THE COMANCHE PEAK FORMATION

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THESIS

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P R E F A C E

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Professor F. W. Simonds has graciously extended the use of his private library, for which the writer wishes to express his gratitude.

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INTRODUCTION

The Comanche Peak Formation assumes a medial position in the Fredericksburg division of the Cretaceous of Texas where it overlies the Walnut formation and underlies the Edwards formation. According to R. T. Hill, the name Comanche Peak beds was proposed by Dr. Shumard in 1891 and as such, gained formal recognition by Hill in the same year.[1] The term "beds" was subsequently changed to "formation" by Hill, Taff, and others in later publications.

The Comanche Peak formation has its typical development in the Brazos River valley where the type locality may be seen at Comanche Peak in Hood County. Southward, westward, and northward from this locality the formation has marked regional variations, both laterally and vertically which presupposes the existence at this time of an epicontinental sea with varying degrees of depth ranging from near shore conditions in central Texas to a deeper sea in west Texas, while conditions in Mexico seem to point to greater depths in the same sea there. The most persistent characteristic of the formation is its chalkiness. With the exception of a few finely arenaceous layers it is predominantly calcareous and chalky, influenced by varying degrees of hardness. In central Texas it forms the bluff-like slopes beneath the scarps of the Edwards formation with which it is intimately related and in a sense can be referred to as basal Edwards inasmuch as it appears to be a transitional zone between the Walnut clays and the Edwards limestone. On the whole it may be described as a persistent bed or beds of white, chalky, fossiliferous limestone rarely exceeding 50 feet in thickness. At exposures where it is rapid-

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[1] Hill, R. T.: Bulletin of the Geological Society of America, May 5, 1891, pp. 505-528.

ly weathered or cut by stream action it is massive and homogeneous in structure from the base to the top. On weathered slopes it disintegrates into conchoidal fragments of various sizes, and in the more arid climates it exhibits etched potholes and schratten weathering. The bluff-like slopes of its outcrop are narrow and accumulate but little soil and its surface is more or less barren of vegetation. Rich, black residual soils occur where the Comanche Peak forms a level plateau summit or bench.

Beginning at Benbrook, Tarrant County, and in southern Parker County, where a distinction can first be detected between the chalky limestone of the Comanche Peak and the hard limestone of the Edwards, the zone of strike of the Comanche Peak follows in a slightly southwest direction. From Tarrant County to the south the exposure widens as it progresses through Johnson, Hood, Somerville, and Erath counties. The outcrop attains its greatest width from east to west through Hill, McLennan, Bosque, and Coryell counties with outliers represented to the westward in Hamilton, Mills, Comanche, Brown, Coleman, Taylor, and Nolan counties. Continuing southward through Bell, Burnett, Williamson, and Travis counties it narrows in passing around the central Mineral Region where it reaches the Balcones fault zone and is cut off by displacement after being represented at Mt. Barker, 3 miles N. E. of Austin, Texas. It also appears in the hills of western Travis County near the summit of the Edwards Plateau.

West and south of the Central Mineral Region the Comanche Peak has not been studied in sufficient detail to determine all the localities of its occurrence. In Gillespie and Mason County it can be seen forming the summits of the hills where the Cretaceous overlaps the Paleozoics. It is represented in a small zone on the Medina River in north eastern Medina County.[2]

[2] Liddle, R. A.: University of Texas Bulletin No. 1860, Oct. 25, 1918, Geology and Mineral Resources of Medina County.

Stanton[3] and Baker[4] have described its occurrence in the Quitman and Davis mountains. In Tom Green, Pecos, Concho, and Runnels counties it forms the slopes of all Cretaceous outliers. Southward into Mexico the Comanche Peak is represented by the Upper Albian.

The Goodland limestone, in part the north Texas correlative of the Comanche Peak, is represented in Tarrant, Parker, Wise, Denton, Montague, Cooke, and Grayson counties. It continues northward across the state of Oklahoma to Marietta, Arkansas. Throughout the extent of its occurrence in Texas the stratigraphy of the Comanche Peak exhibits three regional variations which will be considered separately.

As elsewhere stated in this paper, the Comanche Peak is intimately related to the Edwards limestone. Hill[5] has pointed out in an earlier work that the Comanche Peak and Edwards formations plus their northern correlative, the Goodland limestone, represent the greatest extent of any of the Cretaceous formations in Texas. Hill also states that lithologically, the Comanche Peak might be considered basal Edwards. Recent investigations by the writer and others in west Texas seem to justify this statement as a valid one in that area as well as in the area covered by Hill's report. The fauna of the Comanche Peak, however, seems to indicate a zone of transition between the Walnut Clays and the Edwards Limestone.

