GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, C.M.G. F.R.S., Etc., Director.

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME III. (Quarto).

ON VERTEBRATA FROM THE TERTIARY AND CRETACEOUS ROCKS OF THE NORTH WEST TERRITORY.

BY

E. D. COPE.

I.—The Species from the Oligocene or Lower Miocene beds of the Cypress Hills.

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The present Report is the first of a series of descriptive and illustrated quarto memoirs on the Vertebrata of the Tertiary and Cretaceous rocks of the Canadian North West Territory, kindly prepared for the Survey by Professor E. D. Cope of Philadelphia. It is exclusively devoted to a consideration of the species from the Lower Miocene deposits of the Cypress Hills in the district of Alberta, and consists of twenty-seven pages of letter press, illustrated by fourteen full page lithographic plates.

Part 2, which will contain illustrated descriptions of the vertebrates of the Laramie formation of the North West Territory, by the same author, is now in course of preparation.

ALFRED R. C. SELWYN.

Geological Survey Department,

Ottawa, 28th February, 1891.

GEOLOGICAL SURVEY OF CANADA.

The Vertebrata of the Tertiary and Cretaceous Rocks of the North West Territory.

By E. D. Cope.

1. *The Species from the Oligocene or Lower Miocene beds of the Cypress Hills.*

The collection on which the present report is based was made by Messrs. R. G. McConnell and T. C. Weston, in 1883-84, in the Cypress Hills, North-West Territory, about long. 109°, lat. 49° 40′. The Cypress Hills, in the District of Assiniboia, were examined geologically by Mr. R. G. McConnell, of the Dominion Geological Survey in 1885. He found them to constitute a plateau of considerable extent, consisting largely of beds of conglomerate (see p. 31 C. Report Geol. Survey of Canada, 1885), chiefly quartzitic, and evidently derived from the harder and older rocks of the Rocky Mountains. The conglomeritic character of the beds accounts for the generally broken condition of the fossils.

Dr. A. R. C. Selwyn, Director of the Survey, having sent the fossils to me for identification, I gave a preliminary list of the species in the American Naturalist for February, 1885. It was then pointed out that the genera and species obtained by Messrs. McConnell and Weston proved the beds in question to belong to the White River Oligocene series. The presence of a genus of well-marked Creodonta (Hemipsalodon, Cope) was regarded as an indication that the Cypress Hills, Swift Current Creek beds are probably somewhat older than those of the typical locality on the White River of Dakota and Nebraska. But the presence of this genus may be yet ascertained in the latter locality. Explorations set on foot during the year 1888 resulted in the obtaining by Mr. T. C. Weston, of the Canadian Survey of a number of additional species, some of which are of considerable interest. These were described in the American Naturalist of 1889. Most of these specimens were also in a fragmentary condition, owing to the conglomeritic nature of the deposit. The total number of species is twenty-five.

PISCES.

HALECOMORPHI.

AMIA L.

The Amiidae appear in the Laramie formation, and are represented in the Puerco and in the Wasatch Eocene. They occur abundantly in the Bridger Eocene, but were not known from any later formation, until discovered by Mr. Weston in the Cypress Hills Oligocene beds, as here recorded. As *Amia* is a well known genus of the present period, it is to be looked for in all the beds between the Bridger Eocene and the Pleistocene, inclusive.

Amia whiteavesiana, Sp. nov.

Founded on an anterior vertebra of large size, which differs in various respects from that of the Eocene species. There are no diapophyses, and there are tuberosities external to and adjoining the neurapophysial facets. The latter are so much worn that it is impossible to make out their character. There is a minute, round notochordal foramen above the middle of the centrum. In outline the centrum is a tranverse oval, more transverse than in any other species of the genus at present known. External walls smooth. Two fossæ, separated by a narrow median rib, on the inferior surface.

Measurements.

		Mm.
Diameters of centrum	Anteroposterior	9
	Vertical	26
	Transverse	40

This species is dedicated to Mr. J. F. Whiteaves, of Ottawa, the distinguished palæontologist of the Geological Survey of Canada.

Amia macrospondyla. Sp. nov.

