OKLAHOMA GEOLOGICAL SURVEY
Chas. N. Gould, Director

Bulletin No. 40-WW

OIL AND GAS IN OKLAHOMA

BEAVER, TEXAS, AND CIMARRON COUNTIES

By
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NORMAN
MAY, 1930

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FOREWORD

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

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

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

This separate, which deals with the petroleum geology of the three Panhandle counties, Beaver, Texas, and Cimarron, has been prepared by Mr. Ray L. Six, instructor in geology in the University of Oklahoma. The general geology of these three counties is embodied in Bulletins 34, 37, and 38 of the Oklahoma Geological Survey published in 1925 and 1926. Mr. Six spent some time during the summer of 1929 in field work in these counties and has brought the information in the above bulletins up to date.

Norman, Oklahoma

May, 1930.

CHAS. N. GOULD,

Director.

BEAVER, TEXAS, AND CIMARRON COUNTIES

By

Ray L. Six

INTRODUCTION

LOCATION

Beaver, Texas, and Cimarron Counties are located in the extreme northwestern portion of the State. They form the area formerly called "No Man's Land" and in territorial days "Beaver County". After statehood it was divided into three approximately equal parts and "Beaver" was retained for the eastern third. This area is sometimes referred to as the "Panhandle" of Oklahoma and for obvious reasons.

This area embraces Tps. 1 to 6 N., inclusive, and Rs. 1 to 28 E., C. M., inclusive; and lies between 36° 30′ and 37° 00′ N. Latitude and 100° and 103° W. Longitude. Its northern boundary is the state lines of Colorado and Kansas; its eastern is Harper and Ellis counties of Oklahoma; its southern is the Texas line and its western is the New Mexico state line. This series of counties lies in the Great Plains phy-

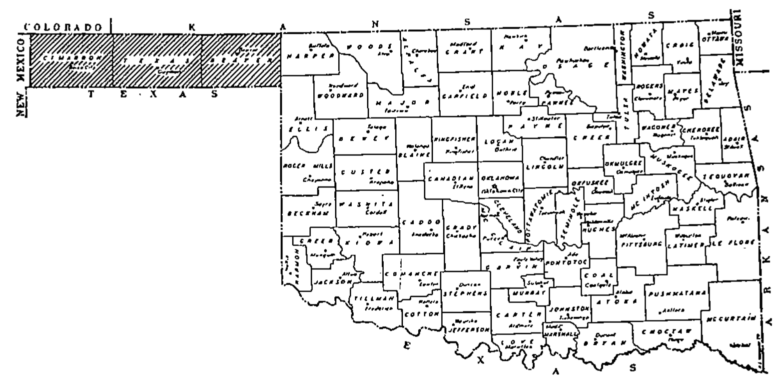


Figure 1. Index map of Oklahoma showing location of Beaver, Texas, and Cimarron counties.

siographic province. With the exception of shallow, saucer-like depressions and two stream valleys the area is a featureless plain drained by the Cimarron and the North Canadian Rivers and the tributaries. The former has carved a series of beautiful canyons in northwestern Cimarron County near Kenton and its environs. After flowing two-thirds of the way across this county this river flows north into Kansas then returns to Oklahoma just east of the center of the north line of Beaver County. The North Canadian enters Oklahoma in southwestern Cimarron County and flows almost across the southern part of the county before it flows into Texas. It reenters Oklahoma just a few miles west of the southeast corner of Texas County and continues eastward through central Beaver County. This stream is extremely interesting in that it flows in a valley grooved out of the top of the divide between the Cimarron and the South Canadian Rivers.

The geology of this region is simple excepting for some stratigraphic relationships in northwestern Cimarron County. There is need of much detailed field work to clarify these relationships. This comment also applies to the relationships of the Tertiary gravels.

The following generalized geologic column presents the writer's understanding of these stratigraphic relationships of these three counties in May, 1930. Plate I of the report shows the general areal relationships. A number of corrections have been made on previous maps of the area but many inaccuracies still exist.

ACKNOWLEDGMENTS

Inasmuch as sufficient time was not available for detailed field studies of this very interesting area on the part of the writer, especial thanks are due those whose data has made parts of this report possible. The publications of Gould and Lonsdale,[1] Rothrock, Lee, Darton, Stanton, and many others have been very helpful. The writer is also deeply indebted to Mr. R. C. Tate of Kenton for personally conducting him to the places of geologic interest in the northwestern part of Cimarron County and its environs. The Oklahoma Geological Survey prepared the maps for this report.

Structurally this area lies within the monoclinal province east of the southern Rocky Mountains. The western part of Cimarron County is broken by a series of undulations whose axes are nearly parallel to that of the Rockies to the west. These folds are probably related to the orogenic disastrophism of these mountains.

1. Gould, Chas. N., and Lonsdale, John T., Geology of Beaver County: Oklahoma Geol. Survey Bull. 38, 1626.

BEAVER COUNTY

Location

Beaver County is the eastern one of the three Panhandle counties. It is rectangular and includes all of forty townships and four-sixths of nine others. It embraces Tps. 1 to 6 N., Rs. 20 to 28 E., C. M. The northern boundary is the Oklahoma-Kansas line. On the east it is bounded by Harper and Ellis counties, on the south by the Texas line, and on the west by Texas County of Oklahoma. It has an area of 1,728 square miles.

The W. F. & N. W. Ry. enters the county at Gate and follows the divide between the Cimarron River and Beaver Creek westward to Forgan. From here it runs due west to Hooker in Texas County. At Forgan a branch line known as the B. M. & E. Ry., connects it with Beaver City, which is the county seat, on the south bank of Beaver Creek six miles south or Forgan.

The population of Beaver County is approximately 17,000 which is an aveearge of about 10 per square mile. Important towns are Beaver City with a population of 1,500, Forgan 700, Gate 250, and Knowles 225.

Topography

Beaver County lies on the eastern edge of the Great Plains province. The surface is a plain which slopes gently eastward. The northeastern part of the county is dissected and drained by the Cimarron River and its tributaries. The central and southern portions of the county are drained by Beaver Creek (North Canadian River) and its tributaries, the most important of which are Kiowa, Duckpond, Clear and Jackson Creeks. The North Canadian and its tributaries drain approximately five-sixths of the county.

GEOLOGY

Surface Formations

The following formations outcrop in Beaver County; Whitehorse sandstone, Day Creek dolomite(?), and Cloud Chief Gypsum of Permian age; Cretaceous oyster beds(?); late Tertiary volcanic ash, limestones, and clays; later Tertiary sands and gravels; and Quaternary alluvium and dune sand.

WHITEHORSE SANDSTONE

This formation outcrops in the eastern and central portions of the county along Kiowa and Camp Creeks and the North Canadian River and the valleys tributary to it from the south. It is also found along the Cimarron River in the northeastern part of the county. The Day Creek dolomite is probably present in the same areas separating it from the overyling Cloud Chief. The Cloud Chief gypsum is found in the valleys of Camp and Kiowa Creeks along the south wall of the North Canadian and in practically all of the tributary valleys from the south and also in a number of those from the north.

CRETACEOUS OYSTER BEDS

These beds occur in isolated localities in the county and are composed largely of *Gryphea* shells of Lower Cretaceous age. Judging from the water-worn character of these shells they may be transported Cretaceous material, Tertiary in age. They may be observed in T. 3 N., R. 24 E., C. M., along Clear Creek, in the SW. cor., T. 3 N., R. 25 E., C. M., and in the NW. cor., T. 4 N., R. 25 E., C. M..

TERTIARY VOLCANIC ASH

These deposits may be found in many localities. A typical one is found north of Gate in sec. 10, T. 5 N., R. 28 E., C. M., one and one-half miles west of another deposit of the same material. The first deposit is approximately 10 feet in thickness and 120 by 450 feet in extent. A deposit 12 feet in thickness occurs in the NW.¼ sec. 1, T. 5 N., R. 27 E., C. M., Numerous other deposits of the same will be found listed and described by Frank Buttram.[2]

Later Tertiary sands and gravels cover approximately four-fifths of the surface area of the county. Within or under these gravel deposits in many areas are found limestone and fine clay deposits containing fossil leaf and fish remains. These are most abundant in the east-central part of the county north and south of North Canadian River. Three deposits are found south of Cline and one 2½ miles west of Zelma. Two others are found 4 miles northwest of this along Kidd's Creek in sec. 23, T. 4 N., R. 26 E., C. M. An extensive deposit occurs one mile north of Riverside in secs. 3 and 10, T. 3 N., R. 25 E., C. M. Udden, Berry, Darton, Gould, and others have described fossil leaves from these localities.

LATE TERTIARY SANDS AND GRAVELS

These deposits belong, perhaps, to the Loup Fork (Miocene), Goodnight(?), and the Blanco (Pliocene) of the Texas Panhandle Tertiary. This subdivision of the Tertiary in the Panhandle of Texas is based upon vertebrate fossils as identified by Cummins and Cope. Quaternary alluvial deposits occur along the Cimarron and North Canadain Rivers. A strip of fine sand varying in width from one to five miles lies north of the North Canadian. Northwest of Beaver City and southwest of Floris dunes are found to reach their maximum development. In a number of localities the Tertiary gravel or "mortar beds" yield abundant *Equus* and *Elephas* remains. The "mortar beds" and the Tertiary gravels cover most of the county.

