

ON REMAINS OF MASTODONS FOUND IN TEXAS, ANANCUS BRAZOSIUS AND GOMPHOTHERIUM CIM- ARRONIS

By OLIVER P. HAY

Associate of the Carnegie Institution of Washington

In the course of his paleontological work the writer has had the opportunity to study many interesting remains of mastodons found in Texas. It is proposed in this paper to describe those of two species.

A. ON ADDITIONAL SPECIMENS OF *ANANCUS BRAZOSIUS* HAY

1. ON A LARGE MOLAR FOUND IN TEXAS AND NOW IN THE BRITISH MUSEUM

In 1886 Lydekker¹ under *Mastodon cordillerum*, recorded a third molar, said to be an upper, which had been found at an unknown locality in Texas, at some time before 1869. In the United States National Museum is a well-made cast of this tooth which was prepared at the British Museum of Natural History. This cast shows distinctly that the first crest of the crown is supported by a single fang, which extends wholly across the tooth. In an upper tooth there would be present two fangs, the inner of which would support likewise the inner end of the second crest. It must be concluded, therefore, that the tooth in question is the lower right third molar. From the British Museum of Natural History the writer has received photographs of this tooth and these are here reproduced (pls. 1, 2).

The molar is in a fine stage of growth and in a good state of preservation. Wear due to mastication had attacked only slightly the first and second crests. Apparently some of the enamel is missing from the outer face of the hinder talon. The length of the crown is 225 mm.; the width of the second crest is 90 mm. The cones of the outer ends of the crests possess buttresses which, when meeting those of columns in front and behind, block the valleys. At an early stage of wear the cones and their buttresses would present distinct trefoils, as is shown on the first crest. The inner ends of the valleys are open and the inner cones of the first,

¹ Cat. Foss. Mamm. Brit. Mus., pt. 4, p. 46.

second, and third crests are furnished with buttresses, narrow front and aft, which do not meet to close the valleys, but which, at a medium stage of wear, would produce trefoils. The basal lobes of these would naturally be smaller than those of the outer trefoils.

In the United States National Museum is also a cast, the gift of the British Museum of Natural History, of the left ramus of the lower jaw figured in Falconer and Cautley's *Fauna Antiqua Sivalensis* (on pl. 35, figs. 3 and 3a). This jaw was obtained in the Pleistocene of Buenos Aires, and on the plate cited was referred to as *Mastodon andium*; but in 1886 it was identified by Lydekker² as *M. humboldtii*. This species has been supposed to be distinguished from *M. andium* by the presence of trefoils on both ends of the crests, but the character is now recognized as variable. The buttresses of the inner ends of the crests of the Texas specimen are more prominent than those of the jaw from Buenos Aires. The writer does not see, therefore, why the Texas molar should not be referred rather to *M. humboldtii* than to *M. cordillerum*. The latter name is that employed by Lydekker for the mastodon called by other authors *M. andium* or *M. cordillerarum*.

2. ON A LOWER JAW FOUND AT CAMERON, TEXAS

From Dr. Mark Francis, of the Texas Mechanical and Agricultural College, College Station, Texas, the writer received in August, 1923, for examination, the horizontal portion of the left ramus of a lower jaw of a mastodon whose teeth present trefoils. This jaw was found in 1897, in a gravel pit near Cameron. From Judge Jeff T. Kemp, of Cameron, it is learned that the gravel pit was about 2 miles north of Cameron, at a height of between 40 and 50 feet above high water in Little River. The bone of this jaw extends from the symphysis to a short distance behind the third molar. The symphyseal region is injured and somewhat waterworn. The bone on the inner face was broken away so that the hinder root of the great molar was exposed. An additional part was lifted by the writer, in order to expose the other fangs (pl. 2, fig. 2; pl. 3, fig. 1). As to the dimensions of the jaw, the distance from the hinder end of the last molar to the hinder end of the symphysis was close to 235 mm. The depth of the ramus at the middle of the last molar is 160 mm.; the thickness, 138 mm.; the height at the front of the socket for the second molar is 190 mm.

In this mandible is present the socket for the second molar. This molar may have fallen out just before the death of the animal or afterwards. The cavity for its anterior fang is 50 mm. or more deep. The hinder fang must have been mostly absorbed. From the

² Cat. Foss. Mamm. Brit. Mus., pt. 4, p. 42.

front of the anterior socket to the front of the third molar is 100 mm. The tooth itself was probably several millimeters longer than this.

The hindmost molar is much injured. The rear is badly shattered, so that most of the enamel of the fourth crest and of the talon is missing. The enamel of the inner ends of the three front crests is broken away. Notwithstanding the injuries, the structure of the tooth is well shown on the anterior crests. The first crest is worn down in front nearly to the base, and the part of the fourth crest remaining is well worn. When the second molar was yet in its place both it and nearly the whole of the third molar were in action. The length of the last molar is, allowance being made for the enamel missing in front, 225 mm.; the width at the second crest, 89 mm. The anterior crest presents a single lake of dentine and this opens into another surrounded by the enamel of the outer end of the second crest. The outer ends of the three front crests and the remaining part of the fourth display large trefoils. The enamel is about 7 mm. thick and is much folded, especially at the base of the trefoils. The inner ends of the crests present only a part of each figure produced by wear. It will be seen from the illustration (pl. 3, fig. 1) that trefoils with small basal lobes are developed.

It appears well to describe briefly the roots of this third molar: In front, supporting the first crest, is one great fang, 70 mm. wide near the crown and 179 mm. long, extending downward and backward to opposite the middle of the length of the crown. Behind this is a fang bearing the inner end of the second crest. The remainder of the crown rests on the great hinder fang, 100 mm. long, 100 mm. fore and aft near the crown, and 70 mm. at the distal end. The tips of these fangs rest on the bone roofing the inferior dental canal. It can hardly be that such powerful roots are required to hold the tooth in its place. Their great extent and the direction taken suggest that their purpose is to distribute over a great surface the pressure brought to bear on the crown during mastication.

