

DESCRIPTIONS OF SOME PLEISTOCENE VERTEBRATES FOUND IN THE UNITED STATES.

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In the following paper the writer describes the materials found in six collections of fossil vertebrates. Most of these collections were made many years ago and have lain in various museums unstudied. Two collections came from eastern Tennessee, one of them from Rogersville, Hawkins County, the other from Whitesburg, Hamblen County. A third collection was made at Cavetown, Washington County, Maryland, by Dr. Charles Peabody and Mr. Warren K. Moorehead, of the department of archaeology in Phillips Academy, Andover, Massachusetts. The fourth collection is one that was gathered from the loess at Alton, Illinois, some time before 1883, by Hon. William McAdams, of the city named. The fifth collection is that obtained in a sulphur spring near Afton, Oklahoma, by Prof. W. H. Holmes, head curator of anthropology in the United States National Museum. A few of the larger species of this collection have been described by Dr. F. A. Lucas, in papers of several years ago. The sixth collection was made in 1915 for the writer, from a cave situated near the village of Bulverde, Bexar County, Texas, and is now the property of the United States National Museum. It will be seen that the localities are scattered over a wide range of country, and, as a consequence, the collections furnish a considerable variety of species. So far as the writer can determine they consist mostly of animals that lived at about the middle of the Pleistocene period. Most of the remains found in the spring at Afton, Oklahoma, are regarded as belonging to animals that lived during the Aftonian interglacial stage, but it is not unlikely that others got buried there at later times, some possibly near or in the Recent.

1. COLLECTION FROM NEAR ROGERSVILLE, HAWKINS COUNTY, TENNESSEE.

This collection consists of a few bones and teeth which were sent to the Smithsonian Institution in 1887, by Mr. James W. Rogan, of Rogersville. They were reported as having been found in the marble

quarry of Messrs. Hounshell, Pierce & Co., situated a little more than 1 mile north of Rogersville. The fossils are all of Pleistocene age and they were doubtless buried in crevices in the marble. The matrix that is attached to some of the bones is the red earth characteristic of cave deposits. Only two species are recognized, *Equus leidyi* and *Platygonus setiger*, a species regarded as new.

Family EQUIDAE.

EQUUS LEIDYI Hay.

A single tooth of a horse accompanies the collection—an upper right first or second true molar. Its antero-posterior diameter is 26 mm. its width 24 mm. It has the catalogue number 520 of the United States National Museum.

Family TAYASSUIDAE.

PLATYGONUS SETIGER, new species.

Plate 3, figs. 21-23.

Type specimen.—A lower right canine, with most of the crown missing. Cat. No. 519, U.S.N.M.

Type locality.—Hawkins County, Tennessee.

Type formation.—Pleistocene.

Diagnosis.—A large species. Section of crown at base a nearly equilateral triangle. The outer face convex, with broad low ridges on the outer face of the crown. Inner face with a groove along the middle of the width and with a ridge in front and behind the groove. Root with longitudinal grooves and ridges on each lateral face; the hinder face occupied by one broad deep groove.

There is in the collection from Rogersville a part of a large lower left canine (Cat. No. 519) of a peccary, which is here named *Platygonus setiger* (pl. 3, figs. 21-23). Nearly the whole of the crown is missing, but the freshness of the break indicates that the collector did not preserve the missing part. Also a little of the extremity of the root is broken away. The length of the portion of the tooth preserved, measured along the anterior border, is 114 mm. Evidently the tooth belonged to a fully grown, but not aged, individual. The curvature is about the same as in *Platygonus compressus*. The section of the crown at the break is triangular. The inner face is flat and 14 mm. wide; the hinder face, slightly concave (due partly to wear against the upper tooth) and 15 mm. wide; the outer face, convex and 18.5 mm. wide. The front of the tooth presented a subacute edge. The hinder face of the root has a broad channel throughout its length. The inner face is flat, rounding off behind into the hinder face. All of the faces are grooved and ridged. The writer has

described a crown of a lower canine of a large peccary¹ as *Mylahyus? temerarius*. This crown, however, was broadly rounded in front, and therefore quite different from the tooth from Rogersville.

The limb bones of a peccary from Rogersville are referred provisionally to this species. They consist of a left humerus, lacking the upper end; a shaft of a right humerus; a left radius, lacking the distal end; a right astragalus; and the distal end of a metapodial, lacking the epiphysis. These have the catalogue number 518. The humerus lacks the upper end down to where the ridge ascending to the ulnar tuberosity leaves the deltoid ridge. The distance from the extreme end of the inner condyle to the surface of the head must have been not far from 190 mm. The deltoid ridge is sharp. The humerus, at its upper end, as preserved, has an antero-posterior diameter of 42 mm.; the shorter 20 mm. At the middle of the presumed original length the longer diameter is 28 mm.; the shorter 22 mm. The width of the articular surface for the forearm is 37 mm.; the fore-and-aft width of the inner condyle, 48 mm. These dimensions are not greatly different from those obtained from humeri of skeletons of *Platygonus compressus* found at Columbus, Ohio, and now in Yale University.

The radius fits accurately to the humerus just described. The length down to the epiphysial surface is 134 mm. The original length must have been close to 148 mm. The width at the upper articulation is 31 mm.; the greatest diameter at the middle of the length, 19 mm. The bone is nearly straight, not bent as in the existing peccary.

2. COLLECTION MADE NEAR WHITESBURG, TENN.

The collection below described appears, from correspondence in the office of correspondence and documents in the United States National Museum, to have been made in 1885 by Ira Sayles, who was then a collector for the United States Geological Survey. The only record regarding the locality is found written in pencil on the bottom of a paper tray which was with the collection. It runs thus: "One mile north of Whitesburg, Hamblen Co., Tenn., in a kind of koechenmiddens. Probably an old fortification. Sayles." From the correspondence referred to above it is shown that in 1885 Sayles sent a collection of shells from Strawberry Plains, in the next county west of Hamblen.

With the collection are some chunks of the matrix which contained the fossils. This proves to be the red earth which forms in the bottom of caves. These pieces of matrix are crowded with fragments of bones. The earthy material is reddish brown in color.

¹ Iowa Geol. Surv., vol. 23, p. 227, pl. 21, figs. 1, 2.

Evidently the cave is no longer in existence, having probably been eroded away, while its floor was in some way protected from erosion. The following species have been determined in the collection. Those marked with a dagger are extinct.

† <i>Testudo munda</i> , new species.	<i>S. carolinensis</i> .
† <i>Equus leidyi</i> .	<i>Tamias striatus</i> .
† <i>Equus littoralis</i> .	<i>Marmota monax</i> .
† <i>Tapirus tennesseae</i> , new species.	<i>Castor canadensis</i> .
† <i>Mylohyus nasutus</i> .	<i>Neotoma pennsylvanica</i> .
<i>Odocoileus virginianus</i> .	<i>Microtus pennsylvanicus</i> .
† <i>Sangamona fugitiva</i> , new genus and species.	<i>Lepus americanus</i> .
<i>Cervus canadensis</i> .	<i>Ursus floridanus</i> .
† <i>Elephas primigenius</i> .	<i>Procyon lotor</i> .
<i>Sciurus hudsonicus</i> .	† <i>Aenocyon ayersi</i> ?

Twenty species are determined, of which eight are extinct. Possibly materials that are referred to existing species would, if better represented, prove to belong to extinct forms; but they would, at least, be closely related to those recognized.

Family TESTUDINIDAE.

TESTUDO MUNDA, new species.

Plate 3, figs. 1-3.

Type specimen.—Fragments of carapace and plastron. Cat. No. 8944, U.S.N.M.

Type locality.—Whitesburg, Hamblen County, Tennessee.

Type formation.—Pleistocene.

Diagnosis.—A species rather small for the genus. Seventh peripheral with border thickened and recurved; the ninth with border slightly recurved; the marginal scutes not extending to its upper border; plastron thick at center of hinder lobe.

Among the materials from Whitesburg are fragments of both the carapace and the plastron of a tortoise which appears to have belonged to the genus *Testudo*. The principal pieces are illustrated on plate 3. The elements present are part of the left second peripheral; the right first rib plate; the right seventh peripheral; the right ninth peripheral; a fragment of a rib, probably the seventh; a piece of the left hyoplastral bone; a part of both hypoplastrals, coming to the midline; and a piece of each of the xiphiplastrals, meeting at the midline. In the United States National Museum these bones have the catalogue number 8944. These bones show that the animal had a rather thick and heavy shell. The length of the carapace is estimated to have been not far from 135 mm.

The left second peripheral (pl. 3, fig. 1) lacks its inner half. The length along the free border is 17 mm.; the greatest thickness of the bone is 7 mm. The bone is only slightly recurved upward. The right seventh peripheral (pl. 3, fig. 2) is 18 mm. long and 15 mm. high. Its upper and anterior corner is broken off. Seen from within, the anterior part is occupied by a part of the sternal chamber. The anterior part presents the buttress which rose to meet the sixth rib. A part of the buttress is split off, but there is left a pit for the distal end of the rib. The edge which articulated with the hypoplastron is thin and sharp, so that the union of the two bones appears to have been weak, at this point at any rate. The right ninth peripheral is intact. It is 14.5 mm. long, 16 mm. high, 5.5 mm. thick in front and a little thinner behind.

The right first costal plate lacks about the distal half. It is 21 mm. wide. The proximal end is occupied by parts of the first and second vertebral scutes. The other rib fragment by its narrowness appears to indicate the usual alternation of wide and narrow costals. The elements of the hypoplastron appear to have come forward nearly to the hyohypoplastral suture. It is believed that the bone on the right side (left of the figure) reached the suture mentioned. As shown by the figure (pl. 3, fig. 3) there is a fragment of the xiphiplastron which belonged to the free border, but just how near it approached the remainder of the xiphiplastral is uncertain. The plastron is about 9 mm. thick at the crossing of the hypoxiphiplastral suture and the median one; but it thins rapidly in all directions. The lower surface of the hypoplastron presents ridges and grooves due to the growth of the horny plates. The greater part of the surface of the carapace is smooth, but a fragment of one peripheral displays ornamentation.

Family EQUIDAE.

EQUUS LEIDYI Hay.

In the Whitesburg collection there is an upper right second premolar of a horse which is referred to this species (U. S. Nat. Mus. No. 8945). It is worn down to about one-half of its original length, and the anterior style is broken off. The height of the crown is 42 mm.; the width across the worn face at the posterior outer style, 25 mm. The length of the grinding surface was probably close to 35 mm. When compared with a corresponding tooth of *Equus complicatus*, from the region about Charleston, South Carolina, the Whitesburg tooth is seen to be considerably smaller. There is present also a part of an uncut milk molar of a horse, probably *E. leidyi* (Cat. No. 8946).

EQUUS LITTORALIS Hay.

In the collection there is a lower tooth of the right side of the jaw of a small horse (Cat. No. 8947). The crown is worn down nearly to the base, the height being only 17 mm. and the roots are absorbed. The length of the crown is 22 mm.; the width in front, 13 mm.; at the rear, 11.5 mm. The outer median valley is pushed inward between the contiguous ends of the two inner valleys. The small size of this tooth makes it probable that it belonged to *Equus littoralis*, being too small for either *E. complicatus* or *E. leidyi*.

There are two incisors of a colt, which, on account of the small size as compared with those of the young of the domestic horse, are referred to *E. littoralis* (Cat. No. 8948). They are very little worn. The larger has the crown 17 mm. high on the front face, 20 mm. wide at the cutting edge, and 11 mm. wide at the base. The smaller is somewhat more worn, is 13 mm. high, 16 mm. wide on the cutting edge, and 10 mm. at the base. The roots of both teeth have been gnawed off by rodents.

Family TAPIRIDAE.

TAPIRUS TENNESSEAE, new species.

Plate 3, figs. 4-11.

Type specimen.—Ten teeth, Cat. No. 8949, U.S.N.M.

Type locality.—Whitesburg, Hamblen County, Tennessee.

Type formation.—Pleistocene.

Diagnosis.—Size probably smaller than in *T. terrestris*. Parastyle feeble, no tubercles at ends of valleys of lower teeth.

In the collection are 10 teeth, which belonged to a young tapir. These consist (as the writer identifies them) of an incisor; a right third upper premolar, showing extremely little wear, having a large pulp cavity and no roots; the front lobe of the right fourth premolar, slightly worn; the hinder lobe of the upper left first molar, with a band of attrition on the front of the transverse ridge; a nearly complete crown of the upper right second molar, with the anterior border gone, having a large pulp cavity and slight wear; the lower left second premolar, slightly worn and injured; the lower right third premolar, touched slightly by attrition; the right fourth premolar which had not yet been cut; the lower right second molar, without roots, with a large pulp cavity, and some wear on hinder faces of the ridges; the front lobe of the corresponding tooth of the left side; and the as yet uncut lower left hindermost molar. They have the catalogue number 8949. These have been compared closely with the corresponding teeth of a specimen of *Tapirus terrestris*, from Guatemala (No. 61221 of the United States National Museum)

and with the teeth of *Tapirus veroensis*, as described by Sellards.¹ The following measurements are presented. The figures in parentheses represent the widths of the hinder lobe of the first upper molar of the three species.

MEASUREMENTS OF TEETH OF TAPIRS IN MILLIMETERS.

	Upper teeth.			Lower teeth.		
	<i>T. terrestris.</i>	<i>T. veroensis.</i>	<i>T. tennesseae.</i>	<i>T. terrestris.</i>	<i>T. veroensis.</i>	<i>T. tennesseae.</i>
Second premolar:						
Length.....	18	18.5	.....	22.5	.....	21
Width.....	18.5	23	.....	11.5	.....	.....
Third premolar:						
Length.....	21	19	19	21	.....	22.5
Width.....	23	24	20	14.5	.....	17
Fourth premolar:						
Length.....	19.5	20	.....	21	.....	20
Width.....	24.5	26	22.5	16.5	.....	17
First molar:						
Length.....	21	21.9	.....	21.5	23	.....
Width.....	22 (20)	26(16.7)	(22.5)	16	18	.....
Second molar:						
Length.....	23	24	.....	23.5	.....	25
Width.....	25.5	28	26	17.5	.....	19.2
Third molar:						
Length.....	22	25	.....	24	.....	22.5
Width.....	24	29.3	.....	17	.....	20

It will be observed that all of the upper teeth of the Tennessee specimen are smaller than the corresponding ones of *T. veroensis*; we may hence conclude that they probably belonged to a smaller species. One of the striking characters of the upper teeth of Sellards' species is the size of the parastyle, this being nearly as large as the paracone. In the case of the teeth here described the parastyle is relatively weak. There appears to have been no exterior cingulum in the upper teeth; nor is there any tubercle between the paracone and the metacone. Likewise the inner tubercle is weak in the Tennessee teeth, but large in *T. veroensis*. The ridge which descends from the summit of the paracone to the bottom of the median valley appears to be considerably weaker than it is in *T. veroensis*. It seems to be safe to regard the tapir under consideration as distinct from *T. veroensis*.

Excepting the second molar, of which only the front border is missing (pl. 3, fig. 5), the upper teeth are all smaller than the corresponding ones of *T. terrestris*. On the other hand, the most of the lower teeth are somewhat larger. The second lower premolar (pl. 3, fig. 6), is shorter than in *T. terrestris*, but its hinder lobe is damaged. At the middle of this tooth the thickness is 12 mm.; in

¹ Tenth and Eleventh Ann. Rep. Fla. Geol. Surv., 1918, p. 57, pls. 1-4.

T. terrestris it is only 10.5 mm. In the lower teeth of the last-named species there is a tubercle at both ends of the transverse valley; in *T. tennesseae* the tubercles are wholly missing. On the plate quoted (figure 4) is the upper right third premolar. Its greatest length is 20 mm.; its width, 19.5 mm. Figure 7 represents the lower right third premolar. Its length is 22.5 mm.; its width, 17 mm. The tooth of figure 8, the lower right fourth premolar, is 20 mm. long and 17 mm. wide. A fragment is missing from the inner border in front. Figure 9 is taken to be the lower right second molar; length, 25 mm.; width, 19.2 mm.

The parastyle of the upper teeth of *T. terrestris* is more strongly developed than in the Tennessee tapir, as well as the ridge descending from the summit of the paracone. Evidently, also, the hinder transverse ridge is set farther forward in *T. tennesseae* than in *T. terrestris*, so that the postfossette is larger. The position of the incisor (pl. 3, fig. 11) has not been determined. Its crown is 12 mm. wide and 11.5 mm. from front to rear at the base, 8 mm. from front to rear of the hinder cusp, and 11 mm. high in front. *Tapirus haysii*, as represented by its teeth, was a much larger species.

Family TAYASSUIDAE.

MYLOHYUS NASUTUS Leidy.

Plate 3, figs. 12-13.

This species appears to be represented by three upper canines (Cat. Nos 8950-2, U.S.N.M.). Two of the canines are here figured (pl. 3, figs. 12, 13). These are quite different in size, but the smaller one may have belonged to a female. All of the teeth are worn, not only in front, but also near the tip, on the outer or more convex face. The large tooth has a diameter of 15 mm. at the base of the crown and a thickness of 10 mm. The inner face is nearly flat; the outer convex. Evidently the front border was broadly rounded, but the hinder border forms a sharp edge. Both lateral faces are furnished with grooves and ridges, the inner with about 8, the outer with about 10 ridges. The ridges are sharper and more distinct than in *Platygonus compressus*. This sculpture of the teeth is well shown in Leidy's figure of the type of the species.¹ From that figure it will be seen that the upper canine is strongly curved. That of *P. compressus* is not so much curved.

Family CERVIDAE.

ODOCOILEUS VIRGINIANUS (Zimmermann).

This species appears to be represented by 5 upper molars, 15 lower molars, and 1 right first incisor. No premolars are present.

¹ Journ. Acad. Nat. Sci., Phila., vol. 8, 1869, p. 385, pl. 28, figs. 1, 2.

To these teeth are given the catalogue number 8953. The most striking character of some of the teeth is the small size as compared with those of most specimens of *O. virginianus*. A lower last molar is hardly 18 mm. long; a lower first molar, 13 mm. long. The upper molars are furnished with a well-developed tubercle at the mouth of the inner valley; the lower ones each with a tubercle at the mouth of the outer valley.

SANGAMONA, new genus.

Type species.—*Sangamona fugitiva*, new species.

Type locality.—Eastern Tennessee.

Type formation.—Pleistocene.

Diagnosis.—Upper molars of medium height, broad. Outer face of anterior lobe with a feebly developed style; the outer face of the hinder lobe deeply concave and devoid of style. Lower molars relatively broad; inner faces of front and hinder lobes flat and with feebly developed styles.

This genus differs much from our other deer in the nearly complete absence of the strong ribs which occupy the outer faces of the lobes of the upper molars. If, as is supposed, the lower molars found in the loess at Alton, Illinois, belong to the same genus, the lower molars also differ from those of our other deer in having the styles on the inner faces of the lobes feebly developed. The teeth resembling most those here described are found in *Dama dama*; but here too, the style of the upper front lobe is stronger, and the outer face of the hinder lobe is not so deeply excavated; while the lower styles are well expressed.

The generic name is given in allusion to the Sangamon stage of the Pleistocene, during which this large deer is supposed to have lived.

SANGAMONA FUGITIVA, new species.

Plate 3, figs. 14–15.

Type specimen.—An upper left second molar (Cat. No. 8954, U.S.N.M.)

Type locality.—Whitesburg, Hamblen county, Tennessee.

Type formation.—Pleistocene.

Diagnosis.—Styles, or ribs, on paracone and metacone absent or obsolete. Size intermediate between the Virginian deer and the wapiti.

This supposed new species is based primarily on a single upper cheek tooth, taken to be a second true molar of the left side (pl. 3, figs. 14, 15). It is worn down moderately. The greatest length at the outer border of the crown is 20 mm., at the base 16 mm.; width at the base of the front lobe, 22 mm.; at the base of the hinder lobe,

20.5 mm. In the case of the first molar of *Cervus canadensis* the length at the base of the crown is 21 mm.; the width, 26 mm. The fossil tooth differs from the cheek teeth of *Cervus canadensis* and *Odocoileus virginianus* in the almost complete absence of the median ribs on the outer faces of the anterior and posterior lobes. In both of the species named these ribs, especially the anterior one, are very prominent.

CERVUS CANADENSIS Erxleben.

In the collection from Whitesburg there is a fragment of an upper left molar which appears to belong to this species (Cat. No. 8555). This fragment consists of the outer wall of the paracone. The ridge which descends on the middle of the outer face of this part of the tooth in this species is well developed. Another fragment of a lower molar (Cat. No. 8556), belonging possibly to the same species, is not so satisfactorily determined.

Family ELEPHANTIDAE.

ELEPHAS PRIMIGENIUS Blumenbach.

Plate 3, fig. 16.

In the collection from Whitesburg there is found the rear of a second milk molar, probably a lower one (pl. 3, fig. 16). There are present only one ridge plate and the talon. On geographical grounds one would conclude that the tooth belonged to *Elephas columbi*. However, the plate is remarkably small. From side to side the width is only 26 mm.; the height also, close to 26 mm. Its small size indicates a tooth of the southern form of *E. primigenius*. Inasmuch as the latter species has been recognized as far south as Beaufort, North Carolina, and in Texas, it might, perhaps during a Pleistocene glacial stage, have peopled the mountain regions of eastern Tennessee. The specimen has the catalogue number 8957.

Family SCIURIDAE.

SCIURUS HUDSONICUS (Erxleben).

The writer has found a single upper right incisor which he refers to this squirrel. It is very slightly smaller than in recent specimens that have been examined, but further search would probably bring to light recent teeth as small. The catalogue number is 8958.

SCIURUS CAROLINENSIS Gmelin.

This species appears to be represented by an upper left (Cat. No. 8959) and a lower right (Cat. No. 8960) incisor. While resembling closely the teeth of recent specimens these fossil teeth are thinner. However, a specimen of *S. carolinensis extimus*, from Osceola County, Florida, No. 111394 of the United States National Museum, appears

to have incisors not perceptibly different from those from Whitesburg.

TAMIAS STRIATUS (Linnaeus).

Of this species there is present only a single tooth, a lower right incisor (Cat. No. 8961). On comparison with the corresponding tooth of a recent specimen it appears to be slightly larger.

MARMOTA MONAX (Linnaeus).

