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OF THE

UNIVERSITY OF TEXAS

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Descriptions of Some Fossil Vertebrates Found in Texas

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The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

Sam Houston

Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

Mirabeau B. Lamar

DESCRIPTIONS OF SOME FOSSIL VERTEBRATES FOUND IN TEXAS

By Oliver P. Hay, Research Associate, Carnegie Institution of Washington

In the following paper the writer describes various species of Vertebrata, nearly all of which he had the opportunity to see in Texas, in December, 1914. Some of these were examined at Baylor University, at Waco; some at College Station, in the collection of Dr. Mark Francis; and others at the State University, at Austin. Many of the specimens were afterwards sent to the writer at Washington where they could be studied with more care. For the use of these materials the writer is especially indebted to Dr. John K. Strecker, of Baylor University, Dr. Mark Francis, of the Agricultural College, and Prof. F. L. Whitney, of the State University.

The greater number of the species described here belong to the Pleistocene; but the pycnodont fishes were derived from the Lower Cretaceous deposits of Texas.

PISCES

Pycnodontidae

Pycnodus comminuens, new species

Type specimen.—A considerable portion of the right splenial, with the teeth pertaining to it. The specimen belongs to the collection of Baylor University, Waco, Texas.

Type locality and formation.—Walker's Crossing, Bosque River, McLennan county, Texas, and from the Cretaceous.

The fragment (pl. I, fig. 1) has a total length of 60 mm. The upper border of the bone and a part of the coronoid process are present. Along the lower border is the suture for its fellow bone. This suture has a breadth of 10 mm. The plane of the suture indicates that the teeth of the principal row of one side came into close contact with those of the other side.

From side to side at the coronoid process the jaws had a thickness of probably 60 mm. From the lower edge of the symphyseal suture to the upper border of the last tooth of the uppermost row is a distance of 54 mm.

There are three rows of teeth. In the principal row six teeth are represented, but the place of two of these is taken each by two much smaller teeth. This is perhaps to be regarded as a freak. In front of these four small teeth is the base of a lost crown which has the form of the hinder teeth. The normal teeth of this row are about three times as long as wide, the hindermost having a length of 23 mm., and a width of 7 mm.; the third a length of 22 mm., and a width of 8 mm. The upper end is somewhat wider than the lower. From one end to the other the grinding surface is convex in the upper two-thirds, concave or straight in the lower third. Nine teeth are found in the second row, with an unoccupied space. In the third row, as preserved, the same number of teeth are represented but only three have preserved their crowns. The teeth of the third row are somewhat larger than those of the second row; and those of both rows have the diameter transverse to the jaw somewhat greater than the fore-and-aft diameter.

All the small teeth, including those of the principal row, have a central indentation. In their unworn condition these teeth have the whole grinding surface ornamented with fine wrinkles, which anastomose and radiate from the center; but these soon disappear on wear. The large teeth of the first row have no indentations. Where unworn they present fine transverse wrinkles.

Typodus diastematicus (Cope)

Mesodon diastematicus, Cope, E. D., Jour. Phila. Acad., ser. 2, vol. 9, 1894, p. 443, fig. 5.

This species is based on a vomer found at some place in Texas now unknown and in some terrain of the Fredericksburg series of the Lower Cretaceous. The arrangement of the teeth seems to indicate that the species belongs to *Pycnomicrodon;* but Woodward (Cat. Foss. Fishes, pt. iii, p. 213) regards the genus as uncertain.

Typodus dumblei (Cope)

Mesodon diastematicus, Cope, E. D., Jour. Phila. Acad., (2) vol. 9, 1894, p. 444, pl. 20. fig. 7.

This species is known from a part of a left splenial found probably in the Cretaceous of Texas. Like *Typodus diastematicus,* it was sent to Professor Cope by Dr. E. T. Dumble, formerly director of the Geological Survey of Texas. At the front of the principal row of teeth there are, mesiad of it, some small teeth. Probably because of these, the species has been referred to *Mesodon* (*Typodus*). It seems possible that these small teeth are somewhat abnormal, as are some in the main row of *Pycnodus comminuens.* If so, the species may belong to *Pycnomicrodon.*

Typodus valens, new species

Type specimen.—A portion of the vomer, with the teeth belonging to it. The specimen belongs to the collection of Baylor University, Waco, Texas.

Type locality and formation.—On Hog Creek, near Speegleville, McLennan county, Texas. From probably the Lower Cretaceous.

This piece of pycnodont vomer (pl. I, fig. 2) presents a length of 26.5 mm., measured along the median row of teeth. The distance across the specimen at the hindermost tooth of the outer series is 27.5 mm.

The form of the vomer reminds one of that of the genus *Uranoplosus* Sauvage, in that the teeth of the exterior row are on a higher level than those of the median row. The greater portion of the tooth-bearing surface is very flat. Along the median part of this are arranged the teeth of the principal row. At a considerable distance on each side of this principal row is placed the first lateral row. While these lateral rows are on nearly the same level as the median row, the teeth are tilted somewhat upward at their outer ends. Close to them and above them come those of the external row; and these have their grinding faces at nearly a right angle to the faces of those of the median row.

The teeth of the principal row are about twice as long as broad, but they vary somewhat in size and form. The teeth of the second row are about two-thirds as large as those of the median row and vary in form from nearly circular to subquadrate. Those of the external row are nearly as large as those of the median row. The form is approximately triangular, with the angles rounded and the apex directed downwards and backward.

All the teeth have a relatively large central indentation, that of each tooth of the median row being elongated. From this indentation there radiate outward anastomosing folds somewhat coarser than those on the teeth of *Pycnodus comminuens*. The hindermost tooth of the median row had not yet come into use. Around the greater part of its crown is an elevated border. The teeth of this row become worn flat. All the teeth of the outermost row have a worn, outwardly directed, facet on the upper border.

This vomer is referred provisionally to the genus *Typodus* (*Mesodon* Wagner). Inasmuch as the matrix attached to the specimen is much harder than that of the type of *Pycnodus comminuens* it is probable that they were not found at the same locality.

