MINERAL RESOURCES OF TEXAS

During the latter part of 1930 several wells were drilled into serpentine in the vicinity of Kimbro in Travis County. One of these on the Allen farm drilled in December, 1930, is reported to have obtained oil in commercial quantities.

MCANGUS WELL IN TRAVIS COUNTY

A well recently drilled on the McAngus farm $\frac{3}{4}$ mile northwest of Elroy, Travis County, has added in an important way to the knowledge of the geologic section at that locality. The well was drilled to 1352 feet by J. W. Allen and was then taken over by Otto Stolley and associates and drilled to 3100 feet.

The well starts in the Navarro formation. No cores were received from the Upper Cretaceous, but the Austin appears to have been reached at or near 900 feet and the Edwards, according to the driller's records, at 1302 feet. Cores were received at intervals from 1854 to 3100 feet. The first core received, depth 1854, represents the Glen Rose which apparently continues to depth 2920. The interval from the top of the Edwards to the base of the Glen Rose is thus 1618 feet, the thickness of the Glen Rose being in excess of 1066 feet. The Glen Rose is in places highly porous and contains an anhydrite stratum at depth 2367. An ovster shell stratum is found at depth 2768, and a show of oil and water is reported at depth 2864 to 2866 Flowing water is reported at 2660 feet. Black and feet. gray shales alternating with limestones are found at depth 2730 to 2746.

The Travis Peak formation is entered at or near 2920 and extends to the bottom of the well, 3100 feet. It consists largely of calcareous sands, clays, and conglomerates. An anhydrite stratum was found at depth 2988.

ADDITION TO GEOLOGIC MAP OF TRAVIS COUNTY

A manuscript map kindly supplied by Dr. L. W. Stephenson makes it possible to add somewhat to the Travis County map previously published (p. 42). The addition, shown in Figure 7, is chiefly in the Austin-Taylor which is here shown as a fault contact, the downthrow of the fault being to the east. The Taylor-Navarro contact not shown for this part of the county on the previous map is added. (Fig. 7, p. 70.)

Page 69 of the report on Travis County was printed in December, 1930.



WILLIAMSON COUNTY

E. H. SELLARDS

Williamson County is located at the west margin of the Gulf Coastal Plain in Central Texas. Its principal mineral resources are clay, limestone, petroleum, sand and gravel, and surface and underground water. The Missouri, Kansas, and Texas, Southern Pacific, and Missouri Pacific railroads cross the county. The elevation varies from about 500 feet at the east side to 1200 or 1300 feet at the west side of the county.

STRATIGRAPHIC GEOLOGY

The formations found at the surface in Williamson County are those of the Cretaceous and Lower Eocene. In the western part of the county the Lower Cretaceous formations are exposed including in order from west to east the Glen Rose, Walnut, Comanche Peak, Edwards, Georgetown, Del Rio, and Buda. Owing to the southeastward dip and to faulting, the Lower Cretaceous passes underground and is not seen at the surface east of the central part of the county. The Upper Cretaceous formations of the eastern half of the county as passed over in traveling from west to east are, in order, the Eagle Ford, Austin, Taylor, and Navarro. At the extreme southeast side of the county the Midway and Wilcox formations of the Eocene come into the section. Overlying the Cretaceous and Eocene formations

FIG. 7. Map of Williamson County and a small part of Travis County, showing formation contacts and well locations. Mapping adapted from manuscript maps by F. L. Whitney, R. H. Cuyler and J. W. Wells; L. W. Stephenson (Upper Cretaceous); and Julia Gardner (Midway). Map entries accompanying wells give depth to the Edwards formation. Key to wells, location of which is shown on the map: 285, Blomstedt; 1645, Forwood 1; 1658, Klattenhoff; 1914, Pflueger; 1997, Bengston (in Travis County); 2195, Reithmeyer; 2233, Mager; 2641, Schram (Chapman); 2844, S. W. Jones (Lloyd); 3202, Brown (Texas Co.). Pleistocene terrace deposits which cover much of the eastern part of the county are not shown on the map. Scale, 1 inch equals 8 miles.

Issued by the Bureau of Economic Geology, The University of Texas, December, 1980.

Williamson County

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are extensive gravel and sand deposits probably of Pleistocene age. Alluvial deposits are found in the valley of Little River and its tributaries.

Underneath the Cretaceous at depth of from 600 to 1000 feet in the western part of the county are rocks which are believed to be Paleozoic in age. These rocks under the Cretaceous are known from several wells. The Conway well near the west county line passed the base of the Cretaceous at or near 695 feet. Samples from 695 to 1080 feet show a series of rocks which include dark to gray thinly laminated somewhat shalv limestone and chert. close-textured drab limestone, hard micaceous shale, and shiny black, often slickensided, shale, and green or gray sandstone or quartzite. These several types of rock are present in almost every sample and the formation probably consists of successive thin strata of these different rocks. Calcite veins are seen traversing the rocks and minute faulting and folding is occasionally seen in the laminated rock. Some large pieces from depth 997 to 1000 show the close-textured, drab limestone and chert cut by many calcite veins. Minute crystals of iron pyrites are found in the rock arranged in interconnecting, broad bands. The rock contains some pyrite in bands between the laminae. Black, noncalcareous hard shale is apparently present throughout but is most abundant in the upper part of the section. Some of it contains pyrite in very small crystals disseminated through the rock. The sandstone is found more particularly in the lower part of the section of this well. The shales are more or less bituminous and upon heating will in some samples deposit oil and give off fumes that burn. The well is cased to depth 690.

Three samples from this well tested for magnesium and calcium in the Bureau of Industrial Chemistry by Mr. David McKnight gave results as follows:

Depth in feet	Magnesium carbonate Per cent	Calcium carbonate Per cent
950	0.8	15.3
962-964	0.3	20.2
970	2.1	16.3

The rocks are siliceous but the amount of silica was not determined.

