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MINERAL RESOURCE SURVEY
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The information contained in this circular was gathered by a unit of the WPA Mineral Resources Survey of Texas, a project sponsored by The University of Texas, Bureau of Economic Geology. The purpose of this survey is to assemble information concerning mineral products and to gather other geologic data and make it available to the public. With this information in the hands of the public, it is reasonable to suppose that industries of value to the State may be developed. The following report is based on work done in Baylor County by Work Project No. 5765, from April to July, both inclusive, 1938.

REPORT ON THE MINERAL RESOURCES OF BAYLOR COUNTY, TEXAS*
by Glen L. Evans, Supervisor

The objectives of this survey were twofold, first, to locate road building material, and, second, to make observations on the surface geology of the county. Work on road materials was confined to those areas most likely to contain such deposits and to areas in the county where there was a great need for such materials.

LOCATION AND DRAINAGE

Baylor County is situated in north-central Texas and comprises about 900 square miles of territory. It is drained by Brazos, Big Wichita, and Little Wichita rivers and their tributaries. The larger streams flow in a general easterly direction. The topography varies from gently rolling in some parts of the county to hilly in other parts.

ROAD MATERIALS

Gravel deposits in Baylor County are widespread and represent a variety of occurrences and ages. They occupy different topographic positions ranging from the surfaces of interstream divides and ancient peneplain remnants to the present stream beds where deposits are still in process of accumulation. The workable gravel beds occur along the eroded edges of the Seymour deposits which are present on the interstream divides in the western part of the county; in the terraces of Big Wichita River, Brazos River, and Miller Creek; and as residual accumulations in various parts of the county. The Seymour deposits and stream terraces contain mixtures of gravel and clay, or of gravel and caliche, that are suitable for open surface roads; gravel comparatively free of fine-grained material suitable for aggregate in sealed surface roads (penetrating asphalt or water-bound macadam roads); and clean sands and gravels suitable for concrete work. The residual deposits can be used satisfactorily only for open surface roads.

The investigation included examination of old pits and natural exposures; in addition several hundred test holes were made in unworked localities where information concerning the quality and quantity of the material could not be otherwise determined. Although a number of very good deposits was located, not every deposit appearing in the following list is to be considered of the highest quality. In some instances, where unimproved county roads are so far removed from any known supply of the better grade materials that surfacing from such deposits would prove costly or impracticable, easily accessible deposits of somewhat inferior materials are listed. However, no deposit will be listed that is not considered of sufficient quality to make an open surface road that is easily passable in all weather conditions or that is not sufficiently accessible for economical development.

Location No. 1. — On land owned by the Seymour Merchantile Company, about 0.8 mile west and 0.5 mile south of Red Springs:

This deposit is in the edge of the Seymour gravels and caps a low ridge lying on the east side of a county road. The workable material is from 3 to 7 feet in thickness and is covered by a light overburden of soil. The material is composed mostly of rounded quartz and quartzite pebbles in a matrix of sandy clay and caliche. It is estimated that this deposit contains enough material to surface from 3 to 4 miles of road with a standard course.

Location No. 2. — On the Arthur McReynolds farm, about 1.5 miles northeast of Shady School, and on the east slope of a small creek valley:

At this locality the workable material is found in a series of small ridges extending outward on the slope of a creek valley. Since the low areas between the ridges are barren of gravel, the deposit would have to be worked as several small pits. The overburden is very light at the outer edge of the outcrop but increases in thickness up the valley slope. The gravels in this deposit are well rounded quartz and limestone pebbles and are intermixed with a small amount of sandy clay and some caliche.

Location No. 3. — On land owned by Tom Shawver, 1 mile west of the Shell Pipeline Company station, and about 0.3 mile south of a county road:

This deposit caps a low ridge immediately outside the northeast corner of a cultivated field. The material is composed of limestone fragments and claystone nodules mixed with calcareous clay. The deposit has a thickness of about 3 feet and is covered by a thin mantle of soil. This is not a large deposit, but it has the advantage of ready accessibility, and it can be worked economically.