On comparing the hindmost molar of this Cameron specimen with that in the British Museum, one can hardly escape the conclusion that they belong to the same species.

3. ON AN UPPER MOLAR FOUND NEAR WACO, TEXAS

In 1917³ the writer provisionally referred an upper right second molar, found near Waco, to the then newly described species *Gomphotherium elegans* (now recognized as *Anancus mirificus*). This second molar is now believed to belong to *Anancus brazosius*. A remarkable character of this tooth is the large hinder talon forming a kind of half crest.

³ Proc. U. S. Nat. Mus., vol. 53, p. 221, pl. 26, fig. 3.

4. ON THE RELATION OF THE TEXAN MASTODON TO THE SOUTH AMERICAN SPECIES

Boule and Thevenin⁴ have shown how difficult it is in many cases to identify isolated teeth of the two recognized species of South American mastodons. They have demonstrated, furthermore, that the skulls and the tusks of the two species are wholly different. Now, in the case of the animal which bore such teeth as those represented by the Cameron specimen and the one in the British Museum, we know nothing about the skull or even the tusks. However much the teeth may resemble those of *M. humboldtii* or *M. cordillerum*, the upper tusks may have been straight or curved or twisted, or spiral, with or without an enamel band. The skull may have been in a stage of development like that of *M. andium* or in one like that of *M. humboldtii*; or it may have been in an intermediate stage.

Furthermore, it is uncertain that there is a single species of North American fossil vertebrate which is identical with a South American form. There is finally another reason why the Texas mastodon should not be referred to either of the species belonging in South America. This is found in the greater height of the crowns of the teeth. The height of the outer column of the third crest of the British Museum specimen, measured from the lower edge of the enamel to the summit, is 93 mm. The height of the corresponding column of the tooth in the lower jaw No. 19951 of the British Museum as represented by the cast mentioned above, is only 76 mm.

In the United States National Museum is the cast of another tooth belonging to the British Museum and recorded by Lydekker⁵ by the number 19952e, and referred to *M. humboldtii*. This tooth is the lower right third molar and is 200 mm. long. In this, due allowance being made for the slight wear, the height of the column measured in the other specimens is little more if any than 60 mm. It appears evident, therefore, that the Texas tooth is more hypodont than those of the South American species.

5. ON THE STATUS OF THE GENERIC NAME ANANCUS

For certain species of mastodons, including the one described above, the writer employs the generic name *Anancus*. This was first used for mastodon remains by Aymard in 1854,⁶ when he announced a supposed new species *Anancus macroplus*; but he gave no description of either the genus or the species. Falconer⁷ cited page 276 of the *Congrès Scientifique de France*, 1855, for the name.

⁴ *Mammifères foss. de Tarija*, 1920, pp. 44, 63, 64.

⁵ *Cat. Foss. Mamm. Brit. Mus.*, pt. 4, p. 44.

⁶ *Ann. Soc. Agric. Sci. le Puy*, p. 597.

⁷ *Palaeont. Memoirs*, vol. 2, p. 20, footnote.

There appears to be no copy of this work in America and the librarian of the British Museum of Natural History informed the writer that the name does not appear on that page, but that it occurs on pages 241 and 271. Having received from the British Museum photostats of those pages, I find that no description of either the genus or the species was given by Aymard in this paper. His name is therefore a *nomen nudum*.

In 1859, Lartet⁸ quoted *Anancus macroplus* as a synonym of *Mastodon arvernensis*. This gave *Anancus* a nomenclatural standing; so that those who, like the writer, regard *Mastodon arvernensis* as belonging to a genus distinct from *Mammut* and from *Gomphotherium*, must accept the name *Anancus* Lartet. The writer, for the present, at least, regards the mastodon remains described above as belonging to the same genus.

6. ON THE SPECIFIC NAMES OF THE TEXAN SPECIMENS ABOVE DESCRIBED AND OF THE TWO SOUTH AMERICAN SPECIES

In 1923⁹ the writer described a species of mastodon under the name *Anancus brazosius*, based on a right side of a mandible containing the second and third molars. These teeth present trefoils on the inner columns of the crests, but with the basal lobes smaller than those of the outer columns. The hindermost molar has five crests; but, as is usual, the fifth is relatively small. In the British Museum specimen referred by Lydekker to *M. cordillerum* the talon is so large as to simulate a crest (pl. 1). In the Cameron specimen the fifth division of the crown was large, but its structure is unknown. For the present the writer refers to *Anancus brazosius* the Cameron specimen, the molar from Waco, and the Texas tooth assigned by Lydekker to *M. cordillerum*.

In the preceding discussion the writer has employed for one of the South American species the names *Mastodon andium*, *M. cordillerarum*, and *M. cordillerum*. As pointed out in the writer's paper just cited, Fischer de Waldheim's name *Mastotherium hyodon* antedates all three of those mentioned. The species dealt with in the present paper will bear therefore the names *Anancus humboldtii*, *A. hyodon*, and *A. brazosius*.

B. DESCRIPTION OF REMAINS OF *GOMPHOTHERIUM CIMARRONIS* (Cope)

1. HISTORY OF THE SPECIMENS

From Dr. Mark Francis, of College Station, Texas, the writer has received for examination a collection of mastodon teeth and tusks which had been made in 1915, on the farm of Ed. Noble, about 5

⁸ Bull. Soc. Geol. France, ser. 2, vol. 16, p. 493.

⁹ Pan-Amer. Geologist, vol. 39, p. 112, pl. 8, figs. 1, 2.

miles southeast of Navasota and half a mile south of Woods, Grimes County, Texas. The remains had already been removed from the ground when Doctor Francis learned of them. As is natural, when persons undertake to collect such fossils without instructions or previous experience, the remains suffered from the extraction. The collection consists of teeth in good condition (except the loss of the roots), portions of several upper tusks, a part of a lower tusk in a fragment of a jaw, and parts of two tusks of a young mastodon. From this same locality were collected some of the fossils which the writer described in January, 1924,¹⁰ besides other species, not yet determined. Rhinoceros bones are not uncommon. The remains occur in the Fleming formation; and the writer concluded that this belongs in the Upper Miocene. Doctor Francis deserves commendation for having rescued such precious materials.

