Fossil Vertebrates Collected Near, or in Association With, Human Artifacts at Localities near Colorado, Texas; Frederick, Oklahoma; and Folsom, New Mexico

By

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The fossils described in the following paper were collected in part on Lone Wolf Creek, near Colorado, Mitchell County, Texas; in part on Red Bank Creek, 18 miles below the town of Colorado; in part near Michies, Dawson County, Texas; and in part about 22 miles east of Raton, Colfax County, New Mexico; but the greater number of the species were obtained at Frederick, Tillman County, Oklahoma.

All of these localities assume special importance and significance from the fact that well-worked and distinctive human artifacts were found in association with the faunas described herein. Details of this association have been given in previous papers herein noted, and the present contribution is an important supplement to these reports.

The first locality, Lone Wolf Creek, was described by the junior author in 1925 (Science n.s., vol. 62, pp. 459-460; also in the Scientific American for November, 1926, pages 333-336, with illustrations of the geology and of the objects found there. Besides *Equus littoralis* and *Bison figginsi,* Mr. Cook mentions an undertermined species of *Elephas,* a large undetermined species of *Equus* and a camel (*Camelus* or *Camelops*). These were collected in the immediate vicinity and in corresponding deposits. It appears that at some time in the Pleistocene, or more probably earlier, the overlying Cretaceous beds had been eroded by a stream, down into the underlying Triassic. Some time during the Pleistocene this valley had become partly refilled by sand and gravel and these were later cemented solidly by a calcareous cement. After this deposit was laid down a change of elevation or an increased flow of water, or both, caused a recutting through the Pleistocene filling to its bottom. However, patches of this were left along the banks of the stream; and it was in one of these that the skeleton of *Bison figginsi* was discovered. This was so solidly embedded in the cemented sand and gravel that the skeleton was removed with difficulty. It lay at the bottom of the deposit and was overlain by about seven feet of undisturbed sand and gravel. No doubt can be entertained that the skeleton had not been disturbed since that deposit covered it.

About 240 miles further north, in Briscoe County, Texas, where tributaries come down from the staked plains to enter Red River, is a long-known locality along Rock Creek where about twenty species of vertebrate fossils have been collected, all of which are those of extinct animals and which certainly belong in the early Pleistocene. At

this locality had occurred erosion of Miocene beds into the Triassic, a later refilling of the valley with four distinct deposits of Pleistocene age; and, at a still later time, a part of the last-named beds had been removed down into the Triassic. These Pleistocene beds are as old as the first interglacial; and an equally distant age must be assigned to the deposit along Lone Wolf Creek.

The most interesting feature of the discovery of *Bison* near Colorado, is that, intermingled with the bones, were found three finely made arrowheads. Two of these are now in the Colorado Museum of Natural History and a figure of them is published in the Scientific American as cited above.

At the second locality, Red Bank Creek, was collected a lower jaw of *Equus complicatus*. Geological conditions observed by the junior writer in the area along Red Bank Creek are closely comparable to the general conditions found along Lone Wolf Creek and near Michies, Dawson County. In fact corresponding deposits are widespread over an area which the junior writer examined, at least a hundred miles in extent, wherever subsequent erosion had not removed such evidence. Heavy and extensive deposits of coarse sand and gravels, generally well consolidated by carbonate of lime, are incised by the shallow meanders of Red Bank Creek and its short tributary arroyos. Were the exposures more numerous it is most probable that far more fossils could be located. A third locality, near Michies, Dawson County, Texas, furnished additional evidence of a geologic history similar to that described around Colorado, Texas. Here a skull, jaws and partial skeleton of the type of *Bison texanus* were found; also several fragmentary specimens of *Elephas* cf. *columbi,* in the Pleistocene deposits. A deeply buried skull and part of a skeleton of *Bison bison* was found near here, in a situation indicating considerable antiquity. The junior writer and his assistant, Mr. N. J. Vaughan, saw numerous fragments of a large *Elephas* skeleton which had washed out of a deeply cut arroyo, about 100 yards from the Michies post office. According to the postmaster, the whole skeleton was present, standing in position in the side of the bank, as though the animal had originally been bogged down there. A local flood exposed it in the side of the arroyo. He stated that he had tried to dig it out some two years before, after the water subsided, and piled the fragments on the bank where we saw them, but the bones were soft and most of them fell to pieces as he dug them out. Thus was yet another splendid *Elephas* skeleton ruined by misdirected enthusiasm of untrained hands.

The fourth locality is about one mile north of Frederick, Oklahoma. This has furnished 25 or more species of mammals, all of extinct types. A commercial sand and gravel pit, operated by Mr. A. H. Holloman at this point, is situated in the top of the highest ridge of the vicinity. This ridge is about half a mile wide, and is capped by an ancient river channel bed, with a maximum thickness in excess of twenty feet, which furnishes heavy deposits of coarse sand and gravel. These deposits are partly cemented locally into dense rock, but in the main are loosely coherent deposits clearly showing the original bedding planes. They are largely cross-bedded and lenticular, but divide up into three principal zones of deposition. The lowest of these is a very characteristic heavy stream channel deposit, whose bottom member is principally a well cemented gravel bed, or coarse sandstone. This section of the bed carries water at the very bottom—on top of the "Red Beds" into

which the ancient stream had cut its channel. The second stage of deposition is a characteristic flood plain deposit, made at a period when the main stream had migrated to a new and deeper channel but was still subject to deposition of silt, and at times sand and gravel, during periods of overflow. The third, or upper deposit, is a still more advanced flood plain stage, in which only rather still backwaters overflowed as a rule, bringing in and depositing very fine silts, for the most part of a type not readily deposited from rapidly moving water. The fact that this third stage was still subject to such overflow, and occasionally of a more radical type, is demonstrated by the granitic gravel, up to an inch or more in diameter, which occurs sparingly at stages in the fine silts of the upper deposit.

Fossils occur in all three beds, but most abundantly in the lower and older stream channel deposits. It is from the middle and lower members that artifacts are reported.

Since the crest of this hill, with its gravel bed, is about one hundred feet above the level of the adjoining lowlands, and about 200 feet above the bed of the present Red River, a few miles distant, it is obvious that erosion has removed that amount of surface from the surrounding sloping territory since that Pleistocene stream ran there—inasmuch as no local structural disturbances exist to account for it.

In January, 1930, Mr. A. H. Holloman sent quite a large shipment of recently discovered fossils, etc., from his sand and graved pit, for identification, to the Colorado Museum. In this shipment were several stones, among which are two that are clearly human shaped and used as "manos" or hand stones used as pestles, in connection with metates, to pulverize or break up all sorts of dried foods, including meats, nuts, roots, fruits or seeds. These are of simple and primitive type, which might be expected with the metates such as we have previously described from these pits.[1] In a letter from Mr. Holloman to the junior writer, received shortly after these specimens, he states that he found these personally in position in the gravel layer "A" (the lower bed of our earlier section) at depths of between 12 and 16 feet from the surface; but he had "removed them (from the bank) before taking particular notice of them." He states they were found on the gravel layer, near the bottom of the old river bed. He has likewise sent to the Colorado Museum two broken arrow points, also found in these lower beds, he states. One of these, the smaller, was seen and photographd *in situ* by a representative of Dr. C. N. Gould, head of the Geological Survey of Oklahoma. The originals of these artifacts are returned to Mr. Holloman, but casts are retained for record in the Colorado Museum of Natural History, Denver. Dr. Gould and the senior writer have published on the smaller of these two "arrowpoints."[2]

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[1]Figgins, J. D., The Antiquity of Man in America. Natural History, Vol. XXVII, No. 3, 1927, pp. 229-247.