In Rev. J. F. Blake's Monograph on the Cornbrash (Palaeontogr. Soc. Vol. for 1907, p. 32), the name *Macromesodon* is proposed as a substitute for *Mesodon* Wagner. *Typodus* is not mentioned.

Pycnomicrodon, new name

The name *Microdon*, having been employed in 1803 by Meigen for a genus of insects, is not available as a generic name for a fish. Inasmuch as there appears to be no claimant for the vacant place the writer proposes *Pycnomicrodon*.

Pycnomicrodon texanus (Gidley)

Mr. James W. Gidley (Proc. U. S. Nat. Mus., vol. 46, 1913, p. 445) described a species of pycnodont fish which he called *Microdon texanus*. The type is a vomer, which was found in

Hamilton county, Texas. The describer here made use of the preoccupied generic name *Microdon*.

Coelodus fabadens Gidley

Coelodus fabadens, Gidley, J. W., Proc. U. S. Nat. Mus., vol. 46, 1913, p. 446 figs. 3, 3*a*.

Based on a left splenial, which was found near Gainesville, Cooke county, Texas, and probably in Lower Cretaceous beds.

Coelodus decaturensis Gidley

Coelodus decaturensis, Gidley, J. W., Proc. U. S. Nat. Mus., vol. 46, 1913, p. 447, figs. 4, 4*a*.

The type is a part of a left splenial, which was discovered at Decatur, Wise county, Texas, and probably in Lower Cretaceous deposits.

Pycnodus planidens, new species

Type specimen.—A part of a left splenial having a principal and two other rows of teeth. Catalogue No. 16, U. S. Nat. Museum.

Type locality and formation.—Vanderpool, Texas; probably Lower Cretaceous.

With his *Microdon texanus* Gidley associated as paratype, a portion of a splenial bone having on it three rows of teeth, of which those of the inner row were much larger than the others. This specimen had been found near Vanderpool, Texas. In *Microdon*, as defined by A. S. Woodward (Cat. Foss. Fishes, pt. iii, p. 221), there is an additional row of small teeth mesiad of the principal row. The writer has examined the specimen figured by Gidley and finds no reason for supposing that this additional row existed. The splenial seems to belong really to the genus *Pycnodus*. The teeth resemble considerably those of *Pycnodus comminutus*; but those of the principal row are wider relatively to the length. The length of the middle one of the three is 17 mm., the width 7 mm. In the two anterior teeth

of this row the lower end is flattened and on the hinder half there is a ridge running parallel with the long axis of the tooth. The surface of this lower half of the tooth is merely rough and not wrinkled as in *P. comminuens.*

The second row of teeth in the Vanderpool specimen is more sunken below the two other rows than in the case of *P. comminuens;* while those of the third row have a more ovate form than in the species last mentioned. For these reasons the Vanderpool specimen is here regarded as a distinct species.

REPTILIA

EMYDIDAE

Terrapene whitneyi, new species

Type specimen.—A shell nearly complete, now in the collection of the State University of Texas, at Austin.

Type locality and formation.—City of Austin, Texas: from the Pleistocene.

Diagnosis.—Carapace broad and high; with broad vertebral scutes and without dorsal keel. Plastron with lateral hinges equal to one-third of the length of the hinder lobe; femorals one-half as long as the abdominals; anals one-half the length of the hinder lobes.

The beautiful shell (pl. I, figs. 4, 5; pl. II, fig. 1) forming the type of this species is complete, except an area on the upper surface which was struck by the pick of the workman who found the specimen. It was discovered in 1911, while an excavation was being made for a building at the northeast corner of Congress Avenue and Sixth Street, in Austin.

The length of the shell from the front of the plastron to the rear of the carapace is 160 mm. The length of the carapace, from the front border of the nuchal scute to the furrow between the two supracaudal scutes is 154 mm. All of the bones of the carapace had been consolidated into one mass and all of those of each lobe of the plastron into another. The width, taken slightly above the transverse hinge-line, is 108 mm.; taken across the eighth marginal scutes, 116 mm. With the shell resting on

a surface the height at the third vertebral scute is 95 mm. The width of the plastron at the hinge-line is 82 mm.; at the outer ends of the gulo-humeral furrows, 75 mm.; at the hinder ends of the lateral hinge-lines, 93 mm.; at the outer ends of the femoro-anal furrows, 66 mm. The antero-posterior length of the front lobe of the plastron is 60 mm.: of the hinder lobe, 91 mm.

The carapace may be said to be free of any trace of the median keel found in most of the species of the genus. The borders of the carapace in front and behind flare upward very little. Above the bridges there is hardly more than a suggestion of lateral keels.

The following are the measurements of the vertebral and costal scutes in millimeters:

Measurements of Vertebral Scutes

Scutes	Length	Greatest Width
1?	72 m.	35
2?		46+
3	37	41
4	40	38
5	23	38

Measurements of Costal Scutes

Scutes	Height	Width
1	60+	46
2	69	36
3	61	38
4	36	24

The forms of the various scutes may be determined from the illustrations. As to the marginal scutes, the ninth rises unusually high between the lower ends of the third and fourth costals. The eleventh extends forward but little beyond the fifth vertebral scute. The length of the gular scutes on the midline is 27 mm.; of the humerals, 12 mm.; of the pectorals, 20 mm.; of the abdominals, 30 mm.; of the femorals, 45 mm.; of the anals, 46 mm.

The plastron is rather thin. The thickness of the anterior lobe at the middle of the hinge is 5 mm.; that at the outer border of the hinder lobe, just at the rear of the lateral hinge, is 7 mm.

In 1878 Cope described (Proc. Amer. Philos. Soc., Vol. XVII, p. 229) a species which he called *Terrapene marnochi*. It had been found in the Equus beds of Atascosa county, Texas. Where the specimen now is the present writer does not know. It consisted of the hinder lobe of the plastron only. In 1908 (Fossil Turtles of North America, p. 362, pl. 58, figs. 1, 2) the present writer described a carapace which had been found in the Equus

beds, near San Diego, Texas, and this he referred to Cope's *Terrapene marnochi*. If this identification is correct, the specimen found at Austin is certainly not *T. marnochi*. The width of the carapace of the latter is two-thirds of its length; while in *T. whitneyi* the width is equal to three-fourths of the length. In the carapace referred to *T. marnochi*, the vertebral scutes are considerably longer than wide; while in the Austin specimen at least the second and the third vertebrals are wider than long. There are various other differences in the two carapaces.

