SCHOOL OF GEOLOGY
NIVERSITY OF TEXAS
AUSTIN TEXAS

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Dr. Morgan Callaway,
Chairman Committee on Theses.

Dear Sir:

The undersigned begs leave to report the approval of the Thesis of Mr. Benj. F. Hill, B.S. entitled: "The Geology of Shoal Creek, with Accompanying Section".

Very respectfully

[redacted]

The Geology of Shoal Creek,

With Accompanying Section.

By

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Thesis for M.S. 1897.

University of Texas.

The City of Austin is situated in the valley of the Colorado River at a distance of a mile from the place where that stream emerges from the Grand Prairie region into the Black Prairie region of the State of Texas.

Above the point of emergence the river traverses thick limestone strata, and has eroded for itself a considerable canon, while below the City its banks are low lying and alluvial and its course is, for the most part, through the decomposed marls and shales comprising the famous Black Waxy belt of Texas.

Austin is located on the left bank of the river between two Creeks, Waller on the East and Shoal on the West. The locality presents an excellent field for the Geologist, as in this region there is exposed a greater variety of Cretaceous deposits than in any other area of equal extent in the United States. Here occur the division marks between the Upper and Lower series of the Cretaceous, together with horizons of life, such as the Exogyra Arietina which is known to exist in one formation only.

A feature that complicates matters is the oc-

currence of numerous small faults, besides some of considerable magnitude, with their resulting local metamorphism, tending to make the study more difficult, while at the same time more interesting. Such then, is the environment of Shoal Creek, the Geology of which has been made the subject of the investigation herein recorded.

The stream itself is small, as regards the volume of water, but has worn for itself a valley of considerable size in the western portion of the city. The Creek proper is about ten miles long, rising among the hills in the neighborhood of Duval Station and flowing in a southerly direction. It traverses the western limits of the City and empties into the Colorado a half mile above the wagon bridge. It shall be my purpose to confine myself to the facts and problems presented in the geology of the Creek as to those parts only within the City limits, since above this, the valley diminishes and the canon becomes insignificant.

Before going into detail concerning the geology of this particular locality it will be of advantage to understand the

relations of the rock series of the region in general. The area, of which we have been speaking, lies in the great Cretaceous Belt of Texas. The belt is divided roughly into the Grand and Black Prairie regions already mentioned, each of which in turn is subdivided into several minor parts, according to the various formations shown.

The Black Prairie region constitutes the Upper Cretaceous, and according to Dana, corresponds to the green sands and marls of the Atlantic border. This long and comparatively narrow strip extends in a northerly and southerly direction completely across the State from the Red to the Rio Grande River. It is, in general, comparatively level and has few strata exposures, although the large area of the Black Waxy is due to the decomposition of its calcareous members. The lowest division of the series has been called the Lower Cross Timbers and is composed of brown sands and clays. Above the Cross Timbers, which are lacking in many localities, are the Eagle Ford Shales, consisting of a bluish clay and shale, with thin beds of limestone. Resting on the latter is the Austin-Dallas Chalk, which is consider-

ed the most characteristic member of the Upper Cretaceous series. It consists of a massive, white, chalky limestone, averaging about five hundred feet in thickness. Overlying the Chalk are the Exogyra ponderosa marls, so named from the occurrence of a large oyster, Exogyra ponderosa, in them.

In some portions of the State a Glauconitic division is recognized above these marls, but they are missing in the vicinity of Austin. The other members mentioned are well exposed in the neighborhood of Austin.

The Grand Prairie occupies a belt directly west of the Black Prairie region and is a similar strip having the same general direction. It is the Lower division of the great Cretaceous system and rests directly on pre-Cretaceous rocks. It corresponds to the Potomac series of the Atlantic border. The Lower Cretaceous in Texas is divided into three parts, the Lower, Middle and Upper, which are also called the Trinity, the Fredericksburg and the Washita, respectively. All these are minutely subdivided, but only those of the Upper are of immediate interest to us, as it is through this formation

that the Canon of Shoal Creek has been eroded.