A well on the Miller farm $3\frac{1}{2}$ miles east of Liberty Hill and about 10 miles east of the Conway well passes the base of the Cretaceous at about 826 feet. From this depth to the bottom of the well, about 1910 feet, as indicated by numerous samples, are chiefly shiny, black often slickensided shale with some sandstone. The shales and harder sandstones are cut by calcite veins. The shale disintegrates more or less in water and according to the driller the well caved badly especially in the lower part. The first casing was rested at 844 feet below which depth the well is reported to have been free of water.

In the city well at Georgetown the base of the Cretaceous was passed at or above 1260 feet. Immediately under the Cretaceous at depth 1260 and 1280 are red and gray well indurated shales cut by quartz veins. At greater depth, 1340 to 1820, the rock is chiefly black apparently crumpled shale similar in character to the black shale of the Miller well.

In the Miller well the shales, sandstones, and quartzites are drilled into with little variation for about 1084 feet and in the Georgetown well for 560 feet. The Conway well presents a somewhat different section since in addition to the black shales, there is dark and drab limestone. In all of the wells the rock shows the effect of stress the laminated rock showing folding, minute faulting, and the shale slickensiding and crumpling. Indistinct objects in limestone in the Conway well at depth 830 may be sponge spicules, otherwise the rock is nonfossiliferous and its age is undetermined. From the Conway well to the nearest exposures of pre-Cretaceous rock (Pennsylvanian) is 9 or 10 miles. H. D. Miser who has examined samples from these wells believes that the Conway well may contain Big Fork chert, Ordovician.

Underneath the Upper Cretaceous and Eocene formations of the eastern part of the county are Lower Cretaceous formations. The depth to these formations varies,



the dip being southeastward. The Edwards formation which is at the surface at Georgetown, lies at a depth of 3200 or 3300 feet at the southeast corner of the county.

Serpentine is found in the Thrall and Chapman oil fields. In both of these fields the serpentine lies near the base of the Taylor formation. A special report has been issued on the Thrall field.¹ The wells of Figure 8 afford a geologic section across the county.

FORMATION CHARACTERISTICS AND THICKNESSES

In the table which follows, the formations of this county exposed at the surface are listed in order including thicknesses. In general the formations thicken eastward, down the dip.

Table of Formations

Wilcox	Not fully exposed in this county	Sand and clay
Midway	300+(Swenson) (full thickness not determined in this coun- ty; probably 300 or 400 ft.)	Chiefly clay
Navarro	Not determined from well rec- ords; probably about 400 ft.	Clay marl
Taylor		Clay marl and some chalk
Austin	342 (Bremond 1, Chapman); 325 (S. W. Jones 1, Lloyd Oil Corp.)	Chalk and lime- stone
Eagle Ford	43 (Blomstedt); 148 (S. W. Jones 1, Lloyd Oil Corp.*); 71 (Bremond)	Clay
Buda	32 (Blomstedt); 30 (Taylor city well); 63 (Bremond); 59 (S. W. Jones 1, Lloyd Oil Corp.); 36 (Klattenhoff)	Limestone

FIG. 8. Geologic section across Williamson County on the line A-B of Figure 7 showing formations and principal water horizons. The wells used in the section are as follows: 1, Conway; 2, Miller; 3, Walsh, 4, Georgetown; 5, Taylor; 6, Stiles; 7, Brown. The principal water horizons are: Edwards sulphur water recorded in wells 4, 5, and 6 and water in the basal Cretaceous sands in wells 1 and 6. These sands thicken eastward and contain two or more water horizons. For description of these wells see pages 83 to 88.

¹Univ. of Texas Bull. 66, 1916; reprinted in part in Univ. of Texas Bull. 2539, 1925. *This thickness, 148 feet, is from the log only, no samples having been received from below the Austin.



Fig. 8. For explanation see page 75.

Del Rio 57 (Blomstedt); 90 (Taylor city well); 46 (Bremond); 58 (Peter Schram 1, Chap- man); 52 (S. W. Jones 1, Lloyd Oil Corp.); 66 Klat- tenhoff)	Chiefly clay
Georgetown	Limestone
Edwards Comanche Peak { Not determined	Limestone
walnut	Some clay strata in lower part
Glen Rose335±(Conway). Much thicker eastward, probably 1000 feet or more	Limestone some sand
Travis Peak360±(Conway). The basement sands thicken eastward. See Taylor well	Sand and lime- stone

A considerable thickness of chalk (Taylor and Austin formations) is recorded in wells in the southeastern part of Williamson County, as much in some wells as 580 feet (Texas Co. No. 1 Brown). In these wells it is difficult. even where cores are obtained, to determine the top of the Austin. Probably a part at least of the chalk is Taylor. In Travis County the interval from the top of the chalk to the top of the Edwards is 431 feet near Creedmoor and 677 in the northeastern part of the county (Travis County, pp. 59 and 61). In southeastern Williamson County this interval is usually between 600 and 700 feet, average about 650, but may exceed 800 feet as in Brown 1, Texas Company, and S. W. Jones 1, Lloyd Oil Corporation. The considerable variation in thickness observed is in part due to defective records, but is in part real. This variation in thickness of formations makes it difficult to estimate the depth to the Edwards formation.

Group Thickness

Midway to Georgetown, inclusive: 2715 (Brown) Midway to Austin, inclusive: 2407 (Brown) Navarro to Glen Rose, inclusive: 3290+(Stiles) Austin, Eagle Ford, Buda, Del Rio, and Georgetown: 689 (Bremond*); 653 (Pflueger); 608 (Schram)

*The Bremond well, E. L. Chapman, located across the line in Milam County, is included for purposes of comparison.