[2]Gould, Charles N., On The Recent Finding of Another Flint Arrow-head in the Pleistocene Deposit at Frederick, Oklahoma. Wash. Acad. Sci., Vol. XIX, No. 3, Feb. 4, 1929.

Hay, Oliver P., On The Recent Discovery of Flint Arrow-head in Early Pleistocene Deposits at Frederick, Oklahoma. Jour. Wash. Acad. Sci., Vol. XIX, No. 5, March 4, 1929.

List of Fossils Found at Frederick, Oklahoma

Megalonyx jeffersonii
Mylodon harlani
Glyptodon petaliferus
Felis sp. indet.
Equus complicatus
E. littoralis
E. achates
E. pacificus
E. sp. indet.
Tapirus haysii
Platygonus sp. indet.
Camelops niobrarensis
C. sp. indet., large
C. sp. indet., smaller
Lama hollomani
Ovibos? or Symbos? sp. indet.
Odocoileus heminous?
Odocoileus sp. indet.
Cervid, gen. et sp. indet.
Gomphotherium priestleyi
Stegomastodon sp. indet.
Elephas haroldcooki
E. columbi
Homo sapiens (artifacts).
Amyda emoryi
Testudo? sp. indet.

On a branch of the head of Dry Cimarron Creek, about 22 miles east of Raton, Colfax County, and about 11 miles west and north of Folsom, Union County, New Mexico, the Colorado Museum of Natural History opened a most important quarry.[1] This was worked for two seasons by that institution, and the ensuing year the American Museum of Natural History, New York, was invited to cooperate in a joint expedition, to work out the deposit. Here were discovered more than thirty skeletons of a new race of extinct bisons, *Bison taylori,* together with a few bones of other mammals; and with them and *in situ,* were discovered some 17 flint points of a previously unreported type. Some of these were studied *in situ* by representatives of several technical institutions, both of this and other countries. Part of these artifacts are now on exhibition in the Colorado Museum, Denver, and part in the American Museum, New York. The deposit is situated in a refilled valley, which had been cut into the Cretaceous (Pierre); and recent floods of the past ten years have cut out and developed a deep narrow arroyo, up the valley floor, exposing the bone bed. The old valley was refilling at the time these bison died, and our excavations exposed the original valley floor of that time, over quite a large area. The main part of the area occupied by the skeletons was buried at a depth of about six to twelve feet, on the old sloping surface. Scattered bones still occur in the north side of the cut, at the deepest part exposed, where the old surface is going still deeper toward the center of the old valley, which was apparently some yards north of the present limits of excavation.

The junior writer has made geological studies of the whole region surrounding this deposit. There is a good deal of evidence here bearing on the age of these beds; but until studies are more complete, it seems premature to say more than has already been stated by the present writers and others, as to their exact age.

All of the species listed from this quarry still exist, except the bison and possibly the *Citellus.*

[1]Figgins, J. D., The Antiquity of Man in America. Natural History, Vol. XXVII, No. 3, 1927.
Cook, H. J., New Geological and Paleontological Evidence Bearing on the Antiquity of Man in America. Natural History, Vol. XXVII, No. 3, 1927.

List of Species from the Folsom Bison Quarry

Bison taylori.
Bison sp. indet.
Odocoileus hemionus
Cynomys ludovicianus
Citellus sp. indet.
Lepus californicus

Megalonyx jeffersonii (Desmarest)

C.M.N.H. No. 1072.

In the collection from Holloman's gravel pit at Frederick, Oklahoma, is a fragment of bone, identified as a part of the front face of the lower half of the shaft of the right humerus of a species of *Megalonyx,* probably *M. jeffersonii.* The specimen is heavy and thoroughly fossilized. The fragment is 240 mm. long and 50 mm. wide. The medullary cavity is empty and has a diameter of about 25 to 30 mm. The bony walls are from 10 to 15 mm. thick. At its lower end the fragment forks at the internal epicondylar foramen; and above this is seen a part of the musculo-spiral groove. The deltoid tract is marked by strong ridges.

This bone is said to have been found in the lowest Pleistocene bed, the cemented sand and gravel at the bottom of bed A.

Mylodon harlani Owen

C.M.N.H. No. 1073. Plate I, figures 1, 2; text-figure 1.

The Holloman gravel pit has contributed various parts of the skeleton of the ground-sloth *Mylodon harlani.* A tooth (plate 1, figure 1) somewhat damaged, is indentified as the upper fourth of the left side. A cross section is presented (text-figure 1). In this the hinder face of the tooth looks downward on the page; the notch,

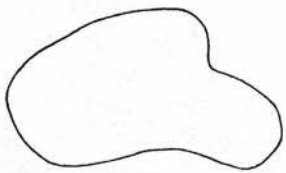

Figure 1. Section of tooth of *Mylodon harlani.* X 1

which represents a groove, looks toward the tongue of the animal. The position of this tooth in the jaw is such that the face above designated as the hinder is directed outward and backward. From Stock's figure (Pub. 331, Carnegie Instn. Wash., plate XXIII, figure 1; text-figure 63) it is seen that there is considerable variation in the form of this tooth. The one from Frederick appears to be more concave on the rear face than those of Stock's figures; also to have a more prominent inner lobe. The tooth was found in the lowest stratum composed of cemented sand and gravel.

A second specimen of *Mylodon* (C.M.N.H. No. 1071, plate I, figure 2) is a practically complete left humerus. The figure shows the front surface. The length from the surface of the head to the middle of the distal articular surface is 396 mm. (15.5 in.). The greatest width at the lower end, measured obliquely, is 241 mm. Stock (op. cit., p. 146) gave the measurements of a humerus of the species found in the asphalt pits of Rancho La Brea, near Los Angeles. The length, taken in the same way as with the Frederick specimen, is 429.6 mm.; the width at the lower end, 261.4 mm.

This humerus is reported as being buried in the cross-bedded sand with gravel at about the middle of the deposit at Frederick.

One of the bones loaned to the writers by Mr. Holloman is an axis of probably *M. harlani*. The neural arch is mostly missing and the rear of the keel of the lower side of the bone is broken off. The distance from the front of the odontoid process to the upper edge of the rear of the bone is 77 mm. From the hind border of one surface for articulation with the atlas to that of the other is 87 mm. These articular surfaces are oval and each looks outward and forward. The long axis (77 mm.) of each surface is directed upward. The axis at right angles with this (30 mm. or slightly more) is directed toward the tip of the odontoid process. This process is large, 30 mm. long, 25 mm. wide, and 27 mm. high at the neck. In front of the neck the end of the bone is rounded off in all directions. The neck is flattened below. In front of it is the articular surface for contact with the atlas. This surface is 23 mm. long and 27 mm. wide, and convex from side to side. Dr. Chester Stock (Pub. Carnegie Instn. Wash., No. 331, p. 134) has described this vertebra as found in *M. harlani*. He wrote that the long axis of the lateral articulation varies much in its direction. G. M. Allen described (Mem. Mus. Comp. Zool., Harvard, volume XL, p. 328, plate IV, figure 3) and figured the axis of *Mylodon garmani*. His figure shows the long axis of the articular surface for the atlas as being directed upward and strongly backward; also the lower end of this surface as coming farther forward than in the Frederick specimen.

