

MINERAL RESOURCES OF TEXAS

TRAVIS COUNTY

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Travis County is located on the Colorado River at the west or inner margin of the Gulf Coastal Plain. Its principal mineral resources are clay, limestone, sand and gravel, surface and underground water, and possibly petroleum. The Missouri, Kansas, and Texas; Missouri Pacific; and Southern Pacific railroads cross the county. Its public road system includes Highways No. 2, 20, 29, 71, and 81, and lateral roads.

STRATIGRAPHIC GEOLOGY

Travis County is chiefly in the belt of Cretaceous formations, the entire series of formations of the Cretaceous system as developed in this part of the State being exposed in this county. As the formations dip eastward the earliest of the Cretaceous formations, the Travis Peak, is at the surface in the west part of the county, succeeded in order eastward by the Glen Rose, Walnut, Comanche Peak, Edwards, Georgetown, Del Rio, Buda, Eagle Ford, Austin, Taylor, and Navarro.

In the western part of the county large areas are occupied by the Travis Peak, Glen Rose, and Edwards formations, and relatively small areas usually in escarpments or "breaks" by the Walnut and Comanche Peak, both of which are thin formations. The Austin, Taylor, and Navarro formations form broad belts across the eastern part of the county. The intervening formations, Georgetown, Del Rio, Buda, and Eagle Ford are relatively thin, and partly for this reason and partly because they lie within the Balcones fault zone, occupy but limited surface exposures. In the sketch map (Figure 5) several of these formations in the fault zone are combined in mapping.

Near the east margin of the county north of the Colorado River the Midway formation comes into the county.

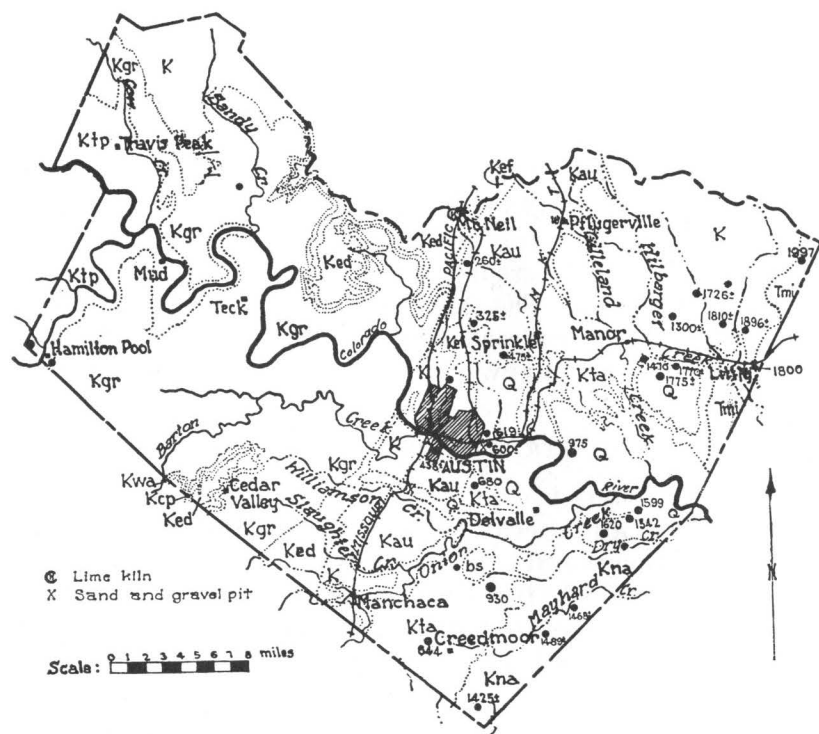


Fig. 5. Map of Travis County showing formation contacts and well locations. Mapping chiefly from Folio 76, U. S. Geol. Survey. The Austin contact has been adjusted from thesis manuscript map of S. O. Burford. The Midway contact is from manuscript map of Dr. Julia Gardner. Brick plant and sand and gravel pits at Austin are not indicated for lack of space. Map entries accompanying wells give depth to the Edwards formation. Key to wells, location of which is shown on map: 260, Gault; 325, Robinson; 438, Norwood; 475, Walling; 600, Pannell; 619, Giles; 644, Johanson; 680, St. Edwards University; 930, Ross; 975, Rowe; 1,300, Richie; 1,425, Peyton; 1,468, Jacobson; 1,489, Schreiber; 1,470, Johnson; 1,542, Childress; 1,599, Republic Bank and Trust Co.; 1,620, Washington; 1,726, Carlson; 1,770, Parsons; 1,775, Wolfe; 1,800, Sharp; 1,810, Giese; 1,896, Lockwood; 1,997, Bengston. Cretaceous undivided (K) includes in the northwestern part of the county, Fredericksburg; in the central part, Washita and Eagle Ford; and in the northeastern part, Taylor and Navarro.

Overlying the Cretaceous and Midway east of the Balcones fault zone are extensive gravel terrace deposits of Cenozoic age. The oldest terrace occupies the highest lands. Pleistocene and recent alluvial deposits are found in the valley of the Colorado River and its tributaries. A basaltic

knob known as Pilot Knob occurs about eight miles south of Austin and a basaltic dike occurs on Barton Creek 13 miles by public road west of Austin,¹ and three miles south-southeast of Cameron Ferry.

Serpentine has been found in a number of wells in the northeastern part of the county. The serpentine is found in or just above the Austin or within the Taylor. Igneous rock, serpentine, and basalt are found at a number of localities in and south of Austin as reported in University of Texas Bulletin 2744, pp. 15 and 119 to 123. In a well drilled at the residence of G. A. Parkinson, Riverside Drive, South Austin, the igneous rock is reported to extend from the surface to depth 180 feet.

FORMATION CHARACTERISTICS AND THICKNESSES

In the table which follows, the formations are listed in order including their thickness as determined either from surface outcrop or from drilling records:

¹Dr. T. L. Bailey has supplied the following note on the dike: A dike of nephelite basalt showing a maximum width of 15 feet and striking N. 20° E. is well exposed in the bed and north bank of Barton Creek, cutting the Glen Rose limestone. This limestone is slightly metamorphosed for a distance of 3 to 36 inches from the contact on both sides of the dike. The contacts seem to be approximately vertical. Two other poorer exposures were seen, (1) on south side of Barton Creek 300 yards, S. 20° W. of the main exposure, and (2) near the road on the north side of Barton Creek about 500 yards, N. 20° E. of the main exposure in creek bed. These two minor exposures show the dike to be thinner, especially No. 2, which is topographically about 75 feet higher than the main exposure. It had a width of only a foot so far as could be ascertained from the poor outcrop at this last point. This looks like a dike which was not intruded far enough up to be exposed at the surface except where streams have cut into the surface. It probably was forced up higher at certain localities than it was over most of its extent, thus producing discontinuous outcrops. See also Univ. of Texas Bull. 2744, p. 15.

Table of formations

Midway	Not fully exposed in this county	Clays and shell marls
Navarro	600± (Bengston); 600± (Lockwood)	Clay and marls
Taylor	550± (Surface) ² ; 540 (Surface) ³ ; 700± (Richie)	Clay, marl and chalk
Austin	309 (Childress); 361 (Giese); 294 (Giles); 275 (Johanson); 284 (Emma Johnson); 330 (Pannell); 297 (Republic); 400 (Richie); 339 (Ross); 290 (St. Edwards); 340 (Walling)	Limestone and chalk
Eagle Ford.....	45 (Childress); 40 (Giles); 24 (Emma Johnson); 40 (Pannell); 39 (Republic); 35 (Robinson); 24 (Ross); 36 (St. Edwards); 49 (Walling); 35 (G. W. Walling); 42 (Surface) ⁴ ; 47 (Surface) ⁵	Clay, shale, and flagstone ledges
Buda	45 (Giles); 54 (Emma Johnson); 30 (Pannell); 48 (Republic); 40 (Robinson); 51 (Ross); 25 (G. W. Walling); 45 (Surface). ³	Hard limestone
Del Rio.....	80 (Giles); 41 (Axel Johanson); 63 (Emma Johnson); 65 (Robinson); 55 (Ross); 58 (G. W. Walling); 77 (Surface)	Clay with hard ledges
Georgetown	118 (Childress); 130 (Giles); 46 (Axel Johanson); 113 (Emma Johnson); 85 (Stark Washington 2); 71 (Surface) ⁷ ; 80 (Surface) ³ ; 80 (Surface) ⁶	Limestone
Edwards	300± (Surface) ³ ; 287+ (Surface) ⁷ ; 308± (Lovelace)	Limestone with flint layers and nodules
Comanche Peak.....	50± (Surface) ⁷ ; 49 (Surface) ⁸ ; 55 (Surface) ²	Nodular limestone
Walnut	15 (Surface) ³ ; 15 (Surface) ⁷	Calcareous clay and limestone
Glen Rose.....	643± Asylum well; 500 to 700 (Surface) ³	Alternating limestone and marls
Travis Peak.....	263 (Surface) ³ ; 315± (Asylum well)	Limestones and sands

