States.

PRODUCING SANDS.

The oil in the Ranger field is obtained from about nine producing sands, which occur in the Strawn formation, Smithwick shale, and marble Falls limestone, all of Pennsylvanian age. Most of the oil is obtained from the Marble Falls limestone, at depths of 3,200 to 3,400 feet.

The following list of the producing sands shows the intervals at which they occur above (+) or below (−) the top of the "Black lime."

	Feet.
Pay sands in the Strawn formation:	
Ray sand	+1,850–1,970
Scott sand	+1,600–1,850
Harris sand	+1,250–1,640
Pay sand in the Smithwick shale:	
"Smithwick lime"	+300
Pay sands in the Marble Falls limestone:	
Brelsford sand	+75–160
Top of "Black lime."	
Base of "Black lime"	−80–130
McClesky sand	−170–230
Lower part of Marble Falls limestone	−350–475

PAY SANDS IN THE STRAWN FORMATION.

Oil and gas are encountered in the Strawn formation in many parts of the Ranger field at depths of 1,300 to 2,000 feet. The yield of the oil wells is usually small, and most of the producing areas cover only 100 to 200 acres. The initial production of the oil wells ranges from 20 to 1,000 barrels a day but is usually less than 100 barrels. The initial production of gas wells ranges from 1 to 75 million cubic feet a day. The oil and gas coming from these depths are derived mainly from three sandstones occurring in the central part of the Strawn formation at approximately the same horizon at which oil and gas are obtained in the shallow-sand pool in Palo Pinto County, about 2 miles west of Strawn. According to the logs these sandstones vary greatly in thickness and persistency. In the series of plotted logs on Plate XVI a correlation of these sands has been attempted. As shown there they thicken toward the northwest and pinch out toward the southeast. Their depth below the Ranger limestone is fairly constant, but the interval between them and the top of the "Black lime" decreases toward the northwest. The three producing sands to which all the shallow productive sands appear to be referable have been here named after the leases on which important production was first obtained in them.

Ray sand.—In tract 2–D of the North Eastland block (see Pl. XVII) there is a small pool in which oil is obtained from a sand lying about 1,650 feet below the surface or about 1,200 feet below the Ranger limestone. The initial production of the wells in this pool averaged about 100 barrels a day. The thickness of the sand ranges from 20 to 45 feet. The limits of the pool have not yet been completely defined. Gas was encountered at the same horizon near and south of Pleasant Grove Church. In most of the wells the gas was mudded in so that drilling could be continued to the McClesky sand, but a few shallow wells were put down to the gas sand, and the gas was used for drilling other wells. The sand has been named the Ray sand because the first notable production of oil from it was obtained in Root, Hupp & Duff's No. 1 well on the J. M. Ray farm (No. 65 on the map).

Scott sand.—Oil and gas are obtained in a number of localities from a sand which lies for 250 to 300 feet below the Ray sand and ranges in thickness from 10 to 75 feet. Oil in considerable amount was first obtained from this sand on the D. K. Scott lease, about 1 mile east of Olden, where in 1918–19 about a dozen wells were brought in, with initial production ranging from 20 to 100 barrels a day. The sand lies about 1,320 feet below the surface and the same distance above the top of the "Black lime." In tract 1–F of the North Eastland block and tract 1–A of the West Ranger block (Pl. XVII) oil is obtained from a bed at the same horizon in the Holleman shallow-sand pool, which is the most productive shallow-sand pool of the Ranger field. In July, 1920, about 30 oil wells had been drilled in this pool, with initial daily production ranging from 100 to 1,000 barrels. The sand here lies about 1,900 feet below the surface, or 1,500 feet below the Ranger limestone, and is approximately 1,630 feet above the "Black lime." South of the oil pool gas is obtained from the same horizon in the wells designated by Nos. 14, 15, 20, 57, 58, and 59 on the map. Well No. 58, the Harrell No. 1, had an initial daily volume of 75 million cubic feet of gas, which escaped into the air for several weeks before the well could be brought under control.

Farther southwest, in tract 3–E of the North Eastland block (Pl. XVII), about half a dozen wells are producing oil from the same sand. A few scattered wells north and west of Olden are also yielding oil from the Scott sand, among which are wells Nos. 243, 249, 257, 258, and 277, Plate XVII.

Harris sand.—Oil has been obtained at two localities in what appears to be a rather persistent sand, which lies about 350 feet below the Scott sand and which is here called the Harris sand, as oil was first obtained in it in the N. B. Harris well (No. 276 on the map), near Olden. In this well the sand is about 25 feet thick and

is about 1,770 feet below the surface, 1,700 feet below the Ranger limestone, and about 1,415 feet above the "Black lime." Two wells also obtained oil from the same horizon in tract 3–B of the West Ranger block. One of these is well No. 85 on Plate XVII. Here the sand lies about 1,975 feet below the surface, 1,800 feet below the Ranger limestone, and 1,640 feet above the "Black lime."

PAY SAND IN THE SMITHWICK SHALE.

The Smithwick shale yields most of the oil obtained in the Caddo and Breckenridge fields, but in the Ranger field oil has been obtained from it only in relatively small amounts, chiefly in the northern part of the field. The "Smithwick lime," known variously as the Breckenridge, Caddo, and "False Black lime," although the main producing bed in Stephens County, was not considered as a possible source of oil in the early development of the Ranger field, but after good wells had been completed in this limestone along the county line in the northwestern part of the area mapped, northwest of the main producing field, some of the older wells in the North Eastland block were shot in it and fairly good yields obtained, though only a slight show of oil was noted when the limestone was penetrated.

The thickness of the pay sand at this horizon could not be definitely determined, but the rapid exhaustion of the wells indicated that it was comparatively slight. According to K. C. Heald the failure of the wells to yield oil in commercial quantity until they were shot and their relatively high yield after shooting probably indicate that sand is absent and that the oil is obtained from the cavities of a very moderately porous limestone.

Any hope that this bed will be productive under much of the field is discouraged by the distinct localization of the producing wells in a moderately well-defined area northwest of the pool where oil is produced from underlying beds. The possibility that it is an important pay sand decreases toward the south, for in that direction it becomes less siliceous and finer textured. In the area mapped the wells numbered 1, 2, 5, 7, 8, 9, 10, 61, and 167 on Plate XVII produced oil from the "Smithwick lime." Their initial daily production ranged from 50 to 2,500 barrels.

PAY SANDS IN THE MARBLE FALLS LIMESTONE.

Probably 90 per cent of the oil obtained so far in the Ranger field has come from the Marble Falls limestone. Oil appears at many horizons in the formation, but most of it apparently comes from about four different sands, three of which are in the upper half of the formation. The most productive sand—the McClesky—is a pure sandstone; the others are apparently sandy limestone and shale and consequently are not confined to any definite horizons.

Brelsford sand.—In the northeastern part of the West Ranger block and in the vicinity of Eastland, west of the main producing field, the black shale member of the upper part of the Marble Falls limestone, which usually occurs about 75 feet above the "Black lime," includes a sandstone that yields both oil and gas. In the northeastern part of the Ranger field this bed is one of the chief producing sands and is often mistaken by the drillers for the "Black lime," which in that locality is very sandy. It attains a maximum thickness in this area of 45 feet. It pinches out south and west of tracts 2–B, 2–C, 2–D, 2–E, and 2–F of the West Ranger block, but was found in the wells drilled near Eastland, where it attains a maximum thickness of about 40 feet and yields oil and gas in most of the wells, including Nos. 170, 261, 261A, 302, and 304 on Plate XVII. The initial production in these wells ranged from 20 to 110 barrels a day. The sand is here called the Brelsford sand because oil was first encountered at this horizon in the Gulf Co.'s Brelsford No. 1 well (No. 261 on the map).

Pay sand at the top of the "Black lime."—Oil and gas are encountered in the top beds of the "Black lime" throughout the Ranger field. The productive bed is a sandy limestone and, next to the McClesky sand, is the most valuable in the field. The best wells obtaining oil at this horizon are north of Pleasant Grove Church and Colony School. The initial production of the wells in the "Black lime" ranges from a few barrels to 1,000 barrels a day, but only a few have yielded more than 500 barrels.

Pay sand at the base of the "Black lime."—At 75 to 130 feet below the top of the "Black lime" there is a second pay sand that produces oil in the eastern part of the Ranger field and in a few wells in other areas. The oil occurs in a sandy limestone that lies near the base of the "Black lime."

McClesky sand.—Most of the oil in the Ranger field comes from a sandstone that is generally known as the McClesky sand, from the fact that it was the pay sand in the discovery well drilled on the J. H. McClesky lease. This sand is also known to the drillers as the "Ranger" sand and "Big pay." It is apparently present in almost the entire producing area of the Ranger field. It occurs 200 feet below the top of the "Black lime," and nearly everywhere it is immediately overlain by a gray limestone 10 to 50 feet thick, but at some localities in the eastern part of the field it is separated from this gray limestone by a few feet of black shale. In most areas a black shale underlies it. The persistence of this sandstone, its relation to overlying beds, and the almost universal presence of oil in it make it an easily recognizable and useful marker. The McClesky sand is a medium to coarse grained sandstone made up of gray or

white angular quartz grains which range in size from 1 to 3 millimeters. It is probably the purest and most persistent sandstone in the "Bend series." As shown on Plate XIX its thickness ranges from 40 feet or more on anticlinal areas to a knife-edge in synclinal areas. An explanation of this difference is offered on page 132. The initial production from this sand ranges from 10 to 11,000 barrels a day.

Pay sands in lower part of Marble Falls limestone.—In a few wells scattered throughout the field oil has been obtained below the McClesky sand at depths of 350 to 475 feet below the top of the "Black lime." In most of these wells the production is very small. The pay sand apparently is a porous layer in a sandy limestone and does not represent any persistent producing bed. If more wells had been drilled through these deep-lying strata it might be possible to recognize two or more of these producing sands, but no attempt has yet been made to classify them, and they have been grouped together.

FACTORS THAT DETERMINED THE OCCURRENCE OF THE OIL.

Importance of structure.—A cursory glance at the structure map (Pl. XVIII) shows no apparent relation between the producing areas and the folding of the strata, but a study of the field as a whole and of the facts of production shows that the main producing areas are on anticlinal folds, although the distribution of producing wells does not fully reveal this relation. In the early history of the field, as a result of competitive drilling, the wells were located along property lines, and so large a part of the oil recoverable from each property was obtained from these marginal wells that the oil companies often found it unremunerative to drill inside properties from which the oil had been drained or in which, owing to the waste of gas in the earlier wells, the gas pressure was so low that the oil could not be recovered from the sands. With the exception of parts of the New Hope anticline and the northwest spur of the Merriman anticline, all the anticlinal folds were potential oil-producing areas. In the synclinal troughs, on the other hand, only a few wells have been drilled, and these have yielded but small amounts of oil. In fact, in every part of the field where development has approached synclinal areas the yield of the wells shows a decrease, and, with a few exceptions, dry holes or wells in which salt water drowned out the oil have been obtained in the synclines. The syncline that extends northward through the town of Ranger is unproductive, but the anticlinal fold to the west and a part of the anticline to the south are productive. The synclinal belt lying between the Ranger and Olden anticlines is unproductive except for some small wells in its northeastern part. The whole extent of the syncline that begins in the southwest corner

of the West Ranger block, swings around the nose of the Olden anticline west and north of Pleasant Grove Church, and extends northeastward between the New Hope and Ranger anticlines marks a belt of salt water, dry holes, and wells of small yield, whereas in the adjoining anticlinal areas the best production of the field was obtained. Southwest of the main producing field, in the southern part of the Eastland block, there are a number of oil wells that are located on an anticline.

The best production, as a rule, has been obtained in and along the flanks of anticlinal spurs. Thus in the eastern part of the field the largest yields were obtained along the west spur of the West Ranger anticline, and probably the best producing area of the whole field lies along the narrow fold of the Olden anticlinal spur. Gas, though apparently present in large volumes in all the earlier wells, was encountered in the greatest quantities near the crests of the folds and apparently occupied all the pore spaces in the sands in the crest of the Ranger anticline. Salt water in the "Bend" strata has appeared only in synclinal areas. Thus it is seen that throughout the field structure appears to have been an important factor in the segregation of oil and gas.

Importance of the thickness of the McClesky sand.—The occurrence of oil in the Ranger field also shows a close relation to the thickness of the McClesky sand. This sand, in which 75 per cent of the oil produced in the field has been obtained, has a thickness of 30 to 50 feet in the most productive part of the field, and almost the entire producing area lies within the line marking a thickness of 25 feet. In areas where the sandstone is thinner than 25 feet the wells have very small yields, and where the sand is absent dry holes are encontered even on anticlines unless, as occurs in the northeastern part of the area, other porous beds are present. The thickness of the sand is apparently a measure of its porosity. Where it is less than 20 feet thick it is apparently too fine grained or contains too much argillaceous and calcareous matter to yield oil. Where it is thicker it becomes a reservoir for oil, and its pore spaces are large enough for the oil to drain or be forced by gas into the bore hole when the sand is penetrated by the drill.

In the parts of the field where oil occurs in the shallow sands (the wells producing from which are shown in red on Pl. XVII) the lenticularity of these sands is apparently as important a factor as the structure in determining the distribution of the oil, for although all the wells producing from shallow depths except those in the Holleman shallow-sand pool, in the northeastern part of the North Eastland block, are on anticlines, the small extent of the pools, most of which contain but a few wells, indicates that the sandstone yielding

the oil is lenticular. It is probable, however, that by further testing these shallow sands will be found to be productive over larger areas than are indicated by the present wells.

To summarize, the principal facts as to the occurrence and production of oil in the Ranger field are that the main producing areas are those where the McClesky sand attains a thickness of 20 feet or more and the strata have been folded into anticlines, and that the best yields are obtained on plunging anticlines.

GRADE OF OIL.

The oil produced in the Ranger field is of high grade. Its gravity ranges from 35° to 40° Baumé. The average gravity of the oil from different horizons, according to M. M. Garrett, geologist for the Sinclair Oil Co., are: Holleman shallow-sand pool (Scott sand), 35.7° Baumé; "Smithwick lime" (Breckenridge lime), 40.3°; Marble Falls limestone, 39.0°.

ORIGIN OF THE OIL.

The oil occurring in the "Bend series" apparently has had its origin in the organic matter deposited in the black shales and limestones that make up the greater part of the series. The oil in the Strawn formation may have migrated upward from the "Bend," but as some of the shales interbedded with the sandstones of that formation are black it has probably been derived from these shales. The higher gravity of the oils in the "Bend" strata may be due to the fact that these strata, which are older and more intensely folded than those of the Strawn, have been subjected to greater regional stresses. According to White,[32] this would result in a higher grade of oil.