2. DESCRIPTION OF THE PREMOLAR TEETH

What the writer takes to be the lower right and left third premolars are in the collection, and they are in a fine state of preservation. It is doubtful if they were erupted, for they show no signs of attrition. Photographs of these are here reproduced. The one of the left side presents the grinding surface; that of the right, the inner face (pl. 3, figs. 2, 3).

The base of the crown of these premolars is oval and slightly wider behind than in front. The tooth of the left side is 28 mm. long and 20 mm. wide. The crown consists of two parts, the anterior of which, occupying seven-tenths of the length, forms a transverse crest rising 18 mm. from the base of the crown; the posterior part presents a low crest of two conules. The two parts are separated by a very distinct transverse valley. The inner face of the crown slopes away from the summits of the crests more slowly than the outer face. The anterior crest is composed of two closely appressed cones, the inner of which is the larger, although the two are of the same height. This inner cone consists of three conules, one in front of and one behind the principal conule. The hindmost forms a broad ridge which descends into the transverse valley, partially blocking it. In front, at the base of the anterior crest, is a small but distinct fold of enamel forming a talon. There is no trace of a cingulum on the sides of the crown. The hinder portion of the crown, occupying three-tenths of the length, presents a crest consisting of two low conules well separated. The inner of these is the larger. Applied rather closely to the rear of this is a smaller conule, whose hinder border merges into a sharp minutely tuberculated ridge. The conule and the ridge form a sort of talon at the rear of

¹⁰ Proc. Biol. Soc. Washington, vol. 27, pp. 1-20.

the crown. The tooth of the right side is very similar to the left one, but it is slightly smaller, the length being 26 mm., the width 19 mm.

The roots of these teeth had evidently attained considerable size but both are broken off where they joined the crowns. In the base of each crown is a pulp cavity 11 mm. long and 6 mm. wide; and this was continued into the root. The walls of the root were from 3 to 5 mm. thick. There appears to have been one fang in front and a larger one behind. The fourth premolar, if there was one, is not in the collection. It will be further mentioned under the description of the fourth milk molar. A fourth premolar was present in *Gomphotherium leptodon* (*Mastodon angustidens*).

These teeth have the narrow oval form of the upper second premolar described by Schlesinger¹¹ but this is only 22 mm. long and 15.7 mm. wide. On the other hand, the Navasota teeth are considerably shorter, and relatively much narrower than the upper third premolar described by Schlesinger;¹² and the structure is different. Schlesinger gives the length as 39.4 mm., the width as 29 mm. It is evident, however, that the Navasota animal was smaller than the one in Schlesinger's hands, and the lower premolars are likely to be narrower than the upper ones.

The Navasota teeth differ from both the second and the third premolars described by Schlesinger in having the two crests more sharply separated by the transverse valley. Were it not that these premolars have been found in place in the jaw (Schlesinger, as cited) one might conclude that the left one belonged on the right side and *vice versa*. The Navasota teeth appear to agree in structure with the lower third premolar (designated as the first) of *Gomphotherium leptodon* described and figured by Lartet in 1859.¹³ This appears, however, to have had a cingulum on the outer face.

3. DESCRIPTION OF THE MILK MOLARS AND TRUE MOLARS

In the collection are the lower third milk molars, right and left. The one of the left side is the most nearly complete, the crown being wholly uninjured, but most of the hinder root and a part of the front root are broken off. In the one of the right side the front root is gone and with it a part of the first crest. The crown consists of three crests and front and rear talons. The crests are directed across the crown obliquely outward and backward. The crown of the left tooth is 60 mm. long, 28 mm. wide at the first crest, and 35 mm. at the third (pl. 4, figs. 1, 2). On the inner side the second crest is 23 mm. high. The summits of the cones of all

¹¹ Denkschr. Naturh. Staatsmus., Vienna, vol. 1, p. 14, pl. 2, fig. 3.

¹² Idem, same page and plate, fig. 4.

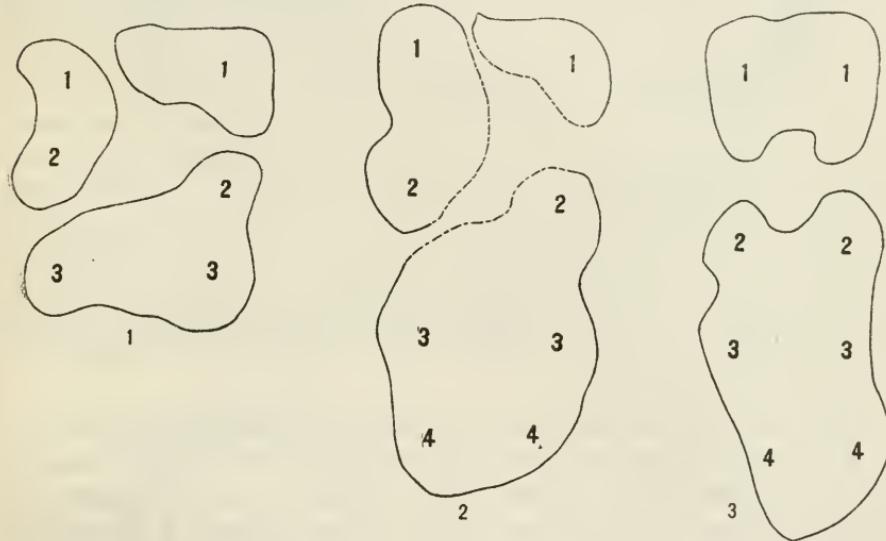
¹³ Bull. Soc. Geol. France, ser. 2, vol. 16, p. 491, pl. 14, fig. 2, B.