Of this species there have been preserved an upper left incisor (Cat. No. 8962) complete; the distal half of the lower left incisor (Cat. No. 8963); the left humerus (Cat. No. 8964), lacking the head; and the left femur (Cat. No. 8965), lacking the distal end. No important differences are observed on comparison with the corresponding parts of a recent skeleton.

Family CASTORIDAE.

CASTOR CANADENSIS Kuhl.

This species is represented by 10 grinding teeth (Cat. No. 8966) and a fragment of the right ramus of a lower jaw (Cat. No. 8967). These parts are not distinguishable from the corresponding ones of the existing beaver.

Family CRICETIDAE.

NEOTOMA PENNSYLVANICA Stone.

Of the Pennsylvania wood rat there are present six lower incisors, one upper incisor, and a lower first molar. To these have been given the catalogue number 8968. Some of the incisors are slender, but Dr. E. A. Goldman, who has given especial attention to the species of this genus¹, gives the assurance that all of the teeth belong to *N. pennsylvanica*. The writer is of the opinion that this species may prove to be identical with Baird's *N. magister*.

MICROTUS PENNSYLVANICUS (Ord).

A lower left incisor and a lower left first molar (Cat. No. 8969) belonging to this collection are referred to this species. The incisor is rather slender, but it may have belonged to a young individual.

Family LEPORIDAE.

LEPUS AMERICANUS Erxleben.

In the Whitesburg collection are six lower jaws or parts thereof (Cat. Nos. 8970-8975), five of them with teeth; two fragments of left maxillae with teeth, and one of the left side without (Cat. Nos. 8976-8978); a premaxilla with an incisor (Cat. No. 8979); 12 vertebrae,

¹ North American Fauna, No. 31.

mostly lumbar (Cat. No. 8981); two sacra; five damaged ossa innominata; and many limb bones, mostly broken. Some of these bones belong possibly to another species, as yet undetermined.

In studying the teeth and the parts of the skull at hand comparisons have been made with many skulls in the collection of the United States National Museum. No differences are found in either the size or the structure of the teeth. The front end of the zygoma of the fossil appears to be rather broader and smoother than in *L. americanus virginianus*. The lower jaw seems to be more massive than in the species just named. Also, the distance between the tooth row and the hinder face of the incisor in the fossil appears to be greater relatively to the tooth row, and the jaw deeper, than in most large specimens of the recent skulls; but specimens of the latter are met with which appear to bridge over the differences.

According to G. S. Miller¹ the subspecies *virginianus* extends its range southward into the mountains of West Virginia and Virginia. It is possible that the Whitesburg remains belong to a distinct subspecies of *L. americanus*, or even to a distinct species.

URSUS FLORIDANUS C. H. Merriam.

Plate 3, figs. 17-20.

In the Whitesburg collection are several teeth and a much-gnawed fragment of a right ramus of the lower jaw (Cat. No. 8992) of a bear which on comparison with specimens in the United States National Museum are referred to *Ursus floridanus*. One tooth is a lower right third incisor (Cat. No. 8993), the breadth of which is 7.5 mm. An upper right canine (Cat. No. 8994) had been worn down nearly to the base of the crown. The root is flat and measures 22 mm. from front to rear and 12 mm. transversely at the hinder border. Crowns of two other upper, little worn, canines are present (Cat. Nos. 8993, 8995). Of two lower right first molars (Cat. Nos. 8993, 8995), one (pl. 3, fig. 17) is little worn, and presents both roots. The other offers only the front end of the enamel cap of an uncut tooth. The first of these molars is 22 mm. long and 14 mm. wide. A first molar of the left side (pl. 3, fig. 18) is 22.5 mm. long and 14 mm. wide. Two upper left hindermost molars (Cat. Nos. 8993, 8995) had not yet come into use and the hinder edge of each is missing, apparently gnawed off by rodents. The length of No. 8993 (pl. 3, fig. 19) was close to 27 mm.; the width in front 16.4 mm. In a recent tooth of this species the length is 27 mm.; the width 15 mm. In the other upper hindermost tooth (Cat. No. 8995; pl. 3, fig. 20) the preserved length is 24 mm.; the width is 15 mm. Besides the lower incisor tooth mentioned there are present, of lower teeth, the hinder end of the right first molar (Cat. No. 8993); the right and the left

¹ Bull. 79, U. S. Nat. Mus., 1912, p. 348.

second molars (Cat. No. 8993), with roots; and two hindermost molars, a right and a left, of individuals of somewhat different ages. The length of each is close to 17 mm., the width 13.3 mm.

Family PROCYONIDAE.

PROCYON LOTOR (Linnaeus).

This species is represented in the collection by a lower left second molar (Cat. No. 8996).

Family CANIDAE.

AENOCYON AYERSI? Sellards.

Plate 4, figs. 24-26.

There are present in the collection some teeth (Cat. No. 8997) of a large wolf which is referred with some doubt to this species. The teeth are the upper third premolars, right and left; the upper right second premolar; the upper left first premolar; the lower right second premolar, with the front root and part of the crown missing; the upper first and the lower left third incisors. The teeth are practically unworn. The upper third premolars (pl. 4, figs. 24, 26) are 17 mm. long, 7.6 mm. thick. In these measurements they agree exactly with those of the type of *A. ayersi*. In a specimen of *A. dirus* at hand a tooth having the same length has a thickness of slightly less than 8 mm. The cingulum of the Whitesburg tooth is more strongly developed than in the specimen of *A. dirus*.

The upper second premolar (pl. 4, fig. 25) is 16.2 mm. long and 7.5 mm. thick, being thus as long as in *A. dirus*, as reported by Sellards, and longer than in the type of *A. ayersi*. In the *A. dirus* skull at hand the length is 14 mm.; the thickness, 7.8 mm. This tooth differs from the corresponding one of *A. dirus* and that of *Canis nubilus* in having the sharp anterior edge of the cusp continue nearly straight forward to the cingulum, instead of curving strongly inward to meet the latter. The first upper premolar resembles that of *Canis nubilus*, but is larger. The length of the crown is 8.4 mm.: the thickness, 6 mm. The lower second premolar has a thickness of 6.6 mm. The rear portion is furnished externally and internally with a pretty strong cingulum. Behind the cusp there is a tubercle about as large as in the third premolar. From the latter it differs in being lower and thinner.

The upper third incisor resembles that of *Canis nubilus*, but it is larger. The greatest width of the crown is 8 mm.; the thickness of the base, fore and aft, is 7.5 mm.; the upper second incisor measures 7 mm. across the accessory cusps.

3. COLLECTION FROM CAVETOWN, MARYLAND.

In 1908¹ Dr. Charles Peabody published a paper on the Exploration of Bushey Cavern, near Cavetown, Maryland. This village is situated in Washington County, about 8 miles east of Hagerstown. In the account Dr. Peabody mentioned the fact that immediately south of the cavern was a large limestone quarry. On page 12 he stated that in the red earth of this quarry were observed many fossilized or semifossilized animal bones, and that among these was one which had been identified as probably *Equus complicatus*.

The bones which were collected have been sent to the writer for study. They are much fractured and scattered, but are well fossilized. The following species have been identified. Those preceded by the dagger are extinct.

LIST OF SPECIES.

<i>Crotalus horridus.</i>	<i>S. hudsonicus.</i>
† <i>Equus complicatus.</i>	<i>S. carolinensis.</i>
† <i>Equus giganteus?</i>	<i>Marmota monax.</i>
† <i>Mylohyus nasutus.</i>	<i>Castor canadensis.</i>
† <i>M. exortivus.</i>	<i>Ondatra zibethica.</i>
† <i>M. obtusidens</i> , new species.	<i>Neotoma magister.</i>
† <i>Platygonus tetragonus?</i>	<i>Microtus pennsylvanicus.</i>
† <i>P. vetus?</i>	<i>Erethizon dorsatum.</i>
† <i>P. cumberlandensis.</i>	<i>Sylvilagus floridanus.</i>
† <i>Sangamona fugitiva.</i>	<i>Ursus americanus.</i>
<i>Odocoileus virginianus.</i>	† <i>Smilodontopsis mooreheadi</i> , new
† <i>Elephas columbi?</i>	species.
† <i>Sciurus tenuidens</i> , new species.	<i>Felis cougar.</i>

Of the 25 species of this list it will be observed that 12 are extinct. This large percentage of species no longer in existence and the geological history of some of them, as the horses, the peccaries, and the saber-tooth tigers, indicate that the time of their existence was somewhere about the middle of the Pleistocene.

Through the liberality of the Board of Trustees of Phillips Academy this collection has become the property of the United States National Museum.

Family CROTALIDAE.

CROTALUS HORRIDUS Linnaeus.

In the collection from Cavetown there are two crotalid vertebrae which appear to be identical with vertebrae of *Crotalus horridus*. The catalogue number is 9157.

¹ Bull. 4, Archaeol. Phillips Acad., pp. 1-2.

Family EQUIDAE.

EQUUS COMPLICATUS Leidy.

One tooth and several fragments of bones are referred to this species. A milk molar of the upper jaw, with the inner half split off, is in the lot (Cat. No. 9158). It had just begun to be used. The width at the summit is 34 mm.; but at the base, 30 mm. A piece of the upper end of a tibia, 5 inches long is eroded and somewhat crushed. A fragment of the lower end of a tibia about 100 mm. long, has been much gnawed by rodents. The two fragments probably belong together. There are also one first phalanx, lacking a part of the distal end; a nearly complete second phalanx and fragments of two others; also a pisiform bone. These have belonged to a very large horse. The tibia measures 47 mm. across the hinder face; that of a recent horse of medium size measures 40 mm. at the same place. The first phalanx measures across the proximal end 55 mm. These bones have the catalogue numbers 9159-9163.

Some years ago¹ a tooth of a horse that had been found in the red earth of a stone quarry near Cavetown and sent to the United States National Museum for identification was regarded as belonging probably to *Equus complicatus*.

EQUUS GIGANTEUS? Gidley.

Plate 4, fig. 1.

With the Cavetown collection are found two fragments of the upper left second premolar (pl. 4, fig. 1) of a large horse which is referred to this species. The two pieces (Cat. No. 9164) were certainly parts of the same tooth, and they seem to fit together accurately as placed in the figure. This tooth had been worn down to a height of about 20 mm. The hinder part is missing, especially on the outer side; also most of the inner face in front of the protocone.

The type of this species, found in southwestern Texas, is an upper second molar, and it is especially distinguished by its large size, having a length of 40 mm. or more on the grinding surface. As shown by Gidley's figures,² the enamel of the fosettes is rather strongly folded. The length of the premolar from Cavetown can only be estimated. This premolar in a large horse (No. 843, U.S.N.M.) is 40 mm. long, and the distance from the rear of the protocone to the front of the anterior fossette is 23 mm. In the Cavetown specimen the latter measurement is at least 29 mm. and may be as much as 33 mm. We may conclude that the whole length was close to 50 mm. The width can not be exactly determined. The dis-

¹ Bull. 4, Dept. Archaeol. Phillips Acad., 1908, p. 12.

² Bull. Amer. Mus. Nat. Hist., vol. 14, p. 137, fig. 27.

tance from the outer anterior style to the inner face of the anterior fossette is 15 mm.; in the domestic horse mentioned it is 12 mm. The greatest width may have been, therefore, 30 mm. or more. The protocone is 11 mm. wide. The valley behind it has no reentrant loop. The anterior fossette is 23 mm. long and differs much from the usual form. There is no reentrant fold opposite the head of the postprotoconal valley. The enamel at the front of the fossette is much folded. Judging from the tooth at hand, one may conclude that the horse here described may have had linear dimensions about one-fourth greater than our large domestic horses, but it may have been actually not so much larger. *Equus complicatus* had the second premolar but little larger than that given above for *E. caballus*.

Family TAYASSUIDAE.

MYLOHYUS NASUTUS Leidy.

Plate 4, figs. 2-3.

From Cavetown there come two nearly complete, little worn, lower left canine teeth, which are referred provisionally to this species (pl. 4, figs. 2, 3). The total length of the smaller of these two teeth (Cat. No. 9165), taken along the front border, is 80 mm.; but a little of the tip of the root is missing. The crown (pl. 4, fig. 2), similarly measured, is 26 mm. high. At the base the crown measures fore and aft 10.3 mm.; from side to side, 8 mm. The inner and outer faces are convex, the outer more strongly so. The anterior border is rather obtuse, except near the summit of the crown. The hinder border has a rather acute ridge descending from the summit, but just outside of this there is a shallow groove. As a whole the hinder face is quite different from that of the other peccaries observed. Each lateral face is furnished with about four grooves. The one nearest the front border, on the inner face, is broader than the others. The hinder face is slightly worn in its distal half. A view of the outer face of the tooth is presented.

The larger of the teeth (Cat. No. 9166) measures along the front border 93 mm., of which 45 mm. belongs to the crown (pl. 4, fig. 3). The greater diameter at the base of the crown is 11.5 mm.; the smaller, 9 mm. This tooth does not differ from the other in any important respects.

MYLOHYUS EXORTIVUS Gidley.

Plate 4, figs. 4-13.

This species has been described by Gidley.¹ It is based on a series of upper molars and premolars (lacking pm²) of the right side, and a lower jaw bearing all of the teeth, including incisors and canines (Cat. No. 8876). These were found in the cave near Corrigan-

¹ Proc. U. S. Nat. Mus., vol. 57, p. 676, text figs. 11-13.

ville, a few miles north of Cumberland, Maryland. In the collection from Cavetown there is a fragment of the left ramus of a mandible which contains the three molars (Cat. No. 9167). Inasmuch as these are less worn than the teeth of the type, it is thought well to figure them (pl. 4, fig. 4). Measurements are here presented of these teeth and the corresponding ones of the type of the species.

MEASUREMENTS OF LOWER MOLARS IN MILLIMETERS.

	<i>M. exortivus</i> , type.	<i>M. exortivus</i> , Cavetown.
Length of molar series.....	50	53
Length of first molar.....	14	15
Width of first molar.....	13	13
Length of second molar.....	15	16
Width of second molar.....	14	14
Length of third molar.....	19.5	21
Width of third molar.....	13	13

As will be observed there is close correspondence in the measurements. There appears to be equally close agreement in the structure of the teeth.

Figure 5 of the plate 4 represents a lower left third premolar (Cat No. 9168), wholly unworn, whose length is 128 mm. and whose width is 11 mm. Figure 6 gives a view of a lower left first molar (Cat. No. 9169), unworn. It is 15.5 mm. long and 13 mm. wide. A lower left second unworn molar (Cat. No. 9170) is shown by figure 7. Its length is 18 mm.; its width 14.2 mm.

Of upper teeth there are those identified as second, third, and fourth premolars (pl. 4, fig. 8) of one individual (Cat. No. 9171). The following comparative measurements are given of the premolars of the figure just cited:

MEASUREMENTS OF UPPER TEETH IN MILLIMETERS.

	<i>M. exortivus</i> , type.	<i>M. exortivus</i> , Cavetown.
Premolar 2:		
Length.....		9
Width.....		8.2
Premolar 3:		
Length.....	10.4	11
Width.....	11.5	10
Premolar 4:		
Length.....	12.5	13
Width.....	13.8	12.8
Molar 1:		
Length.....	14	14
Width.....	14	13.2
Molar 2:		
Length.....	15	16
Width.....	13.2	14.5

There are also several loose upper teeth which are believed to belong to the same species. Figure 13 (Cat. No. 9172) is from an upper premolar, thought to be the second of the right side. Its length is 10 mm.; its width 9 mm. Figure 9 (Cat. No. 9173) presents a view of an upper right premolar, apparently the fourth; but it is somewhat smaller than that of figure 8. It is but little worn and is 12.5 mm. long and 11.6 mm. wide. Figure 10 (Cat. No. 9174) represents an upper left fourth premolar hardly touched by wear. It is 13.5 mm. long and 13 mm. wide. An upper left first molar (Cat. No. 9175) considerably worn is shown by figure 11. It is 14 mm. long and 14 mm. wide. An upper right second molar (Cat. No. 9176) furnishes figure 12. It is wholly untouched by wear and presents the roots. It is 16 mm. long and 14 mm. wide. Inasmuch as it presents a distinct central tubercle and a slight external cingulum it is possible that it belongs to another species.

MYLOHYUS OBTUSIDENS, new species.

Plate 4, figs. 14-15.

Types or species.—A complete upper canine, and the crown of a lower one (Cat. No. 9186).

Type locality.—Western Maryland.

Type formation.—Pleistocene.

Diagnosis.—Canines, upper and lower, with front and rear borders obtuse. Enamel smooth.

The two canines of the left side (Cat. No. 9186) which are made the type of this supposed new species are considerably worn. It seems probable that they belonged to the same individual, inasmuch as the worn surfaces fit accurately together. The upper canine (pl. 4, fig. 14) presents the tooth in the condition it had when the animal died. The crown has a height of 35 mm. The height of the whole tooth, measured along the anterior border, is 95 mm. At the base of the crown the fore-and-aft diameter is 15 mm.; the side-to-side diameter 11 mm. As far as preserved, the anterior border is broadly rounded, the posterior border somewhat less so. Even toward the tip of the tooth there is no indication of a hinder sharp edge.

The lower canine (pl. 4, fig. 15), broken off at the base of the crown, has there a fore-and-aft diameter of 12 mm., a transverse diameter of 9.6 mm. The front is broadly rounded. On the hinder face there is an indication of a shallow groove; on the outer face a mere trace of a narrow one. The enamel of both canines is smooth and polished.

There is present a fragment, 40 mm. long, of another and smaller lower canine (Cat. No. 9187), which belonged probably to a female. At the base of the crown the fore-and-aft diameter is 10 mm.; the

transverse, 8 mm. There is merely a suggestion of a groove on the hinder face.

PLATYGONUS TETRAGONUS? (Cope).

Plate 4, figs. 16-17.

In the Cavetown collection is part of an inferior right canine (Cat. No. 9188) which differs from any found at either Cavetown or Corriganville, near Cumberland. It appears to conform most closely to Cope's description of his *Mylohyus tetragonus*,¹ but the tooth, as did Cope's species, belongs evidently to *Platygonus*. The fragment here described and illustrated (pl. 4, figs. 16, 17) lacks both the base and the summit. It is 37 mm. long. Near the lower fracture the width is 12 mm.; the thickness, 7.2 mm.; that is, at this level the thickness is 0.6 of the breadth. In the canine described by Cope² the dimensions were 10 mm. and 6 mm.

Cope found that the lower canine of his species had the angle between the hinder face and the inner one truncated by a narrow plane which followed the length of the tooth. Such a plane appears to be represented in the tooth at hand. The hinder face is flat at the lower end of the fragment, slightly concave at the upper. It is bounded on each side by a narrow ridge. Mesial of the inner bounding ridge is a surface flat at the upper end, slightly concave at the lower. Mesially this surface is bounded by a ridge on the inner face. The surface referred to appears to meet the requirements of Cope's description.

The inner face (pl. 4, fig. 16) of the specimen at hand is finely wrinkled in front of the ridge referred to. The outer face is more coarsely sculptured. Figure 17 of the plate cited shows a section of the tooth at the lower fracture. So far as represented, the tooth shows no wear, and it is traversed by the yet open pulp cavity.

PLATYGONUS VETUS? Leidy.

Plate 4, figs. 18-19.

This species appears to be represented by a fragment of the left ramus of the lower jaw (Cat. No. 9189) bearing the first and second true molars (pl. 4, fig. 18). The first molar is pretty well worn down, but the second only moderately so. These are referred to *Platygonus vetus* rather than to Gidley's *P. cumberlandensis*, because of the greater size of the lower teeth of the Cavetown specimen. The following measurements are taken from the specimen from Cavetown, from Leidy's measurements of the type of *P. vetus*,³ and from the type of *P. cumberlandensis*.

¹ Journ. Acad. Nat. Sci., Phila., vol. 11, 1899, p. 260, pl. 21, fig. 3.

² Idem., p. 260.

³ Ann. Rep. Geol. Surv. Penn. for 1887, p. 14.

MEASUREMENTS OF LOWER MOLARS IN MILLIMETERS.

	Cavetown molars.	<i>P. vetus</i> , type.	<i>P. cumberlandensis</i> , type.
Length of first molar.....	15.5	.....	14.4
Width of first molar.....	14.0	.....	11.5
Length of second molar.....	20.0	20.0	17.4
Width of second molar.....	17.0	15.0	14.0
Length of third molar.....	.....	26.5	24.0
Width of third molar.....	.....	17.0	15.0

So far as shown by the first and second molars, the Cavetown specimen is quite distinct from *P. cumberlandensis*. While allowing something for individual variation, which is met with constantly in these peccaries, it appears better to refer the teeth from Cavetown to *P. vetus*. A fragment of the crown (Cat. No. 9190) of a lower tusk also is referred provisionally to this species. This fragment is only 20 mm. long. The section (pl. 4, fig. 19) forms a nearly isocles triangle whose height is 14.5 mm. and whose base (the rear face of the tooth) is 11.5 mm. It resembles considerably the lower canine of the species named by Gidley *M. intermedius*, and possibly it belongs there. It seems to be too sharp on its front border and too thin to belong to *M. cumberlandensis*.

PLATYGONUS CUMBERLANDENSIS Gidley.

The presence of this species in the fissure at Cavetown appears to be indicated by a part of the root of a lower left canine (Cat. No. 9191). The fragment is 30 mm. long. At the lower end the pulp cavity is large; but above it is much reduced. It formed a part of a very large tooth. The fore-and-aft diameter is 17 mm.; the side-to-side diameter, 9 mm. The front border is rounded; the hinder, occupied by a conspicuous and deep groove. There is also on each lateral face a well-defined groove. A section of the tooth forms, therefore, a trefoil. The root is furnished with rather fine ridges and grooves. It appears best to refer this tooth to *P. cumberlandensis*.

Family CERVIDAE.

SANGAMONA FUGITIVA Hay.