When comparison is made between the type of *T. marnochi* and the hinder lobe of *T. whitneyi* the matter is not so easily settled. Unfortunately Cope mentioned characters which are likely to be common to various species and he gave few measurements. His statements regarding the dimensions of the scutes appear to apply quite well to those of the Austin specimen. He informed us that the lateral hinge-line is straight and more than a third of the length of the lobe. In the case of *T. whitneyi* the hinge-line does not appear to be straight and its length is just one-third the length of the lobe. In *T. marnochi* the lobe is said to be nearly flat in every direction; while in *T. whitneyi* it is rather convex in every direction. However, other specimens of those two forms might show that these differences are of no importance. In case the discovery of other examples shall show that the Austin specimen really belongs to *T. marnochi* a new name must be applied to the carapace which the present writer referred to the species just mentioned.

This species is named in honor of Prof. F. L. Whitney, of the State University of Texas, who secured the specimen from the finder.

Recently (8th Ann. Rep. Geol. Surv. Fla., p. 58, pls. IV, V) the writer described *Terrapene antipex*, a species which occurs in the Pleistocene of Florida. Compared with this species, *T. whitneyi* appears to have had a shell which was thinner and smoother. In *T. antipex* the surface of the carapace is undulating or even rough. The Floridian species seems to have attained a greater size than did *T. whitneyi*.

TESTUDINIDAE

Testudo crassiscutata? Leidy

From Dr. Mark Francis, College Station, Texas, the writer has received for examination various parts of a large *Testudo,* which are referred provisionally to *Testudo crassiscutata* Leidy, a species originally described from Florida. Figures of parts of this species will be found in the writer's "Fossil Turtles of North America," page 459.

The first of the remains to be noticed were discovered along the Brazos river near Pittbridge, Burleson county. At this same place have been found a part of a jaw of *Megatherium* and remains of mastodon and elephants. The specimen consisted of two fragments of the right side of the front half of the plastron of evidently one individual. On comparison of these bones with the type of *T. crassiscutata* no reason is found for regarding them as having belonged to a different species. The two fragments do not fit together, but on both pieces there is a part of the entoplastron and a part of the hyoplastron. One piece (pl. II, figs. 2, 3) consists (1) of that part of the hyoplastron which joins the epiplastron and forms part of the free border of the front lobe; (2) of the hinder part of the epiplastron; and (3) of a part of the entoplastron. The hinder piece (pl. II, fig. 4) is made up mostly of the hyoplastron, but includes also a small fragment of the entoplastron.

The first mentioned piece shows the free border of the front lobe from the crossing of the humero-pectoral furrow to a point somewhat behind the crossing of the gulo-humeral furrows. In a straight line this distance is 195 mm. On this border the distance from the humero-pectoral furrow to the suture between the hyoplastron and the epiplastron is 112 mm. The length of the suture just mentioned is 112 mm. Seen from above (pl. II, fig. 3) the bone thickens and rises as a bevel from the acute free border at upper edge of the figure, a distance varying from 40 mm. behind to 60 mm. in front. The bevel is bounded by a low broad ridge, beyond which is a wide shallow groove. Beyond this groove the bone continues to thicken for some distance,

until it becomes 65 mm. thick at the rear of the fragment and 58 mm. thick at its front.

The fragment of entoplastron is 195 mm. long and 70 mm. wide, as seen from below (pl. II, fig. 2). As shown in the figures, it extends to the midline behind (pl. II, fig. 4) but probably did not at its front extend to the midline on the other fragment. Nor is there seen on the front part of the entoplastron any indication of the gulo-humeral furrow; although it could not have been far away. Indeed, the fracture may have followed this furrow. The entoplastron probably had a length of about 350 mm. along the midline and a width of about 300 mm. Where thinnest the bone is 23 mm. thick.

The width of the piece of hyoplastron (pl. II, fig. 4) is 245 mm. On one side it starts at the midline of the plastron, but it certainly lacks much of reaching the line of union with the peripherals of the bridge of the right side. At the midline, on the hinder of the two furrows, the bone is 52 mm. thick; at the outer end of the furrows, 43 mm. The fragment is crossed by two furrows, the humero-pectoral and the pectoro-abdominal. At the midline these are 70 mm. apart. The humero-pectoral continued outward to a point nearly behind the axillary notch, then curved forward to meet that portion of it seen on the lower left corner of figure 2, plate II.

The hyoplastral does not extend backward quite to the hyo-hypoplastral suture.

The lower surface of the bone is mostly smooth; although on the hyoplastron there are many pits and irregularly disposed grooves. Estimate shows that this shell was about 28 per cent larger than that of the type. It seems, therefore, that the shell had a length of over six feet.

From Carrollton, Dallas county, on the Trinity river, Dr. Francis received a large bone which the writer identifies as the right scapula of a *Testudo*, probably *T. crassiscutata*. The ends of the bone (pl. I, fig. 3) are considerably eroded. The procoracoid process has been broken off and the sutural surface of the coracoid is effaced. The total length of the bone in its present condition is 310 mm. The greatest diameter at the upper end of the shaft is 71 mm.; at the middle of the shaft 47 mm.; at the

lower end on the level of the glenoid cavity, 110 mm. It is a massive bone befitting the ponderous animal to which it belonged.

The writer has received from Dr. Francis a right humerus of a *Testudo* which was found in one of the gravel pits at Waco by Mr. R. J. Potts. The pit is situated along the Brazos river about three miles east of town and apparently on the next to the highest terrace. The humerus (pl. II, fig. 5; pl. III, fig. 1) is a large and massive one. In length it lacks only 5 mm. of being as long as the humerus of an Arabian horse in the National Museum. It is in a moderately good state of preservation. The proximal tuberosities have lost their extremities, the head is slightly eroded, and the distal end is somewhat injured.