This species is also indicated by an anterior vertebra. It agrees with the last in lacking diapophyses, and in having a minute *foramen cordæ-dorsalis*, which is, however, nearer the middle of the centrum than in the *A. whiteavesiana*. The *A. macrospondyla* differs much from the latter in its proportions. The vertebra, while absolutely smaller, has a larger anteroposterior diameter, as shown by the measurements below. The neurapophysial facets are too much worn for description. The wearing has left the appearance of a pair of parallelogrammic fossæ at opposite positions of the external wall of the centrum. Where unworn, the surface displays delicate wrinkles in the direction of the long axis of the vertebral column.

Measurements.

		Mm.
Diameters of centrum	Anteroposterior	12
	Vertical	22
	Transverse	26

NEMATOGNATHI.

? RHINEASTES, Cope.

A species of Siluroid is referred with doubt to this genus, since the parts essential for exact determination are wanting. The disposition of the tissue of the vertebral centrum is in vertical laminæ, parallel to those of the articular faces, as is the case with such vertebræ of Rhineastes as are known. Diapophyses are present, and the neurapophyses are coössified with the centrum. The lateral walls of the centrum below the diapophysis are not excavated by fossæ.

This genus has been known hitherto from the Eocene only.

Rhineastes rhæas. Sp. nov.

Represented by a median abdominal vertebra, with which is associated a second, as belonging to the same genus and perhaps species.

The centrum of the former is nearly entire. Its articular faces are a little deeper than wide, and are marked with smooth concentric striæ. No notochordal foramen. Centrum not flattened below, and furnished with a single median fossa. Neural canal with a longitudinal fossa on each side. Two large fossæ on each side between the bases of the neurapophysis and diapophysis. No fossæ on the side of the centrum except a small one below and at the base of the diapophysis. The exposed edges of the vertical laminæ are close together at the middle of the side of the centrum, and they turn forwards below, converging to a point on each side of the inferior fossa. They are less numerous just below the fossa below the diapophysis, and are connected by longitudinal bars. The bases of the diapophyses (all that remains of them) are hollow.

Measurements.

		Mm.
Diameters of centrum	Anteroposterior	12
	Vertical	31
	Transverse	29

The second centrum is fragmentary and may represent another species. It differs in the presence of a very large fossa immediately below the diapophysis, and in the presence of one very large one above the diapophysis. The concentric lines of the articular faces are more prominent. Size similar.

AMIURUS, Raf.

Two species have left vertebræ in the formation of the Cypress Hills, which resemble those of this genus of Siluroids, which still inhabits North America. That they belong to it cannot be positively asserted, since important diagnostic parts of the skeleton are unknown. Neurapophyses coössified; lamination longitudinal; base of diapophyses hollow.

Amiurus cancellatus. Sp. nov.

Two vertebral centra represent this species—one from the median dorsal region, and the other probably from the caudal.

The first-mentioned and best-preserved centrum has sub-round articular faces, a little flattened above and below, and is without *foramen cordæ-dorsalis*. The floor of the neural canal and of the space between the neurapophyses and the diapophyses are excavated, and the floor of both spaces is composed of longitudinal laminæ, which separate rather coarse and deep fossæ, the whole resembling cancellous tissue. Inferior median line with a principal median fossa. Dense tissue of the articular faces, reverted on the sides of the centrum. The space between them with minute longitudinal pores These become coarser and more cancellous as we approach the base of the diapophysis, where a larger cavity, more or less divided by cancellæ, is placed. Concentric layers of articular faces with distinct edges, producing a slight rugosity.

Measurements.

		Mm.
Diameters of centrum	Anteroposterior	11
	Vertical	24
	Transverse	25

The second centrum is perhaps caudal, as it resembles those of Amiurus in having a lateral fossa below as well as above the median lateral portion. The latter is coarsely reticulate cancellous, and a deep fossa separates the two ridges which represent the bases of either the neural or the haemal spines. The anteroposterior diameter is relatively greater than in the vertebra last described.

Measurements.

		Mm.
Diameters of centrum	Anteroposterior	12
	Vertical (restored)	28
	Transverse	23

Amiurus maconnellii. Sp. nov.