PRODUCTION AND DECLINE OF THE WELLS.[33]

When the field work for this report was finished, July 1, 1920, there were in the area mapped, which included the entire Ranger field with the exception of a dozen or so dry holes and small producers east of the town of Ranger, 850 oil wells, 35 gas wells, 150 dry holes, and 220 wells being drilled. The total production of the field up to that time was about 20,000,000 barrels, which probably represents 75 per cent of the total ultimate production of the field. The maximum daily production of the field (80,000 barrels) was reached in the second week of July, 1919. The daily production July 1, 1920, was about 20,000 barrels. The initial production of the individual wells has been high. The first wells drilled in the different parts of the field

[32] White, David, Some relations in origin between coal and petroleum: Washington Acad. Sci. Jour., vol. 5, No. 6, pp. 189–212, 1915.

[33] Valuable statistics as to the production and cost of operating in the Ranger field are given in the following reports, from which part of the data here presented have been obtained: Stephenson, E. A., and Bennett, H. R., Decline and production of Ranger field: Am. Assoc. Petroleum Geologists Bull., vol. 4, No. 3, pp. 221–248, 1920; Wheeler, H. A., Wild boom in North Texas oil fields: Eng. and Min. Jour., vol. 109, No. 13, pp. 741–748, Mar. 27, 1920.

came in with 1,000 to 11,000 barrels each, though few exceeded 5,000 barrels, and most of them produced less than 2,500 barrels. Among the largest producers in the field were the Prairie Oil & Gas Co.'s Emma Terrell No. 1 (No. 93 on the map), the Texas Pacific Coal & Oil Co.'s G. E. Norwood No. 1 (No. 196 on the map), and the Ohio Ranger Oil Co.'s Eli Perkins No. 1 (No. 155 on the map). The initial daily production of these wells was of 7,000, 11,000, and 8,000 barrels, respectively. The large initial production of the wells decreased rapidly. Some wells produced during the first month one-third of their total output and at the end of twelve months or less ceased to produce. Thus the ultimate production of the wells is not large, averaging no more than that of wells producing 100 barrels a day for a year. The ultimate production of the entire field will not exceed 1,000 barrels an acre, though some of the most productive leases will recover from 2,500 to 3,500 barrels an acre. Leases that show a greater acreage production than this are apparently drawing oil from adjoining properties. The possibilities of doing this are apparent from the statements of Stephenson and Bennett [34] that the first well drilled on an average-sized lease obtains approximately 75 per cent of the ultimate production of that lease and gets one-third of this during the first month. Thus a well drilled along a property line, if completed one month ahead of the offset well, will probably obtain 25 per cent of the oil recoverable from the adjoining lease. However, the fact that so small a percentage of the ultimate yield is obtainable by the later wells probably is not so much the result of the draining of the area by the first well as of the lowering of the gas pressure in the sands caused by allowing the gas to flow freely into the air. In the early development of the Ranger field no attempt was made to conserve this gas pressure, and it is probable that the ultimate recovery in this field will be less than one-fourth of the total amount of the oil in the sands. If the gas pressure of the sands had been conserved, a much greater percentage of the oil could have been recovered.

SALT WATER.

Salt water has been encountered in most of the sandstones in the Canyon and Strawn formations but only in a few localities in the "Bend series." It was thought in the early development of the field that there would be no trouble with salt water, but later considerable salt water was encountered in the McClesky sand in synclinal areas in the eastern part of the North Eastland block and in areas north of Pleasant Grove Church and Colony School. The water does not appear, however, to have attained any uniform level throughout the field. In the syncline extending around the nose of the Olden anti-

[34] Op. cit., p. 247.

cline the edge-water line in the McClesky sand attains a level about 2,990 feet below the sea, or a position structurally below the 1,210-foot contour on the "Black lime." In the syncline lying south of the New Hope anticline water is encountered in the same sand in areas lying within the 1,180-foot contour. Wells drilled along the edge of an area where water occurs in the McClesky sand usually encounter oil in the upper part and water in the lower part of the sand. Little water is encountered in the "Bend" strata elsewhere than at this one horizon, but large volumes of water are found in the Ellenburger limestone in almost every well that has penetrated that formation.

RECOMMENDATIONS FOR DRILLING.

The surface structure of the area south and west of the Ranger field indicates that there are in this area localities where the structure is favorable for the occurrence of oil, and there may be other localities in which there are anticlines in the "Bend" strata not represented by the surface structure. The productivity of these localities depends largely upon the presence in the "Bend series" of beds of sufficient porosity to contain oil. The records of most of the wells drilled in the southern part of the area mapped indicate that the principal oil-producing sand of the Ranger field—the McClesky sand—is either absent in that locality or only a few feet thick. Thus it is probable that some of the areas mentioned below will not be productive, and that in none of them will large initial production be obtained unless sands of greater porosity are found in them than have been reported so far in the logs of wells already drilled in this region.

The untested area in the Eastland block that structurally is most favorable lies along a northwest line extending diagonally across tracts 2–B and 3–C. There are good possibilities for obtaining oil in this area either in the sandstone near the base of the Smithwick shale or in the pay sands of the Marble Falls limestone. If gas is encountered in the first wells drilled further drilling should be done a short distance to the northwest. If oil is obtained in this locality there is a possibility that the producing area may be extended southeastward to the Connellee lease, in tracts 5–E and 5–F. The gas wells numbered 306 and 307 on the map probably lie on the crest of a plunging anticline in the "Bend series" that extends northwestward from the anticlinal fold which yields oil on the Connellee lease. In the southwestern part of the Eastland block the most favorable place for a test is in the northwest corner of tract 5–B.

In the Olden block the most favorable areas for future tests are in tract 4–A and the northern part of tract 4–B. In tract 5–F there is a slight possibility that oil may be obtained in the sand that yields oil in the Minnie Sibley well and that lies about 450 feet below the top of the Marble Falls limestone.

In the northern part of the North Eastland block drilling is more active than anywhere else in the area mapped and oil is being obtained in several localities from beds at three or four horizons. In this area the "Smithwick lime" will probably yield oil in tracts 1–A, 1–B, 1–C, and 1–D, and probably in parts of tracts 2–D, 2–E, 2–F, 3–E, 3–F, 4–D, and 4–E. Oil should also be obtained from the McClesky sand or from other pay sands in the "Black lime" in parts of tracts 2–E, 2–F, 3–E, 3–F, 4–E, and 5–D. The shallow sands can also be expected to yield more oil in the northeastern part of the block, and there is a probability that the pay sand at the base of the Smithwick shale will yield more oil in tracts 5–C, 5–D, 6–C, and 6–D. Of the four blocks mapped the North Eastland block will yield the most new production.

The oil-producing areas of the West Ranger block are fairly well outlined by the drill, and there seems to be small opportunity for much new production to be obtained in the block. In rounding out the development tests should not be made in the synclinal areas shown on Plate XIX, except as they are reached by extending existing pools. A more careful test of the shallow sands of this block would result in added production from them along anticlinal areas. Shooting of the "Smithwick lime" will probably result in obtaining oil in many of the old wells in the northern part of the block. It is improbable that oil will be encountered in the Ellenburger limestone.

Throughout the Ranger field great quantities of gas have been encountered in all the oil sands. Much of this gas has been allowed to escape in the main part of the oil field, but in the outlying districts there are a number of areas that are rich in natural gas.

WELL TABLES.

Wells in the Ranger oil field, Eastland County, Tex.

Map No.	Farm.	Well No.	Company.	Elevation (feet).	Total depth (feet).	Depth to top of "Black lime" (feet).	Depth to top of producing sand (feet).	Initial daily production (barrels).	Daily production in January, 1921 (barrels).	Date of completion.	Remarks.
1	— Stokes	1	Fensland	1,506	3,185	[a] 3,398	3,144	2,600		Apr. 30, 1920	
2	S. E. Tolle	1	Ajax	1,497	3,243	[a] 3,450	3,066	2,000		May, 1920	
3	C. J. Harrell	1	Mid-Kansas	1,562	1,765		1,742	[b] 30,000,000		Mar. 14, 1920	
4	F. Muller	1	Tex-Olean Oil	1,576			1,920	[b] 15,000,000			
5	W. H. Ray	1	States Oil Corporation	1,539	3,745	3,490	3,200	1,200	490	May 7, 1920	
6	J. E. Nix	3	do	1,561	1,981		1,965	69	16	March, 1920	
7	J. J. Hand		Texas & Pacific	1,536	3,307	[a] 3,477	3,280	50	±50	May, 1920	
8	J. W. Langford	1	States Oil Corporation	1,622	3,392	[a] 3,561	3,261	50		June, 1920	
9	J. W. Holleman	1	Ajax	1,593	3,392	[a] 3,537	3,237	(?)		June 1, 1920	
10	M. Loper (W)	3	Magnolia Petroleum	1,591	3,314	[a] 3,505	3,274	120	50	Apr. 12, 1920	
11	J. W. Holleman	2	Hercules	1,579	1,900		1,894	500	77	November, 1919	
12	do	5	States Oil Corporation	1,617	1,928		1,917	450	[c] 60	Apr. 7, 1920	
13	do	1	do	1,567	1,876		1,884	288	[c] 60	Dec. 28, 1919	
14	I. J. Shehan	4	do	1,580							
15	I. C. Harrell	3	do		1,858		1,826	[b] 9,000,000		Mar. 22, 1920	
16	M. Loper (E)	2	do	1,578	1,895		1,880	100		Jan. 18, 1920	Gas at 1,883 feet; oil at 1,888 feet.
17	Earnest	4	Sinclair	1,558							
18	I. C. Harrell	6	States Oil Corporation		1,880		1,840	500	[c] 52	Mar. 29, 1920	
19	do	1	do	1,559	1,884		1,871	500		Nov. 5, 1919	
20	I. C. Harrell (E)	1	do		1,884		1,871	[b] 20,000,000	[b] 20,000,000	Dec. 25, 1920	
21	J. G. Christmas	5	Texas & Pacific	1,549			1,709	125			
22	R. H. Danley	2	Prairie Oil & Gas	1,571	3,622	3,388				October, 1919	Dry.
23	do	1	do	1,573	3,392	3,367	3,383	600	0	July, 1919	
24	B. A. Danley	1	do	1,591	3,604	3,385	3,598	3,500	[c] 49	April, 1919	
25	R. H. Danley	3	do	1,573	3,602	3,375	3,598	128	0	February, 1920	
26	J. L. Pierce	2	Strab	1,587		[a] 3,470					
27	C. P. Jones	1	Sinclair	1,593	3,555	3,462		60		September, 1919	
28	J. G. Christmas	1	Sun Oil	1,592	3,455	3,400		0	0		Do.
29	J. E. Barnes	1	Prairie Oil & Gas	1,586	4,300	3,393		0	0	June, 1919	Do.
30	C. E. Terrell	1B	Texas & Pacific	1,603	3,400	[a] 3,430	3,363	1,210	68	October, 1919	
31	E. H. Collins	1	Magnolia Petroleum	1,575	3,833	3,435	3,463	0	0		Do.
32	Baptist Church	1	Stanton	1,590	3,480	(?)	3,305	10	26	November, 1919	
33	S. T. Whitson	1	Texas Pacific	1,533	3,512	3,400	3,328	200	0	May, 1919	
34	D. D. Hestilow	1	Prairie Oil & Gas	1,559	3,440	3,410	3,435	300	0	January, 1919	
35	H. C. Poole	1	Texas & Pacific	1,549	3,600	3,400				December, 1919	Do.
36	L. M. Cook	1	do	1,545	4,359	3,386		0	0		Do.
37	N. S. Whitson	2	do	1,559	3,397	3,397	3,285	30	0	November, 1918	

38	T. H. Connor	2	do	1,541	3,356	3,353	3,324	112	±100	Aug. 13, 1919	
39	N. Walker	1	Magnolia Petroleum	1,476	3,460	3,274		0			Do.
40	R. D. Cooper	1	Texas & Pacific	1,488	3,591	3,230		0	0	Mar. 21, 1919	Do.
41	J. Beidleman	1	do	1,533	3,353	3,310		0	0		Do.
42	D. B. Thompson	2	do	1,558	3,758	3,341	3,632	[b] 3,500,000		November, 1919	Gas well.
43	Harpool	5	Sinclair	1,556	3,271	3,223		50	9	September, 1919	
44	S. S. Griffin	1	Mid-Kansas	1,558	3,435	3,320	[d] 3,245	353	10	June, 1919	
45	do	3	do	1,573	3,340	[a] 3,353	3,268	50	10	March, 1920	
46	Mary Barnes	7	Gulf Oil & Refining	1,555	3,490	3,356	3,470	10		October, 1919	
47	M. Barnes	1	do	1,551	3,571	3,360	3,297	500	0	May, 1919	
48	J. E. Barnes	1	Sinclair	1,569	3,673	3,270	3,653	600	[c] 4	June, 1919	
49	M. Barnes	2	Gulf Oil & Refining	1,577	3,526	3,330	3,244	3,500	0	August, 1919	
50	O. Meadors	7	Texas & Pacific	1,522	3,561	3,307	3,537	150	9	January, 1920	
51	do	6	Prairie Oil & Gas	1,542	3,537	3,310	3,512	9	0	February, 1920	
52	W. W. Crab	2	do	1,578	3,601	3,345	3,597	500	30	January, 1920	
53	Barker	1	Rickard, Tex	1,555		3,347		100		August, 1919	
54	W. T. Davis	6	Gulf Oil & Refining	1,498		3,274					
55	do	2	Sinclair	1,541?	3,305	3,313	3,303	800	5	November, 1919	
56	Barker heirs	1	Gates Extension	1,545	3,522	3,320	3,520	200	0	August, 1919	
57	Corner School	1	States Oil Corporation	1,579			1,470				
58	Harrell	1	Ranger Texas Oil	1,547			1,780	[b] 75,000,000		May, 1919	
59	Bryant	1	Vulcan Oil	1,535	1,750		1,735				
60	J. Harrell	1	States Oil Corporation	1,555	1,780		1,768			December, 1919	
61	Summerall	1	do	1,548	3,363		3,190	750	390	Mar. 23, 1920	
62	G. T. Parrock	1	do	1,623	4,085	3,500	3,662	400	30	June, 1919	
63	do	3	do	1,632	1,703		1,654	100	[c] 60	June, 1920	
64	Calvert	1	do	1,636	1,765		1,650	20	6		
65	J. M. Ray	1	Elbert Hupp	1,611	3,895	3,496	1,644		20		
66	do	2	do	1,580	1,660		1,623	75	45	April, 1920	
67	Watson	1	El Paso Ranger	1,540							Being drilled.
68	do			1,534							
69	Carter	1	Elbert Hupp	1,613	3,577	3,525	3,571	200		June, 1920	
70	S. C. Bond	1	States Oil Corporation	1,644	3,705	3,510	3,548	323	160	February, 1920	
71	Carter	1	do	1,614	3,664	3,495	3,492	50	9	May, 1920	
72	E. Calvert	1	Plateau Oil	1,578	1,904		1,897	125	60	March, 1920	
73	T. W. Henderson	1	States Oil Corporation	1,587	2,200						Abandoned.
74	Harmony Church	1	Mildren Oil	1,529	3,541	3,341	3,506	100	76	May, 1920	
75	W. L. Dooley	1	States Oil Corporation	1,515	3,564	±3,325	3,405	350	71	June, 1920	
76	L. L. Davis	3	Prairie Oil & Gas	1,538	3,529	3,360	3,517	1,500	1,000	April, 1920	
77	do	7	do	1,513	3,406	3,326	3,390	1,200	[c] 600	May, 1920	
78	C. F. Hamor	1	Vulcan Oil	1,552	3,566	3,327	3,543	100	62	January, 1920	
79	do	2	do	1,584	3,820	3,335				March, 1920	Dry.
80	T. Y. Butler	2	States Oil Corporation	1,521	3,424	3,334	3,399	1,000	[c] 400	April, 1920	
81	do	1	do	1,547	3,590	3,380	3,586	3,500	500	September, 1919	
82	R. A. Madding	B3	Prairie Oil & Gas	1,536	3,555	3,360	3,543	20		April, 1920	
83	do	B8	do	1,565	3,650	3,407	3,475	1,000		June, 1920	
84	do	A5	do	1,520	3,605	3,396				do	Salt water at 3,585 feet.

