# DESCRIPTIONS OF TWO EXTINCT MAMMALS OF THE ORDER XENARTHRA FROM THE PLEISTOCENE OF TEXAS.

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Few of the many remarkable animals of the Pleistocene epoch in North America are more interesting than are those which have been known as Edentata, but which now are more properly called Xenarthra. Our interest in them is due in part to their usually large size and their strange forms and habits; in part to the fact that their presence furnishes evidence that about the beginning of the Pleistocene or earlier, there was a sufficiently free communication between the two American continents, that many South American genera of animals migrated into North America and other genera passed from the latter continent into the more southern. On the plains bordering on the Gulf of Mexico and those stretching northward from Texas, the overgrown and unwieldy South American Xenarthra met more highly organized forms, many themselves immigrants from Asia, and in the contest with them suffered extinction.

## GLYPTODON PETALIFERUS Cope.

Plates 3–5.

In the United States National Museum there are considerable parts of a glyptodon which the writer is permitted to describe. It has the catalogue number 6071. This specimen was found in 1908 by Mr. O. S. Shelton near Wolfe City, Hunt County, Tex. This place is in the northeast corner of the State and its position is approximately latitude 33° 16′ and longitude 96° 3′. In a letter written November 18, 1908, Mr. Shelton stated that the remains had been found along the banks of Middle Sulphur Creek, at a depth of about 9 feet from the surface. The bones lay on a bed of gravel and were overlain with clay. Where the enveloping matrix is present it consists of fine clay.

The specimen presents considerable parts of the skull, most of the anterior half of the vertebral column, six caudal vertebræ, considerable parts of the limbs, a fragment of the scapula, a few fragments of the pelvis, and a considerable number of the osseous plates which made up the carapace and sheath of the tail. Undoubtedly much more of the skeleton was present and might have been saved had it been exhumed by a practiced hand.

Professor Cope based the species *Glyptodon petaliferus*[1] on one-half of a single dermal plate which had been found in Nueces County, Texas. This fragment was figured in 1889,[2] showing the object two-thirds the natural size. The diameter was given by Cope in his original description as 45 mm.; that of the central area as 17 mm., the thickness as 15 mm. Where the type is now is not known.

Of the carapace and tail sheath of the Wolfe City specimen there are present about 80 plates. Although these constitute but a small part of the whole, there are enough to show the various forms which these plates assumed. In diameter they vary from 35 mm. to 50 mm. There were some, no doubt, which were smaller and others larger than those which are preserved. In Cope's specimen the central area had a diameter equal to three-eighths of that of the plate. In the animal here described the diameter of the central areas of the plates varies from the relative length given by Cope up to seven-tenths or more of the diameter of the plate. In some cases the central area occupies practically the whole area of the plate. In thickness they vary from 14 mm. or less up to 42 mm. As to the external sculpture, there appears to be nothing shown in Cope's description and figure that can not be found on the plates at hand.

Brief explanations may be given of the elements which are represented on plate 5. Figure 1 shows a bone of the carapace in which the central area is large. The greatest diameter of the plate is 52.5 mm.; that of the central area, 31 mm. At the upper border the thickness is 29 mm.; on the lower 44 mm. The lower surface is rough and uneven as if the plate had been attached by ligaments to some other bone. The greatest diameter of the plate represented by figure 2 is 53 mm. It will be seen that the central area is relatively small. The thickness is 16 mm. The plate of figure 3 has as its greatest diameter, at the outer surface, 50 mm. The central disk comprises nearly the whole of the surface of the plate. The greatest thickness is 22 mm. The diameter of the plate of figure 4 is 44 mm.; that of the central area, 17 mm.; the thickness, 17 mm. The plate shown by figure 5 has as the diameter of its sculptured surface 47 mm.; the thickness is 17 mm.

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[1] Amer. Nat., vol. 22, 1888, p. 345.

[2] Idem, vol. 23, p. 662, fig. 2.

Figures 7, 8, and 9 represent plates which evidently belonged to the anterior border of the carapace, that surrounding the neck. Similar plates are shown by Burmeister.[1] Figures 7 and 9 present views of the inferior surfaces. These are very convex from front to rear and they terminate in an obtusely rounded free border. The free border of figure 7 is toward the right hand; that of figure 9 toward the left. The bone of figure 7 has a thickness of 26 mm.; that of figure 9 a thickness of 23 mm. Figure 8 gives a view of the outer surface; the free border is directed downward. The bone is 28 mm. thick.

Figures 6, 10, and 11 give views of plates which belonged on the tail.[2] From a rather thin front border, about 10 mm., these bones thicken backward and end in a relatively acute point. At this point the bone of figure 10 is 23 mm. thick; that of figure 11, 34 mm. The bone of figure 6 belonged to one of the rings which alternated with the rings composed of such bones as those of figures 10 and 11. The upper half of the figure, which represents the hinder half of the bone, was evidently overlapped by such a bone as that of figure 10, while the lower border joined the front edge of another bone similar to figure 10. The convex pitted outer surface is shown in the lower half of figure 6. The bone is 16 mm. thick.