²Burford, S. O. Thesis manuscript, 1928.³Hill, R. T., and Vaughan, T. W. U.S. Geol. Surv., Austin Folio, 1900.⁴Green, G. E. Thesis manuscript, 1925.⁵Arick, M. B. Thesis manuscript, 1928.⁶Cuyler, R. H. Bull. Am. Assn. Pet. Geol., Vol. 13, p. 1291, 1929.⁷Christner, J. B. Thesis manuscript, 1929. West Travis County 25 feet, and Mt. Bonnell 65 feet.⁸Damon, H. G. Thesis manuscript, 1924.

The very pronounced variation in thickness recorded for some of the formations may be due in part to errors in the drillers' records or measurements. This is likely to apply in particular to the Austin formation since a chalk in the Taylor may be mistaken for the Austin. The Eagle Ford varies in the records from 24 to 47 feet. The minimum thickness of 24 feet appears in two wells, but is based on drillers' records only. The Buda varies from 25 to 54 feet. The record of 25 feet is from a water well drilled on the Walling farm northeast of Austin. Unexpected variation exists in the Georgetown which as recorded varies from 46 to 130 feet, and the Del Rio seems to vary from 41 to 80 feet.

That the variation in thickness is mainly real and not the result of errors in measurement or identification of formations is apparent when group thicknesses are compared. Thus the Axel Johanson well in which the Georgetown is recorded as only 46 feet has Del Rio 41, Buda and Eagle Ford combined 69, and Austin 275, total 431. In other words the entire section from Austin to Georgetown is below the average. In the Childress well in which the Georgetown is 118 feet, the same interval, Austin to Georgetown inclusive is 602 feet.

Table of thickness of formation groups

Midway, basal part, Navarro and Taylor: 1,320 (Bengston).
 Midway, basal part, Navarro, Taylor, Austin, Eagle Ford, Buda, Del Rio, and Georgetown: 1927 (Bengston).
 Navarro and Taylor: 1170 (Giese); 1,186 (Sharp).
 Navarro, Taylor, and Austin: 1,548 (Sharp).
 Navarro, Taylor, Austin, Eagle Ford, Buda, Del Rio, and Georgetown: 1,800 (Sharp).
 Austin, Eagle Ford, Buda, Del Rio, and Georgetown: 677 (Bengston); 602 (Childress); 530 (Emma Johnson); 431 (Axel Johanson); 589 (Giles); 522 (Republic Bank & Trust Co.); 592 (Sharp).
 Eagle Ford, Buda, Del Rio, and Georgetown: 252 (Sharp).

As a result of well drilling the character of the sediments under the Cretaceous is somewhat known in the western part of the county. A valuable record of this kind is afforded by a well drilled on the Evans "Sunset" ranch in the northwestern part of the county from which cores were

obtained. This well starts in the Glen Rose and is in Cretaceous probably to depth 620. Underneath the Cretaceous are sediments of undetermined age.

The cores from this well are described by W. S. Adkins as follows:

Two small core samples from this well came into the laboratory on March 28, 1920. On March 29th about 4 feet of core was obtained by the Bureau at the well. The material came out of the casing from about the depth of 789–793 feet, assuming that the top of this core was 789 feet, stated to be the corrected depth in the log supplied to us. The core is $4\frac{1}{2}$ to $4\frac{3}{4}$ inches in diameter except for a constriction at the top near the attachment of the drill stem. The core came out of the casing in fragments which were numbered i–viii, beginning at the bottom. About April 5th a piece of another deeper core, of essentially the same material as the graywacke here described, was secured by the Bureau, and at that time the coring was stopped. The following description is based on these samples.

General features.—(1) There are bedding or cleavage planes of variable steepness, 5° – 70° .

(2) There is a series of slickensided surfaces on these planes.

(3) There is a series of in part branching calcite and pyrite veins lying in and across these bedding planes and on the slickensided surfaces.

(4) There is a system of small scale faulting, involving both the bedding planes and the calcite veins.

(5) Softer dark slaty colored shale is squeezed between parts consisting of harder light colored non-calcareous sandstone, and at such places there has been extensive irregular crushing of both materials and some evidence of twisted structure. At places this softer material sheared off pre-existing calcite veins and at other places such veins were subsequently laid down across the boundary between the two materials.

(6) There is a system of jointing, with the bedding planes at right angles to each other.

The mass of the material is a slaty-blue laminated non-calcareous shale. It is firm, and most parts of it are easily scratched by the finger nail. This material, which makes up the bulk of the samples, contains, however, in parts of the core, other sorts of material, notably a harder blacker shale, and calcite veins. There is in addition a considerable amount

of slippage and faulting within the material, and at places slickenside markings. The bedding planes lie at variable, usually steep, angles to the axis of the core.

Angle of Bedding Planes.—The majority of the cleavage planes in the core 789–793 feet, fall into almost exactly two measurements— 66° and 23° to the horizontal. These two prevailing planes are therefore at right angles to each other. Some other angles occur scattered in the core, and in addition certain bedding planes are curved, having a variable angle of dip. The direction of dip is unknown. The cores soak up considerable quantities of water between these bedding planes. The water may be seen and heard coming in between the loosely laminated material; and shortly afterwards the cores begin to split along the bedding planes. There are irregularities (apparent angular unconformity) between certain of the bedding planes. From this “playing out” of a few laminae against a bedding plane, a reduction in the steepness of dip of the bedding plane results, hence some of the variability in the angles of cleavage along bedding planes is due to such irregularities in bedding. At such places the bedding is in part straight, and in part curved and irregular. In the dark material the planes often have a glassy obsidian-like surface.

Calcite veins.—In the light material the majority of the bedding planes now visible in the broken core have a thin uniform septa or sheet of secondarily deposited calcite. These sheets average in thickness about 0.2 mm., a thickness which may represent the limit of expansive force of the growing crystals. Only about 30 per cent of the visible calcite veins lie in either of these two sets of bedding planes; the rest are scattered at various angles. Some of the latter are large and branching, and here reach a thickness of 3 mm. They have a network of minute irregular anastomosing veinlets running out from them, apparently filling cavities in the rock. Their centers often contain small pyrite crystals.

Pyrite veins.—Small amounts of pyrite are distributed in small crystals (a) along the bedding planes; (b) in the transverse planes, where they usually form a line of crystals running along the center of the thicker calcite veins, and may or may not be surrounded by a cavity; (c) in fractured areas of the darker material where they form small irregular masses.

Black veins.—Fine veins—thickness 0.1 to 0.4 mm.—of dark asphaltic-looking material lie at all angles in the light colored (sandstone) material. These veins intersect and cross

each other; and at places the core is broken so as to show them as broad irregular blotches in a cleavage plane.

According to A. W. Johnson, who also examined the cores, this rock, in its lithologic characteristics, very closely resembles the Virginia slate of the Upper Huronian of the Lake Superior region.

Sediments of this same general character probably underlie much of the county from the Balcones fault zone westward. A well at the State Insane Asylum at Austin probably drilled through the Cretaceous and into older rocks. Unfortunately, however, samples of the rock penetrated were not preserved. In the southwestern part of the county in the vicinity of Hamilton Pool two wells have been drilled through the Cretaceous and into dark shales. Owing to the absence of fossils the shales are undetermined as to age.

East of the Balcones fault zone in this county sediments below the Cretaceous have not been reached in drilling.