2. Buttram, Frank, Volcanic dust in Oklahoma: Oklahoma Geol. Survey Bull. 13, 1914.

Subsurface Geology

Our knowledge of subsurface conditions in this county is wholly dependent upon logs of the few wells that have been drilled here and in adjacent areas. Deep wells drilled in northwestern Oklahoma within the last two years have revealed a practically complete section of Permian and old rocks as far as the Mississipian. The deep well drilling in sec. 14, T. 26 N., R. 24 W., Harper County, has revealed much more Mississippi limestone than was expected, over 800 feet. Fossils from this section indicate that the Mississippian seas came from the Cordilleran region. Plate II shows the general subsurface relationships of the underlying Permian and the older rocks. The following logs of wells drilled in this county indicate the detailed character of underlying sediments.

Log of Gate Well, Sec. 33, T. 5 N., R. 28 E., Cimarron Meridian

Formation	Top	Bottom
Soil	0	5
Sand clay	5	25
Red rock	25	40
Water sand	40	48
Red rock	48	83
Water sand	83	90
Red rock	90	170
Water sand	170	178
Red rock	178	265
Sandy lime	265	268
Red rock	268	275
Sand	275	300
Red rock	300	350
Sandy lime	350	353
Red rock	353	362
Lime and gyp	362	395
White lime	395	412
Blue shale	412	420
Brown shale	420	450
Sandy lime	450	467
Salt	467	567
Red rock	567	572
Salt	572	585
Red rock	585	620
Salt	620	630
Red rock	630	670
Salt	670	720
Red rock	720	740
Sand	740	743
Red rock	743	840
Sand	840	842
Red rock	842	860
Sandy lime	860	865
Red rock	865	890
Sand	890	892
Red rock	892	905
Blue slate	905	910
Red rock	910	970
Lime	970	978
Red rock	978	985
Sandy lime	985	1000
Red rock	1000	1005
Lime	1005	1015
Red rock	1015	1045
Salt	1045	1048
Sandy lime	1048	1065
Red rock	1065	1067
Sandy lime	1067	1080
Red rock	1080	1085
Sandy lime	1085	1100
Red rock	1100	1123
Red lime	1123	1130
Red rock	1130	1140
Sandy lime	1140	1155
Red rock	1155	1160
Salt	1160	1166
Gray lime	1166	1177
Red rock	1177	1187
Blue lime	1187	1203
Red rock	1203	1215
Lime	1215	1240
Red rock	1240	1250
Salt	1250	1288
Red rock	1288	1290
Salt	1290	1395
Blue slate	1395	1405
Salt	1405	1430
Red rock	1430	1510
Blue slate	1510	1528
Red rock	1528	1548
Blue slate	1548	1563
Red rock	1563	1575

(Continued on page 10)

Formation	Top	Bottom
Brown slate	1575	1600
Red rock	1600	1625
Brown slate	1625	1650
Red rock	1650	1725
Blue slate	1725	1765
Lime	1765	1770
Blue slate	1770	1775
Lime	1775	1780
Blue slate	1780	1795
Lime	1795	1820
Blue slate	1820	1823
Lime	1823	1840
Blue slate	1840	1855
Lime	1855	1895
Slate	1895	1900
Lime	1900	1905
Slate	1905	1915
Lime	1915	1918
Slate	1918	1943
Lime	1943	1958
Salt	1958	1975
Lime	1975	1990
Salt	1990	1997
Slate	1997	2015
Salt	2015	2020
Lime	2020	2035
Salt	2035	2040
Sandy lime	2040	2050
Salt	2050	2063
Limey salt	2063	2087
Lime	2087	2092
Lime and slate	2092	2102
Lime	2102	2107
Salt	2107	2165
Lime	2165	2170
Salt	2170	2190
Slate	2190	2205
Lime	2205	2245
Slate	2245	2248
Lime	2248	2365
Sandy lime	2365	2370
Salt	2370	2395
Lime	2395	2505
Lime	2505	2665
Gray slate	2665	2667
Sandy lime	2667	2750
Water sand	2750	2765
Slate	2765	2770
Water sand	2770	2775
Red slate	2775	2780
Sandy lime	2780	2832
Slate	2832	2837
Lime	2737	2862
Asphalt	2862	2893
Brown sand	2893	2903
White lime	2903	2908
Lime and sand	2908	2918
Gray lime	2918	2940
Black lime	2940	3005
Gray lime	3005	3014
Blue shale	3014	3020
Lime, gray	3020	3030
Brown sand	3030	3040
Lime and much sand	3040	3049
Pink lime	3049	3060
Gray shale	3060	3065
Coarse sand	4065	3068
Brown shale	3068	3073
Gray lime	3073	3079
Black lime	3079	3099
Gray lime	3099	

Log of Skear Well, Sec. 17, T. 3 N., R. 23 E., Cimarron Meridian

Formation	Top	Bottom
Soil	0	10
Red beds	10	250
Sand and water	250	265
Red beds	265	300
Sand and water	300	310
Red beds	310	400
Quick sand	400	425
Red beds	425	600
Salt	600	640
Red beds and blue shale	640	692
Blue shale	692	712
Sand (dry)	712	720
Red beds	720	840
Red beds and salt, mixed	840	860
Brown shale	860	1140
Soft red beds	1140	1500
Hard gray lime	1500	1540
Red beds	1540	1600
Brown shale	1600	1810
Soft cavy red beds	1810	2000
Brown shale	2000	2018
Hard blue shale	2018	2030
Hard white lime	2030	2040
Lime and blue shale, mixed	2040	2072
Sandy lime, good showing oil	2072	2075
Hard blue shale	2075	2102
Hard gray lime	2102	2105
Blue shale	2105	2120

(Continued on page 11)

Formation	Top	Bottom
Brown shale	2120	2123
Blue shale	2123	2250
Black shale, soft	2250	2262
Light blue shale	2262	2272
Hard sandy lime	2272	2287
Black shale, soft	2287	2295
Hard sandy lime, gray	2295	2300
Sand (dry, gray)	2300	2312
Black shale, mixed with soft white formation	2312	2318
Blue shale	2318	2340
Dark shale (fine)	2340	2370
Blue shale mixed with soft white formation	2370	2385
Mixture of lime, salt and sand	2385	2410
Soft blue shale	2410	2427
Coarse dark blue shale and soft white formation	2427	2450
White lime, not very hard	2450	2465
Black shale	2465	2475
Hard lime and blue slate mixed	2475	2522
Hard white lime	2522	2810
Sandy brown lime	2810	2915
Sand and water, about 600 feet water in hole	2915	2985
Brown sandy lime	2985	3005

Log of Empire Well, Sec. 6, T. 1 N., R. 20 E., Cimarron Meridian

Formation	Top	Bottom
Soft red surface	0	19
Soft red mud	19	79
Hard red shell	79	82
Soft red sand	82	85
1 bbl. water per hr.		
Soft red mud	85	125
Hard white lime	125	140
Soft red mud	140	180
Soft red sandy shale	180	195
15 bbls. water at 185′		
Soft red mud	195	255
Soft red sandy shale	255	270
Soft red mud	270	331
Soft red quick sand	331	336
Soft red mud	336	367
Soft red quick sand	367	374
Soft red mud	374	395
Hard red shell	395	402
Soft red sand	402	406
Soft red mud	406	409
Soft red sand, ½ HFW	409	416
Soft red mud-hole cave	416	430
Soft sandy red rock	430	436
Soft red mud	436	447
Soft red mud	447	502
Soft red shell gyp	502	506
Soft red mud	506	512
Hard white rock gyp	512	530
Hard red shell	530	540
Hard white gyp	450	550
Soft red mud	550	580
Hard red shell	580	588
Soft red mud	588	653
Hard white shell	653	670
Soft red rock	670	685
Boulders at 685′		
Hard red shell	685	690
Soft red rock	690	785
Formation	Top	Bottom
Soft red mud	785	820
Hard red shell	820	825
Soft red mud	825	885
Soft red salt	885	895
Soft red mud	895	1040
Hard red sand	1040	1065
Soft red mud	1065	1165
Soft red shale	1165	1175
Soft red mud	1175	1275
Hard sandy shell	1275	1290
Soft red mud	1290	1340
Soft red sandy mud	1340	1360
Soft red sandy shale	1360	1450
Soft red mud	1450	1480
Soft gray lime mud	1480	1490
Hard gray lime	1490	1535
Soft red mud	1535	1595
Hard gray shell	1595	1610
Soft red mud	1610	1620
Hard white salt-caving	1620	1695
Soft red mud	1695	2040
Soft red shale	2040	2085
Hard white lime	2085	2090
Soft gray shale	2090	2115
Soft red mud	2115	2145
Hard gray shell	2145	2148
Soft gray slate	2148	2175
Soft blue slate	2175	2200
Hard white lime slate	2200	2320
Hard white lime	2320	2350
Hard white salt	2350	2355
Hard white lime	2355	2385
Soft blue slate-lime	2385	2530
Hard white lime	2530	2850
Hard white sandy lime	2850	2855
Hard white lime	2855	2860

(Continued on page 12)

Formation	Top	Bottom
Hard brown sand	2860	2905
Soft brown sandy lime	2905	2940
Hard white lime	2940	2975
Soft white sand	2975	2980
Hard white sandy lime	2980	3012
Hard white lime	3012	3037
Soft blue slate	3037	3040
Hard white lime	3040	3050
Soft white sandy lime	3050	3060
Hard white sand	3060	3083
Hard white lime	3083	3107
Soft blue slate	3107	3110
Hard white lime	3110	3119
Soft white sand	3119	3129
Soft blue slate	3129	3132
Soft white sand	3132	3140
Hard white sandy lime	3140	3147
Hard white lime	3147	3150
Hard white sandy lime	3150	3205
Hard black lime	3205	3245
Hard gray lime	3245	3290
Hard red mud	3290	3295
Hard white sandy lime	3295	3385
Soft white sand	3385	3392
Hard white lime	3392	3415
Hard black lime	3415	3423
Hard white sandy lime	3423	3475
Hard gray lime	3475	3537

STRUCTURE

The structure of the surface rocks of Beaver County is a monocline dipping gently to the east. The Tertiary and Quaternary rocks covering most of the county show little, if any, underlying structure of this area. It is only along the valleys of the Cimarron and North Canadian rivers and the lower portions of their tributaries that mapable horizons are found. A comparison of logs of wells drilled in this county reveals a marked similarity to those drilled at Texhoma, Oklahoma, and in Liberal, Kansas as well as in the northern part of the Panhandle of Texas. In all of these places oil or gas has been found in commercial quantities. Figure 2 shows the general structure of this region and its relation to the Anadarko Basin.