Mr. Holloman also sent a calcaneum of the right side in good condition. In three places the dense outer layer of bone has been destroyed. The length from the rear end to the front of the inner shelf-like lesser process is 210 mm. The greatest height, at the rear of the articulation with the astragalus, is 125 mm. The rear half is expanded to a width of 120 mm. The plane of this portion is oblique to the plane of the greater anterior dimension. The foot of this and some other sloths was turned inward and the animal in walking applied the outer edge to the ground.

A caudal vertebra forwarded for examination by Mr. Holloman is referable to a young individual of the same species; and a fragmentary lower jaw, containing two molars with the crowns freshly broken off is clearly *Mylodon,* but appears small to include in this species. However, it is too badly damaged to be certainly identified.

Glyptodon petaliferus Cope

C.M.N.H. No. 1069. Plate I, figure 3; Plate III, figure 2.

From the Holloman gravel pit a single plate of the carapace of a glyptodon was first discovered. Later Mr. Holloman picked up from the gravel several other shell fragments. On a visit made to Frederick by Dr. Charles N. Gould, director of the Oklahoma Geological Survey, and Dr. Leslie Spier, professor of anthropology in the University of Oklahoma, they discovered a large part of the carapace of a glyptodon. This they exhumed and took to the University. This carapace was found at a depth of several feet from the original surface and at some little distance from the gravel pit. On examination the writers see no reason why all these remains should not be referred to Cope's *Glyptodon petaliferus.* This species was based by Cope on a half of a single carapacial plate found in Nueces County, Texas, described in 1888 (Amer. Naturalist, volume XXII, p. 345) and figured in 1889 (Amer. Naturalist, volume XXIII, p. 662, figure 2).

In 1916 the senior author described considerable parts of a skeleton, including portions of the skull, of a glyptodon which had been discovered in Hunt County, Texas, and which was believed to belong to Cope's species (Proc. U. S. Nat. Mus., volume LI, pp. 107-116, plates III-V). Again in 1926 (*ibid,* volume LXVIII, article 24, p. 2, plates I, II) he described and figured some parts of a lower jaw and of a carapace which had been collected on the Aransas River in southwestern Texas. These remains were likewise referred to *Glyptodon petaliferus.*

The figure (plate I, figure 3) of the bone found at Frederick shows its outer surface of the natural size. The groove surrounding the central area is indistinct and those radiating out from it are still more so. The thickness of the plate varies between 13 mm. and 16 mm.

It has been suggested that the animal found at Frederick is identical with *Glyptodon clavipes,* a species not uncommon in Argentina, South America. The writers do not believe that this identification should be accepted. One reason for this is that it is improbable that such a slow-moving animal would have made its way from Argentina to Texas and Oklahoma without undergoing specific changes. The writers know of no species of fossil mammals which are common to South America and North America. Only rare cases are known of living mammals common to the two continents. Certainly the sculptured plates of the Texas and Oklahoma animals resemble closely those of *G. clavipes,* but this does not preclude differences in other parts. The South American species *G. asper* and *G. elongatus* of Burmeister's monograph are regarded by Lydekker as identical with *G. clavipes.* On comparing some of the upper teeth of the Hunt County specimen with Burmeister's figure of *G. elongatus* and *G. asper* differences are observed which are probably specific. The same may be said of some parts of the skull and skeleton. The sculptured tube enclosing the caudal vertebrae of the North American specimens has not been discovered and this may be peculiar.

Since the above was written other portions of the skeleton have been put into the hands of the writers. Among these is a fragment of the carapace found by Drs. Gould and Spier and a part of this is figured (plate III, figure 2). From Mr.

Holloman came one fragment 3.5 by 5 inches and an inch thick, and of a red color; also a triangular fragment 8 inches wide, 8.5 inches high and 1.5 inches thick. This is stained black by iron or manganese oxides and perhaps by organic matter. The central area of the rosettes is usually slightly depressed. In the specimen found in Hunt County, Texas, they are usually flat or slightly elevated, but the writers do not believe it necessary to suppose that the Frederick animal belonged to a species different from that found in Hunt County. A glyptodon described by the senior writer and found in San Patricio County, Texas, has the central areas depressed.

With the remains sent by Mr. Holloman is the damaged right side of the lower jaw. All of the teeth are missing except the sixth and seventh and these are broken off at the level below the rims of the sockets. The tooth row appears to have had about the length of that of *Glyptodon asper,* of Burmeister's plate XXVII (An. Mus. Nac. Buenos Aires, volume II, 1870-1874), 185 mm. The extreme fore-and-aft length of the sixth tooth is 28 mm.; its greatest width, 17 mm.; both dimensions greater than those of the same tooth of *G. asper.* The seventh tooth is 25 mm. long and 17 mm. wide; both dimensions being slightly greater than in *G. asper.* In general the teeth resemble those of *G. asper,* but the lobes are directed nearly perpendicularly across the sockets. The teeth present none of the characters peculiar to the genus *Glyptotherium* as described and figured by Gidley (U. S. Geol. Surv. Profess. Paper 140, p. 92, figure 4). Likewise the front of the ascending ramus appears to have made approximately a right angle with the grinding face of the teeth. In *Glyptotherium* (Gidley, op. cit. p. 140, plate XL) the angle is 56 degrees. In *G. asper* the angle is 70 degrees (Burmeister, op. cit., plate XXIV).

The writers retain the name *Glyptodon petaliferus* for the remains here described notwithstanding Dr. Simpson's ruling (Bull. Amer. Mus. Nat. Hist., volume LVI, p. 583) that it is a *nomen nudum.*

Felis sp. indet.

C.M.N.H. No. 1143.

In the collection made in the Holloman gravel pit and now in the Colorado Museum of Natural History is the basal half of the first phalange of the third toe of the left hind foot. When compared with the corresponding bone of the puma the fossil is found to be larger. Measured at the distance of an inch from the near end the transverse diameters are respectively 14.5 mm. and 12.5 mm.

Equus complicatus Leidy

C.M.N.H No. 1086. Plate II, figures 2-4; Plate III, figure 3.

In the collection made in Holloman's gravel pit, at Frederick, Oklahoma, are five large upper cheek teeth and a part of the left side of the lower jaw containing the second premolar (pm_2), referred to *Equus complicatus.* All of these are thoroughly mineralized, heavy, and of stony hardiness.