the crests are slightly worn, the dentine being exposed on the outer ends of the first and second crests. The first valley is widely open, the buttress on the outer half of the crests being feebly developed. The second valley is partially blocked by the meeting of the buttress descending on the rear of the second crest and that on the front of the third. There is also a buttress on the front of the outer half of the third crest. At the front end of the crown is a distinct talon, but it is not prolonged into a cingulum on the sides. At the rear is a more considerable talon bearing four tubercles. On the front end of the crown is a polished area 15 mm. wide, where the tooth pressed against the hindmost milk molar. No pressure area is seen on the hinder end. The root consists of two fangs (pl. 4, fig. 2) the anterior of which supported the first crest; the second, the other two crests. Near its base the hinder root is 28 mm. wide. In the space between the front and the rear fangs of the right tooth is a fragment of bone 18 mm. high, 20 mm. fore and aft, and 17 mm. from side to side. If there was below this a fourth premolar, its summit must have lain at least 18 mm. below the crown of the milk molar or well at one side of the nodule of bone.

The upper right second molar presents a nearly perfect crown, lacking only a fragment of enamel on the outer cone of the second crest. Evidently this was splintered off during the life of the animal. The roots are broken off near their bases. The crown is well worn on the first and the second crests, only moderately so on the third (pl. 3, fig. 4). The length is 106 mm.; the width at all of the crests is 66 mm. On the inner ends both the first and the second valleys are obstructed by the strong buttresses of the rear and of the front of the inner cones. The wear of the main cones and the buttresses produces trefoils. There are mere traces of inner buttresses and there are no subsidiary cusps or conules produced in the valleys. There is present, on the inner face of the crown, a heavy tuberculated cingulum, which is carried around both the front and rear ends of the crown. On the outer face are hardly any traces of this cingulum. There are large polished pressure areas on both ends of the crown, that on the hinder fitting accurately against the third molar. There is in patches a thin layer of cement. The roots are disposed as is usual in the mastodons (text-fig. 1). One fang supports the outer end of the first crest; an inner fang supports the inner ends of the first and second crests; while a third supports the inner end of the third crest and the outer ends of the second and third.

The crown of the upper third molar lacks no part (pl. 3, fig. 5), but the roots are broken off near their bases. The crown is 136 mm. long and 73 mm. wide at the front crest. The height of the outer cone of the second crest is 50 mm., measured from the base of the crown. Only the summits of the cones of the first crest are worn, and these slightly. Evidently the tooth abutted against the second

molar just described. The anterior buttress of the first inner cone passes downward and outward in a broad ridge to join the well-developed front cingulum. Buttresses from the confronting faces of the first, second, and third crests join and close the first and second valleys. The third valley is rather open, there being on the hinder face of the third inner cone only a sharp ridge. The other buttresses are composed of conules more or less free at their summits. On a proper amount of attrition trefoils would be produced at the inner ends of the first, second, and third crests. No buttresses are present on the outer cones, but there is on the hinder face of the third one a tubercle which one may suppose might in some descendant have developed into a buttress. The rear of the tooth is a low mass of conules which represent an incipient crest fused with a talon.



FIGS. 1-3.—*GOMPHOTHERIUM CIMARRONIS*. $\times .5$. DIAGRAMS TO SHOW POSITION OF THE FANGS OF THE ROOTS. VIEWED WITH CROWN DIRECTED DOWNWARD. THE NUMERALS INDICATE THE CRESTS SUPPORTED. 1, UPPER RIGHT SECOND MOLAR; 2, UPPER RIGHT THIRD MOLAR; 3, LOWER LEFT THIRD MOLAR

At the inner end are two stout conules, the anterior of which appears to represent the principal cone of a crest. The still larger conule behind this may belong to the talon. Between these two conules and the outer one is a row of three smaller ones. The talon is completed by two small conules one of which is applied against the large hinder and inner conule. The second outer cone shows at its summit a row of five conules; while the third displays only two. Each inner cone has a conule applied to its face next the median fissure. The cingulum in front is continued on the inner face as a well developed tuberculated and beaded ridge. It ceases behind the third transverse valley. In the valleys there is a considerable accumulation of cement, and a coat of this covers the bases of the roots. The roots are disposed as in the second molar described above (text-fig. 2), but the hinder root is larger than in the second molar.

The crown of the lower left hindmost molar (pl. 3, fig. 6) is in perfect condition. The roots, except their bases, are missing, a result apparently, of rude methods of collecting. The left, or outer, border of the crown is nearly straight, the inner border is slightly convex. The wear from mastication has affected the summits of the three crests. We may judge therefrom that this tooth did not belong to the same individual as did the upper third molar.

The length of the crown is 136 mm.; the width at the first crest, 62 mm.; at the third, 64 mm. The height of the second inner cone, slightly worn, is 45 mm. There may be said to be four crests, the fourth not yet separated from the talon. The buttresses applied to the front and rear faces of the outer cones join and block the valleys. On sufficient wear the cones and buttressing conules would produce trefoils with large basal lobes. The buttress on the hinder face of the third outer cone is composed of three or four conules. The imperfect fourth crest and the talon fused therewith form a rosette inclosing a pit. The crest portion is composed of an outer and an inner pair of conules, the pairs being separated by the thin fissure which traverses the crown from front to rear. In each pair the conule next the fissure is the smaller. In the outer pair the smaller conule is situated in front of the larger one and corresponds to a buttress. The talon portion is composed of a curved row of six closely appressed conules. There is no cingulum except the usual ridge in front. A large tubercle at the outer end of the valleys may represent the cingulum.

The inner cone of each crest is divided by a thin fissure into two parts, a small inner one and a larger outer. Each outer cone is divided by an oblique fissure which cuts off a conule forming the anterior buttress. A small amount of cement appears in the valleys and in thin patches elsewhere. The roots (text-fig. 3) consisted of an anterior fang which supported the anterior crest and a larger one which sustained the remainder of the crown.