STRUCTURAL GEOLOGY

The regional dip of the Cretaceous formations in Travis County is in an easterly or southeasterly direction. The Balcones zone of faulting crosses the county in an approximately north-south direction passing near Austin. At Mt. Bonnell just west of Austin the major fault of this zone has a throw, as measured by Damon, of 668 feet, the downthrow being to the east.⁹ At the north margin of the county the faults are somewhat reduced in throw. The fault zone is occupied by several formations not separately mapped on the sketch map. The faults of this zone are normal and as a rule have downthrow to the east. Faulting in this zone is so extensive that it is impracticable to name individual faults. The following, however, will serve as illustrations: East foot of Mt. Bonnell, major fault with Georgetown and Del Rio on the downthrow, Edwards in the drag, and Glen Rose in the upthrow; in public road opposite Camp Mabry, Del Rio on the downthrow and Georgetown on the upthrow; and Shoal Creek below 34th Street crossing, Buda on downthrow and Del Rio on the

⁹Damon, H. G. Thesis manuscript, 1924.

upthrow. The location of a number of other faults is indicated on the Austin folio of the United States Geological Survey.

West of the Balcones fault zone eastward dip in the Cretaceous formations is moderate, not exceeding 10 or 20 feet per mile.¹⁰ East of this zone the dip is greatly accentuated amounting to 100 or 125 feet per mile. Thus the Edwards formation which is at the surface at the fault zone is buried at the east margin of the county to a depth of 2,000 or more feet.

ECONOMIC GEOLOGY

Basalt.—Basalt rock at Pilot Knob eight miles south and two east of Austin is at present not being utilized. This rock is several miles from railway transportation which has probably delayed its utilization. It is a very hard rock and is difficult to crush.

Bentonite.—Bentonite is found at several localities in Travis County. In the Eagle Ford at Waters Park and in Austin several layers of bentonite occur, varying from one to five or six inches in thickness. About one mile west of Kimbro is an exposure of a bentonite horizon occurring near the top of the Taylor.

Celestite.—The strontium sulphate mineral celestite is found in limestones of the Glen Rose formation at Mt. Bonnell and elsewhere in Travis County. Small quantities of the mineral have been mined from the rock where it occurs in pockets.

The occurrences of this mineral have been studied recently by Professor L. S. Brown whose conclusions are that the mineral in this part of Texas is restricted in occurrence to the Glen Rose formation and that it crystallized directly from the Glen Rose seas essentially contemporaneously with the deposition of the sediments.

Clay.—The clay bearing formations of this county are the Del Rio, Eagle Ford, Taylor, Navarro, and Midway, and the alluvial deposits of the river valley. The Del Rio

¹⁰Hill, R. T., and Vaughan, T. W., U. S. Geol. Surv. 18th Ann. Rpt., pt. II, p. 258, 1898.

and Eagle Ford clays are found in the vicinity of Austin and thence north and south, their outcropping belts approximately coinciding with the Balcones fault zone (see map). The alluvial clays of the river valley are utilized at Austin where the Butler Brick Company has a plant manufacturing common brick.

Limestone.—Limestones are extensively developed in the central and western parts of Travis County. The principal limestone bearing formations are Glen Rose, Comanche Peak, Edwards, Georgetown, Buda, and Austin. The limestones of the Edwards formation are at many localities of high grade, including both pure limestone and magnesian limestone or dolomite. Dolomite ledges in the Edwards formation are reported on the west side of the Missouri Pacific Railroad one mile south of Duval. The limestone of the Buda formation is mostly hard, compact, and high grade. The Glen Rose contains heavy ledges alternating with softer strata. The Comanche Peak and Georgetown contain mostly nodular limestones.

Building Stone.—Building stone is obtained from the Glen Rose, Edwards, and Austin formations. The stone used in the foundation and interior walls of the State Capitol building is from the Oatmanville or Convict quarry in the Glen Rose formation near Oak Hill, about 7 miles southwest of Austin. Stone from this quarry was used also in the old Travis County courthouse and in St. Edwards College. Several other quarries have been opened in this formation. Several small quarries have been worked intermittently in the Edwards formation. One of these, the old Behnke quarry, is located on University land near the Austin dam. Other quarries in the Edwards are near Deep Eddy and at Duval. The Austin formation has been quarried at Bouldin Creek and on Onion Creek. The Lutheran Church at Austin recently completed is of rock from the Onion Creek quarry.

The rock of the Deep Eddy quarry known as "Austin marble" is a hard limestone containing many fossil shells the body cavities of which are in many instances filled with

crystallized calcite. The rock which polishes beautifully and wears well has been favorably commented upon in the literature on building stone.¹¹

Lime.—Of the several limestone-bearing formations, the Edwards is probably the best adapted to the manufacture of lime. The Austin White Lime Company located on the Missouri Pacific Railroad at McNeil in the northern part of the county obtains limestone from this formation.

Cement.—Cement is not being made in Travis County. Several of the formations of the county, however, are promising as cement material. Among these are the Austin chalk and the Taylor clay, or the Austin and the Eagle Ford shale. These formations are present on and near transportation lines in the county. The Georgetown limestone and Del Rio clay would probably also afford suitable locations for cement. These formations occupy a narrow belt extending in a north-south direction through the central part of the county (see sketch map).

Oil and Gas.—Some asphalt is found on Walnut Creek about one mile east of Waters Park, and oil shows occur in wells from near Waters Park south to near Fiskville. Among wells showing oil are the following: Gault well, about one-half mile south of Waters Park; Holman well, two miles slightly west of south of Waters Park; and the Robinson well, one mile northwest of Fiskville and three miles south of Waters Park. These wells are described in the section on well records.

In these wells the oil show is from the Edwards or Georgetown formations. Near the asphalt show on Walnut Creek a shaft has been dug. On the dump at this shaft are Del Rio fossils indicating that that formation was penetrated. Near the shaft several test wells have been drilled on the

¹¹Merrill, G. P., *Stones for Building and Decoration*, p. 231, John Wiley & Sons, 1910. Hill, R. T., and Vaughan, T. W., *U.S. Geol. Surv., Austin Folio*, 1900, p. 5.

Bird and Palmer farms. One by the Sun Company is said to have found oil shows at depth 750 and 850 feet.

Several other oil shows have been reported in the county. The Pilot Knob well contained asphaltic material at 640–650 feet, and a show of gas at 1,000 feet. On March 28, 1916, Mr. M. D. Maynard, Cedar Park, Williamson County, Texas, reported that he had found a little oil at 170 feet in a boring on low land on the south side of Sandy Creek about 2 miles below Nameless, Travis County, on land belonging to Mr. G. W. Kirk. The oil is very dark and rather thick. This oil is apparently from the Glen Rose.

On the Childress farm near Garfield a well drilled for water many years ago was reported to have made a show of oil. A second well drilled one-half mile south of the first gave a show of oil at 234 feet. Additional wells have since been drilled. (See Well Records, Childress 2.)

Sand and Gravel.—Sand and gravel deposits are found in the terraces and river beds east of the Balcones fault zone. Sand and gravel are produced in the county by the following firms: Austin Sand and Gravel Company, Austin; Lon Martin, Austin; Southern Sand and Gravel Company, Austin; and Travis County Sand and Gravel Company, Austin.

Water.—The principal underground water reservoirs in Travis County are found in the sands of the Trinity division at and near the base of the Cretaceous. In addition there are water bearing horizons at higher levels in the Cretaceous with smaller supplies. The basal Cretaceous water reservoirs have been best developed in the vicinity of Austin where several wells have been drilled. Among these wells are the following:

AUSTIN NATATORIUM WELL, 5TH AND SAN JACINTO STREETS.

DRILLER'S LOG¹²

	Depth in feet		Depth in feet
Dirt	20	Limestone	1,190
Gravel bed	25	Sand rock (small flow)	1,215
Limestone	125	Limestone	1,515
Shale	195	Blue shale	1,575
Limestone	220	Limestone	1,675
Blue marl	260	Sand rock (main flow; freestone water)	1,875
Limestone	360	Blue shale	1,915
Sand rock	370	Sand rock	1,965
Limestone	440	Blue shale	2,025
Sand rock and limestone in strata of about 10' min- eral water of medicinal value	590		

The flow when first drilled was about 250,000 gallons a day, temperature, 100 degrees. Pressure not tested, but probably between 70 and 80 pounds. Casing used, 300 feet 10" pipe, 600 feet, 8", 300 feet, 7", 200 feet, 6". The medicinal vein was separated from the freestone vein by letting the flow come up between the 8 and 10 inch pipes.