Of the upper cheek teeth two are premolars. One (C.M.N.H. No. 1086. plate II, figure 3) is the left fourth. The height is about 72 mm.; the length of the grinding surface, 30 mm.; the width 30 mm.; the width of the protocone, 13 mm. The postprotoconal valley has a deep caballine fold at its head. The enamel of the fossettes is well plicated. The tooth, numbered 1096, is little worn, the height being 95 mm. on the outer face. The fossettes are not yet wholly separated. It, too, is probably a hindmost premolar, but not of the same individual as No. 1086. The grinding face is 30 mm. long and 29 mm. wide. The protocone is 16.5 mm. wide. The postprotoconal valley has a deep caballine fold at its head and nearer the protocone a smaller one. The styles of the outer face are 7 mm. wide. The crown is curved, the front and the outer faces convex. It differs from the tooth No. 1086 in having wider styles and wider protocones. It is possible that this tooth belongs to *Equus holmesi,* (Hay, Proc. U. S. Nat. Mus., volume LVIII, 1920, p. 119, plate VII, figures 9-12).

A right molar (C.M.N.H. No. 1089) probably the first, is worn down to a height of about 50 mm. The length of the grinding face is 29 mm.; the width, 30 mm.; the protocone 16 mm. The enamel of the fossettes is strongly folded and there is a deep caballine fold in the postprotoconal valley. The tooth numbered 1088 is a much worn left molar, probably m^1. A hindmost upper left molar, No. 1087, is little worn. At half the height the fore-and-aft length of the outer face is 30 mm.; the width of the tooth at this level, 26 mm.; the protocone, 15 mm.

The fragment of the left ramus (C.M.N.H. No. 1100) includes a part of the symphysis. The distance of the rear of this from a perpendicular drawn from the front of the premolar to the lower border of the jaw is 36 mm. The height of the jaw at the front of this premolar is 55 mm. The upper border in front of the premolars is sharp, thus differing from No. 615.

In front of the second premolar is a small hole which may have lodged the root of a minute first premolar. The crown of the second premolar is only about 40 mm. high. The length of the grinding face is 40 mm.; the width is 15 mm. This tooth differs only slightly in width from others referred to this species (Iowa Geol. Surv., volume XXIII, 1914, p. 162, figure 54). Other teeth figured in the volume cited are considerably wider. In the simple arrangement of the enamel the tooth just described differs much from the corresponding one of the jaw found on Red Bank Creek (C.M.N.H. No. 615). The tooth cited from the Iowa Survey volume is in some degree intermediate in complication of enamel between Nos. 615 and 1100. To *Equus complicatus* is referred likewise a part of the left side of a lower jaw containing the two hindmost molars (plate II, figure 4) which was found at Mr. Holloman's gravel pit. It has the catalogue number 1099. The lower border of the jaw is broken away and the fragment is only 175 mm. long. The bone and the teeth are of a stony hardness. The molars are worn down to less than one-half their original height. The grinding face of the second molar is 27 mm. long and 15 mm. wide, the cement not included. The same face of the third molar is 35 mm. long and 14.5 mm. wide. The plication of the enamel is simple.

In the collection is a part of an equine lower jaw which was found in Red Bank Creek, 18 miles below Colorado, Texas (C.M.N.H. No. 615, plate III, figure 3).

This presents the symphysis with four incisor teeth and a part of the right ramus with two premolars (pm_2 and pm_3). The bone is devoid of animal matter, but is not highly mineralized. The animal was a young adult, inasmuch as the second and third incisors of each side were hardly yet out of the bone. The premolars (plate II, figure 2) are little worn. The animal appears to have been a large and heavy-boned one. At the front of the first premolar present (pm_2) the height of the jaw is 74 mm.; in an unusually large domestic horse (No. 174,960 of the U. S. Nat. Mus.) the corresponding height is only 67 mm. At the rear of pm_3 the height is 95 mm.; in the large domestic horse, 86 mm. At the middle of the space between the front premolar and the rear of the symphysis the bone is 21 mm. thick; in the domestic horse, 18.5 mm. The front of the jaw is unusually short. The distance from the front of pm_2 to the upper incisive border (130 mm.) contains the length of the grinding face of the two premolars (74 mm.) 1.75 times; in the domestic horse the same comparison gives 2.31 times. In the fossil the symphysis is 90 mm. long; in the domestic horse, 105 mm. The anterior premolar (pm_2) is 72 mm. high; the length near the grinding face is 38 mm.; the width is 15 mm., the cement layer excluded. The next premolar (pm_3) is 85 mm. high, 34 mm. long on the grinding face, and 15 mm. wide. In the domestic horse used for comparison the corresponding measurement of the length and width of the grinding face of pm_2 are 36 mm. and 16 mm.; of pm_3, 30 mm. and 19 mm. The teeth of the fossil are seen to be much thinner than in *E. caballus*.

An apparently important character of this fossil horse is observed in the complication of the enamel of the premolars, especially in the hinder lobe, as shown on the grinding face (plate II, figure 2). The expansion of the hinder inner valley fore-and-aft along the middle of the grinding face presents 6 or 7 outwardly directed loops of enamel. The enamel of the anterior inner valley is somewhat less folded. A similar complication of the enamel is seen in milk molars referred to *Equus scotti* (Hay, Iowa Geol. Surv., volume XXIII, p. 157, figure 70); also in *E. fraternus* (Hay, Proc. U. S. Nat. Mus., volume XLIV, p. 573, figure 6).

The incisors are broad and deeply cupped and on the front face of each is a deep groove. The width of the first incisor is 19 mm.; that of the second, 20 mm. They narrow toward the bases. The teeth are referred provisionally to *E. complicatus*.

Equus littoralis Hay

C.M.N.H. No. 616. Plate II, figures 5, 6; text-figure 2.

In the collection is a part of the right ramus of a lower jaw of a small horse. This was found in the "bison quarry," on Lone Wolf Creek, near Colorado, Texas. The fragment is about 140 mm. long (plate II, figure 6) and contains three premolars (pm_2—pm_4) and two molars (m_1—m_2). These teeth are worn down to about one-half their original height. The length of the five teeth on the grinding surface is 102 mm.; that of the premolars is 63 mm.

The following table gives the measurements of the individual teeth:

MEASUREMENTS OF LOWER TEETH IN MILLIMETERS

Teeth	Length on grinding face		Width on grinding face	
	E. littoralis	E. francisi	E. littoralis	E. francisi
Pm_2	22	----	12.5	------
Pm_3	20	----	13	------
Pm_4	20	22	14	14.5
M_1	18	20	12.5	13
M_2	19	20	11.5	12.5

In the table are shown the measurements of the teeth of *Equus francisi* (Proc. U. S. Nat. Mus., volume XLVIII, 1915, p. 539). It will be observed that the lower teeth of the latter are both longer and wider than the grinding faces of the corresponding teeth of the Lone Wolf Creek specimen, but not greatly so. The arrangement of the lines of enamel in the two specimens differs slightly. The height of the jaw at the front of the first molar is 70 mm. in *E. francisi*; in the jaw from Lone Wolf Creek, 68 mm.

