PALEOZOIC GEOLOGY OF THE SHOVEL MOUNTAIN AREA,
BLANCO QUADRANGLE, TEXAS

Approved:

E. H. Sellards

F. McAllister

J. E. Pearce

Approved: Henry W. Harper

Dean of the Graduate School

May 31, 1929.

PALEOZOIC GEOLOGY OF THE SHOVEL MOUNTAIN AREA,
BLANCO QUADRANGLE, TEXAS

THESIS

Presented to the Faculty of the Graduate School of
The University of Texas in Partial Fulfill-
ment of the Requirements

For the Degree of

MASTER OF ARTS

By

Hans Winkler, B.A.

Austin, Texas

June, 1929

PREFACE

The writer wishes to express his indebtedness to Dr. E. H. Sellards for suggesting this problem and for help he gave as the work progressed.

Thanks are expressed to Dr. F. L. Whitney and to Mr. F. B. Plummer. Dr. Whitney furnished an unpublished road map of the region which was made by students of the Department of Geology under the direction of Dr. H. P. Bybee. Mr. Plummer accompanied the writer on a field trip and gave valuable suggestions.

Hans Winkler

Austin, Texas
May 29, 1929

CONTENTS

ILLUSTRATIONS

Plates

Figure

PALEOZOIC GEOLOGY OF THE SHOVEL MOUNTAIN AREA, BLANCO QUADRANGLE, TEXAS

I. INTRODUCTION

1. Location

The Shovel Mountain area is located in the northwestern part of Blanco County and the southern tip of Burnet County, Texas. It is forty miles northwest of Austin and five miles south of Marble Falls. The area contains about one hundred and twenty square miles. The Paleozoic formations described in this thesis outcrop over about one quarter of this area.

The topographic base map of this Quadrangle which was made in 1884 is not accurate. The control on this map must have been insufficient and not enough stations were located to put the topography in accurately. Fortunately an accurate road map made by students of the Department of Geology under the direction of Dr. H. P. Bybee was available. Cypress Mill is the only landmark which appears on both maps and all roads have been completely changed since the topographic map was made. The old map does not show Spicewood, the largest village in this region at present.

2. Previous Work

In 1901 R. T. Hill[1] included the Shovel Mountain area in his report on the Black and Grand Prairies of Texas. In 1916 J. A. Udden, C. L. Baker and Emil Böse[2] published a geological map of Texas which shows the geology of this region. The Paleozoic formations were not differentiated, however.

3. Topography

The region is hilly. The lowest elevation (600 feet) is on the Colorado River and the highest (1500 feet) is on Shovel Mountain. The maximum relief, therefore, is 900 feet. The Paleozoic rocks do not offer much relief but occupy the lower rolling valleys between the terraced Cretaceous hills. The nearly horizontal beds of the Cretaceous rocks form a characteristic topographic type. This form of bench weathering due to hard and soft layers makes it easy to recognize the Cretaceous hills even from a distance.

II. DESCRIPTIVE GEOLOGY

The formations outcropping in this area are of Paleozoic and Cretaceous age. The field work was limited to the Paleozoic formations, and while the outcrop of the Cretaceous

---

[1] Hill, R. T.: "Geography and Geology of the Black and Grand Prairies of Texas," U.S. Geol. Surv., 21st Ann. Rept., Pt. 7, 1901

[2] Udden, J.A., Baker, C.L., and Böse, Emil: "Review of the Geology of Texas,"Bur. Econ. Geol., Univ. of Texas Bull. 44, 1916.

rocks was mapped no attempt was made to subdivide this system. The Paleozoic systems represented are the Cambrian, Ordovician and Pennsylvanian.

1. Paleozoic

a. Cambro-Ordovician

1) The Ellenburger Limestone

The Ellenburger limestone was named by Sidney Paige[3] from the Ellenburger Hills in the northwestern corner of the Burnet quadrangle. The lower part is Cambrian in age and the upper part is Ordovician. It rests with apparent conformity on the Wilberns formation in most places and is unconformably overlain by carboniferous strata.

