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GEOLOGY OF TEXAS COUNTY OKLAHOMA

By
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With Chapters on
AGRICULTURE
By
PROF. H. H. FINNELL
And
HISTORY
By
PROF. M. L. WARDELL

NORMAN
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GEOLOGY OF TEXAS COUNTY

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FOREWORD

PURPOSE OF REPORT

During the second special session of the Ninth Legislature of the State of Oklahoma, 1924, legislation was enacted providing for an "agricultural soil survey of Beaver and Texas counties (State Lands)." Under the provisions of the legislation the Geological Survey was charged with its accomplishment. This report contains the results of the work done in carrying out the provisions of the above legislation in so far as Texas County is concerned.

An attempt is made as far as practicable to discuss the conditions affecting the agriculture and soils of the county. In as much as the fundamental factors of agriculture and soils are geographic, physiographic and geologic, these conditions are considered here. Accordingly the report contains chapters on the Geography, Physiography, Stratigraphy, Water Resources, Mineral Resources, and History of the county in addition to the section on Agriculture proper.

METHOD AND TIME OF WORK

Because of the fact that the time for doing the work was too short and the amount of money appropriated for this work ($250.00) was totally inadequate to prepare a complete report the field work done in connection with this report was of the reconnaissance type rather than detailed. Field work was done during the months of November and December, 1924, and April and June, 1925. During these periods of field work the rock formations were mapped, general conditions investigated and data collected for the compilation of this report. The draft of the manuscript of the first five chapters was prepared by the junior author of this report.

Arrangements were made with the Dean, C. T. Dowell, of the School of Agriculture of the Oklahoma Agricultural and Mechanical College, by which Prof. H. H. Finnell, assistant agronomist of the Panhandle Agricultural College at Goodwell, was enabled to prepare the section on agriculture which appears as Chapter VI of the report. The history of the county, Chapter VII, was written by Prof. M. L. Wardell, Assistant Professor of History at the University of Oklahoma, and formerly a resident of Texas County who has specialized on the history of the Panhandle of Oklahoma.

ACKNOWLEDGEMENTS

The authors of this report wish to acknowledge their indebtedness to the people of the county for their hearty co-operation and help during the field work. Special thanks are due to Professors Wardell and Finnell who in addition to writing the chapters on History and Agriculture, (no slight task for busy men), have furnished much other valuable information and data.

PREVIOUS GEOLOGIC WORK IN THE COUNTY

The first geological work in what is now Texas County, Oklahoma, was done by the senior author of this report during the summer of 1903. At that time a party was in the field under the direction of the United States Reclamation Service, the object being to study the water conditions of this part of the Great Plains. Other members of the party were Chas. T. Kirk, Pierce Larkin, Chester A. Reeds, and Charles Long. The party outfitted at Woodward, and worked westward between the north Canadian and Cimarron rivers to the heads of these streams. Camps were made in what is now Texas County, near the mouth of Coldwater Creek near the old town of Hardesty (now abandoned), at Guymon, and near the postoffice of Redpoint. The results of this trip were published in a government report,[1] and the geologic map which accompanied this report has since served as the standard map of the region. The chief change made on the map which accompanies the present report is the addition of greater detail.

1. Gould, Chas. N., Geology and Water Resources of Oklahoma, U. S. Geol. Survey, Water-Supply Paper 148, 1905.

Chapter I

GEOGRAPHY

LOCATION OF AREA

Texas County is the central one of the three counties which constitute the so-called "Panhandle of Oklahoma," lying east of Cimarron County and west of Beaver County. Its south boundary is the Oklahoma-Texas line while its north boundary is the line separating Oklahoma and Kansas. Figure 1 is a sketch of the State showing the location of Texas County.

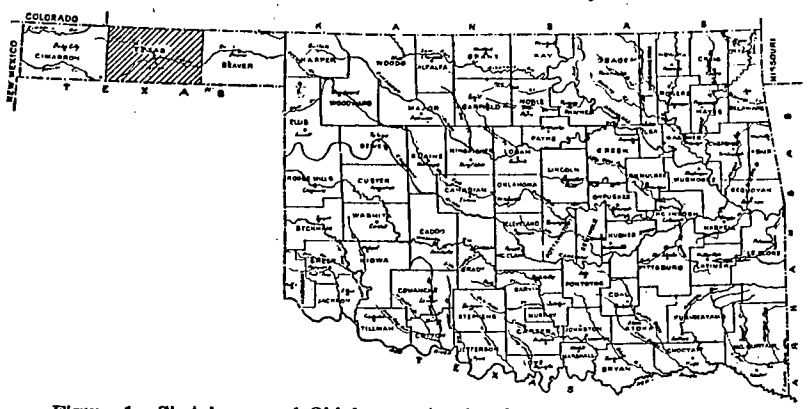


Figure 1. Sketch map of Oklahoma, showing location of Texas County.

LATITUDE AND LONGITUDE

In latitude the county lies between 36° 30′ north and 27° north, while in longitude it extends from a few miles east of 101° west to a few miles west of 102° west longitude. The public land surveys of the Panhandle of Oklahoma were made at a later date than those of the remainder of the State of Oklahoma, and were referred to a different base line. The principal ranges in the Panhandle are located east of the Cimarron Meridian which is the west line of the State being 103° west longitude, while townships are located north of the base line established on 36° 30′ north, the south line of the Panhandle. This often leads to confusion since, for example, T. 1 N., R. 1 E. in Oklahoma could be either in Cimarron County or Garvin County, if the lines of reference are not specifically stated.

WITH RESPECT TO CITIES AND POINTS

The central part of Texas County is approximately 228 miles from Hutchinson, Kansas, 72 miles from Dalhart, Texas, 479 miles from El Paso and 250 miles from Oklahoma City, Okla. The Panhandle of Texas lies immediately south of the county while the southeast corner of Colorado is only a few miles distant, northwest of the northwest corner of the county.

SIZE OF AREA

Texas County comprises 60 townships, but the northernmost tier of townships is not full-sized, being four miles wide in the west part of the county, and five miles wide in the eastern part. Accordingly the area included in Texas County is approximately 2,065 square miles. An east-west line through the center of the county would be 60 miles long, while a similar line from north to south would be 34½ miles long.

RELIEF

Unevenness of land surfaces is called relief. Texas County is a part of the general region, known as the "High Plains," which extends eastward from the Rocky Mountains and includes parts of Colorado, Kansas, New Mexico, Texas and Oklahoma. This High Plains region is characterized by comparatively low relief being usually flat and relatively level. In Texas County, the area covered by this report, the maximum relief is not more than 200 feet, the deepest valley being about this figure below the highest uplands. There are no outstanding elevations such

Plate I. Characteristic Topography of Texas County, 10 miles south of Guymon.

as prominent hills or peaks, but the valleys are often, in part at least, precipitous on their side slopes. Due to erosion certain areas at the heads of valleys contain sheer cliffs several feet in height, the rock forming the crest of slopes being more resistant than the underlying material. Plate I, taken 10 miles south of Guymon, is characteristic of extensive areas of the county.

It is not possible at this time to obtain exact altitudes of the highest and lowest points in the area for the reason that no precise level lines have been run in this county. From data furnished by the Chicago, Rock Island & Pacific Railway, altitudes of points along that railroad from northeastern to the southwestern part of the county were secured. These altitudes are: Liberal, Kansas, immediately north of area, 2,851; Tyron, Oklahoma, three miles south and seven miles west of northeast corner of county, 2,937; Hooker, 2,996; Optima, 3,031; Guymon, 3,139; Goodwell, 3,298; and Texhoma, near the Texas line, 14 miles east of west border of the county, 3,497.

From these figures it seems probable that the highest point on the western borders of the county is in the neighborhood of 3,750 feet above sea-level, and that the lowest, in the eastern part, is about 2,700 feet above sea-level, giving a slope of about 17½ feet per mile. The western portion of the county is approximately 1,000 feet above the eastern part.

DRAINAGE

MASTER STREAMS

There are no large rivers in Texas County. Little of the rainfall ever reaches the streams, but flows into basins and there evaporates. The chief stream of the county is Beaver Creek, which enters the county from the southwest in sec. 1, T. 1 N., R. 11 E., flows in a northeasterly direction to a point near the old postoffice, Redpoint, about 11 miles west of Guymon, where it turns to the eastward, holding this general course until the border of the county is passed in sec. 1, T. 2 N., R. 19 E. This stream contains water throughout the year but exhibits the great variability common to streams of semi-arid regions. During dry periods the stream may dwindle until it is represented by a succession of shallow pools connected by the merest threads of water. During periods of more abundant rainfall, the stream may fill its channel from bank to bank, covering in some instances, a distance of several hundred yards.

Therefore it is difficult to give an accurate figure for the width of this stream. As stated above, in time of flood the width is much greater than during dry periods. If the width of alluvial sand found in the valley be taken as a measure of

the maximum width it may be safely stated that in some cases the stream is several hundred yards wide. In the dryest time on the contrary, there are stretches of the stream only a few feet across with a corresponding slight depth.

TRIBUTARY STREAMS

Palo Duro, Hackberry and Coldwater creeks are the main tributaries of Beaver Creek, all entering from the south. On the north side of the stream Pony, Goff, and Teepee creeks are tributaries, and are rather less important than those mentioned above. Other smaller streams, in most cases unnamed, are also found entering the Beaver, most of which are dry the greater part of the year and flow only a few hours after rains.

The streams mentioned above are for the most part intermittent in character. During wet times they may flow with considerable volume, but during the drier parts of the year many of the channels are simply isolated pools. Palo Duro Creek is the largest of the tributaries and flows throughout the year. This stream rises in the Panhandle of Texas and enters Texas County, Oklahoma, from the southwest not far from Range postoffice.

The channels of all of the streams of the area contain accummulations of sand. In flood time the streams take on torrential aspects, developing great transporting powers. At such times a great load of sediment, mostly sand, is transported, only to be dropped when the volume of the stream diminishes. This results in a wide belt of alluvial sand in the stream valley. The deposits of sand thus formed afford large quantities of loose material which the wind is able to transport and sort. Since the prevailing winds are from the southwest, it is usual that sand dunes are formed on the north slopes of the larger streams from the alluvial sand. These will be discussed in more detail in another part of the report.

CLIMATE AND WEATHER

TEMPERATURE

Texas County enjoys climatic and weather conditions typical of the greater part of the High Plains region. During the summer months maximum temperatures of above 100° Farenheit are experienced, but because of relatively high altitude and low humidity the nights are usually cool, and the heat of the days not excessively oppressive. Hot dry winds from the south and southwest are of rather frequent occurrence in the summer, but in winter the wind varies in direction alternating between north and south causing great and sudden changes in

Monthly, Annual and Average Precipitation

GOODWELL

Year	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	.....	.....	.00	1.83	.80	.26	3.69	2.07	.55	.02	.05	.03	.....
1911	.....	T	T	.70	3.12	.09	3.65	2.59	.73	1.65	.50	1.18	15.53
1912	.....	.10	1.48	.95	1.32	2.51	3.01	1.90	3.31	2.63	T	.26	T	17.47
1913	.....	.45	.90	.10	.52	1.32	3.65	1.10	1.81	3.63	.07	2.75	2.69	18.99
1914	.....	.03	T	.15	1.23	6.89	2.54	4.70	2.32	.00	4.42	.00	.18	22.51
1915	.....	.30	1.25	.30	3.63	2.45	5.02	4.32	4.06	3.52	1.50	.10	.30	26.75
1916	.....	.35	.00	.15	2.20	.20	3.53	.33	2.14	1.95	.12	.16	.53	11.66
1917	.....	.50	.25	.20	.38	2.75	1.03	2.36	5.39	2.48	.20	.52	.00	16.56
1918	.....	.47	.17	1.32	1.81	3.46	.72	1.41	3.75	1.75	1.73	.74	2.80	20.13
1919	.....	.10	1.39	2.60	2.15	2.59	.00	.48		2.76	1.19	.93	.73	.....
1920	.....	.40	.10	.43	.58	2.47	2.90	.71	1.22	3.50	1.15	.73	.60	14.79
Mean	.....	.27	.73	.56	1.49	2.60	2.07	2.24	2.65	2.10	1.10	.61	.82	17.24

GUYMON

Year	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909	.....	.....	.....	.....	.....	6.53	1.02	1.13	1.53	4.13	4.14	1.60	
1910	.....	.30	.70	.00	1.26	2.00	1.45	4.23		.25	.00	.28	
1911	.....	.17	1.44	.00	.58	4.48	T	8.09	4.17	3.90		1.53	
1912	.....	T	5.20	1.55	1.70	3.31	4.00	1.64	3.26		.20	.00	22.97
1913	.....	1.30	1.25	.50	1.03	1.36	1.45	1.38		2.13	T	3.43	2.96	
1914	.....	T	T	.25	2.55	4.10	1.92	2.92	2.80	5.33	.60	.00	.38	20.37
1915	.....	.66	3.20	.55	7.35	4.24	4.92	3.25	3.19	T	5.45	.00	.55	34.99
Mean	.....	.40	1.96	.48	2.50	3.25	2.90	3.23	2.85	3.98	2.10	.50	1.05	25.59

HOOKER

Year	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1906	.....	.....	.....	.....	.....	1.40	4.91	3.00	4.15	3.66	1.50	.63	
1907	.....	.50	T	T	1.80	3.19	5.95	1.96	1.95	1.77	1.02	.28	.70	19.12
1908	.....	T	1.50	T	.80	.50	1.12	3.37	.68	.60	.90	.97	T	10.44
1909	.....	.20	.10	.94	1.00	2.48	4.86	1.09	.24	1.56	1.57	3.41	.20	17.65
1910	.....	.26	.25	T	1.11	.99	1.03	3.22	2.39	.06	.02	.03	.03	9.39
1911	.....	.04	2.73	T	.49	3.31	.09	3.71	2.74	.63	2.49	.59	2.95	20.03
1912	.....	T	2.92	.67	1.65	2.86	3.71	2.19	2.19	1.95	T	.05	T	18.19
1913	.....	.30	.69	.10	1.08	1.55	1.42	1.89	.93	2.89	.36	3.05	1.75	16.01
1914	.....	T	.05	.05	.82	6.01	1.18	4.41	2.57	.14	3.93	.00	.18	19.39
1915	.....	.44	1.87	.18	4.75	6.64	5.45	2.09	2.54	3.76	1.40	.05	.42	29.59
1916	.....	.31	.....	T	1.96	.04	3.14	.29	1.82	6.50	.54	.03	.51	15.14
1917	.....	.25	T	T	1.70	1.44	1.58	1.21	5.69	1.62	.33	.60	.05	14.67
1918	.....	.30	.20	T	1.37	3.14	.64	3.40	.98	3.41	3.11	.50	2.85	21.58
1919	.....	T	.16	1.72	1.73	2.45	2.66	2.43	.25	2.38	1.26	.46	.20	17.03
1920	.....	.50	1.60	1.61	.56	3.90	2.27	3.28	3.69	3.07	3.39	.73	.94	22.23
Mean	.....	.33	.87	.40	1.49	3.73	2.37	2.55	2.11	2.30	1.64	.82	.76	18.32

temperature. Severe northwinds of winter are spoken of as "northers" or "blizzards" and occur to a limited extent nearly every winter. They rarely continue for more than three days. The maximum temperature for the winter months is about 50° Farenheit.