This species appear to have been larger than the last. It differs from it in the much finer cancellation of the lateral surfaces, over which the articular dense layer is much less reverted. Instead of a cancellated tract between the diapophysis and the neural spine, there are two deep fossæ, and there are two large shallow fossæ on the inferior face instead of one deep one. Near the articular borders a few cancellous lines are vertical in direction. The species presents some of the characters of the *Rhineastes rhœas*. Vertebræ, only, of this species were found. They indicate large size, the measurements being:

		Mm.
Diameters of centrum	Vertical	40
	Transverse	38
	Anteroposterior	14.5

This centrum has a subquadrate outline, so far as can be determined in the absence of the superior border. It has a minute transverse notochordal foramen. The diapophysis is rudimental and superior in position; it presents no articular facet. Both above and below it, is a shallow fossa. Except a pair of shallow fossæ on the inferior face, the lateral walls are without fossæ, but are finely impressed with minute longitudinal pits.

A second centrum, probably caudal, belongs to a still smaller individual. Its outline is subpentagonal, the apex inferior and without a single median fossa. No diapophyses. Three superior fossæ—one large median and a smaller one on each side. Minute pits of external walls sub-round.

		Mm.
Diameters	Vertical	21
	Transverse	21
	Anteroposterior	7.5

This catfish equalled in dimensions the large *A. nigricans* of the Mississippi. It is dedicated to the able geologist Mr. R. G. McConnell, of the Dominion Survey.

REPTILIA.

TESTUDINATA.

TRIONYX, Geoffr.

Trionyx leucopotamicus. Sp. nov.

This species is represented by a part of a single costal bone, with the sculpture well preserved. This specimen would scarcely serve as a basis for a specific description, but I have a number of well-preserved fragments of apparently the same turtle from the White Buttes of Dakota, which render important aid. The latter furnished me with the first indication of the presence of this genus in beds of White River age, as they have not been yet found in the best known regions of this formation in Southern Dakota and Eastern Colorado.

The costal bones are flat and rather thin, but thickest medially, as usual. The sculpture consists of large, sub-round and sub-oval fossæ, which are separated by ridges much narrower than themselves. In the Cypress Hills specimen the fossæ tend to form longitudinal series towards the distal extremity of the bone. The sutural borders are not preserved, but in the Dakota specimens the sculpture continues to show, and does not give place to a band of nearly smooth and transversely-lined surface, as is the case in the *T. punctiger*,[1] Cope, also from the White River bed of Central Dakota.

This species resembles in its sculpture the *Trionyx uintaensis* of Leidy from the Bridger Eocene. The sole difference which the latter presents is the presence of bands of grooves parallel to the long axis of the carapace, along the intercostal sutures. It is probable that the costals are thicker in the Bridger species, a character still more strongly marked in those of the Wasatch series.

STYLEMYS, Leidy.

(?) Stylemys nebrascensis, Leidy.

A few fragments, including a marginal bone, not distinguishable from this species, were obtained by Mr. Weston.

MAMMALIA.

GLIRES.

PALÆOLAGUS, Leidy.

Palæolagus turgidus, Cope.

Report U. S. Geol. Survey Terrs., III., Bk. I., p. 882, pl. lxvi., f. 28; lxvii., 13-27.

Mandibular rami identical in character with those from the White River beds of Dakota and Colorado.

[1] Besides the character above described, the sculpture of the costal bones of the *T. punctiger* is much less distinct than in the *T. leucopotamicus*. It is both punctate and groove-like, and the ridges are thickened and irregular, and towards the distal ends of the bones obscure. While not wider than those of the latter species, the costals are thicker and more curved, the thickness continuing to the free margin, where they are bevelled off, with a prominent rib-end in the middle. Measurements of No. 1:—Width of costal, 48 mm.; thickness at lateral suture, 5 mm.; at middle, 9 mm. No. 2:—Width of costal, 52 mm.; thickness at middle, 11 mm. This is Trionyx sp. 2, Cope Proceeds. Am. Philos. Soc., 1883, p. 217.

BUNOTHERIA.

CREODONTA.

HEMIPSALODON, Cope.

This genus belongs to the Oxyænidæ, and is the only one of that family that has been found in beds higher than the Bridger Eocene. The only known species is the largest of the Creodonta, and the jaw from which it is known is more robust than that of any existing carnivore. Its dimensions are about those of the *Achænodon insolens* of the Bridger beds. The genus Hemipsalodon differs from the others of the family in the presence in the lower jaw of the full dental series of four premolars and three true molars without diastema behind the canine. Incisors three. The only crown perfectly preserved is the last true molar. It is of the type of Oxyæna, but has probably no internal tubercle or metaconule; (specimen worn at that point). It has a heel more or less cutting.