Eagle Ford and Buda: 75 (Blomstedt) Eagle Ford, Buda, and Del Rio: 132 (Blomstedt) Eagle Ford, Buda, Del Rio, and Georgetown: 347 (Bremond); 308 (Brown) Eagle Ford to Travis Peak, inclusive: 1416 (Blomstedt) Buda, Del Rio, and Georgetown: 276 (Bremond); 184 (Klattenhoff) Buda to Travis Peak, inclusive: 1373 (Blomstedt) Del Rio and Georgetown: 213 (Bremond); 148 (Klattenhoff) Del Rio to Travis Peak, inclusive: 1341 (Blomstedt) Georgetown to Travis Peak, inclusive: 1284 (Blomstedt) Edwards sulphur water horizon to base of Cretaceous: 1160 (Blomstedt); 1960+(Taylor city well); 1175 (Georgetown city well); 1300 (Round Rock city well) Glen Rose and Travis Peak: 695±(Conway); 1600±(Taylor city well)

Lower Cretaceous: $1350 \pm (\text{Georgetown})$; $2200 \pm (\text{Taylor})$

STRUCTURAL GEOLOGY

The Balcones fault zone crosses the central part of Williamson County. The faulting in this zone in Williamson County, however, is not so pronounced as in Travis and other counties farther south. The dip in the Cretaceous formations, east of the Balcones fault for 20 or 25 miles is about 90 or 100 feet per mile. East of Thrall the dip increases to 150 or 200 feet per mile as measured from the Stiles well in the Thrall oil field and the Brown well in the southeastern corner of the county. West of the Balcones the dip is probably 20 or 30 feet per mile as measured from the Conway well to the Miller well. The direction of dip is slightly south of east.

As a result of eastward dip accentuated by faulting the Travis Peak formation which is within a few hundred feet of the surface at the west side of the county is buried at the east margin to a depth of about 4500 feet.

The well records available are insufficient to decipher the structural features under the Cretaceous. However, the brecciated, slickensided, minutely faulted condition of the rock indicates great deformation and the structural conditions are doubtless complex including intense folding and faulting. In the sketch map (Figure 7), depth to the Edwards formation is given for a number of localities in the county. The depth to other formations may be approximately obtained by interpolating from the table of thicknesses on page 75.

ECONOMIC GEOLOGY

Clay.—The principal clay formations of Williamson County are the Del Rio, Eagle Ford, Taylor, Navarro, and Midway. The outcrop of these formations is shown on the map (Figure 7). In addition, alluvial clays are found in the valleys of the larger streams. Formerly clays were utilized for brick manufacture near Taylor.

Limestone.—The principal limestone formations are the Glen Rose, Edwards, Comanche Peak, Georgetown, Buda, and Austin. The purest limestones are found in the Edwards. These formations, as will be seen from the map, lie in the western half of the county. Dolomitic limestone is found in the Edwards formation on the Walsh farm $51/_2$ miles west of Round Rock.

Lime.—The Edwards formation is used in the manufacture of lime at Round Rock. The company operating is the Round Rock White Lime Company.

Building Stone.—Of the several limestone-bearing formations, those of the Fredericksburg group have been most used for building stone. Quarries in these formations are being operated at Cedar Park and at Round Rock. The companies operating are the Texas Quarries Company and E. Cluck at Cedar Park, and B. C. Richards at Round Rock.

Sand and Gravel.—The gravel and sand deposits of Williamson County are extensive and are best developed east of the Balcones fault zone. The gravel is produced chiefly for local use. Celestite is found in the Glen Rose formation in a bluff on San Gabriel River northwest of Leander between the railroad and public road bridges. This locality has been examined by L. S. Brown who states that the celestite is found near the top of the Glen Rose formation.

Oil and Gas.—Two oil fields have been developed in Williamson County. The Thrall field was discovered in 1915. In this field the oil is obtained from a much altered basic igneous rock. The principal oil production was obtained from what appears to be reworked porous beds associated with the original rock mass. The igneous rock is found within the Taylor formation, that formation being presumably the source of the oil. The Thrall field, now almost exhausted, is located one mile southeast of Thrall. The production from about 480 acres has averaged somewhat above 4,000 barrels per acre. The oil has a paraffin base and a gravity of about 39 B. This field is described in The University of Texas Bulletins 66 and 2539.

In January, 1930, a well on the Abbott farm in the southeastern part of the county obtained oil at depth 1834 feet. This well starts in the basal part of the Wilcox and the oil producing horizon is from serpentine found in and near the base of the Taylor formation.

It is difficult from well records to determine the limits of the several formations in this field from the Wilcox at the surface to the Austin which underlies the serpentine. In the discovery well, Abbott 1, sandy shale is reported at depth 325 feet which may be the base of the Wilcox or possibly upper Midway. Green sand reached in this well at depth 600 to 615 (-73 to -88) is probably the green sand which lies at or near the base of the Midway. This green sand gives a show of oil in some other of the wells and is the sand from which a small quantity of oil was obtained in several wells on the Bahn farm in Bastrop County (p. 29).

A sand or sandy shale containing a show of oil reported in the discovery well at depth 1155 to 1164 (--628 to --637) is near the base of the Navarro or in the upper part of the Taylor. The same sand is reported in numerous other wells and usually contains a show of oil or gas.

The Austin formation is reached in this part of the field at a depth approximating 2125 feet giving for the Navarro and Taylor including the serpentine a thickness of about 1510 feet.