4. DESCRIPTION OF THE TUSKS, UPPER AND LOWER

The fragments of upper tusks represent at least four individuals. One is indicated by only one fragment about 95 mm. long, but its diameters exceed all of the others, its greater axis being 66 mm., its smaller 49 mm. A very young individual is represented by two lower tusks. Four fragments of upper tusks contain the pulp cavity. These appear to have belonged to two individuals. Of one of these there are three pieces. The most important tusk consisted of several fragments, one of which is missing. The pulp cavity is 100 mm. deep, but it is estimated that it was originally at least 140 mm. deep. The fragment which connects with the one just mentioned is 96 mm. long, and it came down near the end of the

premaxilla (text-fig. 4). The base of this tusk is at the left end of the figure. There is accurate contact between the two pieces on the side not seen. The diameter of the tusk at the proximal end is 60 mm., and 50 mm. at the end of the premaxilla. The cross-section (text-fig. 5) is somewhat pear-shaped. The enamel band is

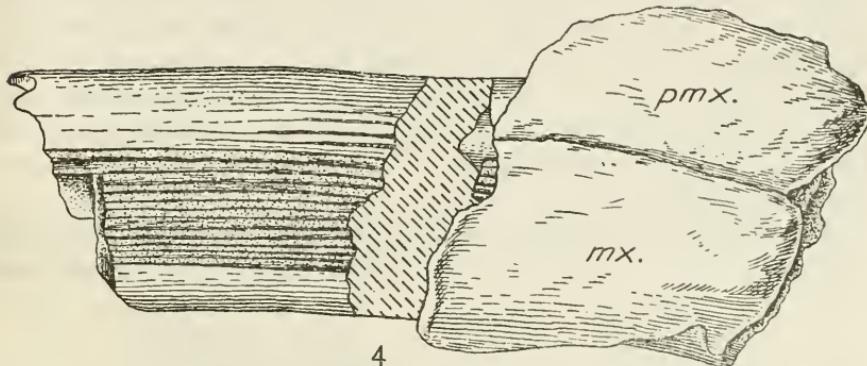
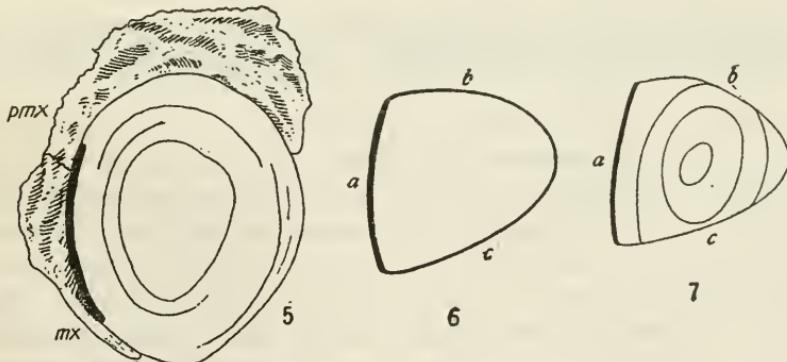


FIG. 4.—*GOMPHOTHERIUM CIMARRONIS*. VIEW OF BASE OF UPPER RIGHT TUSK, SEEN FROM OUTSIDE. *mx.*, FRAGMENT OF MAXILLA. *pmx.*, FRAGMENT OF PREMAXILLA. $\times .5$

shown by the thick black line. Five fragments fitting accurately and cemented together are believed to belong to this same tusk. At its proximal end the greater diameter is 56 mm., the lesser 47 mm. Inasmuch as the diameter at the distal end of the premaxilla is only

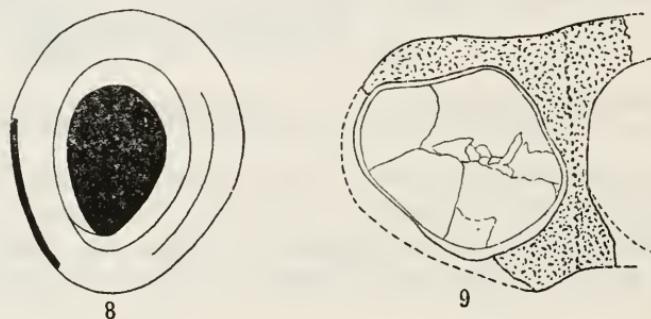


FIGS. 5-7.—*GOMPHOTHERIUM CIMARRONIS*. 5, CROSS SECTION OF TUSK OF FIGURE 4, WHERE IT EMERGES FROM THE SKULL. SEEN LOOKING TOWARD THE SKULL. ENAMEL BAND BLACK. $\times .75$. 6, CROSS SECTION OF TUSK 150 MM. ABOVE DISTAL EXTREMITY. SEEN LOOKING TOWARD SKULL. $\times .6$. *a*, ENAMEL BAND; *b*, UPPER SURFACE; *c*, LOWER SURFACE. 7, CROSS SECTION OF TUSK TAKEN 100 MM. ABOVE DISTAL END. SEEN LOOKING TOWARD SKULL. $\times .6$. *a*, *b*, *c*. AS IN FIGURE 6

4 mm. more than this, the length of the piece missing can not be great, but it can hardly be determined. This distal portion (pl. 4, fig. 3) is curved outward and slightly downward. The band of enamel is on the concave side. This band becomes reduced in width at the proximal end as age advances. On the fragments bearing the pulp-

cavity the width of the band varies from 24 to 30 mm. On the long fragment figured the width is 40 mm. Toward the distal end the form of the section varies. This happens because of the wear to which the ivory was subjected. On the whole inner face of the long fragment the ivory is worn, the amount increasing toward the distal end. This was produced probably by the friction of the proboscis. A cross-section 100 mm. from the distal end is shown by text-figure 6; another, 150 mm. from tip, by text-figure 7. The lower border of this area of attrition comes down to the lower edge of the enamel band, and thus was formed a sharp cutting instrument for a distance of nearly 250 mm. The distal end of the tusk is likewise rounded off and polished.