Interpretation of driller's log: Terrace deposit, 0 to 25; Austin, 25 to 125; Eagle Ford and Buda, 125 to 220 (95 feet); Del Rio, 220 to 260 (40 feet); Georgetown, 260 to 360±; Edwards to Glen Rose inclusive, 360 to 1,675 (1,315 feet); Travis Peak, 1,675 to 2,025.

Flow of medicinal water reported from Edwards at 440 to 590; small flow from Glen Rose at 1,190 to 1,225; principal flow of freestone water from basement sands at 1,675 to 1,875.

STATE CAPITOL WELL, DRILLED 1889–90

DRILLER'S LOG

	Depth in feet		Depth in feet
Clay, soil, sand and clay....	7	Limestone, hard, light, and dark	168
Drift and white Cretaceous limestone	25	Clay shale with fine peb- bles and pyrite	180
Bluish Cretaceous lime- stone	68	Blue clay shale (Arietina clay)	239
Gray argillaceous lime- stone	106	Light colored limestone (Washita)	252
Shaly limestone, harder than preceding, with bands of harder material	148	Darker limestone (Wash- ita)	267

¹²The records of the Austin Natatorium, the Insane Asylum, and the Manor wells are all republished from the 18th Annual Report of the U.S. Geol. Surv., pt. 2, by R. T. Hill and T. W. Vaughan, pp. 280–286, 1898. The log of the well at the State Capitol is abbreviated from a detailed record preserved by E. T. Dumble, then, 1889, State Geologist.

	Depth in feet	Depth in feet
Limestone, light, dark and yellowish	342	1890, the derrick was moved 8' to the S. E. and a new hole started with 8" bit on Jan. 3. On Feb. 6, the depth of 1,023' was reached in the new hole.)
Limestone, grayish yellow (Washita)	370	Grayish yellow limestone with clay.....
Water-bearing sand.....	374	Blue clay with little limestone
(At this point the water was strongly impregnated with sulphuretted hydrogen, and has a salty taste. The water gradually rose in the well until it stood within 30' of the floor of the derrick, and there was therefore 344' of water in the well.)		Bluish gray limestone with a little clay.....
Water-sand with shaly clay and thin layers of limestone	502	Blue clay shale and limestone
Limestone with traces of sand	510	Grayish yellow limestone with blue clay shale.....
Limestone	530	Gray limestone without shale
Limestone with chalk flint	547	Gray limestone with blue shale
Limestone without flint....	551	Yellow gray limestone without shale.....
Limestone with thin layers of clay shale.....	571	Yellow gray limestone with clay
Limestone, lighter color, without clay shale.....	575	Yellow gray limestone without clay.....
Yellowish light and dark limestone, gray.....	812	Yellow gray limestone with yellow clay shale.....
Limestone, dark gray and lighter color, with clay shale	840	Yellow gray limestone without clay.....
Yellowish limestone with blue shale.....	850	Yellow gray limestone with a little white clay.....
Blue clay shale with limestone	886	Yellow gray limestone mixed with about 50% white clay.....
Yellowish limestone with shale	945	Yellowish gray limestone without clay.....
Yellowish gray limestone..	951	Yellowish gray limestone..
Yellowish and light gray limestone, with shale....	973	Yellow gray limestone with a little white clay..
Yellowish limestone.....	985	Yellow gray limestone without clay.....
Yellowish gray limestone....	989	Yellow gray limestone..
Bluish shaly limestone.....	993	Yellow gray limestone with a little clay.....
Gray shaly limestone.....	1,001	Yellow limestone of light color
Gray and yellow limestone	1,004	Yellow limestone with a little clay.....
Yellowish gray limestone..	1,007	Limestone, light yellow....
Yellowish gray limestone with shale.....	1,023	Limestone, light yellow, with clay.....
(At this point the drill rods were broken and lodged in the well, and this well was abandoned, Dec. 31, 1889. Jan. 1,		

	Depth in feet	Depth in feet
Limestone, darker, with clay	1,406	Yellow gray limestone with sand and dark clay shale
Limestone, dark to medium yellow, with sand....	1,417	Yellow gray limestone with sand and dark clay shale
Limestone, dark to medium yellow with bluish clay	1,422	Yellow gray limestone with sand and dark clay shale
Limestone, dark to medium yellow with sand....	1,427	Dark clay shale with limestone and sand.....
Sand, with limestone, dark shale and pyrite.....	1,437	Dark clay shale with limestone sand and pyrite....
(At this point the water flowed out in a solid stream, 2½"x3½".)		Dark clay shale, calcareous, with sand and flint..
Dark clay shale with limestone	1,450	T. D.
Dark clay shale with limestone and sand.....	1,455	(At this point the well was discontinued, the flow of water being 86,400 gallons per 24 hours, March 8, 1890.)
Water sand with little limestone	1,460	

Interpretation of driller's log: Terrace deposit, 0 to 7; Austin, 7 to 106 (99 feet); Eagle Ford, 106 to 148 (42 feet); Buda, 148 to 180 (32 feet); Del Rio, 180 to 239 (59 feet); Georgetown at 239. This well was drilled to within probably 100 or 150 feet of the large Trinity flow.

Flow of sulphur water at 370 to 502 feet from the Edwards formation. Flow at 1,427 to 1,437 is from probably 225 or 300 feet above the principal water horizon of the basement sands.

INSANE ASYLUM WELL, NORTH AUSTIN

DRILLER'S LOG

	Depth in feet	Depth in feet
Dark shale.....	80	Limestone
Very hard limestone.....	105	Sand, water-bearing.....
Blue marl.....	195	Blue shale or marl, no limestone
Limestone and alternations of limestone, marl and sand.....	1,300	Water flowed to height of 40 feet above surface.
Water-bearing sand.....	1,315	Yielded 150,000 gallons a day.
Limestone	1,375	
Rotten shale.....	1,425	

Interpretation of driller's log: Eagle Ford, Buda, and Del Rio, 0 to 195. Georgetown, Edwards, Comanche Peak, Walnut, and Glen Rose, 195 to 1,485 (1,290); Travis Peak, 1,485 to 1,800 (375); undetermined 1,800 to 1,975. First recorded water-bearing sand, 1,300 to 1,315 is that of the Capitol well at 1,427. Principal flow at 1,485 to 1,800.

MANOR WELL

DRILLER'S LOG

	Depth in feet		Depth in feet
Black soil.....	6	Hard rock, Buda.....	1,075
Yellow clay.....	17	Blue clay (caves) Del Rio	1,135
Flint rock and gravel (surface water).....	20	Lime rock Georgetown Ed- wards	1,250
Yellow and joint clay.....	50	Water-bearing rock (wa- ter flows at 1,250 feet)	1,400
Blue clay.....	590	Hard rock.....	1,420
Soft white rock.....	664	Solid limestone.....	1,900
Indigo-blue clay.....	665	Blue marl.....	1,910
Rock, hard and soft alter- nately	1,000	Solid limestone.....	2,350
Shale (caves badly), Eagle Ford	1,025		

No log is available below 2,350 although the well is reported to have been continued to depth 2,560. At this depth the well may have been in the basal Trinity sands. A sample said to be from the bottom of the well is described by Hill as a calcareous sand. Hill suggests that the flow from this well is from the first basal Cretaceous horizon rather than from the deeper sands.¹⁸

Discharge of 99,984 gallons per day. Size of discharge pipe 6". The temperature of the water is 93 degrees.

Aside from surface water in the gravel, the first water reported in this well is in the sulphur water horizon of the Edwards, depth 1,250 to 1,400.

Interpretation of driller's log: Taylor, 0 to 665; Austin, 665 to 1,000 (335); Eagle Ford, 1,000 to 1,025 (25); Buda, 1,025 to 1,075 (50); Del Rio, 1,075 to 1,135 (60); Georgetown, Edwards, Comanche Peak, Walnut, and Glen Rose, 1,135 to 2,350+ (1,215); 2,350 to 2,560, no record.