A well located on the R. L. Abbott farm near the southeast margin of the field, entering the Austin at or near 2180 feet, appears to have reached the Edwards at 3015 feet. This interval of 835 feet cannot be satisfactorily divided into formations in this log. However, in the Bremond well in Milam County a few miles to the northeast, the formation thicknesses within this interval are: Austin, 342; Eagle Ford, 71; Buda, 63; Del Rio, 46; Georgetown, 167; total 689 feet. In the S. W. Jones well a few miles southwest of the field this interval shows formations as follows: Austin, 325; Eagle Ford, 148; Buda, 59; Del Rio, 52; Georgetown, 170: total 754 feet.

The Austin formation underlying the producing zone is highest at the west side of the field and lowest at the southeast, indicating the normal southeast dip of this region. Some irregularities occur but the records are too few as vet to determine whether these irregularities are actual or are due to imperfect logging of the wells.

The serpentine is a lens-shaped mass flattened at the top and irregularly flattened at the base where it rests upon the Austin formation. The serpentine thins laterally and well records show clays coming in between the serpentine and the Austin.

Above the serpentine, at places resting upon it and elsewhere separated by shale, is a chalk stratum in the Taylor formation which is variable in thickness and possibly also in position. The irregularity of this chalk stratum makes contouring at this horizon doubtful. However, insofar as the records can be used at all, contouring on this chalk indicates a dome corresponding in position to the mass of serpentine.

Contouring on the sand near the base of the Navarro or in the upper Taylor indicates a dome agreeing in position with the serpentine and having a closure imperfectly defined at the west side of the field but apparently between 100 and 200 feet.

The structural conditions here described based on the relatively few records are being further checked as new wells are drilled and only the contouring on the serpentine is given at this time.

The area underlaid by serpentine approximates 6,000 by 4.000 feet. As in other serpentine fields initial production varies greatly and large initial production occurs irregularly over the field. The maximum thickness of the serpentine is undetermined. Wells drilled through the serpentine record thickness varying from 525 feet to a few inches or none at the margins. Many wells, especially in



Fig. 9. Chapman oil field. Contoured on top of the serpentine. Contour interval 100 feet. Subsequent drilling will doubtless somewhat modify the contouring particularly at the east side of the field where but few wells have been drilled.

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the central part of the field, terminate in the serpentine. It is difficult to determine from the logs where production comes into the wells, but apparently at varying depths in the serpentine. The grade of oil in this field is 37° to 37.5° B. The closure on the serpentine dome is between 300 and 400 feet (Fig. 9). A well on the J. C. Abbott farm, No. 4 of the Ertel 30-acre lease, drilled 954 feet of serpentine, 1666 to 2620. The well at this depth was still in serpentine and probably indicates the location of a vent through which the serpentine came.

If the serpentine of this field is intrusive, the igneous flow rose through the Austin and entered the Taylor at some time subsequent to the close of the Cretaceous. The doming of the overlying Cretaceous and the slight thickening of the Taylor-Navarro section supports the theory of intrusive origin. If of extrusive origin, the lava flow came near the close of Austin or in early Taylor time. To maintain the theory of extrusive origin of the serpentine in this field it is necessary to account for the doming in the overlying Cretaceous in which case it would be difficult to account for the thickening of the section. Structural highs existing at the time of deposition of sediments result ordinarily in the thinning of the section.

Water.—The underground water of Williamson County is obtained chiefly from sands at and near the base of the Cretaceous. In the western part of the county these sands are within 400 or 600 feet of the surface. Dipping eastward they lie in the Balcones fault zone at Georgetown and Round Rock at 1100 or 1200 feet. East of the Balcones fault zone the dip is more rapid and at Taylor the sands are found at a depth of about 2500 feet. East of Thrall these sands have not been drilled into but in the southeast corner of the county may be expected at 4500 or 5000 feet.

The water of the basement sands is usually good although a well drilled on the Walsh farm 5 miles west of Round Rock obtained salty water. At Taylor where the formation is deeper the water of the basement sands contains some hydrogen sulphide which, however, escapes when the water is aerated. The following wells illustrate the water supply conditions:

Conway 2, Donnelly et al.; Burleson league, at Hopewell, one mile east of Burnet County line, seven miles southwest of Liberty Hill. Starts near the top of Glen Rose. Elevation 1150 T. T. D. 1133.

DRILLER'S LOG

I	Depth in	Feet
Surface soil		
Blue rock-water at 60 feet, rises 50 feet	112	
Blue rock—water at 205 feet	220	
Blue rock and clay strata—caving fast	280	
Blue clay and rock strata—caving fast	306	
Blue rock, some sand—caving fast	335	
Light brown or red rock—caving fast from above	375	
Granite sand—caving (water)	436	
Brown color—caving	470	
Brown color-caving-lighter, conglomerate	490	
Brown color clay	509	
Brown color clay—lighter	516	
Dark rock	537	
Light brown rock		
Slate colored rock—caving; 6¼-in. casing set at 558	560	
This interval includes "pepper and salt" sand	565	
White rock	575	
Red	588	
Cream colored rock	596	
Cream colored rock—lighter color	634	
Light red rock	643	
White sand	655	
Red clay	666	
Blue clay	679	
Brown rock, some sand. (5 3/16-in. casing set at 690. I water below this depth.)	No 695	
Black shale	700	

Log wanting below 700 feet. Samples indicate prevailingly gray to dark finely laminated limestone, chert, shale, and quartzitic sandstone from 700 to 1080. The character of the rock in this interval is indicated by the following description of samples from depth 962 to 967. (From records of the Bureau of Economic Geology. Described by H. T. Kniker.)