The length, measured in a straight line, from proximal surface of the head to the distal surface of the condyle is 295 mm. The greatest diameter of the head is 73 mm.; the least fore-and-aft diameter at the middle of the bone is 51 mm.; the vertical diameter, 45 mm. The width of the distal end is 120 mm.

It seems probable that this humerus belonged to the species that furnished the other bones here described, *Testudo crassiscutata*. This tortoise appears to be the largest one yet found in America.

From the Pleistocene of Florida the writer has lately (8th Ann. Rep. Geol. Surv. Fla., p. 49, pl. VIII, figs. 6-8) described *Testudo sellardsi*, a large species related to *T. crassiscutata*. From the lack of parts common to the two species from Florida and that described above it is impossible to determine the exact status of the Texan remains. It is not improbable that they represent a distinct species.

CROCODYLIDAE

Alligator mississippiensis

In the collection at Baylor University is a left ramus of the lower jaw of an alligator. The teeth had all fallen from the sockets. On direct comparison with a lower jaw of the existing alligator no differences were noted. This jaw is said to have

been found in the White Rock gravel and sand pit on the east side of the Brazos river and about three miles from the city. This pit is on the uppermost terrace.

MAMMALIA

MEGATHERIDAE

Nothrotherium texanum Hay

This species was described in 1916 (Proc. U. S. Nat. Mus., Vol. LI, p. 116; pls. VI, VII). It is based on an incomplete skull now in the National Museum and acquired by exchange from Baylor University, Waco, Texas. It is said to have been obtained about the year 1900, from a well in Wheeler county, at a depth of about 40 feet. The skull lacks the lower jaw, parts of the facial region, and some of the teeth. The discovery of this skull adds an important element to the Pleistocene fauna of this region. This genus had its home originally in South America, as did *Megatherium*, *Mylodon*, *Megalonyx*, *Glyptodon*, and *Glyptotherium*, remains of all of which have been found in Texas. Two other species of *Nothrotherium* have been described from California, one *N. shastense*, on teeth which were found in a cave in northern California; the other, *N. gracilicеps*, on a skull found in the asphalt beds at Rancho La Brea, near Los Angeles. The Texan skull resembles greatly the one last mentioned, but there appear to be sufficient differences to indicate two distinct species.

Since the preceding paragraph was put into type Stock (Bull. Dept. Geol., Univ. Calif., Vol. X, p. 137) has concluded that his *N. gracilicеps* is the same as *N. shastense*.

GLYPTODONTIDAE

Glyptodon petaliferus Cope

This species was originally described by Cope from Nueces county, Texas. Cope had in his possession only one-half of one of the hexogonal plates which make up the shell of the animal.

In the U. S. National Museum there are parts of the skull and considerable parts of the body and limbs of a glyptodon which was found near Wolfe City, Hunt county, Texas, by Mr. O. S. Shelton. This was described by the writer in the Proceedings of the U. S. National Museum, Vol. LI, page 107, and illustrated on plates III-V.

Mylodon harlani Owen

In the collection at Baylor University is the distal end of a right femur which is referred to *M. harlani*. The fragment was found by Mr. J. K. Prather, on Hog Creek, McLennan county, at a distance of three miles northwest of Speegleville. The containing deposits belong to the Pleistocene.

The fragment rises only 160 mm. above the outer condyle. On the inner side the break continues down to the upper border of the inner condyle. The following measurements have been secured:

Measurements of distal end of femur in millimeters.

Width of surface for patella	103
Rise of this surface above the intercondylar notch	49
Distance across the lower articulatory surfaces	180
Greatest width of outer condyle, rear view	57
Greatest width of inner condyle, rear view	85
Greatest width of intercondylar notch	45
Fore-and-aft diameter of the outer condyle	100
Greatest diameter of inner condyle, taken obliquely	152

When this fragment is compared with Owen's figure of the corresponding part of *Mylodon robustus* no important differences are noted.

Equidae

Equus sp. indet.

From the White Rock gravel and sand pit at Waco comes a second phalanx of the leg of a horse. It is in good condition, being but little water-worn. It appears to have belonged to a fore foot.

Total length of the phalange	81
Length along the middle of the lateral border	73
Greatest width of the upper end	48
Width of upper articulatory surface	46
Width of lower articulation	37

Camelidae

Camelops hesternus Leidy

In the collection of Baylor University, Waco, Texas, is a part of the right side of the lower jaw of a camel which is referred to *Camelops hesternus* Leidy. This was found in what is known as the White Rock gravel pit, which is situated on the eastern side of the Brazos river, opposite the city of Waco and a mile or two further up the river. The gravel is certainly a deposit of the earlier half of the Pleistocene. The bone is well fossilized and the teeth are in a good state of preservation. But little more of the jaw is preserved than that part which contains the teeth. Of the teeth there are present the three molars and the fourth premolar. On the front of the latter, close to the grinding surface, is a small worn facet which shows that another premolar was present, which rose to a height of 19 mm. above the alveolar border. It may have been merely a slender one-rooted column. The last premolar rises above the parting of the roots a distance of only 20 mm.: a condition which indicates that the other teeth too are considerably worn. This fact needs to be kept in mind in considering the measurements of the lengths of the grinding surface. In the following table there are presented the measurements of the lower teeth of the Waco specimen; the measurements obtained from Leidy's description of the type of the species (found in California); the measurements given by Cope in his description of a Texas specimen; and the measurements given by Dr. J. C. Merriam (Bull. Dept. Geol. Univ. Cal., Vol. VII, p. 316) from a specimen found at Rancho La Brea, California. Cope's specimen was found on the Brazos river, at Bowie Bend, Austin County, Texas.

Measurements of lower teeth of Camelops hesternus in millimeters.