It must be borne in mind that in order to get a clear conception of depositional conditions during the period in which the Comanche Peak formation was laid down one must consider the whole of the Fredericksburg division. The first factor in such a consideration is that the sea at this time was one

[3] Stanton, T. W.: Stratigraphic Notes on the Malone Mountains and the Surrounding Region Near Sierra Blanca, Texas, U. S. Geol. Surv. Bull. 266, pp. 29-32, 1905.

[4] Baker, C. L.: Exploratory Geology of a Part of Southwestern Trans. Pecos, Texas.

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

of encroachment . The Walnut represents the first phase of deposition as the sea progressed over the land. It was laid down in a basin in central Texas and was contributed to by argillaceous land sediments which were swept therein. This is evidenced by its marly and impure nature. Secondly, this sea continued to receive sediments of this nature as it transgressed the land. Inasmuch as the fauna of the Comanche Peak is essentially the same as that of the Walnut with exceptions which shall be made elsewhere, and since the hard Comanche Peak limestone in one locality gives place to a marly phase in another, the only logical conclusion to be reached is that the contact between the Walnut and Comanche Peak is one of transgression.

The same applies to the upper contact under slightly different conditions. In the greater part of Texas the faunal and lithological differences of the Edwards and Comanche Peak are readily distinguishable, but north of Parker County the two are represented by the Goodland limestone, a comparatively thin and lithologically homogeneous representative. Because of this homogeneity in lithological characteristics and because of its comparative thinness it has not been and is not at the present time imperative that a division should be made within it. Neither would such a division be of stratigraphic importance since the Goodland as a whole is an easily recognized mapable unit.

With these generalizations in mind, the area where the Comanche Peak was first delimited will now be considered. This territory embraces the strike of the outcrop as it is found between the Brazos and the Colorado rivers. The following section taken at Comanche Peak in Hood County is typical of the northernmost occurrence of the formation.

Section No. 18
Section of the Fredericksburg Division of the Comanche Series[6]
From the Top of Comanche Peak (Altitude 1250 feet) to Top of Paluxy Sands

Edwards limestone:

	Ft.
7 i. Hard, chalky limestone, character uniform throughout. Fossil rudistids, occuring very irregularly. From cap rock of mountain..........	33

Comanche Peak beds:

6 h. Slightly softer, chalky limestone. More variable in hardness than the Edwards (Caprina), thus forming slopes..........	66
g. Hard limestone, which bears numerous small Gryphaea at the upper edge..........	3
f. Friable, marly limestone, in which are Gryphaea..........	8
e. Ledge of hard limestone..........	1
d. Marly limestone, weathering easily; contains Gryphaea..........	5
c. Harder limestone layer..........	1
b. Marly lime, exhibiting chalky character in the upper portion..	15
a. Flaggy limestone, containing Gryphaea..........	1
	133

Walnut Formation:

5. Arenaceous and argillaceous lime marl with layers of harder limestone:	
e. Argillaceous lime marl, grading downward into arenaceous laminated marl in the basal portion..........	20
d. Compact argillaceous limestone..........	2
c. Argillaceous lime marl with Gryphaea..........	3
b. Thin compact limestone..........	1
a. White marly limestone..........	5
	31

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[6] Ibid., p. 204

		Ft.
4.	Bedded *Gryphaea*	10
	On the surface, after long weathering, this rock appears as a yellow or light-buff friable marl. In fresh exposures it is a compact light blue limestone with softer thin layers of marly lime intervening between the harder and thicker strata.	
3.	Yielding argillaceous lime marl, bearing numerous individuals of *G. pitcheri (marcoui)*..................................	14
2.	Marly and hard layers of limestone alternating:	
	g. Hard *Gryphaea* limestone..................................	2
	f. Marly lime on weathered surface..........................	4
	e. Thin layer of compact limestone..........................	1
	d. Marly limestone, friable on weathered surface............	2
	c. Limestone ledges with *Gryphaea*..........................	3
	b. Marly limestone with many *Gryphaea* and *Exogyra texana*; weathers readily into soft material.......................	4
	a. Persistent layer of limestone............................	2
		18
1.	Arenaceous lime marls with *Gryphaea*.	

In the greatest westward extension of the Cretaceous over the Bend Arch in Comanche and Brown counties the lower beds are lacking. Hill's section taken at Logans Gap seems to indicate that such is the condition there.

Section No. 19
Section at Logans Gap, Comanche County, Texas[7]

Edwards limestone:

		Ft.
10.	Soft, chalky limestone....................................	10
9.	Three strata of so-called magnesian limestone with cherty nodules between them containing *Requienia*..................	40

[7]Ibid., p. 205.