In the collection from Cavetown there are some remains of a deer which are referred to the species described above from Whitesburg, Hamblen County, Tennessee, as *Sangamona fugitiva*. These remains consist of a lower right first incisor; a lower left first, or possibly second, true molar; the distal end of the left radius; a right scaphoid, a part of the right innominate bone surrounding the acetabulum; a left external malleolar bone, the proximal half of an

astragulus; a right calcaneum; two probably metatarsal sesamoids; and first, second, and third, probably hinder phalanges. To these remains, excepting the incisor, has been given the catalogue number 9193. This tooth and the bones are entirely too large to have belonged to any known species of *Odocoileus* and too small for any known species of *Cervus*. The incisor (Cat. No. 9192) is considerably larger than the corresponding one of the Virginia deer. It is little worn. The crown is 8 mm. high and 7.5 mm. wide. The molar is worn down nearly to the base of the crown. The length is 20 mm.; the width 14.8 mm. There is a rather strong tubercle at the mouth of the principal valley. The first molar of a wapiti at hand is 24 mm. long and 15 mm. thick; in *Odocoileus virginianus*, 12.5 mm. long, 9 mm. thick. The radius is represented by only a fragment, 50 mm. long; but the articular end is unfortunately a little injured. The distal end of the ulna has been split off. The following measurements of this part in the fossil in *Odocoileus virginianus* and in *Cervus canadensis* are presented:

MEASUREMENTS OF THE DISTAL END OF RADII IN MILLIMETERS.

	<i>Sangamona fugitiva.</i>	<i>C. canadensis.</i>	<i>O. virginianus.</i>
Width of bone just above articular surface.	48	65	40
Thickness of bone at same level.	31	45	27

It will be observed that in size the distal end of the radius of *S. fugitiva* is somewhat nearer the Virginia deer than to the wapiti. The scaphoid bone is 26 mm. long and 32 mm. broad, these dimensions in the Virginia deer being, respectively, 19 mm. and 26 mm. The acetabulum of *S. fugitiva* has a length of 45 mm.; that of *O. virginianus* 37 mm.; that of the wapiti 57 mm. The external malleolar bone has a horizontal diameter of 26 mm. The calcaneum has lost the epiphysis. The following measurements afford means for comparisons:

MEASUREMENTS OF CALCANEA IN MILLIMETERS.

	<i>S. fugitiva.</i>	<i>C. canadensis.</i>	<i>O. virginianus.</i>
Total length.	105 ±	138	103
Height at articulation for fibula.	44	56	32
Thickness at lateral process.	33	40	30

It will be seen that the bone in the fossil is a little longer than that of the Virginia deer. It is possible that more is missing than the epiphysis. The astragulus applies itself quite accurately to the calcaneum and may have belonged there originally. The width across the surface for the tibia is 30 mm. The two sesamoids are those

situated at the ends of the row of four and are about one-third larger than the corresponding bones in the Virginia deer.

The first phalanx, probably a hinder one, is a larger and heavier bone than the corresponding one in the Virginia deer and smaller than in the wapiti. The following measurements are presented:

MEASUREMENTS OF HINDER FIRST AND SECOND PHALANGES IN MILLIMETERS.

	<i>S. fugitiva.</i>		<i>C. canadensis.</i>		<i>O. virginianus.</i>	
	First.	Second.	First.	Second.	First.	Second.
Total length.....	66	42	68	48	53	41
Height of proximal end.....	28	26	35	35	21	22
Width of proximal end.....	23	19	27	25	17	17
Height of distal end.....	18	24	21	29	14	18
Width of distal end.....	19	16	26	26	15	12

The ungual phalanx mentioned fits accurately to the second phalanx just described. The extreme end is broken off; but the original length was not far from 45 mm. The height, taken perpendicularly to the plantar surface, is 30 mm; the greatest thickness 18 mm.

ODOCOILEUS VIRGINIANUS (Zimmermann).

Apparently belonging to this deer are the distal ends of two radii, right and left (Cat. No. 9194). The largest piece is about 65 mm. long. Both pieces show well the articular end. The width just above the articular surface is 35 mm. While there is a possibility that these bones belong to another species there is nothing in them to prove this.

Family ELEPHANTIDAE.

ELEPHAS COLUMBI? Falconer.

From Cavetown there are present two fragments (Cat. No. 9195), taken together measuring about 300 mm., of a bone which appears to be the radius of an elephant; and, if this identification is correct, the species is very probably that named above. The bone is somewhat crushed, but its conformation agrees better with that of the elephant than that of the mastodon. There is in the collection the neural arch of a dorsal vertebra of a proboscidean (Cat. No. 9196); but it is impossible to say whether this belonged to an elephant or to a mastodon.

Family SCIURIDAE.

SCIURUS TENUIDENS, new species.

Plate 4, fig. 20.

Type specimen.—An upper left incisor, with part of the skull.

Type locality.—Cavetown, Washington County, Maryland.

Type formation.—Pleistocene.

Diagnosis.—Upper incisors broad and unusually thin; front border rounded.

The type and only known specimen of this species is a left incisor and a part of the premaxilla (Cat. No. 9197) exposed on a lump of cave earth. It is illustrated on plate 4, figure 20. The width of the tooth is 3.9 mm.; its thickness only 1.3 mm. On the same lump of clay is an upper incisor, referred to *S. carolinensis*, whose width is 3.2 mm. and whose thickness is 1.5 mm. The detached tooth referred below to *S. hudsonicus* is only 2.9 mm. wide, and is 1.5 mm. thick. Teeth of *S. carolinensis* nearly as wide as the fossil may be found, but they are thicker. *S. niger* has broad thick incisors. In both of the species just mentioned the front border of the tooth is rather flat and usually traversed by a shallow groove. In the fossil tooth the front border is rounded. An examination of a series has failed to find any squirrel with teeth so broad and thin as the fossil here described.

SCIURUS HUDSONICUS (Erxleben).

A detached upper left incisor (Cat. 9199) is referred to this species. The width is 2.9 mm.; the thickness, 1.5 mm. The incisors of this species are difficult to distinguish from those of *S. carolinensis*, but the former are on an average distinctly smaller.

SCIURUS CAROLINENSIS Gmelin.

On the lump of red clay which bears the type of *S. tenuidens* there are a part of a right premaxilla and the greater part of the corresponding incisor of *S. carolinensis* (Cat. No. 9198). The greater diameter of the incisor is 3.2 mm.; the thickness, 1.5 mm.

MARMOTA MONAX (Linnaeus).

Of this species there is a fragment of the left ramus of the lower jaw which contains the premolar and the first molar (Cat. No. 9200). It belonged to a large, heavy-jawed individual. There are present also a well-preserved lower left incisor (Cat. No. 9201), somewhat larger than any found in the collection of recent skulls, and the distal end of a left humerus (Cat. No. 9202).

Family CASTORIDAE.

CASTOR CANADENSIS Kuhl.

Of the Canadian beaver there are a fragment of a lower incisor whose width is 9 mm., and an upright third molar (Cat. No. 9203).

Family CRICETIDAE.

ONDATRA ZIBETHICA (Linnaeus).

A single lower left incisor is all that, so far as found, represents this species. The tooth belonged to a small individual.

NEOTOMA MAGISTER Baird.

In the Cavetown collection are found a part of the left premaxilla (Cat. No. 9205) inclosing a part of the corresponding incisor; also a left lower incisor (Cat. No. 9206). The latter has been identified by Dr. E. A. Goldman as belonging to *N. pennsylvanica*. The upper incisor appears to differ in no way from the corresponding tooth of Baird's types of *N. magister*, being fully as broad; but some specimens of *N. pennsylvanica* are hardly, if at all, distinguishable. On the whole, the writer prefers to refer these fossil teeth to Baird's species.

MICROTUS PENNSYLVANICUS (Ord).

Of this species there is a part of a skull in a fragment of red earth (Cat. No. 9207). It has been possible to expose an upper incisor and a part of the lower jaw showing its incisor. The remains appear to belong here.

Family ERETHIZONTIDAE.

ERETHIZON DORSATUM (Linnaeus).

Of this species there is the left ramus of the mandible (Cat. No. 9208), only the condylar and most of the coronoid processes being gone. The teeth are in fine condition. The specimen is of interest because the premolar is just making its appearance through the bone. The length of the row of molars is 19 mm. The incisor measures 5 mm. in diameter, somewhat more than in any of the skulls at hand of recent individuals. However, there appears to be no sufficient reason for thinking that it belongs to another species.

Family LEPORIDAE.

SYLVILAGUS FLORIDANUS (Allen).

This rabbit appears to be represented by a part of a left maxilla (Cat. No. 9209), in which are found the first molar, the two premolars, and the socket for the first premolar. After a close comparison with skulls of a number of species in the United States National Museum there appears to be no good reason for not identifying the jaw as that of the existing species *Sylvilagus floridanus*.

Family URSIDAE.

URSUS AMERICANUS Pallas.

In the Cavetown collection there are a nearly complete right ramus of the lower jaw, with the four chewing teeth; a fragment of a canine; a part of the right maxilla, with the bases of the crowns of the fourth premolar and the two molars; another fragment of right maxilla with sockets for the canine, for two premolars and first

molar; an injured proximal end of a left femur; a complete left calcaneum and a lumbar vertebra and two metacarpals. These have the catalogue number 9210. There are in addition 18 detached teeth which represent the canines, the upper fourth premolars, and the two molars; also the lower third premolar and the first and second molars. The corresponding teeth differ considerably in size; but so they do in recent skulls. An upper right fourth premolar is larger than any corresponding tooth found in recent skulls; but probably further search would remove the difference. Its length is 13.4 mm.; its width 10 mm. The total length of the calcaneum is 74 mm. To all these loose teeth have been given the catalogue number 9211.

Family FELIDAE.

SMILODONTOPSIS MOOREHEADI, new species.

Plate 4, figs. 21-22.

Type specimen.—An upper sectorial tooth.

Type locality.—Cavetown, Washington County, Maryland.

Type formation.—Pleistocene.

Diagnosis.—Of moderate size. No protocone. Preanterior lobe very small.

In the Cavetown collection there is an upper right sectorial tooth (Cat. No. 9212) which appears to belong to an undescribed species of saber-tooth cat. It is that of the right side. It had not yet come into use and the roots had not yet developed. Views are presented showing the inner face of the tooth, and the crown from above (pl. 4, figs. 21, 22). The length of the crown is 26.5 mm.; the height of the paracone, 14 mm.; of the metacone, 9.5 mm. The width in front is 11.5 mm.; at the metacone, 8 mm. The protocone is absent. There would probably in time have been an inner anterior root. The metacone has the same length as the principal cone. Its edge is thick and is divided by a broad and very shallow transverse groove. The anterior basal lobe is larger than that of the corresponding lobe in a large specimen of the Oregon mountain lion (*Felis oregonensis*). At its base in front is what may be regarded as an extremely small, sharp preanterior lobe, which grows up from the cingulum. The latter presents one or two distinct tubercles on the outer face of the anterior lobe. From the apex of the anterior lobe there is a sharp edge which runs down on the inner face to the base of the internal root. This lobe constitutes hardly one-fourth of the whole length of the crown. The buttress descending from the summit of the principal cone to where one would look for the protocone is feebly expressed. On the inner side the edge of the crown has been splintered off. This tooth resembles that figured by Barnum Brown¹ as *S. conardi*, but it is

¹ Mem. Amer. Mus. Nat. Hist., vol. 9, 1908, p. 190, pl. 19.

considerably smaller than in Brown's species, and the protocone of the latter forms a distinct tubercle. The sectorial of the Cavetown species is likewise smaller than that of Cope's *Machairodus gracilis*,¹ in which this tooth has a length of 34 mm. As to Cope's *Smilodon mercerii* it is difficult to determine its size. The impression is given that it is somewhat smaller than *Machairodus gracilis*, but the measurements of some teeth indicate equality of size. What appears to be the measurements of the upper sectorial, but spoken of as pm₁ (bottom of Cope's p. 246), gives the length as only 21 mm. Cope's figure 2 of his plate 20 probably represents this upper sectorial of reduced size. In this figure the paracone towers above the rest of the tooth more than in the Cavetown tooth. On page 247 of Cope's paper cited is a description of *Felis inexpectata*. The tooth figured on his plate 21 resembles considerably the Cavetown tooth; but it was regarded as having had a protocone; also there is an angle on the internal side of the paracone descending to the protocone. This is extremely feeble in the tooth here described. The length is given by Cope as 24 mm.; the height of the paracone, 10 mm.; the width at the roots, 9.5 mm. Barnum Brown's species *Felis longierus* may be mentioned (his paper above cited, p. 187, pl. 18). It, too, possessed a protocone. Also the base of the tooth is constricted at the paracone.

In the collection there is a crown (Cat. No. 9213), or rather a part of a crown, of a canine tooth (pl. 4, fig. 23), taken to be a left upper, which the writer has not been able to identify satisfactorily, either generically or specifically. It is quite different from the canines of the mountain lion. It is relatively thin, has sharp edges in front and behind, and the two sides are equally convex. The tooth had probably not been cut, as the great pulp cavity remained and is now full of red clay. On what is probably the outer face some of the material of the tooth is gone. On the other face there appear eight or nine longitudinal ridges, with intervening grooves. They continue to about 10 mm. from the tip of the tooth, and are more distinct toward the base. There are seen traces of similar ridges and grooves on the injured face of the tooth. The tooth as preserved is 25 mm. high. The long diameter at the base was close to 10 mm.; the transverse diameter, close to 6 mm. The writer suggests that this was a milk canine of a saber-tooth cat, possibly of the species here described; possibly of the same individual. Besides these teeth, there is present from Cavetown the proximal end of a femur (Cat. No. 9214) of some large cat-like animal. It resembles closely the same part of a tiger from the Malay Peninsula (No. 49728, U.S.N.M.), and it is but little smaller. In the tiger the distance from the inner surface of the head of the femur to the outside of the

¹ Journ. Acad. Nat. Sci. Phila., vol. 11, 1899, pp. 240-244, pl. 20.

great trochanter is 78 mm.; in the fossil this measurement is 76 mm. The lesser trochanter is not so strongly developed as in the tiger femur at hand.

FELIS COUGUAR? Kerr.

In the collection there is a fragment (Cat. No. 9215) of the left ramus of a lower jaw of a felid which may have been that of the species here described. It contains the roots of the sectorial, but the crown is gone. The height of the jaw is 21 mm. at the sectorial; its thickness is 9 mm. These are almost exactly the height and thickness of the jaw of a mountain lion (No. 21078, U.S.N.M.).

4. COLLECTION FROM ALTON, ILLINOIS.

In the United States National Museum there is a very considerable collection of Pleistocene mammals that was made many years ago by Hon. William McAdams, of Alton, Illinois. He reported briefly on this collection at the Minneapolis meeting of the American Association for the Advancement of Science, in 1883.¹ He stated that the "bluff clays," now called loess, were nearly 100 feet thick at Alton, and were remarkably rich in animal remains, such as teeth and bones, attached to calcareous nodules or clay stones. Remains of 13 different species had been found, all probably extinct.

It appears that McAdams's collection was secured for the United States Geological Survey by Prof. O. C. Marsh. It remained at Yale University many years without being studied. On Professor Marsh's death the collection was brought to the National Museum, and the writer has the privilege of examining it. As stated by McAdams, the specimens of bones and teeth are attached to, or rather are partly or wholly inclosed in, hard nodules. These nodules are composed of very fine grains of sand cemented together by calcium carbonate. The material is very compact, and there is extreme difficulty in removing from it the fossils without injuring the latter. In the collection the writer has found the following species. The extinct forms are indicated by the dagger.

† <i>Megalonyx jeffersonii</i> .	† <i>Bison</i> , sp. indet.
† <i>Equus</i> , sp. indet.	† <i>Mammut americanum</i> .
† <i>Platygonus compressus</i> ?	<i>Marmota monax</i> .
† <i>Sangamona fugitiva</i> .	<i>Castor canadensis</i> .
† <i>Cervalces roosevelti</i> ?	† <i>Castoroides ohioensis</i> .
† <i>Rangifer muscatinensis</i> ?	<i>Geomys bursarius</i> .
† <i>Taurotragus americanus</i> .	<i>Ursus americanus</i> .
† <i>Symbols promptus</i> ?, new species.	

Of the 15 species here identified there are 11 which are now extinct—75 per cent. This high percentage of extinct forms is prob-

¹ Proc. Amer. Assoc. Adv. Sci., vol. 22, p. 268.

ably due to the accidental exclusion of a number of still existing species that might be expected to occur there.

It would be interesting to know exactly the geological age of the deposits in which these species were found. The writer is informed by Dr. E. W. Shaw, of the United States Geological Survey, who is familiar with the Pleistocene deposits about Alton, that there are at that place deposits of loess of three or four Pleistocene stages; but these have not yet been well differentiated, nor is it known exactly where McAdams secured his specimens. Although he said that the loess there was rich in teeth and bones, he also added that a majority of his specimens were found in one quarry. This would appear to mean that they had come from the loess overlying some stone quarry or possibly from that filling a crevice of the limestone. Doctor Shaw assures the writer that the nodules are those of the loess.¹

McAdams very probably had a catalogue of his collection, for on many of the specimens there is pasted a printed number. This catalogue, if there was one, has apparently been lost.

MEGALONYX JEFFERSONII (Desmarest).

The genus *Megalonyx* is represented in the collection from Alton by a fragment, about 1 inch long, of a molar tooth (Cat. No. 8999). After a comparison with Leidy's figures² it is evident that the tooth was a lower right molar, probably the hindermost one. It does not agree wholly with Leidy's three figures of this tooth,³ nor do these figures resemble one another too closely. It is taken that the figure last mentioned, made especially by Leidy, in order to be accurate, is most to be relied on. From this figure it appears that the front and rear faces were convex, while in the Alton specimen they are slightly concave. The inner face of the latter tooth is more rounded than shown in Leidy's figures. The tooth, too, is thinner from front to rear (16 mm.) than in the one described by Leidy (8.5 lines=17.7 mm.). The pulp cavity is shown at one end of the fragment and is filled apparently by fine sand and loess.

EQUUS, sp. indet.

In the Alton collection, with the number 25, is a portion of an incisor of a horse (Cat. No. 9000). It has no loess attached to it, but

¹ Since this paper was put into type Mr. Morris M. Leighton, of the State Geological Survey of Illinois has informed the writer of investigations made by him recently under the direction of the head of the survey, Dr. F. W. DeWolf. Mr. Leighton had the good fortune to find Mr. John D. McAdams, a son of the collector of the fossils, who pointed out to him the quarry in which his father had collected most of the specimens. These occurred at the base of the loess, but apparently in the upper part of the drift. While the exact age of the deposit is somewhat in doubt, Mr. Leighton regards it as belonging probably to the Sangamon.

² Smiths. Contr. Knowl., vol. 7, 1855, art. 5.

³ Idem, pl. 5; pl. 6, fig. 11; and pl. 16, fig. 17.

some brown iron oxide. It is pretty certainly a fossil, but was probably not found in the loess.

PLATYGONUS COMPRESSUS? Leidy.

There is in the collection a fragment of a lower right canine tooth of a peccary (Cat. No. 9001), which is identified provisionally as that named. The fragment is 35 mm. long, 14 mm. from the acute front edge to the slightly concave hinder face, and 11 mm. across this hinder face, the measurements being taken at what was about the middle of the height of the crown. On the outer face there is a median ridge bounded in front and behind by shallow grooves.

SANGAMONA FUGITIVA Hay.

Plate 5, figs. 5-6.

In the collection made at Alton are two nodules of loess with each a part of the right ramus of the lower jaw and three molars of a large deer. In the better specimen (Cat. No. 9002. Pl. 5, figs. 5, 6) the first molar is much damaged and the third has lost most of the hinder lobe. The inner faces of the teeth are mostly hidden in the hard nodule. The first molar was close to 15 mm. in length. The second is 18 mm. long and about 13 mm. wide. The third molar, not including the third lobe, is 18 mm. long; including the third lobe, it was about 22 mm. long; the width, about 13 mm. The crowns are only moderately worn. The other nodule (Cat. No. 9003) presents the same sides of the teeth, the inner faces being more concealed than in the first nodule. The crowns are less worn and have a height of about 15 mm. The teeth are apparently larger than in the other specimen, the first and second lobes of the third molar, taken together, measuring 20 mm.; with the hinder lobe, about 27 mm. At the outer mouth of the median valley of these teeth there is a conspicuous accessory pillar. The crowns of the lower molars are higher than in *Odocoileus*. The inner faces of the lobes are flatter than in *Odocoileus*, and the styles are less conspicuous.

These teeth are entirely too large to have belonged to any of the existing species of *Odocoileus*; and they are, relatively to the length, much broader. They agree in size so well with the upper tooth which forms the type of *S. fugitiva*, found at Whitesburg, Tennessee, and with the lower tooth found at Cavetown, Maryland, that they are referred to that species. In size they agree well with the lower molar found at Cavetown, Maryland, and referred to *S. fugitiva*.

CERVALCES ROOSEVELTI? Hay.

Plate 6, figs. 1-2; 5-8.

To this species are referred, with some reservations, an upper left second premolar, three upper molars, and a fragment of the right

ramus of the lower jaw with four teeth. The upper teeth (Cat. No. 9004) consist of a right third molar and left second and third molars. These are practically free from any loess, while the lower teeth (Cat. No. 9005) are pretty well buried in it. The left upper second and third molars are here figured (pl. 6, figs. 7, 8) and the lower left second and third molars (same plate, figs. 3, 4). The latter came from Afton, Oklahoma, and are described below.

The upper teeth evidently belonged to a young but mature animal, and they are very little worn. The premolar resembles rather closely that of *Alces americanus*. Its length is 24 mm.; its width, 25 mm.

MEASUREMENTS OF UPPER MOLARS IN MILLIMETERS.

	Second molar.	Third molar.
Height.....	25	27
Length on midline.....	29	32
Length on outer face near summit.....	31	34
Width at base of front lobe.....	31	33
Width at base of hinder lobe.....	27	30.5

The writer has described¹ the teeth of the type of *Cervalces scotti*. It will be seen that the teeth of the Alton collection are somewhat larger; especially they are relatively broader, but this may not be decisive. The teeth in hand differ from those of the existing moose as there indicated. The mesostyle of *Cervalces* is more prominent and has an excavation in front of it, especially deep in m¹. Also the style on the face of the anterior lobe is much more strongly developed, increasing in thickness to the cingulum; whereas in *Alces* it subsides before reaching the base of the crown. The lower jaw has a depth of 58 mm. at the second molar. The length of the fourth premolar and the three molars taken together is 122 mm.; that of the three molars, 95 mm. These dimensions are somewhat greater than in the type of *C. scotti*. These teeth are considerably worn and are badly hidden by the hard mass of loess, so that the individual dimensions, especially the thickness, can not be accurately determined. The outer faces are mostly hidden. The fourth premolar is 27 mm. long and apparently 17 mm. thick. The first molar is 25 mm. long; the second close to 30 mm.; the third between 37 and 40 mm. All these lower teeth resemble closely those of *Alces americanus*, but the style on the inner face of the front lobe appears to be somewhat more sharply defined than in *Alces*, and at the base of the tooth comes out even with the plane of its inner face.