This remarkable genus resembles, so far as the characters preserved permit us to judge, the Stypolophus of the Eocenes, which embraces numerous species, none of which exceeded a red fox in size. It is, however, most nearly related to Pterodon, with which Schlosser believes it to be identical. That possesses but three inferior premolars, but the value of this character in this case is not yet certainly known. If no other character distinguish Hemipsalodon but the four inferior premolars, the *Pterodon quercyi* of Filhol, from the French phosporites, must be placed in it. The blade of the last inferior molar is more oblique to the long axis of the jaw than is represented to be the case in the *Pterodon dasyuroides*, making an angle of 30° with it, while the edge of the heel is slightly oblique to it in the opposite direction. This may indicate some peculiarity in the superior molar, or it may be but a specific character.

HEMIPSALODON GRANDIS, Cope.

American Naturalist, 1885, p. 163; Annual Report of the Geol. and Nat. History Survey of Canada, 1885, Appendix C, p. 2.

The species is characterized by the deep compressed form of the ramus, and the long symphysis. The incisor teeth are crowded, the first and third being external and close together, and the second internal in position. The canine tooth is of enormous size, and is directed upwards. The section of the summit of the root is a wide oval without angles. The premolars are all two-rooted, except the fourth. The first is longer than the first true molar. The true molars increase in size posteriorly. The third is very robust, and has elevated cusps, with a sub-triangular section, the median exceeding the anterior. The sectorial edges are very steep, forming together a V. The heel is quite short, and has a cutting keel, which is the summit of the external face, and is nearly median. The coronoid process rises at a very short distance posterior to it. The masseteric fossa does not extend downwards to the inferior edge of the ramus. The latter is inflected on the inner side as far posterior as below the middle of the coronoid process, where it is broken off.

Length of the dental series, M. .212; of true molars, .085; of premolars, .108; diameters of last true molar: anteroposterior .034, transverse .021; do. of canine at base: anteroposterior .040, transverse .029. Depth of ramus at M. 3, .086; length of symphysis, .131.

This species was the largest flesh-eater of the epoch of the White River beds, and the size of its canine teeth proves it to have been a dangerous animal. Its molars are interesting on account of their illustrating a primitive form of a sectorial tooth.

Two femora in the collection probably belong to this species, as they are creodont in the presence of the third trochanter, and their dimensions are appropriate to the lower jaw above described. One of them is larger than the other, and I give its dimensions in comparison with those of two of the largest Carnivora, the grizzly bear and the lion, in millimeters :—

	Hemipsalodon.	Bear.	Lion.
Length	413	445	379
Width at great trochanter	120	112	95
" " little "	74	57	45
" " third " or same position	63	40	35
" " condyles	90	90	81
Depth at rotular ridges	98	73	77

The third trochanter is low, much as in *Protopsalis tigrinus*, and has a thickened, rough edge. It gives the shaft of the femora an external convexity, which is greater than the gentle concavity of the internal border. The great trochanter projects to the horizontal line of the head and not beyond. It is obliquely truncate externally, and narrowly at the extremity. It encloses a deep trochanteric fossa posteriorly, through the strong recurvature of the posterior border. This border continues as a transverse convexity to the little trochanter. The latter is a rounded prominent tuberosity, and has a superior position, as in Carnivora generally, and is not placed low down on the shaft as in Protopsalis. The shaft is flattened from before backwards, with the external edge angulated both above and below the third trochanter. The rotular grove is remarkably elevated and rather narrowed, giving the distal extremity of the femora the massive character of that of an ungulate mammal. Borders of rotular groove subequally prominent, its surface continuous with that of the condyles. Internal face of condyle with a pronounced fossa. Internal condyle a little more prominent than the external. Intercondylar fossa broadly rounded anteriorly.

The deeper trochanteric fossa and more elevated position of the little trochanter distinguish these femora from that of *Protopsalis tigrinus*. It also considerably exceeds that of the latter animal in dimensions.

ANCYLOPODA.

CHALICOTHERIUM, Kaup.

Macrotherium, Lartet, teste Forsyth-Major and Filhol.