		Ft.
8.	Hard crystalline limestone with Requienia and Radiolites........	30
7.	Impure siliceous limestone containing coarse grains............	3
Comanche Peak beds:		
6.	Pure white, chalky limestone in thin friable layers, breaking on exposure and containing Enallaster texana, Exogyra texana, Cardium, Natica, etc..............................	-40
5.	Yellow impure limestone at base of above........................	- 3
Walnut Formation:		
4.	Calcareous clays with thin blocks containing Gryphaea marcoui and Exogyra texana..	10
3.	Blue clays..	30
Paluxy Formation:		
2.	White and red clays..	7
1.	Paluxy sand, as seen in well (packsand).........................	100

Westward from Comanche County the Comanche Peak formation almost entirely loses the characteristics it maintained in the Brazos and Colorado River valleys. The section may be traced by successive outliers across Callahan, Taylor, and Nolan and thence to Coke and Tom Green counties, where it connects with the main Cretaceous area of west Texas. In this area the formation is made up of massive bedded crystalline rocks and the fauna has become very scarce. This indicates a farther off shore deposition where environment was not conducive to the propogation of the fauna found in the eastern extension. A section taken by J. A. Taff[8] at Baker Mountain in Callahan County shows the character of this western phase.

[8] Taff, J. A.: Reports on the Cretaceous Area North of the Colorado River, Geological Survey of Texas, Third Annual Report, 1891, pp. 321.

Section of Baker Mountain from base upward

1. Porous homogeneous "packsand" 95

2. Coarse gritty sand 15

3. Stratified, partially indurated, calcareous sand, which weathers in rough nodular porous masses 50

4. Red and purple clays, locally distributed. In some places it is 10 and more feet in thickness; at others, it is absent.

Total thickness of sand 160

The Glen Rose (alternating) beds are absent, and the sands are unbroken from the Paleozoic to the Texana bed which succeeds the sand.

5. Calcareous indurated sandstone, grading upward into marly or arenaceous crumbling limestone, bearing small Exogyra texana, Gryphaea pitcheri, and associated fauna of the Texana bed, such as Ammonites Toxaster, Natica, and Cardium 20

6. Comanche Peak limestone with probably the basal portion of the Caprina limestone 110

Another section taken by Taff[9] at Church Mountain in the southeast corner of Nolan County carries the formation farther west.

(6) Church Mountain Section.

1. Permian red sandstone, with a zone of quartzite brown sand at the top 80

2. Trinity or Paluxy sand, with a border of pebbly sand at the base in contact with Permian rocks 90

3. Comanche Peak limestone, with Texana bed fauna in contact with the Trinity 80

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[9] Ibid., p. 323

		Ft.
4.	Massive chalky limestone..	20
5.	Compact bedded limestone..	30
6.	Massive chalky limestone, containing flint nodules in considerable quantities..	25

In the winter of 1928 the writer visited a locality with Mr. George G. Henderson at Mount Nebo and at Devil's Courthouse Mountain, twin peaks which appear about eight miles north of San Angelo, Texas. A section was measured at the latter locality and Mr. Henderson has given an excellent description of the formation from thin sections as it appears at Mt. Nebo.

Section from the top of Devil's Courthouse Mountain
to the Trinity

Edwards Formation:

Gray massive limestone with layers of chert........................	20
Hard gray to white limestone with layers of nodular chert..........	13

Comanche Peak formation:

Gray limestone exhibiting schratten weathering.....................	5
Chalky white limestone...	4
Arenaceous white limestone...	12
Soft white limestone weathering to a slope.........................	11
Arenaceous limestone exhibiting schratten weathering...............	4
Gray crystalline limestone with large _Pectens_ and _Toucasia_.........	9
Chalky white limestone weathered to a slope........................	9
Hard gray limestone..	8
Nodular to massive limestone containing cavities which are filled with yellowish calcite crystals........................	10

Walnut Clay Formation: **Ft.**

Buff colored sandy marl with large univalves........................	8
Hard gray limestone...	3
Light buff colored marl containing <u>Exogyra texana</u> and other fauna of the Walnut..	10

Trinity division:

White and yellow crossbedded sands and clays........................	25

Thin sections made of the limestone from Mount Nebo, giving the microscopic content of the Comanche Peak Limestone[10]

Slide

1. 0-8 feet above Walnut Clay

   Fine-grained limestone about 25 per cent sand, the quartz grains being angular, with a few subangular grains. Fossils: Sponge spicule, corals, <u>Nodosaria sp</u>; <u>Biloculina sp</u>; <u>Cristellaria sp</u>; <u>Ostracod sp</u>; other fragments too small to be determined.

2. 8-15 feet above Walnut Clay

   Fine granular limestone with several angular quartz grains present. No fossils noted.

3. 14-17 feet above Walnut Clay

   Fine granular limestone. Only a few quartz grains present. No fossils.