Another plate belonging to the tail, or possibly to the borders of the carapace, and resembling that of figure 11, has a thickness of 32 mm. at the proximal border and of 42 mm. near the hinder border.

In the second volume of the Transactions of the Wagner Free Institute of Science (p. 25) Dr. Joseph Leidy called attention to some carapacial plates of a glyptodon which had been sent to him from Peace Creek, Florida. One of these bones is illustrated on his plate 4, figure 9; another on plate 6, figure 1. The latter presents a radiating striation which is not seen on any of the plates from Texas. The figure on his plate 4 suggests strongly some of the Texan bones, but the pitting appears to be coarser. It is impossible to say whether or not the Floridan specimens belong to *G. petaliferus*. Among the bones of the latter species are none which resemble those of Leidy's figures 11 and 12 of his plate 5.

From the fragments of the lower jaw no information of importance has been obtained.

The length of the upper tooth line was 165 mm. These upper teeth were much curved, in such a way that the outer face is concave, the inner one convex. At the same time they are directed outward as they ascend. The outer faces of the second teeth would have been 55 mm. apart at the grinding surface, about 90 mm. at the middle of their height, and about 100 mm. at the upper ends. The fourth tooth

[1] Anales Mus. Pub., Buenos Aires, vol. 2, pl. 41, fig. 4. [2] Idem, pls. 37–40.

(pl. 3, figs. 2, 3) may be compared with that of Burmeister's figure.[1] This has a length of 26 mm. and a width of 18 mm. across the middle lobe. In *G. petaliferus* the corresponding measurements are 22.5 mm. and 15.5 mm., the longitudinal measurements being taken at the middle of the width. The height of this tooth is 70 mm. in a straight line. In *G. asper* the axis of each of the lobes is at right angles with the axis of the grinding surface; in *G. petaliferus* the axis of the anterior lobe is turned pretty strongly forward at its inner end; that of the second lobe less so; while that of the hinder lobe is turned somewhat backward. In *G. asper* the second tooth is slightly narrower than the fourth, 13 mm. at the middle lobe.

The skull is badly injured, but important parts remain. The axial bones and the occipital region are gone. The roof and lateral walls of the brain case are present, extending forward to about the rear of the orbit. Between this fragment and that presenting the front of the skull an interval is missing. Superiorly the upper surface of the face is present from a line joining the middle of the orbits, to the nasal opening, except a strip on the left side. The palate (pl. 3, fig. 2) is represented on one side or the other along its whole length. Three upper teeth are present. Parts of the facial portions of each maxilla are preserved; likewise a part of the left zygomatic arch. Parts of both lower jaws are present, including a portion of each ascending ramus and one condyle and a portion of each horizontal ramus, with one tooth. The bones of the skull have united so completely that no sutures are visible.

The parietal region (pl. 3, fig. 1) is convex from side to side. The surface is uneven and pierced by openings for blood vessels. The width, where least, just behind the orbits, is 95 mm. The width just above the opening of the ear was close to 104 mm. This fragment shows that the roof over the front of the brain and that just behind and between the orbits was occupied by large sinuses. The length of the cavity for the brain, including the olfactory lobe, was close to 100 mm., the width 60 mm.

The width of the skull taken at the lower border of the lachrymal opening is 148 mm. The height of the upper surface of the face, midway between the orbits, above the midline of the palate is 105 mm.

The length of the palate (pl. 3, fig. 2), measured from the front of the premaxilæ to the hinder nares, was close to 200 mm. The width at the third tooth is 38 mm.; at the hindermost one, 26 mm. The palate is rough and is pierced by many small and about six large foramina. It differs from that of Burmeister's *G. asper*[1] in being narrower and in being more contracted between the hinder teeth. In the species just mentioned the width is equal to 0.22 of the length; in *G. petaliferus*, to only 0.19 of the length.

[1] Anales Mus. Pub., Buenos Aires, vol. 2, pl. 27, fig. 1.

In *G. petaliferus* the second tooth (pl. 3, figs. 2, 4) is different from the fourth. Its length is 20 mm., its width only 9 mm. The outer ends of all the lobes are much reduced. It resembles considerably the first tooth of *G. asper*. The first tooth is missing in the Texas species, but the inner wall of the socket is present. From this it is evident that the lobes were much reduced on the inner side also. It is pretty certain that this tooth was thin and simple in construction, but the length of its grinding surface nearly equaled that of the second tooth.