It is evident that the tusk was subjected to rougher usage than friction by the proboscis. It will be seen (pl. 4, fig. 3) that along



FIGS. 8-9.—*GOMPHOTHERIUM CIMARRONIS*. 8, CROSS SECTION OF AN UPPER TUSK TAKEN A SHORT DISTANCE BELOW THE PROXIMAL END. THE BLACK CENTER REPRESENTS THE PULP CAVITY; THE BLACK BAND, THE ENAMEL. X.6. 9, CROSS SECTION OF DISTAL END OF LOWER JAW, SHOWING RIGHT AND LEFT RAMI AND THE RIGHT TUSK. X.57

the upper edge of the enamel band and near the distal end are four notches. Here the enamel had evidently had pieces broken out of it as though it were glass. This had been done during the life of the mastodon, for the broken edges are rounded off and from each notch there runs a broad shallow groove in the ivory. These had probably been produced by play of roots or vines or branches of trees. Text-figure 8 represents a cross-section of the upper left tusk near its base. This tusk probably belonged to the same individual as did the one just described.

In the collection is a portion of the distal end of the lower jaw containing a fragment 125 mm. long, of the right lower tusk. Text-figure 9 represents a cross-section of this fragment of tusk and bone; and figure 4 of plate 4 is a reproduction of a photograph of the broken end of the tusk. It will be seen that the two tusks were, as in *Gomphotherium productum*, separated by a bony septum. At the rear of the fragment this septum is 7 mm. thick. It will be observed

also that the cross-section of the tusk is different from that of *G. productum*. It is quite different, too, from that of *G. angustidens*, as figured by Schlesinger¹⁴. It resembles more closely the section of lower tusk figured by Cope in his descriptoin of *G. productum*,¹⁵ but is yet different. The long diameter is 49 mm., the shorter one 37 mm. There is a faint groove or channel on the lower side and a similarly faint one on each side of the prominent upper ridge.

In the collection are parts of two tusks of a young specimen supposed to belong to the same species as did the adult remains. The larger piece, now 90 mm., must have been still longer, since no pulp cavity is present. The cross-section is broadly oval, without any ridge or channel. As in other cases, the narrow end of the oval is taken to be away from the midline of the jaw. The rear part of the fragment is yet covered with the thin coat of cement. Where this is removed the surface is traversed by narrow parallel ridges and grooves. At the distal end of these tusks are distinct evidences that they were useful instruments. Figure 5 of plate 4 shows these fragments of tusks as seen from above and of the natural size. It will be noted that each has a large worn and polished surface 35 mm. long. On the underside (fig. 6) is another polished surface not quite so large. On the outer border the two surfaces round into each other. On the face next to its fellow the tusk of the right side has a flat worn surface 18 mm. long, not seen in the figure, as if it had worked in contact with the other one, but this other shows no indications of any such friction. This worn surface is crossed by about 14 grooves. The ridges between these are possibly the outcropping edges of the layers of ivory, but this is uncertain.

5. IDENTITY OF THE NAVASOTA MASTODON

The writer refers the Navasota remains here described to Cope's form which he named *Tetrabelodon serridens cimarronis*.¹⁶ It is therefore to be known as *Gomphotherium cimarronis* (Cope). According to Osborn,¹⁷ this was found in the Upper Miocene near Clarendon, Texas. The type is a tooth said by Cope to be the left lower last molar. To the writer the tooth has greatly the appearance of being the left upper tooth. Possibly the arrangement of the anterior fangs of the root might decide the matter. The fact that there is in the type a cingulum called external appears to show that the tooth is an upper one.¹⁸ The upper hinder

¹⁴ Denkschr. Naturh. Staatsmus., Vienna, vol. 1, pl. 1, fig. 5.

¹⁵ Wheeler's Surv., vol. 4, pl. 71, fig. 8.

¹⁶ Vert. Palaeont. Llano Estacado, 1893, pp. 18–20, pl. 3, figs. 1, 2.

¹⁷ Amer. Mus. Novitates, No. 1, p. 8.

¹⁸ Cope, Wheeler's Surv., vol. 4, p. 19.

molar of the Navasota mastodon is only 6 mm. shorter and 7 mm. narrower than Cope's type. The principal known difference between Cope's *Mastodon serridens* and the form *cimarronis* is that the former is much larger. The type of *serridens* was taken to be a first or second molar whose length is 130 mm. The length of the upper second molar of the Navasota mastodon is only 105 mm. It does not show the original condition of the grinding surface; but the hindmost molar does this; and the cross-crests and the buttresses present nearly the same tuberculated condition as does the type of Cope's *Mastodon serridens*. The differences in the tuberculation of the two forms as pointed out by Cope are probably of minor importance.

Schlesinger¹⁹ describes a form of mastodon to which he gave the name *Mastodon angustidens subtapiroidea*. This resembles in many respects the *G. cimarronis*, so far at least as regards the molars; but the latter species appears to be more advanced. If they should be shown to be identical forms, *cimarronis* would supersede *subtapiroideus*. *Gomphotherium cimarronis* differs from *G. productum* in that the teeth are less hypsodont.

EXPLANATION OF PLATES

PLATE 1

Anancus brazosius

View of occlusal surface of the right lower third molar. $\times .83$. No. 41652.
British Museum of Natural History.

PLATE 2

Anancus brazosius

FIG. 1. Same tooth as that figured on Plate 1. $\times .47$.

2. Mandible and third molar from Cameron, seen from lingual side. $\times .21$.

PLATE 3

Anancus brazosius

FIG. 1. Same mandible and molar as that of Figure 2 of Plate 2, seen from above. $\times .46$.

Gomphotherium cimarronis

FIGS. 2, 3. Lower right and left third premolars. $\times .96$.

2. Left seen from above.
3. Right seen from the lingual side.
4. Upper right second molar. $\times .5$. View of occlusal surface.
5. Upper right third molar. $\times .5$. Shows occlusal surface.
6. Lower left third molar. $\times .5$. Shows occlusal surface.

¹⁹ Denksehr. Naturh. Staatsmus., Vienna, vol. i, pp. 30-38, pl. 7, fig. 3.