Killing frosts in the area may be expected fairly late in the spring and fairly early in the fall, the high altitude combined with the occasional north winds being responsible for this condition. The average date of the last killing frost in spring is April 13th, while that of the first of the fall is October 18th. The latest known date of a killing frost in spring is May 3rd, while the earliest in fall is October 11th. The average growing season is 199 days.

RAINFALL AND HUMIDITY

The average annual rainfall is about 20.35 inches. About 23 per cent of this precipitation occurs during the growing season. Late summer and fall are usually seasons of light precipitation. Snows in winter are not abundant, though not uncommon. The greatest annual rainfall known was in 1915, which averaged 30.44 inches for the county. The lowest rainfall was in 1909 amounting to 9.39 inches.

The evaporation in Texas County, as demonstrated experimentally by the weather station at Guymon, is at the rate of about 60 inches per year. This figure is about three times the precipitation, and records a fact that is of utmost significance in relation to the agricultural conditions of the county. The table below gives the monthly, annual and average precipitation for the county as reported for Guymon, Hooker and Goodwell by the U. S. Weather Bureau.

CULTURE

POPULATION

Texas County possesses the characteristics of much of the High Plains region in culture as in weather and climate. Towns are few and located along the railroads. Occasionally small settlements are found near favorable points on the highways off the railroads, but practically the entire population of the county, with the exception of the few towns along the railroad, is agricultural.

Guymon, the county seat, Goodwell, Hooker, Optima and Texhoma, located on the Chicago, Rock Island & Pacific Ry., are the only towns of importance. The population of these towns as recorded in the 1920 census of the United States is given below:

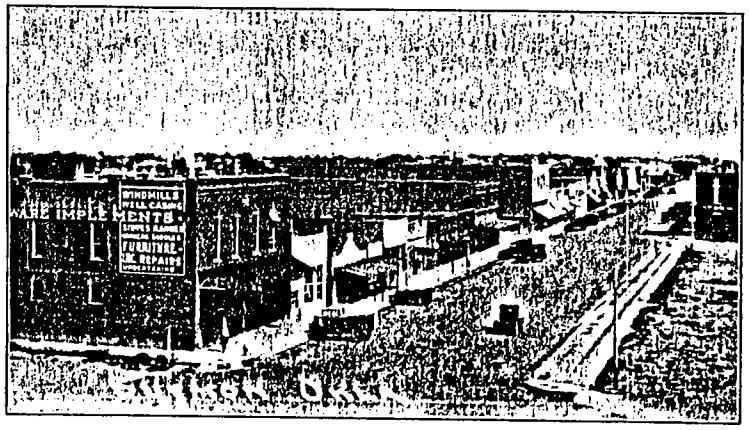


Plate II. Guymon, Oklahoma, county seat of Texas County.

1920 Census of Towns in Texas County, Oklahoma

Goodwell	523
Guymon	1,507
Hooker	946
Optima	479
Texhoma	687

The total population of the county in 1920 was 13,975, an average of 6.8 persons to the square mile. If the urban population is deducted from the total for the county, it will be found that the rural population averages 4.7 persons or approximately one family to the section. A consideration of the statistics given by the Census Bureau reveals the fact that the population of the county is decreasing, as can be seen from the figures given below:

Population in 1907, 1910 and 1920

1907	16,448
1910	14,249
1920	13,975

This recent decline, that is since the world war, has been due largely to difficult agricultural conditions. The rather marked decline in population about 1910 was due to a combination of factors. Texas County was settled largely by entry under the homestead law. Many of the titles on the land were granted about 1907 or 1908. In the same general period a series of unusually poor years from an agricultural standpoint also occurred. The combination of these two factors led many settlers to either sell their land or give it up and move from the county.

INDUSTRIES

Texas County is entirely an agricultural county. The raising of wheat, kafir corn, and milo maize together with the raising of cattle, constitute the basic industrial activity of the region. The climate is too rigorous for successful cotton growing under present conditions though this crop was attempted during 1924, with indifferent success. There is one gas well in the county, but so far the oil and gas industry does not figure in the industrial aspects of the area.

COMMUNICATION

The principal railroad in operation in the area is the Chicago, Rock Island & Pacific, which traverses the county from northeast to southwest. Along it are located the towns of the county which have already been mentioned. This line furnishes direct communication with Kansas City, Chicago, and other great market centers to the east, and with El Paso and California to the west.

A railroad has recently been built across the northwest corner of Texas County. It is part of the Atchison, Topeka & Santa Fe system, and leads from Dodge City and Elkhart, Kansas, passing Boise City, county seat of Cimarron County, Oklahoma, to Felt in the southwest corner of the county. When finally completed, this railroad will probably be a part of the main Santa Fe line between Chicago and California.

A number of good automobile roads are found in the county. One of these parallels the Chicago, Rock Island & Pacific Ry., traversing the entire county diagonally in a northeast-southwest direction. This road is well graded and in places surfaced with the calcareous clay or "caliche" so common in the region. This road is excellent when properly maintained.

Other good automobile roads are found between Texhoma and Elkhart, Kansas, traversing the western part of the county, between Guymon and Spearman, Texas, through the southeast part of the county and between Guymon and Beaver through the eastern part of the county.

The greater part of the secondary roads are found to be in good condition throughout most of the year. They are not repaired extensively or as well as graded as the main roads, but are kept in such condition as to serve very well as outlets to the better roads.

In a few parts of the county, mainly in the neighborhood of stream valleys or along the north sides of streams, where sand is abundant the roads are usually poor.

Practically the entire area of Texas County is covered by Rural Free Delivery Routes. Reference to the Geologic map (in folder at back of report) will show numerous postoffices distributed over the county. All of these are on mail routes and serve as distribution points for the immediate vicinity.

Nearly all of the county is well supplied with telephone service. While exact figures are not available it is estimated that the number of telephones in the rural parts of the county averages at least one for every two families.

EDUCATIONAL FACILITIES

Educational advantages are better in Texas County than in many of the other Oklahoma counties. This is due to the fact that in addition to the usual rural schools and the high schools which are located in larger towns, there is an institution of higher learning in the county. This school, which is known as the Panhandle Agricultural College is located at Goodwell and is one of the six district agricultural colleges maintained by the State of Oklahoma. Situated as it is in the midst of the semi-arid region of the State, it is able to devote its efforts to the agricultural needs of the region which are different from those of much of the rest of the State.

Chapter II

PHYSIOGRAPHY

GENERAL STATEMENT

Texas County lies within that physiographic province commonly known as the Great Plains, which region comprises much of the area between the Rocky Mountains and the Mississippi River. It is bordered on the east by the Central Lowlands and on the south by the Western Gulf Coast Plain. Included in this province, known as Great Plains, is a large area including parts of Texas, Oklahoma, Kansas, and Nebraska which is known as the High Plains. Texas County, Oklahoma, is entirely within this subdivision, the High Plains, and shares with the other portions mentioned rather characteristic physiographic features.

DRAINAGE

The High Plains as a whole are believed to represent a river-deposited apron of debris which flanks the Rocky Mountains.[1] This apron which originally was essentially flat is now

1. Johnson, W. D., The High Plains and Their Utilization, 21st. Ann. Rept. U. S. Geol. Survey, pt. 4, pp. 601-741, 1901. Cont. in 22nd. Ann. Rept. U. S. Geol. Survey, pt. 4, pp. 631-669, 1902.

being dissected by streams, though this work has just started. The High Plains and, therefore Texas County as well, are consequently still in topographic youth, because the streams have only begun this work. No well-developed drainage systems are seen, for the stream divides are broad and flat and the streams themselves are few and small. On these divides rainfall either collects into depressions which are frequently present, or sinks at once beneath the surface to become part of the underground water.

One large stream, Beaver Creek, controls the drainage of that part of the county which is drained by streams. As shown in another place in this report this stream follows a course through the south-central part of the county. It has a few tributaries, some of permanent character, others intermittent.

Only three of the streams of the county, Beaver, Coldwater, and Palo Duro are permanent streams. None of these originate in Texas County, but derive their sources from springs in adjacent regions to the south and west. Since most of the springs of the region covered by this report are located at the base of the Tertiary formations and since this base is exposed in only a few places in the county, the absence of permanent streams is easily accounted for. Palo Duro Creek has cut its bed below the horizon at which springs issue, and undoubtedly a portion of its water comes from springs along its course even in its lower reaches within Texas County. In general streams which are not permanent have not eroded their valleys to the bottom of the Tertiary, but are flowing, when they do flow, on a Tertiary floor. Such streams then are unable to tap the source of water found at the base of the Tertiary and hence are more likely to be of intermittent character.

VALLEYS

The valleys which have been developed in the once-continuous surface of the High Plains are characterized as being wide and shallow. In the case of the larger valleys the distance from the level of the upland, where the valley can be said to commence, across the stream, to the level of the upland on the opposite side, often exceeds three miles. In the case of many of the smaller streams it may be as much as one mile wide. The depth of the valley rarely exceeds 175 feet, and is frequently not more than 100 feet. This results in a broad, shallow trough, which is characteristic for all the streams valleys of the region. The rim of the valley, or the point where the valley may be said to start, is usually marked by an escarpment or precipitous slope, which results from the resistance to erosion of the rock found

immediately below the surface. This material, caliche, will be discussed in some detail in another part of this report. Because the escarpment occurs in this way the slope of the valley walls toward the stream is not gradual, but sudden. In a horizontal distance of less than 300 yards the slope may affect a change of level of as much as 100 feet. The profile, of the valley resulting from this condition is given in the figure below.

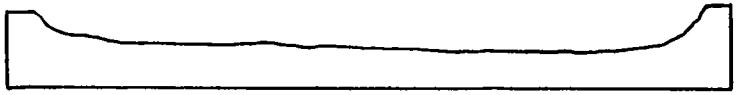


Figure 2. Ideal cross section of a High Plains stream valley.

In the narrower valleys the escarpment and the steep slope still prevail, so that the contrast in surface is still greater than in the larger valleys. In such cases the resulting valley form is gorge-like or canyon-like. These smaller valleys, near their sources, are exceptions to the general statement that the valleys of the area are broad and shallow for in these cases the depth, while less than that of the larger valleys, is a much greater fraction of the width. Plate III shows, in the foreground, the very head of one of the tributary valleys. The escarpment can be seen while in the background is shown the level surface of the upland.

RELIEF

The area of Texas County can be divided into four topographic divisions. These are: (1) Uplands, (2) Lowlands (3) Breaks, and (4) Sand Hills. These will be discussed in order.

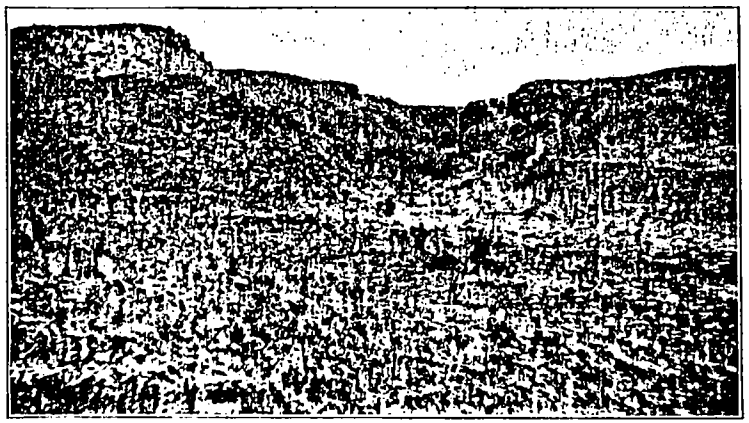


Plate III. Head of a tributary valley.

UPLANDS

This term is applied to the flat, undissected divides which occur throughout the region under discussion. Large areas of such character are present in the county and apparently are essentially the same as that of the original surface, that is to say they have never been disturbed or modified to any extent by erosional process. Since they form the highest areas of the region they are spoken of as uplands.

The general surface of the uplands is actually slightly rolling, as can be seen in the foreground of Plate I, but these minor irregularities of relief are only seen when the plain is traversed, for to the distant observer no hint of their presence is given. Plate IV can be taken as an illustration of the edge of an upland area where it changes into an area of breaks or into one in which stream erosion has started to operate. It will be seen that the distant background is quite regular and that it is unbroken by valleys.

One traversing the uplands may observe that the otherwise even surface is broken by small swells and depressions. The swells are simply the minor elevations of a few feet only, which might be expected on any plain. The depressions on the other hand, in many cases, are of a different nature. For the most part they are basins, more or less circular, which have no outlets. They vary in size from a few feet in diameter to more than a mile. In Texas County only small depressions of this sort are found. These are known locally as "buffalo wallows" because in days gone by buffalo frequented them, especially if the depressions contained water. It seems likely that in the

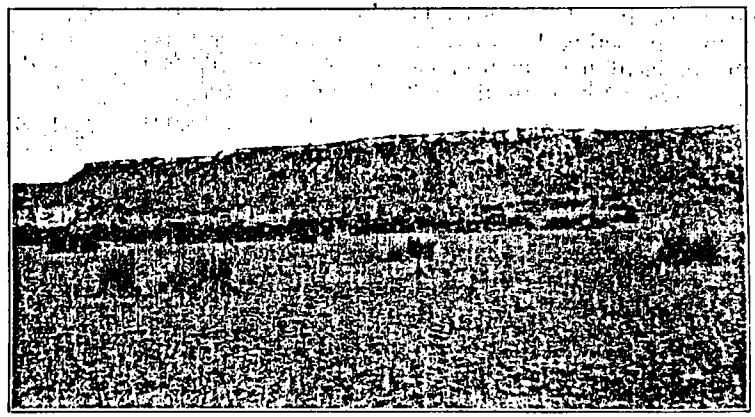


Plate IV. Escarpment of caliche, west of Guymon.

vast majority of cases there is no connection between the presence of the animals and the origin of the depressions, though such an origin as has sometimes been suggested. Since the basins are usually without outlet they frequently contain water in which case the term "playa lake" is often applied to them. In the High Plains region as a whole these depressions are of two general sorts, one being small, saucer-shaped, and never more than a few feet deep; the other large and in some cases 100 feet or more in depth.

The origin of the saucer-like depressions which are quite common in the region has been a matter of some discussion. Johnson[1] has shown that their origin is probably determined by, and coincident with, settling and compacting of the materials beneath the surface. When this settling is finally transmitted to the surface the saucer-like depression results.

LOWLANDS

Under this term is included only that part of the area which is found in the valley bottoms. Because of the limited number of valleys and because of their general slight development this type of topography is found in a small part only of the general area of the county. In some of the larger valleys like that of Beaver Creek and Palo Duro the broad shallow valley bottom may attain a width of more than one mile, but in the majority of cases is much less.

The land materials of the lowlands are alluvial in nature and the lowlands are in fact valley flats, built by deposition by the streams in time of flood. In some cases such areas are composed of silt-like materials which are excellent for agricultural purposes, in which case the area involved can be classed as among the valuable lands of the county. It is common to find ranches located in such places utilizing the rich alluvial land for hay crops, and to smaller extent for grain crops.

It is to be noted, however, that lowlands on the north sides of the valleys, and in general those occupying valleys having a definite east-west trend, are usually less fertile than those described above, for in many cases the alluvial material is largely sand, reworked by the wind. It is a fact that in many valleys, without respect to their direction, sand is a prominent factor and tends to decrease the fertility and value of otherwise good soil.