Location No. 4. — On the Clarence Sanders farm, 2 miles east and 1 mile south of Ogden School, in the north edge of a cultivated field:

This deposit is a terrace remnant of Brazos River. The gravels are well rounded and for the most part are less than 1 inch in diameter; however, some cobbles of quartzite and limestone are present. The workable material has a maximum thickness of about 6 feet in the

*Assistance in the preparation of these materials was furnished by the personnel of Works Progress Administration Official Project No. 665-66-3-233.

area tested. There is a large amount of gravel present at this locality, but most of it underlies an excessive overburden of sandy loam. The best place to work the deposit would be on its north edge where erosion has removed most of the overburden.

Location No. 5. — On the A. P. Donnel land, about 3 miles south of Seymour, and on the east side of State Highway No. 23:

Several acres at this locality lying to the north of Cache Creek and between the State highway and Brazos River are covered with stream-laid deposits consisting of silty clay, sand, and gravel. In at least three places within this area there are concentrations of gravel sufficient to warrant the opening of pits. Most of the gravels are well rounded and have been transported from a distant source, but a few cobbles and boulders of limestone derived from the underlying bed rock are also present in the deposit. Most of the gravel on the Donnel land contains sufficient binding material for road surfacing purposes. The workable material varies in thickness due to the lenticular character of the deposit and to erosion of its surface but is estimated at approximately 5 feet.

Along the riverward edge of the property joining on the south side of the Donnel land is a thick bed of sandy gravel which is cemented in places by caliche. There is a large quantity of this material, part of which, if screened to remove the sand, would serve as a concrete or asphalt aggregate.

Location No. 6. — On the D. Y. Goodwin land, 0.8 mile south of Ogden School, and on the east bluff of a small creek:

The gravel in this deposit is of good quality and is covered by a very light overburden. The material consists mostly of quartz gravels mixed with some sand and calcareous clay. The thickness of the workable material varies from 4 to 10 feet. The deposit contains approximately 8000 cubic yards of easily accessible road gravel.

Location No. 7. — On the Self property, about 0.3 mile south of Miller Creek, and 0.2 mile east of State highway No. 23:

This deposit is in the second terrace of Miller Creek and consists of water-worn limestone fragments derived from the lower Permian limestone beds which outcrop along the drainage area of Miller Creek. This locality has been worked to some extent by the Texas Highway Department, but a large quantity of good road material is still remaining.

A similar deposit which has not been worked can be found on the north side of Miller Creek, about 0.4 mile west of the highway.

Location No. 8. — In the southeast corner of the Craddock ranch, about 0.2 mile west of a county road leading from Seymour to Lake Kemp:

At this locality a series of rather thin deposits of fairly good surfacing material occur along the weathered edge of a stream divide bordering Gray Creek valley. The material is residual in origin; it consists of pebbles derived from an overlying Permian conglomerate and of the coarser and more insoluble residues of clay. Actual use of similar material for surfacing roads in Baylor County has demonstrated its suitability for such purposes. The average thickness of this deposit is not more than 2 feet and for that reason could be worked most satisfactorily along the edge of the divide where the overlying soil has been removed by erosion.

Location No. 9. — On the C. F. Elam farm, 2.5 miles west of Westover, and 0.7 mile north of State highway No. 24:

The material in this deposit is composed largely of hard, irregularly shaped nodules derived from the weathering of clay beds. The workable material has an average thickness of about 2.5 feet and has no appreciable amount of overburden. It is estimated that the deposit contains approximately 6000 cubic yards of good road surfacing material.

A continuation of this deposit can be found on the east side of the adjacent road on the Kate Leathers property.

Location No. 10. — On the Duberry land, 1 mile north of Gimtown station, and on the west side of a county road:

This deposit has a maximum thickness of about 5 feet and is covered by a soil mantle varying from a few inches to 2 feet in thickness. Practically all of the material in this deposit is of local origin derived from the weathering of clay and limestone beds. Some large pieces of rock are found in the deposit, but their number is not large enough to depreciate materially the value of the material for road surfacing purposes. The amount of accessible material in this deposit is estimated at 12,000 cubic yards.

Location No. 11. — On the Charlie Reynolds farm, 5 miles southeast of Seymour, and on the east side of Brazos River:

At this locality several deposits of good material occur along the weathered riverward edge of a stream terrace. Both sand and gravel are present in this deposit. Some of the material would be suitable for a concrete aggregate provided it was washed and screened before using. Most of the material contains too little clay or other binding substances to make a satisfactory open surface road, although it should serve very well for a base material in asphalt or water-bound macadam paving. The deposit has a maximum thickness of about 12 feet and is covered with an overburden from 1 to 4 feet thick. The quantity of available material is estimated at 18,000 cubic yards.