[a] Well not drilled to this depth, but approximately the depth at which the "Black lime" should be reached.
[b] Cubic feet of gas.
[c] Average production of each well on lease.
[d] Log does not show "Black lime" at this depth, but it is about at the depth indicated.

Wells in the Ranger oil field, Eastland County, Tex.—Continued.

Map No.	Farm.	Well No.	Company.	Elevation (feet).	Total depth (feet).	Depth to top of "Black lime" (feet).	Depth to top of producing sand (feet).	Initial daily production (barrels).	Daily production in January, 1921 (barrels).	Date of completion.	Remarks.
85	C. F. Hamor	4	Vulcan Oil	1,546	2,205		1,975	170	56	November, 1919.	
86	W. T. Davis	1	Sinclair	1,503	3,536	3,321	3,526	400	c 6	August, 1919	
87	B. L. Danley	5	Markham & Tidal Oil	1,522	3,540	3,308	3,503	40			
88	do	7	Sinclair	1,499	3,427	3,295	3,292	230	c 40	November, 1919.	
89	T. Davis	1	Humble Oil & Refining	1,527	3,371	d 3,317	3,361	700	c 10	July, 1919	
90	O. E. Meadors	10	Texas & Pacific	1,496	3,335	3,300	3,353	25	0	March, 1920	
91	J. E. Rust	6	Sun Oil	1,477	3,439	3,220	3,434	300	c 10	June, 1919	
92	Copeland	9	Markham & Tidal Oil	1,508	3,332	3,260	3,330	900	c 30	June, 1920	
93	E. Terrell	1	Prairie Oil & Gas	1,511	3,243	3,243	3,455	7,000		December, 1918.	
94	do	4	do	1,502	3,478	3,215	3,448	1,180	c 5	June, 1919	
95	W. J. Nash	4	Magnolia Petroleum	1,513	3,706	3,223	3,684	100	c 3	May, 1919	
96	Copeland	13	Markham & Tidal Oil	1,563	3,535	3,304	3,508	2,000	c 30	June, 1919	
97	do	1	do	1,545	3,505	3,257	3,486	50	30	April, 1919	
98	do	24	do	1,560	3,569	3,322	3,539			May, 1920	
99	W. E. Rock	6	Magnolia Petroleum	1,568	3,535	3,300	3,516	150	150	June, 1919	
100	S. S. Griffin	6	Hamon & Westheimer	1,581	3,380	3,281	3,360	15		September, 1919.	
101	R. L. Howard	5	Prairie Oil & Gas	1,584	3,300	3,325					Dry.
102	W. E. Rock	2	Magnolia Petroleum	1,572	3,545	3,300	d 3,495	1,500		April, 1919	
103	do	2	Dunlap	1,570	3,555	3,275		1,000		December, 1918.	
104	J. W. Jones	1	Humble Oil & Refining	1,560	3,492	3,765	3,148	1,000		July, 1918	3,000,000 cubic feet of gas at 3,148 feet.
104A	do	2	do	1,560		3,210	3,474	1,500		September, 1918.	
105	W. Rice	2	Texas & Pacific	1,536	3,454	3,230	3,442	100	13	March, 1920	
106	Demeck	1	do	1,572	3,504	3,265					Dry.
107	K. Hodges	2	do	1,527		3,220					Do.
108	Eva McDonald		do	1,455		3,164		40	0	December, 1918.	
109	Rust & Weir	1	Plains Oil	1,441	3,190	3,154		7		October, 1918	
110	Steward	2	Texas & Pacific	1,452	3,200	3,137					Do.
111	Pratt	1	Cunningham	1,449	3,520	3,193		8	0	May, 1918	
112	J. M. Rust	1	Texas & Pacific	1,515	3,470	3,225	3,443	648	0	June, 1918	
113	Dean	1	Sammies	1,470		3,178		20	0	September, 1918.	
114	Goforth	1	Lone Star Gas	1,564		3,275		150	0	October, 1918	
115	J. W. Jones	3	Humble Oil & Refining	1,563	3,502	3,243		30		January, 1919	
116	A. L. Duffer	2	Texas	1,560	3,695	3,240	3,436	b 10,000,000		July, 1919	Gas.
117	McClesky heirs	1	Texas & Pacific	1,527	3,458	3,235	3,438	1,000		January, 1919	
118	J. W. Terry	1	Prairie Oil & Gas	1,556	3,470	3,235	3,429	200	2	January, 1918	
119	A. L. Duffer	4	Texas	1,553	3,483	3,243	3,455	600	0	January, 1919	
120	do	3	do	1,558	3,481	3,237	3,446	b 50,000,000		December, 1918.	
121	W. J. Nash	5	Magnolia Petroleum	1,552	3,706	3,253	3,684	100	c 3	June, 1919	
122	J. W. Terry	2	Prairie Oil & Gas	1,522	3,485	3,218	3,456	200	0	December, 1918.	

123	I. Slayden	2	do	1,536	3,487	3,240	3,443	300	0	April, 1919	
124	E. Terrell	5	do	1,498	3,445	3,205	3,415	130	c 4	June, 1919	
125	I. Slayden	7	do	1,552	3,519	3,276	3,487	600	0	do	
126	J. G. Christmas	2A	do	1,520	3,470	3,248	3,440	800	0	March, 1919	
127	J. E. Butler	12	Texas & Pacific	1,477	3,488	3,235	3,440	800	c 23	September, 1919.	
128	E. Terrell	11	Prairie Oil & Gas	1,485	3,457	3,200	3,419	75	c 5	May, 1919	
129	J. E. Rust	2	Sun Oil	1,475	3,434	3,205	3,422	5,000	c 10	April, 1919	
130	E. Roper	2	Prairie Oil & Gas	1,470	3,441	3,210	3,425	6,000	c 3	June, 1919	
131	do	3	do	1,464	3,466	3,240	3,442	1,350	c 1	July, 1919	
132	J. T. Roper	4	do	1,466	3,448	3,218	3,422	10	0	December, 1919.	
133	J. E. Rust	5	Sun Oil	1,492	3,452	3,241	3,440	250	c 10	September, 1919.	
134	W. M. Myers	2	Prairie Oil & Gas	1,439	3,309	3,107	3,297	2,500	c 12	February, 1919.	
135	do	1	Texas & Pacific	(?)	3,411	.....	3,388	10	0	June, 1919	
136	W. T. Boyd	1	Texas	1,489	3,465	3,236	3,448	4,200	c 40	do	
137	J. T. Roper	9	Prairie Oil & Gas	1,468	3,416	.....	3,390	550	c 23	January, 1920.	
138	W. T. Boyd	2	Texas	1,535	3,470	3,225	3,459	3,600	c 40	July, 1919	
139	do	13	do	1,501	3,485	3,255	3,466	800	c 45	January, 1920.	
140	J. T. Earnest	1	Prairie Oil & Gas	1,465	3,312	3,122	3,295	300	c 40	Mar. 8, 1918	
141	R. A. Madding	A3	do	1,522	3,538	3,324	3,505	800	c 10	January, 1920.	
142	do	B7	do	1,553	3,554	3,341	3,530	300	c 90	March, 1920	
143	W. T. Boyd	7	Texas	1,536	3,517	3,306	3,495	555	c 30	do	
144	Wright	1	Ranger Rock Island	1,526	3,483	3,283	3,483	3,000	c 45	September, 1919.	
146	do	1	Central Ranger	1,480	3,305	3,200	3,260	700	.....	August, 1919	
147	E. A. Allen	1	Leon Oil	1,496	3,467	3,255	3,437	300	.....	June, 1919	
148	J. C. Littleton	11	Texas	1,506	3,524	3,285	.....	.....	.....	.....	Dry
149	do	13	do	1,540	3,399	3,311	3,374	1,000	c 65	March, 1920	
150	do	16	do	1,500	3,497	3,277	3,483	630	c 65	January, 1920.	
151	do	7	do	1,503	3,502	3,275	3,493	800	c 65	December, 1919.	
152	E. A. Allen	4	Leon Oil	1,497	3,485	.....	3,466	2,500	.....	September, 1919.	
153	J. W. Turner	4	Barclay	1,502	3,497	3,287	3,493	632	c 72	January, 1920.	
154	do	2	do	1,511	3,513	3,302	3,500	1,800	c 72	November, 1919.	
155	E. Perkins	1	Ohio Range	1,521	3,536	3,307	3,517	8,000	.....	.....	
156	C. Perkins	1	Gulf Oil & Refining	1,507	3,469	3,282	3,448	3,000	0	October, 1919.	
157	Smith-Riggs	.....	Republic Oil	1,500	3,470	±3,300	.....	1,250	400	March, 1920	
158	Brooks	2	Southwestern Oil & Development Association.	1,509	.....	3,315	.....	350	75	December, 1919.	
159	C. Perkins	2	Gulf Oil & Refining	1,513	3,542	3,314	3,540	2,500	c 40	October, 1919.	
160	E. Perkins	1	Root, Hupp & Duff	1,548	3,630	3,354	3,355	71	c 10	September, 1919.	
161	Stateland	7	Humble Oil & Refining	1,520	3,455	3,252	3,436	10	15	.....	
162	H. C. Earnest	1	States Oil Corporation	1,564	3,450	3,367	3,427	1,200	c 37	Nov. 11, 1919.	
163	W. G. Poteet	3	Elbert Hupp	1,526	3,580	3,323	3,367	600	c 25	January, 1920.	
164	do	5	do	1,517	3,390	3,330	3,375	1,500	c 25	December, 1919.	
165	V. Harbin	1	States Oil Corporation	1,539	3,581	3,362	3,550?	.....	.....	October, 1919	Hole full of water at 3,581 feet.
166	Peel	1	do	1,535	3,582	3,375	3,406	100	0	January, 1920	
167	J. C. Dabs	1	do	1,573	3,454	3,454	3,147	500	100	June, 1920	

b Cubic feet of gas.
c Average production of each well on lease.
d Log does not show "Black lime" at this depth, but it is about at the depth indicated.

Wells in the Ranger oil field, Eastland County, Tex.—Continued.

Map No	Farm.	Well No.	Company.	Elevation (feet).	Total depth (feet).	Depth to top of "Black lime" (feet).	Depth to top of producing sand (feet).	Initial daily production (barrels).	Daily production in January, 1921 (barrels).	Date of completion.	Remarks.
168	T. Morton	1	....do	1,574	3,691	[d] 3,430	3,486 3,590	50	24	October, 1919	35,000,000 cubic feet of gas at 1,905 feet.
169	Baumgartner	1	New Domain	1,601	3,668	3,450	3,460 3,480				Little gas.
170	G. W. Simer	1	Caldwell	1,528	3,865	3,465	3,420	20	5	October, 1919	
171	N. Downtain	1	New Domain	1,538							Being drilled.
172	Baumgartner	1	Great Southern	1,570	3,750	[d] 3,452	3,460	240	25		
173	....do	2	....do	1,574							Do.
174	Williamson	1	New Domain	1,564	3,622	3,437	3,614	1,000	576	May, 1920	
175	J. A. Brown	1	Albers Oil	1,576	3,600	3,391				....do	Dry.
176	....do	1	West Virginia & Ranger	1,597	3,682	3,424	3,431	15	40	February, 1920	
177	Hawk	1	Folsom	1,580	3,646	3,438	3,635	2,400	0	November, 1919	Turned to water.
178	Peel	3	States Oil Corporation	1,567	3,597	3,430	3,578	50	0	January, 1920	
179	E. R. Allen	2	Empire	1,548	3,570	3,374	3,568	896	[c] 90	March, 1920	
180	E. R. Hanks	3	Prairie Oil & Gas	1,548	3,575	3,375				May, 1920	Dry.
181	B. D. Barber	1	States Oil Corporation	1,558	3,570	3,342	3,345	800	3	October, 1919	
182	....do	2	....do	1,542	4,505	3,350	1,385	[b] 1,500,000	0		
183	E. R. Hanks	1	Prairie Oil & Gas	1,531	3,561	3,340	3,340	528	0	February, 1920	
184	E. A. Allen	2	Empire	1,508	3,492	3,306	3,478	50		....do	
185	J. M. Turner	10	Magnolia Petroleum	1,511	3,341	3,270	3,330	85	[c] 18	May, 1920	
186	....do	9	....do	1,507	3,503	3,270	3,454	15		....do	
187	N. E. Turner	1	States Oil Corporation	1,534	3,587	3,305	3,509	700	0	July, 1919	
188	State land	1	Humble Oil & Refining	1,546	3,442	3,229	3,419	60	[c] 6	January, 1919	
189	G. E. Norwood	29	Texas & Pacific	1,550	3,490	3,275	3,490	400	[c] 20	May, 1920	
190	....do	20	....do	1,486	3,463	3,225	3,441	200	[c] 20	March, 1920	
191	....do	16	....do	1,528	3,475	3,250	3,448	4,000	[c] 20	December, 1919	
192	....do	5	....do	1,535	3,439	3,231	3,419	1,250	[c] 20	November, 1919	
193	T. W. Connellee	13	Magnolia Petroleum		1,468		1,445	600	[c] 13	January, 1919	
194	G. E. Norwood	23	Texas & Pacific	1,486	3,435	3,205	3,395	300	[c] 20	March, 1920	
195	....do	27	....do	1,486	3,432	3,195	3,405	75	[c] 20	May, 1920	
196	....do	1	....do	1,486	3,412	3,195	3,385	11,500	[c] 20	February, 1919	
197	T. W. Connellee	12	Magnolia Petroleum	1,528	3,437	3,240	3,420	250	[c] 15	March, 1920	
198	....do	1	....do	1,524	3,420	3,200	3,405	5,000	[c] 15	January, 1919	
199	J. E. Butler	20	Texas & Pacific	1,490	3,642	3,222	3,222	50	[c] 25	March. 1919	
200	J. W. Turner	5	Texas	1,561	3,567	3,297	3,551	300	[c] 36	March, 1920	
201	J. E. Butler	23	Texas & Pacific	1,476	3,444	3,218	3,422	300	[c] 25	May, 1919	
202	....do	5	....do	1,507	3,451	3,247	3,414	2,000	[c] 25	July, 1919	
203	M. Patton	2	Humble Oil & Refining	1,494	3,530	3,220	3,497	500	[c] 5	May, 1919	
204	....do	3	....do	1,493	3,595	3,220					Do.