BREAKS

Under this term is included the rough, broken land lying between the essentially level lowland, or valley flats, and the

1. Johnson, W. D., Op. cit.

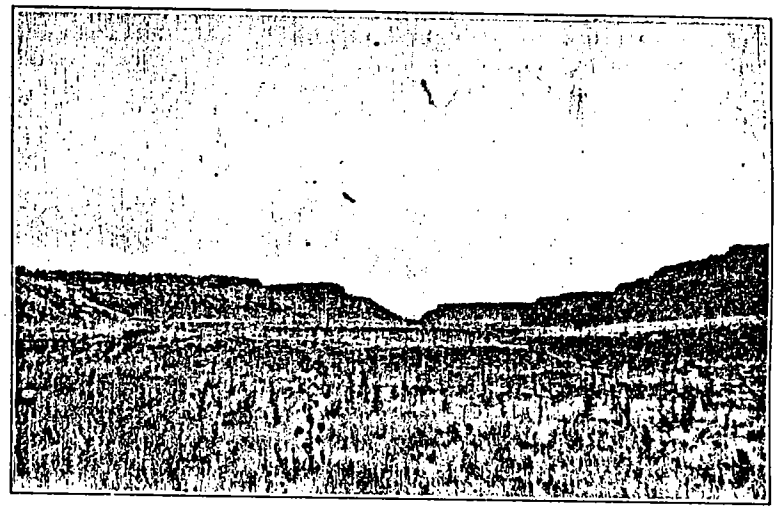


Plate V. Breaks.

essentially level uplands, or undissected stream divides. The term means, to employ the local usage, the place where the plain breaks into the valley.

The breaks exist in the region because of the lack of gradual transition from plain to valley. As has already been shown, the edge of the valley is marked by steep slopes and often by an escarpment. If instead of this escarpment and steep slopes a gradual slope existed, the breaks would represent a much smaller area than is now the case. In the wider valleys the area occupied by the breaks is narrow, but in the case of tributary valleys which are too young to have developed noticeable valley flats, the entire width of the valley will be rough and broken and will correspond to the definition given for breaks. In some cases where a narrow valley has several tributary gullies and ravines the whole area involved by them will be a succession of steep slopes and escarpments. Such topography throughout the High Plains region has come to be known as the breaks. Much of the scenes covered by Plates III, IV, and V would be classed as breaks.

As stated above, the steep slopes and escarpments of the valley walls are responsible for the formation of the type of topography under discussion. These features, slope and escarpment, are due to the presence near the surface of a layer of hard, calcareous material, sometimes called caliche, and known locally as rim rock or cap rock. This material which will be discussed

in greater detail in another part of the report in almost all cases forms the steep escarpment of the region and because of its light color in outcrops can often be seen for miles. Plate IV shows a typical escarpment of caliche west of Guymon.

SAND HILLS

The fourth and last type of topography found in Texas County is known as sand hills, comprising certain areas of variable extent in which wind-blown sand occurs. These areas of sand hills, or sand dunes, are usually associated with the stream valleys; for the alluvial material of the valleys is the source of the greater part of the sand of the dunes. The beds of the streams consist largely of sand, and in times of drought the strong winds of the region transport this material. Since the prevailing winds of the region are from the south, the greatest concentratation of sand dunes is on the northern or lee sides of the valleys, and ordinarily all larger valleys with an east-west trend, are flanked on the north by a belt of sand dunes. However, nearly all valleys exhibit this feature to a certain extent. The most extensive occurrence of sand hills in the county is found in the eastern part of the county on the north side of Beaver Creek near the postoffice of Grand Valley. Extensive deposits of sand are also found in the southwest part of the county along Beaver Creek west of Goodwell.

The belt of sand hills in each case mentioned above extends for a variable distance north of the stream and forms a mantle spread over the territory involved. The greatest thickness of sand is nearest the stream and from this point the thickness gradually decreases until evidence of the sand is no longer seen. In Texas County the width of the belt or zone of sand is rarely more than two or three miles, but in some localities in the High Plains sand dunes are found over much greater distances from the streams in some cases the distance being as much as fifteen miles. For this last type of dune the senior author[1] has expressed the opinion that other agencies than the winds were partly responsible for the present location. Water worn pebbles as large as walnuts have been found on the crests of such dunes. It seems hardly credible that the wind alone could be responsible for the transportation of materials of this size. It is believed that in such cases the material is probably essentially in place and that the dune configuration arose partly from removal of other material by the wind.

In the belts of wind-blown sand as found in Texas County no evidence was seen that other agencies than the wind had op-

1. Gould, Chas. N., Geology and Water Resources of Oklahoma: U. S. Geol. Survey, Water-Supply Paper 148, pp. 82-84, 1905.

erated to bring about the dune formation. A cross section of the sand area is shown below.

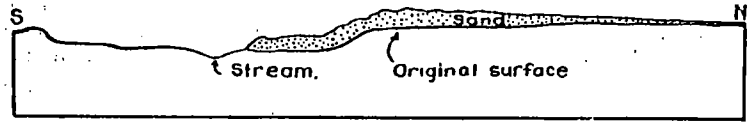


Figure 3. Ideal cross section of sand hills belt.

As can be seen the sand extends as a mantle over the surface of the land and gradually thins out with distance from the valley which was the source of the material. The largest dunes are nearest to the river while in the extreme edge of the belt away from the river dunes may be absent and the sand present as a sheet only a few inches in thickness. The dunes present near the river are numerous and frequently attain heights of 20 or more feet above the general level. In their aggregate they exhibit all of the features common to dune topography. A rounded hummocky surface is common and in some cases the hummocks (dunes) are free from vegetation. Such dunes are growing or moving with the wind, while in other cases where vegetation has gained a foothold the dunes are stationary.

Chapter III

STRATIGRAPHY

GENERAL STATEMENT

The geology of Texas County is of a simple order. No great, complex rock structures are found, and no great diversification of rock types exist within the area. The formations present are of sedimentary origin, a part being of marine origin, part being river deposits, part deposited by the wind, and finally a part being desert salts. The greater portion of the rocks of the county are those of marine or river origin.

Three geological periods are known to be represented by the formations which appear at the surface within the area of rocks west of Guymon, to be described later. The formations found are of Permian, Triassic (?), Tertiary and Quaternary ages. The first two, Permian and Triassic (?), are represented by exposures of red beds although no great area is covered by them. The Tertiary is represented by extensive deposits of poorly consolidated sandstone, conglomerate and shale which make up the greater part of the surface rocks in the county. The Quaternary is known through the accumulations of wind-blown sand, and the alluvium of the stream bottoms.

These formations will be described in the order in which they have been mentioned. Reference to the geologic map (in pocket at back) will show the total area and location of the respective formations. As has been mentioned in another place in this report, on account of lack of funds the field work done in connection with this survey was of the reconnaissance type. It is not to be expected therefore that the descriptions which follow will be as detailed as those of a more exhaustive survey.

PERMIAN ROCKS

CLOUD CHIEF FORMATION

Three areas of red beds are found in Texas County. The most extensive of these is in T. 1 N., Rs. 18 and 19 E., along the south side of Beaver Creek beginning near the point at which Palo Duro Creek enters that stream and extending southward past the postoffice of Range along the valley of the Palo Duro beyond the limits of the county into the state of Texas. A second occurrence of red beds is in the valley of Beaver Creek eight miles west and two miles north of Guymon near the old postoffice of Redpoint. Here for a few miles along both sides of the stream, but more extensively on the north side, these red rocks are exposed. A third exposure is on Tepee Creek, in T. 3 N., R. 12 E. While these occurrences are of the type known as red beds, the exact geologic age has not yet been accurately determined, some geologists believing that the rocks of these exposures in the western part of Texas County are Permian in age, while others consider them as Triassic. At no other place within the county except the three localities described are exposures of red beds known to exist. In all cases the exposures are confined to that part of the stream valley where erosion has removed the overlying Tertiary deposits and revealed the red beds beneath. The exposures accordingly are narrow and not extensive. It is possible however that at other points along Beaver Creek these red rocks may be found, but if this is the case drifting sand has obscured their outcrops.

Further east in Oklahoma the Permian red beds are divided into the following formations, the youngest being first named.

Enid formation; red clay shales and sandstones.
Duncan sandstone; massive beds of sandstone with clay shales.
Chickasha formation; red and vari-colored shales and sandstones.
Blaine gypsum; massive white rock gypsum with interbedded shales and dolomites.
Dog Creek shales; red clay shales with interbedded dolomite.
Whitehorse sandstone; massive cross-bedded red sandstone.
Day Creek dolomite; massive white dolomite.
Cloud Chief gypsum; massive beds of white rock gypsum interbedded with red clay shale.
Quartermaster formation, red sandy clays.

The Cloud Chief formation as exposed in this county consists for the most part of red clay or shale with minor layers of beds of gypsum and sandstone. The greatest thickness observed was 70 feet in the hill east of Range postoffice, but since no detailed sections are available this figure is only approximate. Undoubtedly a thickness of many feet of the formation is not exposed but is buried beneath the surface. As stated above the greater part of the formation as exposed consists of clay shale. This is usually reddish in color, but contains subordinate areas of gray or green shale, a common feature of the red beds and one which has not been satisfactorily explained.

The gypsum beds of the Cloud Chief formation are found in only one locality in the area covered by this report. This is located about a mile east of Range postoffice in the southeastern part of the county along Palo Duro Creek. At this place a definite ledge of massive gypsum outcrops in the valley walls, and since the gypsum is more resistant than the shale with which it is associated, it is somewhat emphasized in the topography. The thickness of the ledge is not more than three feet as a maximum, while in many places erosion has left a smaller thickness present. Gypsum was not observed in either the Redpoint or the Tepee Creek area. The entire section, some thirty feet in thickness, is composed of mottled red and green shale or clay. The absence of gypsum beds has been used to strengthen the suggestion that this area of red beds is of Triassic age rather than Permian.

CONCRETIONARY SANDSTONE MEMBER

In the area of the Cloud Chief in the southeastern part of the county there occurs, in addition to the shale and gypsum mentioned above, a stratum of sandstone. This is well exposed in sec. 17, T. 1 N., R. 19 E., about two and one-half miles east of Range. Eight feet of this material was observed outcropping in the valley wall at a horizon some 25 feet above the gypsum member mentioned above. The sandstone is buff to brown in color and is very fine grained.

Disseminated throughout the sandstone mass in a fairly regular fashion are numerous dendritic-shaped, concretionary aggregates of some dark colored material. This seems to be manganese oxide, but without chemical analyses it is impossible to state definitely the composition of the material constituting these bodies. The concretionary aggregates are about one-sixteenth inch in diameter and are present to the number of approximately 10 to the square inch of rock surface. A drawing of these bodies as they appear beneath the microscope is shown below. In addition to the dendritic shaped bodies mentioned above the sandstone also contains rounded concretions of iron

oxide. These are spherical in shape and range in size from a small shot to slightly larger than a pea. These concretions are composed of limonite, but evidently were originally pyrite or marcasite balls since altered to limonite.

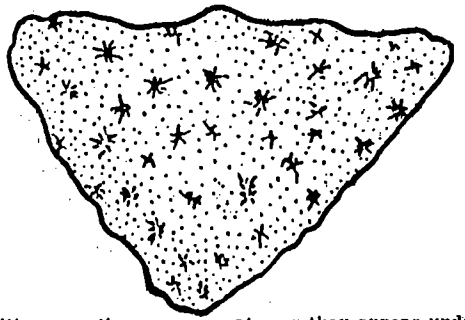


Figure 4. Dendritic concretionary aggregates as they appear under the microscope.

As stated above the sandstone is fine grained. Under the microscope it is seen to consist almost entirely of rounded grains of quartz. A small amount of calcite in grains is present and rarely grains of magnetite are noted. The dendritic concretions appear to be grains of manganese oxide collected into certain definite areas within the rock.

The weathering of the sandstone here described is characteristic. There is a marked tendency toward the development of concentric boulders some of which are perched. These suggest a concretionary structure in which the size of individual concretions varies from a few inches in diameter to over six feet. Plate VI shows one of the largest of these boulders.

Plate VI. Concentric boulders formed by the weathering of sandstones.

The sandstone as a whole is not unlike the Big Basin sandstone first described by Cragin[1] from exposures in Big Basin, Clark County, Kansas, this being the highest formation of the Cimarron series. The Big Basin exposures lie about 80 miles to the northeast of those at Range.

At the present time the correlation has not been established between the two highest Permian formations of Kansas, the Hackberry and Big Basin, and the two upper Permian formations of Oklahoma, the Cloud Chief and Quartermaster. So far as the authors are aware no gypsum representing Cloud Chief age has been found in the post Day Creek of Kansas.

CORRELATION

The red beds of the southeastern part of the county are assigned to the Cloud Chief formation. In a previous paper[2] the senior author of this report classified the red beds of Texas County as "red beds of uncertain relation." At that time data were lacking upon which to base a more definite classification of these rocks. Since that time our knowledge of the red beds of western Oklahoma has been greatly increased, and now based upon similarity to known sections of Cloud Chief it is believed that these beds should be correlated with the Cloud Chief formation of western Oklahoma. Further it has been found that by tracing the exposures of the red beds carrying gypsum along the south side of Beaver Creek east from Texas County across Beaver, Harper, Ellis, and Woodward counties, it is possible to correlate the formations exposed near Range with the Cloud Chief formation as exposed in southern Beaver County.

TRIASSIC (?) ROCKS

The occurrences of red bed rocks at Redpoint and along Tepee Creek in western Texas County, are here assigned no definite age, but are mapped as questionable Triassic. While these beds are very similar to those of the Cloud Chief, near Range in the southeastern part of the county neither the gypsum nor the sandstone of the latter occurrence were observed at Redpoint. Furthermore work by geologists of oil companies has revealed evidence which suggests that these beds are not of Permian age. Mr. H. D. Miser[3] of the United States Geological Survey, and others have expressed the opinion that the rocks exposed at Redpoint may belong to the Triassic rather than the Permian and accordingly no more exact correlation is attempt-

1. Cragin, F. W., The Permian System in Kansas, Colorado College Studies, Vol. 6, pp. 46-48, 1896.
2. Gould, Chas. N., Geology and Water Resources of Oklahoma, U. S. Geol. Survey, Water-Supply Paper 148, p. 73, 1905.
3. Oral Communication.

ed in this report. In a recent bulletin of the Oklahoma Geological Survey,[1] the senior author of this report, says:

> "It is the present opinion of the writer that the rocks in question are upper Permian (probably Cloud Chief formation), rather than Triassic. However, in deference to the opinions of other geologists, perhaps better qualified to judge, the beds are here tentatively referred to as Triassic."

Dr. T. W. Stanton, of the United States Geological Survey, our best authority on the Mesozoic, in a letter dated January 26, 1926, to Mr. Sidney Powers (who kindly gave permission to use the letter) says:

> "I have not a particle of direct evidence concerning the age of the red beds in Texas and Cimarron counties, Oklahoma. * * * * * The only reason for suspecting that the upper part of the underlying red beds may be of Triassic age is that the Triassic (Dockum formation) is known to be present in the Staked Plains region of Texas, and also in New Mexico on the Conchas River, southeast of Las Vegas."