	Waco	Type	La Brea	Austin Co.
P⁴ length	23	27	27.5	27
width	14	12.5	13.4	16
M₁ length	35.5	42	39	38
width	21	21.9	21.5	19
M₂ length	39	54.2	46	44
width	21	21	21.2	20
M₃ length	52	64.6	58	56
width	19	21	18.5	16

It will be observed that there is a good deal of variation in the measurements of the several examples, especially in the fore-and-aft length of the crowns. This is probably due mostly to the fact that as the teeth are worn down the grinding surface becomes shorter. It may be that this will account for the relative smallness of the Waco teeth, but this is not certain.

The teeth from Waco resemble those of *C. hesternus* in having very flat inner faces, thus differing from those of *C. sulcatus*, a species found in the Pleistocene of Texas. *P. macrocephalus*, also of the Texas Pleistocene, has the inner faces of the molars flat; but the teeth are much smaller, the second molar being reported as having a fore-and-aft length of 24 mm. and a width of 13 mm. In *C. huerfanensis* (Cragin) the first and second molars have the front and rear lobes separated on the inner face by a rather deep groove. The jaw in the type specimen is much heavier than in the Waco specimen, the depth at the front of the last molar being 86 mm.; in the Waco camel, only 72 mm. The ages of the two specimens do not appear to have been very different.

From the same gravel pit at Waco there is in the Baylor University collection approximately the upper two-thirds of the left hinder cannon bone. It is impossible to determine what was its original length. It is here compared with the corresponding bone of *Camelus dromedarius*. The fossil was evidently longer than the recent bone.

Measurements of hinder cannon-bones in millimeters.

	Camelops	Camelus dromedarius
Length of bone along outer face	—	364
Width of upper articulatory surfaces	52	53
Diameter at middle of length on inner face, fore-and-aft.	36+	32
Diameter at middle of length on outer side, fore-and-aft.	32+	34
Diameter side to side at middle of length	31	31
Distance across distal articulatory surfaces		78

On comparing the form of the hinder cannon bone with that of *Camelus dromedarius* the following differences are noted:

(1) The bone was quite certainly longer than that of *C. dromedarius*, while the other dimensions are not greatly different.

(2) In the upper half, seen from in front, the inner half of the shaft (metatarsal iii) stands out somewhat further forward, instead of the outer half as in *C. dromedarius.*

(3) Seen from behind, the groove descending on the hinder face is narrower and deeper than in *C. dromedarius.*

(4) In the upper third of the bone the outer ridge bounding the groove projects further backward. In the middle third the inner ridge projects further backward. In *C. dromedarius* the ridges are much less prominent and are narrower.

(5) In the fossil, the outer and inner faces of the shaft are flat or convex. In the dromedary the faces in the middle third of the length, are more or less concave.

From the same gravel pits at Waco there has been obtained the distal end of a hinder cannon bone. The length of the fragment is 195 mm. The width across the distal articulatory surface is 86 mm. The width of each surface is 38 mm. The bone is split to a height of 60 mm. On account of the state of preservation of the specimen the width of its upper end cannot be accurately determined, but it was not far from 35 mm. There is in this fragment and the one above described certainly some common part. The front face of the lower fragment is much more convex and rounds more gradually into the convex lateral faces than in the case of the lower end of the upper fragment. It seems quite certain that two species are indicated in these two partial hinder cannon-bones.

Elephantidae

Gomphotherium gratum, new species

Type specimen. A portion of a right maxilla containing the second and third molars; also the third molar of the left side of the same individual. The property of Dr. Mark Francis, College Station, Texas.

Type locality and formation. Pittbridge, Burleson county, Texas, on the Brazos river. Pleistocene.

Diagnosis. Second upper molar with three cross-crests, third upper molar with four. Inner halves of the crests furnished

with anterior and posterior buttresses and, on being worn down, presenting trefoils.

In the collection of fossil vertebrates assembled by Dr. Mark Francis are the remains noted above. The fragment of the right maxilla shows, besides the teeth mentioned, the sockets for the first true molar, a part of the hard palate, and the suture for union with the left maxilla. There is preserved a part of the wall of the socket for the right tusk. This tusk was evidently of considerable diameter.

The second molar, as seen from the illustrations, had suffered wear on all the crests, while the third molar had been abraded only a little on the first crest. The lateral views of the specimen (pl. IV, figs. 1, 2), presenting the specimen turned upside down, shows that in moving downward and forward, the hinder molar makes a considerable angle with the plane of wear of the second molar and thereby has its anterior end first attacked.

The following measurements have been secured from the teeth.

Measurements of teeth in millimeters.

Dimensions taken	M^2	M^3
Length of tooth at the base	113	178
Width at the first crest	77	87
Width at second crest	83	87
Width at third crest	81	83
Width at fourth crest		73

Besides the four cross-crests of the third molar there is a talon consisting of two large coalescent tubercles.

An observation of the grinding face of the second molar (pl. III, fig. 3) shows that there is produced on wear a distinct trefoil on the inner half of each crest. The lobes of these which are produced by the front and rear buttresses of each crest come into contact at the middle of the width of the tooth and block up the transverse valley. These buttresses are relatively thin from side to side; and hence the lobes of the trefoil thus produced are small as compared with the one produced by the inner principal cone. As will be seen on the second crest, there is a small fourth lobe situated next the median longitudinal fissure and between the front and rear lobes. There are no traces of buttresses on the outer halves of the crests.

The anterior buttress of the first crest passes forward and outward into a talon-like cingulum. From the hinder buttress of third crest a ridge joins a posterior tubercular talon. The inner end of each of the transverse valleys is blocked by a cingulum.

In the third molar (pl. III, fig. 4) the buttresses are similar to those of the second molar; but as the crests are not worn, the trefoils do not appear. The anterior buttress continues into the anterior cingulum. There are only imperfect buttresses in the third transverse valley; hence the latter is open across the tooth. At the rear is a tubercular talon, the outer conule of which joins closely the hinder buttress of the fourth crest. The buttresses end in summits free from the main cones. Each of the outer cones ends in three conules. Besides the anterior cingulum there is no other. The surfaces of the inner cones are somewhat rugose from summit to base; as they are also in the second molar.