The lowest subdivision of the Washita is the Limestone Flags, upon which rest the Upper Caprotina beds. The next in the series is the Washita, or Fort Worth limestone, the characteristic beds of the Upper division. Upon the Washita rests the interesting Exogyra arietina clay deposit, and immediately above this comes the massive Shoal Creek limestone, the capping series of the Lower Cretaceous in Texas. It is with these last formations that we have particularly to deal, in our study of the Geology of Shoal Creek, and it is along this Stream that their outcrops are the most favorable for close investigation.

If reference be made to the accompanying map it will be seen that Shoal Creek approaches San Gabriel Street, which runs north and south, at 28th Street, which runs east and west. This will be a starting place, and the study of the geology of the Stream will be pursued down towards the river from this spot. At the point where the Creek touches the Street is a bluff of limestone, varying in color from white to Gray, and to almost black

on exposed surfaces. It is much jointed, fractured and weathered, and is, at this point, about forty feet thick. The bottom stratum does not extend to the water's edge, but the intervening space is covered with detritus and talus from the cliffs, hiding the underlying beds. This limestone, from its peculiar markings, its red and pink spots, (due, no doubt to local metamorphism) and remains of animal life, is recogniged immediately as the Shoal Creek limestone. The most conspicuous fossils are large pecteus, Vola roemeri, Hill., which are so characteristic as to cause the formation to be sometimes known as the Vola Limestone. The Strata at 28th Steet are not horizontal but form a shallow syncline, tilting in either direction, north and south, at an angle of fifteen degrees. Surmounting these beds is a thin layer of black soil, resulting from the decomposition of the Eagle Ford Shales of the Upper Cretaceous, the Cross Timbers not being present in this vicinity.

At 26th Steet, the Creek makes a turn to the left and runs for three hundred yards in a Westerly direction, when it again turns

and resumes its southerly course. The scarp of the limestone extends directly south on the eastern bank of the Creek, but follows the windings of the stream on the western side. A valley of considerable width is thus left, the floor of which is strewn with fossil shells of Exogyra arietina and Graphaea pitcheri washed out from the Exogyra clays. The limestones, after tilting up for some distance, become horigontal for a short space and then assume a gradual dip, which is constant to 15th Street.

The strata of Shoal Creek limestone vary in height above the stream from nothing to about one hundred and fifty feet, as shown by a series of barometrical measurements made by the author.

The first good exposure of Exogyra arietina clay is in a bluff of that deposit opposite 25th Street. The bluff rises on the right bank of the Creek and is almost vertical to the height of thirty feet. It consists of a bluish, fine-grained clay containing innumerable Oyster shells in a very perfect state of preservation. Some of the specimens of Exogyra arietina

have their calcium carbonate replaced by iron pyrite, and before tarnishing by exposure are very beautiful. Another characteristic species, besides the Exogyra, is a species found near the top of the bed, Grapheea pitcheri, Mort., which, according to Hill appear as the variety navia. Another interesting feature of this clay is the occurrence of numerous crystalline masses of gypsum, variety selenite, disseminated through it. The selenite has been accounted for as the result of the action of the sulphuric acid, generated from the decomposition of the iron pyrites, acting on the calcium carbonate of the shells, causing the formation of calcium sulphate (gypsum) and carbonic acid and water. Another characteristic of this formation is the peculiar, brownish-green color exhibited on exposed surfaces, an effect brought about, in all probability, by the oxidation of the iron pyrite into an impure limonite.

The clay strata are here about fifty feet thick and are directly overlaid by the Shoal Creek Limestone. Both formations extend horizontally up to a spot near 24th

street, when the limestone, which in this neighborhood is particularly broken and jointed, comes to an end. The top of the limestone at this point is a little more than a hundred feet above the level of the stream. Immediately south of the place where the limestone ends, a draw or gully enters the bed of the creek, cutting its way through the Exogyra clays and showing a very beautiful exposure of them. In this gully, plates of selenite over a foot wide may be collected, and perfect specimens of Exogyra arietina may be shovelled up by the thousand.