205	J. T. Johnson	7	Prairie Oil & Gas	1,437	3,385	3,160	3,350	20	0	May, 1919	
206	J. G. Christmas	B2	do	1,512	3,450	3,215	3,408	200	c 5	June, 1919	
207	do	A3	do	1,513	3,470	3,220				February, 1919	Do.
208	do	B1	do	1,534	3,480	3,230	3,440	700	c 5	May, 1919	
209	J. H. McClesky	3	Mid-Kansas	1,464	3,426	3,163	3,350				
210	Dan McClesky	3	Hamon & Westheimer	1,537	3,420	3,220	3,412	1,500	c 43	February, 1919	
211	J. H. McClesky	1	Texas & Pacific	1,515	3,434	3,215	3,427	1,500	(?)	October, 1911	Discovery well.
212	T. W. Duncan	2	do	1,521	3,425	3,216	3,410	1,200	c 15	April, 1919	
213	do	1	do	1,483	3,395	3,170	3,375	1,000	c 15	January, 1918	
214	L. Williams	1	do	1,474	3,423	3,162	3,355	100	0	May, 1918	
215	J. H. McClesky	3	do	1,480	3,437	3,195	3,431	50	c 5	February, 1919	
216	V. V. Cooper	1	do	1,465	3,715	3,181				August, 1918	Dry.
217	do	2	do	1,504	3,458	3,184					
218	J. H. Clemmer	1	do	1,470	3,385	3,155	3,375	30	c 25	March, 1919	
219	W. T. Pitcock	1	do	1,451	4,020	3,129					Do.
220	J. T. Earnest	1	Prairie Oil & Gas	1,465	3,312	3,135	3,295	300		August, 1918	
221	W. M. Meyers	3	do	1,442	3,322	3,102	3,292	950	c 12	June, 1919	
222	do	1	do	1,455	3,330	3,136	3,325	600	c 12	April, 1919	
223	W. E. McClesky	1	Texas & Pacific	1,482	3,368	3,161	3,341	100	c 18	July, 1919	
224	I. B. Hand	3	do	1,446	3,320	3,100	3,290	1,500		May, 1919	
225	J. T. Earnest	2	Prairie Oil & Gas	1,452	3,305	3,097	3,295	600	c 20	January, 1919	
226	W. E. McClesky	2	do	1,428	3,310	3,102	3,298	20	c 15	April, 1919	
227	C. J. Keaghey	A2	do	1,441	3,365	3,130		138	c 3	July, 1919	
228	do	A3	do	1,429	3,358	3,130	3,327	10	c 3	June, 1919	
229	J. W. Duncan	1	Sun Oil	1,424	3,388	3,120	3,363	50	0	March, 1919	
230	do	2	Prairie Oil & Gas	1,438	3,298	3,164	3,294	200	c 5	April, 1919	
231	Dee Moss	2	Sinclair	1,455	3,422	3,185	3,380				
232	E. S. Davis	1	Magnolia Petroleum	1,525	±4,050	3,260				June, 1919	Do.
233	Moss	1	Harwell	1,461	(?)	±3,164				do	Do.
234	Hamilton	1	Hamon & Westheimer	1,522	3,470	3,220	3,239	15	0	August, 1919	
235	do	6	do	1,506	3,630	3,203				March, 1920	
236	do	2	do	1,527	2,580		2,570	150		September, 1919	
237	Davis	2	Magnolia Petroleum	1,492	3,450	3,215	3,427	2,500	c 15	June, 1919	
238	T. W. Connellee	3	do	1,502	3,442	3,210	3,410	1,200	c 15	August, 1919	
239	W. A. Parton	3	Gulf Oil & Refining	1,514	3,500	3,204	3,470	5		September, 1919	
240	N. B. Harris	2	Magnolia Petroleum	±1,545	1,850		1,795	150	c 6	August, 1919	
241	do	3	do	1,550	3,456	3,212	3,422	256	c 6	August, 1918	
242	T. W. Connellee	19	do	1,517	3,441	3,200	3,415	75	c 15	May, 1920	
243	do	8	do	1,532	3,440	3,200	3,425	100	c 15	October, 1919	
243A	do	15	do	1,532	1,453		1,435	25	c 11	December, 1919	
244	M. Cotton	1	Rickard Tex	1,540		3,220		2,000		June, 1919	
245	W. A. Harris	7	Magnolia Petroleum	1,560	3,446	3,250				May, 1920	
246	J. O. Sue	1	Humble Oil & Refining	1,572	3,509	3,274	3,462	100	0	July, 1919	
247	State land	13	do	1,579	3,518	3,305	3,480	100	c 6	January, 1920	
248	T. Y. Butler	3	States Oil Corporation	1,625							Being drilled.
249	O. J. Cotton	2	Griffey & Gillespie		1,440		1,400	30	0	October, 1919	
250	do	2	Prairie Oil & Gas	1,549	3,476	3,252	3,450	18	0	March, 1920	
251	Forgason	10	Humble Oil & Refining	1,541	3,517	3,285	3,480				Dry.
252	McCord	2	Magnolia Petroleum	1,568	3,563	3,200	3,555	10		February, 1920	
253	do	1	do	1,544	3,600	3,300	3,503	60	c 10	December, 1919	

b Cubic feet of gas. c Average production of each well on lease. d Log does not show "Black lines" at this depth, but it is about at the depth indicated.

Wells in the Ranger oil field, Eastland County, Tex.—Continued.

Map No.	Farm.	Well No.	Company.	Elevation (feet).	Total depth (feet).	Depth to top of "Black lime" (feet).	Depth to top of producing sand (feet).	Initial daily production (barrels).	Daily production in January, 1921 (barrels).	Date of completion.	Remarks.
254	J. R. Niver	1	Montreal	1,554	3,420	3,342	3,360	50	20	January, 1920	
255	do	1	Kentucky Oil	1,561	3,345	3,321	3,330	600			
256	J. Z. Miller	1	Ranger-Hudson Oil	1,516	3,785	3,270				July, 1919	Dry.
257	do	2	Mother Pool Oil	1,502	1,576		1,560	[b] 12,000,000	[b] 3,000,000		
258	do	1	do	1,497	1,586		1,546	70		August, 1919	
259	T. M. Johnson	2									
260	Kinkaid	1	Ardizone Braden	1,483	3,510	3,330	3,207	100	50	September, 1919	
261	Brelsford	1	Gulf Oil & Refining	1,442	3,520	3,245	3,204	40	0	March, 1919	
261A	H. P. Brelsford	2	do	1,510							
262	T. E. Downtaine		F. Day	1,471							
263	T. Connellee	1	Prairie Oil & Gas	1,554	3,444	3,266	3,432	616	[c] 60	January, 1920	
264	J. Hague	1	Humble Oil & Refining	1,556	3,501	3,223	3,300			June, 1920	
265	McClarney heirs	1	Gulf Oil & Refining	1,563	3,475	3,247	3,467	30		February, 1920	
266	Olden School	1	Sheppard Oil	1,560	1,540		1,470			June, 1920	
267	Mrs. Connellee	1	Arkansas Natural Gas	1,572	(?)	(?)	(?)	300		August, 1919	
268	N. B. Harris	5	Magnolia Petroleum	1,549	3,440	3,236	3,430			May, 1920	
269	R. S. Harris	3	do	1,559	3,474	3,255	3,457	250	[c] 40	do	
270	J. M. Scott	1	Humble Oil & Refining	1,559	3,444	3,231	3,417	100	0	June, 1919	
271	G. W. Dawson	1	Cosden		3,212		2,988	600	10	February, 1920	
272	Charles Allman	1	Phillips	1,569	3,715	3,230	3,444	20	0	October, 1919	
275	R. S. Harris	1	Magnolia Petroleum	1,549	3,451	3,177	3,430	3,000	(?)	May, 1919	
276	N. B. Harris	1	do	1,548	3,402	3,187	3,394	1,500	0	February, 1919	
277	P. O. Harris	2	do								
278	do	1B	do	1,535	3,650	3,231		50		June, 1920	
279	Scott et al	3	Crosby & Davis	1,565	1,330		1,315	20		October, 1918	
280	do	5	do	1,560	3,600	3,190	1,340	40	0	November, 1918	
281	G. W. Fox	3	Texas & Pacific		1,330		1,321	10	[c] 4	April, 1919	
282	C. U. Connellee	1	Magnolia Petroleum	1,553	1,360		1,326	30		October, 1918	
283	Mrs. L. C. Webb	1	do	1,561	3,672	3,200				December, 1918	Do.
284	E. H. Webb	1	Prairie Oil & Gas	1,479	3,495	3,121				January, 1919	Do.
285	L. Huffman	1A	Texas & Pacific	1,429	3,319	3,072	3,282	200	[c] 50	May, 1919	
286	do	3A	do	1,416	3,305	3,067	3,245	300	[c] 50	April, 1919	
287	F. Brewer	1	do	1,444	3,298	3,121	3,288	2,300	0	June, 1918	
288	M. V. Brewer	2	do	1,413	3,259	3,050	3,250	150	0	January, 1919	
289	do	1	do	1,405	3,248	3,033	3,040				
290	F. Brewer	14	do	1,454	3,283	3,091	3,178	1,500		November, 1918	
291	do	16	do	1,452	3,307	3,095	3,289	100	[c] 12	July, 1919	
292	J. T. Earnest	2	Prairie Oil & Gas	1,447	3,305	3,097	3,295	600	[c] 20	January, 1919	
293	M. C. Hanson	1	Texas & Pacific	1,431	3,278	3,070	3,259	100		March, 1919	
294	J. M. Rush	1	Mid-Kansas	1,433	3,297	3,088	3,200	10	0	November, 1919	
295	L. A. Galloway	1	Texas & Pacific	1,423	3,351	3,070	3,273	5	0	March, 1919	

296	Brashear	1	do	1,448	3,315	3,053	3,231				
297	J. T. Falls	2	Prairie Oil & Gas	1,421	3,700	3,040				April, 1919	Do.
298	do	1	do	1,442	4,070	3,040				February, 1919	Do.
299	James Cooksey	1	Jackson Oil & Refining	1,535	3,509	3,165	3,371	Gas			
300	C. C. Holcomb estate	1	Cosden	1,486	3,830	3,197					
301	Downtaine	1	Gulf Oil & Refining	1,450	3,625	3,183					
302	G. E. Norwood	1	States Oil Corporation	1,451	3,493	3,205	3,127 3,310	50	14	June, 1919	
303	Burnett	1	Eastland Mid Co	1,446	3,285	3,102	3,282			do	
304	Cogsdell	1	Day		3,230	[a] 3,280	3,185	110		August, 1920	
305	T. E. Downtaine	1	Sullivan	1,471	3,405	3,150	1,560	0	0		15,000,000 cubic feet of gas at 1,560 feet.
306	Burkett	1	Unity	1,447	(?)		3,271	[b] 15,000,000		June, 1920	
307	do		Occidental	1,440	(?)		(?)	[b] 30,000,000		April, 1920	
308	Mrs. T. Connellee	2	Arkansas Natural Gas	1,511	3,361	3,130	3,348				Gas.
309	C. U. Connellee	2	do	1,503	3,336	3,106	3,309	[b] 10,000,000 140		August, 1919	
310	Mrs. T. Connellee	1	do	1,515	3,329	3,131		650		December, 1919	
311	C. U. Connellee	1	do	1,542	3,800	3,115	3,292	30		March, 1919	
312	W. S. Barber	1	Cosden	1,512	(?)	3,085	(?)				Dry.
313	J. Lyerla	1	Arkansas Natural Gas	1,537	3,296	3,145	3,292	[b] 15,000,000			
313A	J. H. Bransford	1	Prairie Oil & Gas	1,493	3,955		3,138			June, 1919	Do.
314	Dr. Johnson	1	Sammies Oils	1,474	3,508	3,036				May, 1919	Do.
315	H. Brashear		Leon Oil	1,478	4,000	3,035	3,045	120		June, 1919	
316	do	2	do	1,477	3,624	3,020					
320	do	1	Hamon & Westheimer	1,460	3,601	3,012				May, 1919	Do.
321	M. Sibley	1	Wichita Ranger	1,422	3,565	2,942					Do.
322	S. Parker	1	Leon Oil	1,419		2,950					Do.
323	M. Sibley	1	R. Duncan	1,385		2,972		5			
324	L. B. Bourland	1	Leon Oil	1,425	3,512	2,923					Do.
325	J. P. Hazard	1		1,387							

[a] Well not drilled to this depth, but approximately the depth at which the "Black lines" should be reached.

[b] Cubic feet of gas.

[c] Average production of each well on lease.

Logs of wells in Ranger oil field, Eastland County, Tex.

S. E. Tolle No. 1, Ajax Oil Co.

[Tract 1-B, North Eastland block; map No. 2. Elevation, 1,497 feet. Completed Apr. 30, 1920. Made no show until shot with 500 quarts of nitroglycerine in "Smithwick lime," and then began to flow 2,000 barrels daily.]