As regards the roots, those of the second molar are disposed as in the *Mammut americanum*. One rather large root supports the outer two-thirds of the first crest; another supports the inner end of the same crest and that of the second crest; while a large root supports the outer end of the second crest and the whole of the third. The roots of the hinder molar are not well developed, but so far as seen they are three in number. The two anterior would function as in the second molar; while the third very large root would support the two hinder crests and the outer end of the second.

From the Blanco beds, of Texas, belonging to the Pliocene, Cope has described four species of mastodons: *Tetrabelodon shepardi, Dibelodon humboldii, D. tropicus,* and *D. praecursor.* All of these are referred by the present writer to the genus *Gomphotherium.* It is not imposible that some of these may have continued on into the Pleistocene. The form here described as *Gomphotherium gratum* cannot be the same as *G. humboldii;* for the molars of the latter have strongly developed trefoils on both halves of the crests. It is doubtful whether these Pliocene specimens belong to *G. humboldii;* for the latter is a Pleistocene species found in South America, possibly also in Mexico.

In *Gomphotherium tropicum* there is in the second true molar a large hinder talon and in the third molar five crests. Also

there is a tendency toward the development of conules and buttresses on that half of each crest which is usually devoid of buttresses. The Texan teeth referred by Cope to *humboldii* may belong to this species.

There are left, therefore, only *G. shepardi* and *G. praecursor*. There is not sufficient evidence to justify our referring Cope's Texan lower jaw (4th Ann. Rep. Geol. Surv. Texas, p. 57, pl. XV) to the species represented by the fragment of upper tusk which forms the type of *G. shepardi*. Moreover, the tooth figured by Cope on plate XVIII of the work just cited, and forming the type of *G. praecursor*, is evidently an upper tooth which belonged to the same species as did the lower jaw just mentioned. That is, the lower jaw is to be referred to *G. praecursor*. In this species the buttresses lack much of being as sharply separated from the principal cones as they are in our *G. gratum*.

Gomphotherium elegans, new species

Type specimen.—A lower left third molar, numbered 8255 in the catalogue of the United States National Museum.

Type locality.—McPherson, Kansas.

Type formation.—Equus beds of the Pleistocene.

Diagnosis.—Lower last molar long and narrow; with five crests and a talon. Besides the buttresses on the outer halves of the crests, there are buttresses on the inner halves of the three anterior crests. The buttresses are composed each of one or more conules.

The length of the type molar is 217 mm.; the width at the first cross-crest, 85 mm. The talon is so large that it may be regarded as a sixth crest, but in other specimens it may be less strongly developed. The two principal cones composing each crest seem to be made up each of two subordinate cones closely pressed together. A deep narrow cleft runs the length of the tooth between the right and left halves of the crests. There is a strong tendency to the formation of conules in the valleys between the crests.

An upper right second molar which is referred to this species belongs to the collection of Baylor University. This was found in Pleistocene deposits on Hog Creek, McLennan county, Texas, not far from Speegleville, a town about eight miles west of Waco. A view of the grinding surface is here presented (pl. III, fig. 2). The crown is complete, but the roots are broken off. It appears that the inner anterior root did not extend so far under the second crest as in *Mammut americanum*. The tooth is unusually large, being 145 mm. long and 90 mm. wide. There are three crests and a large talon. The wear of the two anterior crests has produced on the inner half of each of these a large trefoil. The enamel of that part of these which joins the outer cone is considerably folded. The valleys between the crests are closed by the buttresses whose wear produces the front and rear elements of the trefoils. There are very distinct buttresses connected with the outer half of each of the crests. Here and there are accessory conules, especially at the ends of the transverse valleys.

FELIDAE

Smilodon? sp. indet.

From the White Rock gravel and sand pits at Waco there has been obtained the upper half of the right humerus of a Felid. It is here compared with the same bone of an African lion, No. 163,109 of the National Museum. The total length of the fragment is 215 mm.

	Smilodon? sp.	Felis leo
Length from upper surface of head to outer end of distal articulatory surface.	—	290
From rear of head to front of greater tuberosity	87	84
Greatest width of bone through the head	68	65
Fore-and-aft diameter at mid-length	35	39
Side-to-side diameter at mid-length	27	25

In these measurements the middle of the fossil bone is taken at the same distance from the head as in the bone of the lion.

The greater tuberosity of the fossil is more massive than in the case of the lion. In the latter the inner face of the bone

in its upper half is nearly flat, in the fossil it is concave, especially so between the two tuberosities. In connection with the greater thickness of this fossil bone the hinder face is flatter than in the lion.

EXPLANATION OF PLATES

All figures should be viewed with one eye closed, in order to get stereoscopic effects.

PLATE I

Fig. 1. *Pycnodus comminuens.* Type. × 1.
Fig. 2. *Typodus valens.* Type. × 1.
Fig. 3. *Testudo crassiscutata?* Right scapula. × ⅓.
Figs. 4-5. *Terrapene whitneyi.* Type. × ½.
4. Shell seen from below.
5. Shell showing the rear.

PLATE II

Fig. 1. *Terrapene whitneyi.* Type. × ½. Shell seen from the right side.
Figs. 2-5. *Testudo crassiscutata?* × ⅓.
2. Parts of front lobe of plastron, consisting of a part of the entoplastron, a part of the epiplastron, and a part of the hyoplastron. Lower surface.
3. Same fragment showing the upper surface.
4. Part of hyoplastron and a small part of the entoplastron.
Fig. 5. Right humerus seen from above. ×. 36. The head of the bone is directed downward.

PLATE III.

Fig. 1. *Testudo crassiscutata?* Right humerus. × ⅓.
Fig. 2. *Gomphotherium elegans.* Upper right second true molar. × 3/5.
Figs. 3, 4. *Gomphotherium gratum.* Type. × ½.

3. Upper second right true molar, showing worn grinding surface.

4. Upper right third true molar, showing unworn grinding surface.

Plate IV

Figs. 1, 2. *Gomphotherium gratum.* Type. × .28. Fragment of right maxilla containing penultimate and ultimate molars. Figures inverted.

