THE UNIVERSITY OF TEXAS
Bureau of Economic Geology
July 8, 1936

MINERAL RESOURCE SURVEY
Circular No. 12

REPORT ON RIVER TERRACES IN BELL COUNTY, TEXAS, AS A PART OF A MINERAL RESOURCE SURVEY IN BELL COUNTY

by C. O. Nickell, Supervisor

The largest stream in Bell County is Little River, which is formed by the confluence of Leon and Lampasas rivers southeast of Belton and nearly south of Temple. For the study of river terraces in Bell County, the area south of Temple on Little River was chosen, because an excellent development of terraces may be seen there, and it was believed that conditions in that area may be typical for other streams in the county. A plane table map was made for the vicinity of the villages of Little River and Sparks, and the traverse was continued south to the town of Holland. On this map, outcrops of bed rock are shown and also some data on depths of water wells, which in this area are closely related to the depth of bed rock. Samples of gravel were taken from several pits within this area and analysed for percentages of different types of pebbles.

Within the area mapped there are three main terraces, which are numbered 1, 2, and 3, beginning with the lowest. There is also a small development of a sub-terrace between numbers 1 and 2, which is given the number 1-A.

Terrace No. 3
100, Y

Terrace No. 3 is usually about 40 feet above No. 2, or approximately 100 feet above average low water level in the river. It is often conspicuous as a bench considerably above the well settled farming districts bordering the river and has on its eroded slopes coarse flint gravel mixed with black soil, which is rich but too full of rocks for easy cultivation. However, the top of No. 3 often has a black soil sufficiently free from stones and gravel to make rich farm lands. No gravel pits were seen on terrace No. 3 within the area mapped, although there is a small pit in the face of the terrace near station No. 162. Where this gravel has been exposed by erosion it is predominantly of flint, with a small amount of limestone. Terrace No. 3 is underlain by the Austin chalk in the northwest corner of the plane table sheet and by Taylor marl south of the village of Little River, on the south side of the river.

Terrace No. 2
60, 40

Terrace No. 2 is usually from 35 to 40 feet above No. 1, or about 60 feet above average low water level in the river. Wherever sufficiently developed, it forms a rich farming area and supplies a large part of the population of the county with good farm lands. Several gravel pits are located on this terrace, the material being predominantly of limestone, with a rather large proportion of reworked Cretaceous fossils, especially *Gryphaea.* Some large fossil bones are found in these gravels, one having been observed near the surface during this fieldwork; also some flints were found that appear to have been shaped for tools or points for arrows or spears. The thickness of this deposit is from 25 to 30 feet. Near the village of Little River it is underlain by Austin chalk.

Sub-terrace No. 1-A

There is a small area about 10 feet above the flood plain south of the village of Little River, on which the farm homes of the Wilson Valley community are located. It is called a sub-terrace because it appears to be of only local importance.

Flood Plain Terrace (No. 1)
25, 0, 0, Z'

The lowest terrace, No. 1, might also be called the flood plain, as it is subject to overflow. It is farmed in most places, but has few if any permanent buildings on it. The soil is very rich, being river sediment. This terrace is usually about 25 feet above the normal water level of the river and has a maximum thickness of about 25 feet. It is underlain by Taylor marl south of the village of Little River, and by Austin chalk southwest of the village. Within the area mapped, no gravel pits were seen on this terrace. A part or all of this terrace is under water at flood stage.

The Cross Section

The cross section shows the terraces of Little River south of Temple. In the Austin chalk the river has cut a shallow valley, flanked by terraces on the north, which are reflected in the surface terraces of gravel, sand, and silt. An upper terrace, No. 3, forms the boundary for the broad expanse of the present valley, as the term would commonly be used. However, to speak more accurately, the present river valley may be said to include terrace No. 3 and to extend back to the outer margins of No. 3, at the base of the higher old lands composed of bed rocks, not shown in this section. The section is drawn to scale, within reasonable limits, and is based on plane table mapping, water well data, pits and borings.

In the Mineral Resource Survey circulars, terraces are designated by the formula X,Y in which X is height of top of terrace and Y, height of base of terrace above average low water level in the streams. Actual values are inserted for X and Y when known.

Terraces in Other Parts of Bell County

Reconnaissance work on terraces in other parts of Bell County is shown on the United States Rural Delivery Routes map. Terrace No. 1 is colored green on this map, No. 2 red, and No. 3 brown.

An unusually good development of sub-terraces may be soon southeast of Belton, on the north bank of Lampasas River. These sub-terraces are usually small in area, so far as they were observed, but they are important because their presence must be carefully noted to avoid confusion in correlations.