The lower teeth were nearly straight, as shown by the one present and by the sockets in the fragments of the lower jaw. The one present (pl. 3, fig. 5) had a height of 75 mm., a length of 21 mm. on the grinding surface, and a width of 12.5 mm. on the middle lobe. The tooth present, belonging on the right side, is placed opposite the front border of the ascending ramus and is probably the sixth in the series. There were at least two others behind it. In *G. asper*, as figured by Burmeister, the grinding surface of this tooth has a length of 21 mm. and a width of 16 mm. across the middle lobe. In *G. petaliferus* the length is 21 mm., the width 13 mm. In the tooth of this species the axes of the lobes are little turned from a perpendicular to the longitudinal axis; in *G. asper* they are much more strongly deflected.

In all the teeth, upper and lower, the central core of vasodentine which sends lateral branches into the lobes undergoes secondary divisions there, as in *G. asper*.

The atlas is missing. In the glyptodonts the axis and the succeeding three or four cervicals are consolidated into one mass. Usually in the genus *Glyptodon* the mass includes the sixth cervical, but from Burmeister's description[1] it seems that in two species it is sometimes free and sometimes confluent. In the specimen at hand the sixth was evidently free and is missing from the collection. The consolidated second to fifth vertebræ (pl. 3, fig. 6) are injured somewhat; especially, the transverse processes are gone. The mass resembles much that of the forms figured by Burmeister. From the outside of one lateral articular surface for the atlas to that of the other is 80 mm. Hence the bone is smaller than any of those figured on the plate just cited. The distance from the outer side of one postzygapophysis to that of the other of the fifth vertebra is likewise 80 mm. The height of the neural spine above the floor of the neural canal is 63 mm.

Judging from the character of the surfaces by which the sixth cervical was united with the seventh, there was not much motion between them.

[1] Anales Mus. Pub., Buenos Aires, vol. 2, p. 296, pl. 29.

As usual in the glyptodonts, the seventh cervical is united solidly with the first and second dorsals. The width of the mass (pl. 3, fig. 7) near the rear is 150 mm. That of *G. asper*[1] appears to have been about 180 mm. wide behind and wider still in front. This mass, as figured and described by Burmeister, had along each border two rather deep notches and three processes. These are not seen in the specimen before us. On each side is an irregular surface, with several small facets for union with the head of the first rib. The motion here was evidently unimportant. The surface on each side for the second rib indicates more liberal movement. On each side below are two large openings for nerves. These divide each into two canals, one opening out on the upper surface of the mass, the other on the lower. The superior openings are much larger than those of Burmeister's figures. At the rear of the mass the postzygapophysial surfaces of the two sides coalesce under the spine. On each lateral process is a surface for union with corresponding surface on the front of the third dorsal.

The third dorsal and the succeeding ones, up to and including the twelfth are, in the glyptodonts, consolidated into a single mass in which the individual vertebræ can be distinguished only by the foramina for nerves and the facets for the ribs. In *G. petaliferus* the floor of the spinal canal is in places less than a millimeter in thickness; in the last dorsal, however, 5 mm. thick. The dorsal spines are greatly reduced and coalesced into a median ridge of small and irregular height. In the series, as preserved, on the assumption that there were twelve, there is missing most of the sixth and of the seventh dorsals and a part of the eleventh. The front of the third dorsal presents, superiorly (pl. 3, fig. 8) a crescentic zygapophysial surface for the second dorsal; also on each side a semicylindrical surface on the lateral process, for union with a corresponding surface on the second dorsal, already noted above. Above the rear of the articulatory surfaces for the fourth pair of ribs the bone corresponding to the fourth vertebra is 109 mm. wide. According to Burmeister's figure of *G. asper*[2] the same bone had a width of about 132 mm. Burmeister's figure indicates that the front end of this vertebral tube, in the region of the articulations of the third, fourth, and fifth pairs of ribs, was bounded on each side by a ridge; but in the specimen here described there are here no such ridges. However, further backward these ridges become very prominent. Again, the median ridge, composed of the coalesced spinous processes, which in Burmeister's figure is still prominent opposite the tenth and eleventh pairs of ribs, is obsolete in *G. petaliferus*. The rear of the twelfth vertebra is rough and was joined to the first lumbar probably

[1] Burmeister, Anales Mus. Pub., Buenos Aires, vol. 2, pl. 30. [2] Idem, pl. 30, fig. 1.

by fibro-cartilage; hence there was some movement at this point of the vertebral column.

The whole congeries of vertebræ which compose the lumbosacral tube is missing, except a fragment which appears to represent the fourth and fifth sacrals, and another fragment which furnishes the hinder part of the centrum of the seventh sacral and the whole of the eight. To the latter is attached a large part of each lateral process. On the front edge of each of these processes is a stump of the lateral process of the seventh sacral. The hinder end of the centrum of the eighth sacral, smooth for movable union with the first caudal, has a width of 73 mm. and a height of 55 mm.