1. Maxilla and teeth, outer view.
2. Maxilla and teeth, mesial view.

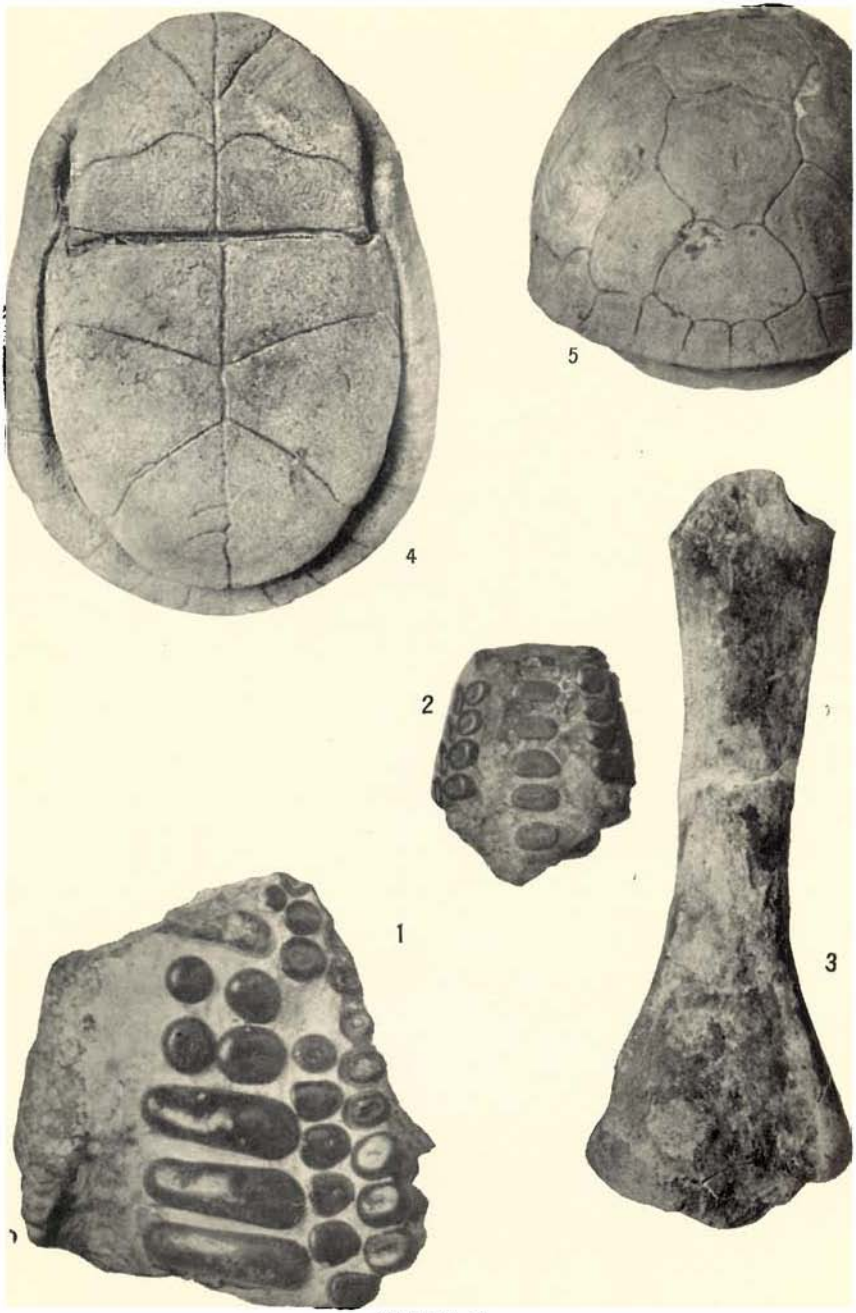

PLATE I.

Fig. 1. Pycnodus comminuens.
Fig. 2. Typodus valens.
Fig. 3. Testudo crassiscutata?
Fig. 4. Terrapene whitneyi.
Fig. 5. Terrapene whitneyi.