The remarkable character of this genus, as discovered by Filhol, has been mentioned in the American Naturalist.[2] It has little relation to the family of Perissodactyla to which it has given the name, and which it so resembles in molar dentition. It must form a family by itself, and the genera with which it has been associated must form a family to which the name Lambdotheriidæ has been applied. The anterior ungual phalanges of Chalicotherium are of prehensile character and not ungulate, but rather unguiculate. The phalanges resemble those of the Edentata, but the carpus and tarsus are according to Filhol, diplarthrous in structure, while the Edentata are taxeopodous. We have in the Chalicotheriidæ the antithesis of the Condylarthra. While the latter is

[1] Cope, American Naturalist, 1889, p. 153 ; American Journal of Morphology, 1889, p. 142.

[2] Osborn on Chalicotherium, American Naturalist, 1888, p. 728.

ungulate with an unguiculate carpus and tarsus, the former is unguiculate with an-ungulate (diplarthrous) carpus and tarsus. Thus the Chalicotheriidæ must be referred to a distinct order of unguiculate Mammalia, which I have called the Ancylopoda, with the above definition. Two genera belong to the single family, the Chalicotheriidæ, viz., Chalicotherium Kaup, and Ancylotherium Gaudry. Marsh has not yet shown how his genus Moropus differs from Ancylotherium. The species described by Marsh under this name are from the Loup Fork bed of Kansas.

Although the species of Chalicotherium from the Cypress Hills is the first one described from North American beds, it is not the first discovery of the genus. Professor Scott showed me a series of superior molars from the Loup Fork formation of Kansas, from the Agassiz Museum, which he identified as belonging to this genus. The present species is of larger size than the Kansas form, and is apparently equal to the *C. goldfussii* of the Upper Miocene of Europe. The occurrence of this form in the Oligocene or Lower Miocene (White River), as well as the Upper Miocene (Loup Fork), of this country, is a noteworthy fact, but is parallel to its history in Europe. Described from the Upper Miocene by Kaup, it was afterwards found in the Middle Miocene (*C. grande*) by Lartet, and in the Upper Eocene (*C. modicum*) by Gaudry.

Chalicotherium bilobatum, Cope.

American Naturalist, 1889, p. 151.

Founded on a mandibular symphysis and part of the left ramus of an adult animal, which contains the alveoli of the anterior four molars and part of that of the fifth. All the premolars are two-rooted, showing that they are but three in number. Canines and incisors wanting, the anterior alveolar margin thin and prominent and bilobed, with a median emargination. Symphysis coössified, with an angulate inferior margin, posteriorly with a fossa on each side of the median line, sloping regularly upwards to the alveolar margin, and concave above behind the margin. Minute traces of alveoli of a canine and two incisors on each side, which were probably present in the fœtus. Length of symphysis above, 120 mm.; depth posteriorly, 48 mm. Length of symphysis in front of p. m. iii. Length of premolar series, 75 mm. Length of m. i., 40 mm.

DIPLARTHRA.

PERISSODACTYLA.

MENODUS, Pomel.

This genus has received numerous accessions within the last few years through the labors of Professors Scott, Osborn[1] and Marsh. To these may be added the species obtained from the Cypress Hills area of the White River series. As remarked by Professors Scott and Osborn, the species of Menodus present parallel relations to those of Symborodon, which latter may be regarded as descendants of the former, of more special-

[1] Preliminary Account of the Fossil Mammals from the White River Formation in the Mus. Comp. Zoölogy, Bull. of the Mus., Vol. xiii., No. 5, 1887; Amer. Jour. Sci. and Arts, 1887, p. 323; Cope, Amer. Naturalist, 1887, p. 926.

ized character and probably later age. The nine species of Menodus may be compared with five of those of Symborodon, as follows :—

		Nasals long; horns short.	Nasals and horns intermediate.	Nasals short; horns long.
Menodus	Nasals transversely angulated	*M. americanus.*	*M. syceras.*	*M. platyceras.*
		M. coloradoensis.	*M. proutii.*	*M. dolichoceras.*
	Nasals not angulated	*M. angustigenis.*	*M. tichoceras.*	
		M. selwynianus.		
Symborodon	Nasals angulated	*S. trigonoceras.*		*S. acer.*
	Nasals not angulated	*S. bucco.*	*S. altirostris.*	