In the Llano and Burnet quadrangles Sidney Paige[4] estimated the thickness of this formation as 1000 feet. No opportunity was found to measure the thickness in this region, but it is thought to be essentially the same. In the area mapped the Ellenburger is at the surface only in the northwestern part. Elsewhere it underlies later formations. It is a highly crystalline dolomitic limestone, very massive and fine textured, and contains considerable white and yellow

---

[3] Paige, Sidney: "Geology of the Llano and Burnet Quadrangles," U.S. Geol. Surv., Geol. Folio 183, 1912, p. 7.

[4] Ibid.

chert. The color varies from gray and brown to a creamy white.

Three miles west of Cypress Mill on the road to Round Mountain (see Plate II, B) the formation consists of light gray, finely textured, slightly spotted limestone. The fracture is uneven and the rock weathers to rounded, irregular shaped boulders that are smooth on the surface. When rubbed with the hand a white, gritty powder will come off. Near the gin at Shovel Mountain are exposures which have a distinctly friable feel. The weathering affects only a thin layer on the surface and the center remains hard and unaltered. Caliche is formed in places and the soil is sandy and a deep brown in color. It differs from the thin soil that is usually found on the Marble Falls limestone.

No fossils have been found in the lower part of the Ellenburger limestone. Sidney Paige[5] states that two species of Helicotoma? and two species of Ceratopea are abundant in Texas. These fossils are found only in the upper hundred feet of the formation.

b. Pennsylvanian

The Pennsylvanian is represented in this region by the Marble Falls and Smithwick formations.

---

[5] Ibid., p. 8

1) Marble Falls Limestone

The Marble Falls limestone was named by R. T. Hill[6] in 1889 from the town of Marble Falls where this formation forms a good exposure on the Colorado River. In the type locality as described by Hill the formation unconformably overlies the Ellenburger limestone. This is true also in the Shovel Mountain area. The Mississippian limestone and the Barnett shale which are found on the northern side of the Llano Uplift, twelve miles southeast of the town of San Saba, are not present at the south side of the uplift.

The Marble Falls limestone outcrops along the northern border of the Shovel Mountain area and in the bed of Little Cypress Creek. It also outcrops at Cypress Mill in the southern part of the area. The two exposures are separated by a ridge of lower Cretaceous, of which Shovel Mountain forms a part. On the west the Marble Falls limestone is in contact by faulting with the Ellenburger limestone. Due to the faulting and the limited exposure no estimate could be made of the total thickness of the Marble Falls in the Shovel Mountain area. At Marble Falls the thickness as measured by F. B. Plummer and R. C. Moore[7] is 352 feet.

On the north side of the creek at Cypress Mill the Marble

---

[6] Hill, R. T.: American Geol., May 1889.

[7] Plummer, F. B. and Moore, R. C.: "Stratigraphy of the Pennsylvanian Formations of North-Central Texas," Univ. of Texas Bull. 2132, 1921, p.21.

Falls limestone is light gray in color and very fine-grained. It is traversed by small veins of clear calcite and much smaller veins of calcite colored brown by impurities. The fracture is subconchoidal. It is massively bedded and weathers to a much darker gray with a surface that is finely pitted but rather smooth to the touch. With slight variations in texture, bedding and the appearance of the weathered surface, this light-colored phase is the part of the Marble Falls limestone which is in contact with the Ellenburger limestone on the west. Fossils are scarce in this part of the Marble Falls formation and some difficulty is experienced in distinguishing it from the underlying Ellenburger. The following observations were found helpful in making the distinction in the field:

1. Feel: The Ellenburger is slightly friable, and when the surface is rubbed with the hand a white, gritty dust will come off.

2. Weathering: The Ellenburger weathers to smooth boulders of various shapes while the Marble Falls limestone often shows dendritic weathering (see Plate II, B).

3. Cherts: The Ellenburger carries much larger masses of chert than the Marble Falls and they are lighter in color, usually almost white or slightly yellowish. Sometimes fossils are found associated with the cherts of the Marble Falls.

In the laboratory the light-colored Marble Falls can usually be distinguished from the Ellenburger limestone by studying thin sections of the rock. The most marked difference between a thin section of Ellenburger and one of Marble Falls limestone is that the Marble Falls, even in small fragments, usually shows some traces of organic structures. J. A. Udden and V. V. Waite[8] have published a bulletin which gives the characteristics of these two limestones.