	Feet.
Not recorded	0–825
Shale, blue	825–920
Lime	920–945
Shale, blue	945–965
Rock, brown	965–995
Lime, hard	995–1,003
Sand; water	1,003–1,010
Shale, blue	1,010–1,015
Lime	1,015–1,025
Shale, blue	1,025–1,050
Sand; water	1,050–1,075
Shale, blue	1,075–1,095
Slate	1,095–1,165
Lime, shells	1,165–1,220
Slate	1,220–1,230
Lime	1,230–1,240
Shale, red	1,240–1,250
Slate, black	1,250–1,315
Slate, blue	1,315–1,330
Lime	1,330–1,340
Slate, blue	1,340–1,355
Rock, red	1,355–1,400
Sand, gray	1,400–1,410
Slate, blue	1,410–1,490
Lime	1,490–1,495
Shale, red	1,495–1,510
Shale, blue	1,510–1,515
Slate, blue	1,515–1,555
Lime	1,555–1,560
Shale, blue	1,560–1,610
Slate, blue	1,610–1,620
Slate, white	1,620–1,645
Shale, blue	1,645–1,800
Lime	1,800–1,805
Shale, blue	1,805–1,820
Slate, blue	1,820–1,853
Sand	1,853–1,873
Shale, blue	1,873–1,880
Slate, white	1,880–1,935
Sand; salt water	1,935–1,955
Slate	1,955–1,965
Sand; water	1,965–1,990
Slate, blue	1,990–2,010
Shale, sandy	2,010–2,030
Slate	2,030–2,051
Shale	2,051–2,071
Shale, blue	2,071–2,265
Shell	2,265–2,270
Sand; water	2,270–2,285
Shale, sandy	2,285–2,665
Sand	2,665–2,685
Sand	2,685–2,725
Slate, sandy	2,725–2,730
Sand, white	2,730–2,760
Shale, sandy	2,760–3,020
Shale, black	3,020–3,045
Slate, black	3,045–3,103
Lime, black..	3,103–3,189
Slate, black..	3,189–3,194
Lime, black..	3,194–3,215
Slate, black..	3,215–3,222
Lime, black, hard.	3,222–3,243

"Smithwick lime" (Breckenbridge lime).

M. Loper (E) No. 2, States Oil Corporation.

Tract 1-A, West Ranger block; map No. 16. Elevation, 1,578 feet.]

	Feet.
Sand, red	0– 35
Shale	35–172
Lime, white	172–205
Shale, white	205–290
Shale, blue	290–332
Lime, black	332–340
Shale	340–348
Lime, white, hard	348–360
Shale, white	360–385
Lime, white	385–425
Unrecorded	425–1,820
Shale, sandy	1,820–1,830
Shale, blue	1,830–1,864
Shale, white	1,864–1,880
Sand; 2,000 cubic feet of gas at 1,883 feet; top of oil pay sand at 1,888 feet (Scott)	1,880
Total depth	1,895

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

J. E. Barnes No. 1, Prairie Oil & Gas Co.

[Tract 1-D, West Ranger block; map No. 29. Elevation, 1,586 feet. Drilling commenced Mar. 29, 1919; completed July 9, 1919. "Well abandoned," dry hole.]

	Feet.
Soil, soft	0–20
Lime, white, hard	20–55
Lime, white, hard	55–160
Shale, blue, soft	160–230
Shale, blue, soft	230–300
Lime, white, hard	300–340
Shale, blue, soft	340–510
Shale, blue, soft	510–620
Lime, black, hard	620–765
Slate, blue, soft; four bailers of water, at 800 feet	765–800
Sand, white, soft	800–815
Slate, blue, soft	815–850
Lime, white, hard	850–865
Slate, blue, hard	865–1,095
Lime, white, hard	1,095–1,100
Slate, blue, hard	1,100–1,260
Slate, blue, hard	1,260–1,360
Slate, blue, hard	1,360–1,400
Lime, white, hard	1,400–1,405
Slate, blue, hard	1,405–1,580
Sand, white, soft	1,580–1,760
Slate, blue, hard	1,760–,1860
Lime and sand, white, hard	1,860–1,995
Slate, blue, hard	1,995–2,010
Shale, white, soft	2,010–2,100
Sand, white, soft	2,100–2,110
Slate, white, hard	2,110–2,120
Sand, white, soft	2,120–2,140
Shale, blue, soft	2,140–2,150
Sand, white, soft	2,150–2,260
Slate, white, hard	2,260–2,340
Slate, white, hard	2,340–2,480
Shale, blue, soft	2,480–2,570
Sand, white, hard; four bailers of water, at 2,685 feet	2,570–2,685
Slate, white, hard	2,685–2,695
Sandy shale, blue, soft	2,695–2,935
Slate, black, hard	2,935–3,100
Slate, black, hard	3,100–3,120
Lime, white, hard	3,120–3,160
Lime, white, hard	3,160–3,220
Slate, black, hard	3,220–3,296
Lime, white, hard	3,296–3,300
Slate, black, hard	3,300–3,335
Lime, black, hard	3,335–3,340
Slate, black, hard	3,340–3,370
Lime, white, hard	3,370–3,393
Lime, black, hard ("Black lime")	3,393–3,420
Slate, black, soft	3,420–3,430
Lime, black, hard	3,430–3,440
Slate, black, soft	3,440–3,455
Lime, black, hard	3,455–3,465
Slate, black, soft	3,465–3,475
Lime, black, hard	3,475–3,490
Slate, black, soft	3,490–3,500
Lime, black, hard	3,500–3,510
Break, black, hard	3,510–3,595
Lime, black, hard	3,595–3,625
Slate, black, hard	3,625–3,680
Lime, black, hard	3,680–3,685
Slate, black, hard	3,685–3,725
Slate, black, hard	3,725–3,740
Slate, black, hard	3,740–3,750
Lime, black, hard	3,750–3,780
Lime, black, hard	3,780–3,800
Lime, black, hard; show of oil	3,800–3,865
Lime, black, hard	3,865–3,980
Slate, black, hard	3,980–4,080
Lime, white, hard (Ellenburger); hole full of water	4,080–4,300

Casing record:
15-inch, 52 feet 6 inches, pulled.
12½-inch, 745 feet 2 inches, pulled.
10-inch, 1,621 feet 10 inches, pulled.
8-inch, 2,093 feet 1 inch pulled, 169 feet left in.
6⅝-inch, 3,299 feet 11 inches pulled, 100 feet left in.

S. S. Griffin No. 1, Mid-Kansas Oil & Gas Co.

[Tract 2-E, Ranger block; map No. 44. Elevation, 1,558 feet. Initial daily production May 3, 1919, 353 barrels; production July 21, 1919, 75 barrels.]

	Feet.
Soil	0–6
Sandstone and gravel	6–15
Mud	15–45
Limestone (Ranger)	45–100
Shale	100–290
Limestone	290–360

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

S. S. Griffin No. 1, Mid-Kansas Oil & Gas Co.—Continued.

	Feet.
Shale	360–590
Limestone	590–630
Shale	630–780
Limestone	780–800
Shale	800–970
Shell	970–1,050
Sandstone, dark	1,050–1,060
Shale, blue	1,060–1,110
Shale and shell	1,110–1,180
Shale	1,180–1,310
Sandstone	1,310–1,325
Shale	1,325–1,415
Sandstone	1,415–1,480
Sandstone	1,480–1,500
Sandy shale	1,500–1,540
Shale	1,540–1,625
Sandstone and shale	1,625–1,735
Limestone	1,735–1,785
Shale	1,785–1,800
Sandstone	1,800–1,850
Sandy shale	1,850–1,960
Limestone and sandstone; 4 barrels an hour at 1,970 feet	1,960–1,980
Water sandstone; hole full at 2,020 feet	1,980–2,020
Limestone and sandstone	2,020–2,085
Shale	2,085–2,370
Shale and sandstone	2,370–2,500
Sandstone	2,500–2,610
Shale and sandstone	2,610–2,710
Hard sandstone	2,710–2,740
Limestone	2,740–2,820
Black shale	2,820–2,890
Black shale and shell	2,890–3,035
Black shale	3,035–3,050
Black shale and shell	3,050–3,115
Black shale	3,115–3,180
Shale	3,180–3,220
Limestone	3,220–3,233
Limestone, black; first pay sand at 3,245 feet	3,233–3,250
Limestone, hard	3,250–3,350
Cave	3,350–3,360
Limestone	3,360–3,365
Sandstone and limestone; second pay sand at 3,370 feet	3,365–3,370
Hard limestone	3,370–3,435

Casing record:
15½-inch, 42 feet.
12½-inch, 590 feet.
10-inch, 1,560 feet.
8¼-inch, 2,090 feet.
6⅝-inch, 3,245 feet.
5 3/16-inch, 3,360 feet.

Parrock No. 1, States Oil Corporation.

[Tract 2-E, North Eastland block; map No. 62. Elevation, 1,623 feet. Oil from McClesky sand; initial daily production, 400 barrels.]

	Feet.
Red rock	0–30
Limestone, red	30–60
Limestone, white	60–85
Slate	85–110
Sandstone, broken	110–180
Slate, dark	180–210
Slate, dark	210–300
Limestone	300–310
Slate, black	310–320
Slate, blue	320–380
Sandstone, white	380–405
Limestone, shell	405–409
Shell, blue	409–427
Limestone, hard	427–436
Shale, blue	436–478
Limestone (Ranger)	478–490
Shale, black	490–543
Limestone, hard	543–561
Shale, blue	561–615
Limestone	615–627
Shale, brown	627–642
Limestone, white	642–673
Shale, blue	673–693
Limestone	693–698
Slate, blue	698–708
Limestone	708–716
Shale, blue	716–766
Shale, white, with slate	766–928
Limestone	928–938
Slate, blue	938–943
Limestone, gray	943–970
Slate, blue	970–1,010
Slate, black	1,010–1,030
Sandstone	1,030–1,040

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Parrock No. 1, States Oil Corporation—Continued.

	Feet.
Slate, blue	1,040–1,060
Sandstone, white	1,060–1,070
Slate, blue	1,070–1,080
Limestone	1,080–1,090
Slate, blue	1,090–1,160
Slate, black	1,160–1,195
Red rock	1,195–1,210
Limestone	1,210–1,225
Slate, blue	1,225–1,235
Slate, blue	1,235–1,335
Limestone	1,335–1,350
Slate, pink	1,350–1,355
Sandstone	1,355–1,373
Slate, blue	1,373–1,445
Sandstone	1,445–1,460
Slate, blue	1,460–1,650
Limestone	1,650–1,655
Slate, blue	1,655–1,695
Sandstone	1,695–1,715
Shale, blue	1,715–1,886
Limestone	1,886–1,891
Sandstone	1,891–1,910
Shale, blue	1,910–1,986
Sandstone, white	1,986–1,996
Limestone, black	1,996–2,006
Slate, black	2,006–2,245
Sandstone, white	2,245–2,290
Slate	2,290–2,309
Limestone, black	2,309–2,349
Slate, white	2,349–2,465
Slate, black	2,465–2,570
Lime and sandstone	2,570–2,610
Slate, black	2,610–2,620
Lime and sandstone	2,620–2,720
Limestone, gray	2,720–2,748
Sandstone	2,748–2,875
Shale, blue	2,875–2,890
Sandstone	2,890–2,925
Limestone	2,925–2,940
Slate, black	2,940–3,000
Lime and sandstone	3,000–3,020
Slate, black	3,020–3,195
Limestone, black ("Smithwick lime")	3,195–3,198
Slate, black	3,198–3,200
Limestone, black, hard	3,200–3,265
Shell and slate	3,265–3,349
Slate, black	3,349–3,500
Limestone, black, hard ("black lime")	3,500–3,531
Slate, black	3,531–3,603
Limestone, black, hard	3,603–3,618
Slate, black	3,618–3,662
Sandstone, soft, gray (McClesky sand)	3,662–3,682
Slate, black	3,682–3,692
Slate, black	3,692–3,728
Limestone, gray	3,728–3,745
Limestone, black	3,745–3,760
Slate, black	3,760–3,792
Limestone, black	3,792–3,803
Slate, black	3,803–3,818
Limestone, black	3,818–3,860
Limestone, gray	3,860–3,866
Limestone, black	3,866–3,893
Slate, black	3,893–3,898
Limestone, black	3,898–3,970
Slate, black	3,970–4,078
Limestone, white (Ellenburger)	4,078–4,085

Truman Davis No. 1, Humble Oil & Refining Co.

[Tract 3-C, West Ranger block; map No. 89. Elevation, 1,527 feet. Initial daily production at 3,361 feet, 700 barrels.]

	Feet.
Clay, red	0–50
Shale, blue	50–105
Slate, white	105–135
Limestone, white (Ranger)	135–170
Slate, white	170–250
Limestone, white	250–300
Shale, blue	300–330
Water limestone, white	330–350
Shale, blue	350–360
Limestone, white	360–380
Slate, white	380–420
Sandstone, white	420–430
Slate, white	430–555
Limestone, white	555–565
Water sandstone, white	565–570
Slate, white	570–610
Limestone, brown	610–615
Limestone, brown	615–635
Slate, broken	635–640
Red rock	640–660
Slate, blue; 14 barrels at 705 feet	660–705

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Truman Davis No. 1, Humble Oil & Refining Co.—Continued.

	Feet.
Water sandstone, gray	705–725
Water sandstone, white	725–735
Slate, white	735–765
Limestone, white	765–775
Slate, white	775–935
Slate, broken	935–995
Limestone, broken, hard	995–1,025
Slate, white	1,025–1,035
Shale, brown	1,035–1,160
Slate, white	1,160–1,180
Shale, broken	1,180–1,240
Slate, white	1,240–1,510
Water sandstone, white	1,510–1,525
Limestone, white, hard	1,525–1,530
Sandstone, gray	1,530–1,545
Shale, white	1,545–1,556
Slate, white	1,556–1,560
Shale, gray, sandy	1,560–1,580
Slate, white	1,580–1,990
Shale, gray, sandy	1,990–2,213
Slate, white	2,213–2,590
Sandstone, white	2,590–2,625
Slate, white	2,625–2,750
Shale, white, sandy	2,750–2,770
Sandstone, white	2,770–2,820
Shale, white	2,820–2,855
Slate, black	2,855–3,030
Limestone, black, hard	3,030–3,060
Limestone, black	3,060–3,160
Slate, blue	3,160–3,220
Slate, black	3,220–3,280
Limestone, black, sandy	3,280–3,292
Slate, black	3,292–3,342
Limestone, blue-black ("Black lime")	3,342–3,371

Casing record:
15½-inch, 105 feet.
12½-inch, 765 feet.
10-inch, 1,597½ feet.

Jones No. 1, Humble Oil & Refining Co.

[Tract 3-E, West Ranger block; map No. 104. Elevation, 1,560 feet. Initial daily production, 1,000 barrels.]