PLATE 4

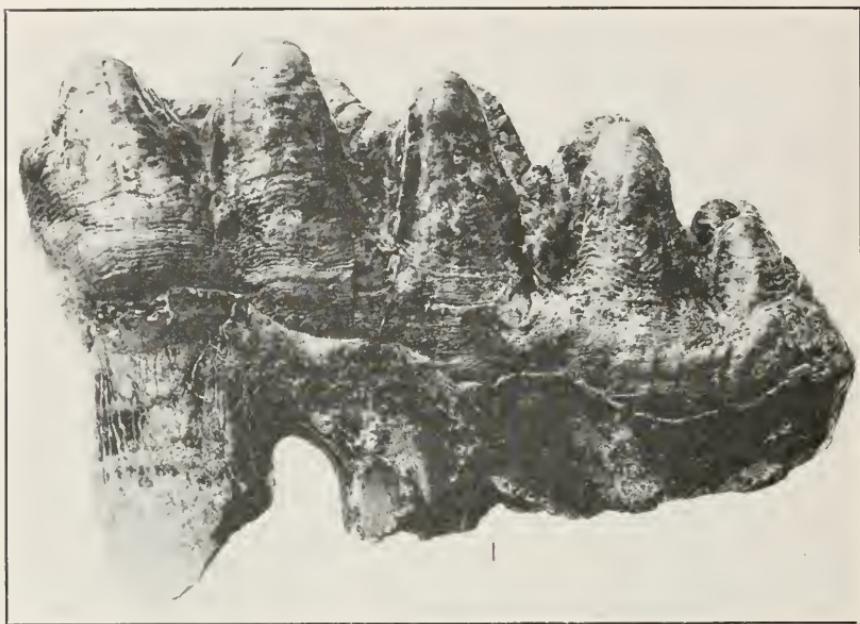
Gomphotherium cimarronis

- FIG. 1. Lower left third milk molar. $\times .94$. Shows occlusal surface.
2. Same milk molar. $\times .51$. View of left, or outer, face.
3. Part of upper tusk of right side. $\times .17$. View of outer and upper
surfaces.
4. Cross-section of a lower left tusk. $\times .91$. Seen from front.
5. Right and left lower tusks of young individual. $\times 1$. Seen from above.
6. Left tusk of Figure 5. Seen from below.