The sample consists of a dozen large fragments from ¼ to 2 inches in diameter. There are three different kinds of rock represented. Two fragments consist of a dark gray laminated limestone, extremely brecciated and cut by a number of calcite veins; some are irregular and others run parallel to each other. The veins vary in thickness from less than 1 mm. to 3 or 4 mm. In one specimen there is considerable pyrite, principally in the calcareous rock. In one fragment the limestone is crushed, brecciated and cut by joints and open fissures. Some of the open fissures measure ½ mm. in diameter. The rock is finely laminated. Another type of rock consists of a greenishgray sandstone. In one fragment a band of dark greenish material about 3 mm. wide is noted. This band is separated from another similar band by some light green material about 3 or 4 mm. wide. In thin section, the sand grains are worn and round, and are held together by some calcareous material. The grains are $\frac{1}{2}$ mm. in diameter and less. A third type of rock is a stony and argillaceous cherty shale, cut by straight joints along which the rock is darkened. This also is laminated, but gives no reaction with acid. One fragment shows 34 laminae in 14 mm. Oil show reported at 1030. Trinity water rises to within 252 feet of the surface.

Formations identified from cuttings: Cuttings from 695 to 1080, 39 samples, show laminated limestone and chert and black shale, mostly bituminous. Near the bottom is some sandstone or quartzite. The rock is throughout broken by faulting and is traversed by calcite veins; no fossils observed except a few obscure sponge spicules.

Interpretation from log and samples: Glen Rose, 0 to 335; Travis Peak, 635 to 695; Paleozoic, Ordovician(?), 695 to 1135.

Miller 1, Miller and Mayfield; Malone surv., 3½ mi. east of Liberty Hill. Elevation 1050 T. Starts probably near base of Walnut. T.D. 1910. Drilled 1926.

Depth in	Feet*		Depth in	Feet
White lime	20	Gray lime rock		790
Blue lime	60	Pink gumbo		802
Gray lime	95	Sand rock-water		820
Water sand	110	Brown gummy shale		826
Gray lime	210	Blue gumbo		833
Water sand	216	Brown shale		858
Gray lime	288	Dark lime rock		867
White lime	310	Sand nock		872
Gray lime	334	Sand rock		908
Sand shale and shell—gas	365	Shale with gas		016
Shale	378	Black lime		067
Blue gumbo	389	Diack line	1	001
Sand and shell	396	Sand and shale	1	1001
Gray lime rock	401	Sand and shale		1021
Sand and shell	420	Pack sand		1070
Gray lime	428	Gray lime		
Sand rock	437	Blue shale		1100
Sand and shell	449	Black lime		1130
Gumbo	456	Sand rock		1144
Gray lime rock	498	Shale and boulders		1169
Trinity sand—water	568	Black lime		1182
Lime rock	604	Gray shale		1193
Sandy lime and shell	649	Shale and sand		1203
Gumbo, blue	669	Gray lime crystallize	d1	1205
Shale	681	Gray shale and sand		1213
Gumbo	. 696	Black lime		1223
Lime rock	721	White lime		1241
Sand	738	Blue clay and shale		1289

*Lime as used in these logs is the driller's term for limestone. Below the Cretaceous the rock so logged is largely dark quartzitic sandstone as shown by samples.

Williamson County

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Depth in Feet	Depth in Eeet
Clay and lime1299 Blue clay and black lime1307 Black lime1352	Blue shale with streaks of hard black lime rock 1830 Blue-gray shale with strata
Black shale and lime 1440	of black hard lime1840
Blue shale and black lime	Black shale1900
rock1500	Strata of black lime and shale 1910

Six and five-eighth inch casing set at 844 feet; 5% inch casing set at 1300 feet; second casing set to prevent caving in shale. The Trinity water does not flow at surface. No water below 844 feet.

Formations identified from cuttings: 696 to 826, Cretaceous; 859 to 1910, black shales, sandstones, and quartzites, shale predominating.

Interpretation from log and samples: 0 to 826, Cretaceous; 826 to 1910, Paleozoic.

Walsh 1, Palm Valley Oil Co.; Dillard Surv., 5½ miles west of Round Rock. Starts in Edwards. Drilled by rotary. Elevation 839A. T. D. 1210.

DRILLER'S LOG

Depth in	Feet	Depth in	Feet
Surface	4	Gray lime	775
Gravel	8	Slate	785
Lime	178	Lime	800
Water sand	198	Slate	820
Lime	238	Brown shale	835
Slate	243	Slate	890
Lime	303	Water sand, shell and slate	918
Slate	313	Lime	938
Lime	464	Lime and sand, fresh water	960
Water sand	_478	Lime	975
Lime	518	Lime shell, pink clay, show-	
Slate	541	ing "asphaltum"	985
Lime	601	Lime	990
Slate	621	Red clay	992
Lime	631	Lime, showing "asphaltum"	1000
Slate	661	Coarse and fine sand, salt	
Lime	681	water	1027
Slate	696	Lime	1076
Lime	700	Soft and hard lime with	
Changeable, light, showing		streak of pink and brown	
of oil	750	shale. Slight showing of	
Slate	760	"asphaltum"	1108

Mr. Ed Walsh says that fresh water was obtained to depth 800 feet or more; and much salt water at 1000 feet or more. Salt water rose in the well but did not flow at the surface.

Formations identified from samples: 960 to 1035, basal Cretaceous; 1090, 1200, 1210, 1230, sandy, porous, white or pink rock with some greenish shales.

Interpretation from log and samples: Cretaceous, 0 to 1035; formation undetermined, 1035 to 1210. A second well on this property was drilled to about 1300 feet. In this well an oil show in sand is reported at about 1100 to 1130 feet. The well was drilled by Walsh Brothers.

Georgetown city well; two blocks southeast from Missouri Pacific Railroad. Elevation 750. T.D. 1820. Drilled, 1914.

DRILLER'S LOG

Depth in Feet	Depth in Feet
Black soil 5	Gray lime rock 502
Yellow clay 20	Blue lime rock 535
White lime rock 30	Lime rock1050
Blue shale 65	Green shale1051
White lime rock 85	White limestone1056
Stratified lime rock and	White sand rock1260
water (see notes) 115	Red mud1280
Brown lime rock 198	Red mud1340
Blue lime rock 430	Black rock 1473
Blue shale and mud 435	Black shale1807
Blue lime rock 460	

Water struck at depth 100, rose to within 60 feet of the surface, and at 1100 and 1200 feet other veins of water were found which also rose to within 60 feet of the surface. Very hard drilling below 1260.