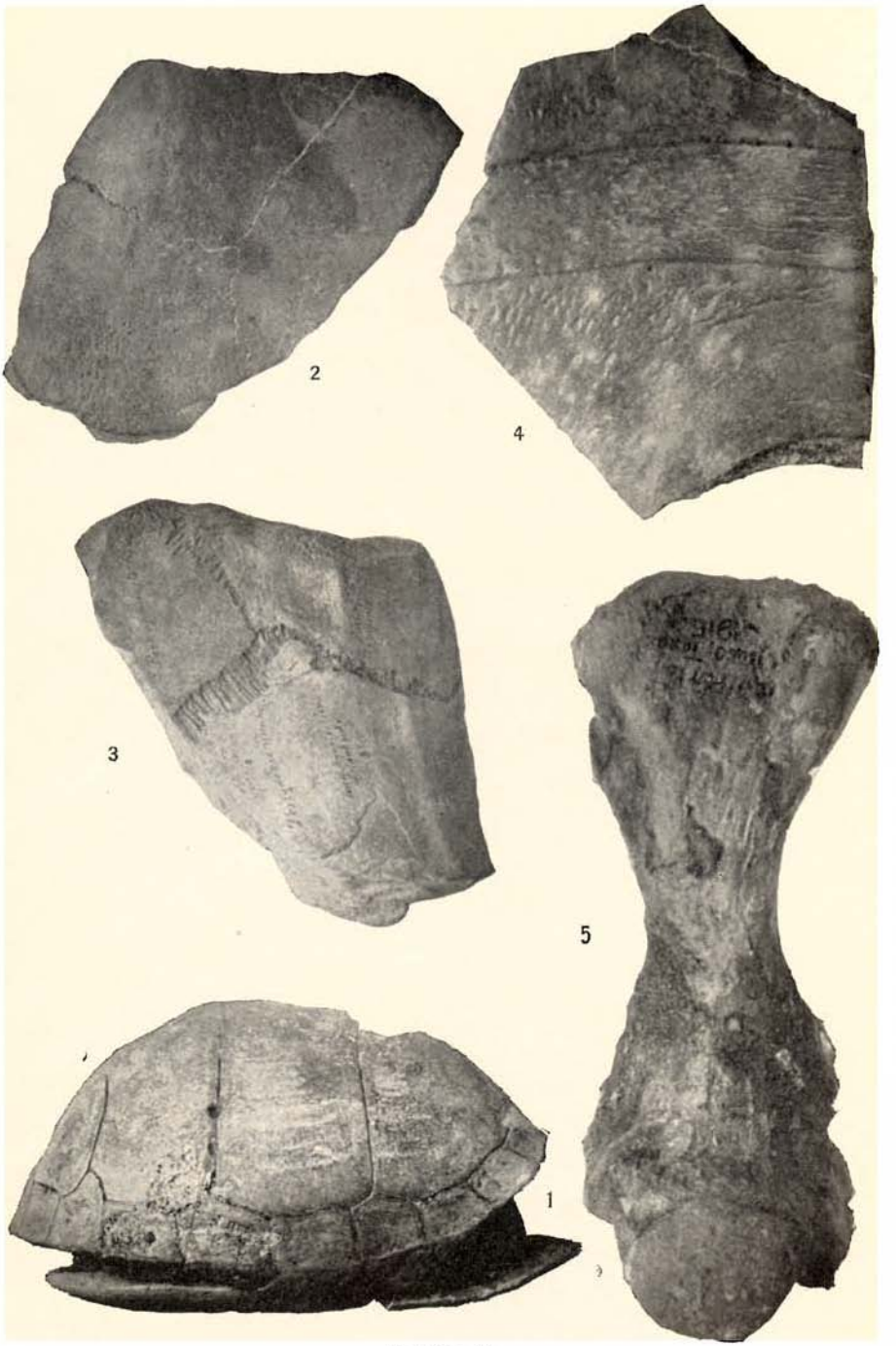

PLATE II.

Fig. 1. Terrapene whitneyi. Figs. 2-5. Testudo crassiscutata?

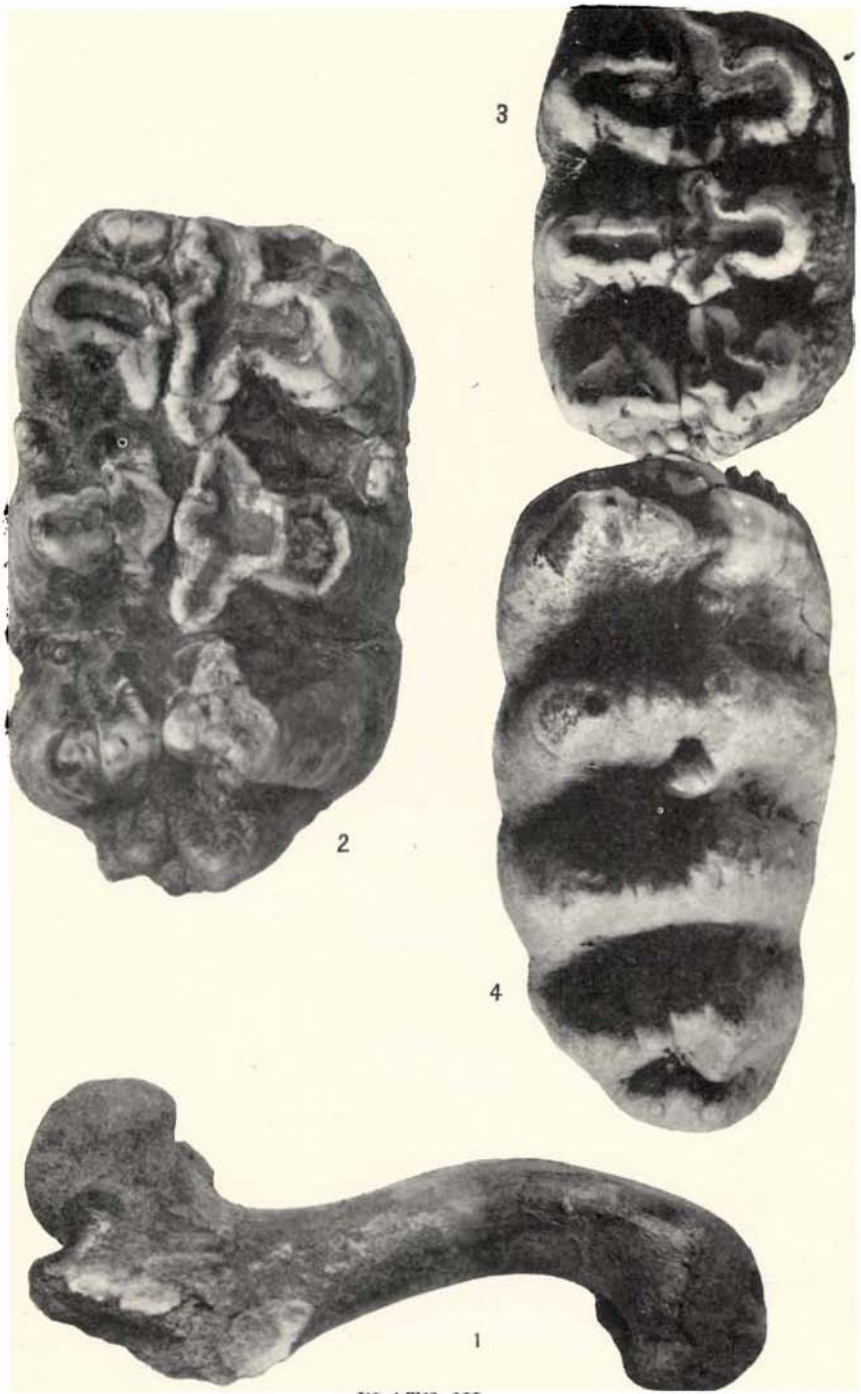

PLATE III.

Fig. 1. Testudo crassiscutata? Fig. 2. Gomphotherium elegans.
Figs. 3, 4. Gomphotherium gratum.

PLATE IV.

Gomphotherium gratum.