Fig. 6. Geologic section made from well records across Travis County from Austin to near the east line showing formations and principal water horizons. Wells as follows: No. 1, Insane Asylum, north Austin; 2, Well on Capitol grounds, Austin; 3, Well at San Jacinto and 5th Streets, Austin; 4, Norwood well, South Austin; 5, Well at Manor; 6, Well of Shell Pipe Line Company in eastern part of county. Three principal water zones are indicated. Of these the sulphur water horizon in the Edwards formation is recorded in wells No. 2, 3, 4, and 5. The probable place of this horizon is recorded in wells 1 and 6 is indicated although the horizon is not given in the logs. The first basal Cretaceous water horizon is recorded in wells 1, 2, and 4. The probable place of this horizon is indicated in the other wells. In well No. 3 a water sand not reported in other wells is recorded at depth 1,190 to 1,215. The main Trinity water is recorded in wells 1, 3, and 6, the other wells not having been drilled to this horizon.

¹⁸21st Annual Report, U.S. Geol. Surv., p. 512. Record on this well below 1900 ft. is from 21st Annual Report, U.S. Geol. Surv., pt. 7, p. 512.

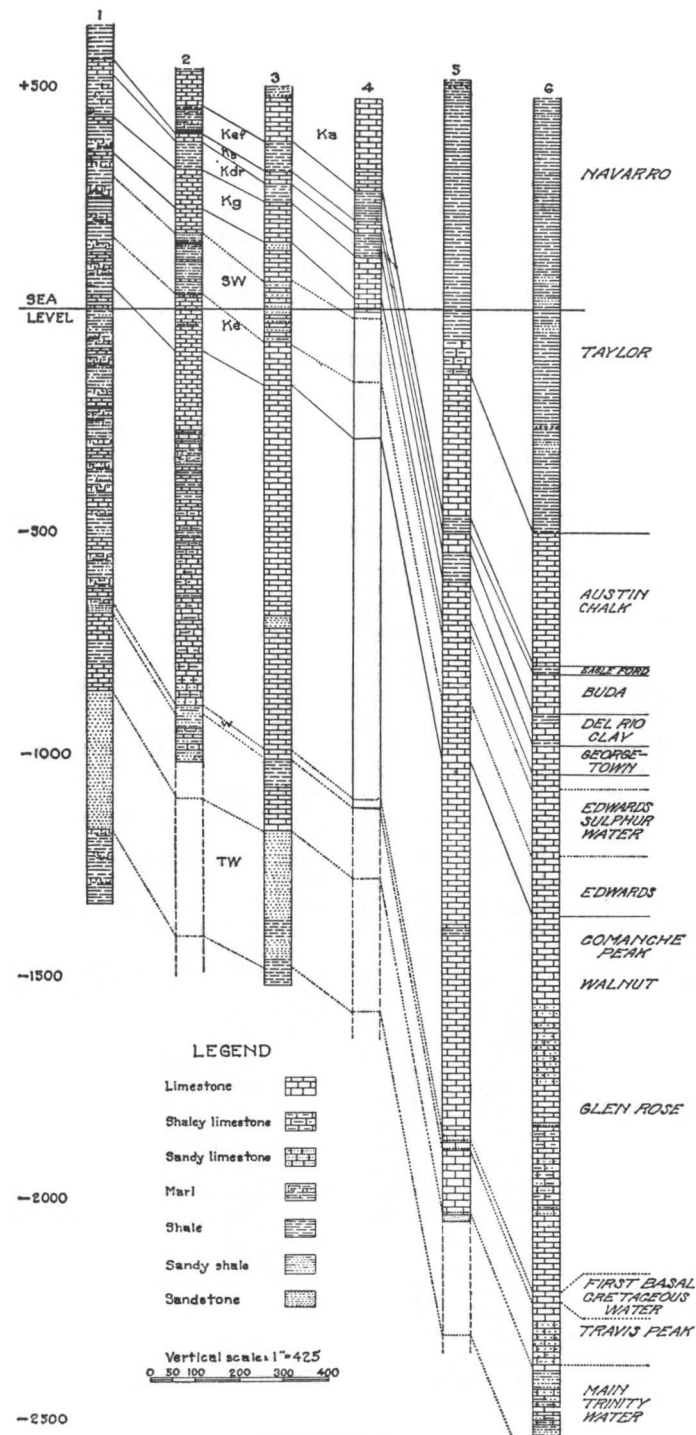


FIGURE 6

NORWOOD WELL

The Norwood well, 1012 Edgecliff, Travis Heights, starting in the Austin formation obtained sulphur water from the Edwards at about 500 feet. The principal water horizon in this well is reported to be at depth 1,570 to 1,595. The water is apparently from the first basal Cretaceous horizon, the deeper horizon not having been reached.

PHILQUIST WELL

Claus Philquist farm, drilled by Shell Pipe Line Co.; Thomas Westbrook surv., Stone Point Station, within about 2 miles of Bastrop County line. Elevation 480. Drilled 1929. Casing: 10"—114'; 6 3/8"—2,719'. T. D. 3,008.

DRILLER'S LOG

	Depth in feet		Depth in feet
Clay	35	Lime	2,305
Sand rock.....	38	Hard sandy shale.....	2,312
Sticky shale.....	400	Lime (cored).....	2,323
Sandy shale.....	418	Sandy lime (streaks of shale)	2,372
Sticky shale.....	450	Lime	2,385
Sandy shale.....	465	Sandy lime (streaks of shale)	2,402
Sticky shale.....	503	Sandy lime.....	2,413
Sandy shale.....	528	Sandy lime (streaks of shale)	2,465
Hard shale.....	655	Sandy lime.....	2,490
Sticky shale.....	665	Hard sand.....	2,501
Hard shale.....	680	Sandy lime.....	2,516
Sticky shale.....	740	Broken lime and shells.....	2,528
Shale and gravel.....	747	Lime and shells (cored)....	2,530
Sticky shale.....	772	Porous lime and shells.....	2,575
Sandy shale.....	795	Lime and shells.....	2,615
Hard shale.....	840	Lime	2,752
Sticky shale.....	895	Sandy lime.....	2,870
Shale	960	Blue sandy shale.....	2,887-2,889
Sticky shale.....	976	Hard sandy shale and lime	2,908
Chalk and shale.....	980	Hard sandy lime (streaks of shale)	2,919
Chalk	1,083	Hard sandy lime.....	2,925
Chalky shale.....	1,117	Hard sandy lime and shale	2,934
Broken chalk.....	1,260	Hard sandy lime.....	2,943
Chalky shale.....	1,271	Lime and shells.....	2,965
Chalk	1,281	Sandy shale with streaks of lime.....	2,985
Sticky shale.....	1,296	Lime and shale.....	2,991
Lime	1,387	Sand and shale (cored)....	3,008
Sticky shale.....	1,401	Water slightly salty. Well flowing water with 70 pounds pressure when closed in.	
Lime	1,448		
Sticky shale.....	1,450		
Lime	1,510		
Edwards limestone.....	2,039		
Sandy lime (cavities).....	2,172		
Sandy lime.....	2,221		
Lime	2,263		
Hard lime.....	2,295		

Medicinal Water.—A well drilled in 1916 located on the Webberville road about one mile east of the Austin city limits affords a water that is sold for medicinal purposes. The well which starts in basal Taylor is said to be 1,147 feet deep. The well is reported to flow 280 gallons per minute and to have a pressure of 42 pounds. The well is owned by the Mineral Water Company, Austin.

Medicinal water is reported from the Edwards formation in several of the wells in the vicinity of Austin.

WELL RECORDS

In the following records, depth to the top of the Edwards is given for most of the wells. Where not recorded in the well this depth is obtained approximately by applying formation thicknesses given in the table. To obtain depth to other formations, interpolate from the tables giving thickness of formations and formation groups. The elevations given for wells are those which accompany the log or such as have been otherwise obtained. Abbreviations are used in connection with elevations as follows: P, plane table; T, from topographic map; A, aneroid. All elevations are to be regarded as approximate. Sea level datum (S. L. D.) at the top of the Edwards given for some of the wells must likewise be considered as approximate. Wells west of the Balcones fault zone with a few exceptions start either in or below the Edwards.