¹Thirty-sixth Ann. Report Geol. Surv. Ind., p. 626.

RANGIFER MUSCATINENSIS? Leidy.

In the collection, with McAdams' number 11, is a tooth of a *Rangifer*, apparently an upper right fourth milk molar (Cat. No. 9006). This is referred provisionally to the species named above. The length of the crown near the outer face is 17 mm.; the width is 13 mm.

TAUROTRAGUS AMERICANUS Gidley.

Plate 5, figs. 7-11.

In the collection made by Mr. McAdams there are found 11 molar teeth, upper and lower, which are to be referred to the species described by Gidley, from a cave at Corriganville, Maryland. Of these 11 teeth, 3 belong to the upper jaw; the remainder to the lower. The upper teeth consist of second molars, right and left, and a left third molar, probably all of the same individual. Of the lower teeth there are first molars, right and left; a right second molar; a left third molar, practically complete, and part of that of the right; all of which, except probably the last, may have belonged to the same individual to which the upper teeth belonged. All these have the catalogue number 9007. Then, there is another last molar which is much more worn than those above recorded (Cat. No. 9008). One of the other somewhat damaged teeth is determined as a lower right first molar (Cat. No. 9008). The height of these teeth is given in the following table of measurements. It varies, of course, in the same tooth with the degree of wear, and perhaps with the degree of development of the base. The width is taken on the flat face of the tooth and about 25 mm. above the base. The thickness is the greatest, taken at the base.

MEASUREMENTS OF MOLAR TEETH IN MILLIMETERS.

Teeth.	<i>T. americanus</i> , Alton.		<i>T. americanus</i> type.
	Upper.	Lower.	Upper.
Molar 1:			
Height.....		40	28
Length.....		29	29
Width.....		20	26
Molar 2:			
Height.....	44	48	40
Length.....	33	33	34
Width.....	30	24	29
Molar 3:			
Height.....	50	42	50
Length.....	37	50±	35
Width.....	33	22	32

No differences that are certainly of specific importance are observed on comparison of the upper second and third molars of the

Alton specimens with those of the type. The mesostyles and parastyles of the latter appear, however, to be slightly more strongly developed, while the ribs, or styles, on the faces of the lobes are narrower and more sharply defined on the Alton teeth. In the valley between the two lobes of the last molar, on the inner face, there is seen an accessory pillar, small on one tooth, well developed on the other. A very small pillar occurs rarely in the same position in the molars of *T. oryx*.

Figure 8 of plate 5 presents a view of the inner face of the lower left first molar. It is considerably larger than the corresponding tooth of the African eland. It appears to be slightly worn, but the apex is hidden in the hard nodule. At the rear of the anterior lobe, in the upper half of the crown, a style develops which becomes quite prominent. At the hinder border of the tooth is another sharp style. The writer has found no specimen of the African eland with unworn teeth with which to compare the upper halves of the crowns. The lower right second molar (pl. 5, fig. 9) is shown here. On the inner face, at the rear of the anterior lobe, is a style similar to that of the first molar. Evidently there is nothing of the kind in the African eland. Figure 10 of plate 5 represents the inner face of the lower left hindermost molar. It had not yet come into use and the base had hardly been completed. It differs from the corresponding tooth of *T. oryx* in having a style on the rear of the anterior lobe. On the plate cited (fig. 11) is shown the upper right second molar. The measurements of it are given in the table.

In the United States National Museum there is a lower left hindermost molar (Cat. No. 4987) of this species which was collected several years ago at Kimmswick, Missouri, about 20 miles south of St. Louis and 40 miles south of Alton. The height of this tooth is 50 mm.; the length 53 mm.; the thickness at the base of the first lobe, 23 mm.; that at the base of the second lobe, 24 mm.; that at the base of the third lobe, 15 mm. At their summits the thickness of the lobes in their order is 19 mm., 18 mm., and 11 mm. It is difficult to distinguish these lower hindermost molars from the corresponding ones of camels.

In 1913¹ Dr. Paul Matchie noted Gidley's description of the American eland. He was unable to find a series of teeth in the African eland which corresponded to Gidley's figure of the fossil eland or was in any way similar to it ("oder ihr wenigstens ähnlich ist"). It is difficult to understand in what sense this statement is to be taken. The teeth of both animals are not greatly different in size and proportions. They are strongly hypsodont and are similarly lobed. In both series of molars the parastyles, the mesostyles, and the metastyles are prominent; the faces of the lobes between these

¹ Sitz.-Ber. Ges. Naturf. Freunde, Berlin, 1913, p. 258.

styles are traversed each by a corresponding and very similar rib. In many details they are closely alike. In case Matchie meant that the two sets of teeth are not absolutely alike, that is another matter. The premolars of the two animals do differ, and possibly a distinct genus might be erected on the differences; but that need not exclude the idea that they would be closely related.

The fourth premolar of the existing eland has its anterior and rear styles thinner and more prominently outstanding than has the fossil. The fossil tooth has its inner face more flattened than that of the existing eland. The same remark is true with regard to the third molar. Also, in the existing eland there is a deep channel just behind the anterior style, which is only slightly indicated in the fossil. In the fossil eland the lower molars possess a distinct style on the inner face at the hinder border of the anterior lobe, or metaconid.

A tooth (Cat. No. 9009) which appears to be the lower right fourth milk molar is represented on plate 5, figure 7. Most of the inner face of the hinder lobe is broken away. The tooth had not yet come into use. Its height is 22 mm., its greatest length 37 mm., its thickness 15 mm. There is, besides, a damaged tooth (Cat. No. 9009), which may be an upper milk molar. Its height is 25 mm., its length about 28 mm., its width at the hinder end 16 mm. On the hinder border is a prominent cingulum, which has in front of it a deep pit, somewhat as in the same tooth in *Odocoileus*.

SYMBOS PROMPTUS? new species.

To this species are referred a single tooth, taken to be a lower left second molar, whose base is buried in a loess nodule (Cat. No. 9011). The molar is worn down until it is only about 15 mm. high. The crown is 34 mm. long, and 25 mm. wide near the base. The tooth must be referred only provisionally to this species, the type of which is described below, from Afton, Oklahoma. The inner face of the tooth from Afton lacks the styles and ribs which characterize the corresponding tooth of *Taurotragus*.

BISON, sp. indet.

In the McAdams collection there are found three upper molars (Cat. No. 9012); namely, second molars, right and left, and a hindermost right molar. These are in separate nodules, but they are little or not at all worn, and may all have belonged to the same individual. The following measurements are furnished:

MEASUREMENTS OF SECOND AND THIRD UPPER MOLARS OF BISON IN MILLIMETERS.

	Height.	Length at base.	Length at summit.	Width at base.
Second molar.....	70	35	39	31
Third molar.....	56	35	41	29

There is also an upper third right molar of another individual (Cat. No. 9014).

These teeth are larger than any known to the writer which belong to *Bison bison*, even larger than those of a large male from Alberta.¹ There is present also a lower hindermost left molar (Cat. No. 9013), considerably worn, and also damaged in front. Its length at the base was 50 mm. It is impossible to say to what species of *Bison* these teeth belonged; but quite certainly not to *B. bison*. They are larger also than the teeth of *B. occidentalis*.² Possibly they are the teeth of *B. latifrons* or those of *B. regius*.

MAMMUT AMERICANUM (Kerr).

This species is meagerly represented in McAdams' collection. There are only a fragment of what appears to have been a root of a molar (Cat. No. 9015) and a fragment of a cusp (Cat. No. 9016) of a very immature molar.

MARMOTA MONAX (Linnaeus).

Of this species there are in the collection four incisor teeth. Two are upper incisors, side by side in a nodule. Another upper incisor is partly inclosed in a nodule, and a lower incisor is similarly placed. There appears to be no reason for regarding these teeth as belonging to any other species.

CASTOR CANADENSIS Kuhl.

This species is represented by 13 nodules, which contain the lower teeth or some of them, with sometimes a part of the bone badly preserved; and by several loose lower teeth and a single upper molar. These specimens have the United States Museum numbers 9020-9034. One nodule (U.S.N.M. Cat. No. 9026), marked by McAdams' number 205, presents four molars and a part of one lower incisor. This still retains its orange color. The length of the tooth row on the grinding surfaces is 30 mm. The incisor is 7 mm. wide. Another nodule (Cat. No. 9027), mostly dissolved away or never formed, presents the molars and most of that part of the incisor which was yet in the bone. The incisor is still yellow. The length of the tooth row is 31.5 mm. The part of the incisor present is 58 mm. long and 8 mm. wide. In one nodule (Cat. No. 9021) the incisor has a width of 9 mm.; the anterior grinding tooth, a width of 8 mm. These must have belonged to an unusually large individual.

CASTOROIDES OHIOENSIS Foster.

In the collection there is a lower left incisor with some of the base missing and a little of the tip. The length of the fragment is 240

¹ Thirty-sixth Ann. Rep. Geol. Surv. Ind., p. 648.

² Twenty-third Ann. Rep. Geol. Surv. Iowa, p. 320.

mm. The vertical diameter is 29 mm.; the transverse, 23 mm. There are, besides, a fragment of another incisor and a single enamel plate of a molar.

GEOMYS BURSARIUS (Shaw).

In the collection there are over 50 nodules which contain remains of this species of *Geomys*; besides which there are various detached incisors. In most cases little more than teeth are to be seen. In a few of the nodules, however, there are exposed considerable parts of the skull, so that most of the characters can be determined. Most of the specimens have incisors which are broader than those of the average individuals represented in the United States National Museum; but in the collection mentioned there are a few which have equally large teeth. In two of the skulls from about Alton the upper incisors show a faint groove near the outer border. This has been observed by the writer in several recent skulls.

URSUS AMERICANUS Pallas.

A right ramus of the lower jaw, with well-preserved third and fourth premolars and the two molars, together with the canine lacking the tip, is not distinguishable from these parts of the existing bear, *U. americanus*. The United States National Museum catalogue number is 9097.

5. COLLECTION FROM NEAR AFTON, OKLAHOMA.

In 1903¹ Prof. W. H. Holmes reported on The flint implements and fossil remains from a Sulphur Spring at Afton, Indian Territory. The importance of this spring, which is situated between Afton and Miami, was first noted by Dr. R. H. Harper, of Afton, who, about the year 1900, discovered in it remains of mastodons and elephants in close association with flint implements. Excavations were undertaken there by Professor Holmes, and his efforts were rewarded by the finding of some hundreds of weapons and implements of flint and bone, and the teeth and bones of many mammalian animals. These bones and teeth are now preserved, partly in the department of paleontology, partly in that of anthropology, in the United States National Museum. In the report referred to the animals mentioned are two species of elephants, buffalo, deer, elk, and horses, domestic and extinct.

By far the greater part of the bones and teeth, as well as the artifacts, were found within a few feet of the funnel of the spring and between depths of 2 and 7 feet. At the surface was muck to a depth of 2 or 3 feet, but thinning out away from the spring. Below was a bed of fine sand, not local but extending out on all sides as if deposited by water. Downward, this bed becomes more gravelly

¹ Rep. U. S. Nat. Mus. for 1901, pp. 237-252, pls. 1-26.

In this muck nothing was found except fragments of buffalo bones. The remains of extinct animals were all found in the sandy and gravelly layers. In Professor Holmes's report (pl. v) is shown a section of the excavation and the distribution of the teeth and bones. On account of the incoming water the work of excavating was troublesome. As a result of this perhaps the depths at which the various specimens were secured was not recorded, except in a few cases.

The writer has had the opportunity of studying this collection and has identified the following species:

† <i>Equus complicatus</i> .	<i>Alces americanus</i> .
† <i>E. laurentius</i> .	† <i>Symbos promptus</i> , new species.
† <i>E. excelsus</i> .	† <i>Bison</i> , sp. indet.
† <i>E. hatcheri</i> .	<i>Bison bison</i> .
† <i>E. holmesi</i> , new species.	† <i>Mammut americanum</i> .
† <i>Camelops kansanus</i> ?	† <i>Elephas columbi</i> .
† <i>C. nitidus</i> , new species.	† <i>E. imperator</i> .
<i>Odocoileus virginianus</i> .	† <i>Castoroides ohioensis</i> .
<i>Cervus canadensis</i> .	<i>Canis nubilus</i> .
† <i>Cervalces roosevelti</i> ?	<i>C. latrans</i> .

The writer does not believe in Professor Holmes's theory (his report, p. 243) that these bones and teeth had been gathered up in the surrounding country by Indians and thrown into the spring as offerings to the spirits. His section just referred to confutes this view. The species mentioned and most of the others must originally have been left in the deposit not far from the spring. The horses and camels and the imperial elephant belong to the fauna of the first interglacial stage, the Aftonian. Some of the other species are known to have existed at the same time and all of them may have existed then. Some of these species certainly may have been buried there at a later time. Certainly too, that bed of muck, 2 feet or more in thickness, had not accumulated there within a short time, and it was almost barren of fossils. It will be observed that 14 out of the 20 species represented are now extinct. The writer has elsewhere discussed the discovery at Afton.¹

Family EQUIDAE.

EQUUS COMPLICATUS Leidy.

Plate 7, fig. 1.

Of this species there are identified three large second upper pre-molars (Cat. No. 9098), an upper left milk molar (Cat. No. 9099), and

¹ Amer. Anthropologist, vol. 20, 1918, pp. 21-23.

13 lower teeth, premolars and molars (Cat. No. 9100). Three teeth (Cat. No. 9101) are the premolars of the right side of the lower jaw and are here illustrated (pl. 7, fig. 1).

EQUUS LAURENTIUS Hay.

To this species are referred six upper premolars and molars (Cat. No. 9102). They are all well-preserved teeth, mostly not much worn. Similarly preserved lower teeth, 12 in number (Cat. No. 9103), are referred provisionally to the species; but they, or some of them, may belong with the upper molar here identified as *E. excelsus*.

EQUUS EXCELSUS Leidy.

An upper tooth (Cat. No. 9106), probably a fourth premolar, is identified provisionally as that of *Equus excelsus*. The enamel surrounding the fossettes is little plicated. The crown is 70 mm. high, 27 mm. long, and 26 mm. wide, and it is considerably curved. An upper tooth (Cat. No. 9105), apparently the first molar, is 60 mm. high, 24.5 mm. long, and 26.6 mm. wide. Another tooth, now in the department of anthropology, is referred to the same species. It is considerably curved, so that the outer and the front faces are convex. It is not unlikely that some lower teeth belong here.

EQUUS HATCHERI Hay.

Plate 7, fig. 2.

A single tooth (Cat. No. 9107) is recognized as belonging to this species. A view of a cross section is given (pl. 7, fig. 2). This is taken at the middle of the height of the crown. The length is 28 mm.; the width, 28 mm. It will be observed that the enamel is considerably plicated. The tooth appears to be a first or a second upper molar.

EQUUS HOLMESI, new species.

Plate 7, figs. 9-12.

Type specimen.—Four upper teeth of the right side—namely, premolars 3 and 4, molars 1 and 2. Cat. No. 8642, U. S. National Museum.

Type locality.—Northeastern Oklahoma.

Type formation.—Pleistocene.

Diagnosis.—Teeth large. Enamel of fossettes, with only medium complication; styles unusually broad.

In the department of paleontology are four upper teeth which have the catalogue number 8642. Four similar teeth have been retained in the department of anthropology. These all appear to have belonged to the same individual. Those in the department of paleontology consist of the third and fourth premolars and the first and second molars, all of the right side. Two of those in the depart-

ment of paleontology pm⁴ and m² are figured (pl. 7, figs. 9-12). They have suffered only a moderate degree of wear. The measurements obtained from these teeth are as follows:

MEASUREMENTS OF UPPER PREMOLARS AND MOLARS.

	Height.	Length.	Width.	Width of protocone.
Third premolar.....	62	33	32	15
Fourth premolar.....	63	31.5	32	15.5
First molar.....	55	30	30.5	15.5
Second molar.....	68	29	29.5	16.5

The parastyles and mesostyles of these teeth are unusually broad. The width of the parastyle of the third premolar is nearly 8 mm.; that of the mesostyle, 8.5 mm. The widths of the styles of the fourth premolar are only slightly less. The parastyles are traversed by a well-defined narrow channel. The styles of the molars are about 5 mm. wide at the grinding surface, but they broaden somewhat toward the base. The second molar has the styles obscurely channeled. These styles are broader and more distinctly grooved lengthwise than are those of a very large domestic horse at hand.

The measurements show that the protocones do not vary much in width in the different teeth; also they diminish little or not at all in width toward the base of the tooth. The post-protoconal valley is directed so that its axis continued would meet the front of the tooth at the middle of the width. The direction is the same in premolars and molars. In *E. caballus* the axis of the valley of the molars is inclined toward the inner face of the tooth. At the head of the valley of the premolars of *E. holmesii* there is an inflection of the enamel; in the molars this is minute or wanting. The enamel of the fossettes is relatively simple, more so than in *Equus caballus*. In the premolars there is a pretty deep notch or loop in both the front and the rear walls of both fossettes. In the front wall of the post-fossette, outside of the large loop, there are one or two small inflections of the enamel. Facing the head of the post-protoconal valley is a deep somewhat M-like inlet into the fossette. In the molars the notch in the front of the pre-fossette is small or wanting. The cornua of the fossettes are broad. According to Professor Holmes's account already referred to (his page 241) these teeth were regarded as those of the domestic horse. They were found, however, at a depth of 7 feet or more and closely associated with teeth of apparently *Elephas imperator*. These teeth are too large to have belonged to the domestic horse; the enamel is of too simple a pattern, the styles are too broad, and there are other differences. The size of the teeth is not different from the teeth of *E. scotti* (probably the

same species as *E. complicatus*); but there are many characters in the way of regarding the Afton teeth as belonging to this species. The teeth of specimens of *E. scotti* in the American Museum of Natural History, from which the writer has a squeeze of the left cheek teeth of No. 10628, have the enamel strongly plicated; the post-protoconal valleys of the premolars have deep inlets at the head, and they are directed nearly toward the outer anterior corner of the tooth. The axis of the protocones is also oblique. In the molars the valley mentioned is turned more toward the inner side of the tooth and the protocones are nearly parallel with the axis of the tooth row.

In general the teeth from Afton are not greatly different in size from those of *E. occidentalis*;¹ but, according to Merriam's measurements, the width of each tooth is less than the length of the grinding surface; while in *E. holmesi* the width at least equals the length. The plication of the enamel of the fossettes in *E. occidentalis* is still simpler than in *E. holmesi*. In many respects the teeth from Afton resemble those teeth from Silver (or rather Christmas) Lake, Oregon, which were described and figured by Gidley.² In those teeth, however, the enamel of the fossettes is far more complicated than in the teeth from Afton. For the present, therefore, it is thought best to apply a new name to the latter. This is given in honor of Prof. W. H. Holmes, in recognition of his contributions to geology and anthropology.

Family CAMELIDAE.

CAMELOPS KANSANUS? Leidy.

To this species are provisionally referred five teeth. All appear to be thoroughly fossilized and are stained blue or black. An upper left first molar belongs in the department of anthropology. It is only slightly worn. The type of *C. kansanus* had no teeth and the teeth that have been referred to this species may belong to other species. The Afton teeth are here compared with teeth of *C. huerfanensis* (Cragin). They belong possibly to this species. Measurements in millimeters of this tooth and the corresponding one of the type of *C. huerfanensis* are presented.

MEASUREMENTS OF UPPER FIRST MOLARS.

	Type tooth.	Afton tooth.
Length of crown at base.....	33	28
Length of crown 35 mm. above base.....	38.5	43
Width of posterior lobe at base.....	30	25

¹ Merriam, J. C., Bull. Dept. Geol. Univ. Calif., vol. 7, p. 410.

² Bull. Amer. Mus. Nat. Hist., vol. 14, 1901, p. 116, fig. 11.

It will be observed that the Afton tooth is both shorter and narrower at the base, but that it expands more rapidly upward. At the summit its length is 53 mm. Its whole height is 60 mm.

Another tooth is a lower left hindermost molar, now in the department of anthropology. Its dimensions in millimeters are here compared with those of the corresponding molar of the type specimen of *C. huerfanensis* and those of a specimen from Minidoka, Idaho.

MEASUREMENT OF LOWER HINDERMOST MOLARS.

	Type.	Minidoka tooth.	Afton tooth.
Height of crown.....	65	63	50
Length of crown at middle of height.....	62	56	51
Width at base of second lobe.....	21	20	21

The Afton tooth is seen to be somewhat smaller than the others. It differs from the others in having on the inner face a pronounced groove opposite each of those on the outer face, and in having in front of each groove a pretty strongly developed style. There is a part of another lower third molar, the second and third lobes, in the department of paleontology. Two upper fourth premolars are preserved, one in each of the departments mentioned. The one in the department of anthropology is little worn; the other (Cat. No. 9109) is well worn. The following measurements allow these to be compared with the corresponding tooth of *C. huerfanensis*:

MEASUREMENTS OF UPPER FOURTH PREMOLARS.

	Afton tooth.	Afton tooth.	<i>C. huerfanensis</i> .
Height of crown as preserved.....	45	24	35
Length of crown at base.....	16	18	22
Length at height of 25 mm.....	19	21.5	26
Width of crown at base.....	24	25	25

While one must expect differences in the size of teeth of these camels, they are so great between the form found at Afton and the corresponding teeth of the type of *C. huerfanensis* that it appears to be better to refer those from Afton to *C. kansanus*, with some doubt.

CAMELOPS NITIDUS, new species.

Plate 7, figs. 3-8.

Type specimen.—A lower first molar, No. 9111, United States National Museum.

Type locality.—Region about Afton, Oklahoma.

Type formation.—Pleistocene.

Diagnosis.—An animal of medium size. First lower molar as in *Auchenia*, except that the anterior outer style is missing.

In the collection from Afton there are found three teeth which are regarded as having belonged to a species of camel. It has further been found impossible to refer these teeth to any of the hitherto described species; hence a new name is proposed.