4. 17-19 feet above Walnut Clay

   Fine granular limestone. Only a few quartz grains present. Fossils: <u>Miliolina sp</u>; a piece of a <u>Nodosaria</u>; <u>Orbitolites</u> (?)

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[10] Henderson, George G.: <u>The Geology of Tom Green County</u>, <u>University of Texas Bulletin No. 2807</u>, Feb. 15, 1928, p. 28.

5. 19-25 feet above the Walnut Clay

Very fine-grained limestone, one or two pieces of quartz, very small. Fossils: apparently several Triloculinae sp; a piece of Nodosaria; Miliolina sp.

6. 25-28 feet above the Walnut Clay.

Very fine-grained limestone. Fossils: Anomalina sp; Triloculina sp; fragments of other fossils.

7. 28-31 feet above the Walnut Clay

Like the above sample. Fossils: Textularia sp; Miliolina sp; Triloculina sp; Anomalina sp; coral; sponge spicules; and other fragments.

8. 31-38 feet above the Walnut Clay

Requienia beds.

Fossils: Miliolina sp; Planorbulina sp; Textulariae in abundance, two pieces or more; Biloculina; sponge spicules; coral, probably two pieces; Orbitolina sp; in abundance, several Ostracods.

9. 37-44 feet above the Walnut Clay

Very fine grained limestone.

No fossils.

10. 44-47 feet above Walnut Clay

Like No. 9.

11. 47-53 feet above the Walnut Clay.

Like No. 9.

12. 53-56 feet above the Walnut Clay

Like No. 9.

13. 56-59 feet above the Walnut Clay

Like No. 9.

14. 59-62 feet above the Walnut Clay

Like No. 9.

15. 62-75 feet above the Walnut Clay

Like No. 9.

16. 75-78 feet above the Walnut Clay.

Like No. 9.

17. 78-82 feet above the Walnut Clay

Like No. 9.

18. 82-86 feet above the Walnut Clay

Like No. 9.

19. 85-105 feet above the Walnut Clay

Caprina beds.

20. 105-108 feet above the Walnut Clay

Like No. 9.

Apparently few fragments of fossils but too small to be determined.

In certain sections of the Colorado River valley the Comanche Peak is well represented by a more predominantly limestone facies. The bluffs forming the sides of the San Gabriel River valley in Williamson County are almost entirely made up of Walnut and Comanche Peak capped by about twenty-five feet of Edwards. There are practically no argillaceous layers in the Walnut or the Comanche Peak in this area. The cliffs shell off in brecciated masses of various sizes and leave the crowning cap of Edwards standing out with vertical faces.

Ft.

3. Edwards limestone containing Toucasia and layers of flint...... 25

2. Chalky Comanche Peak limestone containing Cyphosoma texanum Enallaster texana, Anatina sp.; Anatimya sp.; Gryphaea marcoui; Exogyra texana, The middle portion is soft, white and chalky while the upper portion is in beds three to eight feet thick... 160

1. Walnut formation; upper Gryphaea bed.

A section described by Taff[11] at Pilot Knob shows the same general characteristics.

Section No. 6
Pilot Knob
From the top of Pilot Knob to the bed of San Gabriel River below Gabriel Mills

4. Caprina limestone (Edwards) a remnant of the basal flint horizon remains, forming the cap rock of the peak. Many fragments of flint occur upon the surface and in the indurated limestone............ 10

3. Comanche Peak limestone. Debris from the Caprina beds and from the surface weathering conceals surface exposures upon the slopes of the peak.. 110

2. Texana bed (Walnut), which is exposed in the slopes and breaks of the San Gabriel River valley between Pilot Knob and Gabriel Mills. There is but little if any variation in the bed at this locality and in that described under No. 10 of Bachelor Peak section..... 100

1. Glen Rose (alternating) bed

Southward in western Travis County this relatively thick limestone, as represented in Williamson County, diminishes in thickness by almost one third. This points to the conclusion that there was a relatively deep arm of the

[11] Taff, J. A: 8 ibid., p. 362.

sea immediately north of the Colorado River which passed northwest around the Central Mineral Region and extended out into the Lampasas Cut Plains. Hill's[12] section on the Bee Caves-Burnet road, at western border of the Austin quadrangle shows the change in depositional conditions south of the Colorado River.

Section No. 21
Section at border of Blanco and Travis Quadrangles
Four miles south of the Colorado River

10. Firm white limestone containing flints 1-inch thick, which have been worked by the Indians. This is the lower portion of the Edwards limestone, which is here preserved as a cap rock less than 100 square feet in area.