Location No. 12. — On the south side of the Rendham town site:

This deposit is composed of limestone and claystone fragments inclosed in a groundmass of somewhat earthy, calcareous clay. In places the deposit is cemented into a conglomerate by caliche, and the individual fragments of the unconsolidated material are coated by lime. The material varies in thickness but will probably average about 2.5 feet. The west edge of the deposit contains the best material and has the advantage of a lighter overburden.

Location No. 13. — On the Roy Quiesenberry farm, 1 mile north and 0.7 mile east of Gimtown station, and about 0.2 mile south of a county road:

The material in this deposit has an average thickness of about 3 feet and covers an area about half an acre in size. The deposit caps a low ridge which lies partly in a cultivated field and partly in the adjoining pasture. This gravel will make a satisfactory open surface road. The overburden is comparatively thin and will not present any difficult problem of removal.

Location No. 14. — On the Self property, adjacent to a dirt road leading past Self School, and about 0.8 mile southeast of State Highway No. 23:

This deposit is in a terrace remnant of Brazos River. It has been worked at intervals for gravel to make a base for an asphalt road and for concrete sand and gravel. The material consists mostly of quartz sand and gravel. There is very little clay or other foreign substances in the deposit. A large quantity of good material is still present in this locality, and the overburden is not great enough to hinder further development of the pit.

Location No. 15. — On the J. T. Cockrell survey, 1.4 miles west of Ogden School, and on the north side of a county road:

The gravel in this deposit is a good quality surfacing material. It consists mostly of quartz pebbles mixed with alluvial clay. The deposit has a maximum thickness of at least 10 feet and is covered by a very light overburden. The good quality of the material in this locality and the fact that the deposit lies adjacent to a good county road make it a likely place for future development.

Location No. 16. — In the southwest corner of the J. T. Cockrell survey, on the east side of Brazos River:

This deposit is in the riverward edge of a high terrace of Brazos River. The gravel is of good quality and contains adequate clay to provide a binder for the coarser particles. The overburden is very thin near the river bluff but thickens up the slope away from the river. The workable material, in some places at least, has a thickness up to 15 feet. It is estimated that at least 40,000 cubic yards of good road gravel could be taken from this deposit without stripping more than a few feet of overburden at any point. This locality has the disadvantage of being located some distance from the nearest road. It would be necessary to open a road about 0.5 mile long before the deposit could be worked.

Location No. 17. — On a farm owned by Paul Prickett, 1.5 mile northeast of Westover:

The material at this locality is composed largely of limestone pebbles and nodules mixed with calcareous clay, soil, and sand. The deposit has an average thickness of about 4 feet, with an overburden of about 1.5 feet. Like most of the other deposits in Baylor County in which the material is derived from a local source, this material could be used only for making an open surface road. The best place for opening a pit at this locality would be in the southwest corner of a small pasture and to the north of a wooden barn.

Location No. 18. — On the Will Hale farm, about 2 miles east of Westover, and on the north side of a county road:

The workable material in this deposit has an average thickness of about 2 feet, and covers an area of about 1 acre. The best material, which is also under the lightest overburden, is found near the top of a slope on both the north and south sides of a small earthen water tank. The material is not of high quality but is suitable for road surfacing purposes.

A similar deposit, also on the Hale property and near the farm house, has been worked to some extent for road surfacing material.

Location No. 19. — On the Jacob Sykora farm, 1 mile south of Westover, and on the east side of a county road:

The material in this deposit is composed of quartz and limestone pebbles mixed with soil and clay. The gravel has been worked to a limited extent and used for road surfacing purposes. The best part of the deposit is found capping a low hill immediately adjacent to the county road.

This list does not include pits that are so well known in the county that further discussion would be superfluous or gravel-bearing areas not investigated by the survey, nor does it include localities in which tests revealed the deposit to be of little or no practical value.

Since 1935, approximately 120,000 cubic yards of local material have been produced in Baylor County for use on county roads and State highways. In view of the substantial benefit to the populace of the county that can be effected by surfacing unimproved roads and with consideration of the large quantity of cheap and easily available local material, it appears evident that the gravel deposits occupy an important place in the economy of Baylor County.