The teeth belong to the left side and are identified as the fourth premolar and the first and second molars. They belonged certainly to as many individuals. The premolar (Cat. No. 9110) is much worn (pl. 7, figs. 7, 8). It retains both roots. The length is 18 mm.; the width, 9.1 mm. On the inner face is shown a deep sulcus, in front of which the tooth is bent somewhat inward. It was at first concluded that this premolar might be referred to *Camelops macrocephalus* (Cope); but the length is too great, and in that species the anterior part is straight, not incurved.¹ The hinder end is deeply notched by wear against the first molar. The tooth taken to be the first molar (Cat. No. 9111) is only moderately worn and is in good condition of preservation (pl. 7, figs. 3, 4). The roots are broken off and there is a considerable pulp cavity, now filled with clay. The height of the crown is 26 mm.; the length at about half the height of the crown, 26 mm.; the width at the base, 23 mm. On the inner face there is a rather deep groove between the two lobes and opposite the outer groove. The inner and outer grooves are only slightly separated. In front of the inner groove there is a well-developed rib, as there is in the llama. According to Cope, as cited, this rib is not present in the first molar of *Camelops macrocephalus*, but is present in the second molar. On the inner face there is a narrow style along the front of the tooth and a broader one along the rear of the hinder lobe. The tooth resembles closely that of the llama, but does not have the prominent fold found on the anterior border of the outer face of the tooth. The tooth identified as the second molar (Cat. 9112) is only slightly worn (pl. 7, figs. 5, 6). The height of the crown is 45 mm.; the length, taken at the base, is 24 mm.; at half the height, 25 mm. The tooth differs in some ways from the first molar and possibly belongs to another species. There is hardly that difference in size that might be expected. The anterior inner style is more prominent than in the first molar, while the rib in front of the internal groove is hardly perceptible in the lower half of the crown. As will be observed from the figure of the inner face, the hinder lobe is shorter fore and aft than the anterior lobe; but it is possible that this is abnormal and due to pressure on the pulp before calcification.

¹ Cope, Rep. Vert. Paleont., Llano Estacado, 1893, p. 86, pl. 23, fig. 5.

Family CERVIDAE.

ODOCOILEUS VIRGINIANUS (Zimmerman).

In the paleontological collection are a part of an antler, six cubo-navicular bones, an upper right very slightly worn molar, apparently the hindermost, and a lower left second molar. These have the museum's catalogue number 9113. They probably belong to the species named above, but the upper molar by its size and development of the styles seems to approach *O. hemionus*. This molar is 15.5 mm. long on the outer face and at the base; 18 mm. at the summit. The width is 16 mm.; the height of the crown, 14.5 mm. Several metapodials and fragments of antlers are preserved in the department of anthropology of the United States National Museum.

CERVUS CANADENSIS (Erxleben).

This species is represented by one tooth, a lower right fourth premolar (Cat. No. 9114), and a fragment of an antler.

CERVALCES ROOSEVELTI? Hay.

Plate 6. figs. 1-2, 5-8.

In the Afton collection there are three upper premolars, a part of an upper molar, a lower incisor, and a part of the left ramus of the lower jaw, with the second and third molars. To the incisor has been given the catalogue number 9115; to the premolars and fragment of molar, the number 9116; to the lower molars, the number 9117. More especially on geographical grounds these teeth are referred to *C. roosevelti*. The writer has not had the opportunity to compare them with those of the fine specimen of *C. scotti*, at Princeton, New Jersey. The upper premolars differ from those of *Alces americanus* in the much wider anterior style, this having a width of about 8 mm. at a level 10 mm. above the base of the tooth. What is taken to be an upper third premolar measures 23 mm. in length at the base, 29 mm. in width. A fourth premolar is 25 mm. long at the base and 30 mm. wide. The incisor, a first or second, differs from that of the existing moose in having a much longer lingual surface (pl. 6, figs. 5, 6). The width is 14 mm. The lower molars (pl. 6, figs. 1, 2) resemble closely those of *Alces*. On comparison with a number of teeth of the latter it appears that on the inner face of the hindermost molar the ribs on the first and second lobes of *Cervalces* are more strongly developed, so that the face is hardly concave, and may be even convex. The median rib increases in width as it approaches the cingulum and coalesces with the style behind it, which is also broader than in *Alces*. In the case of the second molar these differences do not seem always to hold good. The length of the second molar is 27 mm.; its width, 21.5 mm. The length of the third molar is 41.5 mm.; its anterior width, 21.5 mm.

ALCES AMERICANUS Jardine.

Plate 6, figs. 3-4.

Of the existing moose there is found in the collection a single incisor (Cat. No. 9118). It presents no differences when compared with the same tooth of a recent specimen. It is shown here in comparison with the incisor of *Cervalces roosevelti* (pl. 6, figs. 3, 4).

Family BOVIDAE.

SYMBOS PROMPTUS, new species.

Plate 6, figs. 9-10; plate 8, figs. 1-6.

Type specimen.—An upper left third molar (Cat. No. 9120, U.S.N.M.)

Type locality.—Northeastern Oklahoma.

Type formation.—Pleistocene.

Diagnosis.—Upper molars with the external styles less strongly developed than in *S. cavifrons*; the fossettes less angular.

In the collection made near Afton are various remains of a musk ox which appear to be referable to the genus *Symbos*, but which do not belong to any of the species described. There are present a molar taken to be the upper hindermost (Cat. No. 9120), a part of an atlas, a cervical vertebra, two dorsals, and one lumbar. All of the vertebrae are more or less damaged by loss of parts.

The upper molar (pl. 6, figs. 9, 10) is worn down to about one-half of the original height of the crown. The present height is about 25 mm. The length is 39 mm. at the grinding surface, on the outer face of the tooth; 38 mm. near the base; and 36 mm. along the middle of the width. The width at the base of the front lobe is 36 mm. On comparing this tooth with a photograph of the teeth of a fine skull of *Symbos cavifrons* found near Ann Arbor, Michigan, and described by Dr. E. C. Case,¹ it appeared that the parastyle and the mesostyle were less strongly developed than in *S. cavifrons*. The tooth was, therefore, sent to Doctor Case for direct comparison. He has kindly reported that the styles of *S. cavifrons* stand out 5 mm. from the excavation forming the outer face of the front lobe; while in the Afton tooth this distance is only 3 mm. Also, the inner wall of the fossettes of the molars of *S. cavifrons* is angular, while in *S. promptus* they are broadly rounded.

The writer has not seen the materials forming the type of Mr. Barnum Brown's *Symbos australis*.² However, the second molar, the type of this species, is considerably smaller, the length at the base being given as only 32 mm.; the width, 30 mm. The third molar

¹ Occ. Papers Mus. Zool. Univ. Mich., No. 13, 1915.

² Mem. Amer. Mus. Nat. Hist., vol. 9, 1908, p. 203, pl. 22.

would probably not have been wider. The inner face of the hinder lobe of *S. promptus* is considerably more flattened than in *S. australis*. The parastyle of the latter appears to be less prominent than in *S. promptus*. Also, the outer face of the anterior lobe of *S. australis* is not so deeply excavated as in the tooth from Afton; so that in the former the rib on the middle of the face stands out beyond the parastyle; in the Afton species, not so far as the parastyle. It may be noted that the two teeth compared are worn down almost exactly the same amount.

Besides the upper tooth, there is preserved a part of an atlas (Cat. No. 9121) which is referred provisionally to this species. It is quite unlike the same bone in *Bison* and resembles that of *Ovibos*. The atlas of *Ovibos* differs from that of *Bison* in being of heavier construction, almost all parts of the bone being thicker than the corresponding parts in *Bison*. Below the spinal canal the atlas from Afton is 44 mm. thick; in *Bison*, 35 mm. On each side there is a broad and deep notch at the outer end of the cavity for the corresponding occipital condyle; in *Bison* this is absent or of trifling depth. The spinal canal is smaller than in *Bison*. In *Ovibos* there is, in front of and just below the spinal canal, a median tuberosity that is not present in *Bison*. The cavities for the occipital condyles are not so deep as in *Bison*.

In the fossil atlas the arches are missing and the bone has been eroded. In general the vertebra agrees with that of *Ovibos*; but the hinder end of the spinal canal measures transversely about 50 mm., instead of 40 mm., as in *Ovibos*. The anteroposterior extent of the bone in the midline below is 67 mm.; in *Ovibos*, only 46 mm. The lateral extent of the bone was originally 200 mm. or more.

The cervical vertebra (pl. 8, figs. 4-6) is regarded as being the fifth. The neural spine is eroded off, as well as the transverse processes. The bone has so many points of agreement with the corresponding one of *Ovibos moschatus* that the relationship is undoubted. The anterior articular end of the centrum is similarly convex; the hinder one similarly concave. As in *Ovibos*, the foramina for the vertebral arteries are reduced in diameter. In the vertebra at hand the foramina have a diameter of only 4 mm. They are on a level with the floor of the spinal canal; in *Ovibos* much below this position. The height of the centrum, from the floor of the spinal canal to the lower surface in front, is 61 mm.; the width, taken at the level of the spinal canal is 92 mm.; the length, taken between the centers of the two ends, 54 mm. The spinal canal is oval, 30 mm. high and 24 mm. wide.

The dorsal vertebrae appear to have belonged near the front of the series, but they are so extensively damaged that exactitude can not be attained. There is so much difference in size that they may have

belonged to different individuals, but their color and manner of fossilization appear to associate them. One of these (pl. 8, figs. 1, 2) has the rear of the centrum 70 mm. deep, 95 mm. wide, and 53 mm. long. Apparently the neural arches stood on pedicels, which remain and show a deep pit. The other dorsal has part of the arch remaining, but the spine and most of the lateral processes are gone. The depth of the centrum is 56 mm.; the width, at the level of the spinal canal, 73 mm.; the length, 55 mm.

The lumbar vertebra (pl. 8, fig. 3) appears to belong about the middle of the series. It has lost the neural arch and the lateral processes, but the centrum is well preserved. The articular ends are nearly flat. The length is 59 mm.; the height behind is 54 mm.; the width 56 mm. between the ends the bone is somewhat constricted. The spinal canal is 25 mm. wide. This lumbar differs from those of *Ovibos* in being higher than wide; the fourth of *O. moschatus* being 37 mm. high and 55 mm. wide.

BISON, sp. indet.

Remains of one or more species of *Bison* were found in the excavation at Afton. Among these remains are upper and lower teeth, incisors, premolars, and molars. Probably some of them belonged to the existing bison, but others pretty certainly to one or more extinct species. Inasmuch as no horn cores were found, the species can not be determined. Eight teeth (Cat. No. 9122), belonging to at least two individuals, are regarded especially as being those of an extinct species. They appear to be well mineralized and they have the enamel blackened. They are fully as large as the largest teeth of the existing buffalo. In the department of anthropology there are other similar teeth. Other teeth present little evidence of any considerable geological age, but this may be deceptive.

There are present also an anterior left cannon bone (Cat. No. 9124), a tibia (Cat. No. 9119), and an astragalus (Cat. No. 9127), all of which are apparently fossilized and are heavy and contain little animal matter.

BISON BISON (Linnaeus).

In the spring at Afton there was found a nearly complete skull, which evidently was that of a cow bison of the existing species. The bone is not greatly changed from its original condition. Among the loose teeth are some which are white and fresh in appearance and which are probably those of *Bison bison*. Others more or less stained with iron and more mineralized must for the present remain unidentified. The skull belongs in the department of anthropology.

Family ELEPHANTIDAE.

MAMMUT AMERICANUM (Kerr).

In Professor Holmes's paper of 1903 it was said that he took from the spring at Afton at least 100 mastodon teeth. Many of these are in the collections at the United States National Museum. Some were illustrated in Holmes's report on plates 6 and 7. Figures of some have been published by the present writer.¹ All of these teeth are stained brown or black and appear to have lost practically all of their animal matter. The pores, however, are not filled with mineral matter, and broken surfaces adhere strongly to the tongue.

ELEPHAS COLUMBI Falconer.

In the department of paleontology in the United States National Museum are about a dozen teeth of this species which were secured in the spring near Afton. These teeth include upper and lower teeth of both the milk and the molar series. Some of them are finely preserved. They are usually stained black and show the presence of but little animal matter. Some are so thoroughly mineralized that they ring on being struck. One of these teeth was figured by Prof. W. H. Holmes in 1903² and by Dr. F. A. Lucas.³ Others have been illustrated by the present writer.⁴ Other teeth from this locality are in the department of anthropology in the United States National Museum.

ELEPHAS IMPERATOR Leidy.

In the United States National Museum there are three fine molars of this species which were found in the spring near Afton. One of these teeth, an upper last molar, was figured by Holmes in 1903;⁵ and a lower molar was illustrated by two figures on his plate 8. The same teeth were described by the present writer in 1914.⁶ Apparently there was only one other tooth of this species found by Holmes; these teeth therefore being presumably rarer than those of *E. columbi*.

In the Dyar Museum, Public Library, Kansas City, Missouri, is a lower jaw which appears to belong to this species. In each ramus there is a well-worn molar, apparently the second. The specimen was presented by Mr. R. H. Harper, and was probably found in the spring explored later by Professor Holmes.

¹ Geol. Surv. Ind., vol. 36; Iowa Geol. Surv., vol. 23.

² Rep. U. S. Nat. Museum for 1901, pl. 9, lower fig.

³ Md. Geol. Surv., Pleistocene, vol. 38.

⁴ Geol. Surv. Ind., vol. 36; Iowa Geol. Surv., vol. 23.

⁵ Rep. U. S. Nat. Mus. for 1901, pl. 9, upper fig.

⁶ Iowa Geol. Surv., vol. 23, p. 422, pls. 66, 67.

Family CASTOROIDIDAE.

CASTOROIDES OHIOENSIS Foster.

Nothing of this species has been secured from Afton except a fragment of an incisor (Cat. No. 9126).

Family CANIDAE.

CANIS NUBILUS (Say).

In the department of anthropology in the United States National Museum is a skull of a wolf that may be referred to the large species now inhabiting that region. It is white and presents no evidences of great geological age, but no certain conclusions can be drawn as to the length of time it had been buried there. Besides the skull

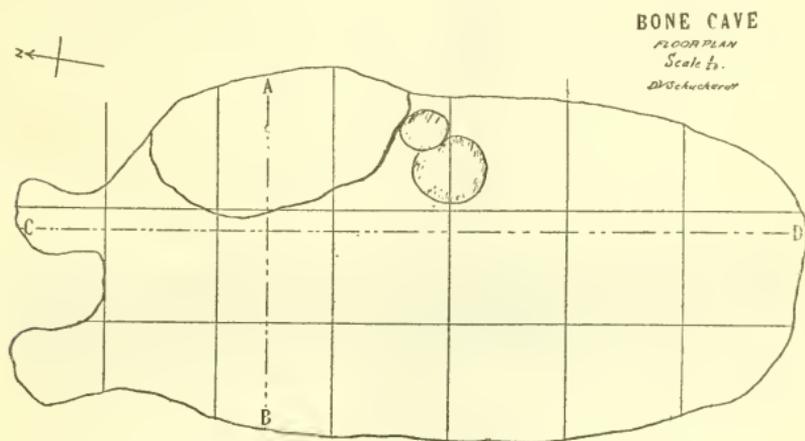


FIG. 1.—FLOOR OF BULVERDE CAVE. THE SQUARES ARE 10 FEET ON EACH SIDE. THE ELLIPTICAL FIGURE INCLOSING A REPRESENTS THE BOTTOM OF THE SHAFT.

there are many teeth and some bones. These wolf remains are in the department of anthropology.

CANIS LATRANS Say.

In the collection from Afton there is an axis (Cat. No. 9131) which certainly belonged to this species or to a close relative of it.

6. COLLECTION MADE IN A CAVE NEAR BULVERDE, BEXAR COUNTY, TEXAS.

Within a few miles of the village of Bulverde, Bexar County, Texas, there is a cave which has furnished a considerable number of species of fossil vertebrates. In the month of December, 1915, the writer employed Mr. D. V. Schuchardt, of San Antonio, then a stu-

dent in the Agricultural and Mechanical College at College Station, to spend some days in making a trial collection. This collection has been presented to the United States National Museum and is described below.

Mr. Schuchardt kindly furnished the writer with plans of the cave, drawn to scale. Although these were not produced with the expectation that they would be published, they are here presented (figs. 1-3), inasmuch as they give a good idea of the size, the form, and the position of the cave. As engraved, 1 inch represents a length of 20 feet. In figure 3 the floor is divided into squares 10 feet on each side.

As Dr. T. W. Vaughan has informed the writer, this cave has been excavated in the Edwards limestone, a member of the Lower Cre-

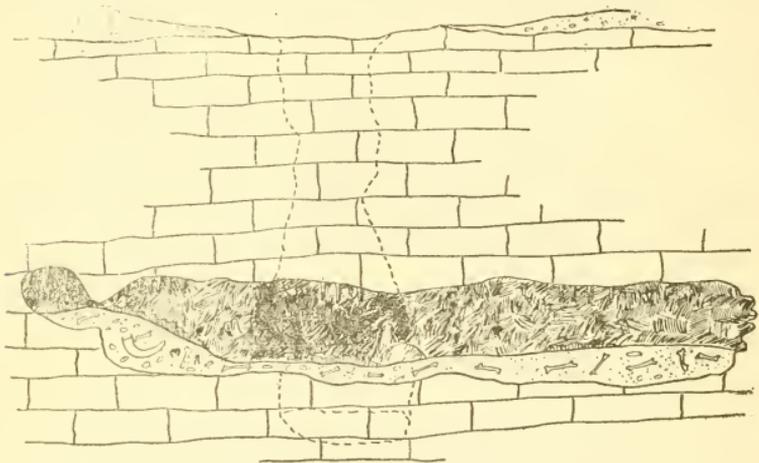


FIG. 2.—A SECTION OF THE CAVE ALONG THE LINE C-D OF FIG. 1.

taceous. The surface conditions in the neighborhood are not known to the writer. The entrance to the cave is a perpendicular shaft, having a diameter of somewhere about 8 feet and a depth of approximately 35 feet. When the horizontal part of the cave is reached it is found to be nearly 70 feet long and 33 feet wide. The height may be as much as 7 feet, but this varies, being sometimes much less. As represented by Mr. Schuchardt, the floor is covered with a layer of fossil-bearing materials as much as 3 feet in thickness. To what extent the thickness has been determined in different parts of the cave the writer does not know. As shown by the materials sent, this is made up to a great extent of unconsolidated sand and clay; but in places it is cemented together by calcium carbonates and iron oxide; and there appear to be layers of travertine of unknown horizontal

extent. In these deposits are to be found numbers of bones and teeth, some admirably preserved, but often broken up, as is shown by the fragments of limb bones of large proboscideans.

Usually the bones are entirely free from the matrix, but sometimes they are encrusted by the deposit of travertine. On the walls of the cave and of the shaft leading to it there are, as shown by the drawings, stalactitic deposits. On the floor are blocks of fallen rock. No lower opening from the cave is known, but Mr. Schuchardt suspected that there had been one formerly at the north end; and the heaping up of materials at that end appears to add probability to this view. This or any other opening would, however, probably be, not into the free air, but into other caves. While some bones may have been washed into the cave through such openings, it seems probable that most of the remains are those of animals that fell into the cave through the open shaft.

It is to be hoped that the coming season will be a favorable one, so that Dr. E. H. Sellards, of the Texas Geological Survey, may be able to carry out his plan for working this important deposit.

From Mr. Schuchardt's collection there have been determined the following list of fossil vertebrates:

- | | |
|--|--------------------------------|
| † <i>Alisodon mirus</i> , new genus and species. | <i>Promyscus</i> , sp. indet. |
| † <i>Terrapene whitneyi</i> . | <i>Geomys texensis</i> ? |
| † <i>T. bulverda</i> , new species. | <i>Perodipus</i> , sp. indet. |
| † <i>Gopherus atascosae</i> ? | <i>Sylvilagus</i> , sp. indet. |
| <i>Crotalus atrox</i> ? | <i>Ursus americanus</i> . |
| <i>Didelphis virginiana</i> . | <i>Canis latrans</i> . |
| † <i>Bison</i> , sp. indet. | † <i>Aenocyon dirus</i> ? |
| † <i>Mammut americanum</i> . | † <i>Dinobastis serus</i> . |
| † <i>Elephas primigenius</i> . | † <i>Felis</i> , sp. indet. |

Of these 18 species those marked by the † may be fairly regarded as extinct. These would constitute 55 per cent of the whole number.

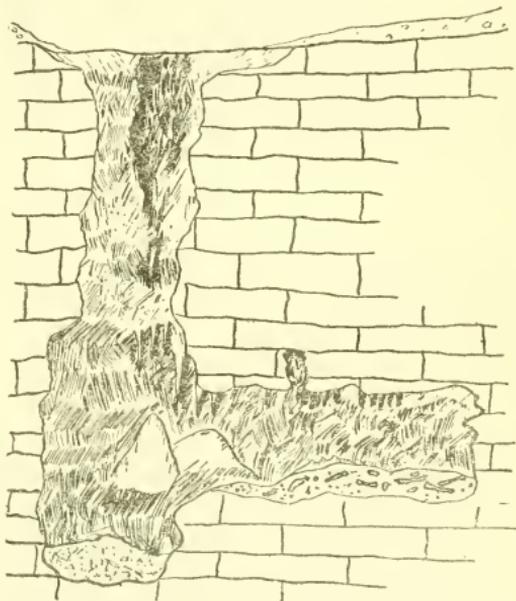


FIG. 3.—A SECTION OF THE CAVE ALONG THE LINE A-B OF FIG. 1.

We might conclude therefrom that as a whole the fauna belongs to about the middle of the Pleistocene. Inasmuch as in the list are found no remains of *Elephas imperator*, or of any camels, or of any horses, there seems to be no special reason for holding that it is older. Possibly the shaft had not been opened to the surface during the early Pleistocene.

PISCES.

Family CYPRINIDAE.

ALISODON, new genus.

Type species.—*Alisodon mirus*, new species.

Type formation.—Pleistocene.

Diagnosis.—Pharyngeal teeth in one row, probably 3-3; stalked; the grinding surface expanded and deeply concave.

The name is derived from "αλεισον a cup, and ὀδόν a tooth.

ALISODON MIRUS, new species.

Plate 9, figs. 8-9.

Type specimen.—A pharyngeal bone bearing two teeth (Cat. No. 9219, U.S.N.M.).

Type locality.—Bexar County, Texas.

Type formation.—Pleistocene.

Diagnosis.—Same as for the genus.