	Feet.
Soil	0–10
Sand, dry	10–25
Red rock	25–30
Water gravel	30–35
Mud, blue	35–38
Lime, gray	38–40
Clay, blue	40–120
Lime, gray	120–150
Shale, blue	150–170
Lime, gray	170–172
Shale	172–235
Lime	235–239
Shale	239–254
Lime	254–285
Shale	285–400
Lime	400–402
Shale	402–432
Lime	432–440
Shale	440–456
Sand, dark, dry	456–468
Shale, blue	468–485
Lime, sandy	485–490
Shale, blue	490–530
Lime, gray	530–565
Shale, blue	565–570
Red rock	570–580
Shale	580–627
Lime, shell	627–631
Water shale	631–645
Lime	645–654
Water sand	654–659
Shale, blue	659–692
Lime	692–694
Shale, sandy	694–728
Sand, dark, dry	728–746
Shale, blue	746–815
Lime	815–821
Shale	821–838
Lime, sandy	838–855
Shale	855–880
Lime	880–890
Shale, brown	890–900
Shale, blue	900–930
Lime	930–953
Shale	953–961
Shale, brown	961–971
Shale, sandy	971–974
Water sand, broken	974–995
Shale, blue	995–1,030
Lime	1,030–1,040

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Jones No. 1, Humble Oil & Refining Co.—Continued.

	Feet.
Shale	1,040–1,075
Lime	1,075–1,078
Sand, dark, dry	1,078–1,098
Shale	1,098–1,115
Lime	1,115–1,237
Sand, dark, dry	1,237–1,250
Shale, blue	1,250–1,325
Lime	1,325–1,330
Shale, black	1,330–1,367
Sand, dark, dry	1,367–1,383
Lime, hard	1,383–1,394
Sand, dark, dry	1,394–1,402
Lime	1,402–1,433
Shale	1,433–1,503
Lime	1,503–1,518
Shale	1,518–1,675
Lime, black	1,675–1,705
Shale	1,705–1,740
Lime	1,740–1,765
Shale	1,765–1,848
Lime	1,848–1,860
Shale	1,860–1,875
Lime	1,875–1,881
Sand, white, water	1,881–1,904
Lime, sandy	1,904–1,911
Shale	1,911–1,915
Sand, white, water	1,915–1,933
Shale	1,933–1,935
Lime, white	1,935–1,947
Shale	1,947–1,958
Lime	1,958–1,965
Shale	1,965–1,973
Lime	1,973–1,978
Shale	1,978–2,001
Shale, sandy	2,001–2,055
Shale	2,055–2,401
Lime, sandy	2,401–2,409
Shale, blue	2,409–2,465
Sand, dark, dry	2,465–2,491
Shale	2,491–2,495
Sand, hard	2,495–2,502
Shale	2,502–2,520
Sand, dark, dry	2,520–2,526
Shale	2,526–2,550
Shale, sandy	2,550–2,627
Water lime, hard	2,627–2,638
Shale, sandy	2,638–2,700
Shale	2,700–2,770
Shale, black	2,770–2,850
Lime, black	2,850–2,857
Shale, black	2,857–2,930
Shale, black	2,930–2,947
Lime, black	2,947–2,968
Shale, blue	2,968–2,973
Lime, black	2,973–2,983
Shale, black	2,983–2,995
Lime, black	2,995–3,035
Shale, black	3,035–3,063
Shale, black	3,063–3,067
Lime, black	3,067–3,071
Shale, brown	3,071–3,104
Shale, blue	3,104–3,135
Shale, black	3,135–3,140
Lime, black	3,140–3,144
Shell lime, black; 3,000,000 cubic feet of gas (estimated) at 3,148 feet	3,144–3,160
Lime, black	3,160–3,197
Shale, brown	3,197–3,204
Lime, sandy	3,204–3,253
Shale, black	3,253–3,265
Lime, black ("Black lime")	3,265–3,285
Sand; show of gas	3,285–3,290
Lime, black (steel-line measurement)	3,290–3,309
Lime, sandy; show of oil	3,309–3,324
Shale, sandy	3,324–3,331
Lime, black	3,331–3,436
Lime, gray	3,436–3,464
Shale, black	3,464–3,471
Lime, shells	3,471–3,474
Oil sand	3,474–3,492

Casing record:

15½-inch, 40 feet.
12½-inch, 692 feet.
10-inch, 1,473 feet.
8-inch, 1,960 feet.
6⅝-inch, 3,197 feet.

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

E. Roper Farm No. 2, Prairie Oil & Gas Co.

[Tract 4-C, West Ranger block; map No. 130. Elevation, 1,470 feet. Initial daily production 6,000 barrels. Drilling commenced Apr. 21, 1919; completed June 25, 1919.]

	Feet.
Lime, white, hard (Ranger)	0–65
Shale, pink, soft	65–135
Lime, white, hard	135–195
Shale, pink, soft	195–205
Lime, white, hard	205–280
Shale, blue, soft	280–335
Lime, white, soft	335–375
Shale, blue, soft	375–495
Lime, white, hard	495–565
Shale, blue, soft	565–610
Sand, gray, soft	610–630
Shale, blue, soft	630–700
Sand, gray, hard	700–720
Shale, sandy, blue, soft	720–870
Lime, gray, hard	870–890
Shale, blue, soft	890–1,020
Lime, white, hard	1,020–1,029
Shale, blue, soft	1,029–1,400
Water sand, gray, hard	1,400–1,430
Shale, blue, soft	1,430–1,900
Lime, gray, hard	1,900–1,930
Shale, blue, soft	1,930–1,970
Water sand, white, hard	1,970–1,995
Shale, blue, soft	1,995–2,180
Shale, sandy, gray, soft	2,180–2,285
Slate, black, soft	2,285–2,385
Shale, sandy, blue, soft	2,385–2,900
Lime, white, hard	2,900–2,935
Lime, gray, soft	2,935–2,965
Broken lime, gray, soft	2,965–3,015
Shale, blue, soft	3,015–3,210
Lime, black, hard ("Black lime")	3,210–3,275
Shale, black, soft	3,275–3,290
Sandy lime, black, hard	3,290–3,304
Shale, black, soft	3,304–3,400
Lime, gray, hard	3,400–3,416
Shale, black, soft	3,416–3,425
Oil sand, soft (McClesky sand)	3,425–3,441

Casing record (all casing left in well):
15½-inch, 10 feet.
12½-inch, 639 feet 10 inches.
10-inch, 1,477 feet 11 inches.
8¼-inch, 2,020 feet 1 inch.
6⅝-inch, 3,250 feet 3 inches.

Wright No. 1, Ranger-Rock Island Oil Co.

[Tract 4-A, West Ranger block; map No. 144. Elevation, 1,526 feet. Daily production Sept. 8, 1919, 3,000 barrels.]

	Feet.
Clay	0–20
Limestone (Home Creek)	20–60
Shale	60–165
Limestone (Ranger)	165–240
Shale	240–250
Limestone	250–255
Shale	255–370
Limestone	370–400
Shale	400–435
Limestone	435–445
Shale	445–475
Limestone	475–478
Sandstone	478–510
Shale, sandy	510–595
Sandstone; water	595–605
Shale	605–664
Limestone	664–695
Shale	695–700
Shale, cave	700–715
Shale	715–750
Sandstone	750–775
Shale	775–785
Sandstone	785–818
Shale	818–825
Sandstone	825–835
Limestone	835–845
Shale	845–860
Sandstone	860–870
Shale	870–990
Limestone	990–1,000
Shale	1,000–1,065
Limestone	1,065–1,105
Shale, blue	1,105–1,110
Limestone	1,110–1,115
Shale, black	1,115–1,140
Shale, blue	1,140–1,160
Shale, white	1,160–1,200
Shale	1,200–1,385
Limestone, white	1,385–1,390
Sandstone; water	1,390–1,415

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Wright No. 1, Ranger-Rock Island Oil Co.—Continued.

	Feet.		Feet.
Shale	1,415–1,535	Shale, black	2,890–2,975
Limestone	1,535–1,540	Limestone, broken	2,975–3,120
Shale	1,540–1,595	Shale, black, soft	3,120–3,140
Limestone	1,595–1,600	Shale, gray, soft	3,140–3,160
Shale	1,600–1,915	Limestone, black	3,160–3,165
Shale, black	1,915–1,930	Shale (cave), gray	3,165–3,270
Broken sandstone	1,930–1,940	Limestone, black, hard	3,270–3,275
Sandstone; water	1,940–1,995	Shale, soft	3,275–3,280
Black shale	1,995–2,020	Sandstone; show of oil at 3,282 feet	3,280–3,283
Sandstone, white, soft	2,020–2,110	Limestone, hard, black ("Black lime")	3,283–3,328
Shale, white	2,110–2,465	Limestone, broken	3,328–3,343
Limestone, white, hard	2,465–2,470	Sandstone, broken, hard	3,343–3,352
Sandstone, white, soft	2,470–2,635	Shale, black	3,352–3,380
Limestone, white, hard	2,635–2,640	Limestone, broken, black	3,380–3,455
Shale	2,640–2,690	Limestone, gray, hard	3,455–3,483
Limestone	2,690–2,700	Oil sand (McClesky sand)	3,483–
Sandy shale	2,700–2,725		
Broken sandstone	2,725–2,850		
Shale, white	2,850–2,890		

Baumgartner No. 1, Great Southern Oil Co.

[Tract 5-D, North Eastland block; map No. 172. Elevation, 1,570 feet. Well when shot at 3,460 to 3,480 feet made 10 barrels an hour.]

	Feet.		Feet.
Clay, red	0–6	Limestone, hard	690–700
Limestone, hard	6–56	Sandstone, hard	700–730
Slate, blue	56–86	Slate	730–735
Limestone, white, hard	86–125	Slate, limestone	735–740
Sandstone, white	125–135	Slate, black	740–750
Slate, blue	135–150	Limestone, white	750–775
Limestone, hard	150–160	Slate, blue	775–785
Slate, blue	160–210	Sandstone	785–795
Limestone, hard	210–250	Shale, black	795–811
Coal	250–257	Shale, blue	811–865
Slate, blue	257–265	Lime	865–899
Limestone, hard	265–305	Shale, blue	899–965
Sand; water	305–345	Lime	965–970
Slate, white	345–375	Shale, sandy	970–980
Limestone, white	375–395	Sand	980–988
Slate, blue	395–425	Shale, blue	988–1,058
Limestone, hard	425–470	Lime	1,058–1,070
Slate, blue	470–485	Sand	1,070–1,085
Limestone, hard	485–515	Shale, blue	1,085–1,215
Slate, blue	515–525	Lime	1,215–1,252
Limestone, white	525–555	Shale, blue	1,252–1,515
Slate, white	555–595	Shale, sandy	1,515–1,555
Limestone, hard	595–640	Shale, sandy, hard	1,555–1,565
Sand, white	640–650	Shale, blue	1,565–1,862
Lime	650–680	Shale, shady	1,862–1,872
Slate, black	680–690	Shale	1,872–1,880

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Baumgartner No. 1, Great Southern Oil Co.—Continued.

	Feet.
Sand	1,880–1,925
Shale	1,925–2,115
Slate	2,115–2,131
Lime, black	2,131–2,142
Sand, gray	2,142–2,165
Sand, white	2,165–2,187
Shale, blue	2,187–2,193
Shale, hard, sandy	2,193–2,200
Sand, hard	2,200–2,210
Shale, sandy	2,210–2,299
Shale, blue	2,299–2,323
Lime, gray	2,323–2,395
Shale, blue	2,395–2,499
Shale, sandy	2,499–2,551
Lime, gray	2,551–2,565
Shale, blue	2,565–2,650
Shale, sandy, white	2,650–2,680
Shale, blue	2,680–2,850
Slate, black	2,850–2,928
Lime, gray	2,928–2,960
Slate, black	2,960–3,055
Lime, black	3,055–3,075
Slate, blue	3,075–3,155
Lime, black	3,155–3,290
Slate, black	3,290–3,317
Shale, blue	3,317–3,322
Slate, blue	3,322–3,400
Shale, light	3,400–3,452
Slate, hard ("Black lime")	3,452–3,454
Shale, brown	3,454–3,464
Limestone, gray	3,464–3,542
Slate, black	3,542–3,560
Lime, black	3,560–3,604
Shale, black	3,604–3,607
Lime, black	3,607–3,619
Lime, gray (McClesky sand)	3,619–3,638
Shale, blue	3,638–3,643
Lime, black	3,643–3,680
Lime, gray	3,680–3,700
Slate and sandstone	3,700–3,750

Casing record:
- 15½-inch, 340 feet.
- 12½-inch, 803 feet.
- 10-inch, 937 feet.
- 8-inch, 2,337 feet.
- 6⅝-inch, 3,267 feet.

G. E. Norwood No. 1, Texas & Pacific Coal & Oil Co.

[Tract 5-B, West Ranger block; map No. 196. Elevation, 1,486 feet. Initial daily production, 11,500 barrels.]

	Feet.
Shale	0–33
Lime, hard (Ranger limestone)	33–98
Shale	98–180
Lime and shells	180–182
Shale, blue	182–250
Lime, white	250–277
Shale, blue	277–345
Lime, hard	345–356
Shale, blue	356–439
Lime, hard	439–488
Shale, blue	488–542
Lime, hard	542–565
Shale, blue	565–585
Shale, brown	585–602
Lime, hard	602–618
Shale, blue	618–625
Sand, light	625–641
Shale, blue	641–670
Shale, blue	670–696
Sand, light	696–729
Shale, blue	729–740
Shale, gray	740–850
Shells and shale	850–925
Red rock	925–953
Shale, gray	953–1,045
Sand, light	1,045–1,054
Shale, blue	1,054–1,100
Shale, blue	1,100–1,285
Sand	1,285–1,301
Shale, gray	1,301–1,360
Shale, blue	1,360–1,480
Sand	1,480–1,515
Shale, gray	1,515–1,540
Sand	1,540–1,575
Shale, gray	1,575–1,612
Shale, blue	1,612–1,801
Shale, gray	1,801–1,865
Lime	1,865–1,888
Shale, gray	1,888–2,065
Lime shells	2,065–2,090
Shale, gray	2,090–2,170
Shale, white	2,170–2,420
Lime, sandy	2,420–2,448

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

G. E. Norwood No. 1, Texas & Pacific Coal & Oil Co.—Continued.

	Feet.		Feet.
Shale, blue	2,448–2,495	Shale, blue	3,085–3,118
Shale, blue	2,495–2,557	Shale, brown	3,118–3,195
Sand and shells	2,557–2,782	Lime, hard black ("Black lime")	3,195–3,218
Shale, black	2,782–2,900	Sand; good show of oil	3,218–3,285
Lime	2,900–2,936	Slate, broken	3,285–3,354
Shale, blue	2,936–2,945	Limestone and sandstone	3,354–3,385
Lime and shale, blue	2,945–3,038	Oil sand (McClesky sand)	3,385–3,412
Shale, black	3,038–3,047		
Shale, dark	3,047–3,085		

Dan McCleskey No. 3, Hamon & Westheimer Oil Co. et al.