GEOLOGIC FORMATIONS IN BAYLOR COUNTY

The rock formations exposed within this county belong to the Wichita and Clear Fork groups of Permian age. The strata are composed of shale, limestone, sandstone, and conglomerate, named in order of their abundance. Overlying the Permian rocks along the principal streams are some river terraces, representing several erosional cycles of Pleistocene and Recent times, and the unconsolidated Seymour deposits which occupy the interstream divides in the western part of the county. These strata are discussed in The University of Texas Bulletin 3232, published by the Bureau of Economic Geology. A preliminary edition of a geologic map showing the outcrop of some of the more persistent of the Wichita limestones was issued by the same Bureau in 1930.

WICHITA GROUP

The Wichita group of strata occupies the eastern part, and roughly one-half of the area, of Baylor County. The uppermost beds (Lueders formation), which mark the western limit of the Wichita outcrop belt, enter the county near the southwest corner, strike north-northeast to pass by the town of Seymour and out of the county approximately north of the Lake Kemp dam. Where these beds enter the county on the south they are predominantly marine limestones and shales, but most of the members undergo lateral gradation to red bed facies before passing out of the county to the north and east. As a consequence of this change in facies, the topography in the southern and central parts of the county consists of a series of low, limestone-capped escarpments, and gently northwest sloping divides; while the northeast portion of the county is largely gently rolling prairie. The Wichita group has been subdivided into the following formations, each with several members: Moran, Putnam, Admiral, Belle Plains, Clyde, and Lueders. Of these formations all but the two lowermost, the Moran and Putnam, are present in Baylor County.

Admiral formation. — The Admiral formation occupies the extreme southeastern corner of the county. It is composed mostly of soft shales and marly clays, but some sandstone and thin lentils of impure limestone are also present. Good exposures are rare, as none of the members of this formation in Baylor County is sufficiently resistant to form escarpments or rugged terrain. Also, a part of the formation is concealed beneath terrace and eolian sands. The beds weather into dark-colored, sticky, calcareous soils. This formation makes up the surface strata in the Portwood oil field.

Belle Plains formation. — This formation consists of several shale and thin limestone members. It has an average thickness of about 300 feet and outcrops in a belt approximately 6 miles wide through Baylor County. The lower contact of this formation with the underlying Admiral is indefinite, as no dependable marker is present at that horizon. However, a limestone member consisting of two beds separated by several feet of shale which, to the writer's knowledge, has not been traced into the county from a known locality, outcrops along Dagget and Godwin creeks in the eastern part of the county and again at apparently the same horizon in the bed of Deep Creek on the N. Dennis Survey. This member is thought to be the Jagger Bend limestone from its position at or near the base of the Valera shale. If this assumption is true, and considering the Jagger Bend to be 80 or 100 feet above the base of the formation, the lower contact of the Belle Plains formation can be approximated by a line drawn through the towns of Round Timbers and Westover and projected to a point on the eastern county line. The upper contact of the formation is in most places clearly defined by the Beaverburk limestone, one of the most persistent and distinctive beds in the Wichita group.

The thicker shale beds in this formation are predominantly red in color but usually change to blue-gray or green in their upper few feet. Lentils of cross-bedded sandstone are common in the shales, especially in the Valera where the sandstones sometimes attain a thickness of 20 feet and are often nearly pure white in color. Hard calcareous nodules and geodes which are often lines with calcite or barite crystals are likewise common in the red shale beds.

Three limestone members of the Belle Plains formation are present in Baylor County: the Jagger Bend (?) to which reference has already been made, the Bead Mountain, and the Beaverburk. There are also several thin beds and lentils of limestone within the

formation which thin out and disappear along the strike. A section generalized from a number of measurements is given to show the relative position and approximate thickness of the several members.

	Thickness in feet
10. Beaverburk limestone	1.5
9. Shale, red with gray flecks	42.0
8. Limestone, impure and soft	1.2
7. Shale, soft, blue-gray	17.5
6. Bead Mountain limestone (massive)	1.8
5. Shale, bluish-gray	8.0
4. Limestone (a lentil)	0.6
3. Valera shale, approximately	135.0
2. Jagger Bend limestone, two beds	8.0
1. Shale, containing sandstone lentils	80.0 (?)