Terraces on Smaller Streams

Small intermittent streams may have well developed terraces. This is illustrated on the upper reaches of Elm Creek, in the northeast part of Bell County. On the east side of this small creek there is a good development of terraces No. 1 and 2. There is a small gravel pit on No. 2, the type of the gravel indicating that it was deposited by the creek and that it is not a part of the river system. It is a limestone and caliche gravel, free from flint, whereas the river gravels all contain flint.

The headwaters of Cedar Creek west of Pendleton, in the northern part of Bell County, begin to show a small No. 1 terrace, though the drainage line is so slight as to be scarcely noticeable as one drives through the country. Southwest of Pendleton this creek has a well defined terrace No. 1 on the east side of the stream and a definite terrace No. 2 on the west side of the stream, 12 feet above the stream level, 6 feet thick, and composed of limestone gravel (terrace 12,6). As this stream approaches Little River it flows across resistant limestone through which it has cut a canyon, and in this part of its course has no terrace deposits.

Terrace Gravels

Terrace No. 3.—Two samples of gravel were taken from terrace No. 3; sample No. 4 from the small area of terrace No. 3 near the northwest corner of the plane table sheet and sample No. 6 from near station No. 132, co-ordinates F-12, south of the river. Both of these samples are predominantly of flint, low in limestone, and contain many pebbles of black chert. At several places along the highway between Holland and Sparks, gravel of No. 3 terrace may be seen in road cuts, and there is one small pit in the face of No. 3 terrace near station No. 162, co-ordinates G-18. In all these places it is predominantly a flint gravel.

At three places, however, gravel that appears to belong to terrace No. 3 contains a considerable proportion of limestone and re-worked *Gryphaea* shells. These places may represent a sub-terrace between Nos. 2 and 3, or they may prove to be local exceptions. More work needs to be done on this part of the problem. (However, it is noted that in University of Texas Bulletin No. 3016, Geology of Bell County, Texas, on page 69, terraces on Little River as listed by Alexander Doussen show a limestone gravel for the terrace No. 4, which is 104-108 feet above the river level and which may correspond to terrace No. 3 of this paper.) One of the places referred to above is near station No. 167, co-ordinates P-3, between Holland and Sparks, where limestone pebbles and re-worked *Gryphaea* are in a gravel that apparently is from a railroad cut in terrace No. 3. Another place is a gravel pit about half a mile north of Belton where the gravel closely resembles material from terrace No. 2. A third place is a gravel pit southeast of Belton, on the west side of Leon River, on the Glass farm. This gravel resembles that from terrace No. 2 in having limestone pebbles and re-worked *Gryphaea* shells, while also resembling a No. 3 gravel in having a large amount of coarse flint pebbles and small boulders. Wherever observed in good exposures, gravel of terrace No. 3 contains a considerable quantity of black chert, some red quartzite, and some Hickory sandstone.

Terrace No. 2.—The gravel of terrace No. 2 is predominantly of limestone, with some flint, and a large proportion of re-worked *Gryphaea* shells. Black chert is present, but in smaller quantities than in No. 3. In these gravels may be found occasional large fossil bones and some flints that appear to have been shaped for spear points or for scrapers. The pits of terrace No. 2 supply most of the gravel for road and concrete work.

Terrace No. 1.—A few pits in terrace No. 1 were seen east of Belton. This gravel appears to be a mixture of re-worked material from terraces Nos. 2 and 3. It is reported that large fossil bones and flint arrowheads are found in this gravel.

Historical Significance of Gravels

The gravels of the terraces in Bell County are noticeably lacking in granitic material from the Llano-Burnet area of the Central Mineral region. No. 3 gravel contains some Hickory sandstone pebbles up to 1½ inches in diameter. No. 2 gravel has very few pebbles of Hickory sandstone, and they are small, about one-half inch in diameter, perhaps having been re-worked after original desposition in No. 3. Gravels of terrace No. 1 are of no particular significance from the standpoint of historical geology, as they are re-worked material from terraces No. 2 and 3. From these characteristics of the gravels, one may conclude that one of the branches of Little River, probably the Lampasas, formerly obtained material from the Central Mineral region where the Hickory sandstone was exposed, but did not receive granitic gravel from there. Since then the drainage lines have changed, for at present no drainage from the Central Mineral region reaches Little River.

In contrast to this historical record, Colorado River was receiving material from the Central Mineral region when its high terrace (the Asylum terrace) was being deposited, because in this terrace there is much granitic material, and several pebbles of blue opaline granite have been found in it.