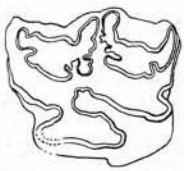

Figure 2. Upper left second molar of *Equus littoralis*. X 1

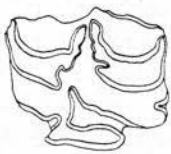

Figure 3. Upper left second molar of *Equus achates*. X 1

At a place a few yards above the "bison quarry" was found an upper left second molar (C.M.N.H. No. 623-A) of a small horse (plate II, figure 5). It too, is worn to about half height. It also has lost the outer enamel face. The grinding surface is 21.5 mm. long; the width must have been about 19 or 20 mm. The width of the protocone is 12 mm. The postprotoconal valley is narrow and has near its head a very small caballine notch. The enamel of the fossettes is considerably plicated, somewhat more than in the type molars of *Equus littoralis* (Proc. U. S. Nat. Mus., volume XLIV, p. 575, figures 17, 18). In size and other respects the tooth agrees so well with *E. littoralis* that it is referred to this species. Inasmuch as the lower jaw described above was found at the same locality it, too, is believed to belong to *E. littoralis*. There are no lower teeth of *E. littoralis* with which the teeth of the little jaw, No. 616, may be compared.

Text-figure 2 shows the structure of the enamel of the tooth No. 623-A. For this figure the writers' thanks are due to Dr. Childs Frick, of the American Museum of Natural History, New York.

Equus achates sp. nov.

C.M.N.H. No. 1085. Plate I, figure 4; text-figure 3.

In Holloman's gravel pit at Frederick, Oklahoma, was found a tooth of a small horse to which has been given the catalogue number 1085 of the Colorado Museum of Natural History. It is reported as found in the lowest stratum. It is identified as the second upper molar of the left side, (plate I, figure 4). It has lost the enamel of the outer face, but is otherwise uninjured. It is silicified and the space between the enamel of the fossettes and that of the outer face is mostly occupied by a layer of agate. The enamel of the other faces is of a chestnut brown color. The tooth had only begun to be worn at the death of the animal. It is strongly curved, so that the outer face and the front face are convex. The height measured on the outer face and in a straight line is 83 mm.; on the inner face only about 70 mm. The front-to-rear diameter is 20 mm.; the transverse was nearly the same. The width of the protocone is 9 mm. The enamel of the fossettes is moderately folded on the sides adjacent to each other, but on a section 25 mm. from the grinding surface, the course of the enamel becomes much simpler, as is shown by text-figure 3, kindly furnished by Dr. Childs Frick, of the American Museum of Natural History, New York.

Another tooth of doubtless the same species has been loaned the writers by Mr. Holloman. It was found in the gravel pit at Frederick. It is apparently a molar, probably the first, of the right side. It belonged to a horse of about the same age as that which furnished the type. It is somewhat less strongly curved. The enamel of the outer face is missing and a part of the protocone. The width of the outer face at one-half the height is 23 mm. No other differences appear. The tooth is not silicified.

The writers know of no described fossil molar so high, slender, and strongly curved. The tooth No. 623, described under *E. littoralis,* is quite different from the molar here described. The enamel is more complicated and the postprotoconal inlet terminates more abruptly. The writers propose to give the tooth No. 1085 a distinctive specific name. This may offer an opportunity to some future student to reduce it to synonomy.

Equus pacificus Leidy

In a collection of bones and teeth found in his sand pit near Frederick and loaned the writers by Mr. Holloman is a large left upper second premolar which is referred to *Equus pacificus.* The tooth was directed in its socket strongly downward and backward, as is shown by the obliquity of the grinding surface to the body of the tooth. It is also distinctly curved, so as to make the outer face convex, the inner face concave. The height of the tooth on the outer face is 81 mm. The length of the grinding face is 45 mm.; the greatest width is 28 mm., excluding the cement. At a higher level the width is 30 mm.

The enamel of the fossettes does not present the complexity that is seen in Gidley's figures (Bull. Amer. Mus. Nat. Hist., volume XIV, p. 117), but a section taken at a higher level would probably show more folding. The diameter of the protocone is 13 mm., slightly less than in the figures cited.

The animal was certainly considerably larger than the existing horse.

Equus sp. indet.

C.M.N.H. No. 1090. Plate II, figures 7, 8.

In the collection made at Frederick, in a gravel pit one-half mile north of the Holloman pit, are two fragments of two different lower jaws. One of them (C.M.N.H. No. 1090, plate II, figure 7) contains three premolars (pm_2—pm_4). The bone and the teeth are thoroughly fossilized. The animal was an old one, as the teeth are worn down to less than an inch of their roots. The length of the three molars is 93 mm. The length of the grinding surface of the second molar (pm_2) is 33 mm.; the width, without the cement, is 15 mm.; of the third premolar, 29.5 mm. and 16 mm.; of the fourth, 28 mm. and 16 mm. Some peculiarities are noted in these teeth. In the second premolar the enamel of the anterior inner valley is complicated. The fold is broad, and from its middle the enamel is returned to the inner border of the crown, thus producing an M-like complex. In the third and fourth premolars the inner end of the outer valley is turned forward in an unusual way (plate II, figure 7).

From the same locality as that furnishing C.M.N.H. No. 1090 was obtained a fragment of the right side of a horse's lower jaw containing the three molars, (C.M.N.H. No. 1091, plate II, figure 8). On one side of this jaw is a piece of the matrix composed of sand cemented together by carbonate of lime and very hard. The bone of the inner side of the jaw is gone, thus laying bare the crowns and roots of the teeth. The length of the three molars along the grinding faces, is 80 mm. The following were the measurements of these teeth: m_1, height 45 mm.; length 24.5 mm.; width 15.5 mm.; m_2, height 55 mm.; length 24 mm.; width 15 mm.; m_3, height 60 mm.; length 28 mm.; width 13 mm. The third molar as it descends into the jaw is curved strongly backward.

It might be supposed that these two fragments belong to the same species, but there is apparently too great a difference in the sizes of the teeth; also the arrangement of the enamel bands is quite different in the two sets. In No. 1091 the outer valley is not turned so much forward, and on the inner face the infold of enamel between the metaconid and the metastylid is deeper. For the present the specific identity of the two jaws must be left undecided. A few other teeth, lower premolars or molars and some incisors, are present, but are not specifically determinable.

Among the bones loaned the writers by Mr. Holloman is a right hind third metatarsal of an undetermined species of horse. The measurements are here given, together with those of the same bone (Cat. No. 11,233, U. S. Nat. Mus.) collected at Summer Lake, Oregon, and probably belonging to *Equus pacificus*.

Measurements of Metatarsals of Fossil Horses

	Equus sp. indet.	Equus pacificus
Length on outer border	292.0	288.
Width at upper end	51.5	61
Side-to-side diameter at middle of length	37	42
Fore-and-aft at middle of length	35	39
Width of distal articulation	50	57

It will be seen that while the length of the two bones is almost the same, the Oklahoma horse had much slenderer limbs than those of the Oregon animal.

Since the above was written, a number of fossil horse bones, of various unidentified species, including disassociated teeth, metapodials, limb bones, foot bones and vertebrae from the Frederick pits, found by Mr. Holloman, have been examined by the junior writer. It is obvious from these that wide differences of size and type are present. As Mr. Holloman is continually finding new materials, and saving them, at some later date it will be possible to make more comprehensive studies of this material, and add greatly to our knowledge of this important fauna. We do not wish to delay further the publication of this report to include studies of this material herein.

Tapirus haysii Leidy

Plate IV, figure 3.