Comanche Peak:

		Ft.
9.	White chalky limestone	15
8.	Firm calcareo-siliceous clays containing great quantities of *Exogyra texana*	10

Walnut beds:

7.	Thin, indurated layers	25
6.	Calcareo-arenaceous clays containing great quantities of *Exogyra texana*	15
5.	Yellow, rotten, honey combed limestone	1
4.	Yellow clay with abundance of *Exogyra texana*	10
3.	White chalky limestone band with *Exogyra texana*	2
2.	Firm limestone	2
1.	Yellow arenaceous limestone, forming ledge	2

12 Op. cit., p. 211

Glen Rose beds:

Top of Glen Rose beds: firm, yellow arenaceous limestone weathering into ledges.

Total Comanche Peak beds in section..25

Total Walnut beds in section...32

Total Glen Rose beds in section...280

In Gillespie County the limestone phase of the Comanche Peak has entirely disappeared and is represented by a yellow calcareous sandstone. The sea did not cover the Central Mineral Region during the deposition of this formation which accounts for the sandstone here which was deposited on an advancing shore line. A section taken by Professor F. L. Whitney shows the nature of this section in this area.

Section taken 3 miles west of Fredericksburg on the Mason road:

3. Edwards limestone.

2. Comanche Peak formation represented by a yellow to buff calcareous sandstone containing numerous casts of Rostellaria sp., Modiola sp., Granocardium sp., Pinna sp., Tylostoma sp........................Ft. 37

1. Walnut formation...20

North eastern Medina County contains an exposure which is described by Liddle.[13] The formations here seem to indicate that the conditions of deposition vary slightly from those which prevailed in western Travis County.

Liddle describes the Comanche Peak as a nodular, argillaceous, impure limestone overlying the Walnut and underlying the Edwards limestone. It is 30 to 35 feet thick in this area.

[13] Ibid., p. 29.

Conditions of deposition during the Comanche Peak sub epoch in the Fort Stockton Quadrangle seem to indicate a closer adherence to the characteristics of the northern part of the type locality between the Brazos and the Colorado rivers. According to Adkins,[14] the formation here is composed of soft, nodular, argillaceous, thin-bedded, limestone. Marly layers are conspicuous in the base and middle, but the upper part contains hard rudistid-bearing layers. The section here also shows a predominance of clay which contains many fossils. Adkins tentatively correlates this clay with the Goodland on the basis of the ammonite fauna. Since the Comanche Peak in central Texas contains clay beds of this type the more logical conclusion seems to be that it could be called Comanche Peak instead of Fredericksburg Clay or Goodland. A generalized section given by Adkins of the Fredericksburg Division of the Fort Stockton Quadrangle shows the rocks he refers to this division:

		Ft.
3.	Clay (Kiamichi and ? post-Kiamichi)	66.5
2.	Clay (Goodland)	50
1.	Limestone (Comanche Peak and ? Walnut)	91.5
	Total	208

As elsewhere noted in this paper the Comanche Peak formation does not occur in Texas north of Parker County except as it is interpreted to be in part correlative within the stratigraphic limits of the Goodland limestone. In the northern-most part of the state, as well as in Oklahoma and Arkansas, it is impossible to separate the Comanche Peak from the Edwards limestone. Both together are represented by the Goodland, a chalky, white limestone which more nearly resembles the Comanche Peak in its brecciated and chalky appearance.

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[14] Adkins, W. S.: The Geology and Mineral Resources of the Fort Stockton Quadrangle, University of Texas Bulletin No. 2738, Oct. 8, 1927.

A section taken at Lake Worth six miles northwest of Fort Worth shows the Fredericksburg as it is commonly divided into the Goodland and the Walnut. This locality is representative of the Goodland as it appears in its southern-most extension, although it could just as well be referred to as the Comanche Peak were it not for the fact that most authorities agree that the upper four or five feet is probably Edwards. Since it is impossible to divide this limestone because such a division would fall within a homogeneous bed, it will be assigned to the Goodland.

Lake Worth Section, 6 miles northwest of Fort Worth

Kiamitia

Goodland:	Ft.
Massive limestone in layers intercalated with thin marl seams.......	6
Chalky brecciated limestone....................................	8
Blue gray marl...	1
Marl layers intercalated with thin limestone layers................	3
Brecciated limestone...	4
Marl layers intercalated with limestone layers with blue marl at base	5
The lower part of these strata contain: Enallaster texanus, Cyphosoma texanum, Oxytropidoceras species, O. acutocarinatum, Neithea, Gryphaea marcoui, Exogyra texana, Pinna sp., and many gastropods.	
Chalky limestone...	5
Blue lime marl...	6
Massive chalky limestone containing Gryphaea marcoui, Oxytropidoceras acutocarinatum, and celestite or gypsum veins..........................	13
Blue lime marl containing Neithea irregularis, Enallaster texanus, and many gastropods..	7

	Ft.
Chalky limestone..	10
Massive chalky brecciated limestone..................................	48
Total...	116

Walnut:

Upper Gryphaea marcoui shell conglomerate.