There are present six caudal vertebræ. The average length of these is 77 mm. These belong at the base of the tail and all bear facets for chevrons. According to Burmeister's figure[1] and that of Lydekker[2] the tail of *Glyptodon* has 11 vertebræ. Of the whole length of the tail the basal six vertebræ occupy a little more than one-half. It seems probable, therefore, that the tail of *G. petaliferus* had a length of about 840 mm. An estimate indicates that our Texas species had a length of head, body, and tail of about 7 feet.

Both humeri are defective. The heads of both are present and the distal ends of both; but intervening portions are missing. It is, therefore, impossible to determine with certainty the original length of the bone. The humerus figured by Burmeister[3] as that of *Glyptodon asper* may be taken for comparison. On the inner border of the bone of the Texas specimen (pl. 3, fig. 9) there are, as in the one just referred to, a pair of tuberosities. Assuming that these are in the same relative positions in the two species the total length of the humerus of the Texas specimen will be 340 mm. The following measurements are taken:

*Measurements of humeri of Glyptodonts in millimeters.*

| | *G. asper.* | *G. petaliferus.* |
|---|---|---|
| Total length | 360 | 340± |
| Distance from distal end to upper border of the upper inner tuberosity | 220 | 208 |
| Width across epicondyles | 130 | 103 |
| Side-to-side diameter of shaft where least | 60 | 40 |
| Distance across distal articulatory surface | 88 | 63 |

It will be seen that the bone of the Texas species is slenderer than in the other, both in relation to the total length and to the distance of the inner tuberosities above the distal end.

[1] Anales Mus. Pub., Buenos Aires, vol. 2, pl. 33.
[2] Anales Mus. La Plata, vol. 3, 1894, pl. 5.
[3] Anales Mus. Pub., Buenos Aires, vol. 2, pl. 32, fig. 2.

Both ulnae are preserved and the left one is wholly uninjured. This may be compared with the corresponding bone of Burmeister's *Glyptodon asper*.[1] The one of the right side is figured (pl. 4, fig. 1) because with it may be shown the corresponding radius.

*Measurements of ulnae of Glyptodonts in millimeters.*

| | *G. asper.* | *G. petaliferus.* |
|---|---|---|
| Total length of bone | 250 | 242 |
| From end of olecranom to front of coronoid process | 110 | 70 |
| Depth of bone at sigmoid cavity | 65 | 51 |
| Depth of bone at middle of length | 70 | 50 |
| Thickness of bone at middle of length | ............ | 20 |
| Depth of bone at lower articulatory surfaces | 85 | 53 |

The two bones differ little in length, but that of *G. petaliferus* is much slenderer in all parts. A comparison of the figures show considerable differences in the form. In the South American species the middle of the surface for the articulation of the head of the radius is below the middle of the length of the ulna, while in the Texas species it is above the middle. The ulna of the latter is nearly straight, while that of *G. asper* is bent downward toward the distal end.

The right radius (pl. 4, fig. 1) is complete; the left is represented by the distal three-fourths. The total length of the bone is 170 mm.; the greatest width at the upper end is 52 mm.; the greatest at the lower end 55 mm.; the fore-and-aft diameter at the middle of the length, 27 mm.; the side-to-side diameter at this point 20 mm. The total length of the radius of *G. asper* appears to have been 167 mm., while the fore-and-aft diameter was about 26 mm. The bone appears to have had about the same size and proportions in the two species.

Of the innominate bones only fragments have been preserved.

The right femur (pl. 4, fig. 2) is practically complete. It is here compared with that of *Glyptodon asper*, as figured by Burmeister,[2] who says that his figure is one-half the natural size.

*Measurements of femurs of Glyptodonts in millimeters.*

| | *G. asper.* | *G. petaliferus.* |
|---|---|---|
| From summit of head to distal part of internal condyle | 510 | 425 |
| Side-to-side diameter of head | 88 | 70 |
| Width across the trochanters | 298 | 238 |
| Side-to-side diameter at middle of length | 124 | 90 |
| Fore-and-aft diameter at middle of length | ............ | 55 |
| Width at summit of the third trochanter | 190 | 142 |
| Width across condyles | 195 | 123 |

[1] Anales Mus. Pub., Buenos Aires, vol. 2, pl. 33, fig. 2.

[2] Idem, pl. 34, fig. 2.

The femur measured by Burmeister is, as seen, considerably longer than that of the Texas species here measured. In the upper part the proportions are nearly the same, the length of the bone being made the standard of comparison. However, the width at the middle is somewhat less in *G. petaliferus*. While the width across the third trochanter of *G. asper* is 0.425 of the length of the bone, in *G. petaliferus* this width is only 0.334 of the length. Likewise, the width across the condyles of *G. asper* is 0.382 of the length, in *G. petaliferus* only 0.29.