Mr. Holloman sent the writers a fragment of the right ramus of a large tapir which was found in the gravel pit at Frederick. This contains two milk molars and their uncut successors and the first true molar. There remain also a part of the socket for the second molar and a part of the second premolar, which must have been about ready to appear. The outer wall of the bone has been removed temporarily so as to expose the teeth (plate IV, figure 3). It will be seen that the roots of the third premolars were pretty well developed; those of the fourth one had hardly begun to form. The roots of the third milk molar were partly absorbed; those of the fourth were yet untouched. It is doubtful whether the second milk molar had yet been lost. The crowns of the exposed teeth are somewhat damaged. Those of the two milk molars present are slightly worn. The crown of the first true molar had not yet begun to wear. The outer cone of the anterior loph is broken away and a part of the inner one. The following are the measurements secured from the teeth:

Measurements of Teeth

Teeth	Length	Width
Second milk molar	25	18.5
Third milk molar	26	21.4
Third premolar	27	-----
Fourth premolar	26	-----
First true molar	27.5	23.5

The type tooth of *Tapirus haysii* (Leidy in Holmes' Post-Pliocene fossils of S. Car., p. 106, plate XVII, figures 7, 8) is only slightly smaller.

From the Pleistocene of Vero, Florida, Dr. E. H. Sellards described a complete skull (lacking the lower jaw) of a tapir which he named *Tapirus veroensis* (10th and 11th Ann. Rep. Fla. Geol. Survey, pp. 57-70, plates I-IV). The senior writer has before him a well-made cast of this skull and a good cast of the upper jaws of the specimen from Port Kennedy, Pennsylvania. Dr. Sellards compared the meas-

Amyda emoryi Agassiz

C.M.N.H. No. 1141.

In the collection made at Frederick by the Colorado Museum of Natural History is the right femur of a small soft-shelled tortoise which can not be distinguished from that of *Amyda emoryi* (Agassiz). It belonged to an immature individual, the total length direct from the head of the femur to the distal end being only 39 mm. The length of the corresponding bone of a specimen from Phoenix, Arizona, whose carapace is 156 mm. long is 49 mm. In other respects the two bones agree closely. The carapace of the fossil was probably close to 120 mm. long.

Testudo? sp. indet.

Among the bones collected by Mr. Holloman in his sand pit are a few fragments of a species of land tortoise belonging probably to the genus *Testudo.* Some of the pieces are an inch thick. The animal must have been a large one.

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Description of Plates

PLATE I.

Figs. 1, 2. *Mylodon harlani* Owen.

(1) Upper left fourth molar. X 1
The grinding surface is directed upward; the border next the cheek is on the left side of the figure; the front and inner faces are toward the observer.

(2) Left humerus presenting the front face. X .32.
The outer border of the bone is on the right side of the figure.

Fig. 3. *Glyptodon petaliferus* Cope.
A single plate of the armor covering the body. X 1

Fig. 4. *Equus achates* sp. nov.
Upper left second molar, presenting the front face. X 1

Fig. 5. *Camelops niobrarensis?* Leidy.
Metapodial, presenting rear face. X .32

PLATE II.

Fig. 1. *Lama? hollomani* Hay and Cook.
Left heel bone seen from inner side. X .66

Figs. 2-4. *Equus complicatus* Leidy. X 1

(2) Lower right second and third premolars, presenting the grinding faces.

(3) Upper left fourth premolars, showing the grinding face.

(4) Lower left second and third molars, showing grinding faces.

Figs. 5, 6. *Equus littoralis* Hay. X 1

(5) Upper left second molar, grinding face. Details not well shown.

(6) Lower right second premolar to second molar.

Figs. 7, 8. *Equus* sp. indet. X 1

(7) Lower left second, third, and fourth premolars.

(8) Lower right first to third molars.

PLATE III.

Fig. 1. *Elephas haroldcooki* Hay.
Lower jaw and hindmost molar. Type. X 5

Fig. 2. *Glyptodon petaliferus* Cope.
Part of armor covering the body. X 1

Fig. 3. *Equus complicatus* Leidy.
Part of lower jaw and teeth. X .32

PLATE IV.

Fig. 1. *Lama? hollomani.*
Portion of lower jaw, inner face. X 8

Fig. 2. *Stegomastodon* sp. indet. X .92
View of grinding face. Front end is directed downward.

Fig. 3. *Tapirus haysii* Leidy.
Part of right lower jaw seen from outside. Bone removed, exposing roots of two milk molars and of first molar; also the third and fourth premolars not yet cut. X .8

PLATE V.

Fig. 1. *Elephas haroldcooki* Hay.
Lower right hindmost molar. X 1
Shows grinding surface.

Figs. 2, 3. *Camelops niobrarensis* Leidy.
(2) Second right lower incisor, rear face. X 1
(3) Same incisor with outer border toward observer. X 1

PLATE VI.

Figs. 1, 2. *Lama? hollomani* sp. nov. Type. X 1
(1) Hind cannon bone, upper end, showing rear face.
(2) Same bone, lower end, showing front face.

Fig. 3 *Bison texanus* Hay and Cook. Type.
Upper right premolars and molars, presenting outer faces. X 1

PLATE VII.

Figs. 1, 2. *Simobison figginsi* Hay and Cook. Type.
(1) View of skull from right side.
(2) View of skull from in front.
Both figures are much reduced.

PLATE VIII.

Upper and Lower Teeth of Bison. X 1

Figs. 1, 2. *Bison taylori* Hay and Cook.
(1) Right upper fourth premolar and the three molars.
(2) Right lower three premolars and the three molars.

Figs. 3-5. *Bison texanus* Hay and Cook.
(3) Upper right premolars and molars.
(4) Lower right premolars and molars.
(5) Front premolar of the left side in good condition.

PLATE IX.

Figs. 1-2. *Bison texanus* Hay and Cook. Type.

(1) View of skull from left side.
The diameter of the horn-core is proportionately considerably increased because of the nearness of the camera.

(2) Front view of skull.

(3) View of skull from behind.
All three figures much reduced.

PLATE X.

Fig. 1. *Bison* sp. indet. No. 1237.
Front view of skull.

Figs. 2, 3. *Bison taylori* Hay and Cook. Type.

(2) Front view of skull.

(3) Rear view of skull.
Figures much reduced.

PLATE XI.

TEETH OF BISONS. X 1

Fig. 1. *Bison texanus* Hay and Cook.
Lower right premolars and molars, seen from outside.

Figs. 2, 3. *Bison bison* Linnaeus.

(2) Upper premolars and molars of right side.

(3) Lower premolars and molars of right side.

PLATE XII.

Figs. 1, 2. *Gomphotherium priestleyi* sp. nov.
Lower right second molar. Type. X 1

(1) Seen from above.

(2) Seen from the rear.

PLATE XIII.

Elephas haroldcooki Hay. Type.
Outer face of horizontal part of lower jaw. X .5

PLATE XIV.