DEVELOPMENT

Thus far only three wells have been drilled in Beaver County. The logs of these are given under "Subsurface Geology" of this county.

Location of wells drilled in Beaver County.

WELL	LOCATION	DEPTH Feet	REMARKS
Gate	Sec. 33, T. 5 N., R. 28 E., C.M.	3,099	Dry
Skeer	Sec. 17, T. 3 N., R. 23 E., C.M.	3,055	Dry (1924)
Empire	Sec. 6, T. 1 N., R. 20 E., C.M.	3,537	Dry (Sept. 1925)

Considerable interest has been manifested in this county due to commercial production of natural gas in Clark County, Kansas, at Texhoma in Texas County and both petroleum and natural gas in the Texas Panhandle. Producing horizons known to the east of the county should be nearer the surface in the western part of Beaver County than in the extreme northwestern part of Oklahoma east of the Panhandle.

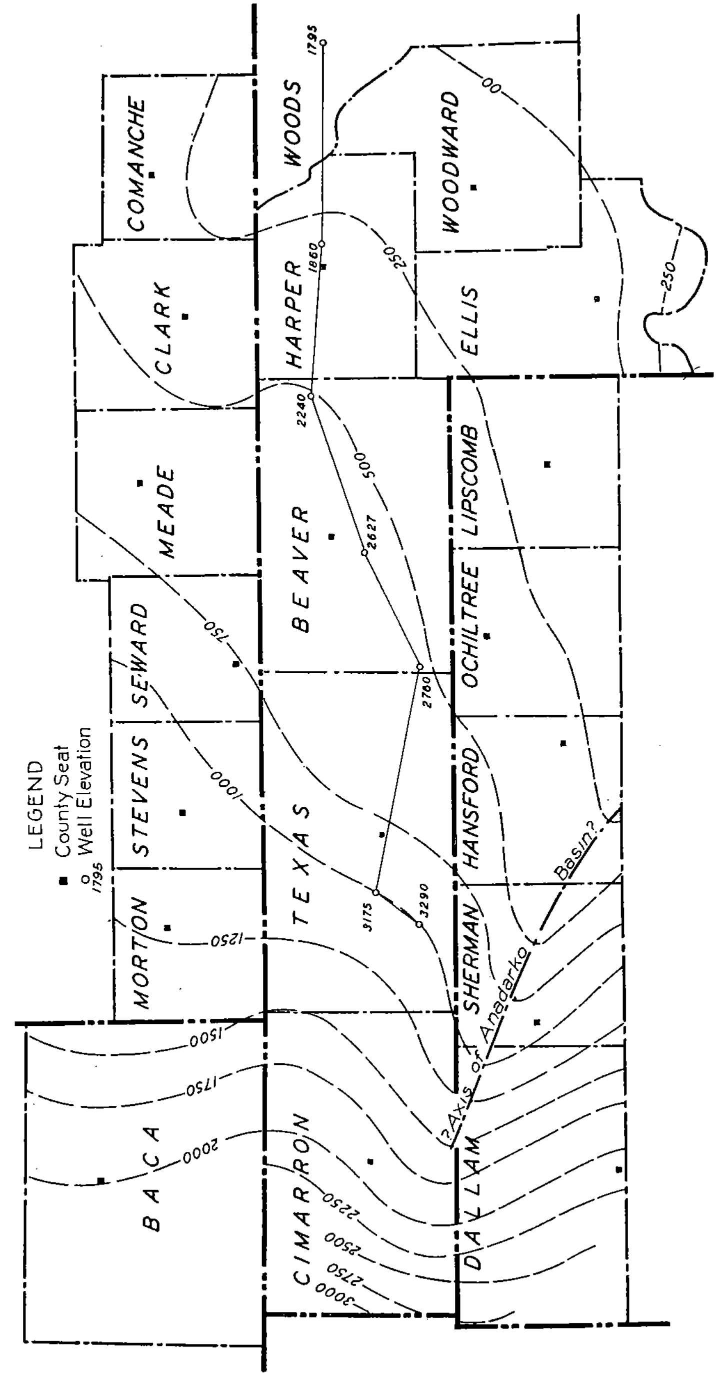


Figure 2. Map showing the relationship of this area to the Anadarko Basin. Contours on the base of the red beds.

The western part of Beaver County is composed of a portion of the High Plains the subsurface rocks of which dip eastward. Gore drilling and geophysical methods would give more accurate information to guide prospecting in the area. Inasmuch as Beaver County lies along the northern rim of the Anadarko Basin and along the west rim of what is believed to be a structural high, it would not be surprising to find production in this area. The exact nature of the structure of the producing areas in Kansas on the north and in Texas County to the west is in question. So far as the writer is informed, these producing areas were not determined from surface indications.

Generalized geologic section of surface rocks of Beaver, Texas, and Cimarron Counties, Oklahoma

ERA	SYSTEM	FORMATION
RECENT	Quaternary	Alluvium and eolian deposits
CENOZOIC	Pliocene	Black Mesa Basalt and Volocanic ash
	Angular unconformity	
	Pliocene and Miocene	Limestones, clays, sands and gravels
MESOZOIC	Cretaceous	Benton shales and limestones Dakota sandstone
	Comanchean	Purgatoire formation
		Morrison formation Exter sandstone
		Unnamed varigated shales Red beds
	Triassic	Red beds
PALEOZOIC	Permian	Quartermaster (?) Cloud Chief formation Day Creek dolomite (?) Whitehorse sandstone

TEXAS COUNTY

Location

Texas County is the central one of the Oklahoma Panhandle counties. It is rectangular in shape and includes all of fifty townships and two-thirds of ten others. The area embraces Tps. 1 to 5 N., inclusive and four miles of Tps. 6 N., Rs. 10 to 19 E., C. M., inclusive. (From the base-line on the 36° 30′ parallel N. Lat.) The northern boundary of the county is the Oklahoma-Kansas line, and the southern is the Oklahoma-Texas line. To the east is Beaver County and to the west is Cimarron County. The area of Texas County is approximately 2,065 square miles.

The main line of the Rock Island enters the county near the northeast corner and runs southwest through Tyrone, Hooker, Optima, Guymon, Goodwell, and Texhoma where it enters Texas. The B. M. & E. Ry. enters the county one and one-half miles north of the southeast corner T. 5 N., R. 19 E., C. M. and runs due west through Baker, Hooker, and Mouser to Hough, a distance of 34 miles. Another branch of the Rock Island enters the county at the northeast corner and runs southwest through Baker, Adams, and Hardesty and across the Texas-Oklahoma line at Hitchfield. A branch line of the Santa Fe from Elkhart, Kansas to Boise City in Cimarron County crosses the northwest corner of the county.

The population of Texas County is approximately 20,000 which is an average density of 10 per square mile. The principal towns are Guyman, the county seat, with 1,600 in population, Goodwell, Hooker, Tyrone, and Texhoma. The Panhandle State Agricultural College has an excellent plant at Goodwell.

Topography

This county is in the High Plains physiographic province and consequently has little relief. The elevation varies between 2,900 feet at the eastern side of the county to 3,700 feet at the northwest corner. Beaver Creek (North Canadian River) with its tributaries drains the county. The principal tributaries are Paloduro, Hackberry, Coldwater, Pony, Goff, Tepee, South Fork and North Fork of Beaver Creeks. Owing to light rainfall these creeks are dry during the greater part of the year. The average rainfall is only twenty inches. Water is obtained from wells drilled into the Tertiary gravels which cover most of the area of the county.

With two exceptions the county is an unbroken plain sloping gently to the east. The North Canadian and its tributaries have carved a shallow valley through the central portion of the county and the valley of Paloduro Creek presents a rough, broken terrane. Most of the county is without drainage lines. The stream valleys are usually small canyons. In the northern and western parts of the county are a number of shallow, saucer-like depressions without surface drainage outlets which form shallow lakes after rains. These lakes seem to be characteristic of High Plains topography and their origin is problematical. Springs occur at the base of the Tertiary gravels where streams have cut through into the underlying red beds.