[Tract 5-E, West Ranger block; map No. 210. Elevation, 1,537 feet.]

	Feet.		Feet.
Limestone	0–60	Shale	1,495–1,620
Shale	60–110	Limestone, hard	1,620–1,660
Limestone, gray	110–125	Limestone, soft	1,660–1,730
Slate, blue	125–170	Sandstone	1,730–1,748
Limestone	170–190	Shale	1,748–1,848
Shale	190–200	Sandstone, white	1,848–1,902
Limestone, hard	200–225	Slate	1,902–2,206
Slate, blue	225–300	Limestone, soft	2,206–2,264
Sandstone, water	300–320	Shale	2,264–2,490
Slate, blue	320–410	Sandstone, gray	2,490–2,510
Limestone, hard	410–425	Shale	2,510–2,880
Sandstone	425–450	Limestone, hard	2,880–2,902
Shale	450–490	Limestone, soft	2,902–2,946
Limestone, hard	490–525	Shale	2,946–3,120
Shale	525–600	Limestone, white	3,120–3,140
Limestone	600–630	Shale	3,140–3,204
Shale	630–665	Limestone	3,204–3,206
Sandstone, white	665–695	Pencil cave	3,206–3,220
Shale	695–850	Limestone, black ("Black lime")	3,220–3,265
Limestone	850–885	Slate, black	3,265–3,385
Shale	885–1,080	Limestone, gray	3,385–3,405
Slate	1,080–1,105	Shale, black	3,405–3,412
Limestone	1,105–1,445	Oil sand (McClesky sand)	3,412–3,420
Sandstone, white	1,445–1,475		
Limestone	1,475–1,495		

Brelsford No. 1, Gulf Oil & Refining Co.

[Tract 1-D, Eastland block; map No. 261. Elevation, 1,442 feet. Initial daily production 40 barrels.]

	Feet.		Feet.
Clay	0–16	Shale, gray	205–225
Shale and gravel	16–34	Limestone	225–330
Shale, blue	34–118	Shale, blue	330–440
Limestone	118–155	Limestone	440–475
Shale, blue	155–167	Shale, blue	475–635
Water sand	167–175	Limestone, white	635–643
Limestone	175–190	Shale, blue	643–650
Shale, black	190–205	Water sand	650–675

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Brelsford No. 1, Gulf Oil & Refining Co.—Continued.

	Feet.
Shale, blue	675–750
Limestone, blue	750–760
Shale, blue	760–820
Limestone, white	820–830
Shale, blue	830–885
Limestone, white	885–895
Shale, blue	895–900
Sandstone, water	900–905
Shale, blue	905–1,095
Limestone, white	1,095–1,130
Shale, blue	1,130–1,180
Sand, gray	1,180–1,190
Shale, blue	1,190–1,210
Sand, white	1,210–1,220
Slate, blue	1,220–1,270
Sand, white	1,270–1,285
Shale, blue	1,285–1,385
Slate, white	1,385–1,400
Shale, blue	1,400–1,600
Limestone, white	1,600–1,615
Shale, blue	1,615–1,668
Sand, water; show of gas	1,668–1,673
Shale, white	1,673–1,773
Shale, blue	1,773–1,940
Shale, blue	1,940–1,945
Sand	1,945–2,165
Limestone and shale	2,165–2,200
Shale, blue	2,200–2,395
Shale, black	2,395–2,470
Limestone and shale	2,470–2,500
Shale, blue	2,500–2,535
Sand	2,535–2,590
Shale, black	2,590–2,750
Sand	2,750–2,762
Black slate	2,762–2,954
Lime	2,954–3,065
Lime shell and slate	3,065–3,155
Sand; gas and oil	3,155–3,170
Lime shell and slate	3,170–3,245
Lime ("Black lime")	3,245–3,267
Sand; gas and oil	3,267–3,277
Lime	3,277–3,279
Lime, sandy	3,279–3,283
Lime	3,283–3,287
Brown oil and sand	3,287–3,292
Lime, black	3,292–3,340
Sand, black	3,340–3,350
Lime, black	3,350–3,355
Slate, black	3,355–3,370
Lime, black	3,370–3,395
Slate; salt water	3,395–3,405
Lime, black; some salt water	3,405–3,440
Slate	3,440–3,446
Sand	3,446–3,455
Lime	3,455–3,465
Slate	3,465–3,480
Lime	3,480–3,485
Slate	3,485–3,490
Lime	3,490–3,520

Casing record:

15½-inch, 34 feet, pulled.
12½-inch, 650 feet, pulled.
10-inch, 1,400 feet, pulled.
8¼-inch, 2,016 feet, left in.
6⅝-inch, 2,330 feet, left in.
6 3/16-inch, 3,156 feet, left in.

R. S. Harris No. 1, Magnolia Petroleum Co.

[Tract 1-B, Olden block; map No. 275. Elevation, 1,549 feet.]

	Feet.
Soil	0–30
Sandstone; water	30–60
Limestone (Ranger)	60–75
Slate	75–80
Limestone	80–100
Slate	100–115
Limestone	115–140
Slate	140–295
Limestone	295–335
Shale	335–490
Limestone	490–500
Shale	500–515
Limestone	515–525
Shale	525–540
Limestone	540–545
Shale	545–660
Sandstone	660–685
Shale	685–695
Limestone	695–705
Shale	705–730
Limestone	730–760
Shale	760–860
Limestone	860–870
Shale	870–950

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

R. S. Harris No. 1, Magnolia Petroleum Co.—Continued.

	Feet.
Limestone	950–960
Shale	960–990
Limestone	990–1,000
Shale	1,000–1,135
Limestone	1,135–1,140
Sandstone	1,140–1,155
Shale	1,155–1,245
Limestone	1,245–1,255
Shale	1,255–1,285
Sandstone	1,285–1,300
Shale	1,300–1,380
Limestone	1,380–1,395
Shale	1,395–1,470
Limestone	1,470–1,495
Shale	1,495–1,560
Limestone	1,560–1,680
Shale	1,680–1,810
Sandstone	1,810–1,830
Shale	1,830–1,920
Limestone	1,920–1,930
Shale	1,930–2,100
Limestone	2,100–2,110
Shale	2,110–2,220
Limestone	2,220–2,250
Shale	2,250–2,590
Limestone	2,590–2,615
Shale	2,615–2,930
Slate, black	2,930–3,135
Limestone	3,135–3,140
Shale, black	3,140–3,177
Limestone, black ("Black lime")	3,177–3,280
Shale, black	3,280–3,340
Limestone	3,340–3,355
Shale	3,355–3,368
Limestone, gray	3,368–3,400
Slate	3,400–3,422
Limestone	3,422–3,430
Sandstone; oil and gas at 3,451 feet	3,430–3,451

J. E. Crosby No. 5, Crosby & Sweet.

[Tract 1-D, Olden block; map No. 280. Elevation, 1,560 feet.]

	Feet.
Soil	0–4
Limestone, white (Ranger)	4–50
Slate, white, soft	50–55
Limestone, white, soft	55–70
Slate, white, soft	70–140
Limestone, white, hard	140–160
Slate, white, soft	160–170
Limestone, white, hard	170–180
Slate, white, soft	180–195
Limestone, white, hard	195–220
Slate, white, soft	220–230
Limestone, white, hard	230–275
Slate, white, soft	275–327
Limestone, white, hard	327–382
Slate, white, soft	382–455
Limestone, white, hard	455–475
Slate, white, soft	475–505
Limestone, white, hard	505–520
Slate, black, soft	520–563
Limestone, white, hard	590–600
Slate, black, soft	600–610
Sandstone, white, medium	610–630
Sandstone, black, soft	630–680
Sandstone, white, medium	680–700
Slate, white, soft	700–800
Red rock, soft	800–810
Slate, white, soft	810–840
Limestone, white, hard	840–850
Slate, white, soft	850–920
Limestone, white, hard	920–930
Slate, white, soft	930–940
Red rock, soft	940–950
Slate, white, soft	950–990
Limestone, white, hard	990–1,000
Slate, black, soft	1,000–1,030
Limestone, white, hard	1,030–1,040
Slate, white, soft	1,040–1,060
Limestone, white, hard	1,060–1,070
Slate, black, soft	1,070–1,090
Limestone, white, hard	1,090–1,100
Slate, white, soft	1,100–1,152
Limestone, white, hard	1,152–1,162
Slate	1,162–1,340
Oil sandstone (Scott sand); small production	1,340–1,370
Slate, white, soft	1,370–1,415
Limestone, white, hard	1,415–1,425
Slate, black, soft	1,425–1,455
Limestone, white, hard	1,455–1,465
Slate, white, soft	1,465–1,495
Limestone, white, hard	1,495–1,505
Slate, white, soft	1,505–1,540

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

J. E. Crosby No. 5, Crosby & Sweet—Continued.

	Feet.
Limestone, white, hard	1,540–1,550
Slate, black, soft	1,550–1,575
Limestone, white, hard	1,575–1,580
Slate, black, hard	1,580–1,598
Limestone, white, hard	1,598–1,608
Slate, white, soft	1,608–1,618
Slate, white, hard	1,618–1,622
Slate and limestone, white	1,622–1,930
Sandy slate	1,930–1,960
Slate and limestone, white	1,960–2,340
Sandstone	2,340–2,370
Slate and limestone	2,370–2,605
Sandstone	2,605–2,620
Slate, black, soft	2,620–2,680
Limestone, white, hard	2,680–2,695
Slate, black, soft	2,695–2,755
Sandstone, white, soft	2,755–2,825
Slate, black, soft	2,825–2,880
Limestone, black, hard	2,880–2,980
Slate, black, soft	2,980–2,985
Limestone, black, hard	2,985–2,990
Slate, black, soft	2,990–3,190
Limestone, black, hard ("Black lime")	3,190–3,250
Slate, black, soft	3,250–3,260
Limestone, black, hard	3,260–3,270
Slate, black, soft	3,270–3,365
Limestone, gray, hard	3,365–3,380
Slate, black, soft	3,380–3,415
Limestone, gray, hard	3,415–3,445
Slate, black, soft	3,445–3,490
Limestone, gray, hard	3,490–3,515
Slate, black, soft	3,515–3,560
Sandstone, gray, hard	3,560–3,570
Slate, black, soft	3,570–3,600

Casing record:
12½-inch, 660 feet.
6⅝-inch, 3,200 feet.

Floyd Brewer No. 1, Texas & Pacific Coal & Oil Co.

[Tract 1-E, Olden block; map No. 287. Elevation, 1,444 feet. Initial daily production (estimated), 2,300 barrels.]

	Feet.
Soil	0–20
Lime	20–50
Shale, blue	50–200
Lime	200–210
Shale, blue	210–225
Lime	225–235
Shale, blue	235–245
Lime	245–255
Shale, blue	255–315
Lime	315–324
Shale, blue	324–330
Lime	330–335
Shale, blue	335–360
Lime	360–380
Shell	380–485
Sand	485–495
Shale, white	495–500
Shells	500–550
Shale, blue	550–610
Sand, white	610–620
Shale, blue	620–630
Water sand	630–650
Shale, blue	650–660
Lime	660–665
Shale, blue	665–740
Lime	740–760
Shale, brown	760–770
Shells	770–1,210
Sand	1,210–1,220
Shale, sandy	1,220–1,230
Sand	1,230–1,260
Shale, brown	1,260–1,300
Lime	1,300–1,305
Shale	1,305–1,450
Lime	1,450–1,485
Shale	1,485–1,510
Lime	1,510–1,520
Shale	1,520–1,555
Lime	1,555–1,565
Shale	1,565–1,640
Lime	1,640–1,650
Shale	1,650–1,660
Lime	1,660–1,696
Shale	1,696–1,702
Water sand	1,702–1,740
Shale	1,740–2,110
Gas sand	2,110–2,125
Shale	2,125–2,310
Sand	2,310–2,355
Shale	2,355–2,365
Sand	2,365–2,420
Shale	2,420–2,445

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Floyd Brewer No. 1, Texas & Pacific Coal & Oil Co.—Continued.

	Feet.		Feet.
Sand	2,445–2,470	Shale, black	3,000–3,110
Shale	2,470–2,480	Shale, brown	3,110–3,111
Sand	2,480–2,490	Shale, black	3,111–3,121
Shale	2,490–2,550	Lime, black ("Black lime")	3,121–3,140
Sand, broken	2,550–2,810	Shale, brown	3,140–3,170
Shale, black	2,810–2,830	Lime	3,170–3,185
Lime, black	2,830–2,865	Shale, black	3,185–3,260
Lime, black, broken	2,865–2,890	Lime shells	3,260–3,265
Shale, black	2,890–2,960	Shale, sandy black	3,265–3,274
Lime, black, broken	2,960–2,965	Lime, brown	3,274–3,289
Shale, brown	2,965–3,000	Oil sand (McClesky sand)	3,289–3,298

Cooksey No. 1, Jackson Oil & Refining Co.

[Tract 2-B, Olden block; map No. 299. Elevation, 1,535 feet.]

	Feet.		Feet.
Soil	0–5	Limestone	1,450–1,460
Sandstone	5–30	Shale	1,460–1,500
Slate	30–40	Limestone	1,500–1,505
Limestone (Ranger)	40–130	Slate	1,505–1,770
Slate	130–285	Sandstone; hole full of water at 1,770 feet	1,770–1,800
Limestone	285–320	Slate	1,800–1,810
Water	320–325	Limestone	1,810–1,820
Slate	325–400	Slate	1,820–2,050
Limestone	400–410	Limestone	2,050–2,055
Slate	410–460	Slate	2,055–2,310
Limestone	460–465	Sandstone	2,310–2,530
Slate	465–500	Blue shale	2,530–2,760
Limestone	500–510	Limestone	2,760–2,775
Slate	510–565	Slate	2,775–2,900
Limestone	565–585	Limestone, black	2,900–2,970
Slate	585–645	Slate, black	2,970–2,980
Limestone	645–650	Limestone, black	2,980–3,010
Slate	650–700	Slate	3,010–3,165
Sandstone	700–760	Limestone, black ("Black lime")	3,165–3,235
Slate	760–870	Slate, black	3,235–3,355
Limestone	870–880	Limestone, gray	3,355–3,371
Slate	880–895	Sandstone (McClesky sand); gas	3,371–3,381
Limestone	895–910	Shale	3,381–3,507
Slate	910–1,000	Shell	3,507–3,509
Limestone	1,000–1,020	Slate, blue.	
Slate	1,020–1,100		
Limestone	1,100–1,120	Casing record:	
Slate	1,120–1,135	12½ inch, 650 feet.	
Sandstone, water	1,135–1,150	10 inch 1,506 feet.	
Slate	1,150–1,265	8 inch, 1,906 feet.	
Limestone	1,265–1,280	6⅝ inch, 3,165 feet.	
Slate	1,280 1,355		
Sandstone, top hard	1,355–1,370		
Shale	1,370–1,450		

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

G. D. Norwood No. 1, States Oil Corporation.

[Tract 2-F, Eastland block; map No. 302. Elevation, 1,451 feet.]