Bengston 1, Plateau Oil Co.; Henry Martin surv. 65, northwest part of survey, 500 yards south of Lund. Elevation 571. Starts near Midway-Navarro contact; ends in Edwards. T. D. 2,102. Drilled 1925, rotary.

Formations identified from cores: 1,050 and 1,104, Taylor; 1,335, Austin; 2,050, Edwards.

Interpretation from log and samples: Midway, basal part, Navarro, and Taylor, 0 to 1,320; Austin, Eagle Ford, Buda, Del Rio, and Georgetown, 1,320 to 1,997 (677 feet); Edwards, 1,997 to 2,102. S. L. D. Edwards, —1,426.

Alfred Carlson 1, Gulf Production Co.; Lemuel Kimbro surv. 64, northwest part of survey, 1 mi. northwest of Kimbro. Elevation 557 P. Starts in Navarro. T. D. 1,138. Drilled 1926.

Interpretation from log: Navarro and Taylor, 0 to 742; serpentine, 742 to 1,126; Austin, 1,126 to 1,138. Depth to Edwards, estimated, 1,726.

W. W. Childress 2, Adanac Oil Co. (R. B. Nichols); Antonio-Navarro Grant, 2 mi. east of Garfield, 2½ mi. from county line. Elevation 440 P. Starts in Navarro; ends in Edwards. T. D. 1,630. This well is 30 feet west of W. W. Childress 1, Somers-Reese (successor to Adanac Oil Co.). Drilled 1923, rotary.

Formations identified from cores: 960, Austin; 1,405, Del Rio; 1,525, Georgetown; 1,550, Edwards.

Interpretation from log of well No. 1 and samples of well No. 2: Navarro and Taylor, 0 to 940; Austin, 940 to 1,249 (309 feet); Eagle Ford, 1,249 to 1,294 (45 feet); Buda and Del Rio, 1,294 to 1,426 (132 feet); Georgetown, 1,426 to 1,542 (116 feet); Edwards, 1,542 to 1,630. S. L. D. Edwards, —1,086.

D. Collins 1, E. Nalle et al; at west side of Pilot Knob, eight mi. south of Austin. Elevation 575 T. T. D. 2,425. Drilled 1920, rotary.

Formations identified from cores: 1,925, Glen Rose; 2,095 and successive samples to 2,425, Lower Cretaceous calcareous sands and sandstones.

Evans 1, P. F. Griffin; Dalton & Wichita Ry. surv. No. 95, 9.3 mi. southwest of Leander. Elevation 1,024 A. Starts in Glen Rose. T. D. 1,500. Drilled 1921, rotary.

Formations identified (a) from cuttings: 620 and successive samples to 660, undetermined Pre-Cretaceous; (b) from cores: 789 and successive samples to 1,500, undetermined Paleozoic or Pre-Paleozoic.

James Gault; ½ mi. south of Waters Station. Elevation 725 T. Starts in Austin; ends in Edwards. T. D. 307. Cased 170 or 180 feet. Show of oil reported at 190 feet. Water at or near 307 feet. Rises to within 135 feet of the surface. Depth to Edwards, estimated, 260.

Several other wells have been drilled for water in the Waters Park region all of which reach the Edwards formation. In addition, several test wells for oil have been drilled from one to two miles east of Waters Park. See page 51.

Anna Giese 1, Humble Oil & Refining Co.; Wm. Hind surv., near west line of survey, 1 mi. east of Kimbro. Elevation 494 (530).

Starts in Navarro; ends in Edwards. T. D. 1,895. Drilled 1926, rotary.

Formations identified from cores: 1,851 and 1,895, Edwards.

Interpretation from log and samples: Navarro and Taylor, 0 to 1,170; serpentine and shale, 1,170 to 1,188; Austin, 1,188 to 1,549 (361 feet); Eagle Ford, Buda, Del Rio, Georgetown, and Edwards, 1,549 to 1,895. Depth to Edwards, estimated, 1,810.

B. W. Giles 1, Wolff, Werchan, and Henze; on Manor Road, .8 mi. east of Austin city limits. Elevation 570 T. Starts Taylor-Austin contact; ends in Edwards. T. D. 675. Drilled 1928.

Formations identified from cuttings: 657, Edwards.

Interpretation from log and samples: Surface materials, 0 to 30; Austin, 30 to 324 (294 feet); Eagle Ford, 324 to 364 (40 feet); Buda, 364 to 409 (45 feet); Del Rio, 409 to 489 (80 feet); Georgetown, 489 to 619 (130 feet); Edwards, 619 to 675. S. L. D. Edwards, —49.

Willis Holman; 2 mi. slightly west of south of Waters Park. Starts in Austin; ends in Edwards. Casing set below Del Rio. T. D. 370. Oil show reported at 250 or 300.

Insane Asylum well, Austin. See page 55.

Jacobson 1, Roy Clark; Peter C. Harrison surv., northwest part of survey, ½ mi. southwest of Elroy. Elevation 552. Starts in Navarro. T. D. 880.

Formations identified from cuttings: 868 and 876, Austin.

Interpretation from log and samples: Navarro and Taylor, 0 to 868; Austin, 868 to 880. Depth to Edwards, estimated, 1,468.

Axel Johanson 1, Dixie Oil Co.; Santiago del Valle Grant, 120 varas southwest from the northeast line and 1,100 varas northwest from the southeast line of the survey, 1 mi. northwest of Creedmoor. Elevation 675. Starts in Taylor; ends in Edwards. T. D. 745. Drilled 1925, rotary.

Formations identified from cores: 644, Edwards.

Interpretation from log and samples: Taylor, 0 to 213; Austin, 213 to 488 (275 feet); Eagle Ford and Buda, 488 to 557 (69 feet); Del Rio, 557 to 598 (41 feet); Georgetown, 598 to 644 (46 feet); Edwards, 644 to 745. S. L. D. Edwards, +31.

Emma Johnson 1, Mid-Kansas Oil & Gas Co.; Wayman Wells surv., 1 mi. south and 1 mi. east of Manor. Elevation 598. Starts in basal Navarro; ends in Edwards. T. D. 1,490. Drilled 1928.

Formations identified from cores: 825, serpentine.

Interpretation from log and samples: Navarro, basal part, and Taylor, 0 to 825; serpentine, 825 to 829; shale and chalk ?, 829 to 940; Austin, 940 to 1,224 (284 feet); Eagle Ford, 1,224 to 1,248 (24 feet); Buda, 1,248 to 1,302 (54 feet); Del Rio, 1,302 to 1,365 (63 feet); Georgetown, 1,365 to 1,468 (113 feet); Edwards, 1,468 to 1,490.¹⁴

Presto Lockwood 1, Humble Oil & Rfg. Co.; Wm. Hines surv., west of center of survey, 2 mi. east of Kimbro. Elevation 513. Starts in Navarro. T. D. 1,320. Drilled 1926.

Interpretation from log: Navarro and Taylor, 0 to 1,294; serpentine, 1,294 to 1,296; Austin, 1,296 to 1,320. Depth to Edwards, estimated, 1,896.

Lovelace 1, Nance and Bailey; 1.5 mi. south of Austin. Starts in Austin. Drilled 1923.

Formations identified from cuttings: 262, Del Rio; 340, Georgetown; 500 and successive samples to 730, Edwards; 740 to 750, Comanche Peak and Walnut; 780, Glen Rose ?.

Interpretations from samples and driller's notes¹⁵: Austin (in part), Eagle Ford and Buda, 0 to 262; Del Rio, 262 to 327 (65); Georgetown, Edwards, Comanche Peak and Walnut, 327 to 780± (453); Glen Rose at 780±.

Natatorium well, Austin. See page 53.

O. O. Norwood, 1012 Edgecliff, Travis Heights. Elevation 475 T. Starts in Austin; ends in Travis Peak. T. D. 1,595. Drilled 1929.

Formations identified from cuttings: 495 and 501, Edwards.

Interpretation from log and samples: Austin, 0 to 208; Eagle Ford, Buda, and Del Rio, 208 to 348 (140 feet); Georgetown to Travis Peak inclusive, 208 to 1,595. Depth to Edwards, estimated, 438.