GEOLOGY

Surface formations

The oldest rock occurring on the surface is the Cloud Chief gypsum of Permian age. This formation and overlying "mortar beds" form the precipitous valley walls of Paloduro Creek and its tributaries

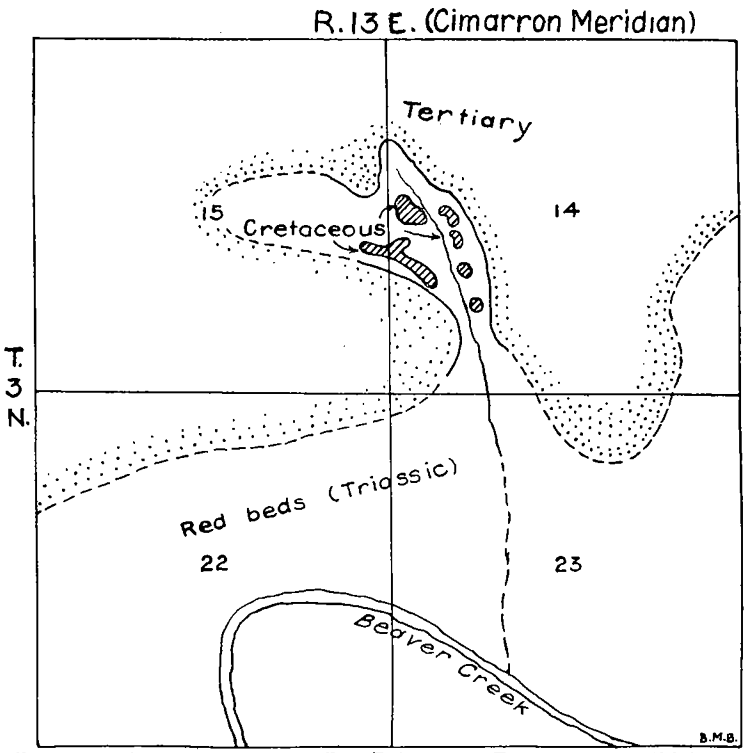


Figure 3. Sketch map of the Red Point area, Texas County, Oklahoma. (After Bullard)

in the southeast part of the county in the vicinity of Range and Grand Valley in Tps. 1 and 2 N., Rs. 18 and 19 E., C. M. The thickness of the Cloud Chief gypsum just east of the Range postoffice is approximately 70 feet. Gypsum beds form a prominent part of the Cloud Chief formation at only one point in the area and that is about one mile east of the Range postoffice in the valley wall of Paloduro Creek. At other places the formation is composed of red, gray, and green shales with some red sandstone lentils. A concretionary sandstone member lies about 25 feet above the gypsum member previously mentioned. It occurs in sec. 17, T. 1 N., R. 19 E., C. M., about 2½ miles east of Range. The thickness of this member is about 8 feet and it is buff to brown in color and very fine grained. Within it are numerous dendritic-shaped, concretionary aggregates averaging one-sixteenth of an inch in diameter and numbering about 10 to the square inch of rock surface. These are dark in color which is due, perhaps, to the presence of manganese oxide. There are numerous concretions of iron

oxide spherical in shape and ranging in size from small shot to the size of a pea. These are, no doubt, pyrite or marcasite altered to limonite. This sandstone member is similar to the Hackberry and Big Basin of the Kansas Permian. It is possible that a part of this area mapped as Cloud Chief is really Whitehorse.

Two areas of red beds occur in this county, one near Red Point on the North Canadian River in T. 3 N., R. 13 E., C. M. and another along Tepee Creek in T. 3 N., Rs. 11 and 12 E., C. M. These beds are Triassic in age.

Six Lower Cretaceous outliers are found in secs. 14 and 15, T. 3 N., R. 13 E., C. M. They rest directly upon the Triassic red beds and are composed of soft, white to yellow-brown sandstone which, due to its ferruginous content, weathers to dark red. This is very similar in color to the underlying Triassic and Clifton[3] was the first to differentiate between the red Tertiary and the red Triassic. For a detailed discussion of this area the reader is referred to Bullard's[4] report embracing this area, and to the following map (fig. 3) for the areal relationships of the rocks of this area.

The Tertiary rocks cover more than nine-tenths of the surface area of this county and lie unconformably upon the older rocks. They vary in thickness from 300 to 500 feet. The following log taken from a well drilled at Optima in the north-central part of the county reveals the general character of the Tertiary of the area.

Log of the Optima well, Texas County.

Character	Thickness	Depth	Character	Thickness	Depth
Sandy shale	100	100	Yellow sand	15	388
Reddish Clay	15	115	Dry sand	10	398
Sandy clay	114	229	Brown sand	5	403
Red clay	64	293	Sand clay	3	406
Dark clay	56	349	Blue shale	80	486
Blue clay	4	353	Sandy gravel and shale	12	498
Yellow clay	20	373			

The Tertiary rocks of this portion of the High Plains present a very complex problem, and the differentiation and correlation of these gravels with the Tertiary of the northern and southern Great Plains has not yet been accomplished. Fragments as large as one foot in diameter are found in Texas County over 100 miles from their nearest known source. The streams which transported these clastics were very different from those now existing in this region. On the surface the clastics have a mortar-like appearance, hence the name, "mortar beds."

Overlying these Tertiary deposits and widely distributed throughout this portion of the Great Plains are caliche deposits which are usually overlain by gray, clacareous soil. This caliche varies from one

3. Clifton, R. L., personal communication to Chas. N. Gould, 1925.
4. Bullard, Fred M., Lower Cretaceous of western Oklahoma: Oklahoma Geol. Survey Bull. 47, 1928.

to 20 feet in thickness and occasionally one observes two or more accumulations, one above the other. It is the same as the "cap rock" of the Texas Panhandle and the tops of the Antelope and Twin Hills of Roger Mills County. Excellent exposures of the caliche and underlying Tertiary gravels may be observed in the Rock Island railroad cuts between Guymon and Optima. Remains of vertebrates are obtainable in the railway cut on the north side of North Canadian River about two miles southwest of Optima. Figure 4 is a photograph taken at this location which shows the deposit. The University of California has made extensive collections here of several species of horses, camels, elephants, saber tooth tigers, and ruminants. Extensive collections have been made from numerous other localities in this county.

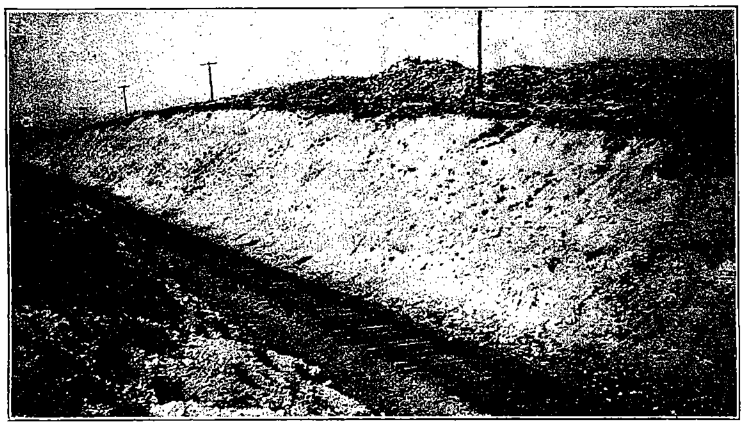


Figure 4. Caliche in railroad cut between Guymon and Optima.

For detailed description of the previously mentioned caliche deposits, the reader is referred to work of Gould and Lonsdale[5] on Texas County.

The Quaternary system of rocks in this area is represented by alluvial and dune deposits, the latter occurring in the broad, flat bottoms of the canyon-like valleys of the major drainage lines. Dune sand occurs north of North Canadian River in the southeastern part of the county. This is a westward continuation of the eolian deposits of Beaver County. The height of these dunes reach as much as sixty feet, length a quarter of a mile, and width fifty yards.

Subsurface Geology

The subsurface formations are Cretaceous and older. These and the Triassic rocks outcrop in the vicinity of Red Point in the west-central part of the county in the vicinity of Range. Of pre-Permian formations little is known. It is reasonable to suppose, however, that the same formations which underly Beaver County to the east also underlie Texas County at shallower depths. The regional dip of rocks is a gentle monocline to the southeast. Very little diagnostic criteria relating to the structure of the pre-Cretaceous rocks is available as they are overlain unconformably by Tertiary and Quaternary sands and gravels. A considerable number of wells have been drilled in the county in recent years and the following logs reveal the general character of subsurface horizons to a depth of about 3,000 feet. The use of the core drill and geophysical instruments will reveal more. Core drill holes should be drilled to exceed 300 feet since the Tertiary deposits are almost that thick.

5. Gould, Chas. N. and Lonsdale, John T., Geology of Texas County: Oklahoma Geol. Survey Bull. 37, pp. 30, 33, 1926.

The following well logs show the general character of the subsurface formations in the southern and west central portions of the county.

Log of Texhoma well sec. 4, T. 1 N., R. 1 E., C. M.

(Elevation, 3,500 feet?)

Formation	Top	Bottom	Formation	Top	Bottom
Sandy soil	0	15	Red shale	1425	1450
Sand and gravel	15	174	Red sand	1450	1467
Hard sand	174	200	Red shale	1467	1500
Red rock	200	315	White lime	1500	1525
Sandy shale	315	355	Sandy lime	1525	1575
Red shale	355	400	Salt rock	1575	1650
Lime shale	400	420	Gyp rock	1650	1655
Flint rock	420	425	Black lime	1655	1670
White lime	425	433	Red shale	1670	1700
Red brake	433	480	Red sand	1700	1740
Red sand	480	510	Red shale	1740	1750
Red shale	510	600	Broken sand	1750	1800
Sandy shale	600	640	Lime shale	1800	1825
Red shale	640	700	Red mud or shale	1825	1860
Red water sand	700	760	Broken sandy	1860	1880
Red shale	760	775	Sandy hard lime	1880	1910
Gyp rock	775	800	Red shale	1910	1950
Red brake	800	825	Red shale	1950	2125
Hard lime	825	860	Red cave	2125	2160
Red shale	860	875	Sandy shale	2160	2180
Salt rock	875	900	Hard lime	2180	2190
Red shale	900	910	Blue shale	2190	2200
Red sand	910	930	Sandy shale	2200	2210
Salt rock	930	985	Red shale	2210	2220
Red shale	985	1000	Hard lime	2220	2240
Soft sand	1000	1025	Red cave	2240	2250
Hard red sand	1025	1100	Lime hard	2250	2260
Soft red sand	1100	1220	Shale red	2260	2270
Red shale	1220	1280	Lime hard	2270	2275
Red sand	1280	1300	Blue shale	2275	2280
Red shale	1300	1400	Lime white hard	2280	2290
Red sand	1400	1425	Blue shale	2290	2300