The Beaverburk limestone is the top member of the Belle Plains formation in Baylor County, the Bluff bone bed of Udden being either greatly restricted or entirely absent. This limestone forms a low, southeast-facing escarpment along its outcrop, and gives rise to well developed dip slopes on top of the divides. In some places the Beaverburk is composed of two or more beds. The upper bed, a hard, dark gray to blue, crystalline limestone, contains an abundance of calcite and calcitized fossils and is most distinctive and persistent. At two localities, this limestone was found to contain small crystals of galena in interstitial cavities formed by fossil shells.

While fairly stable and quiet marine conditions were prevalent during the deposition of the Beaverburk limestone, evidence seems to indicate that toward the close of the Belle Plains sub-epoch and before resubmergence in Beaverburk time, the shallow sea waters receded long enough for erosion to become active locally. Following is a summary of this evidence: (1) The disappearance and reappearance along the outcrop of a limestone bed resting just beneath the Beaverburk; (2) the fact that the underlying shale bed varies in thickness as much as 18 feet within a mile and the mud-cracked and weathered appearance of its upper surface; and (3) the presence of calcareous and clay nodules, some of which have the appearance of having been mechanically included, beneath the Beaverburk limestone.

The Beaverburk limestone is well exposed along Deep Creek on both sides of State highway No. 24. It can be distinguished on the basis of its hard, crystalline character, its tendency to weather into flags of a dark gray to blue color, and the fact that it forms a comparatively prominent escarpment along its outcrop.

Clyde formation. — Since this information rests directly on the rather persistent Beaverburk limestone, the lower contact is well defined throughout most of its extent in Baylor County; but the Talpa limestone, top member of the Clyde formation, apparently grades into shale about 5 miles southeast of Seymour, beyond which the upper contact is indefinite. In the southern part of the county the formation consists largely of alternating marine limestones and shales. Some of the limestones in the upper part of the formation contain an abundant marine invertebrate fauna including species of bivalves, cephalopods, gastropods, and brachiopods. At one exposure on Brazos River near the mouth of Miller Creek is a hard gray limestone showing distinct cross-bedding and containing numerous coral clusters on its upper surface. In a shale bed overlying this horizon is a cross-bedded, non-marine sandstone lentil containing fern leaves and other fossil plants. Due to the varied and unstable conditions of deposition which characterized the later part of the Clyde sub-epoch, most of the individual beds can be traced for only a short distance. At a good exposure about 2 miles west of the mouth of Miller Creek, the Talpa limestone has a thickness of at least 16 feet, and while no appreciable thinning is evident until the bed crosses Brazos River, it thins progressively thereafter to disappear entirely within about 6 miles. Because of the rather rapid facies change and disappearance of the limestone beds, no one section of the Clyde formation can be relied upon to apply to more than a limited area in Baylor County. The following section is of the upper part of the formation and was taken with a hand level along Brazos River about 2 miles south of Ogden School:

	Thickness	
	Ft.	In.
10. Limestone (Talpa?), bluish-gray, marly, poorly bedded, and fossiliferous; the upper part of the bed has been removed by erosion	6	4
9. Shale, grayish-green, nodular, and calcareous	4	0
8. Shale, red, soft, contains sandstone lentils	18	4
7. Limestone, yellowish-gray, impure, leached and honeycombed	1	3
6. Shale, red with gray calcareous flecks	15	6
5. Limestone, light gray to brown, medium hard, in four thin beds with shale partings	2	8
4. Shale, greenish-gray, sandy at base	2	0
3. Limestone, poorly bedded, gray to brown, semi-crystalline, has splintery fractures on weathered edges; this bed contains numerous nautiloids in its upper surface	2	6
2. Shale, blue, calcareous	3	6
1. Limestone, medium gray, hard, densely crystalline, contains some small calcitized fossils	4	2
Total thickness of section	60	3

The outcrop of the Talpa limestone has been mapped for about 5 miles in the south-central part of the county and on the east side of Brazos River. Along the strike to the southwest from the known locality the limestone is often concealed beneath river sands and talus from overlying beds, but a lithologically and faunally similar member occupying about the same stratigraphic position as the Talpa outcrops on the west side of Brazos River about 0.6 mile north of Self School. From this point, the member can be traced up Miller Creek valley to within a few miles of the southern boundary of the county. At the Brazos River exposure north of Self School, the limestone contains some small lentils of black, organic shale near its base and is resting upon 10 or 12 inches of reworked limestone gravels. This relation to the underlying beds was not noticed at other exposures.