To this the senior author would add: the Texas and Cimarron County red beds do not resemble the Texas Triassic rocks and do have the facies of the Oklahoma and Kansas Permian red beds. Until fossils are found in the red beds of the Oklahoma Panhandle the question must probably remain unsolved.

TERTIARY ROCKS

With the exception of the areas of red beds already mentioned, some valley bottom areas, and the narrow belts of sand dunes near the streams, the remaider of the rocks of Texas County are of Tertiary age. These rocks consist of sands, clays conglomerates, and impure limestones, occurring in such obscure relationship that only the general classification of Late Tertiary can be assigned them.

These rocks lie unconformably above the unevenly eroded surface of the red beds and comprise all of the area classed here as the uplands. Paleontological evidence is very scanty and from this and other reasons it seems impracticable to attempt to subdivide these rocks, or to refer them to a more definite age than that mentioned above. No complete section was available for study, but from wells it is known that the maximum thickness of these rocks is 300 feet.

The Tertiary as here discussed consists for the most part of clay, sand and gravel. These may all be present interbedded in the same outcrop, or they may occur singly. Frequently a single small exposure less than 20 feet thick and 50 feet wide

1. Gould, Chas. N., Index to the Stratigraphy of Oklahoma, Okla. Geol. Survey, Bull. No. 35, p 103, 1925.

will show as many as ten lenses of these various materials. Cross bedding is a very common feature of these deposits. Sand and gravel predominate over the clay in amount, and exhibit striking characteristics. There is every gradation from very fine stratified sandstone, firmly or loosely cemented as the case may be, to much coarser sand, gravel and finally to conglomerate. At Redpoint, 12 miles west of Guymon, the conglomerate mentioned above is well shown overlying immediately the red beds. At this place the individual cobbles are as large as one foot in diameter, held in a matrix of sand and cemented by lime. The pebbles are of various materials some being vein quartz, some Cretaceous limestone, as recognized by *Inoceramus* and other fossils contained in them, some quartzite, some basalt, and other igneous rocks. It is of considerable interest in this connection that the nearest known source of some of these cobbles is approximately 100 miles distant from the exposure.

In many localities the pebbles and cobbles of the Tertiary are so firmly cemented by calcium carbonate or lime, than the aggregate resembles concrete. Such rocks were long ago dubbed "mortar beds" by the Kansas geologists[1] and present one of the most striking features of the Tertiary of the High Plains. Plate VII and Fig. 5 show typical exposures of the material.

The Tertiary formations of this area, then, consist of clay, sand, gravel, and conglomerate occurring in short, discon-

Plate VII. Mortar bed structure in late Tertiary formation.

1. Haworth, E., Second Ann. Rept., Kans. Univ. Geol. Survey, pp. 247-284.

tinuous lenses, highly cross bedded and presenting very complex stratigraphic conditions. It is impossible to separate or delineate individual beds over wide areas, and very few similar sections can be found even though short distances separate the exposures.

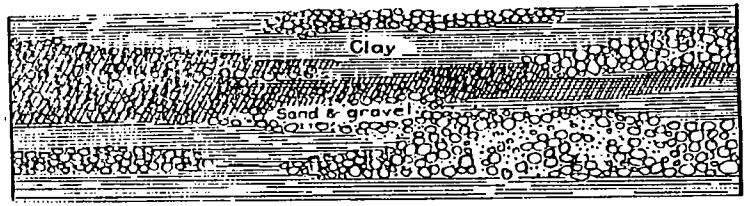


Figure 5. Tertiary rocks, showing structure of mortar beds—after Gould.

This complex relationship of these rocks was long ago recognized and the term High Plains Tertiary assigned to the whole mass of material. This has come to mean that vast aggregation of sedimentary materials which forms a wide apron flanking the east front of the Rocky Mountains, and extending over all the area designated before as the High Plains, including parts of the states of Texas, New Mexico, Colorado, Oklahoma, Kansas, Nebraska, Wyoming, and the Dakotas. Various names such as Loup Fork, Nussbaum, Ogallalla, Goodnight, Palo Duro, Blanco, and Tule, have been used at different times and by various writers to describe the beds here included under the general term Late Tertiary.[1] The scope of this report does not permit an extensive study of these beds and their origin, but it is believed that a summary of current belief concerning them may be of value.

ORIGIN

The concensus of opinion as the origin of these deposits seems to favor stream deposition. It has been frequently stated in geological reports that the surface of the High Plain Tertiary formations slopes to the east and that the size of the materials constituting them decreased in the same direction. The sediments composing the rocks are assumed to have been derived from the Rocky Mountain region, and to have been carried to their present position by streams which originated in mountainous regions and flowed out into an arid plain. Such erosional conditions would result in the gradual diminution of the volume of the streams until in some cases streams would no longer exist. Any sedimentary materials carried by the streams

1. See discussion in Water-Supply Paper 154, U. S. Geol. Survey, pp. 25-28, 1906.

would be dropped as the volume decreased, and the resulting deposit would be a wide apron of rock debris spread over the plain. Similar accumulations but with higher slopes are the alluvial cones and fans found today in most of our western states. The High Plains Tertiary formations are believed to have originated in a similar fashion.

While there still remain many puzzling features concerning these formations, it is difficult to escape the conclusion that they were formed by streams. The highly cross-bedded, lenticular deposits suggest this, and the gradation of the size of materials eastward is significant. The rivers which carried the materials were different in some respects from those in the same region today, for no present day stream heading in the Rocky Mountains and flowing out onto the High Plains carries sediments, the individual fragments of which are a foot in diameter, for distances of 100 miles from their source.

CALICHE

In much of the area covered by the late Tertiary a layer of caliche is found just beneath the surface, and is usually overlain by a grayish calcareous soil. Its thickness ranges from less than one foot to more than 20 feet. In certain localities two or more accumulations, one above the other have been observed, but this is unusual. This material is very abundant in Texas County. It forms the cap rock of the breaks and is especially well exposed in railroad cuts along the Chicago, Rock Island & Pacific Ry. In the cuts between Guymon and Optima, 20 or more feet of the material can be seen. Plate VIII is of this locality, while plates III and IV show caliche from other localities.

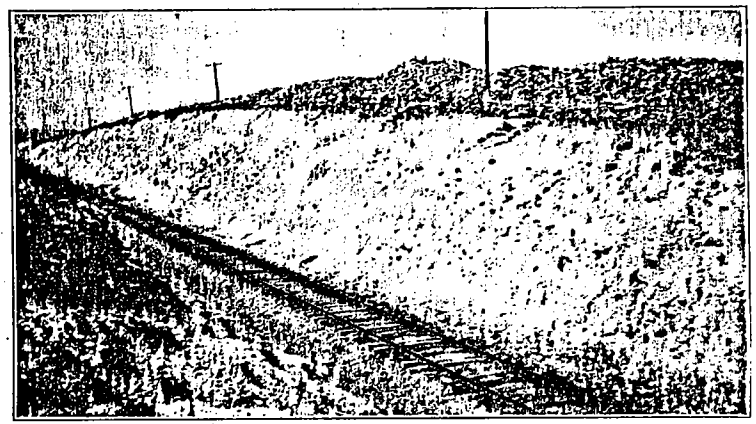


Plate VIII. Caliche in railroad cuts between Guymon and Optima.

CHEMICAL COMPOSITION

Caliche is essentially calcium carbonate in composition, but rarely is it entirely pure. Sand and other materials are usually admixed with the calcium carbonate, so that the correspondence to ordinary limestone is not exact. No analyses of caliche from the area covered by this report are available, but the material is so similar over wide areas that the anlyses quoted below will be helpful in gaining an idea of the nature of the rock. The analysis of caliche is from Cimarron County, the county immediately west of Texas County.

Analysis of Caliche from Cimarron County, Okla.

A. C. Shead, Analysist

SiO_2	10.04
Al_2O_3, Fe_2O_3, FeO	0.30
MgO	0.42
CaO	49.37
H_2O	0.27
H_2O plus Organic	1.03
CO_2	38.32
	99.75

DESCRIPTION

Caliche, then is an impure limestone. Its color varies from pure, chalky white to buff or gray color, depending upon its state of purity. Its upper portion is often dense and massive but the lower part of any occurrence is usually porous and incoherent. In a few cases a fine horizontal lamination can be observed, but this is the exception. In any extended traverse over the region occupied by caliche beds it is soon noticed that the location of the deposit is always near the surface. Plates IV and VII show definite layers of caliche. This suggests a stratigraphic unit, but such is not the case, because it is found that the surface often determines the relative elevation of outcrops. It is believed that this material is characteristic of arid regions and owes its formation to the chemical and physical conditions peculiar to such regions. It may be said at this point that many names besides caliche have been used for this material. Among them are hardpan, cement, surface marl, cap rock, tepetate, lake marls, gyp, and indurated clay. However, it is thought that the constantly growing use of the term caliche is justified, and that geologists and the public will do well to include the material so prevalent over the southwest under this term, for which perhaps a dozen local names have been used.

ORIGIN

Several views have been postulated in the past to account for the origin of caliche. The first geologists to visit the Plains region observed the material and thought it to be a limestone laid down in fresh-water Tertiary lakes. This view is no longer held to account for the extensive deposits known. In 1901 Willard D. Johnson[1] in his paper, "The High Plains and Their Utilization," discussed in detail this material and its origin. He held that the deposition of calcium carbonate is a typical feature of the dwindling streams of arid regions. Their final disappearance on an arid plain is marked by a crust of calcium carbonate. The material thus deposited by the streams is reworked with every rain, and in general carried downward. The great accumulations would result at the groundwater table and our present day horizons of caliche represent old levels of the surface of the underground water.

In 1902 William P. Blake[2] called attention to the caliche of southern Arizona calling the material by this name, and ascribing its origin to a reversal of the underground circulation. He believed that the general underground circulation of southern Arizona contained calcium carbonate in solution, and that the waters of this circulation rising by capillarity came to a zone where evaporation occurred. The depth below the surface at which evaporation would be effective depends on local conditions and would determine the place of greatest accumulation of caliche. The dense upper portion of caliche deposits was accounted for by Blake, by the action of rainwater carrying down some re-dissolved calcium carbonate which on precipitation enriched that already accumulated. Blake's paper is probably the first in which the material considered here is called by the name caliche.

Contemporaneous with Blake, R. H. Forbes, chemist and director of the Agricultural Experiment Station of Arizona, also wrote about the caliche of Arizona.[3] He advanced the view that the caliche was concentrated by rainwater alone, percolating downward and carrying the material in solution as a normal carbonate. Precipitation was supposed to occur at the levels which we see today as accumulations of caliche.

In 1905 Willis T. Lee[4] discussed the caliche of Salt River Valley, Arizona. While agreeing with both Blake and Forbes

1. Johnson, W. D., The High Plains and their Utilization, 21st Ann. Rept. U. S. Geol. Survey, pp. 634-643, 1901.
2. Blake, William P., The Caliche of Southern Arizona; An example of deposition by the Vadose Circulation. Genesis of Ore Deposits, Posepeny and others, pp. 710-715, New York, 1901.
3. Forbes, R. H., Quoted by Lee, Willis T., Water Resources of Salt River Valley, Arizona, U. S. Geol. Survey, Water-Supply Paper 136, 1905.
4. Lee, Willis T., Water Resources of Salt River Valley, Arizona, U. S. Geol. Survey, Water-Supply Paper 136, pp. 107-111, 1905.

as to the origin of certain occurrences of the material Lee stated that in his opinion some deposits could not be accounted for by either process. He demonstrated the presence of carbon dioxide in the underground water of the region and thought that in most cases the calcium carbonate was in solution as a bicarbonate. In this case evaporation would not be necessary for precipitation of the normal carbonate since escape of carbon dioxide as the solutions neared the surface would produce the same result. In a similar fashion the accumulation of a dense upper portion of the caliche once formed would retard evaporation, but not the slight relief of pressure needed for the escape of carbon dioxide. Lee felt that in such cases the escape of carbon dioxide due to relief of pressure as the solutions approached the surface was the probable cause of precipitation of caliche.

Charles L. Baker[1] in 1915 mentioned the occurrence of caliche in the northern Llano Estacado of Texas and expressed the belief that this material resulted from the evaporation of solutions forced upon by capillarity.

Leroy T. Patton[2] in his bulletin on Potter County, Texas, mentions the caliche and calls attention to the fact that while the material is a near-surface accumulation in Tertiary formations, the surface with which it is associated may be near the top of the Tertiary or actually just above Triassic formations. This emphasizes the fact that the essential factor involved in the formation of this material is not the original conditions of sedimentation of the formations with which it is found.

Finally J. A. Udden[3] in 1923 discussed the formation of caliche in the southwest. He believes that it was brought to the surface from underlying formations by solutions drawn upward by capillarity. Long dry seasons with short intervals of considerable rain are thought to be essential for its formation. Rain water is believed to rework the upper part of the deposit and to add to the results effected by the ascending capillary solutions. Udden believes that in general the depth below the surface at which the caliche is found represents the depth at which evaporation of the ascending solutions takes place. Local topographic changes might account for two or more horizons of the material.

From a consideration of the literature on caliche, and from field observation in western Oklahoma, the conclusion seems

1. Baker, Charles L., Geology and Underground waters of the northern Llano Estacado of Texas, Bur. Econ. Geol. and Tech., Univ. of Texas, Bull. 57, p 31, 1915.
2. Patton, Leroy T., Geology and Mineral Resources of Potter County, Texas, Bur. of Econ. Geol. and Tech., Univ. of Texas, Bull. 2339, p. 89, 1923.
3. Udden, J. A., The Rim Rock of the High Plains. Bull. Amer. Assn. Pet. Geol. Vol. VII, pp. 72-74, 1923.

warranted that caliche is not a lake or river deposit. The great extent and continuity of the material would seem to prohibit any such origin. It seems probable that the greatest factor involved in its accumulation is evaporation of ascending solutions drawn upward by capillarity. However, it is believed that certain local accumulations of the material are due to the action of rain water immediately following a rain. In Texas County, Oklahoma, enclosed basins were seen into which collected the immediate runoff after the rain. Upon evaporation of the standing water in the basin a crust of almost pure calcium carbonate was left. As long as such basins remain enclosed this process would be repeated with every rain, resulting in time in a deposit of appreciable thickness. In all cases of this kind observed in Texas County the deposit formed exhibited a fine horizontal lamination. It is entirely possible that many of the occurrences of caliche showing the fine horizontal lamination may have originated in the same way.

QUATERNARY SYSTEM

SAND HILLS

In certain parts of Texas County the occurrence of sand hills, or sand dunes is quite common. These dunes are confined largely to the north banks of streams but, as shown in the discussion on Physiography, small areas are also found in other locations.

As will be seen on the geologic map only one area of any extent is mapped. This is along the north side of Beaver Creek extending from the neighborhood of the mouth of Coldwater Creek to the eastern border of the county. Here is a continuous belt of sand dunes extending about four miles back from the stream. A great part of the sand of the sand hills is derived from the bed of streams, and since the prevailing winds are from the south the sand accumulates on the north, or lee side of the channel. Quartz, the most abundant mineral found in the sands, was eroded from both the Tertiary and red beds formations. Since the prevailing sandy formation of the region is Tertiary, it follows that more sand was derived from that source than from any other.