(Continued on page 20)

Formation	Top	Bottom
Lime dark	2300	2310
Blue shale	2310	2340
Lime and shale	2340	2400
Blue shale	2400	2450
Lime hard	2450	2475
Blue shale	2475	2500
Black lime hard	2500	2520
Blue shale	2520	2545
Lime shale	2545	2555
Red shale	2555	2560
Lime white	2560	2570
Red shale	2570	2580
Lime white hard	2580	2590
Blue shale	2590	2620
Lime broken	2620	2630
Blue shale	2630	2670
Lime black	2670	2695
Gas sand	2695	2707
Lime	2707	2720
Blue shale broken	2720	2735
Red shale	2735	2740
Lime hard	2740	2750
Water sand	2750	2760
Lime hard	2760	2775
Shale red	2775	2780
Shale blue	2780	2800
Lime shale	2800	2825
Soft sand no water	2825	2850
Blue shale	2850	2875
Black and white lime	2875	2900
Red shale	2900	2925
Lime white	2925	2950
Red and blue shale	2950	2980
Lime white	2980	2990
Red shale	2990	3020
Red cave—Total depth	3020	3040

Log of Zea no. 1, sec. 28, T. 3 N., R. 13 E., C. M., Near Redpoint

(Elevation, 3,167 feet)

Formation	Top	Bottom
Surface soil	0	20
Sand and clay	20	50
Sandy clay	50	150
Sand and clay	150	170
Clay	170	200
Sand rock	200	218
Sand and red clay	218	375
Hard sand	375	425
Lime	425	430
Broken lime	430	445
Lime	445	470
Red shale	470	575
Broken lime	575	580
Red shale and clay	580	655
Shale and clay	655	765
Broken sand and lime	765	775
Red bed	775	800
Red shale	800	825
Gyp	825	835
Gyp rock	835	855
Gyp and red shale	855	890
Gyp and shale	890	945
Broken gyp rock	945	955
Sand rock	955	973
Gyp rock	973	975
Gyp	975	976
Red shale	976	1150
Sandy shale	1150	1260
Red shale	1260	1425
Red shale and sand	1425	1498
Gyp rock	1498	1500
Red rock	1500	1505
Shale	1505	1555
Gyp	1555	1585
Lime	1585	1600
Broken lime	1600	1608
Gyp and shale	1608	1634
Broken sand and shale	1634	1654
Shale	1654	1708
Salt	1708	1710
Broken sand and gyp	1710	1728
Lime shell	1728	1732
Broken sand, gyp	1732	1783
Shale	1783	1796
Gyp broken	1796	1798
Broken gyp and shale	1798	1888
Broken sand and shale	1888	1935
Sandy lime, shale	1935	1937
Broken sand, shale	1937	1950
Shale	1950	1995
Shale, gyp, sand	1995	2025
Broken lime	2025	2035
Gyp rock	2035	2045
Broken gyp shale	2045	2055
Broken sand and shale	2055	2075
Shale, sand and gyp	2075	2105
Gyp	2105	2110
Gyp and shale	2110	2125
Gyp and shale	2125	2133
Gyp	2133	2135
Gyp	2135	2143
Gyp and shale, broken	2143	2155
Shale	2155	2184
Gyp shell	2184	2185
Red shale	2185	2190
Broken gyp and shale	2190	2201
Gyp rock—Total depth	2201	2204

STRUCTURE

Very little is known as yet concerning the structure of this county except through inference. The rocks on the surface are largely unconsolidated and do not contain well defined mappable horizons. The Tertiary and Quaternary deposits cover all of the county excepting Range and Red Point like a huge blanket. The nature of the structure at Texhoma is problematic.

Figure 2 shows the general relationships of Texas County to the Anadarko Basin. Contours are drawn by Clifton on the base of the red beds. In the Red Point area there are local variations in dip. At Texhoma a monocline(?) represents the structural relationships.

DEVELOPMENT

Either petroleum or gas has been found in paying quantities in the Panhandle region of Texas to the south, in the vicinity of Liberal, Kansas, to the north and at Texhoma and Red Point in this county. Consequently, Texas County may be regarded as potential oil and gas territory.

The well at Taxhoma was begun by the Home Development Company of Texhoma, November 15, 1922 and completed at a depth of 3,040 feet on December 3, 1923. It is located in the NW.¼ SW.¼ sec. 4, T. 1 N., R. 11 E., C. M. It has been furnishing Texhoma with gas for a number of years. Another well drilled by the same company just one location to the east and drilled to approximately the same depth had produced gas but was not being used when the writer visited the well in the summer of 1929. Exact data regarding the initial production of this well was not available but various estimates range from 5 to 30 million cubic feet. The production comes from the "Big Lime" of the Texas Panhandle which is of Wichita-Albany age (?). The thickness of the producing horizon is 15 feet. It will be observed from examination of the log that the Tertiary rocks were passed through at a depth of 200 feet and the Permian(?) red beds at 2,275 feet with the well ending in the Pennsylvanian.

The well drilled by the H. F. Wilcox Oil and Gas Company in sec. 8, T. 3 N., R. 13 E., C. M. is known as the Zea No. 1. It was begun on September 27, 1925 and completed at 2,204 feet in gypsum which apparently is still in the Permian section. Gas was reported at 2610 feet (3 M. cu. feet) and at 2,680 feet (½ M. cu. ft.) The upper producing horizon (Cottonwood ?) is 50 feet in thickness and the lower is 20 feet thick.

The discovery of gas at Texhoma and at Red Point gave impetus to the lease and royalty business and to drilling activities. Most major oil companies obtained blocks of leases and some have drilled. About fourteen wells have been located or drilled. Texas County has received more play than all the rest of the Oklahoma Panhandle.

Wells drilled in Texas County

COMPANY	LOCATION	DEPTH Feet	RESULTS
Wilcox Oil and Gas Co., E. W. Zea No. 1	SW SE 28, 3N-13E, CM.	4,025	2,685 gas show
Wilcox Oil and Gas Co., Geo S. Honey No. 1	SE SE 21, 4N-14E, CM.	4,400	2,680 gas show
M. M. Valeruis No. 1	NW SW 18, 3N-12E, CM.	4,000	
Dilard Easterwood M. M. Valerius No. 2	SE 32, 5N-12E, CM.	4,001	Gas at 2,690 Gas at 3,339 Gas at 3,940 1,000,000 cu. ft.
(Frantz) Reiter-Foster Hurliman No. 1	NW SW 9, 3N-15E, CM.	3,500	7,000,000 cu. ft. gas, 2,635
Allison-Garber-Pulse Allison No. 1	NW SW 4, 1N-12E, CM.	3,040	15,000,000 cu. ft. gas
(Kugle-Hargrove) Reiter-Foster	Cen. NE 10, 2N-11E, CM.	3,500	Abandoned
H. & H. Oil Co.	NW NW 25, N- E, CM.	Drilling at 200 Ft.	
N. Panhandle Oil Co.	SW 24, 2N-18E, CM.	Drilling at 300 Ft.	
Three Way Oil Co.	NW 11, 1N-18E, CM.	Drilling at 2,200 ft.	
North Panhandle Oil Co.	NW 5, 1N-19E, CM.	Spudded in	
Huddilleson Gas Co.	SE 15, 2N-11E, CM.	3,503	
Texas Co., Gas Co. No. 1 Boone	NE NE 17, 3N-15E, CM.		
Skaer, Hitch No. 1	NW cor. 25, 1N-15E, CM.	250	Shut down
Argus Prod. Co. No. 1 Ralston	C SW 23, 6N-14E	Rig on ground	

Plate II shows the general east-west subsurface relationships based on well logs. Most wells drilled have been too shallow for thorough tests.

The following list includes all wells drilled or located in this county to May, 1930.

CIMARRON COUNTY

Location

Cimarron County is the extreme western of the Oklahoma Panhandle counties. It is rectangular in shape and includes all of 45 townships and two-thirds of 9 others making a total area of 1,836 square miles. It embraces Tps. 1 to 5 N., inclusive and four miles of T. 6 N., from the base line 36° 30′ N. Latitude and from Rs. 1 to 9 E., C. M., inclusive. It is bounded on the west by the New Mexico-Oklahoma line, 103° W. Longitude; on the north by the Kansas-Oklahoma line; on the east by Texas County and on the south by the Texas-Oklahoma line.

The southern or "dry" Santa Fe Trail from Dodge City, Kansas to New Mexico crosses this county from northeast to southwest and can still be traced across the prairies. (See the geologic map of this county for location.) A branch line of the Santa Fe from Elkhart, Kansas has been built southwest through the county to Felt in sec. 12 T. 1 N., R 2 E., C. M. and connects it with Keyes and Boise City which is the county seat.