In the collection made by Mr. Schuchardt there is a single tooth-bearing pharyngeal bone (Cat. No. 9219) of a cyprinid fish, on which there are retained two teeth (pl. 9, figs. 8, 9.×2). Between these teeth there is a considerable space, which was, in life, probably occupied by another tooth; and on the bone there appears a scar which may mark the place where this tooth was attached. There seems to be no reason for supposing that there was a second row of teeth; hence the tooth formula is probably 3-3. From one extremity of the bone to the other, in a straight line, is 14 mm. The teeth are of unusual form. The larger one consists of a basal pedicel about 3.5 mm. wide and 1.5 mm. thick, and an expanded portion about 4.5 mm. wide. The masticatory surface is deeply concave, with the rim somewhat irregular. The smaller tooth has practically the same form.

The writer has found no reference to similar teeth, except in Day's Fishes of India (vol. 2, p. 555), where the teeth of *Amblypharyngodon melettinus*, a species of southern India, are said to have rather concave summits. In that genus, however, there are three rows of teeth on each pharyngeal.

Alisodon seems to fall into the subfamily Mylopharodontinae¹ and next to the genus *Stypodon*. This genus is described as having

¹ Jordan and Evermann, Bull. 47, U. S. Nat. Mus., p. 202.

teeth of the *Mylocheilus* type, more or less cylindrical, with rounded grinding surfaces. What special use a minnow had for such teeth as those of *Alisodon* it is hard to determine.

REPTILIA.

Family EMYDIDAE.

TERRAPENE WHITNEYI Hay.

This species appears to be represented by a fragment of the upper shell, presenting the region occupied by a part of the first costal scute, and the first, second, third, and a part of the fourth, marginal scute areas; also by an anterior lobe of the plastron, lacking a left hinder corner; and a small part of another anterior lobe. These parts have the catalogue number 9220. When these remains are compared with the fine type of the species, now in the United States National Museum, only apparently unimportant differences are observed.

TERRAPENE BULVERDA, new species.

Plate 10, fig. 1.

In the collection are several fragments of one or more species of box tortoise that are not referable with satisfaction to any of the described species. That these fragments belong to one species is doubtful; they certainly belong to more than one individual. It is thought better to give a specific name to the most characteristic piece and to refer the others to it provisionally.

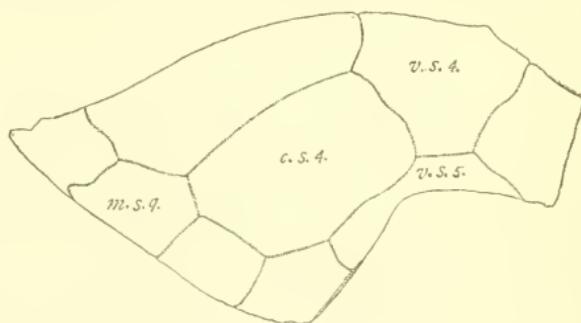


FIG. 4.—TERRAPENE BULVERDA. REAR OF CARAPACE $\times 1$.

The fragment that is made the type of *T. bulverda* is a part of the hinder half of the carapace, including parts or wholes of the fourth and fifth vertebral scutes, the fourth right and left costal scutes, the left third costal scute, and the eighth, ninth, tenth, and eleventh left marginal scutes.

This box tortoise was a large one. The width at the rear of the lateral hinge lines was not far from 140 mm. The bones are all solidly grown together. To illustrate the form of the various scutes a line drawing (text fig. 4) is provided, which represents them as spread out flat. It will be seen that the fourth vertebral scute is urn-shaped and narrow behind. The width at the widest part preserved is 42 mm. Its length was about 35 mm. The fifth vertebral scute was unusually wide, about 48 mm. The ninth marginal is 23 mm. long and 20 mm. high.

The free border of the carapace is sharp on the tenth and eleventh scute areas, but farther forward it rounds off and thickens. Evidently there was no keel connecting the hinder free border with that in front. At the tenth marginal area the shell is 13 mm. thick. In the region described the free border of the shell is not rolled up, but nearly flat; as is also the underside of the same region. In another fragment the edge along the ninth marginal is slightly turned upward. In *T. whitneyi* the ninth marginal scute on both sides is prolonged upward considerably between the third and the fourth costal scutes; in *H. bulverda* this marginal rises but little between the costal scutes mentioned.

There is present a left xiphiplastral bone which appears to belong to this genus (pl. 10, fig. 1). Indeed, it fits against the part of the carapace just described as if it belonged there originally. While, however, the bones of the carapace are solidly coossified, the xiphiplastral was connected with its fellow and the hypoplastral in front by suture. This bone resembles in many ways the same bone of *Terrapene antipex*.¹ It is however, rather more pointed behind. In *T. antipex* the flattened upper surface of the xiphiplastral, that which in life was covered by horn, terminates mesially abruptly; but in the xiphiplastral here described this surface slopes off gradually into the rest of the bone. In *T. antipex* there was found to be a sharp ridge, a keel, connecting above the bridge the rear free border with that in front. As shown by the type fragment of carapace and another supposed to belong to the same species, there is no trace of such a keel. There is present also a right humerus somewhat larger than that of a good-sized *T. carolina*. It may or may not have belonged to *T. bulverda*. In 1908² the writer referred to *T. marnochii* a fine carapace which had been found on San Diego Creek, probably near San Diego, Duval County, Texas. This identification was provisional and somewhat arbitrary. It may yet be shown that the carapace belongs to a distinct species and that the carapace here described as *T. bulverda* is that of *T. marnochii*; or *T. marnochii* may have no claim to either carapace. Future discoveries alone can remove these doubts.

Family TESTUDINIDAE.

GOPHERUS ATASCOSAE? (Hay).

Testudo atascosae HAY, Foss. Turtles, N. A., p. 467, figs. 627, 628.

In the collection from the cave at Bulverde there is a single femur (Cat. No. 9222), which is referred with doubt to this species.

¹ Eighth Ann. Rep. Geol. Surv. Fla., 1916, p. 58, pl. 5, fig. 1.

² Fossil Turtles North America, p. 360, pl. 58, figs. 1, 2.

Family CROTALIDAE.

CROTALUS ATROX? Baird and Girard.

Plate 10, fig. 2.

In the collection are about 50 vertebrae, most if not all of them belonging to one crotalid snake; also a few ribs and one poison fang. The vertebrae indicate a very large serpent. They have been compared with a skeleton of *Crotalus adamanteus* in the United States National Museum, which was about 6 feet long in life. One of the fossil vertebrae (pl. 10, fig. 2), presenting dorsal and hypapophysial spines, is slightly larger than any in the skeleton referred to. From the extremity of one spine to the other is 29 mm.; measured between lines parallel with the body, 27 mm. The poison fang attached to the maxilla belonged to a much smaller snake, but probably of the same species. There is also a left ramus of the mandible, minus the dentary.

MAMMALIA.

Family DIDELPHIDAE.

DIDELPHIS VIRGINIANA Kerr.

Of the Virginia opossum there have been secured a supraoccipital bone; two lower canines, a right and left, probably of one individual; an atlas and a fifth cervical; a right humerus, lacking both extremities; and the upper half of the left tibia. These have the catalogue number 9224.

Family BOVIDAE.

BISON, sp. indet.

An indeterminable species of the genus *Bison* is included in the collection made by Mr. Schuchardt. It is represented by a single lumbar vertebra (Cat. No. 9225). It is heavy and thoroughly fossilized.

Family ELEPHANTIDAE.

MAMMUT AMERICANUM (Kerr).

Plate 10, fig. 8.

In the collection sent by Mr. Schuchardt is the anterior end of what appears to be a hindermost milk molar of this species. It presents two transverse crests, which are wholly unworn (Cat. No. 9226). The owner of the tooth was a quite young mastodon.

In the collection is a left tibia (pl. 10, fig. 8. Cat. No. 9227) which is regarded as belonging to a young animal of this species. Both epiphyses are wanting, and the inner condyle is broken off.

The total length of the bone, measured in front, is 220 mm. The side-to-side diameter at the middle of the shaft is 53 mm.; the fore-and-aft, 43 mm. This is to be compared with the measurements of a similar bone of *Elephas primigenius*, as given below.

ELEPHAS PRIMIGENIUS Blumenbach.

Plate 9, figs. 1-7; plate 10, figs. 3-7; plate 11, figs. 1-6.

The most important part of the collection sent from Bulverde cave by Mr. Schuchardt consists of elephant remains which the writer has been compelled to refer to that widespread and variable species *Elephas primigenius*. These remains consist of a part of a right maxilla, which bears the third (penultimate) and part of the fourth (ultimate) milk molars of one individual (Cat. No. 9229); the right second and third milk molars in a fragment of the maxilla; the detached upper left third milk molar; a detached lower second milk molar and a detached lower third, apparently right, milk molar, all of a second individual (Cat. No. 9230). There are also fragments of milk molars of other young elephants.

The maxilla and its contained teeth (pl. 9, fig. 1; pl. 11, fig. 5) are to be described first. The underside of the fragment is buried in the mingled clay and gravel of the bottom of the cave. The upper surface is covered by an incrustation of clay, calcium carbonate, and iron oxide. The front of the penultimate milk molar has been slightly damaged in front, but it still presents five plates and the hinder talon. It had been worn back to the talon, and it shows well the thin and plicated enamel. Five plates occupy a line 44 mm. long. The width of the tooth is 37 mm.

The hindermost milk molar is represented by five plates and the anterior talon. It had not been touched by wear, and the grinding surface was almost hidden in cement. The writer has ground down somewhat the front of the tooth in order to show the enamel. The figures give a view of the inner face of the teeth and maxilla and a view of the grinding surfaces. The five enamel plates and the intervening plates of cement of the hindermost milk tooth are spanned by a line 52 mm. long. There would thus be 9.6 of these plates in a line 100 mm. long. In case the tooth originally had 12 plates, as is probable, its length must have been close to 130 mm. The width is 49 mm.; the height of the fourth plate, 78 mm. Of the upper hindermost milk molar of *E. primigenius* the writer has at hand no good examples, but its size may be judged pretty well from specimens of the corresponding lower teeth of Alaskan specimen. One of these has been described and figured.¹ It is estimated to have had a length of about 110 mm., but it may have been longer. The same milk molar in a lower jaw from Siberia (No. 8858, U.S.N.M.), with apparently

¹ Iowa Geol. Rep., vol. 23, p. 403, pl. 54, fig. 9.

one plate and the talon missing in front, was close to 105 mm. in length, 40 mm. in width, and 60 mm. in height. Twelve plates are counted. The upper fourth milk molar referred to *E. primigenius* is represented by No. 4836 of the United States National Museum, sent from Waverly, Ohio.¹ It is estimated to have been about 120 mm. long. Its width is 62 mm.; its height at the fifth plate is 110 mm. It is possible, however, that this tooth is the first true molar; but, in any case, it has thinner ridge plates (10 in a 100 mm. line) and the enamel is thinner. It resembles specimens of elephant teeth from Alaska. An upper hindermost milk molar having coarser plates than that of our Bulverde specimen is illustrated in A. Leith Adams' work.² At the same time, it is a narrower tooth.

The Bulverde teeth which belonged to the other and younger individuals may now be described. The second upper milk molar (pl. 9, figs. 5, 6) is small. It has been slightly damaged in front; but there appear to have been only two ridge plates and an anterior and a posterior talon. The length was only about 17 mm.; the width is 13 mm. The fine upper third milk molars have been only slightly affected by wear (pl. 9, figs. 3, 4, 5, 6; pl. 11, fig. 1). They measure 72 mm. in length, 43 mm. in width, and 48 mm. in height. There are eight plates and front and rear talons. The lower third milk molar, worn back only to the fourth plate, is 70 mm. long, 37 mm. wide, and 46 mm. high (pl. 9, fig. 2; pl. 11, figs. 3, 4). It narrows toward the front end. Here, again, are eight plates and front and rear talons. Only the bases of the two roots had been formed, as is the case also with the upper teeth. In both the upper and the lower third milk teeth there are the bases of two roots—a smaller one in front supporting two plates of the upper teeth and three of the lower one, and a larger hinder root for the other plates. In the lower tooth (pl. 11, fig. 4) the interval between the two roots is situated below nearly the middle of the length of the crown; in the upper tooth (pl. 11, fig. 2) it is nearer the front of the tooth.

Good specimens of the penultimate milk molars, upper and lower, of *Elephas primigenius* are rare objects. The writer is now much in doubt about the identity of a supposed lower tooth of this order described³ from Alaska. It is almost certainly a much worn fourth milk tooth. For information we must at present depend on teeth described by A. Leith Adams in his work above cited. Those varied from 39 mm. in length and 21 mm. in width of crown, to 83 mm. and 35 mm., respectively. The average was 56 mm. in length and 31 mm. in width. The teeth from Texas fall within these limits. Adams gives illustrations of a number of these milk molars, upper and

¹ Iowa Geol. Rept., vol. 23, p. 402, pl. 54, fig. 6.

² Mon. Brit. Foss. Eleph., p. 17, pl. 1, fig. 4.

³ Iowa Geol. Rept., vol. 23, p. 401, pl. 54, figs. 3, 4.

lower. A lower second (antepenultimate) milk molar accompanied the teeth of the young individual. A section was made and polished in order to show the structure (pl. 9, fig. 7). There appear to be present three plates and front and rear talons. The crown is 19 mm. long and 15 mm. wide. The penultimate milk molars above described have lost much of their cement. There are present the hinder halves of the upper third milk teeth of two other individuals, both having the same white color as the teeth just described. One of these (pl. 11, fig. 6. Cat. No. 9232) preserves the cement between its plates. There are in the collection several fragments of other third milk molars, and the writer has seen a similar tooth in the collection of the San Antonio Scientific Society. Indeed, it may be the fellow of the lower milk tooth of the specimen which furnished the two penultimate milk molars and the one lower milk molar.

If the remains just described belong to *Elephas primigenius* and not to an unrecognized species, of whose validity the writer has been unable to persuade himself, the known distribution of this wide-ranging species becomes greatly extended in our country. The writer has referred to *E. primigenius* a large tooth now in the collection at Raleigh, North Carolina, and found a few miles north of Beaufort. In the present paper he figures a fragment of a milk molar which is in the collection from Whitesburg, Tennessee. It is a smaller tooth than those from Bulverde. The writer has had sent to him by Prof. Mark Francis, of College Station, Texas, a lower left penultimate milk molar which was found near Temple, Bell County, Texas. It is 62 mm. long and 32 mm. wide (pl. 10, figs. 3, 4).

The teeth from Bulverde have the ridge plates so much thicker than most specimens from Alaska and Siberia that one is naturally led to inquire whether the former may not belong either to *E. columbi* or to *E. imperator*. Of *E. columbi* Leidy described a second (antepenultimate) milk molar¹ and his figure has been copied by the present writer;² but one can hardly rely on teeth of this order in distinguishing species. From Florida Leidy³ described what he regarded as an upper penultimate milk molar; but his figure, reproduced by the present writer,⁴ seems to show the concave surface of wear of a lower tooth. The length of the tooth is 110 mm.; the greatest thickness, 46 mm. This is nearly the size of the hindermost milk molar of the Texas specimen and of others belonging to *E. primigenius*. The present writer has described and figured,⁵ as an upper penultimate milk molar of *E. columbi*, a specimen from the phosphate beds of South Carolina. It is a little used tooth and

¹ Trans. Wagner Inst. Sci., vol. 2, p. 17, pl. 3, figs. 6, 7.

² Geol. Surv. Iowa, vol. 23, p. 413, pl. 61, figs. 2, 3.

³ Trans. Wagner Inst. Sci., vol. 2, p. 17.

⁴ Geol. Surv. Iowa, vol. 23, pl. 61, figs. 5, 6.

⁵ Idem, p. 413, pl. 61, fig. 4

nearly complete. The length was originally a little more than 105 mm. and its thickness is 57 mm. If these teeth really belong to *E. columbi* there is a great disparity in the sizes of the penultimate milk molars of this species and *E. primigenius*, that of *E. columbi* being about as large as the fourth milk molar of *E. primigenius*.

In the Iowa report referred to above¹ the writer described and figured a lower penultimate milk tooth as belonging to *E. columbi*. It had been found at Afton, Oklahoma, where both *E. columbi* and *E. imperator* have been collected. The writer is now inclined to regard the tooth as that of *E. imperator*, partly on account of the size of the tooth and partly because of the thickness of the plates and of the enamel. It is a considerably larger tooth than the corresponding known teeth of *E. columbi* and far larger than that of the teeth from Bulverde.

As more than one other student of elephants, the writer has sometimes been tempted to set off from *Elephas primigenius*, as a distinct species, the form that is found in the United States and southern Canada; but each time that he has approached the subject he has been arrested in the effort to find distinguishing characters.

Two skull bones from Bulverde are referred to the young of this species, but it is possible that they belonged to the mastodon. Figure 1 of plate 10 (Cat. No. 9233) represents, of about one-half the natural size, the left side of the basisphenoid bone. On each side is a large air cavity, which opened below into the hinder end of the nasal passage. Above this are seen openings into other air cells, wholly within the body of the bone. Figure 2 of the same plate gives a view of the inner surface of the right exoccipital (Cat. No. 9234). Four openings to air cells in the bone are seen.

There are present various limb bones of two or more young proboscideans, some of which are referred to the species here described. Others are described above as those of a young mastodon. Among these bones is the base of a left scapula showing the articular cavity. There are also parts of three humeri, all with the epiphyses missing. There appear to be differences among them, but the writer is not able to determine their generic identity.

A left tibia (Cat. No. 9235) of a young animal (pl. 10, fig. 7) is referred to this species. It lacks both the epiphyses. The length, taken in front, is 228 mm. The side-to-side diameter at the middle of the length is 44 mm.; the fore-and-aft diameter, 41 mm. It is thus shown to be a slenderer bone than that of *Mammut americanum* (pl. 10, fig. 8), as recorded under that species. A right tibia (Cat. No. 9236) of a somewhat larger young elephant has lost the upper epiphysis and a part of the lower end of the shaft. Still another

¹ P. 413, pl. 61, figs. 7, 8.

tibia (Cat. No. 9237) is represented by the upper two-thirds of the shaft. Its side-to-side diameter is only 40 mm.

A right femur (Cat. No. 9238) of a young elephant has lost the head of the bone (not yet united to the shaft), the great trochanter, and somewhat of the lower end of the shaft. The total length of the fragment is now 280 mm. It was originally somewhat more than 300 mm. long. Measured across the upper end at the plane of union of the epiphysis with the shaft the width is 103 mm. The greatest diameter at the middle of the shaft is 43 mm.; the least diameter, 33 mm. A left femur (Cat. No. 9239), presenting only the upper half of the shaft, is slightly larger and must have belonged to another individual. These bones are heavy and well mineralized.

A right ulna of a proboscidean, probably an elephant, is represented by the shaft lacking the olecranon and about the lower third of the bone. A left ulna presents about the upper fourth of the bone lacking the olecranon. They probably belonged to one individual and have the catalogue number 9240. The width across the surface for the humerus is 115 mm. The greatest diameter at about the middle of the shaft is 55 mm.; the least, 47 mm.

Three bones of a large elephant (Cat. No. 9246), a dorsal vertebra without its arches and processes, the lower end of a left humerus, and the lower end of the right tibia are in the collection. The vertebral centrum is heart-shaped, the depth from the floor of the spinal canal to the lower border being 125 mm. or more; the width, taken at the bottom of the articular cavities for the ribs, 100 mm. The width across the lower articular surface of the humerus was more than 170 mm. The width of the articular surface for the astragalus was 130 mm.

Family CRICETIDAE.

PEROMYSCUS, sp. indet.

A single lower incisor tooth (Cat. No. 9247) is all in the collection that represents this genus.

Family GEOMYIDAE.

GEOMYS TEXENSIS? C. H. Merriam.

This species is believed to be represented by an upper incisor and the right side of a lower jaw, containing the incisor and part of one molar (Cat. No. 9248).

Family HETEROMYIDAE.

PERODIPUS, sp. indet.

The genus *Perodipus* is represented in the collection by two upper incisors.

Family LEPORIDAE.

SYLVILAGUS?, sp. indet.

Of what is probably a species of *Sylvilagus* there are in the collection a left ramus of a lower jaw, with molars and part of the incisor, another incisor, and a front molar (Cat. No. 9248).

Family URSIDAE.

URSUS AMERICANUS? Pallas.

Of the genus *Ursus* there are recognized two damaged humeri, the shaft of one femur, a fibula, and the third and fourth metatarsals, all of which probably belonged to the same individual. The length of the most nearly complete humerus is 300 mm. When compared with the corresponding bones of a recent individual of *U. americanus* no important differences are observed. However, the metatarsals are relatively more slender than in recent specimens observed and are not so straight. The bones are not well fossilized, and little can be said regarding their geological age. They were found in the cave at the end most distant from the entrance. They have the catalogue number 9249.

Family CANIDAE.

CANIS LATRANS Say.

Of apparently this species there are present the proximal half of the right femur and the distal half of the right humerus. These parts are well preserved and appear to have lost all their animal matter, but are not thoroughly mineralized. The two pieces may or may not belong to the same individual. To these have been given the catalogue number 9249.

Between the humerus and that of a specimen (No. 1326) in the United States National Museum there is observed no important difference. In the case of the femur the distance from the inner surface of the head to the outer face of the great trochanter is 33 mm. in both the fossil and a femur (No. 1326) in the existing coyote; but the diameter of the shafts differ, the greatest of the shaft at the middle of the length being, in the existing coyote, 12 mm.; in the fossil 13.6. This difference is probably due to individual variation.

AENOCYON DIRUS? Leidy.

Plate 5, figs. 3-4.

In the collection there is a radius (Cat. No. 9251) of the right side, nearly complete, which belonged to a large species of wolf. It is compared with that of a skeleton of *Canis lupus* from the north of

Sweden, which had a length of about 5 feet 4 inches from tip of nose to tip of tail. In this skeleton the radius is 224 mm. long; the fossil radius is 234 mm. long. It is, moreover, a broader bone relatively to the length. The distal end is 40 mm. wide. The bone is well fossilized.

In the collection there is an upper right canine tooth (Cat. No. 9252) which was found in the cave not far from the radius above described. This tooth (pl. 5, figs. 3, 4) has the same fore-and-aft diameter at the base (13 mm.) as has the corresponding tooth of a specimen of *Aenocyon dirus* from Rancho LaBrea, near Los Angeles, California. It is, however, not so thick (9 mm.) as that last-mentioned tooth (10 mm.). The cingulum is strongly developed, especially on the inner side. The root is broad.