Samples identified from cuttings: From 0 to 980, Cretaceous, many samples; 980 to 1260, undetermined; 1260 to 1820, shale, slickensided, cut by calcite and quartz veins, some quartzite. At the top the shales are reddish or gray from partial oxidation.

Interpretation from log and samples: 0 to $1260\pm$, lower Cretaceous (Edwards water at 85 to 115 feet; water at 1100 and 1200); Paleozoic 1260 to 1820. According to Mr. R. C. Ward who was in charge, some water was found at 600 and at 800 feet, but not enough water was obtained at any depth to justify connecting for city supply.

Taylor city well. Elevation 550. Drilled 1913, standard drill. T.D. 3260.

DRILLER'S LOG

Depth in Feet	Depth in Fee
Black soil 1	Blue clay 1557
Yellow clay 40	Hard lime rock2370
Blue clay 500	Blue shale2440
White clay 700	Gray lime rock2470
Soft white lime rock, about	Blue shale and mud251
40 bbls. water per day 800	Dark gray lime rock2580
Blue clay1060	Sand and water2722
Hard white lime rock1090	Hard dark sand rock2762
Blue clay1180	Soft sand and water2812
Hard lime rock1315	Green shale2827
Stratified hard lime rock	White soft sand and water2887
and soft sand rock; sul-	Sand and water stratified 2954
phur water1475	Hard sand rock 2974
Hard white lime rock1556	Trinity sand and water 3260

Edwards sulphur water, 1300 to 1475. Basal Cretaceous sands, 2505 to 3260. Water horizon reported at 2505 to 2722, 2762 to 2812, 2827 to 2954, and 2974 to 3260. The log on this well is probably approximate rather than exact. No samples were received from the well.

The city water supply at Georgetown is obtained from a well dug to depth of about 100 feet, the water being from the Edwards formation. This supply is supplemented as required from springs in the San Gabriel River nearby. The city supply at Taylor is from the deep well, the water coming from the Trinity sands. The water supply at Granger is from the basal Cretaceous sands. The principal water sand is found here at depth 2356 and 2421.

Much of the eastern part of the county has a covering of gravel from which water is obtained in shallow wells. In the western part of the county water is obtained from the basal Cretaceous sands.

WELL RECORDS

Records of the following wells in this county will serve to indicate the formations penetrated and their depth. The wells given are representative but not complete for the county. The elevations given are such as accompany the logs or have been otherwise supplied from various sources. Abbreviations accompanying these elevations are as follows: P, plane table or y-level; T, from topographic map; A, obtained by anaeroid. All elevations should be regarded as approximate, not exact. The depth to the Edwards formation is given for some of the wells in the eastern part of the county. Where this formation was not recorded the depth may be estimated by interpolating formation thicknesses given on page 75.

Jim Abbott 1, Chapman et al; Simon Miller surv., 3 miles from east and 3½ from south county line, 8 miles southeast of Thrall. Elevation 517 P. Starts in Wilcox. Drilled 1930.

Interpretation from log: Wilcox (basal part), Midway, Navarro, and Taylor, 0 to 1834. Well is producing oil at 1834 and is the discovery well of the Chapman oil field.

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Alexander 1, Cummings Oil Co.; Simon Miller surv., 4 miles from east and 3½ from south county line, 8 miles southeast of Thrall about 1 mile southwest of Chapman No. 1 Abbott. Elevation 564 P. Starts in Wilcox. T.D. 2509.

Formation identified from cores: 753, Navarro; 1007 and 1899, Taylor; 2125, Austin (?).

Interpretation from log and samples: Wilcox (basal part), Midway, Navarro, and Taylor, 0 to $2125\pm$; Austin (?) at 2125.

C. A. Blomstedt 2, Round Rock Oil Co.; Donoghue surv., 4 miles northeast of Round Rock. Elevation 720 T. Starts in Austin. (Farm now owned by W. J. Fouse.) T.D. 1530.

Interpretation of log: Austin, 0 to 63; Eagle Ford, 63 to 106 (43); Buda, 106 to 138 (32); Del Rio, 138 to $195\pm$ (57); Georgetown, Edwards, Comanche Peak, Walnut, Glen Rose, and Travis Peak, 195 to 1479 (1284). Sulphur water horizon in Edwards 319 to 340. (No samples received from this well and interpretation of log difficult.) Several shallow wells drilled on same farm, some of which had a show of oil at depth about 110 feet. Depth to Edwards, estimated, 285. Hard rock, formation undetermined, 1479 to 1530.

Brown 1, The Texas Co.; Henry Cook surv., 1½ miles from east and 3 miles from south county line. Elevation 491. Starts in Wilcox. T.D. 3281.

Formations identified from cuttings: 250-303, 306-454, 454-487, Wilcox; 487-488, Midway; 1520, 2126, Taylor; 2326, 2368, and 2536, Austin; 2905-13, Eagle Ford; 3060-70, 3070-80, 3090-3100, 3114, Georgetown; 3202, 3211, 3221, 3241, 3260, 3261, 3281, Edwards.

Interpretation from log and samples: Wilcox (basal part), 0 to 487; Midway, Navarro, Taylor, and Austin, 487 to $2894\pm$ (2407); Eagle Ford, Buda, Del Rio, and Georgetown, 2894 to 3202 (308). Depth to Edwards, 3202.

Conway 2, Donnelly et al. See page 83.