A significant fact is that on the south bank of the gully the Exogyra clay is not capped by the Shoal Creek limestone. In fact the clays extend above the level of the limestone on the opposite bank, showing that a fault or slip has taken place. This is corroborated by the broken and overturned limestone on the north bank of the gully. Judging from the position of the strata, the south side must have dropped down considerably.

Opposite 22nd Street the Shoal Creek

Limestone again makes its appearance above the clay. For a short distance its fossils are obliterated, and it is very hard and semi crystalline, a result brought about by the metamorphism attendant on the fault. The clays seem to be but slightly affected, though the upper surface is here segregated into a thin stratum consisting entirely of fossils.

The effects of the fault are not so plainly marked on the left side of the Cañon, since the banks are sloping and are, for the most part, covered with talus, thus hiding the arrangement of the strata. The soil, due to the decomposition of the Eagle Ford shales, here attains a considerable thickness, but there are no unweathered exposures of the formation.

On the left bank of the stream, at the foot of 22nd Street, there occurs another bluff of the blue clay, with characteristics identical with those of the one we have already described.

From 22nd to 19th Street, the bed of the stream slopes gently towards the South, but its pitch reveals a new formation. At the foot of 19th Street, where the Creek makes

a turn to the East, the Exogyra arietina clay does not extend down to the water's edge, but are exposed higher up in the bluff. Along the bed of the stream and in the banks opposite the tract denoted as Please' Park on the map, there is seen a massive white limestone extending up the bluff for fifteen feet. This limestone is massive, chalky and very fossiliferous, and though weathered considerably, is not nearly so much jointed and fractured as the Shoal Creek Limestone. One of the most abundant and characteristic fossils is the Brachiopod, Terebratula waconsis, Roemer. Other characteristic species are Ostrea carinata, Ostrea sinnata and macraster elegens. These remains of life, and the lithological character of the limestone, stamp it as the Washita or Fort Worth Limestone, the most important series of the Upper division of the Lower Cretaceous.

This Washita Limestone is exposed only on the western side of the Creek, the Eastern bank having been worn away. The exposure is several hundred yards in extent and disappears about opposite 17th Street, at which street the Exogyra clays resume their

position at the lower part of the bluff.

On the opposite side of the creek from the formation above mentioned, the scarp capped by the Shoal Creek Limestone recedes a considerable distance from the creek bed, leaving a comparatively wide valley, whose floor is covered with gravel and limestone pebbles. The soil has resulted from the decomposition of the clay and is very dark colored in places. There is an abundance of the small oyster shells scattered about.

After leaving the course of the stream, as above mentioned, the limestone bluff on the eastern side of the creek, which opposite Pease' Park is about a hundred feet above the stream, recedes from the Creek, but follows its general course. The same thing takes place as regards the West bank, and a considerable alluvial valley is left, extending from the bend south of Pease' Park to beyond the 12th Street bridge. The escarpment on the west retains its height to beyond the old Military Institute, but on the East side, between 14th and 15th Streets, the limestone falls lower and begins to dip at an angle which brings it down quite a distance, so that it

is less than fifty feet above the water's level at the 15th Street bridge.

A study of the rocks shows that a considerable fault has taken place beginning south of 15th Street on the East and extending diagonally across the bed of the Creek in a southwesterly direction and cutting the West bluff below the Military Institute. It strikes the stream at a short distance above the 12th Street bridge, just below a bluff of Exogyra arietina clay, the last exposure of this formation. The downthrow is something less than fifty feet.

South of the fault the limestone dips as before mentioned, and continually approaches the level of the Creek until at 10th Street the lowest part of the series is at the water's edge. Just below the 12th Street bridge the Shoal Creek Limestone is overlaid by a massive, chalky limestone, which upon examination proves to be the Austin-Dallas Chalk of the Upper Cretaceous series. This limestone is next above the Eagle Ford Shales in the scale, but the latter seem to be missing for several blocks, leaving the Chalk resting unconformably on the Shoal Creek Limestone.