The senior author[1] has drawn attention to the possibility that the winds may not have been alone in the formation of these dunes. Since much of the area covered by the sand hills is underlain by Tertiary sandy formations, it may be that some of the dunes were formed in place from the underlying formation.

1. Gould, Chas. N., Geology and Water Resources of Oklahoma, U. S. Geol. Survey, Water-Supply Paper 148, pp. 83-84, 1903.

Since many of the sand dunes are still growing in size today, being supplied with sand from the river, and since the river sand is largely re-worked late Tertiary sand, it follows that the sand hills are of Quaternary age.

ALLUVIUM

As shown in the discussion on Physiography there are certain areas of bottom lands in Texas County. These areas contain considerable deposits of alluvium composed of material derived from the disintegration of red beds and Tertiary formations. The materials thus made available are largely sand and clay. In cases of alluvium originating from red beds a red color may still be seen in the deposit, while in other cases no evidence of this is seen. In a majority of cases the alluvium is a dark brown loamy material which makes an excellent soil. It is probable that much of these deposits consist of a mixture of both red beds and Tertiary sediments.

The area occupied by the alluvium varies with the size of the stream in whose channel it occurs. In the valley of Beaver Creek alluvial deposits a mile wide are not uncommon, and from areas of this size there is a gradation to dimentions too small, in case of the small streams, to be shown on the geologic map. In many places wind-blown sand has drifted over the loamy alluvium, destroying its value for agricultural purposes. The depth of the alluvium varies from two feet to 30 feet.

Chapter IV

WATER RESOURCES

MOVEMENT OF GROUND WATERS

The water supply of a region depends primarily upon rainfall, but also in a large measure upon the porosity of the rocks found beneath the surface and their structural arrangement. If the formations which wells penetrate are of a nature adapted to filter the water which passes through them, this will have a favorable effect on the water obtained. On the other hand, if the rocks beneath the surface contain soluble materials these will be found in the waters which are taken from such rocks, either by wells or from springs issuing at the surface, even though no formations with easily soluble materials are found in the immediate vicinity.

A large part of the water falling upon the surface as rain, sinks into the earth. It is guided in its downward movement by the character and structure of the rocks which it encounters. Porous rocks, such as sandstone, afford the easiest passageway,

and underground water may follow strata of this kind for great distances. Such rocks are known as aquifers and in most regions one or more of them are to be found in wells. Compact, fine-grained rocks like shale or clay do not afford easy passage to waters and in many cases act as absolute barriers through which the water cannot pass.

If ground water in its movement enters an aquifer, its subsequent movement will be governed by that rock. Should the aquifer be limited above and below by relatively impervious beds the effect will be to confine the water to a definite horizon in the rock column of the region. Water-bearing rocks such as sandstone frequently dip in a certain direction. As water follows down the dip a condition is reached in which a hydrostatic head is established. Flowing or artesial wells and bubbling springs, are the result of the tapping such aquifiers, and they show that the water in these rocks is under pressure.

SHEET WATER

In Texas County the prevailing rock at the surface is the Tertiary formation composed of sand, clay and gravel. Water obtained from these rocks is usually sweet, pure and wholesome. The depth at which water is obtained in these formations varies from 50 to 300 feet. Its location depends upon the geologic section found in a given locality. Since the Tertiary varies widely in composition within short distances, no generalized section can be given. The water is usually contained in layers of sandstone or gravel so common to these rocks. At some localities a water-bearing sand will be encountered at a shallow depth, while at other places a much greater depth must be reached before water is obtained. Perhaps the most common horizon from which water is obtained in this region occurs near the base of the Tertiary. There is usually a fairly continuous bed of conglomerate at this horizon which affords easy passage to the water, while the underlying beds of the Permian are relatively impervious shales which limit the downward movement of the water. This occurrence of water is known locally as "sheet water," referring to the fact that practically dry (impervious) rocks may be encountered for considerable depths to be followed by a zone in which water flows into the well in abundance. The presence of a clay or shale layer underneath the aquifer is a common and favorable accompaniment because such a condition limits the downward movement of the water.

There has been some attempt to classify the depths or zones at which water can be found in this region. One often hears of the "first sheet" or the "second sheet" and a figure is frequently given for the depth at which these exist beneath the surface. Such figures may represent conditions over a very

small area but because of the great local variation in the character of the Tertiary formations they have no significance if applied to areas of more than a few square miles. The conglomerate bed at the base of the Tertiary is perhaps the most continuous "sheet" and will probably be encountered in most wells drilled into Tertiary formations.

As stated above, water sometimes moves for great distances within the rocks, it is not believed that such conditions are found in the area covered by this report. It is believed that the water obtained from wells and springs of the region originated from local rainfall and while its movement has been to the extent of a few miles, the water was not derived from a source as far distant as the Rocky Mountains. However, the occurrence of bubbling springs and artesian wells tends to show that in some cases the water exists under artesian pressure.

WATER FROM RED BEDS

Small areas of Texas County are characterized by the occurrence of red beds at the surface. Water derived from these formations is likely to be objectionable for domestic use. The red beds in addition to the common gypsum ($CaSO_4.2H_2O$) and salt (NaCl) often contain sodium sulphate, calcium carbonate magnesium sulphate, calcium chloride and perhaps still other soluble salts. The waters traversing such rocks usually contain part or all of these salts in solution. If the amount of material in solution is small no objection is found to the water for domestic purposes, but in large amounts the water becomes unfit for use. Since the outcrops of red beds are limited in area in this region, and since springs occur at the base of the Tertiary formations, it is possible in most parts of Texas County to secure water without access to the red beds. Ground waters seeping down through the Tertiary formations encounter the conglomerate bed mentioned above. Since impervious red beds underlie this conglomerate the water is forced to move laterally resulting in springs along the red beds-Tertiary contact in the valley walls. Such springs are fairly common and may be relied upon to furnish good water throughout the year.

Figure 6. Ideal section of Tertiary springs—after Gould.

Conditions are also favorable for a good water supply in the areas of sand hills in the county. Water issues along the bluffs on the north side of valleys, and in nearly all cases is of good quality. This water is pure because it has passed through sandy formations without soluble material.

Besides the wells and springs from which water is obtained permanent streams in the area may also be listed among the sources of water supply. Beaver Creek always contains water, as do also Coldwater and Palo Duro creeks, though to lesser extent. These streams furnish a supply of water for stock pastured in their valleys and in a few cases could be used for purposes of irrigation.

The question of water supply for domestic purposes in Texas County is never serious. Though the rainfall is sometimes deficient for agricultural purposes this does not apply to water used for other purposes. Wells in the Tertiary are usually easily obtained in most localities and supplemented by springs and the streams furnish an adequate water supply. Since wells in the Tertiary are frequently fairly deep, windmills are almost universally utilized for pumping the water. It is customary to build an earthen dam across some depression in the vicinity and empound the water raised to the surface by windmill and pump. Such bodies of water are called "tanks" and are common features of the High Plains.

WATER ANALYSIS

The difference between water secured from the red beds and from the Tertiary formations is shown by two water analysis given below. The Guymon water was from the Tertiary, while that from Beaver came from the Permian. As can be seen the water from the Tertiary contains only 14.8 grains per gallon of material in solution as contrasted with 560.6 grains per gallon in case of the red beds water.

Analysis of water from red beds at Beaver City and from Tertiary beds at Guymon[1]*:*

Location	CaO	MgO	SO_3	Cl.	CO_2	Ins'ble	Tot. Sol.
Guymon	4.2	0.7	4.6	0.6	4.7	17.9	14.8
Beaver City, Beaver County	72.7	17.8	139.4	316.5	27.2	799.9	560.6

1. Gould, Chas. N., Geology and Water Resources of Oklahoma. U. S. Geol. Survey, Water-Supply Paper 148, p. 146, 1905.

Chapter V

MINERAL RESOURCES

The mineral resources of Texas County are very limited as far as any present development show. Building stone, road materials, sand and gravel, gypsum, lime and natural gas can be listed as the present mineral resources. These will be discussed briefly below.

BUILDING STONE

Certain strata of the Tertiary are known to be firmly cemented so that they can be used as building stone. No rule can be stated as to the occurrence of this material and it occurs in only thin layers, but in the past a limited use of the rocks has been made in constructing buildings. Old houses built of this material are still to be seen at some of the ranches, as for instance at Redpoint.

ROAD MATERIALS

Caliche in the Tertiary, and clayey horizons of both the red beds and the Tertiary have been used in the construction of roads in the county. In locations where sand is so abundant as to impair the condition of the road it is often necessary to add more binding material to render the road firm. Clay and caliche serve this purpose. Caliche because of its high calcium carbonate content is excellent because it binds and makes a firm, hard surface. It is doubtful, however, if this material would be satisfactory under continued wet weather.

SAND AND GRAVEL

Sand and gravel are very abundant in Texas County. Whenever local building conditions demand the use of these materials in concrete or other construction, an adequate supply can usually be obtained from the nearest stream.

GYPSUM

No attempt has been made to use the gypsum in the area for commercial purposes. The supply is not extensive and is observed only in one locality near Range in the southeastern corner of the county. The distance from shipping facilities renders doubtful the utilization of this material.

LIME.

At one time the caliche of the region was burned for the production of lime plaster for local use. Since the caliche is relatively pure, a product of good quality can be obtained. Because of fuel conditions of today it is found advisable to buy lime on the open market rather than to attempt its local production.

OIL AND GAS

TEXHOMA GAS WELL

Natural gas has been found in Texas County. A well was started November 15, 1922 by the Home Developing Company, a local company with headquarters at Texhoma, in the NW 1-4, SW 1-4, sec. 4, T. 1 N., R. 1 E., Cimarron Meridian. Work continued on this well for a little more than a year and it was completed on December 3, 1923. The total depth reached was 3,040 feet. The log of the well as reported to the Corporation Commission is given below.

Log of Texhoma Well, Sec. 4, T. 1 N., R. 1 E., C. M.

	Top	Bottom
Sandy soil	0	15
Sand and gravel	15	174
Hard sand	174	200
Red rock	200	315
Sandy shale	315	355
Red shale	355	400
Lime shale	400	420
Flint rock	420	425
White lime	425	433
Red brake	433	480
Red sand	480	510
Red shale	510	600
Sandy shale	600	640
Red shale	640	700
Red water sand	700	760
Red shale	760	775
Gyp rock	775	800
Red brake	800	825
Hard lime	825	860
Red shale	860	875
Salt rock	875	900
Red shale	900	910
Red sand	910	930
Salt rock	930	985
Red shale	985	1,000
Soft sand	1,000	1,025
Hard red sand	1,025	1,100
Soft red sand	1,100	1,220
Red shale	1,220	1,280
Red sand	1,280	1,300

Red shale	1,300	1,400
Red sand	1,400	1,425
Red shale	1,425	1,450
Red sand	1,450	1,467
Red shale	1,467	1,500
White lime	1,500	1,525
Sandy lime	1,525	1,575
Salt rock	1,575	1,650
Gyp rock	1,650	1,655
Black lime	1,655	1,670
Red shale	1,670	1,700
Red sand	1,700	1,740
Red shale	1,740	1,750
Broken sand	1,750	1,800
Lime shale	1,800	1,825
Red mud or shale	1,825	1,860
Broken sandy	1,860	1,880
Sandy hard lime	1,880	1,910
Red shale	1,910	1,950
Red shale	1,950	2,125
Red cave	2,125	2,160
Sandy shale	2,160	2,180
Hard lime	2,180	2,190
Blue shale	2,190	2,200
Sandy shale	2,200	2,210
Red shale	2,210	2,220
Hard lime	2,220	2,240
Red cave	2,240	2,250
Lime hard	2,250	2,260
Shale red	2,260	2,270
Lime hard	2,270	2,275
Blue shale	2,275	2,280
Lime white hard	2,280	2,290
Blue shale	2,290	2,300
Lime dark	2,300	2,310
Blue shale	2,310	2,340
Lime and shale	2,340	2,400
Blue shale	2,400	2,450
Lime hard	2,450	2,475
Blue shale	2,475	2,500
Black lime hard	2,500	2,520
Blue shale	2,520	2,545
Lime shale	2,545	2,555
Red shale	2,555	2,560
Lime white	2,560	2,570
Red shale	2,570	2,580
Lime white hard	2,580	2,590
Blue shale	2,590	2,620
Lime broken	2,620	2,630
Blue shale	2,630	2,670
Lime black	2,670	2,695
Gas sand	2,695	2,707
Lime	2,707	2,720
Blue shale broken	2,720	2,735
Red shale	2,735	2,740
Lime hard	2,740	2,750
Water sand	2,750	2,760
Lime hard	2,760	2,775

Shale red	2,775	2,780
Shale blue	2,780	2,800
Lime shale	2,800	2,825
Soft sand no water	2,825	2,850
Blue shale	2,850	2,875
Black and white lime	2,875	2,900
Red shale	2,900	2,925
Lime white	2,925	2,950
Red and blue shale	2,950	2,980
Lime white	2,980	2,990
Red shale	2,990	3,020
Red cave—Total depth	3,020	3,040

On September 27, 1925, the H. F. Wilcox Oil & Gas Co., started a well known as the Zea No. 1 in sec. 28, T. 3 N., R. 13 E. C. M., in Texas County. This well is near Redpoint, west of Guymon. The log of this well is given below.

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

	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	1,150
Sandy shale	1,150	1,260
Red shale	1,260	1,425
Red shale and sand	1,425	1,498
Gyp rock	1,498	1,500
Red rock	1,500	1,505
Shale	1,505	1,555
Gyp	1,555	1,585
Lime	1,585	1,600
Broken lime	1,600	1,608

Gyp and shale	1,608	1,634
Broken sand and shale	1,634	1,654
Shale	1,654	1,708
Salt	1,708	1,710
Broken sand and gyp	1,710	1,728
Lime shell	1,728	1,732
Broken sand, gyp	1,732	1,783
Shale	1,783	1,796
Gyp broken	1,796	1,798
Broken gyp and shale	1,798	1,888
Broken sand and shale	1,888	1,935
Sandy lime, shale	1,935	1,937
Broken sand, shale	1,937	1,950
Shale	1,950	1,995
Shale, gyp, sand	1,995	2,025
Broken lime	2,025	2,035
Gyp rock	2,035	2,045
Broken gyp shale	2,045	2,055
Broken sand and shale	2,055	2,075
Shale, sand and gyp	2,075	2,105
Gyp	2,105	2,110
Gyp and shale	2,110	2,125
Gyp and shale	2,125	2,133
Gyp	2,133	2,135
Gyp	2,135	2,143
Gyp and shale, broken	2,143	2,155
Shale	2,155	2,184
Gyp shell	2,184	2,185
Red shale	2,185	2,190
Broken gyp and shale	2,190	2,201
Gyp rock—Total depth	2,201	2,204

According to the common interpretation of the log of the Texhoma well, the Tertiary rocks were passed through at a depth of 200 feet, and the Permian red beds at a depth of 2,275 feet. The initial production from this well was variously estimated from 15 to 30 million cubic feet. We have not been able to secure accurate data as to the actual amount of gas produced. This gas has never been utilized but at the time of our visit to the well November 1924, it was shut in. With the completion of the Texhoma well, Texas County becomes possible oil and gas territory. It seems advisable therefore, to include in the present report some discussion of the origin and accumulation of oil and gas and the prospects for future production in Texas County.