Proceeding northward the Goodland ranges from 15 to 40 feet in thickness and constitutes a massive homogeneous white, chalky limestone which is not divisible stratigraphically.

Section of the Goodland limestone below bridge on Elm Creek two miles south of Myra, Cooke County, Texas[15]

Kiamichi Clay.

Goodland Limestone:

	Ft.	In.
Limestone, hard massive, white to gray, contains Turritella sp., Gryphaea sp., Oxytropidoceras acutocarinatum (Shumard).........	6	0
Alternating beds of blue shale and soft gray limestone which form terraces near the top of the Goodland....................	2	6
Limestone, massive, bluish white, hard, very fossiliferous.....	2	6
Shale, blue..	0	6
Limestone, massive, weathering into small angular fragments, many large O. acutocarinatum..................................	4	6
Clay, soft yellow calcareous, having Gryphaea and small Exogyra cf. E. plexa...	0	1
Limestone, massive gray, weathering into angular fragments; some small O. acutocarinatum..................................	4	0

[15] Bullard, Fred M.: Lower Cretaceous of Western Oklahoma. A Study of the Outlying Areas of Lower Cretaceous in Oklahoma and Adjoining States, Oklahoma Geological Survey Bulletin 47, Oct. 1928, p. 21.

	Ft.	In.
Shale, blue, and brown clay	0	6
Limestone, light gray, containing numerous shell fragments including _Gryphaea sp._, and _Neithea_	2	4
Limestone, yellow arenaceous, irregularly bedded, few fossils	0	4
Limestone hard massive, bluish gray, containing echinoids, _Gryphaeas_, _Pectens_, _Turritillas_	6	3
Gryphaea agglomerate	0	1
Limestone, massive, weathering into large irregular fragments containing yellow spots on weathered surface. Many fossils	2	3
Shale, white to blue sandy, few _Gryphaeas_	0	10
Limestone, light yellow nodular, containing large _Pinna sp._, _Neithea sp._, _Gryphaea sp._, _Tylostoma sp._, echinoids and gastropods	2	6
Limestone, yellow argillaceous, nodular, with _Gryphaea_ and _Turritella_ in great abundance. Also contains _Arctica_, echinoids, and a large _Ostrea sp_	2	0
Limestone, nodular blue sand, resting directly upon blue yellow (Walnut) clay	0	10
Trinity Sand	38	0

World wide correlation of such a comparatively thin formation as the Comanche Peak is necessarily difficult to determine; however, the _Oxytropidoceras_ forms as found within the formation are strikingly world-wide in their distribution. Related forms range from middle to upper Albian in western Europe and they are also found in the Albian of Africa and South America. The Upper Albian of Mexico is correlated in part with the Comanche Peak because of the occurrence within it of _Oxytropidoceras belknapi_ and related species.

With the exception of the lowermost beds, the lithological characteristics of the Comanche Peak vary only moderately in central Texas. From Bell County northward there are numerous marly layers in the basal beds which grade laterally into chalky layers in the Colorado River valley. The upper part, however, is strikingly similar from Travis County northward to the Red River. In general, these upper strata are very chalky and white and weather into conchoidal brecciated fragments. These fragments when broken with a hammer are very brittle and chip off in sharp angular pieces and slivers.

In the immediate vicinity of Central Mineral Region where the Comanche Peak overlaps older formations, it is composed almost entirely of quartz grains, loosely cemented by a calcareous matrix. The quantity of quartz grains is as high as 90% in some cases. They are generally distinctly rounded, but there are occassionally a few subangular ones. In west Texas the upper ten feet has about 25% of subangular quartz grains within an otherwise relatively pure limestone which occurs in thinner beds containing cavaties filled with calcite crystals. These geodes range from the size of a pea to approximately one foot in diameter.

The Comanche Peak has an average thickness of about 90 feet between the Colorado and Brazos rivers where it is typically developed. Within this area it thickens to the southward and shows the following variations: at Comanche Peak, 100 feet; at Shovel Mountain, Burnet County, Texas, 108 feet; at Gabriel Mills, Williamson County, Texas, 110 feet; and 11 miles northwest of Georgetown, 160 feet.

The formation in this area also increases in thickness to the eastward. As the above figures show, it is much thicker near Georgetown than it is farther west in Williamson County. In western Travis County there is 25 feet of the formation, while at Mount Barker, four miles northwest of

Austin, it attains a thickness of 65 feet. The reported thickness of 35 feet in Medina County shows that the formation again thickens southward from western Travis County.