A short distance below the Military Institute the fault strikes the Western Bluff causing the limestone, which here changes its direction and approaches the creek, to drop for some distance, the lower side dipping at a considerable angle and disappearing under the alluvium at the foot of 9th Street.

The Creek from this point has cut its way through a dark brown alluvium, which must have been formed from the decomposition of the Austin Chalk. After disappearing at 9th Street the Shoal Creek Limestone makes its appearance at 7th Street, this time in the bed of the Creek forming its floor. At 7th Street it has resting on it a bluff of Eagle Ford Shales about twenty feet in thickness, presenting a beautiful exposure of this interesting formation.

The Eagle Ford Clay Shales differ in appearance from the Exogyra arietina clays and are much more highly laminated. They are dark blue but do not have the greenish tint common in the Exogyra formation, and large portions are almost black from the occurrence in them of carbonaceous matter. The Shales themselves

contain very few species, though there is a great abundance of sharks' teeth scattered throughout the clay. However the bands of impure limestone that occur with the clay are very fossiliferous, containing a large number of small, flat oyster shells.

From 6th Street where a bridge has its foundation laid directly on the massive Shoal Creek Limestone, extending almost to the mouth of the Creek, the series is in sight, either forming the floor of the stream or rising a few feet above, making its banks. Below the 6th Street bridge it is usually capped by a calcareous conglomerate, or a red alluvium, both river products, and characteristic of this part of the city. Where a small branch stream enters the Creek on 4th Street the limestone is again overlaid by the Eagle Ford shales.

A very interesting thing is shown in the bed of the Creek just below 4th Street. The Shoal Creek Limestone seems to have been faulted internally, as it were. There appear to be two parallel lines of fracture in the limestone forming the Creek bed, between which a wedge shaped

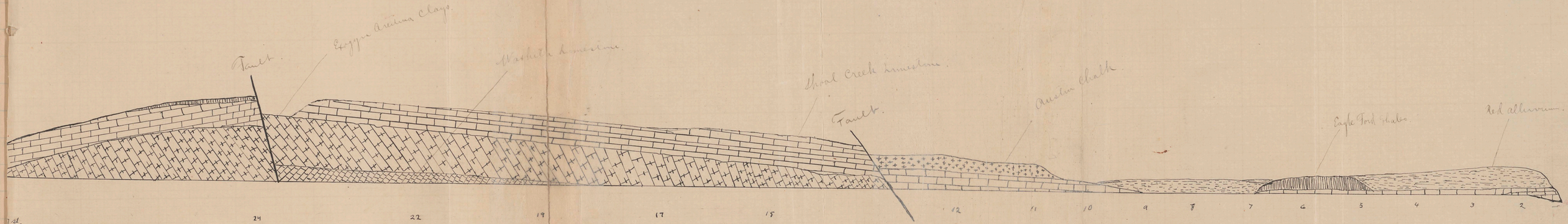
mass of the Shoal Creek Limestone has dropped down about six feet. The "Slickensides" are well shown and the effects are also plainly in evidence on the Eagle Ford Shales. This fault is very small and entirely local, but none the less interesting.

Below the railroad bridge on 3rd street the level of the stream is rapidly lowered. At the bridge the stream runs along the upper surface of the Shoal Creek Limestone, but in traversing the next block, it cuts its way down through about twenty feet of the solid Limestone, forming a plain exposure of it in the bluff. It is overlaid by the red alluvium already mentioned. At about a hundred yards from where the Creek empties into the river, the limestone disappears entirely and the stream cuts its way through the red alluvium already spoken of.

Such then are a few of the facts brought out in the study of the Creek from 28th Street to its mouth. The accompanying general section gives an idea of the relative thicknesses of the several strata. It is very

accurate, having been constructed from a scale from barometrical measurements made along the Creek at frequent intervals.

Prof. R. T. Hill's "Description of the Cretaceous Rocks of Texas" has been frequently consulted in the preparation of this paper, and Dana's "Manuel" has also been referred to. The fossils collected were compared with type specimens in the Palaeontological Laboratory of the University of Texas.



Section of Shoal Creek Canon.

Scale 1 in = 500 feet.