It is possible that this tooth and the radius belong to Sellards' *Aenocyon ayersi*, found in Florida.

Family FELIDAE.

DINOBASTIS SERUS, Cope.

Plate 5, figs. 1-2.

The writer has recently recognized the presence of this species in the cave near Bulverde¹ from one of the canine teeth, the property of the San Antonio, Texas, Scientific Society. In the collection made by Mr. Schuchardt there are some remains of a large catlike animal which are referred provisionally to *Dinobastis serus*. These parts consist of a lumbar vertebra, probably the fourth, a nearly complete left femur, a considerable part of the right femur, the upper end of a third femur, a right tibia, a left cuboid, a left second metacarpal, two second phalangeals, and one unguis phalangeal. To these parts have been given the catalogue number 9251 except to the fragment of the upper end and of a femur. This is differently fossilized and doubtless belonged to another individual. It has the number 9252. The body of the lumbar vertebra is 40 mm. long, 46 mm. wide, and 30 mm. high at the hinder end. The fourth lumbar of a lion is 44 mm. long, 42 mm. wide, and 30 mm. high.

The femur is compared with that of a lion. This in the lion has a length of 315 mm., measured from the upper surface of the head to the lower border of the internal condyle; in the fossil, a length of 303 mm. The shaft, at the middle of the length, is of somewhat greater diameter than in the lion, being from inside to outside, 30 mm. The widths of the two bones from the internal to the external tuberosities is nearly the same; but the anteroposterior diameters of the condyles are very different. In the lion that of the external con-

¹ Proc. U. S. Nat. Mus., vol. 56, p. 107, pl. 28, fig. 4.

dyle is 70 mm.; that of the fossil femur, 57 mm. In this respect the femur resembles that of a bear, but it is otherwise quite different.

The tibia has lost the external part of the articular surface for the astragalus. The total length is 283 mm. The lower half of the shaft is nearly terete, not triangular in section as in the lion. The front border is considerably concave from one end to the other, as in the lion. In the bear this border is straight. The second metacarpal is 102 mm. long, 23 mm. wide, and 25 mm. deep, proximally. The bone is straight, as in the bear, not curved as in the lion and tiger. It is, however, too large to be the metacarpal of any bear of ordinary size. There are present two second phalangeals that are referred to as the same sabertooth. There is preserved also an unguis phalangeal (pl. 5, figs. 1, 2) which resembles much that of a lion. It is, however, thicker from side to side. There seem likewise to have been no lamellae of bone to cover the base of the horny claw.

FELIS?, sp. indet.

In the collection there is a single lumbar vertebra, probably the fourth, which belonged to some felid much smaller than the one here described as *Dinobastis scrus*. The length of the centrum is only 34 mm. The width and height of its hinder end are, respectively, 32 mm. and 19 mm. The outer faces of the neural arches are more nearly perpendicular than in the lumbar of the supposed *Dinobastis*. This vertebra can not belong to *Felis cougar*, for the lumbar of this are at once longer and narrower and have the zygapophyses more widely separated.

EXPLANATION OF PLATES.

PLATE 3.

FIGS. 1-3.—*Testudo munda*. × 1. Type.

1. Left second peripheral.

2. Right seventh peripheral.

3. Fragments of the plastron showing hypoplastrals and xiphiplastrals.

FIGS. 4-11.—*Tapirus tennesseae*. Upper and lower teeth. × 1. Type.

4. Upper right third premolar.

5. Upper right second molar.

6. Lower left second premolar.

7. Lower right third premolar.

8. Lower right fourth premolar.

9. Lower right second molar.

10. Lower left third molar.

11. Lower incisor.

FIGS. 12-13.—*Mylohyus nasutus*. × 1.

12. Upper left canine; inner face.

13. Upper right canine; inner face.

FIGS. 14-15.—*Sangamona fugitiva*. Second molar. × 1. Type.

14. View of grinding surface.

15. View of outer face.

- FIG. 16.—*Elephas primigenius*. Rear of penultimate milk molar. $\times 1$.
 FIGS. 17-20.—*Ursus floridanus*. Teeth. $\times 1$.
 17. Lower right first molar.
 18. Lower left first molar.
 19. Upper left third molar.
 20. Upper left third molar.
 FIGS. 21-23.—*Platygonus setiger*, new species. Lower canine. $\times 1$. Type.
 21. Side view.
 22. Section at base of crown.
 23. View of hinder face.

PLATE 4.

- FIG. 1.—*Equus giganteus?* Upper left second premolar. View of grinding surface. $\times 1$.
 FIGS. 2, 3.—*Mylohyus nasutus*. Two lower left canines. $\times 1$.
 2. Presenting outer face.
 3. Presenting inner face.
 FIGS. 4-13.—*Mylohyus exortivus*. Teeth. $\times 1$.
 4. Lower left molars.
 5. Lower left third premolar.
 6. Lower left first molar, unworn.
 7. Lower left second molar, unworn.
 8. Upper right second, third, and fourth premolars.
 9. Upper right premolars, fourth.
 10. Upper left fourth premolar.
 11. Upper left first molar, worn.
 12. Upper right second molar, unworn.
 13. Upper right second premolar.
 FIGS. 14, 15.—*Mylohyus obtusidens*. Upper and lower canines. $\times 1$.
 14. Upper canine, showing inner face.
 15. Lower left canine, showing inner face.
 FIGS. 16, 17.—*Platygonus tetragonus?* Right canine.
 16. View of inner face. $\times 1$.
 17. Cross section at lower fracture. $\times 2$.
 FIGS. 18, 19.—*Platygonus vetus?* Teeth. $\times 1$.
 18. Lower left first and second molars.
 19. Section of lower canine.
 FIG. 20.—*Sciurus tenuidens*. Upper incisor. $\times 1$. Type.
 FIGS. 21, 22.—*Smilodontopsis moorchedi*. Upper right sectorial tooth. $\times 1$.
 Type.
 21. View of lingual (inner) surface.
 22. View of cutting surface.
 FIG. 23.—Same species? as figures 21, 22. $\times 1$. Left upper canine.
 FIGS. 24-26.—*Aenocyon ayersi?* Teeth. $\times 1$.
 24. Upper right third premolar, inner face.
 25. Upper right second premolar, outer face.
 26. Upper left third premolar, outer face.

PLATE 5.

- FIGS. 1, 2.—?*Dinobastis scrus*. Ungual phalange. $\times 1$.
 1. Side view.
 2. View of rear.
 FIGS. 3, 4.—*Aenocyon dirus?* Canine tooth. $\times 1$.
 3. View of lingual face.
 4. View of median face.

- FIGS. 5, 6.—*Sangamona fugitiva*. Part of lower jaw and teeth. $\times 1$.
 5. View of inner face.
 6. View of grinding surface.
- FIGS. 7-11.—*Taurotragus americanus*. Teeth. $\times 1$.
 7. Lower right fourth milk molar, inner face.
 8. Lower left first molar, inner face.
 9. Lower right second molar, inner face.
 10. Lower left hindermost molar, inner face.
 11. Upper right second molar, outer face.

PLATE 6.

- FIGS. 1, 2, 5-8.—*Cervalces roosevelti?* Teeth $\times 1$.
 1. Lower left second and third molars. Inner faces.
 2. Same teeth, showing grinding surfaces.
 5. Incisor, showing lingual face.
 6. Same tooth, showing lateral face.
 7. Upper left second and third molars, showing the grinding surfaces.
 8. Same teeth, outer faces.
- FIGS. 3, 4.—*Alces americanus*. Incisor. $\times 1$.
 3. View of lateral face.
 4. View of lingual face.
- FIGS. 9, 10.—*Symbos promptus*. Type. Third molar. $\times 1$.
 9. View of grinding surface.
 10. View of outer face.

PLATE 7.

- FIG. 1.—*Equus complicatus* Leidy. $\times 1$. Lower right second to fourth premolars.
- FIG. 2.—*Equus hatcheri* Hay. $\times 1$. An upper left first or second molar, showing a polished transverse section.
- FIGS. 3-8.—*Camelops nitidus*, new species. Lower left teeth. $\times 1$.
 3. Inner face of first molar. Type.
 4. Grinding face of same tooth.
 5. Inner face of second molar.
 6. Grinding face of same tooth.
 7. Grinding face of fourth premolar.
 8. Same tooth, showing inner face.
- FIGS. 9-12.—*Equus holmesii*, new species. Teeth. $\times 1$.
 9. Upper right fourth premolar; outer face.
 10. Upper right second molar; outer face.
 11. Upper right fourth premolar; grinding surface.
 12. Upper right second molar; grinding surface.

PLATE 8.

- FIGS. 1-6.—*Symbos promptus?* Vertebrae $\times \frac{1}{2}$.
 1. Dorsal vertebra, seen from above.
 2. Same vertebra, seen from in front.
 3. Lumbar vertebra, seen from in front.
 4. Cervical, the fifth?, seen from the left side.
 5. Same vertebra, seen from in front.
 6. Same vertebra seen from behind. *r. h.*, position of pit for head of rib;
t. v., position of transverse process; *v. a.*, vertebrarterial foramen.

PLATE 9.

FIGS. 1-7.—*Elephas primigenius* × 1.

1. View of grinding surfaces of third and fourth milk molars.
2. Lower right second milk molar, presenting the grinding surface.
3. Upper left third milk molar, seen from behind.
4. Same tooth, showing grinding surface.
5. Right maxilla, showing the grinding surfaces.
6. Same object, with second and third milk molars, seen from without.
7. Lower second milk molar, showing a polished section.

FIGS. 8-9.—*Alisodon mirus*. Pharyngeal bone. × 2. Type.

8. View showing grinding surfaces of the teeth.
9. View of outer aspect of bone and teeth.

PLATE 10.

FIG. 1.—*Terrapene bulverda?* Left xiphialastral bone, showing upper surface.
× 1.

FIG. 2.—*Crotalus atrox?* Side view of one vertebra. × 1.

FIGS. 3-7.—*Elephas primigenius?* Young animals.

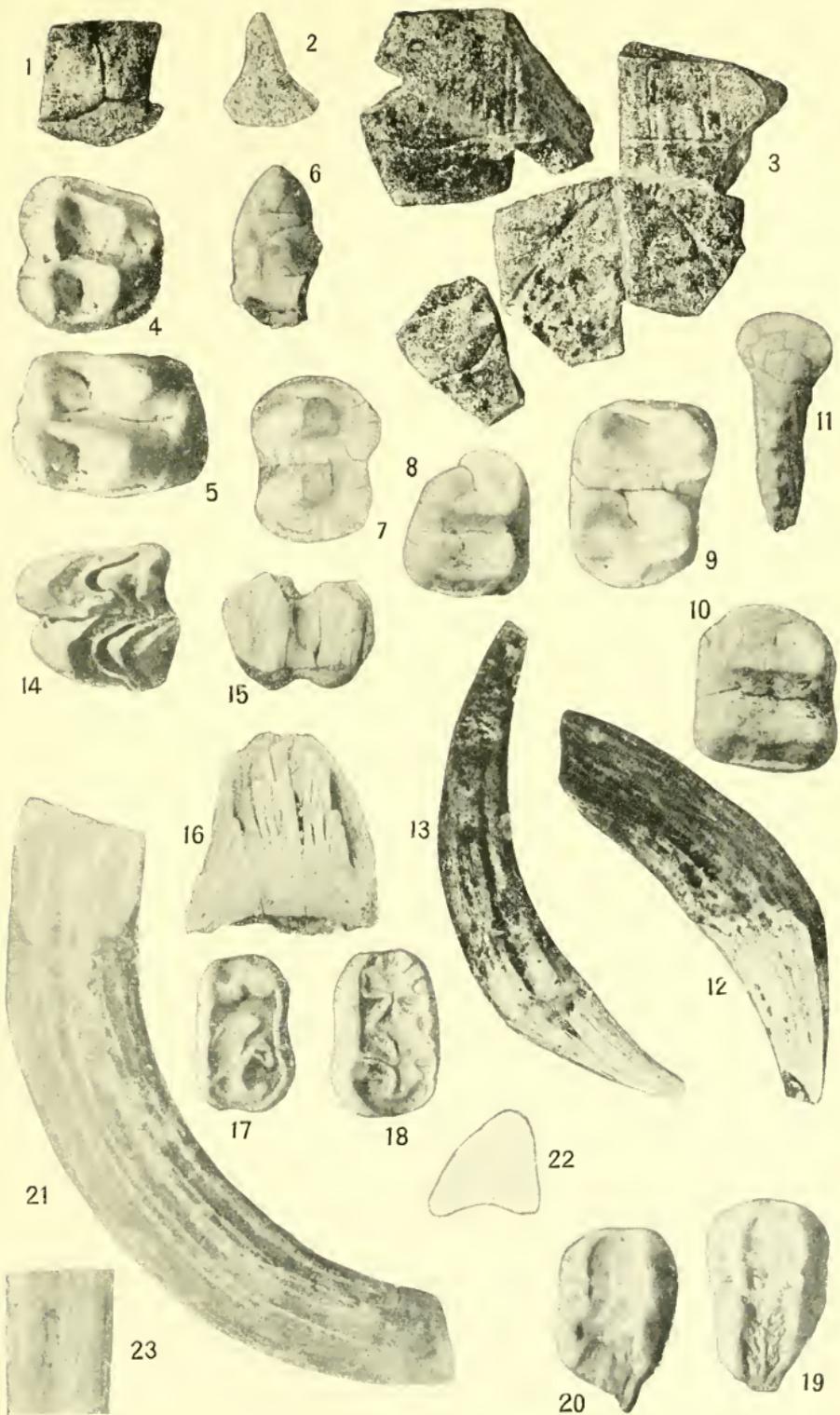
3. Lower left third milk molar from Temple, Texas. View of inner face.
× 1.
4. Same tooth. View of outer face.
5. Basisphenoid seen from the left side. × $\frac{1}{2}$.
6. Left exoccipital, showing inner surface. × $\frac{1}{2}$.
7. Left tibia, lacking the epiphyses. × .35.

FIG. 8.—*Mammot americanum*. Tibia of young animal, lacking the epiphyses.
× .35.

PLATE 11.

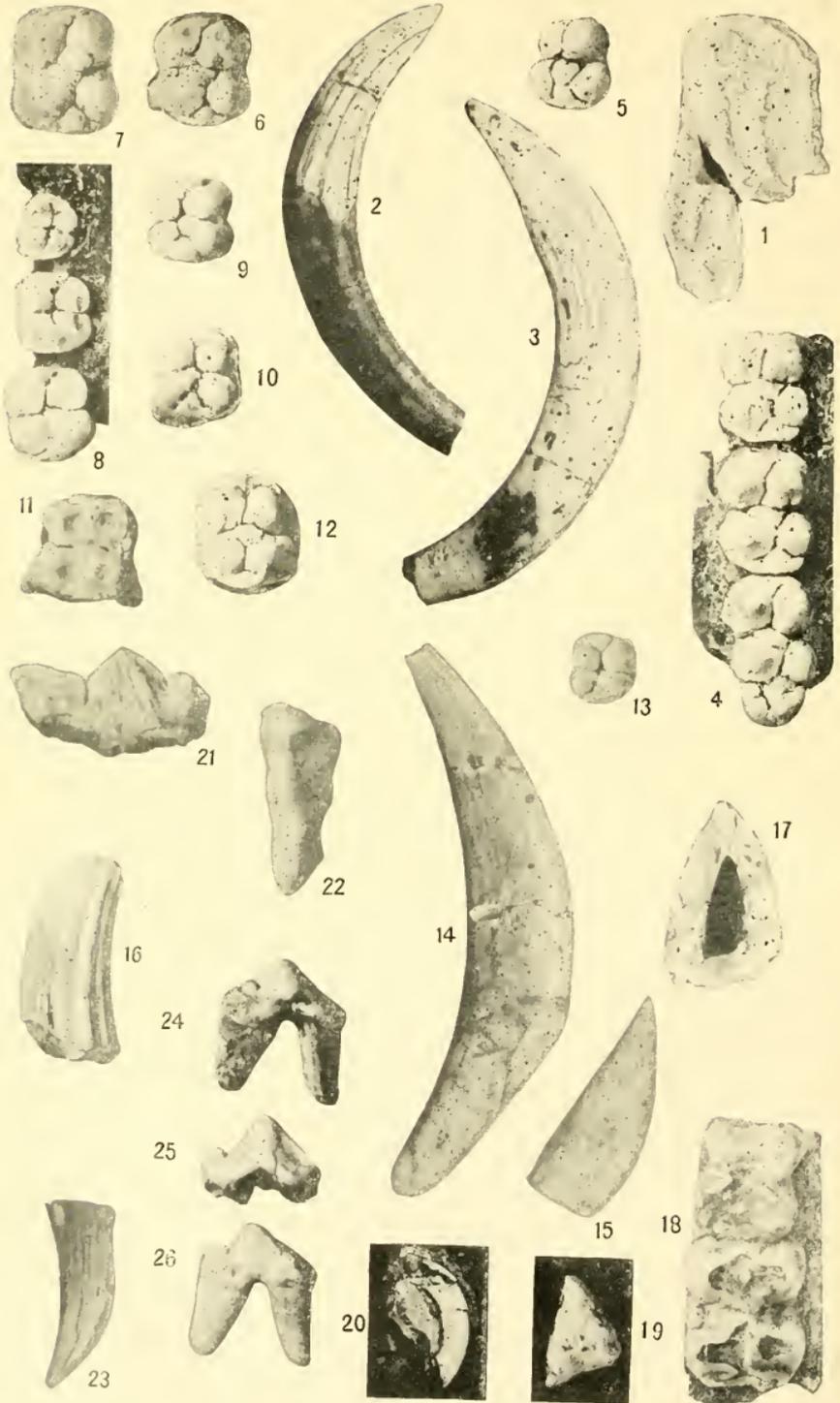
FIGS. 1-6.—*Elephas primigenius*. Teeth.

1. Left upper third milk molar, showing outer face and part of anterior root. × 1.
2. Same tooth, seen from below, to show bases of roots. × $\frac{1}{2}$.
3. Left lower third milk molar, seen from without. × 1.
4. Same tooth from below, to show bases of the roots. × $\frac{1}{2}$.
5. Maxilla with third milk molar and part of the fourth. View from within. × $\frac{1}{2}$.
6. Part of an upper third milk molar, with its coat of cement. × 1.

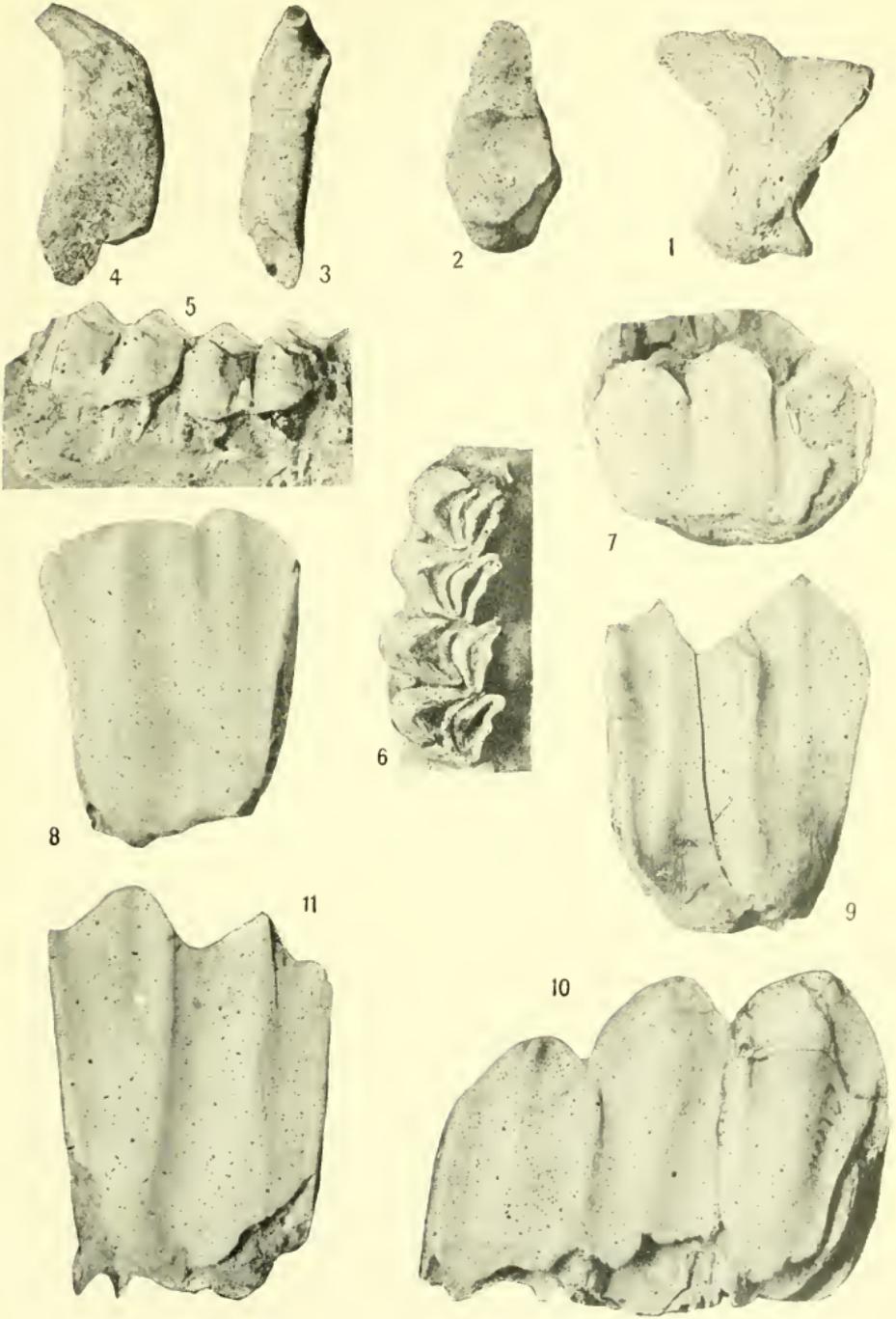


VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF MARYLAND AND TENNESSEE.

FOR EXPLANATION OF PLATE SEE PAGES 143 AND 144.