Amor Forwood 1, Webber and Averill; H.T.&B. Railway Co. surv. No. 4, 1½ miles northwest of Thrall. Starts probably near top of Taylor. T.D. 1009.

Samples identified from cores: 452 to 990, Taylor; 992, 998, 1009, Austin.

Interpretation from log and samples: Taylor, 0 to 992; Austin, 992 to 1009. Depth to Edwards, estimated, 1645.

Walter Fuchs 1, Fritz Fuchs; Simon Miller surv., 3 miles from east and 3½ miles from south county line, 10 miles southeast of Thrall. (In Chapman oil field.) Elevation 527 P. Starts in Wilcox. T.D. 2160. Formations identified from cores: 1107, Navarro; 1730 and 2070, Taylor; from cuttings, 2150, Austin (?).

Interpretation from log and samples: Wilcox (basal part), Midway, Navarro, and Taylor, 0 to 2150; Austin, 2150 to 2160.

H. W. Ganzert 1, Thrall Mutual Production Co.; 6% miles southwest of Round Rock, 1½ miles east of Rutledge on the west side of Southern Pacific Railroad, 4 miles south of public road crossing. Elevation 844 A. Starts in Edwards. T.D. 1050. Drilled in 1921.

Samples identified from cuttings: 600 to 1050, Trinity Group.

Georgetown City Well. See page 86.

Jones 1, O. B. Colquitt; Hamilton White surv., 10 mi. southeast of Taylor. Elevation 549. Starts in Navarro. T.D. 1410. Drilled 1926. Formations identified from cuttings: 660, 825, and 1190 probably Taylor, chalky phase: 1348 and 1398. Austin.

Identification from log and samples: Navarro and Taylor, 0 to 1348; Austin, 1348 to 1410.

S. W. Jones, Lloyd Oil Corporation; A. Nantz surv., 405 feet from west line and 600 feet from north line of survey. Elevation, 503. Starts in Wilcox. T.D. 2900 Cable.

Formations identified from cuttings: 590 to 660, Midway; 685 to 980, Navarro; 1360 to 2020, Taylor; 2090 to 2100, Austin.

Interpretation from log and samples: Wilcox and Midway, 0 to 660 (or 685?); Navarro and Taylor, 685 to 2090 (1405); Austin, 2090 to 2415 (325); Eagle Ford, 2415 to 2563 (148); Buda, 2563 to 2622 (59); Del Rio, 2622 to 2674 (52); Georgetown, 2674 to 2844 (170); Edwards, $2844 \pm$ to 2900.

Klattenhoff 1, J. W. Allen and Eagle Drilling Co.; T. B. S. Strode surv., 2 mi. southwest of Coupland. Elevation 558 P. Starts probably near base of Navarro. Drilled 1925. T.D. 1728.

Formations identified from cores: 775 and 913, Taylor; 1050 and 1412, Austin; 1454, Eagle Ford; 1644, Georgetown; 1658 and 1670, Edwards.

Interpretation from log and samples: Navarro (basal part) and Taylor, 0 to 1050; Austin and Eagle Ford, 1050 to 1474 (424); Buda, 1474 to 1510 (36); Del Rio, 1510 to 1576 (66); Georgetown, 1576 to 1658 (82); Edwards, 1658 to 1728.

Koonsen 1, Bartlett Oil Co.; W. H. Jenkins surv., 8 mi. west of Bartlett and 2¹/₂ mi. southwest of Schwertner. Elevation, 750 T. Starts in Austin. T.D. 2040. Drilled 1924. Formations identified from cuttings: 1750 and successive samples to 2030, Travis Peak. The log of this well is difficult to interpret. White lime, possibly the top of the Edwards, was entered at 559. Water was obtained at 634-39 (Edwards), 1025 (Paluxy?); 1747-52, 1782-1847 (Trinity). An oil show is reported at 2040.

John Kubishac; J. P. Mahan surv., 3 mi. northwest of Thrall. Starts in Taylor. Drilled 1927.

Formation identified from core: 1020, Austin.

L. E. Lawrence 1, Simms Oil Co.; 2000 feet east of Abbott 1. Elevation 533. Reported show of oil 1820-30. T.D. 2201.

Formations identified from cores: 1832, chalk and serpentine.

Interpretation from log and samples: Wilcox, Midway, Navarro, and Taylor, 0 to 2174; Austin, 2174 to 2201.

C. Mager 1, Kuykendall, Powers, and Swenson; southwest corner Byerly surv. Bl. 6; $3\frac{1}{2}$ mi. from south and $9\frac{1}{2}$ mi. from east county line, 5 mi. east of Coupland, $1\frac{1}{2}$ mi. northwest of Swenson 1. Elevation, 563. T. D. 1580. Drilled 1929, rotary rig.

Formations identified from cores: 950, Taylor; 1580, Austin.

Interpretation from log and samples: Wilcox (basal part), Midway, Navarro, and Taylor, 0 to 1580; Austin at 1580. Edwards; estimated, 2233.

Miller 1, Miller and Mayfield, see p. 84.

Partain 1, J. L. Tomberlin and E. L. Chapman; Beader surv., 2½ mi. northwest of Coupland. Starts near top of Taylor. Drilling, rotary.

Formations identified from cores: 1367 and 1400, Georgetown; 1500 to 1518, Edwards.

Interpretation from log and samples: Navarro, Taylor, Austin, 0 to 1179; Eagle Ford, 1179 to 1190; Buda, 1190 to 1250; Del Rio, 1250 to 1322; Georgetown, Edwards, 1322 to 1518.

Pflueger 1, Plateau Oil and Gas Co.; 1 mi. southeast of Coupland, Jos. Hordan surv., 800 ft. from west and 1600 from south survey lines. Elevation, 558. Starts in Navarro. T. D. 2026. Drilled 1925, rotary.