THEORY OF OIL AND GAS ORIGIN

There are four essentials for the production of oil and gas in any particular region, namely: a source of supply, a reservoir rock, a cap rock, and some form of structure which will retain the oil and gas. Though the various essential conditions have been discussed in many places, and at great length, a brief summary may be of value here.

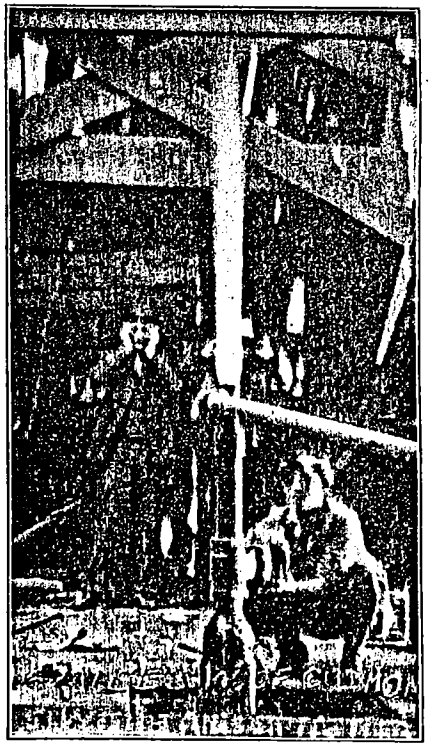


Plate IX. Gas well at Texhoma.

No one knows absolutely how oil and gas are formed. Some scientists contend that these substances are formed chemically in the earth by the action of super-heated steam on the carbides of certain metals, much as acetylene gas is formed by the action of water on calcium carbide. However, it must be said that relatively few geologists or chemists now hold to this theory of the origin of oil and gas. By far the greater number of both geologists and chemists hold to the organic theory for the origin of these substances. They believe that oil and gas were formed by the slow and long continued distillation of minute animals and plants that lived in the ocean when the rocks were laid down, and that these animals and plants gave up their organic parts to form oil and gas. At the present time the general concensus of opinion seems to be that the greater part of oil and gas were derived from waxy plants of marine origin, which were imbedded in mud and ooze which have since been consoli-

dated to form shales. There are even those who would contend that practically all oil and gas are derived ultimately from marine shales.

The second condition necessary for the accumulation of oil and gas is some form of a reservoir rock. This is usually an open, porous sandstone, usually spoken of in oil parlence as an "oil sand." In some fields, however, the reservoir is not a sandstone at all, but is an open, porous shale or broken limestone.

The third essential is a cap rock to retain the oil. This cap rock is usually a dense, massive shale or clay, although other kinds of rock may serve the same purpose.

The fourth essential is some form of structure, usually a dome, an anticline or a fault. To state it differently, there must be a high place in the rocks where the oil and gas may accumulate. In the majority of oil fields throughout the world this high place is in the form of an anticline or dome. In some fields, however, such as Mexia, Wortham, and others in eastern Texas, and in many of the fields in Mid-Continent region, the oil occurs along a fault line. It also occurs in lens-shaped or lenticular sands, where there is no definite surface structure.

LOCATING OIL FIELDS

The geologist in attempting to locate oil fields searches the country for evidences of structure. This is usually determined by the dip of rock ledges on the surface. If the geologist can find a ledge of rocks extending across the country for a considerable distance, and dipping from a high point, something like the comb of a roof, he will know that he has discovered an anticline, and will often be able to recommend that a well be drilled near the axis or apex of this structure. The geologist is never able to guarantee that oil will be found by drilling at any particular place, for he can have only a general idea as to what the underground conditions may be. It sometimes happens that there are no sands or other reservoir rocks, or there may be no cap rock to hold the oil. In many cases the sands encountered will be dry, that is, neither oil or gas will be found in them. A considerable part of the wildcat wells drilled even on well defined structure are non-productive.

During the last few years other methods for locating oil structures have been tried out, some of them with considerable success. The most important is core drilling, which is practiced in regions where there are no definite formations exposed to the surface. A number of shallow wells are drilled to some definite underground stratum, usually a ledge of limestone, and

by plotting the logs of these wells it is often possible to determine the location of a subsurface structure which does not show on the surface.

CONDITIONS IN TEXAS COUNTY

Texas County is not an easy region in which to do geologic work toward the location of oil and gas wells. The reason for this fact is that there are very few exposures of hard rock on the surface. As has already been stated the surface formations in the greater part of the county consist of clays, caliche, and conglomerate of Tertiary age. It is only along the margin of the streams that these beds of caliche and other hard rock forming ledges are exposed on the surface. It has also been shown that this Tertiary rock lies unconformable on the red beds beneath. Most geologists who have studied the entire situation throughout western Kansas, Oklahoma and the Panhandle of Oklahoma, believe that the great folds or structures which are found throughout the Mid-Continent oil field and in fact, throughout the Great Plains area, occurred before the Tertiary rocks were laid down. This being true it will readily be understood that any structures in Texas County, which might profitably be drilled for oil, are in all probability buried beneath the blanket of Tertiary rocks which in most cases effectively conceals them. As far as the writers have been able to determine from the study of surface beds there are no evidences of surface structure at Texhoma where gas was encountered.

When more well logs have been made available it may be possible to work out sub-surface structure in the region. There may even now be information of this character in the confidential files of several of the larger oil companies, but if so these data are not available to the Oklahoma Geological Survey.

CONCLUSIONS

It has also been stated under the head of "Stratigraphy" that the rocks beneath the Tertiary, consisting of red beds, believed to be of Permian age, outcrop in three places in Beaver County; namely, near Range in the southeast corner of the county, near the old postoffice of Redpoint, twelve miles west of Guymon, and along Tepee Creek. Investigations made in connections with the present report failed to reveal favorable structure for oil and gas at either of these locations. Several slight apparent dips which were noticed, were interpreted as cross-bedded rather than true structure.

It is altogether possible that oil and gas may occur in commercial quantities in this county. The finding of large quantities of both gas and oil in the Amarillo region of the Panhandle

of Texas, something like 60 miles south of Texas County, Oklahoma, has given an impetus to drilling in many parts of the Great Plains. The greater number of wells drilled off of well defined surface structures along the Canadian River, however, have proved non-productive. Two notable exceptions are the one referred to, near Texhoma, and a well near Liberal, Seward County, Kansas, not far from the northeast corner of Texas County, Oklahoma.

As this manuscript is being prepared for the press, there is considerable oil activity in Texas County. A number of blocks of leases have been secured and in February 1926, wells are reported as being drilled for oil. It is greatly to be hoped that some of these wells will be successful, and that profitable production will be found in the county.

Chapter VI

AGRICULTURE

By H. H. Finnell

SOILS

With regard to cultural problems the soils of this county fall into two distinct groups, the tight lands and the deep sands.

The tight lands vary in texture of top soil from loam to silty clay loam, but all types have a sub-surface layer of impervious clay loam or silty clay which is very compact in structure and usually from 18 to 24 inches thick.

The sandy soils vary in texture of top soil from loamy sand to loam and do not have sub-surface material finer than a sandy clay which admits of free water movement into the subsoil.

A common type of tight land consists of a dark brown to chocolate silty loam running into a dark brown clay loam at two to five inches which ordinarily merges into a light brown silty loam at 20 to 30 inches. Spots and streaks of calcareous material appear in the lower subsoil. This type of soil was formed by the weathering of Tertiary calcareous clays.

Another common type of tight land is quite similar to the above excepting that the surface soil has in many places been modified by the deposit of wind borne material. The silty loam surface soil 3 to 6 inches deep grades into a reddish brown silty clay loam with hard compact structure reaching a depth of 18

to 24 inches. The lower subsoil is more porous, sometimes running into a sandy silt and containing white to pinkish white calcareous material mottling the red. This soil is the product of weathered Tertiary calcareous silty clay or clay deposits from regions supplying considerable admixtures of red bed materials.

Tight lands in general are very fertile, long wearing soils, high in organic matter, and lie level or very gently sloping. They are adapted to small grains, sorghums, and annual legumes. Winter wheat is the most important crop grown on these soils.

The greatest problem entering into the farming of tight soils is getting a good supply of moisture into the sub-surface and subsoil preparatory to planting the crop. Light showers are ineffective in adding to the subsoil water store so that it is only when periods of several weeks excessive rainfall occur that the soil is able to accumulate much moisture. Should this happen immediately previous to a planting season good yields of any adapted crop may be expected. However, if some time must elapse between the accumulation of moisture and a suitable planting date, the complete control of weeds is necessary to save the moisture for the use of the oncoming crop.

Along with the difficulty of moisture control tighter types of soil possess the advantages of greater water storage capacity and freedom from erosion or leaching, so that available fertility accruing during fallow periods remains intact for the use of the next crop.

One of the most useful types of sandy loams and one of which large areas are found in Texas County has a surface soil of 10 to 12 inches of brown to reddish brown sandy loam, very loose and friable. The subsoil consists of brown to red sandy loam or sandy clay. Spots of white calcareous material occur at depths of from 20 to 36 inches. This soil was formed from sandy deposits of Tertiary or Quaternary age and in some cases materials have been transported to overlay beds of white calcareous clays, while in others the soil is undoubtedly the weathered product of a more sandy Tertiary deposit. Nearly all areas of this kind of soil show evidences of red beds material. The action of wind has complicated the formation of most sandy soils.

These lands do not present the difficulty of absorbing water experienced on tight land. Light rains are more effective in crop production. On the other hand they do not afford as great a storage capacity and slight losses are likely to occur from erosion and leaching. The chief problem of handling sandy soil is in giving constant attention to the prevention of blowing, and

maintaining organic water especially where cultivated crops are grown continuously.

Fertility varies, being low in the loamy sands but ample and highly available in the sandy loams and clays. The topography tends to be more rolling than the tight lands. The rolling character is very gentle and some large areas are to be found where sandy soils are very level and uniform.

These soils are highly prized as row crop lands. The sorghums, including milo, kafir, broom-corn, sweet sorghums and hay sorghums are the main crops. Annual legumes and sweet clover are also adapted crops. Sandy soils are generally preferred for fruit and vegetables especially where supplemental irrigation may be had. Limited areas of sandy soil lie in the stream valleys where sheet water may be reached at depths of 8 to 15 feet. Many very successful fields of alfalfa are to be found in such favored spots.

The native vegetation varies from pure short grass sod to various combinations of short grass, bunch grass, sage and yucca.

Jackrabbits abound in spite of frequent drives in which tens of thousands are killed. The prairie dog being more easily eliminated is gradually disappearing. Coyotes remain but are not serious farm pests except in particular localities.

CROPS AND FARM PRACTICE

Stream valleys cut the county into numerous irregular divisions of flat land. Most of the "break" land is used for grazing purposes, but there is still much tillable land included in the ranches. Considerable areas of farm land in smaller tracts also remains in native sod scattered through the farm communities.

The acreage of crops varies a great deal from year to year and depends somewhat on the planting conditions prevailing at the different seasons of the year. An average figure for Texas County shows 57 per cent of the tilled land in winter wheat, 3 per cent other small grains, 35 per cent milo, 4 per cent other sorghums, including broom-corn, and 1 per cent miscellaneous crops.

Intensive farming has been but little developed. A few private irrigation projects of from 20 to 640 acres are in operation. Alfalfa and market gardening use most of such water available.

Dry farming methods under high plains conditions necessarily call for an extensive scale of farm operation. While the

land was homesteaded in quarter sections the half section farm is now more commonly found. The following description of crop methods in vogue will indicate why large areas may be handled by one man and the cost of production on acre basis is low.

Deep plowing for wheat is not generally practiced and cannot be used unless it preceeds a season of fallow due to the limited rainfall. Since rains are relatively infrequent fewer cultivations are needed to control weeds. Strong wheat soils require only from 20 to 40 pounds of seed per acre. Hessian fly and chinch bug are unknown in the county. Harvest weather is usually favorable and the grain stands well after ripening. Headers have formerly been used to harvest the crop but recently they have given place to the combines. Grasshoppers are an occasional menace to the crop and hail is often severe in narrow strips.

The milo crop is planted in late spring or early summer and allows an opportunity for much of the needed cultivation for weed control before planting time. Lister planting admits of cheap and effective cultivation of the crop. One or two cultivations constitute the regular practice and the crop is harvested with the grain header and stacked in the open field for thrashing. Sheds are not considered essential for caring for broom-corn.

Rotation of crops is uncommon. Alternation of wheat and milo is more or less irregular. The use of legume crops is practically negligible, although tests of many varieties at the Panhandle Experiment Station, Goodwell, show productive possibilities which can be utilized when the type of farming may have changed to require their use.

The beef cattle industry was one of the earlier developments of the county and at the present time many purebred herds of Hereford cattle of a very high grade are to be found on the ranches.

The fluctuation of grain supply from year to year has tended to discourage hog raising on a large scale.

Dairy cattle and poultry are on the increase as indicated by the steady growth of the volume of marketable products of these two farm enterprises being shipped from the county.

CLIMATE, ETC.

The following climatological data is the average of records in the county of 15 years or more, the stations used being Hooker and Goodwell:

Temperature and Rainfall; Mean, Monthly and Annual

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An'l.
Temperature	33.5	36.0	49.9	55.0	62.8	77.5	78.0	82.4	70.3	62.4	44.7	33.4	55.6
Rainfall	0.24	0.80	0.48	1.49	2.70	2.22	2.39	2.38	2.20	1.37	0.72	0.79	19.88

Average length of growing season is 180 days.

Prevailing direction of wind, south.

The following are records for the year 1925 from Panhandle Experiment Station, Goodwell:

Relative Humidity; Mean, Monthly and Annual

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An'l.
Mean	65.9	59.6	50.9	53.9	61.3	53.2	60.9	62.2	65.8	69.6	63.1	62.4	60.7
Mean Max.	92.9	87.7	73.8	79.9	85.4	78.0	85.5	87.8	88.6	89.2	89.3	87.7	
Mean Min.	39.0	31.6	28.0	27.9	37.3	28.4	36.3	36.6	43.1	50.1	36.9	37.1	

Annual evaporation, open tank, 69.44 inches.

Annual wind movement 2½ feet from ground, 76,434 miles or 8.7 miles per hour average for year.

Abundant water of excellent quality is found at depths varying over the county from 100 to 200 feet.

The total area of 1,321,600 acres is roughly estimated based on adjacent surveys to be classified as follows:

Tight soil	666,650 acres
Sandy soil	574,330 acres
Breaks	66,080 acres
Alluvial	14,540 acres

Chapter VII

HISTORY

By M. L. Wardell

THE EARLY SOUTHWEST

Texas County is a part of old Beaver County which has long been known as "No-Man's-Land." The history of this area is the history of great continental land adjustments. The first established boundary of the region was that of the one hundredth meridian west longitude. In 1819 the United States and Spain by treaty determined the line of separation to be in part the Red River, the line one hundred degrees west longitude and the south bank of the Arkansas River. This allowed Spanish jurisdiction over what came later to be called Beaver County. It had been almost three centuries earlier when the Spanish first came into this territory. It was in 1539-1542 that Coronado was tramping about over the Southwest looking for gold. In his marches he crossed this Panhandle area of Oklahoma and in all probability as he traveled in a southwest direction to his base of supplies in New Mexico he crossed Texas County.