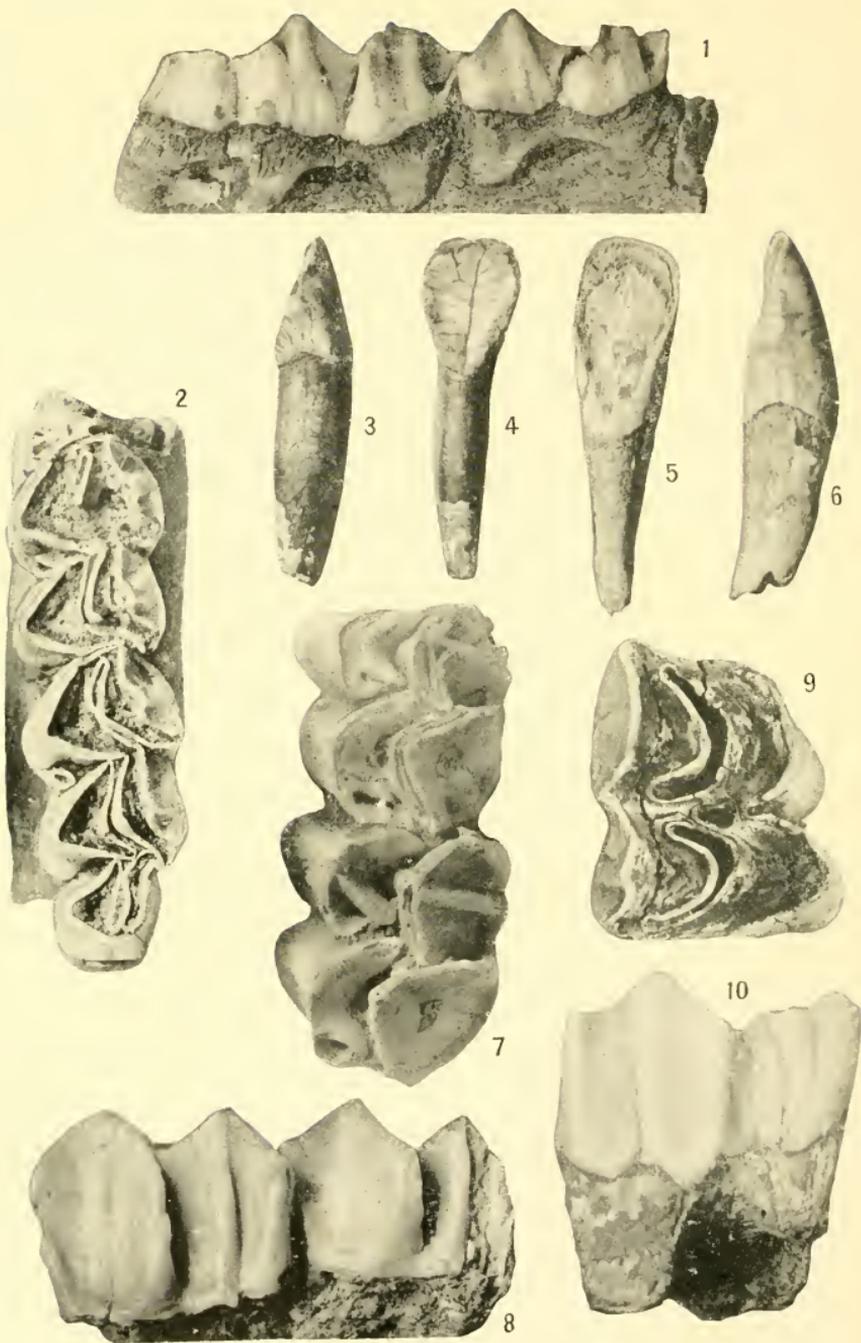


VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF MARYLAND AND TENNESSEE.



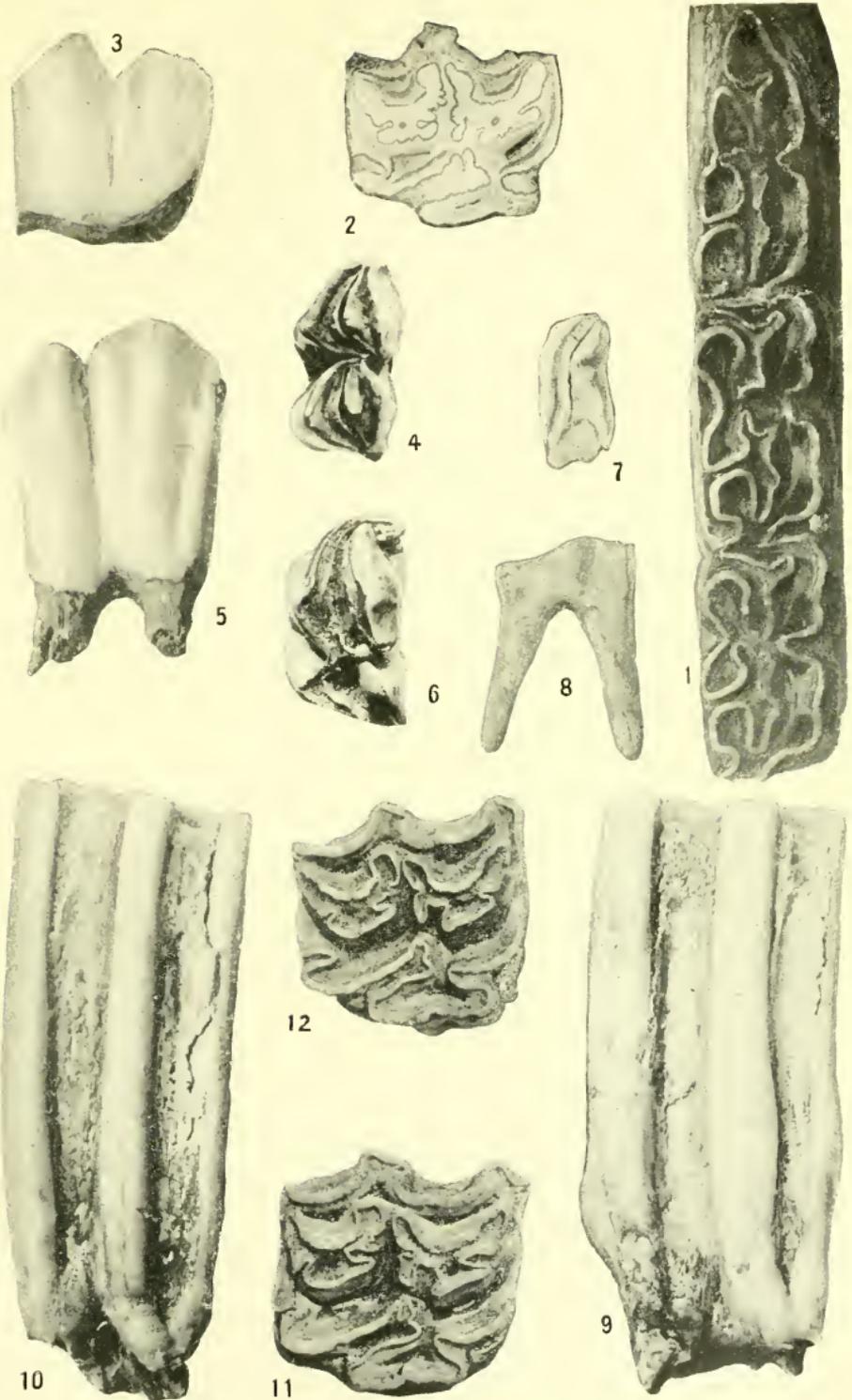
VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF ILLINOIS AND TEXAS.

FOR EXPLANATION OF PLATE SEE PAGES 144 AND 145



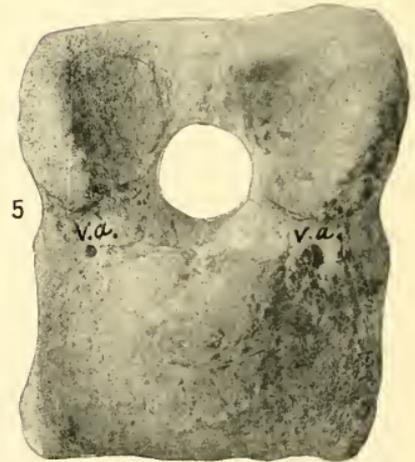
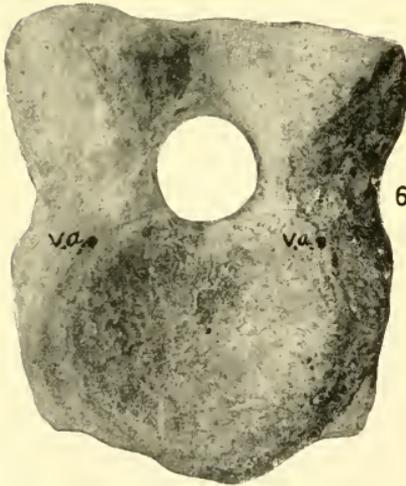
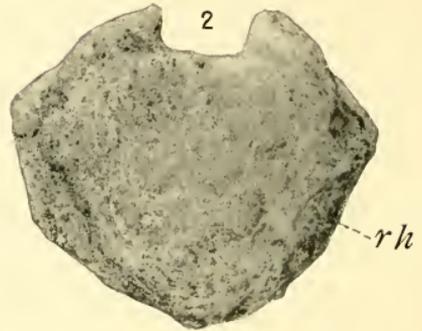
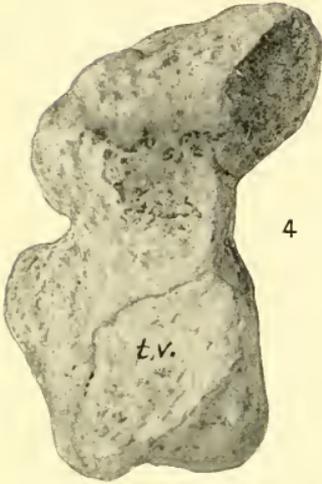
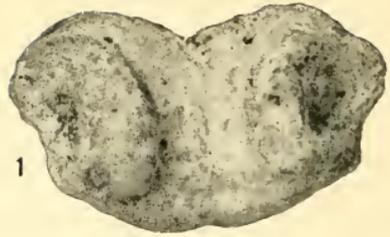
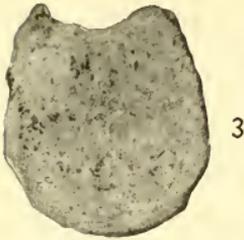
VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF ILLINOIS AND OKLAHOMA.

FOR EXPLANATION OF PLATE SEE PAGE 145.



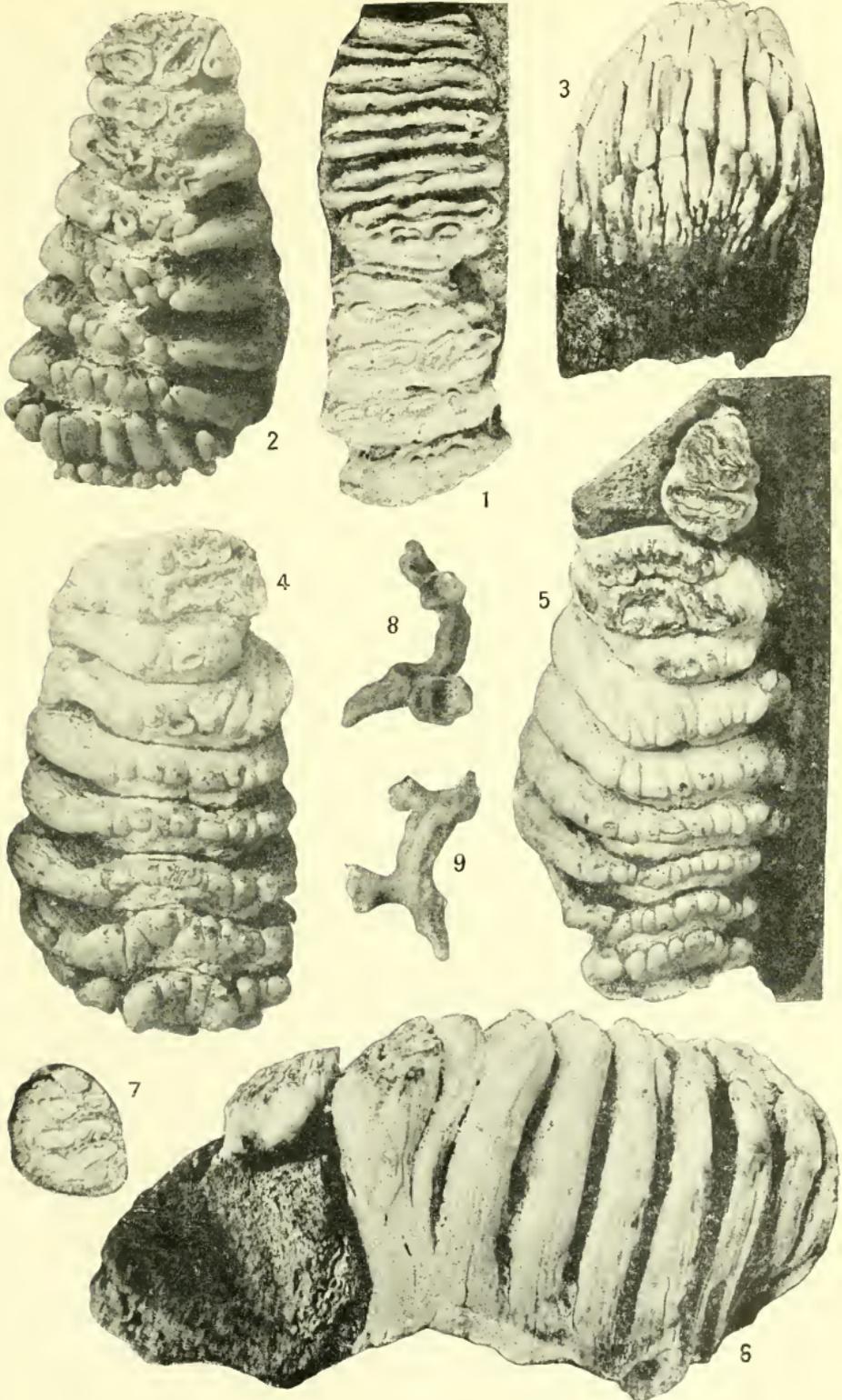
VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF OKLAHOMA.

FOR EXPLANATION OF PLATE SEE PAGE 145.



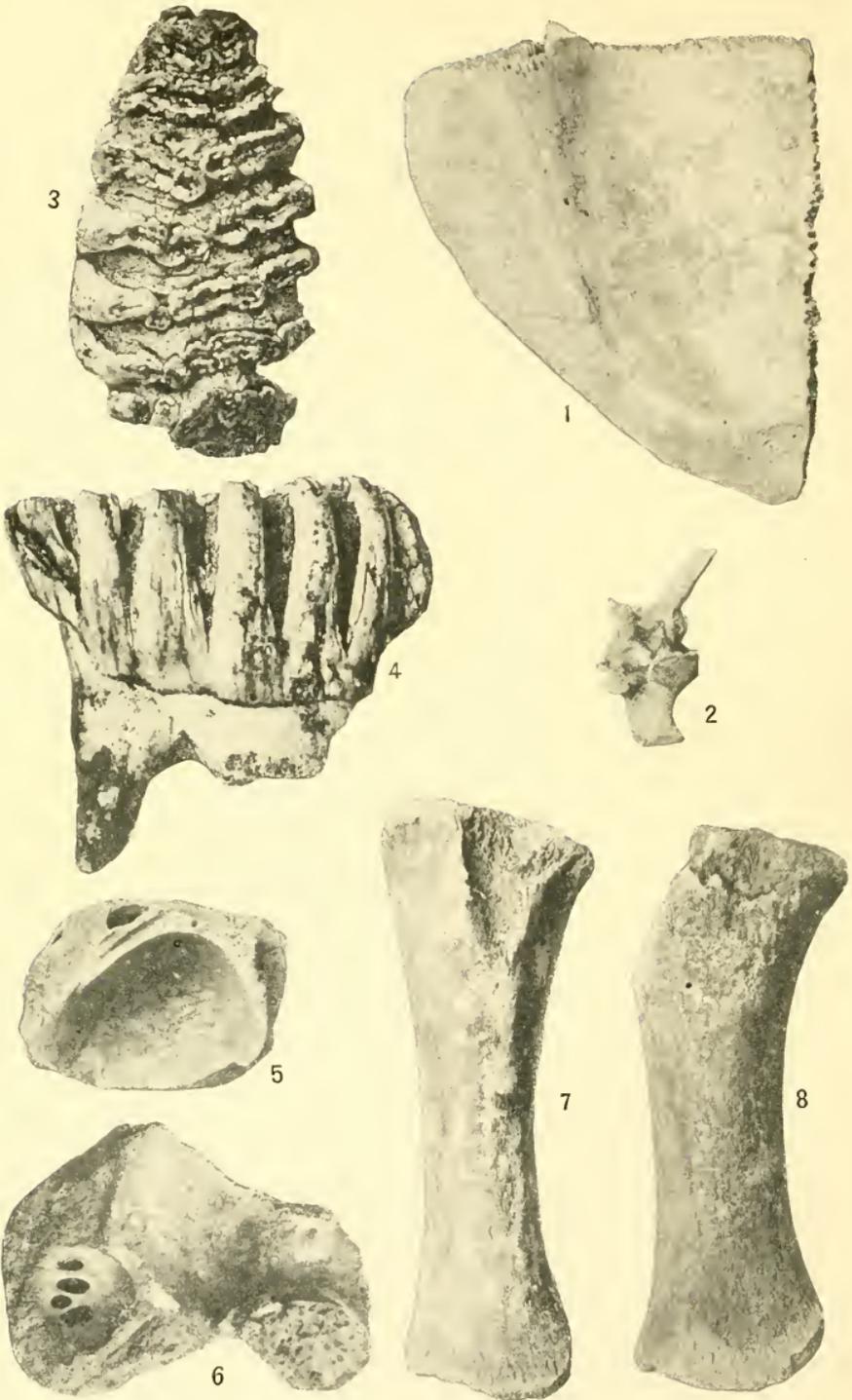
VERTEBRAE OF SYMBOS PROMPTUS?

FOR EXPLANATION OF PLATE SEE PAGE 145.



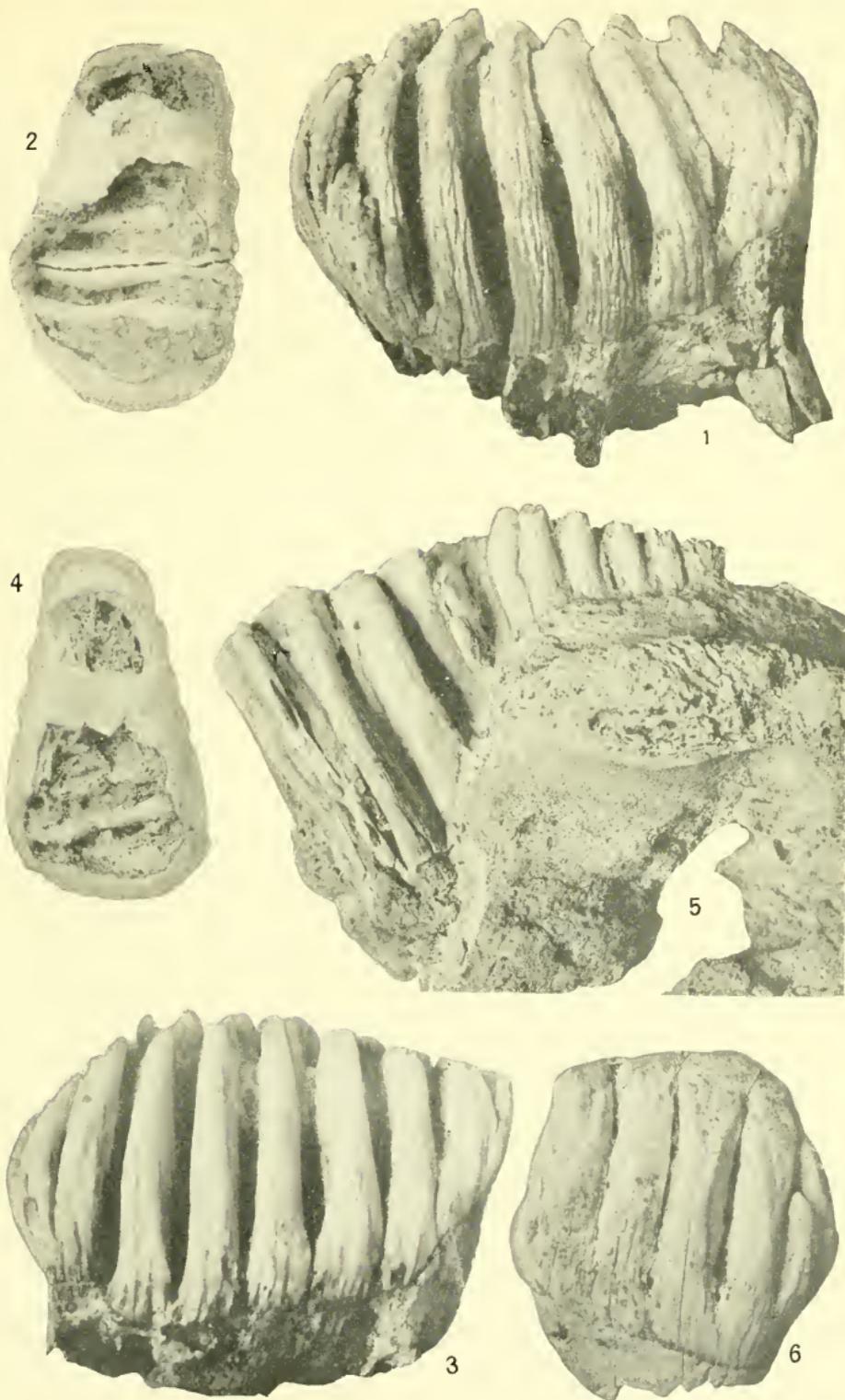
VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF TEXAS.

FOR EXPLANATION OF PLATE SEE PAGE 146.



VERTEBRATE FOSSILS FROM THE PLEISTOCENE OF TEXAS.

FOR EXPLANATION OF PLATE SEE PAGE 146.



TEETH OF *ELEPHAS PRIMIGENIUS* FROM PLEISTOCENE OF TEXAS.

FOR EXPLANATION OF PLATE SEE PAGE 146.