The patella of the left leg is present. Its general form is quadrate. Its length is 84 mm.; its width near the upper end is 75 mm.; near the lower end 60 mm. The two lines of measurement are not, however, in the same plane, the outer end of the lower one being carried somewhat forward.

A part of each tibia is present, that of the right side (pl. 4, fig. 3) lacking that part of the distal end which was ankylosed to the fibula. The fibulas are represented by a single fragment of each.

*Measurements of the tibiae of Glyptodon petaliferus in millimeters.*

| | |
|---|---|
| Total length of the bone | 242 |
| Distance across the articulatory surfaces for the femur | 118 |
| Fore-and-aft diameter of surface for inner condyle of femur | 72 |
| Side-to-side diameter of surface for inner condyle of femur | 58 |
| Greatest diameter where bone is smallest | 62 |
| Width of articulatory surface for astragalus | 96 |

On account of the absence of the fibula and the consequent slight injury to the tibia here described, it is not possible to compare the latter accurately with the same bone of *G. asper*. The one measured by Burmeister[1] had a length of 240 mm., a width of 141 mm. across the upper end, and a width of 96 mm. across the articulation for the astragalus. It is evident that this bone in *G. asper* was, relatively to its length, a stouter bone than that of *G. petaliferus*.

A considerable number of foot bones, including nine ungual phalanges, are preserved, but no foot can be reconstructed from them and a description would hardly add anything of value to what has already been published.

Mr. Barnum Brown has described[2] a new genus and species of glyptodon, *Brachyostracon mexicanus*. The genus is based for the most part on the form of the carapace. The small part of this preserved in the specimen which I describe above and its disorganized condition make a comparison with Brown's specimen impossible. Practically the only common parts are three teeth. It seems to me

[1] Anales Mus. Pub., Buenos Aires, vol. 2, p. 348.
[2] Bull. Amer. Mus. Nat. Hist., vol. 31, 1912, pp. 167–177, pls. 13–18.

that these indicate that Brown's species is not identical with the one here described. The vasodentine of the Texan specimen is more branched than in the Mexican, nearly as much as represented in Burmeister's figure of *G. asper*. This is not well shown in figures 3–5 of plate 3. The second upper teeth are different; likewise the upper fourth tooth and the lower sixth; as a close comparison of the figures will show.

**NOTHROTHERIUM TEXANUM, new species.**

Plates 6, 7.

*Diagnosis*.—Skull larger than that of the Brazilian species *N. escrivanense* Reinhardt and equal to that of *N. graciliceps* Stock; profile strongly convex; pterygoid bullæ widely open below; anterior tooth with hinder face transversely concave; hindermost upper tooth nearly as large as the others, with a deep furrow on the hinder face.

This species is based on a part of a skull now in the National Museum, No. 8353, which was obtained by exchange from the collection of Baylor University, Waco, Texas. It was presented to that institution about 15 years ago by a clergyman who had secured it from some person now unknown. It is reported to have been found in digging a well, at a depth of 40 feet, in Wheeler County, Texas. Wheeler County adjoins Oklahoma and is in the third tier of counties from the northern boundary of Texas. As to the geological age of this species, we can hardly doubt that it belongs to the Pleistocene.

This skull (pls. 6, 7), furnishes us many important parts, although it is considerably damaged. The whole upper surface is present, and the base as far as the front of the brain cavity. The left maxilla is preserved, together with its teeth. A small part of the right maxilla is likewise present. The bones surrounding the nasal opening are retained, except the premaxillæ. A small part of the anterior end of the right malar is attached to the fragment of the maxilla of that side; and the larger portion of the left malar has been saved. In studying this specimen comparison has been made with the skull of *Nothrotherium escrivanense*, as described by Reinhardt,[1] with the type of *N. graciliceps* Stock from California;[2] also with skulls of *Choloepus hoffmanni*.

In comparison with the skull of the fossil species found in a cavern in Brazil, the skull here described is considerably larger, the former having a length of 270 mm., from the rear of the occipital condyles to the front of the maxilla; the Texan species, a length of 300 mm. There are also differences in the form of the skull. In the Brazilian species the profile is nearly straight from the rear of the frontals to the anterior end of the nasals, while in the Texas form this outline

[1] Danske Vidensk. Selsk. Skr., ser. 5, vol. 12, pp. 253–349, pls. 1–5.
[2] Bull. Dept. Geol., Univ. Cal., vol. 7, p. 341.

is convex (pl. 6), but undulating. Also, while the parietal part of the profile in the Brazilian species is pretty strongly convex, in the Texan species it is undulating and little convex.

On the other hand, *N. texanum* is very closely related to *N. graciliceps* Stock. The differences which are believed to exist are considered below.