Elephas haroldcooki Hay. Type.
Inner face of hindmost lower right molar. Shows 7 plates. Rear toward the right. X 1

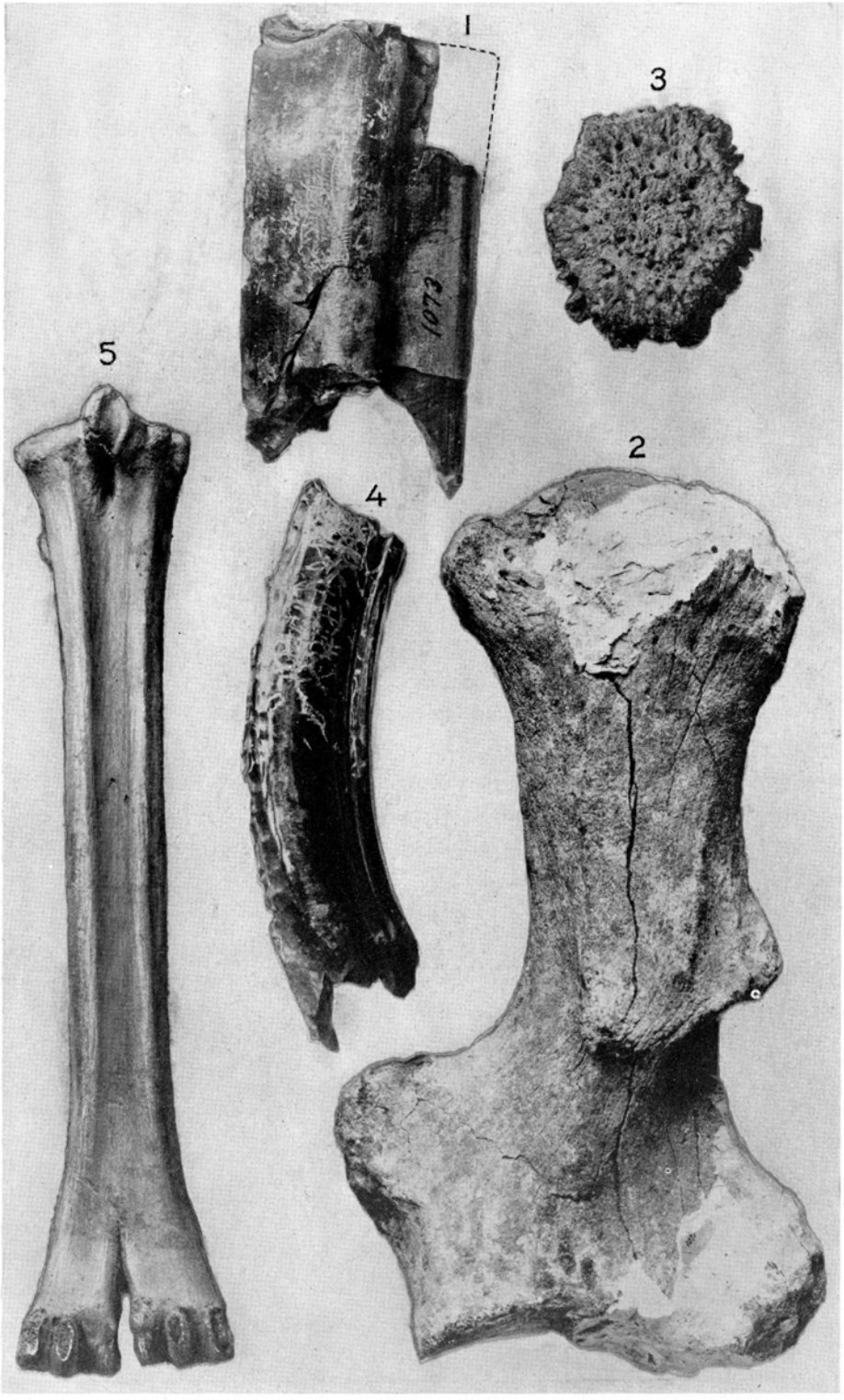
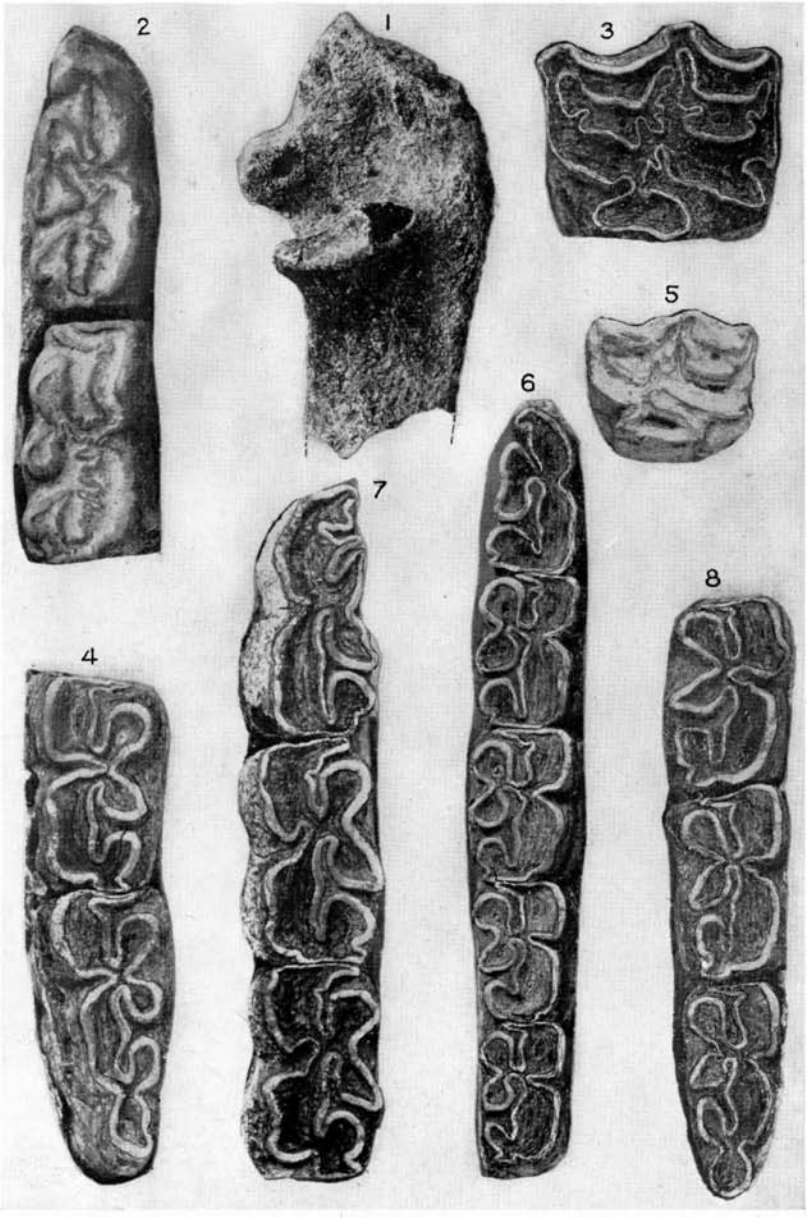