Until 1821 the Spanish colony of Mexico was badly governed. At that time, 1821, Mexico declared herself independent of the mother country and began to carry out the policies of a young nation. One of the policies was that of settling the country. Mexico continued to use the method that Spain had just started to put into operation. This colonization scheme was known as the empresario land system. It was first used in Texas by Moses Austin in 1821, was thereafter generally employed to settle large areas of that part of the Republic of Mexico lying north of the Rio Grande.

This land system was sort of a manorial plan. A man, the empresario, agreed to settle a number of families upon a designated tract of land—hundreds of thousands of acres—within a stipulated time. The empresario realized his profit by the government's granting him a liberal homestead of many hundreds of acres. Such a system did much to bring settlers into Texas as well as to encourage men other than Austin to undertake the promotion of settlement. Practically the whole of Texas was soon covered by empresario grants. Many of these in the present day Texas panhandle section came to nothing because of the distance from the base of supplies, the impossibility of farming and the yet unborn cattle industry.

The land hunger proclivity of the men of the thirties and forties led to the granting of vast tracts north of the Red River and west of the one hundredth meridian. The grant made to Wilson and Exeter included, in part, the north half of what is now Cimarron County and that of Beale and Royuella's, in part, the south half. The greater part of what is now Texas County was included in the Chamber's grant. All of what is the present day Beaver County was incorporated within the grant made to Dominguez.

In 1832 the New Arkansas and Texas Land Company entered into a contract with the State of Coahuila and Texas. Beale and Royuella of this company received permission to colonize a part of the vast unsettled domain. This contract called for the settlement of the south half of Cimarron County. The company had already, it seems, sent a surveying party to determine the boundaries of the grant. The work of this party took them into "No-Man's-Land" as they surveyed northward on the one hundred second degree west longitude approximately the present boundary line between Texas and Cimarron counties. Evidently this was the first official survey marking the boundaries of what in time should become Texas County.

While surveying this region the party found plenty of game and fruit along the creeks. Even an Indian fight of serious consequence was had. The fight, however, occurred, very probably, in what is now Cimarron County near the present Oklahoma-Kansas boundary line. Three men were killed and one slightly wounded before the attacking party was driven off.

The survey made at this time, as well as others, did not wholly come to nothing. Notes and descriptions of early surveys of this region may be found in the records in Beaver, the county seat of Beaver County.

NO MAN'S LAND

In 1845 when Texas was admitted to the Union the claims of boundaries advanced by this state were assumed by the United States. This, with other things, led to the Mexican war and the acquisition of more territory. By 1850 the demand for adjustment of difficulties arising partially from the newly acquired territory led to the great compromise—that of 1850. By virtue of certain provisions Texas was given control of boundaries as they are today. By this legislation the northern boundary became 36 degrees and 30 minutes north latitude. By other terms of the compromise New Mexico extended to the one hundred third meridian west longitude. In time the formation of Kansas and Colorado as Territories and later as states left that area lying south of the thirty-seventh degree north latitude without laws—either state or national—a narrow strip of land, "No-Man's Land." By some it was supposed to be under the jurisdiction of the Cherokee Nation but a supreme court decision in 1885 determined otherwise.

About 1862 Judge N. C. McFarland, Commissioner of the General Land Office, ordered a survey of this somewhat lost land. It was surveyed into townships of six miles square and marked with zinc markers, locally known as "pots." They are still to be found in various parts of the county. Slowly preparation was made for a place in which people could live with some assurance that in time there might be law and order.

At any time between 1880 and 1885 there were many settlers coming into this region. Since no laws were at hand to protect them, they proceeded to devise their own methods of regulation. A complete provisional territorial government was organized with a full quota of officers—executive legislative and judicial. This was the first local government ever provided for this area. It was called Cimarron Territory.

Counties were laid out but rivalry of two parties, purely local, led to disagreements, with one or the other party more or less in the ascendancy. Nevertheless at one time according to divisions made in 1889 what is now Texas County was included in Shade, Springer and Turner counties respectively from east to west: Springer county lay wholly within the present Texas County. The provisional government was lost by the opening of Oklahoma and its later development into Oklahoma Territory.

Great ranches began to cover all of this land by 1880. Soon great herds of cattle were grazing over the entire area. The valleys of Palo Duro creek and the Beaver River (north fork of the Canadian) afforded excellent pasturage. The winter of 1886-1887 was a hard one for all cattle owners. Thousands of cattle died and when spring came there were many men who never again made a serious effort to collect a great herd. This was true over the whole plains country.

Copper mining had considerable attention given it as an industry in the extreme portion of "No-Man's-Land" but the distance to railroads made it an experiment rather than a success. Agriculture was given attention only as much as was necessary to carry on the major industry—that of cattle raising.

SETTLEMENT AND GROWTH

In 1890 by provisions of the Organic Act this "Cimarron Territory" was made into Beaver County. The peculiar condition of non-contiguous land made up Oklahoma Territory. Beaver County was separated from "Old Oklahoma" by Indian lands. Until November 16, 1907, Beaver County comprised this whole strip of land which is one hundred sixty-eight miles long and a little more than thirty-four miles wide. The area is 5,738 square miles. This county was larger than the State of Connecticut by nine hundred and eighteen square miles and more than five times the size of Rhode Island.

The settlement of Beaver County developed slowly during the first few years of its history. The better land farther east attracted settlers more than the "semi-arid" country as maps designated it. The Governor's report to the Secretary of Interior in 1891 showed the population to be 2,982. Two years later it was 2,316 and in 1896, 4,778. There came a time, however, when settlers began filling up the eastern end of the county and gradually settlement pushed farther and farther westward. By 1900 the occupants of the land had entered what is now Texas County and by 1905 the settlement of the entire county was well under way.

The settlers came from neighboring states and the older settled portions of Oklahoma. Many came from the "East"—Illinois, Indiana and no small number came from Arkansas and Kansas. There was somewhat of a tendency for settlers from a particular state to group themselves together and in that way formed colonies. This, however, was not very commonly found.

Those who came into this region to take up land had to have their filing papers completed at Woodward but in order to avoid delay and a long drive, application for filing on homesteads could be made at Guymon. R. B. Quinn was the first United States Court Commissioner with whom application could be made. His office was a very busy place during the years of rapid settlement. The land was easily and quietly occupied. There was but very little claim jumping for the land as a whole is about the same quality and claims were practically equal in value. The distance from the railroad made the greater difference.

This section was greatly benefited by the Chicago, Rock Island and Pacific Railway Company's building into the county in 1900. This road extends diagonally across the county entering at the northeast corner and leaving the county in the southwest

corner. Fifty-five miles of this road are within Texas County. It is said that from a point near Guymon southwest toward Dalhart, Texas, the road has one of the longest stretches without the slightest curve of any in the United States. Such a condition exists because no rough country of consequence obstructs the building of an "air-line" road. Much traffic passes over this road which is the main line extending into the Southwest from Kansas City to El Paso and westward to California.

Along this line towns began to grow very rapidly. Tyrone is the first town on the road after leaving Liberal, Kansas. Southwest of Tyrone is Hooker, named for a man by that name. It, like Tyrone, is a great wheat market. With a railroad, Beaver, Meade and Englewood, now being built from Forgan, Beaver County, to this town, it has a future in being somewhat a distributing center. Between Hooker and Guymon is the little town of Optima. This place has long had a history of some importance.

Guymon, the county seat and largest town was named for E. T. Guymon, a merchant of Kansas who was interested in the building of a store at that place. It is the principal town of the county due to its being the county seat and its central location. It is the only town in the county that has paved streets. In a survey made in 1921 Guymon was rated the highest in the state in the percentage of home owners.

Goodwell gets its name from a good well of water that once was one of the few to be found in the whole country. Wells are drilled quite deep—one hundred to two hundred twenty feet—in order to find water in sufficient quantities. The state school, the Panhandle School of Agriculture, aids very materially in helping the town into its place among the others of the Panhandle country.

On the Texas-Oklahoma state line is situated the town Texhoma. The interests of this town are somewhat varied. The Texas country lying to south is a great grazing section. The cattle on these Texas plains are frequently carried through the severe winters by the feed that is shipped here. The Oklahoma lands around Texhoma are devoted more to farming than to cattle raising.

Early in the county's history there were numerous railroad surveys here and there. In some instances every assurance was given that the road would surely be built. On the strength of such prospects town sites were laid out. Sometimes a town would be built and all plans made for the first train which never came. Such a town that built and waited for a railroad was

Carthage in the northwest part of the county. For years it appeared that a reason might be found for its continued existence. At one time a test well for oil was drilled but nothing came from this enterprise. In time the Atchison, Topeka and Santa Fe Railway Company constructed a road from Dodge City to the Oklahoma-Kansas state line at a point not more than seven or eight miles from Carthage. The terminus of this road for several years was Elkhart, Kansas. This town served the interests of the settlers in the northwest part of the county and caused the final abandonment of Carthage. This road, the Santa Fe, has now (1926) extended far into Cimarron County, having reached Boise City, the county seat, in the summer of 1925. The road as constructed extends across the northwest corner of Texas County.

Alamo, in the north-central part of the county, had an experience not unlike that of Carthage. It one time was a very thriving place and a center of community interest but the construction of railroads in the other parts of the county and the coming of automobiles helped to make it of little importance.

LIFE ON THE CLAIM

Scattered here and there over the county in its early days were many little country stores in which postoffices were housed. Some of these stores were "half dugouts" while others were frame houses which showed that the owner came into the country with finances sufficient to make his residence the center of the community. Gradually these country stores began to disappear as roads improved and the automobiles made the miles shorter. Then, too, in time rural free delivery of mail made many of the postoffices useless or eliminated them at once so there was no reason for the continuance of the store. In many instances the owners of these stores left the country as soon as the claims were "proved up." Sometimes, however, a neighbor would buy the small stock of goods and continue the store. Several causes induced such transactions. With careful buying and selling a small income could be realized. The joy of having someone come in to spend an hour was an item of no small consequence during the long winter days when there was but little to do. Then, too, there was at times the necessity of the postoffice and it could be continued only by some accomodating man. In that case a store had as well be "kept."

The early days in Texas County were truly pioneer days. They did not last as long as in some parts of the United States in the earlier pioneer times. Conditions would not allow it.

Many hundreds of "dugouts" and "half dugouts" were to be found housing families that came to make their homes in the new West. Here were the opportunities to have a quarter section of land for the asking and the perseverence to stay five years. Now and then an old man and his wife who had seen frontier life before would come to take a claim, more often the settlers were young or middle aged. Many unmarried men and women came to take advantage of the free lands. Bachelors and old maids were much in evidence. The former were largely in the majority. All these made up the community of early settlers.

Often when the young farmer and his wife came to the claim in the spring and made ready to plant the crops there was but little prospect for much remuneration. It was a very common occurrence to see the young man hitch his one team to the covered wagon and drive to the harvest fields of Kansas or eastern Oklahoma after the crops had been planted. This was nearly the only way by which finances could be prolonged. It was a hard summer driving to the harvest fields where probably both the husband and wife worked to collect a few dollars before coming back for the winter. Upon his return to the claim the "sod crop" might be nothing or it might have made fodder for the team.

There was no time for regrets. Provision had to be made for the coming winter. It was more than likely that the "dugout" needed repairs and a stable of some sort had to be built for the team. Such duties claimed the attention of the homesteaders during the fall months.

The problem of securing fuel was serious in many cases. Coal cost a good deal of money and moreover it was a long drive to the railroad town for many of the settlers. There was no wood to be had—not even for fencing the farms. The resourcefulness of the American pioneer was never more in evidence than in this extremity for winters are sometimes severe in Texas County. Wagon loads of "buffalo chips" were gathered and burned. Thousands of early settlers warmed themselves by fires kept alive throughout the winter by this product which is no poor substitute for coal and wood.

The transition from a grazing country to one of agriculture is sometimes difficult. It generally means the cattle men who have had the great spaces to themselves retreat with reluctance. They hesitate as long as possible to fence their pastures. It means great expenditures, a drawing in, while heretofore the word has been expansion. It would have saved the cattlemen

much time and labor if the farmers had fenced their small crops and let all the cattle graze the prairies. This was agitated in certain sections of the county. The farmer generally felt that cattle should be carefully herded or placed in pastures. This idea was the prevalent one and all saw the necessity of fencing as many acres as possible.

It was a task to get posts for fencing the pastures. There are but few places in the county where there are trees enough for posts. The farmers in the west end of the county often drove to the west end of Cimarron County or even into New Mexico for cedar posts. The cedars are found in the hilly country and in the foothills of eastern New Mexico. Going into this western end of the Panhandle for posts served a double purpose. Sometimes a few hundred pounds of coal from the surface mines were brought home to supplement the "buffalo chips."

In time the homesteader began to collect cattle around him so he might "stay with the country." Butter and cream could be sold at almost any of the country stores. The income from this source was not large but it was steady and came from no large investment in the beginning inasmuch as the farmer kept the increase of the herd instead of selling it. This made it possible for many to continue living on their claims until better days should come. Herds of cattle increased in numbers until many farmers owned from ten to thirty or more. In many cases by the time the herds had grown to this size a half section or section could be grazed. Those who were able bought adjoining homesteads but if they could not be bought it was not uncommon for the land to be rented even for the paying of the taxes. In this way a rather large pasturage area could be had.

These pioneers were no less enterprising when they were faced with the difficulty of providing churches and schools. As soon as a few families settled in a neighborhood efforts were made to secure a school building suitable for their needs. Either a building was erected, a "half dugout" made or an abandoned house served as a temporary arrangement. The half dozen or more pupils came together to do the best they could under the circumstances. The selection of teachers was limited for the salary was a nominal one, however, there were to be found now and then well qualified teachers who lived on nearby claims and could be employed. They were generally glad to teach school for two or three months and thus add a few dollars to their meager bank account. Very soon after the settlers felt themselves established, better conditions were provided. Sometimes excellent "half dugouts" were the school buildings. Good schools soon came; also more and better teachers.

The school houses were widely used for church purposes. The pioneer preacher had a shorter period of really pioneer conditions than some frontier communities yet some of these itinerant preachers experienced the hardships of long drives in bitter cold weather to preach to these rural communities far from the towns. The moral tone was always good and the influences of the church communities was far-reaching.

There were many events to break the monotony of the year in the first early days. Frequently when the crops were planted and cared for the men and boys met at central points and organized baseball teams. This was a sport that interested all for those who could not play could watch. In the fall coyote hunting afforded much sport and pleasure. Hunting was usually limited to small game. Drives were organized by which method the rabbits and coyotes were driven for miles to a central point. Here the dogs and hunters finished the day. As in all frontier communities dances were often found giving an outlet for social activities. No eight piece orchestras were provided. Sometimes an organ was used but more often a fiddle or two served to make the music. On certain occasions such as the Fourth of July or Thanksgiving a community would gather for dinner at the school house or the church. This afforded a gathering of the rural folk which largely took the place of the log-rolling or barn-raising in the pioneer days of earlier generations who lived in the timbered regions.