The Grape Creek member, which consists of two limestone beds separated by about 10 feet of shale and occurs about 60 feet above the base of the formation, is probably the most persistent member of the Clyde formation in Baylor County. It has been mapped across the east-central part of the county and again around a small creek valley which flows into Big Wichita River at the head of Diversion Lake. So far as the writer knows, the Grape Creek is the only limestone member of the Clyde formation that has been traced as far north as Big Wichita River. In its exposures along the headwaters of Little Wichita River in the region of England School and south of Maybelle, the upper limestone bed of the Grape Creek member is 10 to 12 inches thick, crystalline in character, and quite fossiliferous. This bed is similar in lithology to the Beaverburk limestone but is usually of a lighter color on the fresh fracture, and does not form prominent escarpments. The lower bed is about 1 foot thick, non-crystalline, and of a deep chocolate brown color. The Clyde formation as a whole has an estimated average thickness of 200 feet in Baylor County, although this measurement will probably vary considerably from place to place.

Lueders formation. — The Lueders is the uppermost formation in the Wichita group. In Baylor County it is composed of alternating shales and thin limestones, with some sandstone usually in the form of lentils in the thicker shale beds. The formation has a total thickness in this area of about 150 feet. The subdivisions generally recognized in the Lueders are from bottom to top: Paint Rock beds, Maybelle limestone, and Lake Kemp limestone. Near the base of the formation is a shale bed 50 or 60 feet thick that is generally red in color but which often exhibits maroon to purplish tints in its upper part. Another comparatively thick red shale underlies the Lake Kemp limestone at the top of the formation. Between these two rather thick shales, and making up the middle part of the formation, is a number of thin limestones alternating with almost equally thin green and greenish-gray shales. Some of the green shales tend to swell or creep in damp weather and will disintegrate rapidly when submerged in water; these properties suggest a bentonitic content. The limestones vary in thickness from a few inches to 4 feet. They are for the most part rather impure, medium hard, and some variation of gray in color. Two or more of the thicker limestones have well developed strike and dip joint systems and exhibit a strong tendency to weather into remarkably uniform blocks. Locally in some of the limestones, marine invertebrate fossils are rather abundant, but no bed was found in which fossils were uniformly distributed over a large area.

Like other formations of the Wichita group in Baylor County, the individual beds within the Lueders frequently exhibit changes in coloration, thickness, and texture within a short distance. A section taken in one part of the county, therefore, will compare only in a general way with the same section taken in another part. The upper part of the formation is well exposed along Big Wichita River near the Lake Kemp dam. Other good exposures of this formation can be found south of the town of Seymour on Brazos River and Cache Creek. The following section was taken near the mouth of Cache Creek; it starts very near the lower contact and includes all but perhaps 40 feet in the upper part of the formation. Measurements were made with hand level and steel tape.

	Thickness	
	Ft.	In.
26. Quaternary gravel	4	0
25. Limestone, medium hard, gray, non-crystalline, consisting of one thick and several thin beds	2	2
24. Shale, soft, blue to greenish-gray	1	0
23. Limestone, grayish-white, medium hard	0	4
22. Shale, soft, gray, calcareous	1	10
21. Limestone, massive, gray with dark flecks, breaks into uniform blocks in weathering	1	8
20. Shale and sandstone, red shale with fine-grained, cross-bedded sandstone lentil	18	11
19. Limestone, massive, brown on fresh fracture, gray to yellowish on weathered surface, hard, ripple marked on upper surface	2	6
18. Shale, blue with gray banding, soft	4	6
17. Limestone, gray with yellow mottling, hard, in 3 beds of about equal thickness	1	10
16. Shale, greenish-gray, soft	2	2
15. Limestone, white, somewhat chalky	1	1
14. Shale, dull green, soft	0	8
13. Limestone, gray to yellowish-brown, hard, cellular, thin nodular bed on top	4	1
12. Shale, calcareous, bluish-green	1	9
11. Limestone, gray, hard honeycombed at top	2	0
10. Shale, grayish-green, soft	1	11
9. Limestone, dull gray, hard	1	0
8. Shale, bluish-gray, soft, calcareous	3	4
7. Limestone, gray, hard	0	5
6. Shale, greenish-gray, soft	1	3
5. Limestone, gray to yellowish-gray, hard	0	10
4. Shale (partly concealed by talus), red, with rich purple tints in upper part	53	0
3. Limestone, hard, dark on weathered surface	0	5
2. Sandstone, fine grained, evenly bedded	1	1
1. Shale and limestone, poorly bedded, gray	5	11
Total thickness of section	118	8