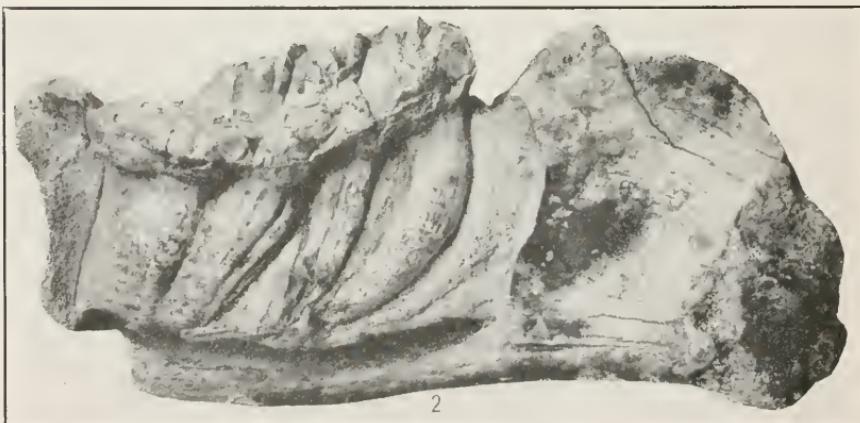


LOWER MOLAR OF *ANANCUS BRAZOSIUS*

FOR EXPLANATION OF PLATE SEE PAGE 14

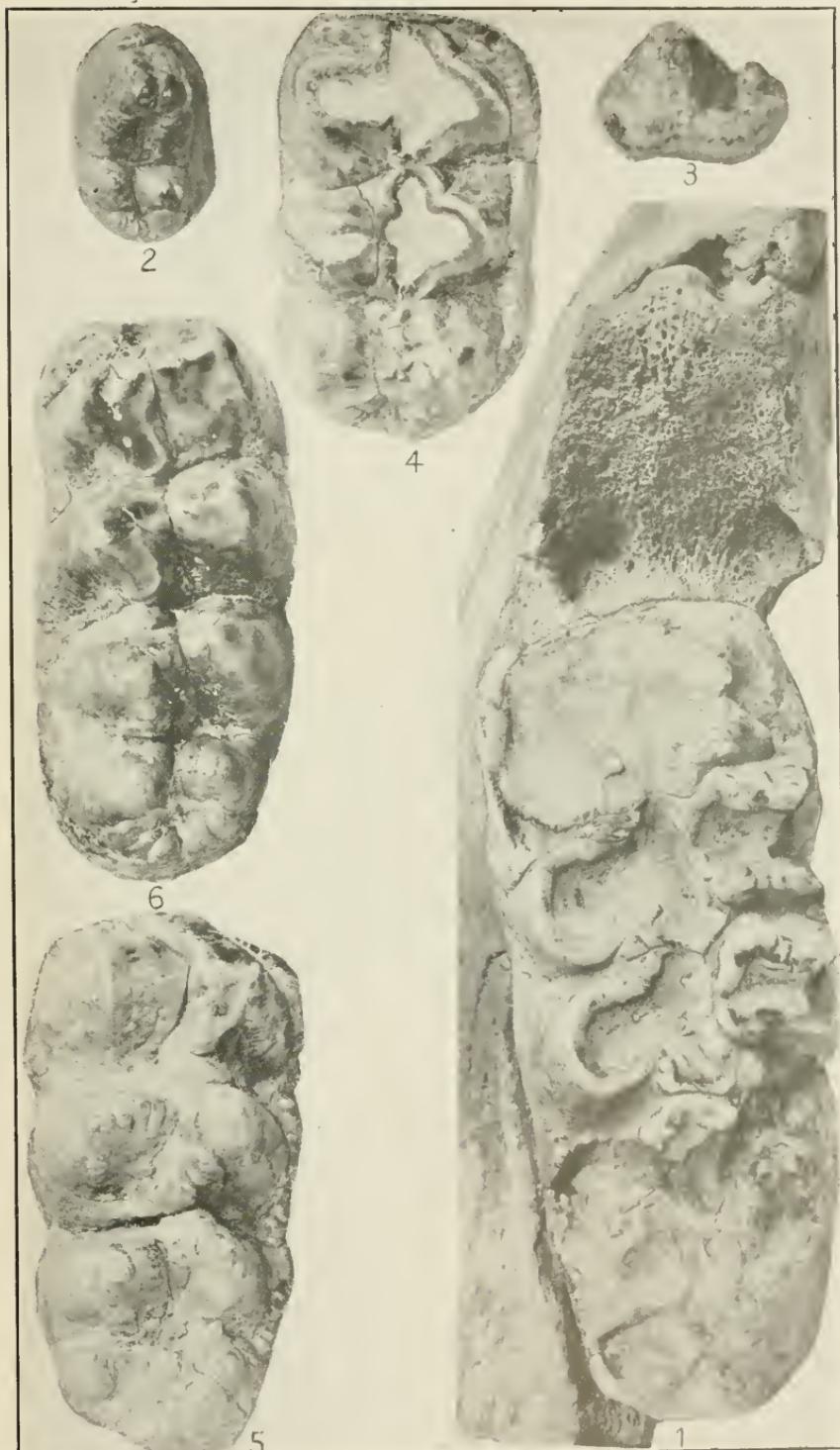


LOWER MOLAR OF ANANCUS BRAZOSIUS



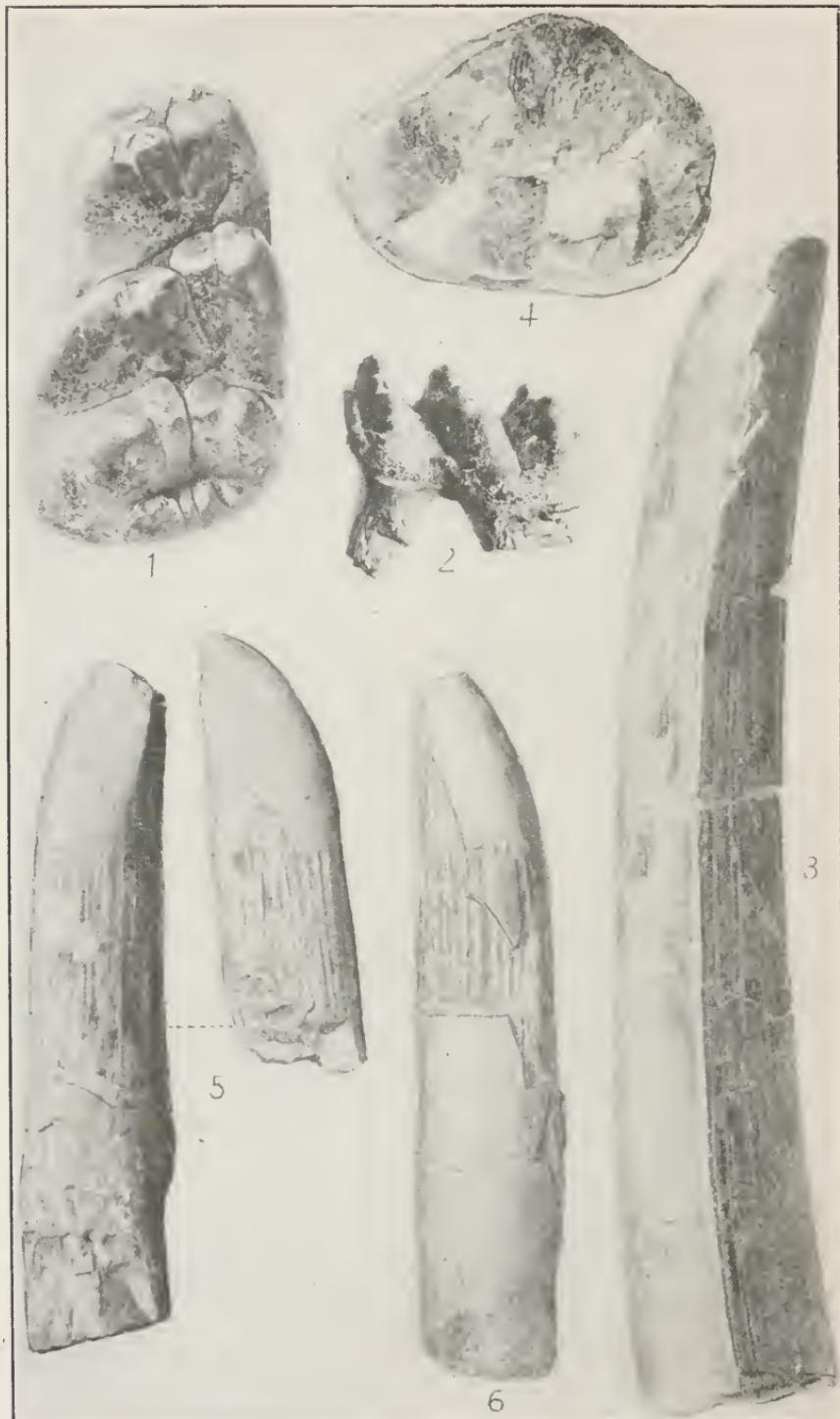
LOWER JAW OF ANANCUS BRAZOSIUS

FOR EXPLANATION OF PLATE SEE PAGE 14



TEETH OF ANANCUS BRAZOSIUS AND OF GOMPHOTHERIUM CIMARRONIS

FOR EXPLANATION OF PLATE SEE PAGE 14

TEETH AND TUSKS OF *GOMPHOTHERIUM CIMARRONIS*

FOR EXPLANATION OF PLATE SEE PAGE 15