The following measurements have been made on the skull at hand. In the second column are the corresponding measurements of the skull forming the type of *N. graciliceps.* The premaxillæ not being present in either skull, the basilar length can be determined only approximately.

*Measurements of skulls in millimeters.*

| | *N. texanum.* | *N. graciliceps.* |
|---|---|---|
| Basilar length | 313± | 323± |
| Distance from front of occipital foramen to front of maxilla | 275 | 286 |
| Distance from rear of occipital condyles to front of maxilla | 300 | 310 |
| Lateral extent of occipital condyles | 76 | 80 |
| Width of skull at mastoid processes | 113 | 112 |
| Width across skull above the orbits | 105 | 102 |
| Length of nasals at the midline | 105 | 95+ |
| Width of nasals, combined, at hinder end | 44 | 57 |
| Height of anterior end of snout | 48 | 60 |
| Width of anterior end of snout | 71 | 72 |
| Height of occipito-parietal suture above lower face of basioccipital | 80 | 83 |
| Height of occipito-parietal suture above lower face of occipital condyles | 92 | 90 |

The upper half of the hinder aspect of the skull presents a very rough surface, for the attachment of muscles. A considerable part of the supraoccipital appears on the upper surface of the skull. The suture between the parietals is 70 mm. long. The parieto-squamosal suture is not as distinct as could be desired, but may be followed with considerable certainty. The squamosals have at the front end a width of 46 mm.

The suture between the frontals has a length of 110 mm. The lower edge of the bone of the right side is broken away; but it is present on the left side, where it is seen to come into contact with the hinder border of the nasal, overlapping its lower hinder angle and the hinder border of the lachrymal. The lower hinder angle of each frontal widely joins the corresponding squamosal. The frontals are coossified with the nasals, but the line of the suture can be easily traced.

The length of the suture between the nasals is 105 mm. These bones are so intimately consolidated with the maxillæ that it has been somewhat difficult to determine the line of union. On the left side there is, at a distance of 32 mm. from the midline and at the anterior border of the frontal bone, a small foramen from which an indistinct, irregular line may be traced for a few millimeters forward. This line is shown on plate 7, figure 1. At the corresponding position on the left side of the figure is seen a white line. The bone on the right of this line had been separated and later cemented on again. On close examination it is found that there are here well-defined sutural surfaces, the maxilla joining the outer border of the nasal. At this point the distance from the outer edge of one nasal to that of the other is 57 mm. To what extent the naso-maxillary sutures determined the lines of fracture seen on the upper surface of the snout is uncertain.

The lachrymal is articulated principally with the maxilla, but its upper hinder border joins the frontal; while below it is united with the anterior end of the malar. It shows a large lachrymal foramen well in front of the orbit. This foramen is the outer opening of a canal which followed inward soon turns and is directed forward, opening into the nasal chamber just in front of the upper end of the first tooth.

In viewing the skull from below (pl. 7, fig. 2) there are observed behind the ear opening the small condyloid foramen and the large foramen lacerum posterius. The ear opening has a diameter of 10 mm. On the right side the tympanic bone is in its place, forming a ring which is incomplete above. Below it is inflated into a bulla of moderate size whose external surface is rough. On the left side the tympanic is missing, a fact which shows that it had not become ankylosed to the contiguous bones. The absence of the bone permits a view of a part of the petrosal. In front of the petrosal is seen the foramen lacerum medius. This, as it appears, is divided into two parts, the more anterior and outer being well in front of the external auditory meatus.

In front of the great pterygoid bulla is seen the foramen ovale. On the right side there is, in front of the ovale, an opening, the sphenoidal fissure. On the right side there are here two foramina, the hinder of which is probably the foramen rotundum. Farther in front and somewhat higher up and nearer the midline are the canals for the optic nerves. It is evident that these opened out at points in advance of the middle of the length of the skull.

A feature which distinguishes this genus from other Gravigrada is the presence of the great pterygoid bullæ (pl. 7, fig. 2). As shown in Reinhardt's figures of *N. escrivanense* these inflations extend well below the midline of the base of the skull. They have their lower surface divided by a longitudinal furrow, broad and deep, into an external portion and an internal. In the specimen from Texas the lower floor of the bullæ is missing, so that the form of this part, if ever present, can not be observed. According to the description of these bullæ in the Brazilian species there is along the median line a space only about 5 mm. wide between them. They are evidently marked off along their inner boundary much more sharply than in the Texan species. In this animal there is between them a broad, longitudinal groove whose sides slope downward and outward gradually into the walls of the bullæ. The length of each bulla is 50 mm.; the width may be taken as 35 mm. The distance from the outer wall of one to that of the other is 90 mm. The median side of each cavity extends inward and upward into the base of the skull until the two are only 15 mm. apart.