PLATE I



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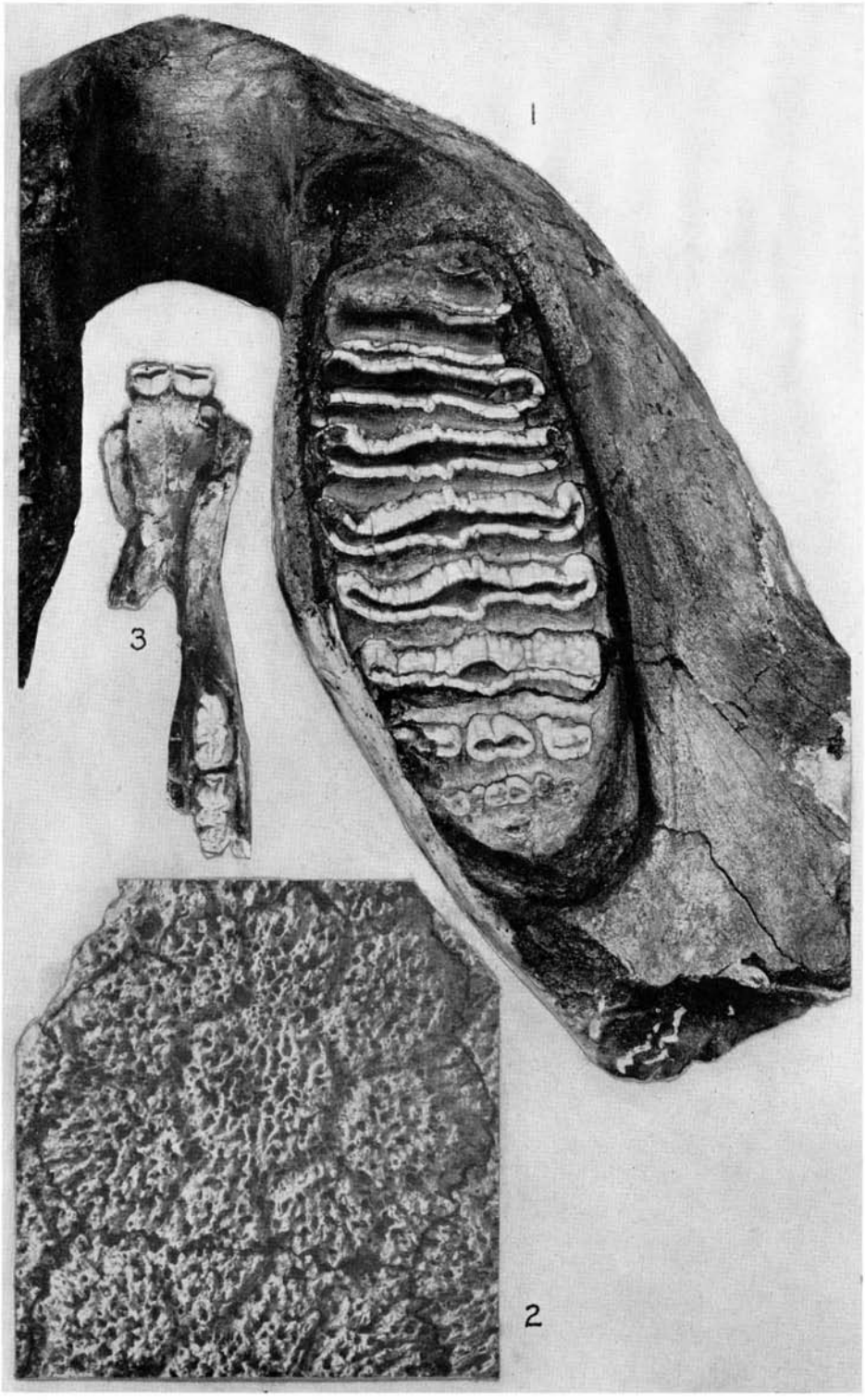

PLATE III

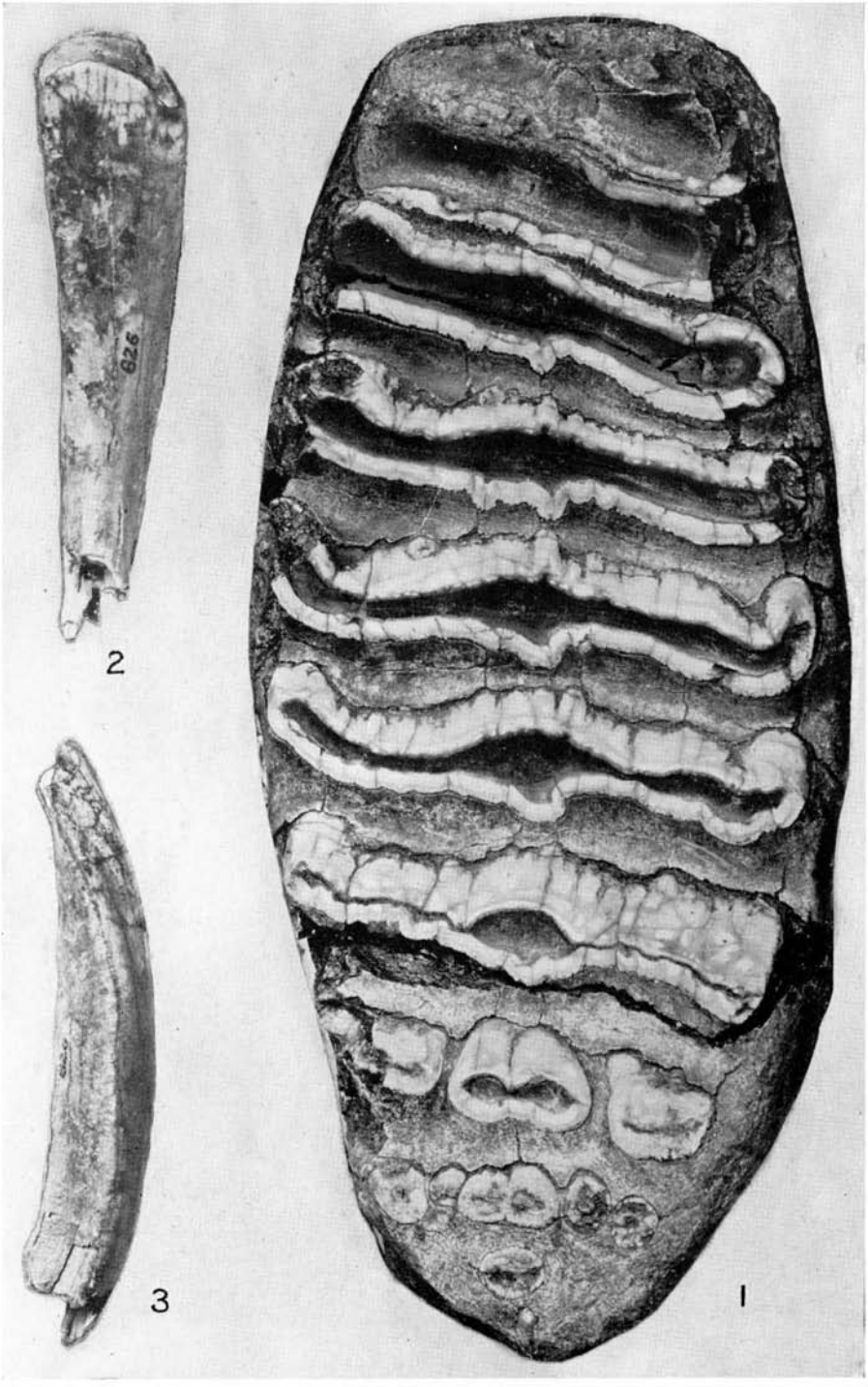

PLATE V