J. S. Pannell; south of Austin-Manor Road and east of Southern Pacific Ry., .8 mi. east of Austin city limits. Elevation 550. T. D. 430. Traces of oil and asphalt reported.

Interpretation of log: surface material, 0 to 10; Austin, 10 to 340 (330 feet); Eagle Ford, 340 to 380 (40 feet); Buda, 380 to 410 (30 feet); Del Rio, 410 to 430. Depth to Edwards, estimated, 600.

A. R. Parsons 1, Gulf Production Co.; Gordon C. Jennings surv. 35, north of center of survey, 3 mi. southwest of Littig. Elevation 617 P. Starts in Navarro. T. D. 1,178. Drilled 1926.

¹⁴Given on map, Fig. 5, p. 42, as 1470.

¹⁵No complete driller's log of the well is available.

Interpretation from log: Navarro and Taylor, 0 to 1,170; serpentine, 1,170 to 1,176; Austin, 1,176 to 1,178. Depth to Edwards, estimated, 1,770.

Peyton 1, Campbell et al; Lockhart road near Caldwell Co. line, J. S. Mora surv. Elevation 640. Starts in Navarro; ends in Austin. T. D. 815. Drilled 1927.

Formations identified from cuttings: 600, Taylor; 815, Austin.

Interpretation from log and samples: Taylor, 0 to 806; Austin, 806 to 815. Depth to Edwards, estimated, 1,425.

Philquist well, Shell Pipe Line Co. See page 58.

H. Reimers 1, E. D. Summerow; at Hamilton Pool, J. C. Little surv. Elevation 800 T. Starts in Travis Peak. T. D. 1,274. Drilled 1926.

Formations identified from cuttings: 400 and successive samples to 1,243, dark non-calcareous carbonaceous shale.

Interpretation from log and samples: Travis Peak, 0 to 266; dark non-calcareous shale of undetermined age, 266 to 1,275.

Republic Bank and Trust Co., Rydal Oil Corp.; J. A. Navarro Grant, on Bastrop Road 18 mi. from Austin, 1 mi. east of Garfield. Elevation 488. Starts in Navarro; ends in Edwards. T. D. 1,780. Drilled 1928. Rotary.

Formations identified from cores: 1,600, Edwards.

Interpretation from log and samples: Navarro and Taylor, 0 to 1,077; Austin, 1,077 to 1,374 (297 feet); Eagle Ford, 1,374 to 1,413 (39 feet); Buda, 1,413 to 1,458 (48 feet); Del Rio and Georgetown, 1,458 to 1,599 (141 feet); Edwards, 1,599 to 1,780. S. L. D. Edwards, — 1,119.

Ralph Richie 1, Walter, Werchan, and Stone; Greenbury Gates surv., south of center of survey, 3 mi. east and 2 mi. north of Manor. Elevation 550 T. Starts in basal Navarro; ends in Eagle Ford. T. D. 1,117. Drilled 1926, rotary.

Formations identified from cores: 681, Taylor; 770, Austin.

Interpretation from log and samples: Taylor, 0 to 708; Austin, 708 to 1,108 (400 feet); Eagle Ford, 1,108 to 1,117. Depth to Edwards, estimated, 1,300.

W. F. Robinson; 1 mi. west-northwest of Fiskville. Elevation 725 T. Starts in Austin; ends in Edwards. T. D. 395.

Interpretation of log: Austin, 0 to 100; Eagle Ford, 100 to 135 (35 feet); Buda, 135 to 175 (40 feet); Del Rio, 175 to 240 (65

feet); Georgetown, Edwards, 240 to 395. Sulphur water at 350. Water rises to within 162 feet of surface; cased to 240. Show of oil from Georgetown or Edwards. Depth to Edwards, estimated, 325.

A second well was drilled for oil 200 yards west of this water well to a depth of about 500 feet. In this well the Buda was 30 feet thick and the top of the Georgetown was at depth 251 feet. A few other water wells have been drilled in the Fiskville region all of which obtain water from the Edwards formation.

Romberg 1, Cypress Creek Drilling Assoc.; James M. Miner surv., on Cypress Creek near Travis-Blanco County line, 1½ mi. north of Austin-Cypress Mills Road. Elevation 800 T. Starts in Travis Peak. T. D. 1,560. Drilled 1927.

Formations identified from cuttings: 834, black non-calcareous shales reported to continue to 1,560 feet. Light shows of oil and gas reported at various depths to 1,560.

James Ross 1, Bybee, Marshburn et al; Barbara L. Mirales surv. 503, near west line of survey, 75 varas northeast from the southwest line and 480 varas northwest from the southeast line of survey, 1.5 mi. southeast of Pilot Knob. Elevation 567 P. Starts in Taylor; ends in Edwards. T. D. 1,005. Drilled 1925, rotary.

Formations identified from cores: 159 and successive samples to 381, Taylor; 406 and successive samples to 713, Austin; 729, Eagle Ford; 771 and 775, Buda; 791, Del Rio; 839, 849, 886, 890, Georgetown; 930, 967, 970, Edwards.

Interpretation from log and samples: Taylor, 0 to 381; Austin, 381 to 720 (339 feet); Eagle Ford, 720 to 744 (24 feet); Buda, 744 to 791 (47 feet); Del Rio, 791 to 846 (55 feet); Georgetown, 846 to 930 (84 feet); Edwards, 930 to 1,005. No water encountered in the well. S. L. D. Edwards, — 361.

Paul Rowe 1, Garrett et al; Ruben Hornsby surv., 7½ mi. east of Austin, 100 yards south of Hornsby Graveyard. Elevation 440. Starts in Taylor; ends in Edwards. T. D. 1,025. Drilled 1928.

Formations identified from cuttings: 690 and successive samples to 745, Austin; 800, Buda; 818 and 870, Del Rio; 882, 890, 895, 935, and 950, Georgetown; 975 and 985, Edwards.

Interpretation from log and samples: Soil and gravel, 0 to 45; Taylor, Austin, Buda, and Eagle Ford, 45 to 818 (773 feet); Del Rio, 818 to 882 (64 feet); Georgetown, 882 to 975 (93 feet); Edwards, 975 to 1,025. S. L. D. Edwards, — 550.

Schreiber 1, Smith and Clark; J. S. Montgomery surv., northwest corner of survey, 3½ mi. south-southwest of Elroy, 1,100 ft. south-

east of the northwest line and 150 ft. southwest of the northeast line of survey. Elevation 575. Starts in Navarro. T. D. 892.

Interpretation from log: Navarro, basal part, and Taylor, 0 to 889; Austin, 889 to 892. Depth to Edwards, estimated, 1,489.

St. Edwards University, Flynn Brothers; 2 mi. south of Austin. Elevation 625 T. Starts in Taylor; ends in Lower Cretaceous. Drilled 1928, drop tools.

Interpretation of log: Taylor, 0 to 150; Austin, 150 to 440 (290 feet); Eagle Ford, 440 to 476 (36 feet); Buda, 476. Depth to Edwards, estimated, 680.

State Capitol well. See page 53.

T. B. Sharp 1, Plateau Oil Co.; Amos Alexander surv., south of center of survey, 1 mi. south of Littig. Elevation 462. Starts near the Midway-Navarro contact; ends in Edwards. T. D. 1912. Drilled 1925, rotary.

Formations identified from cores: 1,800, 1,855, and 1,912, Edwards.

Interpretation from log and samples: Cenozoic gravel and sand, 0 to 22; Navarro and Taylor, 22 to 1,208; Austin, 1,208 to 1,548 (340 feet); Eagle Ford, 1,548 to 1,597 (49 feet); Buda, Del Rio, and Georgetown, 1,597 to 1,800 (303 feet); Edwards, 1,800 to 1,912. S. L. D. Edwards, — 1,338.

W. F. Voelker 1, Humble Oil & Rfg. Co.; Lemuel Kimbro surv., northeast part of survey, ¾ mi. northeast of Kimbro. Elevation 546 (495 Humble). Starts in Navarro. T. D. 1,049.

Interpretation from log: Navarro and Taylor, 0 to 1,018; Austin, 1,018 to 1,049. Depth to Edwards, estimated, 1,618.