The pterygoid bullae of *N. graciliceps* have been described by Stock. They are called by him tympanic bullae, but they are not such. Mr. Gerrit Miller has directed my attention to similarly placed and apparently homologous cavities at the base of the skull in various bats. As shown by Stock the roof of these bullae is formed by the alisphenoids. The side walls and floor in the Brazilian and the Californian species are certainly formed by the pterygoids. In *N. graciliceps* Stock there is along the inner face of the bulla a slit about 30 mm. long which puts the cavity of the bulla in communication with the pharynx. The bulla of *N. texanum* appears not to have had a floor. The pterygoids seem to form a wall which surrounds the cavity on both sides. On the median side the edge of the wall is partly intact, partly injured. On the outer side the wall comes down to a sharp thin edge which appears to be little if at all injured. In places the edge is certainly wholly natural. Such being the case the bulla is incomplete and is a cavity opening below by a mouth 30 mm. wide. In *N. graciliceps* the outer wall has grown downwards and inwards until it has nearly met the inner wall; in *N. escrivanense* the space between the two walls was apparently abolished. In *Choloepus hoffmanni* there are homologous bullae which open at the anterior end into the mesopterygoid fossa. Similarly placed bullae are found in the great anteater (*Myrmecophaga jubata*), but their structure is somewhat doubtful.[1]

In the Texas specimen there is a rough and sharp ridge which begins on the midline between the front ends of the pterygoid bullæ and runs forward as far as the bone is uninjured. A similar struc-

[1] From an examination of skulls of the great anteater in the United States National Museum the writer concludes that the pterygoids and the alisphenoids of each side are so completely coossified that the line of union can not be determined unless it be in younger individuals than are at hand. The bullæ in adult individuals are completely closed. In a not fully grown specimen the impression given is that the bullæ remained open longest on the outer side, near the border of the temporal bone. It is believed that the area called alisphenoid in Weber's figure 332 taken from Pouchet (Säugetiere, p. 434) is not such. Certainly the foramen ovale pierces the alisphenoid; and it is this bone, not the pterygoid, which joins the basisphenoid.

ture is shown in one of Reinhardt's figures. This ridge appears to be on the vomer.

In our specimen the greater part of the palate, the front of the vomer, and the ethmoid bones have been broken away. A part of the hard palate is seen in front, and the underside of this is rough. In the rear of this injured region the cribriform plate has been broken through so as to leave a small opening to the brain-cavity on the left side and a much larger one on the right. In front of this, on the right side (left side of the illustration, pl. 7, fig. 2), are seen openings into sinuses in the frontal bone. The larger of these on each side extend backward to the hinder end of the frontal. Some of the plates of bone nearer the midline evidently belong to the olfactory apparatus. On the right side there remains about 30 mm. of the malar bone. On the left side the front part of the malar is missing, but the hinder part is present. The malar was a triradiate bone. The anterior process joined the lachrymal. The hinder process was directed upward and backward and had a notch in the hinder part of the lower border to receive the anterior end of the zygomatic process of the temporal bone. The lower process is pointed, and it descended about 60 mm. below the level of the palate.

The maxilla on the right side contains the four teeth which are characteristic of this genus (pl. 6; pl. 7, fig. 2). The length of the tooth row is 57 mm. Between each of the teeth and its neighbors is a space of about 5 mm. The grinding surfaces of the teeth stand below the hard palate hardly more than 5 mm. They must have been about on a level with it when the bone was covered with flesh.

The following measurements are obtained from the teeth. The length of the tooth is taken at the middle of its width and far enough above the grinding surface to avoid the effects of wear.

*Measurements of teeth in millimeters.*

| Tooth. | Length. | Width. |
|---|---|---|
| 1 | 10 | 13 |
| 2 | 11 | 15.5 |
| 3 | 11 | 15 |
| 4 | 7 | 14 |

As usual in the genus, there is for each tooth a front and a rear cutting edge. These are separated by a wide furrow. In the second and the third teeth this furrow turns backward, to end at the inner hinder angle of the tooth. The first, second, and third teeth have a somewhat greater fore-and-aft diameter at the inner side than that given in the table; while the last tooth measures 9.5 mm. on the outer face. The front face of the first tooth is flat transversely, that of the others convex. The hinder faces of all are concave—that of the fourth tooth most so of all. The inner faces are flat or slightly convex—that of the fourth rather strongly so. The outer faces are somewhat concave, showing a shallow groove along their whole height. All of these teeth have a height of about 50 mm. They are hollow down to within about 10 mm. of the grinding surface.

On the front end of each maxillary there is a surface for the articulation of the corresponding premaxilla. The two surfaces are separated by a space of 20 mm., and each has a length of 30 mm. On the lower side of the maxilla is another surface for a backwardly directed process of the premaxilla. In case the premaxillae corresponded in size to those of the Brazilian species mentioned above, each had a length of about 30 mm.