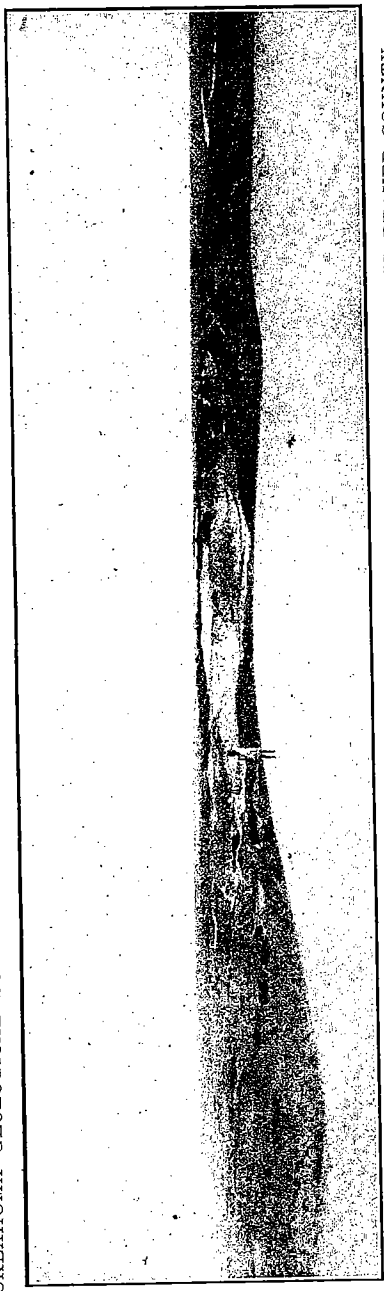
The population of Cimarron County is approximately 5,000 which is slightly more than four persons per square mile. Boise City has the largest population with Felt and Kenton next in size. There are numerous stores and trading posts throughout the county.

Topography

Cimarron County lies within the High Plains physiographic province and, with the exception of the area around Kenton and east along the Cimarron River, it is a gently sloping plain. The area around Kenton, Black Mesa, and Cimarron River Valley presents a beautiful, mature topography. It is replete with historical romance dating from the days of the Basket Makers through the Spanish occupation and the days of the cattle men to the present.

The northwestern part of the county is drained by the Cimarron River and its tributaries the Cold Spring arroyo, South Carrizzo, Tesesquite, West Carrizzo and Gillenas creeks. The eastern part of the county is drained by Goff Creek and North Fork of Beaver. The southern part is drained by North Canadian River and its tributaries Agua Frio, Cieneguilla, and Curumpa creeks. Throughout the central and southern portions many saucer shaped depressions occur similar to

OKLAHOMA GEOLOGICAL SURVEY BULLETIN 40-WW, PLATE III



A. DUNE TOPOGRAPHY ON THE NORTH SIDE OF BEAVER CREEK, SOUTH OF NEW FLORIS, BEAVER COUNTY.

B. THE HIGH PLAINS NORTHWEST OF TEXAS COUNTY, ROAD CROSSES ONE OF THE BROAD SAUCER-LIKE UNDRAINED DEPRESSIONS CHARACTERISTIC OF THE PLAINS.

those in Texas County except that they are larger and deeper. Some are two or three miles in diameter and approximately 175 feet deep and many are occupied by intermittent lakes. These depressions are characteristic of the High Plains topography and their origin is as yet problematical.

GEOLOGY

Surface formations

The generalized columanar section on page 14 indicates the formations which occur at the surface of this county. (Those above the Paleozoic only).

TRIASSIC RED BEDS

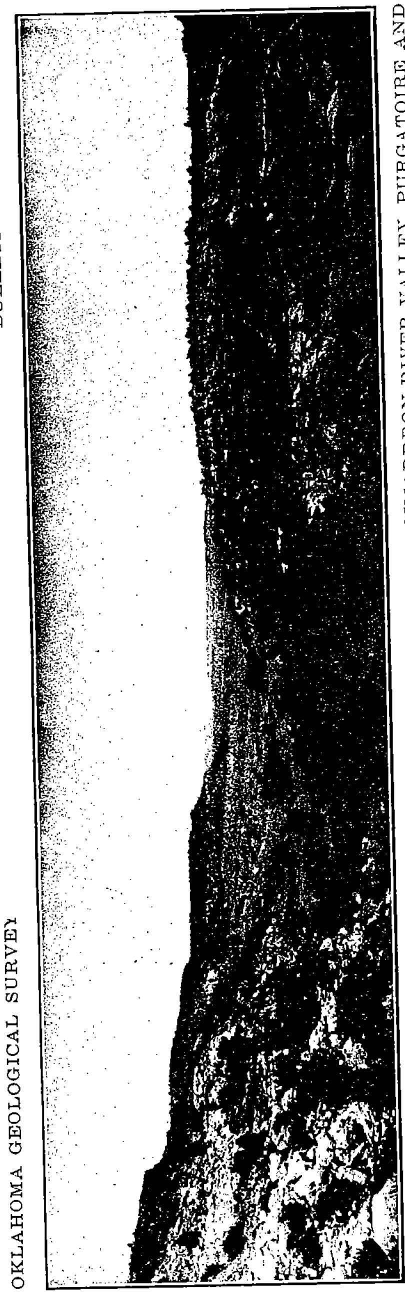
The Triassic red beds are the oldest surface rocks in the county. These outcrop along the Cimarron River in Tps. 5 and 6 N., R. 6 E., C. M. in the valley of the Cimarron River. An excellent exposure is found in secs. 4, 9, and 16, T. 5 N., R 6 E., C. M., on the Burnette Ranch. This exposure is due to the dissection of a small, elliptical fold by one of the tributaries of the Cimarron. Other outcrops of this same formation are found in the valleys of the tributaries of the Cimarron near by. In thickness these red beds are approximately 20 feet in the surface of the exposures. The total thickness in this locality is perhaps as much as 2,000 feet (Rothrock.) A well drilled four miles north of Liberal, Kansas in the SE. cor. sec. 20, T. 33 S., R. 33 E., which is sixty miles east of Cimarron County reports 1,640 feet of red beds. A well drilled fifty miles to the south, near Channing, Texas, shows at least 2,500 feet of red beds. In the Rocky mountains 180 miles to the west, Lee has measured 14,000 feet of red Beds. He suggests, however, that this great thickness may be due to duplication by faulting. If these three localities represent the same stratigraphic horizon as the red beds of Cimarron County, a rapid thickening can be expected to the westward. A well drilled in T. 4 N., R. 1 E., C. M., Cimarron County, logs the red beds 1,670 feet thick.

The character of these Cimarron County red beds is indicated by the following section which was masured by Rothrock.[6]

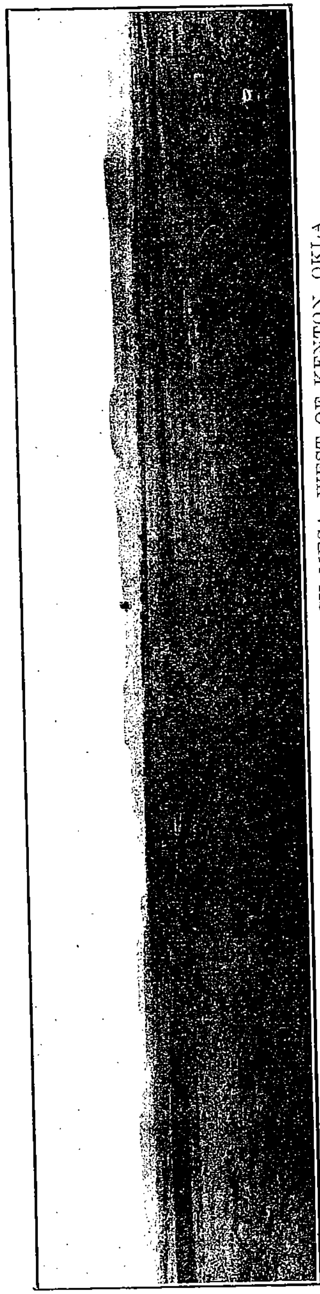
Section of red beds, cen, sec. 9, T. 5 N., R. 6 E., C. M.

	Ft.	in.
Sandstone, buff, in beds 1 foot thick. Much tiny crossbedding	5	6
Soil, brick red, on slope between benches, typical red bed sandstone exposed at this horizon 200 feet to the west	8	6
Sandstone, buff to red, makes a ledge	5	6
Soil, red, indicating red sandstone	19	6

6. Rothrock, E. P., Geology of Cimarron County: Oklahoma Geol Survey Bull. 34, pp. 29, 30, 1925.



A. DAKOTA SANDSTONE TOPOGRAPHY EAST OF KENTON IN THE CIMARRON RIVER VALLEY. PURGATOIRE AND MORRISON FORMATIONS UNDERLIE THE SCARP-FORMING DAKOTA SANDSTONE



B. CIMARRON RIVER VALLEY AND BLACK MESA, WEST OF KENTON, OKLA.

The surface character of this formation is indicated in the following well log.

Well drilled by the Empire Gas and Fuel Co., sec. 22, T. 5 N., R. 5 E., Cimarron County, Oklahoma.

Drilling commenced April 27, 1917. Date of completion not given.

Formation	Thickness	Depth	Formation	Thickness	Depth
Soft red shale	130	130	Red clay	20	1058
Gray sand	40	170	Red clay and gyp	42	1100
Gray lime	15	185	Gypsum	30	1130
Soft red sand	20	205	Sand and gyp	20	1150
Soft red shale	60	265	Gypsum	20	1170
Hard lime	15	280	Clay, gravel and gyp	20	1190
Soft sandy lime	22	302	Clay, gravel and gyp	40	1230
Soft red sand	217	519	Fine sand and shale	45	1275
Soft red rock	23	542	Sand and shale	30	1305
Water sand	10	552	Sand shale and gyp	30	1335
Red rock	15	567	Sand	9	1344
Red clay	20	587	Fine sand	15	1359
Red rock	98	685	Sand	15	1374
Lime	37	722	Fine sand	26	1400
Red rock	92	914	Sand and clay	15	1415
Shale	3	917	Sand	10	1425
Lime	3	920	Clay, sand and gravel	15	1440
Red rock	63	983	Sand and gyp	20	1460
Red clay and gravel	3	986	Sand	30	1490
Red clay and gravel	5	991	Sand and clay	15	1505
Red clay	42	1033	Sand	70	1575
Red clay and gyp	5	1038	Sand and clay	8	1583

Fossils are rare or totally absent in the surface exposure of these rocks, thus making exact age difficult to determine. Seventy miles west near Folsom, New Mexico Stanton mentions red beds containing Triassic dinosaur bones. From the structural relations of this area it is is quite evident that these two outcrops are the same age. Gould believes that these outcrops are more likely Permian Cloud Chief gypsum.