The Lueders formation is of particular stratigraphic importance, especially on the subsurface, over a considerable area of north-central Texas where oil exploration is active. Since it contains marine limestones, it is usually easy to recognize in well samples and for this reason makes an excellent horizon marker for wells that have started drilling in the overlying Clear Fork red beds. The upper limestones are most dependable for mapping surface geology. The top member, the Lake Kemp limstone, has been traced out of the county and as far north as the Rock Crossing oil field in Wilbarger County. The Maybelle limestone and the first thick limestone underlying the Maybelle in the Paint Rock beds are also comparatively persistent and are easy to follow in surface exposures. Some of

the limestones in the middle and lower parts of the formation show distinct ripple markings on their upper or lower surfaces, and frequently they pinch out within a short distance. In one locality, on the north bluff of Big Wichita River about 0.6 mile below the Lake Kemp dam, is a local unconformity in the form of a channeled excavation which has cut out 8 or 10 feet of shale and a limestone bed. The channel is marked by cross-bedded sandstones and conglomerate.

Economic importance of the Wichita formation. — The Lueders formation has been quarried to some extent in Baylor County. Some of the oldest buildings in Seymour are made from this rock and are still in good condition. The building stone is easily accessible and can be quarried within little difficulty because of the well developed joint systems which cause the rock to break into uniform blocks. This rock is sufficiently durable for most building purposes but has the disadvantage of discoloring upon weathering due to its content of iron and other impurities. The Jagger Bend (?) limestone has also been used to some extent in Baylor County for building purposes. This rock has been worked on the Boone ranch in the eastern part of the county. The limestone is broken into irregular blocks about 5 inches thick and used as a rock veneer on the buildings. Very attractive houses are made from this material, and the rock has the advantage of being extremely durable.

The Beaverburk limestone has been used successfully for crushed stone asphalt aggregate. The hard crystalline character of this rock makes it a desirable material for crushing, and its tendency to weather into flags makes it easy to quarry. In its crushed form, the Beaverburk limestone would also make very good concrete aggregate. A large amount of this rock is easily accessible to State highway No. 24 and on the west side of the west fork of Deep Creek.

CLEAR FORK GROUP

The Clear Fork group makes up the middle part of the Permian system in north and northwest Texas. This group has been subdivided into formations and members in some localities, but due to the absence of definite markers the subdivisions cannot be recognized in Baylor County. That portion of the group which is present in Baylor County consists of shale, sandstone, and some conglomerate. The shales, which are by far the most common rocks in this phase of the Clear Fork, are soft, usually yellowish-red in color and are quite frequently sandy or silty. Ferruginous material occurs in all the shales and sandstones and is also quite common in the form of concretions or nodules, secondary crack filling, and replacements of plant stems.

The sandstones and conglomerates are cross-bedded and highly lenticular in character. Some of the sandstones have the appearance of small deltas. While no single sandtone bed was found to be sufficinelty persistent to be traced for any great distance, certain zones within the Clear Fork contain a relatively large number of sandstone lentils. A very good exposure of the lower Clear Fork beds can be found at Table Top Mound on the Craddock and Waggoner lands north of Seymour. This topograpic feature is a remnant of an ancient peneplain and stands some 200 feet above the surrounding valleys. It is capped by a badly weathered arenaceous limestone or dolomite, and its eroded sides expose several shale and sandstone beds.