The Plane Table Sheet

The work on the plane table sheet is done on a scale of 1 inch equals 2000 feet. The outline of terrace No. 2 is traced in red. A remnant of terrace No. 3 is shown in the northwest corner of the map colored brown. South of the village of Little River, a small area colored brown outlines what appears to be a remnant of No. 3; if true, it must have been an island when No. 2 was deposited. Near the west edge of the sheet the outcrop of the Austin chalk is traced in green, and three small exposures of Austin chalk are indicated in green near the south face of terrace No. 2.

Two sets of figures are shown at the stations: the station numbers which range from 1 to 179, and the elevations which range from 440 feet, where the highway crosses the river, to 573 feet on a high part of terrace No. 3 north of Holland.

The traverse was carried to station No. 162 near the south edge of the sheet, and this station was then transferred to near the north edge of the right half of the sheet and the traverse continued south to the town of Holland.

The starting elevation, 503 feet, was taken at a road intersection as shown on the topographic map for Bell County, Temple sheet, which includes Belton. Three parts of the traverse north of the river were closed with errors less than 1.1 feet. It was the intention to check in on elevations at Holland, but the unexpected termination of the work prevented doing so. However, the traverse showed an elevation of 509 feet near the end of a bridge just south of the Holland town limits, while published elevations for Bell County give an elevation of 507 feet for a bridge one-quarter of a mile south of Holland, presumed to be the same location, but a new bridge is there now.

The plan was to carry the traverse to the high level county south of Holland to see whether it would correlate as a part of terrace No. 3. From the work which was done, this appears possible and is so marked on the road map, but more work should be done on this part of the problem.

Above No. 3 in the eastern part of the country there are large areas of black soil on which flint gravel is abundant in patches. The topography often suggests a non-terrace condition, with long gentle slopes and gently undulating hills. Bed rock of shale appears in many road cuts. In some places where the flint gravel is especially abundant, it appears that remnants of a terrace No. 4 are present, but the correct interpretation of these conditions is still open to question. These areas may correspond to the high level area south of Austin, with black soil and flint gravel, named the Uvalde formation in the Austin Folio. The Uvalde is said to have been formed by the merging of alluvial fans washed out from the hills of the Edwards Plateau region. Gravels of this type are discussed as being parts of the Uvalde, or of the Reynosa formation, in University of Texas Bulletin No. 3016, Geology of Bell County, Texas.

Terraces of Little River are listed on page 69 of Bulletin No. 3016, in a quotation from United States Geological Survey Professional Paper 126. It appears that in this list, No. 1, seen at Cameron, corresponds to my No. 1 in Bell County, No. 2 corresponds to my No. 1-A, No. 3 corresponds to my No. 2, and No. 4 corresponds to my No. 3. In each list, the Uvalde flint gravels are found at a still higher level.

Table of Sample Analyses

The following table gives a summary of the analyses of gravel samples. Samples No. 1, 2, and 3 are from terrace No. 2 on the north side of the river. Sample No. 5 is from terrace No. 2 south of the river. Sample No. 4 is from terrace No. 3 on the north side of the river, and sample No. 6 is from terrace No. 3 on the south side of the river. Sample No. 7 is from terrace No. 2 on Elm Creek in the northeast part of the county and is in no way related to the terraces of Little River, being composed entirely of local materials found along its course in Bell County.

	Pit No. 1	Pit No. 2	Creek wall	Northwest Hill Terrace No. 3	Terrace No. 2 east of Sparks	Terrace No. 3 south of river	Elm Creek Terrace No. 2
Flint	12.86	4.46	3.91	80.34	3.67	82.62	
Quartz	(34)	1.22	(11)	16.92	3.25	7.84	
Fossils	11.72	2.56	3.91		14.67	1.23	1.90
Limestone	73.23	91.33	91.29		77.69	3.64	93.58
Black chert	(19)		(5)	2.51	(18)	4.65	(1)
Hickory sandstone	(1)						
Red quartzite				(1)			
Caliche							3.56
Calcite							(3)
Total percent	97.81	99.57	99.11	99.77	99.28	99.98	
Thickness (feet)	16	20	15	10	25?	15	10
Elevation above river (feet)	63	60	65	100?	58?	100	
Elevation above sea (feet)	487	489	491	543		530	
Terrace number	2	2	2	3	2	3	
Number of pebbles in sample	2511	1791	1851	585	2609	1784	421
Underlying bed rock	Austin chalk		Austin chalk	Austin chalk	Taylor marl	Taylor marl	Taylor marl
Sample Number	1	2	3	4	5	6	7
Co-ordinates	C-3	G-6	G-5	A-1		F-12	