COMANCHEAN

Rocks of this age found in Cimarron County consists of a series of red beds resting unconformably upon those of Triassic age. Some geologists do not differentiate between the Comanchean and the older red beds. Above these beds is a series of variegated shales which are as yet unnamed. They are below the angular conformity at the base of the Exter sandstone. They are not present everywhere below the unconformity. Good exposures are found in T. 6 N., R. 1 E., C. M. These are mapped by Rothrock as Morrison. The angular unconformity is much more angular westward in New Mexico.

EXTER SANDSTONE

This lies above the previously mentioned unconformity and can be well observed in T. 6 N., R. 1 E., C. M. Rothrock included this in the Purgatoire formation.

MORRISON

The Morrison lies conformably upon the Exter sandstone and is separated from the overlying Purgatoire by a disconformity.

CRETACEOUS

The lower part of the Cretaceous is Dakota sandstone and the upper is Benton shales and limestones. There are about ten square miles of excellent exposures of the Benton shales around the NW. cor. T. 4 N., R. 2 E., C. M. Rothrock mapped this area as Dakota and Purgatoire.

TERTIARY

Pliocene and Miocene limestones, clays, and gravels lie unconformably upon Cretaceous Dakota sandstone. Lying unconformably upon these is the basalt of Black Mesa which is a lava flow from craters at Bar Seven L Buttes or Piney Mountain. This lies ten miles east of the west end of the Mesa de Maya (Black Msea) of which it forms the cap rock.

QUATERNARY

The Quaternary is represented by alluvium along the major drainage lines, gravels on the highlands in the southern part of the county along Beaver Creek, and some eolian deposits. Rothrock[7] gives a more complete description of these formations in his report on Cimarron County.

Subsurface Geology

The subsurface rocks of this area are Pennsylvanian (?) to Recent in age. The following three logs of deep wells drilled in the County describe the character of these rocks.

Log of Ramsey State School Land No. 1-D well in cen. N.½ N.½ S.½ SE.¼ sec. 34, T. 4 N., R. 1 E., C. M.

Formation	Top	Bottom
Top soil	0	1
White sand stone	1	12
Blue shale	12	17
Sand stone—yellow	17	40
Sand rock	40	100
Blue shale	100	120
White sand soft	120	175
Water sand white	175	205
Shale	205	215
Red rock	215	280
Lime	280	285
Sandy lime	285	290
Sand rock	290	340
Red rock	340	350

(Continued on page 29)

Formation	Top	Bottom
Sand rock red	350	380
White slate	380	397
Hard sand rock	397	400
Sand rock—red	400	420
Red rock hard	420	423
Sand rock	423	470
White mud	470	480
White sandy shale	480	545
Hard sand rock	545	550
Sand stone hard	550	553
Blue slate	553	568
Blue mud	568	640
Sandy shale	640	665
Gray sandy shale	665	675
Red rock	675	693
Red sandy lime	693	698
Red rock	698	739
Sand red rock	739	747
Lime	747	752
Red sand rock	752	754
Lime	754	756
Red rock	756	775
Sand water	775	788
Red sand	788	794
Red rock	794	808
Red sand rock	808	855
Sandy lime	855	862
Lime—some sand	862	870
Red rock	870	923
Sandy lime	923	935
Red rock	935	1008
Sand lime	1008	1025
Red bed	1025	1045
Red mud	1045	1075
Red rock—muddy	1075	1150
Sandy red rock	1150	1275
Lime hard	1275	1283
Red mud	1283	1290
Lime	1290	1333
Red rock	1333	1415
Lime	1415	1425
Red rock	1425	1440
Red sand rock	1440	1520
Sandy rock hard	1520	1535
Red rock	1535	1585
Hard sand rock	1585	1615
Hard lime	1615	1645
Rock salt	1645	1720
Hard white sand	1720	1740
White sandy lime	1740	1750
Rock salt	1750	1815
Lime hard & sandy	1815	1852
Red rock	1852	1880
Sandy lime hard	1880	1896
Hard lime	1896	1916
Fine brown sand	1916	1946
Sandy lime	1946	1965
Brown sand	1965	2015
Red rock	2015	2021
Sandy red rock	2021	2136
Sandy red rock	2136	2187
Quick sand red	2187	2201
Sand	2201	2225
Sand red rock	2225	2240
Sand	2240	2245
Red rock	2245	2253
Hard sand	2253	2268
Red shale	2268	2272
Sand	2272	2295
Sandy red rock	2295	2320
Hard red sand	2320	2327
Hard sand	2327	2341
Sand	2341	2350
Red rock	2350	2360
Sand	2360	2366
Red sand	2366	2374
Red rock	2374	2380
Hard sand	2380	2410
Hard lime	2410	2420
Hard sand	2420	2488
Red mud	2488	2493
Lime	2493	2500
Red rock	2500	2508
Hard lime	2508	2520
Hard red sand	2520	2584
Hard sand	2584	2608
Soft red sand	2608	2616
Red sand	2616	2652
Red rock	2652	2664
Red sand	2664	2707
Red sand rock hard	2707	2745
Sand hard	2745	2765
Red rock	2765	2780
Sand	2780	2785
Red rock	2785	2808
Hard sand	2808	2820
Sand	2820	2840
Red rock	2840	2870
Sand	2870	2890
Red rock	2890	2898
Red rock	2898	2904
Hard sand	2904	2912
Red rock	2912	2940
Sandy red rock	2940	3000
Red rock	3000	3010
Sand	3010	3020
Red sand	3020	3038
Hard rock	3038	3050
Red rock	3050	3068
Sandy red rock	3068	3095
Red clay cave	3095	3110
Red rock & lime	3110	3130
Red sandy lime	3130	3135
Red rock cave	3135	3180

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Formation	Top	Bottom
Sandy lime	1887	1915
Sandy r. r. & shale	1917	2009
Sand	2009	2014
Sandy red rock	2014	2114
Red rock & shale	2114	2144
Sandy red rock	2144	2159
Shale	2159	2171
Sandy r. rock	2171	2406
Sand	2406	2424
Red rock	2424	2456
Sand	2456	2462
Red rock	2462	2498
Shale	2498	2502
Red rock & sand	2502	2673
Shale	2673	2683
Sandy red rock	2683	2783
Shale	2783	2818
Shale & red rock	2818	2859
Sand	2859	2866
Shale	2866	2900
Broken lime	2900	2912
Broken lime & sand	2912	2973
Broken lime & shale	2973	2993
Shale	2993	3001
Red rock	3001	3025
Red sand	3025	3035
Blue shale	3035	3080
Black shale	3080	3085
Blue shale	3085	3100
Black shale	3100	3108
Sand	3108	3128
Brown shale	3128	3140
Sand	3140	3182
Red rock	3182	3200
Sandy red rock	3200	3220
Sand	3200	3230
Sandy lime	3230	3242
Red rock	3242	3275
Lime	3275	3280
Red rock	3280	3300
Sand	3300	3310
Brown shale	3310	3335
Black shale	3335	3355
Lime	3355	3365
Blue shale	3365	3390
Brown shale	3390	3405
Lime	3405	3425
Brown shale	3425	3435
Red rock	3435	3450
Lime	3450	3475
Blue shale	3475	3485
Red rock	3485	3510
Sand	3510	3520
Brown shale	3520	3530
Red rock	3530	3565
Brown shale	3565	3580
Brown lime	3580	3600
Brown shale	3600	3610
Red rock	3610	3625
Red rock	3625	3640
Brown shale	3640	3645
Hard lime	3645	3650
Hard sand	3650	3660
Broken lime & sand	3660	3665
Sand	3665	3705
Red rock	3705	3730
Sand	3730	3755
Red rock	3755	3770
Sandy lime	3770	3785
Hard lime	3785	3800
Sandy red rock	3800	3820
Red sand	3820	3840
Red rock	3840	3890
Sand	3890	3905
Pink shale	3905	3935
Blue shale	3935	3950
Shale & shell	3950	3970
Brown lime	3970	4005
Sand	4005	4050
Red shale	4050	4060
Broken sand & lime	4060	4085
Brown shale	4085	4095
Bkn. shale & lime	4095	4150
Sand	4150	4165
Shale	4165	4200
Shale	4200	4210
Black shale	4210	4235
Bkn. shale & lime	4235	4295
Lime	4295	4305
Sticky shale	4305	4340
Shale & lime	4340	4390
Shale & sand	4390	4400
Shale & lime	4400	4435
Sticky shale	4435	4450
Shale & lime	4450	4470
Red shale	4470	4500
Red shale	4500	4530
Blue shale & lime shells	4530	4550
Blue lime	4550	4565
Gray sand	4565	4570
Slate & lime	4570	4580
Sand	4580	4590
Lime	4590	4615
Lime	4615	4625
Shale	4625	4640
Sand	4640	4660
Gray sand	4660	4665
Sandy lime	4665	4690
Hard sand	4690	4705
Blue slate	4705	4735
Sand lime	4735	4740
Black slate	4740	4765