Other phases are distinctive to the Marble Falls limestone and will not be confused with the Ellenburger limestone. West of Cypress Mill there is a good exposure of dark, shaly, thin-bedded limestone that weathers to flagstones of various sizes and thicknesses. They have an orange colored surface and the center is cream in color. When the weathering is not as far advanced the original bluish color of the rock remains in the center. Some of the flagstones were tested with hydrochloric acid and were found to be made up of sand. All the calcareous matter had been leached out. The thickness of this phase was estimated to be twenty-two feet. There are similar black, shaly beds elsewhere in the Marble Falls but they do not weather to this type of rock.

A section measured at Cypress Mill on the south side of Cypress Creek is as follows:

---

[8] Udden, J. A. and Waite, V. V.: "Some Microscopic Characteristics of the Bend and Ellenburger Limestones," Univ. of Texas Bull. 2703, 1927.

	Feet
Cretaceous conglomerate at top	
10. Massive bedded limestone, gray in color, thickness not determined.	
9. Dark cherts interbedded with small amounts of limestone weathering to a honeycomb structure.	3
8. Massive dark gray limestone containing occasional crinoid stems. . . .	77
7. Thinly bedded hard, dark gray limestone.	4
6. Massive dark gray limestone which weathers to boulders.	3
5. Dark gray shaly limestone which weathers to small flags of creamy color.	22
4. Massive limestone of dark gray color, contains *Productus morrowensis*, weathers to a projecting ledge. . . .	4
3. Thin bedded gray limestone.	6
2. Slightly shaly limestone, weathers with pits on surface.	20
1. Medium bedded dark gray even-textured limestone exposed in the mouth of small branch of Cypress Creek 100 yards below Cypress Mill.	

F. B. Plummer and R. C. Moore[9], who have made extensive collections from the Marble Falls limestone have the following to say about the fauna:

> A critical study of the fauna of the Marble Falls limestone makes evident its transitional position between the typical faunas of the Mississippian and those most characteristic of the Pennsylvanian. The fauna as a whole is different in many respects from the faunas of

---

[9] Plummer, F. B. and Moore, R. C.: *op. cit.*, p. 53.

> approximately the same stratigraphic horizon which have previously been described, for there is in the Marble Falls formation a considerable number of undescribed species. The number of forms which are common to other formations of known geologic age is sufficient, however, to permit no question as to the correlation of the Marble Falls limestone.

Over one hundred species from this formation are recorded in the literature. Many are long range Pennsylvanian species and have no value for correlation purposes. Some phases of the Marble Falls limestone are entirely barren of fossils.

At Cypress Mill south of the road crossing many fossil fragments were found. Crinoid stems are very numerous here. Large stems three-quarters of an inch in diameter were found. Zaphrentis sp. and occasional brachiopod fragments are present.

On Double Horn Creek, north of the road crossing, a small gastropod fauna was found which could not be identified in the literature. There are several species, most of which are turret-shaped, but a few flat coiled forms are present.

2) Smithwick Shale

The Smithwick shale was named by Sidney Paige[10] from the town of Smithwick in the southern part of Burnet County. It represents the highest Pennsylvanian formation exposed in this region. It lies conformably on the Marble Falls limestone and is unconformably overlain by rocks of Cretaceous age. At the type locality the thickness of this formation probably is not greater than 400 feet. It is defined as a slaty shale.

---

[10] Paige, Sidney: op. cit.

F. B. Plummer and R. C. Moore state that two phases can be recognized on the basis of lithology.

> A lower black, fissile, carbonaceous, thinly bedded, slaty shale interbedded with dense, black, thin limestone layers, the whole being about 120 to 200 feet thick; and above, a dark-colored to yellow-green or brown, somewhat sandy shale free from calcareous layers, this series being from 100 to 150 feet thick.[11]

The Smithwick shale outcrops in the mouth of Little Cypress Creek in the extreme eastern part of the area. A thickness of about forty feet can be measured between the creek bed and the base of a Cretaceous conglomerate which overlies it. In the mouth of Little Cypress Creek the Smithwick formation is a dark gray, almost black, fissile shale that weathers to a yellowish color on the surface. It is not fossiliferous.