Formations identified from cores: 1261, basal Taylor or top of Austin; 1907 and 1929, Georgetown; 1960, Edwards.

Interpretation from log and samples: Navarro and Taylor, 0 to 1261; Austin, Eagle Ford, Buda, Del Rio, and Georgetown, 1261 to 1914 (653 feet); Edwards, dobie phase, 1914 to 1929 (15 feet); Edwards, hard phase, 1929 to 2026. Sulphur water in Edwards.

David Reithmeyer, Rhett Wilder and Groueman; White surv., 1000 ft. north of Brushy Creek, 3½ mi. southeast of Thrall. Elevation, 462. Starts near top of Navarro. T. D. 2240.

Formation identified from cores: 2240, Edwards.

Interpretation from log and samples: Navarro, Taylor, Austin, Eagle Ford, Buda, and Georgetown, 0 to 2195; Edwards, 2195 to 2240.

Round Rock City Well; elevation, 720. T. D. 1400. Edwards water horizon at 100. Glen Rose mineralized water at 500. Trinity water at 1400. (Record from R. T. Hill, 21st An. Rpt. U. S. Geol. Surv., Pt. 7, p. 518, 1901.)

Peter Schram, E. L. Chapman; W. West surv., 3 mi. northwest of Chapman oil field. Elevation, 461. Starts in Wilcox.

Formations identified from cores: 1900 and 2060, Austin.

Interpretation from log and samples: Wilcox to Buda, inclusive, 0 to 2433; Del Rio, 2433 to 2491 (58); Georgetown and Edwards, 2491 to 2641. Sulphur water in Edwards in this well at about 2700 feet. Depth to Edwards, estimated, 2641.

Peter Schram 1, Guyler, Smith, and Jarmon; Wilford Cartwright surv., 5 mi. southeast of Thrall. Elevation, 421 P. Starts probably in Navarro. T. D. 2474.

Formations identified from cores: 1296, Taylor; 2203, 2250, and 2306, undetermined; 2333 to 2382, Georgetown; 2412, Edwards.

Interpretation from log and samples: Midway, Navarro, Taylor, Austin, Eagle Ford, Buda, Del Rio, and Georgetown, 0 to 2412; Edwards, 2412 to 2474.

Clarence Sitman 1, Sarsfield, Wilson and McIntyre surv., 3 mi. northwest of Coupland and about 7 mi southeast of Taylor. Elevation 517 P. Starts in Taylor. Drilling, rotary.

Formations identified from cores: 1250, Austin; 1336 to 1346, Eagle Ford; 1346 to 1360, Buda; 1707 to 1711, 1719, Edwards; 2312, 2361, 2369, 2376, 2391, 2942 to 2950, Glen Rose.

Interpretation from log and samples: Navarro to Edwards, inclusive, 0 to 1706; Edwards to Glen Rose, inclusive, 1706 to 2950 (1244). Two strata of sand reported in the interval from 2340 to 2361.

Charles Stauffer, Thrall New Pool Oil Co.; W. Cartwright surv., 2½ mi. south, 1 east of Thrall. Starts in Navarro.

Formations identified from cuttings: 1320 and 1342, Austin.

Interpretation from log and samples: Navarro and Taylor, 0 to 1300; Austin, 1300 to 1342.

Stiles 1, Magnolia Petroleum Co.; Daniel Kimbro surv. Thrall oil field. Started probably in Navarro. T. D. 3414. Elevation, 480. Drilled 1925.

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Formations identified from samples: 3000 and 3134, Glen Rose.

Interpretation from log and samples: Navarro (basal part), Taylor, Austin, Eagle Ford, Buda, Del Rio, Georgetown, Edwards, Comanche Peak, Walnut, and Glen Rose, 0 to 3290; Trinity, basal Cretaceous sand, 3290 to 3414. At this depth the well flowed 150 barrels of water through one-inch choker, temperature, 99.5° F., pressure, 60 pounds.

Swenson 1, Armstrong-Messer; southwest corner of William Byerly surv., block 9, southeast corner, $1\frac{1}{2}$ mi. southeast of Mager 1, $3\frac{1}{2}$ mi. from south and $9\frac{1}{2}$ mi. from east county line, and 6 mi. east of Coupland. Elevation, 550. Starts in Midway. T. D. 1200. Drilled 1928-29.

Formations identified from samples: 300, Midway; 685, 700, 740, Navarro; 875 and 1000, Taylor.

Ben Thonig 1, O. B. Colquitt and Simms Oil Co.; P. Stoddard surv. ¹/₂ mi. south of Beyersville. Elevation, 495. Starts probably in Navarro. Drilled in 1925.

Formations identified from cores: 1190, Taylor; 1305 and 1395, Austin (?).

Interpretation from log and samples: Navarro and Taylor, 0 to 1305; Austin, 1305 to 1395.

Walsh 1, Palm Valley Oil Co. See page 85.

Taylor City Well. See page 86.

Available Literature and Maps.—The geologic map accompanying Part VII of the Twenty-first Annual Report of the U.S. Geological Survey includes Williamson County. The eastern part of the county is included in the geologic map which accompanies U.S. Geological Survey Professional Paper No. 126. The Thrall oil field is described in The University of Texas Bulletin No. 66, and in part is redescribed in The University of Texas Bulletins Nos. 2539 The Midway has been mapped through this and 2744. county by Dr. Julia Gardner (Mns.). Cement materials are briefly described in U.S. Geological Survey Bulletins 243 and 522, and the Thrall oil field in Bull. American Association of Petroleum Geologists, Volume 5, 1921. A geologic report on this county with map is being prepared by F. L. Whitney, R. H. Cuyler, and J. W. Wells to be issued as a bulletin of The University of Texas. A more detailed report on the Chapman oil field in this county will subsequently be published.