In west Texas where the Fredericksburg strata overlie Permian strata on the eastern edge of the Permian basin, the Comanche Peak averages about 90 feet in thickness. In Tom Green County it attains a thickness of 100 feet, and north from Coke and Nolan counties it is approximately 110 feet, which shows a slight increase in thickness to the northward in this immediate vicinity. In the area of the Rio Grande embayment the members of the Fredericksburg division have not been sufficiently studied and delimited to determine the exact thickness of the Comanche Peak equivalent there.

These differences in thickness show that the Comanche Peak formation was laid down on an epicontinental sea bottom which was warped and uneven.

PALEONTOLOGY

The fauna of the Comanche Peak formation is well developed and varied. It appears to be most abundant in the lower beds, which is probably due to the unconsolidated character of the rocks which makes for more rapid weathering and exposing them to view. We note, however, a rapid decline in numbers of certain species as represented in the Walnut beds below.

When the formation was first delimited by Hill, one criterion for fixing the lower contact was the apparent disappearance of the Gryphaea pitcheri (later known as Gryphaea marcoui). Later studies have revealed the fact that the Graphaea marcoui appears in the hard limestone of the Comanche Peak, but it is not abundant, and it is the opinion of the writer that the upper bed of Gryphaea marcoui agglomerate as represented in the Walnut beds is the only logical factor in establishing a definite contact between the Walnut and Comanche Peak. The upper limit of this agglomerate is clearly the best point at which to establish a contact.

The Exogyra texana beds are very striking in their appearance also. They, like the Gryphaeas, occur in agglomeratic beds in the Walnut, but they are not so firmly cemented in a calcareous matrix. Hill[16] says that these Exogyra texana beds are intimately related in the establishment of the lower contact of the Comanche Peak. "This transitional bed is about 20 feet thick and is composed of strata 3 to 6 feet thick, in which the species Exogyra texana abound." Although the E. Texana occurs in the Comanche Peak, it is not found in agglomerates, but is scattered throughout the formation in varying degrees of concentration.

What has been said about the Gryphaeas and Exogyras applies in a some-

[16] Ibid., p. 224.

what less degree to most of the fossils of the Walnut. Their numbers gradually diminish progressively upward in the Comanche Peak. They increase in size in certain beds of the Comanche Peak while in other beds of the same formation they decrease. Thus, as it were, they seem to have been struggling for an existence, but were gradually eliminated and limited from occurrence by an unfavorable environment until they completely disappeared by the time the uppermost beds of the Comanche Peak were deposited.

Some of the species found in the Comanche Peak are important horizon markers for world-wide correlations. The Oxytropidoceros acutocarinatum and O. belknapi or related forms are characteristic of Upper Albian everywhere it is represented. An Inoceramus which occurs in the formation is distinctive because this is almost the lowest level at which this genus has been figured from the Cretaceous of Texas. Böse recently discussed this fossil and identified it as Inoceramus sp. aff. concentricus.

The fauna of the Comanche Peak marks a distinct contrast from that of the Edwards. Few of the species seem to have lived through to be represented in the Edwards.

A list of fossils and the plates which follow give a representation of species found which are for the most part typical of the Comanche Peak formation:

*Exogyra texana	*Pholadomya sancti-sabae
*Gryphaea marcoui	Trigonia crenulata
Neithea irregularis	Modiola concentrice costellata
Protocardia texana	*Engonoceras G. stolleyi
Protocardia sp.	Engonoceras pedernale

[17] Böse, Emil: Cretaceous Ammonites from Texas and Northern Mexico, University of Texas Bulletin 2748, December 22, 1927.

Rostellaria sp.

Tylostoma pedernalis

*Tylostoma chihuahuense

Turritella seriatim-granulata

*Turritella granulata

*Cerithium bosquense

*Enallaster texanus

Cyphosoma texanum

Tapes aldamensis

Lima brazoense

Cardium subcongestum

Diplopodia taffi

*Inoceramus sp.

*Pinna guadalupae

Pinna sp.

Cyprimeria texana

Cyprimeria sp.

Avicula sp.

Hemiaster sp.

Corbis sp.

Anatimya sp.

Pachyma sp.

Nerinea sp.

Anatina sp.

Granocardium

Cucullaea terminalis

Lunatia sp.

Oxytropidoceras belknapi

*Oxytropidoceras acutocarinatum

*Index fossils if taken as a group.

CONCLUSION

The chief deductions from a study of the Comanche Peak Formation are as follows:

1. It is a comparatively thin, chalky, white fossiliferous limestone which has a characteristic brecciated appearance and which weathers into irregular conchoidal fragments. It is limited above by the Edwards limestone and below by the Walnut Clays.

2. It is related lithologically to the Edwards in that it is more or less a massive limestone which is found everywhere beneath the lower beds of the Edwards, but it is more closely related faunally to the Walnut Clays. The fossils of the Comanche Peak are in a better state of preservation than those of the Walnut and have a characteristic white appearance which readily distinguishes them. They also attain greater sizes in the Comanche Peak. This formation is a constituent of a distinct paleontological zone which is world-wide in its importance. This is emphasized by the Oxytropidoceras species in particular because of the occurrence in the Albian of Europe, Africa, South America, and Mexico of species related to those found in the Comanche Peak.