This is not the first discovery of the genus *Nothrotherium* in North America. In 1905 [1] Sinclair reported it, with some doubt, from Potter Creek cave, Shasta County, California. He had for description a part of a lower jaw without teeth and fourteen loose molars. The name *N. shastense* was given to the species.

In order to determine the relationship of the Texan specimen to that found in northern California, it is necessary to compare with the teeth of the former those which Sinclair has represented by figures 3, 5, and 8 of his plate 23. Figures 3 and 5 must be second and third teeth. Of the tooth represented by his figure 3 both the front and the rear faces are convex in section, whereas both the second and the third teeth of *N. texanum* have the front face convex and the rear face concave. Sinclair's figure 5 resembles somewhat the section of the third tooth of the Texan species; but here, as in the tooth of his figure 3, the inner face of the tooth is more or less concave; whereas, in the Texan animal, the inner face is flat. However, it is in the hindermost tooth that the greatest difference is found. In the California species the front of the tooth is convex, the rear flat. In the Texan species the rear of the tooth is deeply concave. It appears to be evident that two distinct species are indicated.

In 1913,[2] Stock described a skull, lacking the lower jaw and some other parts, which he called *N. graciliceps*. The type is now in the Los Angeles Museum of History, Science, and Art, where the writer has had the privilege of examining it. This skull resembles closely that from Texas in size and proportions, as may be seen from the measurements given on page 117. There are, however, in the Texan skull, certain deviations from that of *N. graciliceps* which appear to make it advisable to give to it a distinctive specific name. One can not rely wholly on the differences which are seen in the two skulls for additional specimens may be intermediate.

[1] Bull. Dept. Geol., Univ. Cal., vol. 4, p. 153, pl. 23.
[2] Idem, vol. 7, pp. 341–352, figs. 1–8.

It seems to the writer that *N. graciliceps* had the skull more depressed at the anterior half of the frontals. As a result of this, as Stock says, the nasals have their upper surface transversely convex in front, but becoming flattened posteriorly. In *N. texanum* these bones are rather more convex just in front of the hinder end than in front. In *N. texanum* the end of the snout is apparently more depressed than in *N. graciliceps*. The width is nearly the same in the two skulls, but in the latter the height is 60 mm., while in *N. texanum* it is only 48 mm. Unless a serious error is committed as to the structure of the pterygoid bullae in *N. texanum*, these are sufficient to differentiate the two species. In *N. graciliceps* the nasals have a combined width of only 44 mm.; in *N. texanum* the width is 57 mm.

There are apparently differences in the two species as regards the teeth. The type of *N. graciliceps* had not retained the teeth; but the size and forms of these may be determined from the sockets. Stock had one tooth, apparently the second molar, which had been found in the Rancho La Brea deposits. The sockets of the type skull and the tooth mentioned show that the teeth of *N. graciliceps* were larger than those of *N. texanum*. The anteroposterior diameter of the second molar is 13 mm., and thus 2 mm. greater than in the same tooth of *N. texanum*. In *N. graciliceps* the hinder face of the first tooth was evidently convex from side to side; in *N. texanum* it is slightly concave.

## EXPLANATION OF PLATES.

### PLATE 3.

*Glyptodon petaliferus* Cope.

FIG. 1. Upper surface of rear of skull. × $\frac{1}{2}$.
2. Palate. × $\frac{1}{2}$.
3. Upper left fourth tooth. × 1.
4. Upper right second tooth. × 1.
5. Lower right sixth ? tooth. × 1.
6. Consolidated cervicals, second to fifth, viewed from above. × $\frac{1}{2}$.
7. Seventh cervical and first and second dorsals consolidated. Upper view. × $\frac{1}{3}$.
8. Third, fourth, and fifth dorsals, seen from above. × $\frac{1}{3}$.
9. Right humerus, seen from in front. × .46.

### PLATE 4.

*Glyptodon petaliferus* Cope.

FIG. 1. Right ulna and radius, seen from the right side. × $\frac{1}{3}$.
2. Right femur, seen from in front. × $\frac{1}{3}$.
3. Right tibia, seen from in front. × .32.

### PLATE 5.

*Glyptodon petaliferus* Cope. × $\frac{4}{5}$.

FIGS. 1–5. Dermal plates belonging to the interior of the carapace.
6. A dermal plate belonging to the tail.
7–9. Plates belonging to the front border of the carapace.
10, 11. Plates belonging to the tail.

### PLATE 6.

*Nothrotherium texanum*, new species.

Skull seen from the left side. × $\frac{1}{2}$.

### PLATE 7.

*Nothrotherium texanum.*

FIG. 1. View of the skull from above. × $\frac{1}{2}$.
2. View of the skull from below. × $\frac{1}{2}$.