	Feet.		Feet.
Soil	0–10	Slate, blue	1,500–1,555
Lime	10–60	Sand	1,555–1,570
Slate	60–90	Slate, blue	1,570–1,840
Lime (Ranger)	90–140	Sand and water	1,840–1,885
Slate	140–145	Lime	1,885–1,890
Lime	145–300	Sand and water	1,890–1,900
Slate and shells	300–355	Shale, blue	1,900–1,915
Lime	355–380	Sand	1,915–1,935
Shale	380–400	Shale	1,935–2,250
Sand and water	400–412	Sand	2,250–2,265
Shale	412–585	Slate	2,265–2,305
Lime	585–590	Sand, dry	2,305–2,315
Shale	590–640	Shale	2,315–2,440
Lime	640–645	Sand	2,440–2,455
Shale	645–675	Shale	2,455–2,620
Shale, pink	675–685	Sand, dry	2,620–2,640
Shale, blue	685–725	Shale	2,640–2,890
Red rock	725–730	Lime, black	2,890–3,020
Sand	730–738	Shale, blue	3,020–3,080
Lime	738–745	Slate, black	3,080–3,125
Shale, blue	745–780	Sand; show of oil and gas at 3,127 feet; (Brelsford sand).	3,125–3,142
Sand	780–790	Shale, black	3,142–3,205
(?)	790–800	Lime, black ("Black lime")	3,205–3,230
Shale, blue	800–950	Lime, black sandy	3,230–3,285
Shale, pink	950–960	Shale, black; show of oil at 3,310 feet	3,285–3,385
Shale, light	960–970	Lime, gray	3,385–3,405
Lime	970–980	Shale, black	3,405–3,455
Shale	980–1,006	Lime, black	3,455–3,465
Lime, gray	1,006–1,055	Shale, black	3,465–3,468
Shale, blue	1,055–1,065	Sand, gray	3,468–3,474
Shale, pink	1,065–1,075	Lime, light gray	3,474–3,488
Shale, blue	1,075–1,255	Lime, black	3,488–3,493
Shale, black	1,255–1,290		
Shale, blue	1,290–1,460		
Sand and water	1,460–1,500		

C. U. Connellee No. 1, Arkansas Natural Gas Co.

[Tract 5-F, Eastland block; map No. 311. Elevation, 1,542 feet. Initial daily production, 30 barrels.]

	Feet.		Feet.
Clay and gravel	0–9	Sand, broken	390–433
Lime	9–25	Slate, white	433–465
Yellow clay	25–40	Slate, black	465–505
White clay	40–45	Slate, white	505–540
Lime, gray	45–60	Lime, hard	540–546
Slate, black	60–110	Slate, black	546–585
Lime (Ranger limestone)	110–185	Lime, broken	585–605
Slate	185–341	Slate, white	605–630
Lime	341–370	Red rock	630–635
Slate, black	370–390	Slate, white	635–675

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

C. U. Connellee No. 1, Arkansas Natural Gas Co.—Continued.

	Feet.
Lime, broken	675–695
Slate, white	695–703
Unrecorded	703–795
Slate, white	795–870
Lime	870–880
Slate, white	880–920
Slate, black	920–935
Lime, hard	935–945
Slate, black	945–950
Lime, hard	950–995
Slate, black	995–1,020
Sand, white	1,020–1,052
Slate, black	1,052–1,090
Lime, shell	1,090–1,100
Slate, black	1,100–1,110
Sand	1,110–1,115
Shale, gritty	1,115–1,215
Sand, white	1,215–1,240
Shale, black	1,240–1,350
Slate, white	1,350–1,355
Sand, hard	1,355–1,372
Lime, sandy, hard	1,372–1,395
Unrecorded	1,395–1,448
Slate, black	1,448–1,453
Sand, white	1,453–1,456
Unrecorded	1,456–1,490
Slate, white	1,490–1,725
Sand, gray	1,725–1,758
Lime, gray	1,758–1,819
Sand, gray	1,819–1,826
Slate, black	1,826–1,857
Lime	1,857–1,865
Slate, white	1,865–1,975
Lime	1,975–2,050
Slate	2,050–2,198
Sand	2,198–2,213
Slate, black	2,213–2,248
Sand, gray	2,248–2,392
Slate, black	2,392–2,516
Lime, shell	2,516–2,522
Slate, black	2,522–2,525
Lime, sandy	2,525–2,574
Slate, light	2,574–2,625
Sand	2,625–2,667
Shale, blue	2,667–2,825
Lime, black	2,825–2,917
Shale, black	2,917–3,102
Shale, shells	3,102–3,115
Lime, black ("Black lime")	3,115–3,290
Sand; oil and gas at 3,292 feet (McClesky sand)	3,290–3,293
Lime, gray	3,293–3,310
Slate, black	3,310–3,349
Lime, black	3,349–3,355
Sand, broken	3,355–3,359
Lime, gray	3,359–3,367
Slate, black	3,367–3,380
Lime, gray	3,380–3,394
Slate	3,394–3,400
Shell lime	3,400–3,401
Shale, black	3,401–3,422
Lime, black	3,422–3,429
Shale, black	3,429–3,444
Lime, black, hard	3,444–3,450
Lime, gray	3,450–3,480
Lime, black	3,480–3,525
Sand, brown, hard	3,525–3,540
Lime, gray	3,540–3,565
Lime, black	3,565–3,735
Lime, gray (Ellenburger)	3,735–3,800

Bransford No. 1, Prairie Oil & Gas Co.

[3,000 feet south of tract 6-B, Eastland block; map No. 313-A. Elevation, 1,493 feet. Dry hole; abandoned.]

	Feet.
Sandstone	0–25
Slate, blue	25–105
Limestone (Ranger)	105–125
Slate	125–135
Limestone	135–185
Slate, blue	185–220
Limestone	220–310
Slate	310–325
Limestone	325–335
Slate, blue	335–370
Limestone	370–376
Shale, light	376–400
Limestone and shale	400–405
Shale, light	405–450
Limestone	450–490
Slate	490–595
Limestone	595–610
Shale	610–633
Limestone	633–670
Slate	670–675

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Bransford No. 1, Prairie Oil & Gas Co.—Continued.

	Feet.
Limestone	675–690
Slate	690–750
Sandstone	750–775
Limestone	775–780
Slate	780–788
Limestone	788–800
Slate	800–820
Slate, blue	820–890
Limestone	890–895
Slate	895–940
Shale, blue	940–990
Sandstone, water	990–1,015
Slate, black	1,015–1,045
Red rock	1,045–1,050
Limestone	1,050–1,085
Shale	1,085–1,145
Limestone, shell	1,145–1,150
Shale	1,150–1,325
Sandstone, water	1,325–1,375
Slate	1,375–1,500
Sandstone, water	1,500–1,525
Slate	1,525–1,580
Sandstone, water	1,580–1,690
Shale	1,690–1,715
Sandstone	1,715–1,760
Shale	1,760–2,390
Sandstone, broken	2,390–2,485
Shale, blue	2,485–2,520
Slate	2,520–2,855
Limestone, black	2,855–2,965
Slate, blue	2,965–3,000
Shale, light	3,000–3,020
Slate, blue	3,020–3,065
Limestone, black	3,065–3,085
Slate, black	3,085–3,138
Limestone, black ("Blacklime")	3,138–3,165
Slate, black	3,165–3,178
Limestone, black	3,178–3,200
Slate, black	3,200–3,275
Limestone, shells, black	3,275–3,290
Slate, black	3,290–3,320
Limestone, gray	3,320–3,332
Slate, black	3,332–3,345
Limestone, black	3,345–3,358
Slate, black	3,358–3,365
Limestone, gray	3,365–3,394
Slate, black	3,394–3,425
Limestone, black	3,425–3,470
Slate, black	3,470–3,492
Limestone, gray	3,492–3,512
Limestone, black	3,512–3,520
Limestone, gray, flinty	3,520–3,540
Limestone, black	3,540–3,620
Slate, black, and broken limestone	3,620–3,717
Limestone, white (Ellenburger)	3,717–3,920
Limestone, light-brown	3,920–3,935
Limestone	3,935–3,950
Water	3,950–3,955

Casing record:
- 15½-inch, 105 feet.
- 12½-inch, 804 feet 6 inches.
- 10-inch, 1,393 feet.
- 8-inch, 1,701 feet 1 inch.
- 6⅝-inch, 2,895 feet 6 inches.

Dr. Johnson No. 1, Sammies Oil Co.

[Tract 3-E, Olden block; map No. 314. Elevation, 1,474 feet.]

	Feet.
Limestone (Adams Branch)	0–40
Slate	40–75
Sandstone	75–80
Slate	80–100
Limestone	100–130
Sandstone	130–150
Shale, black	150–185
Limestone	185–195
Slate	195–330
Limestone	330–365
Slate	365–375
Limestone	375–395
Sandstone	395–415
Slate	415–425
Sandstone	425–455
Shale	455–595
Sandstone	595–622
Slate	622–710
Limestone	710–725
Red rock	725–735
Shale, white	735–770
Sandstone	770–800
Shale	800–820
Red rock	820–825

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

Dr. Johnson No. 1, Sammies Oil Co.—Continued.

	Feet.
Shale	825–995
Limestone	995–1,005
Shale	1,005–1,100
Limestone	1,100–1,130
Shale	1,130–1,640
Sandstone, white	1,640–1,680
Shale	1,680–2,320
Sandstone	2,320–2,410
Slate	2,410–2,425
Shale	2,425–2,470
Sandstone	2,470–2,580
Shale, blue	2,580–2,730
Limestone	2,730–2,733
Shale, black	2,733–2,740
Limestone, black	2,740–2,745
Shale	2,745–2,760
Limestone, black	2,760–2,810
Shale, black	2,810–3,030
Unrecorded	3,030–3,036
Limestone, black ("Black lime")	3,036–3,106
Shale	3,106–3,120
Limestone, gray, and shale	3,120–3,125
Shale	3,125–3,185
Limestone, gray	3,185–3,225
Shale, black	3,225–3,250
Limestone, gray	3,250–3,300
Shale	3,300–3,347
Limestone, shells	3,347–3,353
Shale, black	3,353–3,365
Limestone and shale	3,365–3,375
Sandstone, white	3,375–3,385
Shale, black	3,385–3,400
Limestone	3,400–3,410
Shale, black	3,410–3,420
Limestone and shale	3,420–3,445
Limestone, gray	3,445–3,465
Limestone, black	3,470–3,508

Casing record:
12½-inch, 635 feet.
10-inch, 1,485 feet.
8¼-inch, 1,790 feet.
6⅝-inch, 3,030 feet.

L. B. Bourland No. 1, Leon Oil Co.

[Tract 5-E, Olden block; map No. 324. Elevation, 1,425 feet. Well abandoned.]

	Feet.
Surface soil	0–15
Sand	15–30
Shale, blue	30–79
Lime	79–90
Shale	90–95
Sand	95–142
Shale, blue	142–148
Lime	148–152
Shale, sandy	152–175
Shale, blue	175–233
Lime	233–248
Shale	248–258
Red rock	258–272
Shale	272–278
Lime	278–284
Shale	284–310
Sand	310–360
Shale, blue	360–374
Sand	374–410
Shale	410–454
Limestone, sandy	454–464
Shale, blue	464–520
Red rock	520–526
Shale	526–621
Limestone	621–642
Sandstone	642–660
Shale	660–715
Red rock	715–730
Shale, sandy	730–825
Shale, blue	825–854
Red rock	854–865
Shale, blue	865–1,130
Sand	1,130–1,145
Shale, blue	1,145–1,320
Limestone	1,320–1,332
Shale	1,332–1,345
Limestone	1,345–1,355
Sand	1,355–1,366
Shale	1,366–1,383
Lime, shell	1,383–1,385
Shale	1,385–1,425
Lime	1,425–1,432
Shale	1,432–1,598
Sand	1,598–1,615
Shale, gray	1,615–1,676
Shale, blue	1,676–1,775
Lime, shell	1,775–1,779
Shale	1,779–1,910

Logs of wells in Ranger oil field, Eastland County, Tex.—Continued.

L. B. Bourland No. 1, Leon Oil Co.—Continued.

	Feet.
Sand	1,910–1,917
Shale	1,917–2,055
Limestone	2,055–2,060
Shale	2,060–2,135
Lime	2,135–2,140
Shale	2,140–2,156
Shale, sandy	2,156–2,164
Sand	2,164–2,258
Shale	2,258–2,263
Sand	2,263–2,327
Shale	2,327–2,340
Sand	2,340–2,365
Lime	2,365–2,372
Shale	2,372–2,377
Sand	2,377–2,382
Shale	2,382–2,410
Sand	2,410–2,450
Shale	2,450–2,457
Sand	2,457–2,470
Shale, blue	2,470–2,575
Lime, shell	2,575–2,579
Shale, gray	2,579–2,600
Shale, blue	2,600–2,650
Lime, blue	2,650–2,700
Lime. blue	2,700–2,740
Shale, blue	2,740–2,923
Lime, black ("Black lime").	2,923–2,940
Shale, black	2,940–2,945
Lime, black	2,945–2,951
Shale, black	2,951–2,967
Lime, black	2,967–2,971
Shale, black	2,971–2,985
Lime, black	2,985–2,990
Shale, black	2,990–3,000
Lime, black	3,000–3,047
Shale, black	3,047–3,162
Lime, gray	3,162–3,185
Shale	3,185–3,240
Lime, black	3,240–3,246
Shale, black	3,246–3,318
Lime, shell, gray	3,318–3,326
Shale	3,326–3,333
Lime, gray	3,333–3,345
Shale	3,345–3,395
Lime	3,395–3,400
Shale	3,400–3,415
Lime, gray; small show of gas at 3,457–3,460 feet	3,415–3,460
Sand, black	3,460–3,512

Casing record:
15½-inch, 175 feet.
12½-inch, 500 feet.
10-inch, 1,485 feet.
8-inch, 2,485 feet.