2. Mesozoic

a. Cretaceous

The Cretaceous formation in this area belongs to the Trinity and Fredricksburg divisions. They consist essentially of limestones and marls, although there is a varying amount of sand at the base. The limestones are white to yellowish in color and the sands have a reddish color. The Cretaceous rocks are easily recognized from the underlying Paleozoics because they weather to benches due to alternating hard and soft ledges. The contact between the two systems is usually marked by a

---

[11] Plummer, F. B. and Moore, R. C.: op. cit.

conglomerate made up of worn pebbles from the Paleozoic rocks underneath.

III. STRUCTURE

The Paleozoic formations of the Shovel Mountain area are folded and faulted. On the eroded surface of the Paleozoics the Cretaceous formations rest in an essentially horizontal position.

The Paleozoic formations were folded and faulted as a result of the upheaval which produced the Llano uplift, Sidney Paige[12] has the following to say about the faults:

1. They are pre-Cretaceous.
2. Most of them are straight breaks.
3. The greater number are vertical, that is, their trace on the surface is a straight line.
4. Movement along the fault line has been generally in a vertical direction, for in many places two faults combine to include a V-shaped block. A close inspection of a number of such breaks proves that the faults die out horizontally, for they fail to show evidence of any folding that might suggest horizontal movements.
5. They have a northeastward trend, with only one important exception.
6. They are closely related to folds, that is, they are parallel to and locally pass into folds.
7. The throw or displacement varies from a few feet to 1800 feet. [12]

The general dip of the Marble Falls limestone is in a southeasterly direction varying from S. 70° E. to S. 85° E. The strike

---

[12] Paige, Sidney: op. cit.

of the beds ranges from N. 5° E. to N. 20° E. This strike very nearly conforms to the direction of the fault contact of Ellenburger and Marble Falls formations in the northwest part of this area. The amount of dip varies somewhat but the maximum is not over 7 degrees, while there are some strata which have a very slight dip. There are probably faults in at least part of the area which is covered by Cretaceous running in about the same direction as those on the west, so that the strata are repeated.

The Cretaceous rocks lie unconformably on the Paleozoic formations. The regional dip as determined by R. T. Hill[13] is from 13½ to 18 feet per mile in a southeasterly direction. The surface of the Paleozoic formations was very uneven when the Cretaceous was deposited. This is shown by the varying thickness of the basal sands of the Cretaceous. In places they pinch out entirely so that the Cretaceous limestones rest directly on the Paleozoic rocks.

---

[13] Hill, R. T.: op. cit., p. 379.

IV. BIBLIOGRAPHY

Hill, R. T.: American Geologist, May, 1889.

Hill, R. T.: "Geology of the Black and Grand Prairies of Texas," U.S. Geol. Surv., 21st Annual Report, pt. 7, 1901.

Paige, Sidney: "Geology of the Llano and Burnet Quadrangles," U.S. Geol. Surv., Geological Folio 183, 1912.

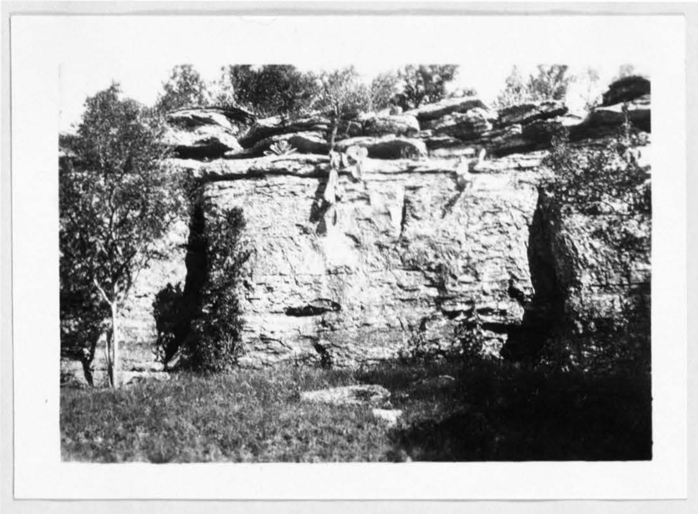
Plummer, F. B. and Moore, R. C.: "Stratigraphy of the Pennsylvanian Formations of North-Central Texas," University of Texas Bulletin 2132, 1921.