3. It was deposited in an encroaching sea which accounts for regional variations found especially in the lower beds. The early phase of the Comanche Peak sea was migrant and received argillaceous sediments in one locality, while elsewhere in deeper portions it received lime deposits. The marginal facies such as that found bordering the Central Mineral Region was sandy in nature.

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PLATE I

Figure 1. Inoceramus aff. concentricus Böse

Figure 2. Inoceramus aff. concentricus Böse

Figure 3. Cyphosoma texanum Roemer

Figure 4. Cyphosoma texanum Roemer

Figure 5. Engonoceras pedernale Roemer

PLATE I.

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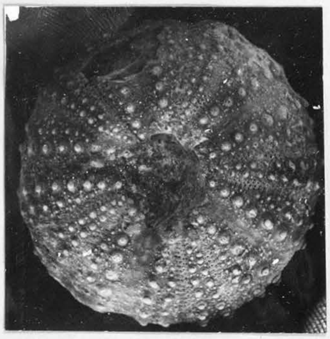

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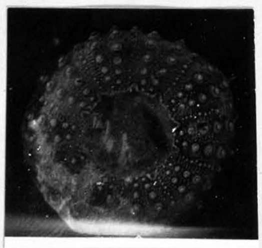

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PLATE II

Figure 1. *Corbis sp.* end view

Figure 2. *Corbis sp.* front view

Figure 3. *Corbis sp.* side view

Figure 4. *Pinna guadalupae* Böse

PLATE II

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PLATE III

Figure 1. <u>Modiola concentrice-costellata</u> Roemer

Figure 2. <u>Turritela granulata</u> Sowerby

Figure 3. <u>Neithea irregularis</u> Böse

Figure 4. <u>Tapes aldamensis</u> Böse

Figure 5. <u>Cardium subcongestum</u> Böse

PLATE III

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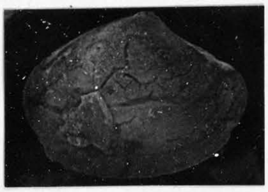

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PLATE IV

Figure 1. (Anatina?) sp.

Figure 2. Tylostoma chihuahuense Böese

Figure 3. Anatimya sp.

Figure 4. Trigonia crenulata Lamarck

Figure 5. Hemiaster (whitei ?)

Figure 6. Pholadomya sancti-sabae Roemer

PLATE IV

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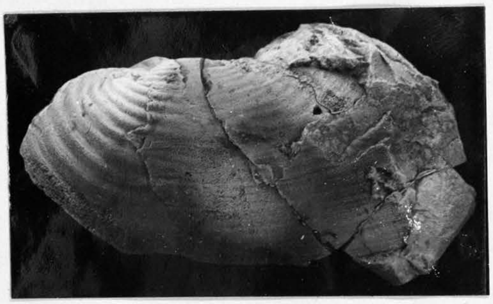

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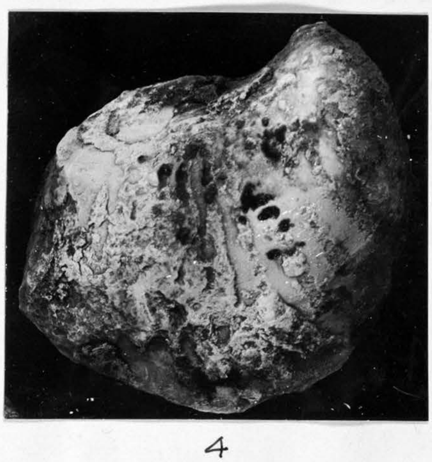

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PLATE V

Figure 1. Cyprimeria texana Roemer

Figure 2. Cyprimeria (Crassa?)

Figure 3. Cerithium bosquense Shumard

Figure 4. Cerithium bosquense Shumard

PLATE V

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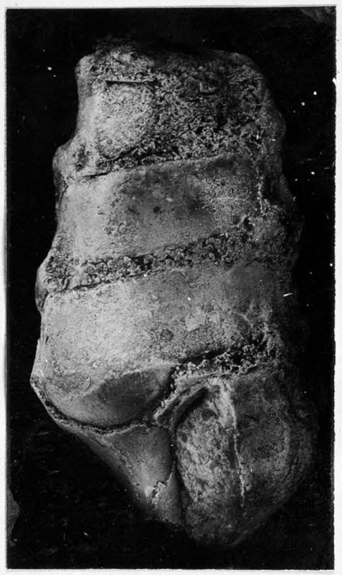

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