STATEHOOD AND TEXAS COUNTY

When Oklahoma Territory was ready for statehood Beaver County was well settled. A very substantial population was to be found in both the towns and country. In dividing the Territory into districts necessary for the selection of delegates to the constitutional convention the west two-thirds of Beaver County, now Texas and Cimarron counties, was designated as district number one. T. O. James, a democrat, of Guymon was elected to represent this district in the writing of the constitution for the new State. This constitutional convention met in Guthrie November 20, 1906 and sat in almost continuous session until April of the next year.

According to the constitution as it was written Texas County was defined as follows:

> All that part of the former county of Beaver, Territory of Oklahoma, extending from range line between nineteen (19) and twenty (20) east of the Cimarron meridian, to the range line between range nine (9) and ten (10) east of the Cimarron meridian. Guymon is hereby designated as the county seat of Texas County.

This is virtually identical with the one hundred first and one hundred second meridians west longitude. There was a "gentleman's agreement" between Guymon and Goodwell that if Goodwell would give its support to Guymon for the county seat the latter town would support Goodwell in its asking for the district agricultural school. This agreement was observed.

The vote of the county on the adoption of the constitution was decidedly in favor of that document, 2561 to 531. At the same time the vote was cast on the adoption of the constitution the prohibition clause was submitted for approval or disapproval. The county favored the prohibition enactment by a count almost two to one, 1839 for and 1005 against it. The vote on state officers indicated a democratic majority which is generally maintained to this day.

With the creation of new counties there arose the necessity of courthouses. Texas County had to secure a suitable place in which the business of the new county could be carried on. There was provided a long one story frame building which was used until January, 1911, when it burned. The county records were then moved into the Summers building where the business of the county was transacted. In 1913 a new location was secured. A rather commodious building that had been used at one time for a hotel was purchased by the county and remodeled for the courthouse. This building is in use at the present time, but a new one costing $150,000 is now being constructed.

Some attention has been given the educational interests of the county, particularly during the earlier days. There is need of the mention of higher educational interests. The principal school of the Panhandle is the Panhandle School of Agriculture, which was first known as the Panhandle Agricultural Institute. The school has grown rapidly from a secondary school to one which is now authorized to offer four years of college work. The school is equipped to care for more than three hundred fifty students. A real service is rendered by this institution in providing not only higher education for the young men and women of the northwest part of the state but as an agricultural experimental station. Seven hundred twenty acres are devoted to agricultural purposes and building sites.

When Guymon was having its boom days and showed a decided increase in population from year to year it was proposed by the Christian church that a college be built there. A piece of land was contracted for and plans laid for the sale of lots but the project came to nothing primarily due to the lack of funds.

At present the county school system incorporates several

consolidated schools. The city school systems have grown proportionately with the other interests. The youthfulness of the county in every respect assists in making each enterprise one of worth. The consolidation of rural schools which has been given such an impetus in Oklahoma has been given every consideration here with generally good results.

In 1913 the School Land Commission conducted a sale of the school land located in the county. This land which comprised thousands of acres that had not been filed upon at the time of the passage of the enabling act, was given the state by the Federal Government to be used for the aid of schools. The disposal of this land by auction, upon very favorable terms, allowed the farmers to buy and add pasture land to their farms. Generally this was land which had been passed over by settlers for the more desirable level tracts. In several ways the county benefited in that it made the land taxable and the farmers felt a sense of ownership which lends support to a growing community.

Along the larger streams and where there is a large acreage of rough land are to be found many large ranches. The bottom land affords excellent pasturage and meadows from which hay for winter feeding can be cut. One of the largest ranches extends up Beaver River and Goff Creek from a point not far from Guymon. The so-called "north pasture" is about thirty-five miles in length and from two to four miles wide. The "south pasture" is hardly so large but can carry as many cattle on account of the well watered Beaver Valley. In the southeast part of the county are several large ranches in which may be found thousands of head of cattle.

The county is crossed by good highways. State highway number eleven enters the county from the east extending to Hooker from which place it parallels the railroad to Guymon. From that town it extends northward about four miles and then westward into Cimarron County. The Dallas-Canadian-Denver highway passes through the county in a generally northwest direction. Both these highways, being kept in excellent condition, are used extensively by motorists on their way to and from the Colorado and New Mexico summer camps.

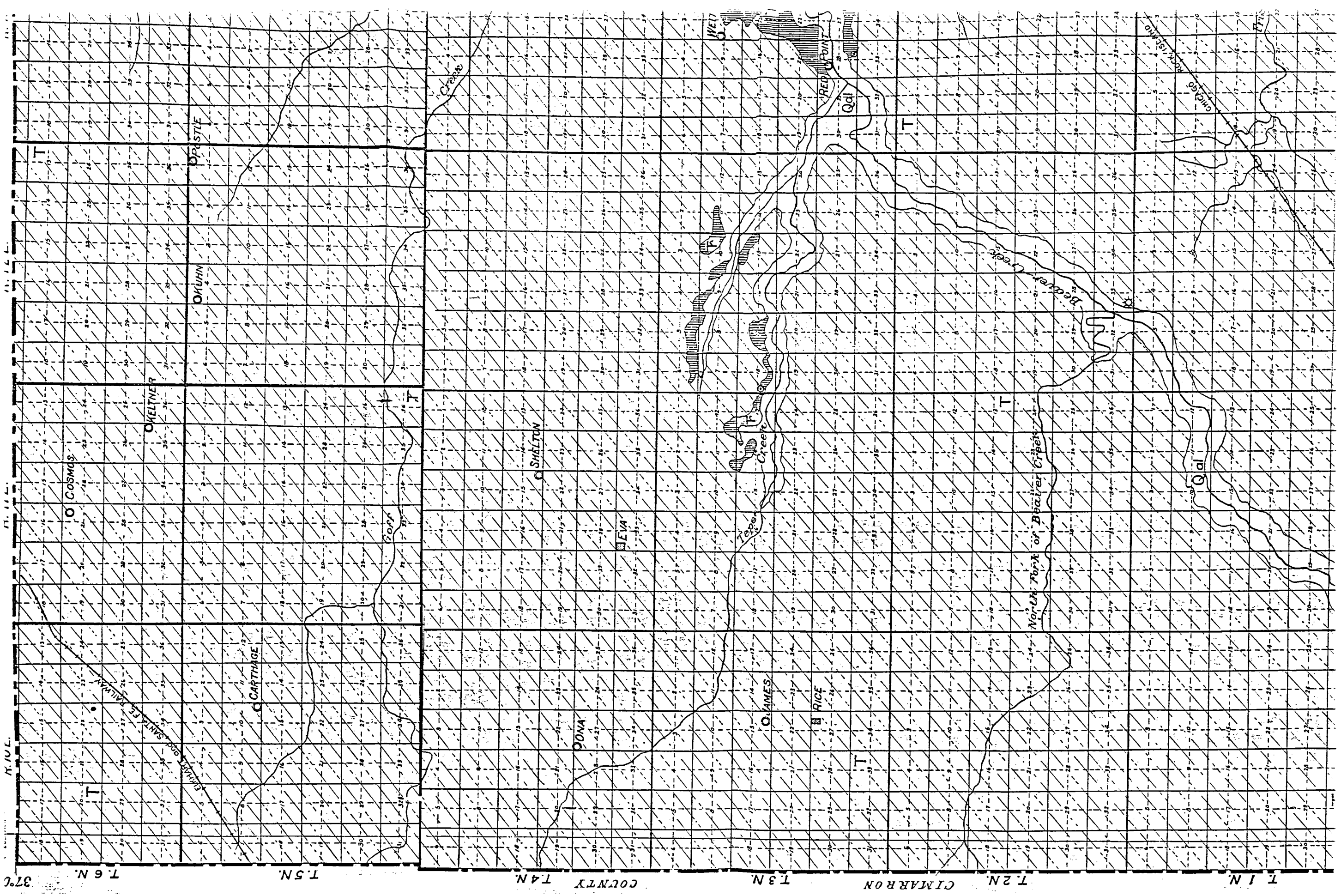
At a very early date the county's first newspaper was the "Hardesty Herald." When Guymon began to build into a town of considerable importance this paper was moved from Hardesty and published under the name, "Guymon Herald." Generally there have been two papers in Guymon. At the present time they are the "Guymon Tribune" and "The Panhandle Herald."

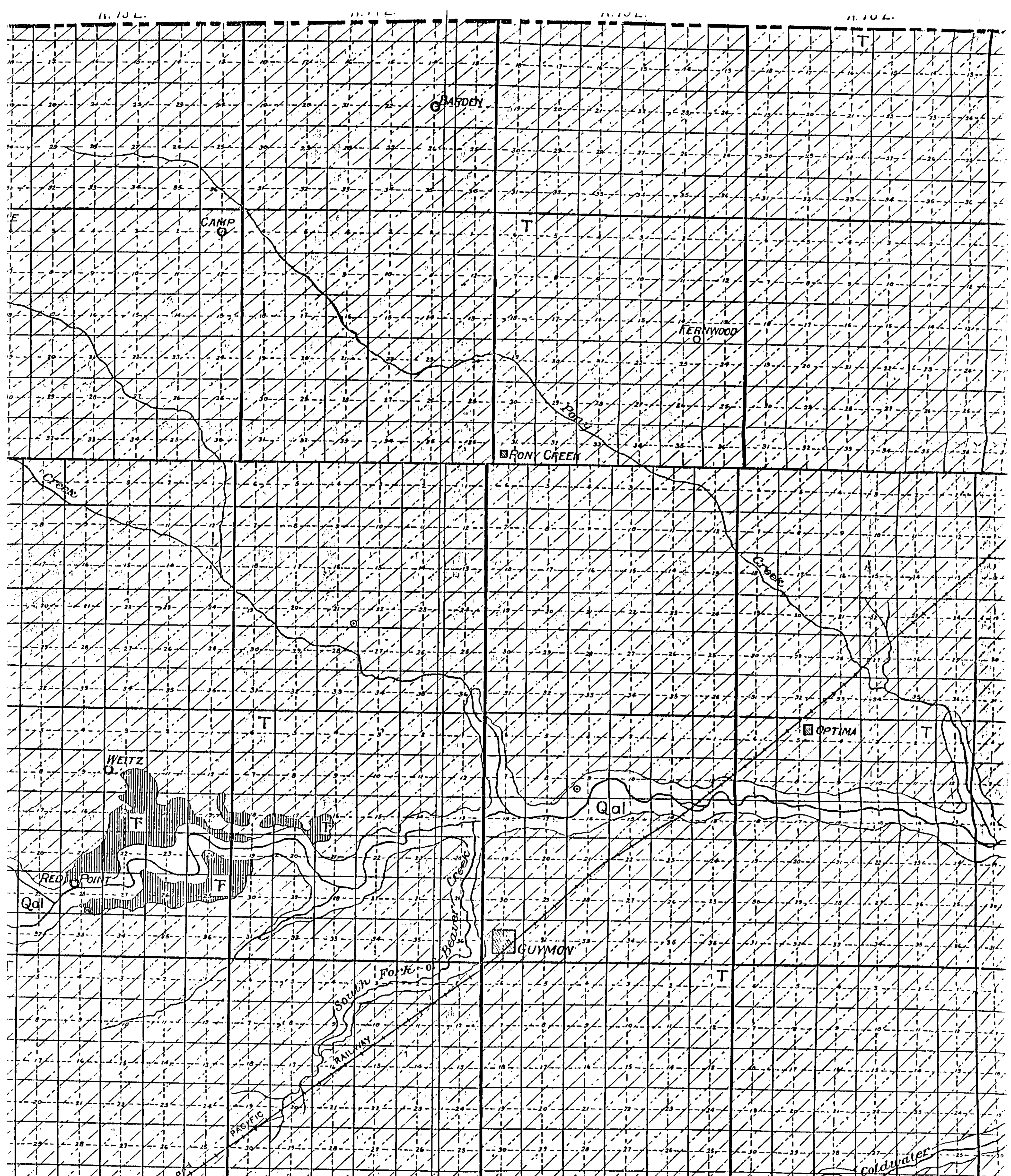
Tyrone and Hooker each have a newspaper. Tyrone publishes the "Tyrone Observer" and Hooker supports the "Hooker Advance," "The Texhoma Times," published at Texhoma serves the interests of both the south side of Texas County and the Texas country joining the county.

There are ten banks in the county. Two of these are state banks located in Optima and Goodwell. The others are national banks, two in each of the towns, Tyrone, Hooker, Guymon, and Texhoma. The county's wealth is founded upon cattle raising and agriculture.

There are in Texas County two things of remarkable importance. One fact is that in 1920 the county was the banner wheat county of the United States. The average yield that year was twenty-two and one-half bushels to the acre. Moreover in past years the grade of the wheat has been such that it has won first place in the International Wheat Exposition, the second point of interest is concerned with the county's part in the Great War. Among those entering the army there were fewer rejections on account of physical defects than in any other county of the state. The hardy pioneer citizenship reflects the frontier characteristics such as have been found in all American frontiers.

Today Texas County has its established principles of progress. The development of oil is at this time causing considerable interest in the county. The major oil companies of the Southwest are engaged in drilling wells in several parts of the county. Thousands of acres are now leased for drilling. Gas wells are already producing in paying quantities. The oil industry is creating a new interest in the county.


COSMOS
KELTNER
KUHN
PASTILE
SHELTON
CARTHAGE
EVA
ONA
JAMES
RICE
WELL
REDLAND POINT
CHICAGO
Qal
Beaver Creek
North Fork of Beaver
Cimarron River
SANTA FE RAILWAY
T 6 N.
T 5 N.
T 4 N.
T 3 N.
T 2 N.
T 1 N.
COUNTY
CIMARRON



BARDEN
CAMP
KERNWOOD
PONY CREEK
Pony Creek
WEITZ
RED POINT
Qal
T
OPTIMA
GUYMON
South Fork of Beaver Creek
CHICAGO ROCK ISLAND and PACIFIC RAILWAY
GOODWELL
Frisco Creek
Coldwater

R. 19 E.

37°00'

T. 6 N.

T. 5 N.

T. 4 N.

T. 3 N.

T. 2 N.

T. 1 N.

COUNTY

BEAVER

TYRONE

HOOKER

HARDESTY

GRAND VALLEY

CARTE

RANGE

Chicago, Rock Island and Pacific Railway

Beaver Creek

Hackberry Creek

Palo Duro Creek

Chiquita Creek

T

Qds

Qal

Ccc

LEGEND

CENOZOIC

QUATERNARY

Qds — Dune sand

Qal — Alluvium

TERTIARY

T — Late Tertiary (Unconsolidated sand, and gravel, caliche)

PALEOZOIC

MESOZOIC

TRIASSIC(?)

Tr — Red beds (Red and buff colored shales and soft sands.)

PERMIAN

Ccc — Cloud Chief gypsum (Red clay-shale with thin ledges of gypsum.)

Post office

Old town

Drilling location

Gas well

Dry hole

GEOLOGIC MAP OF
EXAS COUNTY

GEOLOGY BY
Chas. N. Gould and John T. Lonsda
WINTERS, 1924-1925

SCALE

N

101°30' (APPROXIMATE LOCATION)

S

R. 14 E.

R. 15 E.

R. 16 E.

R. 17E.

R. 18E.

101°00' (APPROXIMATE LOCATION)

R. 19 E.

T

A

S

GARDEN

KERNWOOD

PONY CREEK

PONY

TYRONE

HOOKER

CHICAGO ROCK ISLAND and PACIFIC RAILWAY