Udden, J. A., Baker, C. L., and Böse, Emil: "Review of the Geology of Texas," Bur. Econ. Geol., University of Texas Bulletin 44, 1916.

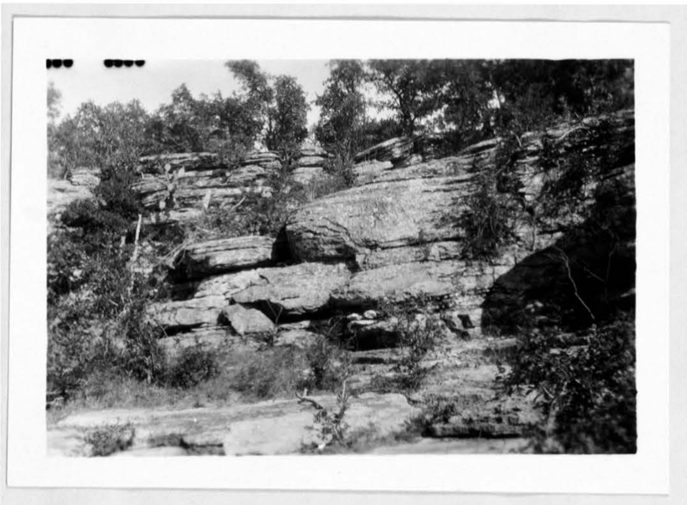
Udden, J. A. and Waite, V. V.: "Some Microscopic Characteristics of the Bend and Ellenburger Limestones," Bur. Econ. Geol,, University of Texas Bulletin 2703, 1927.

A. A porous phase of the Ellenburger limestone exposed west of Round Mountain.

B. Ellenburger limestone showing characteristic weathering exposed in the road between Cypress Mill and Round Mountain west of B.M. 1172.



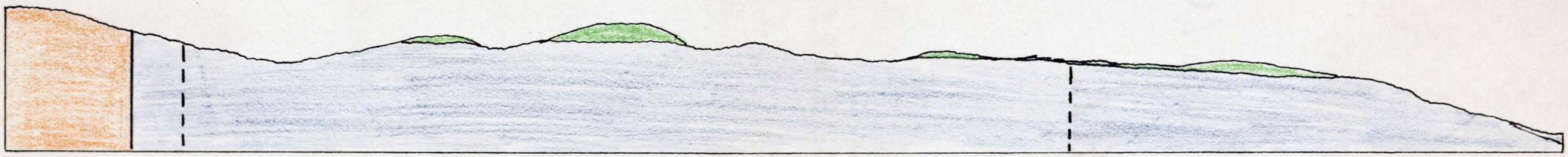
A. Marble Falls Limestone exposed on Cypress Creek 1000 feet below Cypress Mill.