G. W. Walling, Sr.; on Cameron Road, 3 mi. north of Austin. Elevation 740. Starts near top of Austin; ends in Edwards. T. D. 601.

Formations identified from cuttings: 525, Edwards.

Interpretation from log and samples: Austin, 0 to 267; Eagle Ford, 267 to 302 (35 feet); Buda, 302 to 327 (25 feet); Del Rio, 327 to 385 (59 feet); Georgetown-Edwards, 385 to 600. Depth to Edwards, estimated, 475.

Stark Washington 2, Garfield Oil Co.; R. V. Nichols; Navarro Grant, 26 feet south of Washington 1, 1 mi. south-southeast of Garfield. Elevation 468. Starts in Navarro; ends in Edwards. T. D. 1,648. Drilled 1926. Rotary. (Washington 1, E. A. Fields and Co. was abandoned at 1,374 feet.)

Formations identified from cores: 1,350 and successive samples to 1,400, Austin; 1,465 to 1,495, Buda; 1,535, Del Rio-Georgetown contact; 1,560, 1,590, and 1,602, Georgetown; 1,620 and 1,648, Edwards.

Interpretation from log and samples: Navarro, Taylor, Austin, Eagle Ford, Buda, and Del Rio, 0 to 1,535; Georgetown, 1,535 to 1,620 (85 feet); Edwards, 1,620 to 1,648.

Water well; Austin-Georgetown Road, $\frac{1}{4}$ mi. north of Austin water reservoir.

Formations identified from cores and cuttings: 220, Del Rio; 310, Georgetown; 395, Edwards.

P. C. Wells, Humble Oil & Refining Co.; John Harper surv. 42, 450 ft. from the west and 150 ft. from the south line of 1,337-acre tract, 1.5 mi. northeast of Kimbro. Elevation 516. Starts in Navarro; ends in Austin. T. D. 906. Drilled 1926, rotary.

Formations identified from cores: 904, Austin or Taylor. Gas show reported at 705 feet.

Paul Wolfe, Mid-Kansas Oil & Gas Co.; G. C. Jennings surv., 4 mi. southeast of Manor. Elevation 600 T. Starts in Navarro; ends in Austin. T. D. 1230.5. Drilled 1929.

Interpretation of log: Navarro and Taylor, 0 to 1,176; Austin, 1,176 to 1,230. Depth to Edwards, estimated, 1,775.

AVAILABLE LITERATURE AND MAPS

United States Geological Survey, 21st Annual Report, part 7; 18th Annual Report, part 2; Folio 76, Austin Quadrangle by R. T. Hill and T. W. Vaughan, 1900; Professional Paper 126, Geology of the Coastal Plain of Texas west of Brazos River by Alexander Deussen, 1924; Bulletin 243 and 522, Cement Material; Bulletin 470, page 302, Clays; Bulletin 438, Gaging Stations. Geological Survey of Texas, 3d Annual Report, Cretaceous Area North of the Colorado River by J. A. Taff, 1892. University of Texas Bulletins 1821, Ice Crystals; 1902, Exogyra; 2612, Cretaceous foraminifera; 2644, Midway foraminifera; 2645, Igneous rocks; 2744, Serpentine.

DRILLING CONDITIONS

The drilling conditions at Austin, Manor, and in the eastern part of this county are indicated by logs of water wells given on pages 53 to 58. All of these wells enter Cretaceous strata only. In the western part of the county the conditions differ in that the Cretaceous

is relatively thin and wells passing below the Cretaceous enter rocks of undetermined age. The following two wells will indicate the drilling conditions in the western part of the county.

EVANS 1, P. F. GRIFFIN

(For location of well and interpretation of record see p. 60.)

Driller's Log

(Somewhat abbreviated.)

	Depth in feet		Depth in feet
Lime and sandstone.....	49	Blue and brown shale and gumbo, with sand and sulphur (forma- tion very broken in thin layers)	773
Gray limestone.....	84	Blue gumbo with sand.....	778
Gray, shelly limestone.....	130	Blue shale and oil sand (showing of oil).....	781
Shelly limestone.....	215	Correct measure to top of preced- ing stratum.....	653
Lime and sandstone.....	251	Shale, gumbo, and boulders, blue and brown, very broken, still showing a little oil.....	661
Blue gumbo.....	258	Shale and gumbo, with boulders (i.e., lime layers).....	668
Limestone.....	365	Gumbo and shale, blue (showing oil, may be from a higher level)	756
Limestone and shale.....	379	Shale and blue gumbo; blue and brown shale mixed (oil show- ing on pit).....	766
Coarse water gravel.....	445	Shale and gumbo and porous lime (oil of light grade and small gas). Closed down to test.....	771
Coarse water gravel and lime.....	480	Blue gumbo.....	774
Hard limestone boulders and blue gumbo, in alternate layers.....	491	Sand and lime.....	776
Lime and layers of blue gumbo with gypsum between layers, gas underneath.....	508	Lime, sand, and gumbo (dark sand and lime rock in thin layers of mixed colored gumbo and shale. Sand shows some oil.).....	788
Limestone.....	514	Lime and sand, showing oil (for- mation is a lime and oil sand. No gas).....	791
Hard limestone.....	529	Lime and oil sand (dark hard oil sand).....	793
Shelly and hard layers of limestone	536	Dark gray sand.....	795
Shelly shale, shell with some hard limestone and shale in thin layers.....	541	Lime and sand rock.....	803
Brown and blue gumbo (brown on top) in layers.....	551	Black shale.....	815
Brown (chocolate) gumbo, blue and brown.....	558	Corrected depth.....	764
Sand rock.....	564	Lime and sand rock.....	768
Chocolate gumbo.....	581	"Iron rock" showing lime and sul- phur.....	770
Hard limestone.....	582	Iron rock.....	774
Brown and blue shale mixed, a lit- tle oil.....	586	Slate (slate has some iron rock)	785
Brown and blue shale with boulders in layers.....	612	Slate and iron rock.....	788
Gravel mixed with red gumbo.....	624	Blue gumbo and white gravel, no water.....	792
Limestone.....	639	Slate.....	804
Red gumbo.....	654	Total corrected depth.....	789
Blue gumbo and lime layers.....	657		
Lime and blue gumbo in thin lay- ers.....	665		
Blue gumbo and lime layers.....	672		
Gyp and lime—gyp in layers.....	676		
Gyp and lime.....	679		
Lime rock.....	699		
Shelly lime, gray.....	728		
Shale and gumbo in thin layers.....	743		

Log below 789 not obtained. See record from Samples pp. 46 and 60.

REIMER NO. 1, E. D. SUMMEROW

(For location and interpretation of record see p. 63.)

Driller's Log

	Depth in feet		Depth in feet
Soil.....	2	Blue shale.....	55
Sandy limestone.....	40	Blue limestone.....	59
Shell.....	41	Blue clayey shale.....	84

	Depth in feet		Depth in feet
Shale	87	Black slate	414
Blue lime	94	Blue slate	445
Brown shale	102	Blue shale	476
Red clayey shale	109	Shale and slate	492
Hard sandstone, dark	113	Blue shale	497
Sandstone, brown	127	Black slate	549
Sandstone, brown	138	Black slate	550
White limestone	149	Black shale	630
Brown limestone	165	Black shale, flags, and gray lime	658
Red clay	175	Gray lime	657
Red sand and gravel	183	Black shale	658
Lime and shell	187	Gray lime	660
Red sandstone	196	Black slate	695
White limestone and shells	200	Black slate and lime flags	730
Red clay and gravel	245	Black slate and sandy lime	745
White limestone and shells	250	Black shale, oil show	754
Red clay and gravel	265	Shale and slate, oil show	813
White sandstone	266	Limestone	816
Blue shale	268	Shale and lime	822
Base of Travis Peak?		Shale	824
Yellow and blue clay	278	Gray limestone	866
Yellow and green clay	290	Black shale	871
Olive green gumbo	293	Gray lime	872
Gray clayey shale	305	Black shale	984
Black sandy shale	320	Gray lime	986
Gray clayey shale	365	Black shale	1030
Hard black shale	405	Black shale and sand flint rock	1060
Blue shale	410	Black shale	1134