SEYMOUR DEPOSITS

The Seymour deposits are composed of unconsolidated and stratified beds of sandy clay, sand, and gravel. Their average thickness in Baylor County, as estimated from well records and measured exposures, is from 30 to 35 feet. These deposits are confined to the surfaces of the interstream divides in the western part of the county and on the outcrop belt of the Clear Fork Permian. Parenthetically, it might be stated that in all the counties of north-central Texas where the Seymour deposits are present, they are restricted very largely to the Clear Fork outcrop belt. This fact may be significant of the depositional history of these stream-laid deposits, as it is possible that eastward flowing streams beginning along the comparatively steep eastern slope of the Llano Estacado encountered a flattened gradient in crossing the belt of soft Clear Fork shales, and in consequence of this change in gradient the Clear Fork territory became a repository for much of the material derived from the Pliocene beds of the plains area. It is also possible that the Seymour gravels are a surviving portion of a much more widespread formation and that they have persisted because the relatively flat surface and low relief of the terrain upon which they are resting are less vulnerable to the attacks of erosion. Remnants of gravel altogether similar to those of the Seymour which are apparently not related to the present stream courses are found on some of the divides both east and west of the Seymour deposits, respectively in the Wichita and Double Mountain territories. However, the widely scattered character and lack of a dependable fauna would make any attempt to correlate these remnants with the Seymour extremely hazardous.

Although the Seymour deposits are much thinner and much more restricted in area than the Pliocene Panhandle formation of the Staked Plains, the two formations exhibit a strong similarity in the following respects: both formations are fluviatile alluvial deposits; both contain an abundance of caliche in their upper parts; and micaceous pebbles, water-worn Cretaceous shells, arkosic material, and highly crystallized fossil wood are common as minor constituents in both formations. The gravels of the Seymour are evidently from the same original source as those of the Panhandle formation, although they may be secondarily derived from the Panhandle formation. The gravel beds which are commonly present at the base of the Seymour are composed mostly of medium to small, well-rounded pebbles of quartz, quartzite, cobbles of limestone, and clay balls of local origin. In addition to these are the materials already named as minor constituents.

Where the deposits have not been dissected by erosion, the Seymour is usually easy to distinguish from the high terraces of the present major streams by the following criteria: the relatively great abundance of caliche in the Seymour; the Seymour occurs at a higher level on the divides and does not exhibit the riverward surface dip as is frequently true of the terraces; the terraces frequently contain a larger percentage of locally derived material. Since much of the terrace material is derived from the Seymour deposits, differentiation based on lithology of the gravels is not reliable.

Some good exposures of these deposits are found north of Red Springs in the west part of the county and along some tributaries of Big Wichita River which are dissecting the divide by headward erosion. Part of the area lying between Brazos River and Cache Creek is also covered by Seymour deposits, but in this area good exposures are rare.

STREAM TERRACES

The most extensive stream terraces, and the only terraces covering more than a limited area, in Baylor County are along Brazos River. The valley of Big Wichita River is still widening and deepening at a fairly rapid rate, and any terraces that may have existed have

been largely removed in the process. Much of the valley floor in Baylor County is now covered by the waters of Lake Kemp and Lake Diversion, but such of the Big Wichita valley floor as is not concealed reveals only scattered and poorly developed terrace remnants. Only the head waters of Little Wichita River enter Baylor County, and since that part of the stream is still in a youthful stage, erosion is in excess of deposition. Miller Creek, in the southern part of the county, has built a low terrace for at least 8 miles above its confluence with the Brazos. This terrace is composed almost entirely of limestone gravels and alluvial clay derived from the Wichita Permian formations which outcrop along the drainage of Miller Creek. The terrace is from 8 to 25 feet in thickness, rarely more than one-half mile wide, and narrows upstream with the enclosing valley.

The highest terrace measured in Baylor County has its base 100 feet above the low water level, and belongs to Brazos River. This terrace has a maximum thickness of 35 feet. It is well developed along a bend of the river southwest of Ogden School. At one exposure in a meander cut bluff on the east side of Brazos River, the basal 17 feet of this terrace is composed of gravel with some sand and a few limestone boulders of indigenous origin. What appears to be this 100-feet terrace is well developed on the opposite side of the river on the Hashknife ranch.

Lying at a lower elevation than the 100-foot terrace and above the present flood plain of the Brazos are two more terraces. These intermediate terraces are best developed between the town of Seymour and the west county line where, taken together, they attain a width of about 2 miles. The lower of these two terraces — perhaps because it has been subjected to erosion — is more extensively developed, and remnants of it are found along much of the course of Brazos River in Baylor County. The base of this terrace is in some places only slightly above the present flood plain and in other places is as much as 20 feet above the same level. It is composed of silty alluvial clay, sand and gravel, and attains a thickness from 25 to 40 feet. The surface of this terrace, as do the higher flood plain remnants, dips gently in a riverward direction where it has not been disturbed by erosion.