B. Marble Falls Limestone exposed on Cypress Creek 1000 feet below Cypress Mill.

A. Marble Falls Limestone exposed on Cypress Creek 1000 feet below Cypress Mill.

B. Marble Falls Limestone exposed one-fourth mile west of Cypress Mill.



CROSS SECTION FROM SHOVEL MOUNTAIN GIN TO THE MOUTH OF LITTLE CYPRESS CREEK

ALONG THE LINE A-B

Ellenburger ls. — Marble Falls ls. — Smithwick sh. — Cretaceous

Fault (acertained) ———

Fault (inferred) - - - -

Scale 1 in. = 1 mile

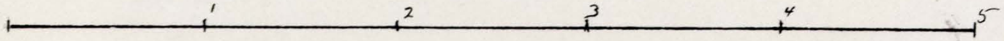
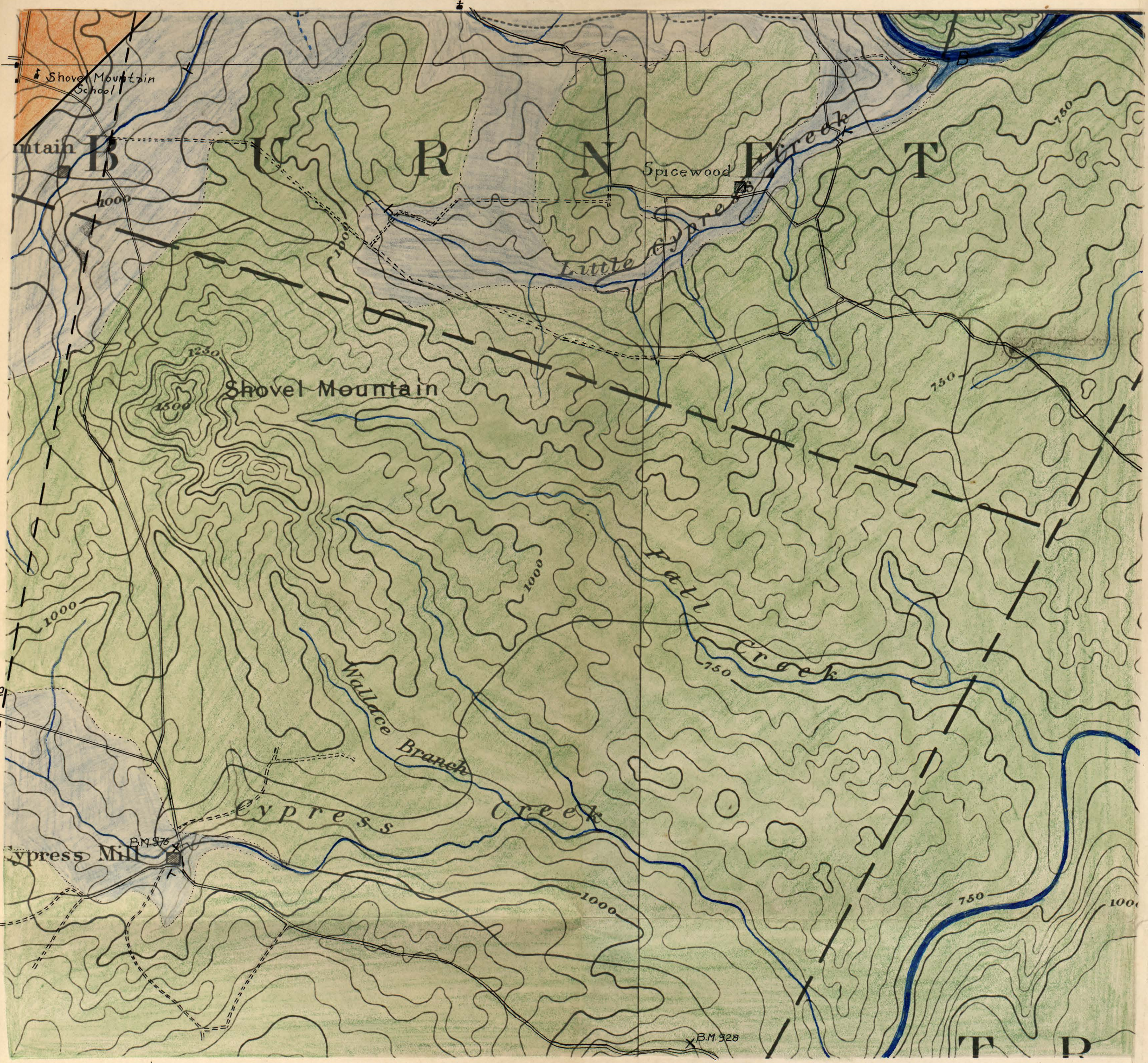


Figure.



GEOLOGIC MAP
OF THE
SHOVEL MOUNTAIN AREA

1929
BY HANS WINKLER

LEGEND

MESOZOIC
CRETACEOUS

UNDIVIDED

PALEOZOIC
PENNSYLVANIAN

SMITHWICK SHALE

MARBLE FALLS LS.

CAMBRO-ORDOVICIAN

ELLENBURGER LIMESTONE

SYMBOLS

FAULT (ASCARTAINED)

FAULT (INFERRED)

DIP

SCALE: 1 INCH = 1 MILE

0 1 2 3