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Formation	Top	Bottom
Red sand	3180	3206
Sand	3206	3223
Red sand	3223	3247
Sandy red rock	3247	3250
Slate blue & gray	3250	3255
Lime	3255	3264
Red rock	3264	3297
Sandy red rock	3297	3312
Sand—HFW	3312	3371
Sand red	3371	3378
Slate blue	3378	3383
Sandy lime	3383	3393
Blue slate	3393	3399
Red rock	3399	3423
Lime	3423	3433
Red rock cave	3433	3496
Lime shell	3496	3500
Red rock & shells	3500	3550
Lime	3550	3573
Sandy lime	3573	3608
Sand	3608	3635
Sandy gray	3635	3642
Sand—hole full water	3642	3665
Blue shale	3665	3670
Sandy lime	3670	3725
Red rock	3725	3732
Sand	3732	3767
Sand	3767	3800
Red sandy shale	3800	3818
Red rock	3818	3855
Lime shell	3855	3858
Gray lime	3858	3865
Red rock	3865	3870
Lime	3870	3880
Sandy lime	3880	3915
Blue shale	3915	3923
Sandy lime	3923	3960
Blue shale	3960	3985
Sandy lime	3985	4010
Sandy lime	4010	4050
Sand	4050	4056
Sandy lime	4056	4090
Water sand	4090	4100
Sandy lime	4100	4190
Sand	4190	4205
Sandy shale	4205	4220
Sandy lime	4220	4235
Sandy brown shale	4235	4250
Sandy lime	4250	4289
Brown shale	4289	4295
Sand	4295	4306
Total depth		4306

Log of Sinclair Oil & Gas Co. School Land No. 48 well in NE.¼ NE.¼ NE.¼ sec. 22, T. 5 N., R. 2 E., C. M.

Formation	Top	Bottom
Lime	0	6
Br. shale	6	20
Shale & lime	20	31
Hard lime	31	41
Sandy shale	41	56
Hard lime	56	64
Red rock	64	71
Sand	71	86
Lime and shell	86	120
Lime and red rock	120	150
Lime and shale	150	342
Red rock	342	432
Lime and shell	432	450
Red rock	450	480
Lime and shell	480	535
Sandy red rock	535	698
Broken shell	698	713
Red shale	713	773
Shell	773	796
Red shale	796	800
Lime	800	806
Red shale	806	816
Broken shell	816	832
Red shale	832	886
Red sh. & shell	886	956
Red rock & shale	956	1118
Br. sand & slate	1118	1157
Red shale	1157	1242
Lime	1242	1246
Red shale	1246	1282
Lime	1282	1290
Broken lime	1290	1340
Shell and lime	1340	1365
Broken shell & L. S.	1365	1385
Broken lime	1385	1440
Sandy red rock	1440	1475
Sandy r. r. sh. & gyp	1475	1527
Gyp & red rock	1527	1540
Red shale	1540	1548
Hard sand & r. r.	1548	1565
Red rock & shale	1565	1587
Shale & lime	1587	1604
Shale & lime	1604	1614
Red r. & shale	1614	1708
Shale	1708	1728
Red r. & shale	1728	1829
Sandy red rock	1829	1853
Broken lime	1853	1885
Shale	1885	1887

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Formation	Top	Bottom
Blue slate	4765	4780
Slate sandy	4780	4800
Blue shale	4800	4860
Sandy shale	4860	4870
Sand-water	4870	4872
Total depth		4872

Log of J. R. Phillips No. 1 well in SE.¼ SE.¼ NE.¼ sec. 24, T. 6 N., R. 2 E., C. M.

Formation	Top	Bottom
Sand	0	25
Red rock	25	35
Sand	35	45
Red rock	45	55
Sand	55	80
Shale	80	100
Gyp	100	105
Shale	105	120
Gyp	120	125
Shale	125	175
Gyp	175	190
Shale	190	220
Shale	220	265
Gyp	265	275
Sand	275	340
Gyp	340	360
Sand	360	700
Red rock	700	875
Sand	875	885
Gyp	885	930
Red rock	930	1000
Gyp	1000	1025
Sand	1025	1085
Red rock	1085	1110
Sand	1110	1140
Red rock	1140	1180
Sand	1180	1225
Salt	1225	1235
Red rock	1235	1245
Gyp	1245	1275
Salt	1275	1300
Gyp	1300	1330
Salt	1330	1380
Gyp	1380	1430
Red rock	1430	1465
Sand	1465	1675
Gyp	1675	1685
Red rock	1685	1700
Gyp	1700	1705
Red rock	1705	1715
Sand	1715	1730
Sandy shale	1730	1760
Red rock	1760	1785
Gyp	1785	1790
Red rock	1790	1805
Gyp	1805	1815
Red rock	1815	1860
Gyp	1860	1885
Red rock	1885	1955
Sand	1955	1990
Red rock	1900	2150
Sand	2150	2200
Red rock	2200	2240
Sand	2240	2255
Red rock	2255	2290
Sand	2290	2335
Gyp	2335	2350
Sand	2350	2385
Red rock	2385	2395
Sand	2395	2410
Red rock	2410	2455
Sand	2455	2588
Sand	2588	2596
Sand	2596	2610
Sandy shale	2610	2625
Sand	2625	2670
Shale	2670	2710
Sandy shale	2710	2770
Sand	2770	2800
Shale	2800	2890
Sand	2890	2920
Sand shale	2920	2984
Lime	2984	2988
Sand	2988	3000
Broken shale	3000	3160
Sand	3160	3170
Shale	3170	3235
Lime	3235	3238
Shale	3238	3290
Sand	3290	3315
Sand shale	3315	3350
Sand lime	3350	3355
Sandy shale	3355	3400
Sandy lime	3400	3415
Shale	3415	3445
Shale	3445	3462
Lime	3462	3487
Sandy shale	3487	3497
Sandy lime	3497	3515
Shale	3515	3590
Shale	3590	3630
Sandy shale	3630	3670
Sand	3670	3675
Lime	3675	3688
Shale	3688	3734
Sandy lime	3734	3745

(Continued on page 33)

Formation	Top	Bottom
Shale	3745	3760
Lime	3760	3800
Shale	3800	3825
Sandy lime	3825	3850
Shale	3850	4005
Sandy shale	4005	4017
Sandy lime	4017	4025
Shale	4025	4045
Broken lime	4045	4105
Shale	4105	4115
Lime	4115	4125
Shale	4125	4130
Lime	4130	4145
Lime	4145	4160
Broken lime	4160	4170
Shale	4170	4187
Lime	4187	4215
Shale	4215	4246
Sandy lime	4246	4268
Broken lime	4268	4315
Conglomerate	4315	4370
Total depth		4370

STRUCTURE

Structural relationships in the eastern and southern parts of the county are not very well known due to overlying alluvial and gravel deposits. Mappable horizons are abundant in the northwestern part of the county. Here can be observed a series of folds whose axes parallel the axial trend of the Rocky Mountain flexures farther west in New Mexico. Numerous small anticlinal folds have been mapped in this county and some have been drilled. In no case thus far have wells proved commercially productive of either oil or gas.

DEVELOPMENT

To date (May 30, 1930) eight wells have been drilled in Cimarron County without production. Further exploration may prove productive.

The table on page 34 gives a list of wells drilled in this county.

SUMMARY

The foregoing report covers that portion of Oklahoma commonly known as the "Panhandle." It is subdivided into Beaver, Texas and Cimarron counties and embraces some 5,790 square miles of territory.

The surface rocks are Permian, Triassic, Comanchean, Cretaceous, Tertiary and Quaternary in age. Of the subsurface formations little is known because the greater part of the surface is covered by Tertiary sands and gravels. Some data are available from well logs indicating rocks as old as Pennsylvanian.

Structurally the region is a part of the monocline forming the Great Plains and the northern flank of the Anadarko Basin whose axis lies to the south in the Texas Panhandle. The outcrops in the northwestern part of the area along the Cimarron River are easily mapped. Those in other areas are difficult because of the unconsolidated nature of the overlying sediments. Axial trend of the folds is nearly parallel to the southern Rocky Mountain orogenic axes.

CAPULIN, A RECENT VOLCANIC CONE IN NORTHEASTERN NEW MEXICO; A POSSIBLE SOURCE FOR VOLCANIC ASH DEPOSITS OF THE PANHANDLE AND ADJACENT REGIONS.

Wells drilled in Cimarron County

COMPANY	LOCATION	DEPTH Feet	RESULTS
Sinclair Oil and Gas Co.	NW SE NE 22, 5N-2E, CM.	3,745	Dry
J. R. Phillips	NE 24, 6N-2E, CM.	3,900	Dry
Ramsey Bros., A1	NE 27, 5N-5E, CM.	4,512	Oil Show
Ramsey Bros., C1	SE SE 4, 5N-6E, CM.	3,957	Dry
Ramsey Bros., D1	NW SE 34, 4N-1E, CM.	320	
Gladys Belle	Cen. 25, 3N-7E, CM.	4,095	Dry
Smith-Krull	NE 2, 2N-9E, CM.	(?)	Rig down, lease lapsed.
Magnolia Pet. Co., School Land No. 1.	Cen. SE NE 22, 5N-5E. CM.	4,356	Abandoned
Magnolia Pet. Co., School Land No. 1.	Cen. SW NE 27, 5N-5E, CM.	100	Drilling

Thus far three tests for oil and gas have been located in Beaver County, fifteen in Texas County, and eight in Cimarron County. Texas County has the majority because gas was discovered in the Texhoma and Red Point districts, giving impetus to the leasing and royalty business in 1925-26.

Much detailed field work will be necessary to determine the exact stratigraphic relationships in this area. Geophysical and core drilling work in addition to ordinary methods should be used.

A number of corrections in the areal geology as shown on the State geological map have been made in the map accompanying this report. Much data of a confidential nature concerning this region is in the files of major oil companies but is not available for publication