Apart from the generic characters, the *Menodus americanus*, Leidy, appears to be an enlarged *S. trigonoceras*, Cope; and the *M. tichoceras*, S. and O., an enlarged *S. altirostris*, Cope. Apart from these, the correspondences are not so close. A definite character which divides Menodus into two groups is the presence of an internal cingulum of the premolars in some of the species. The same character divides the genus Symborodon. According to this character, the species may be grouped as follows, so far as they are known in this respect :—

	Menodus.	Symborodon.
Without cingulum	*M. proutii*	*S. bucco*
	M. tichoceras	*S. altirostris*
With cingulum	*M. americanus*	*S. trigonoceras*
	M. coloradoensis	*S. heloceras*
	M. angustigenis	

The collections of the Geological Survey include fragments of skeletons of five species of Menodontidæ, which I shall refer, some of them provisionally, to the genus Menodus. The *M. americanus* is the only one known to have possessed horns of triangular section. The section is oval in the *M. proutii* and *M. angustigenis*. In *M. selwynianus* the horns are unknown.

In the Annual Report of the United States Geological Survey of the Territories for 1874, p. 480, I gave a general account of the osteology of the genus Symborodon, which applies equally well to the nearly allied genus Menodus. I will now add a few points not referred to in that report, derived from the specimens here described.

The condyles of the humerus have no trace of trochlear crest. The olecranon is expanded laterally and vertically at the extremity. The head of the radius is only convex below. Its carpal extremity is narrowed inwards, and it is bounded below its middle by a fossa. The scaphoid and lunar parts of the surface are not distinguished.

The third trochanter of the femur is not a process but an angle, projecting but little beyond the external face of the femur above it, but bounding a contraction of the diameter below it. The little trochanter is insignificant. The rotular surface is grooved medially, and the lateral ridges are prominent, especially above and proximally, where they rise abruptly from the shaft, which has at this point, and between them, a fossa.

The epiphyses of the ischia are thick and are coössified with each other, forming a Y-shaped mass, the narrow stem of which fills the symphysis ischiopubicus.

Menodus americanus, Leidy.

Rhinoceros americanus, Leidy, Proceeds. Acad. Philadel., 1852, p. 2; Anc. Fauna of Nebraska, 72, pl. xvii., figs. 3-4; *Brontotherium ingens*, Marsh, Amer. Jour. Sci. and Arts, 1874, p. 85; *Menodus ingens*, Cope, Amer. Naturalist, 1887, p. 1063.

This species is represented by a horn of the left side, which has the following dimensions:—

		Mm.
Length from nasal meatus		210
Diameters at base	Anteroposterior	110
	Transverse	100

A fragment of maxillary bone supports the last three premolars. They measure 113 mm. Transverse diameter of p. m. i. about 62 mm. (external wall lost).

Menodus proutii, O. N. & E.

Scott and Osborn, Bull. Mus. Com. Zoölogy, xii., 5, p. 163; *Palæotherium (?) proutii*, Owen, Norwood and Evans, Proceeds. Acad. Philadel., 1858, p. 66; Leidy, c. c., 122; *Titanotherium proutii*. Leidy, The Ancient Fauna of Nebraska, 1853, p. 72.

Horns of two individuals of this species were obtained by Mr. Weston. The dimensions of the largest of these are as follows:—

		Mm.
Length from nasal meatus		245
Diameters at base	Anteroposterior	135
	Transverse	70

The lateral borders of the nasal bones flare upwards, and do not present an inferior longitudinal ridge as in *M. angustigenis* and *M. selwynianus*.

Numerous parts of the skeleton of Menodontes are included in the collection, and I have endeavored to collate them with the horns and nasal bones. Tibiæ and astragali are most numerous, and furnish a starting-point, especially as they may be compared with the corresponding parts of the Symborodons from Colorado in my private collection. Four species are represented by these bones in the Cypress Hills collection.

Three species are represented by astragali, which differ chiefly in size. Three species are also represented by calcanea, one of which has no corresponding astragalus. The same three calcanea have three corresponding tibiæ. Two species are represented by femora and two by humeri.

I observe a series in the tibiæ. Two are more robust than the third, and are of subequal dimensions. Both have an impressed, longitudinal, groove-like fossa on the inner side of the anterior angle below the crest. They differ in three respects. In one there is no popliteal callus; the insertional face of the crest is convex, and the inner anterior distal angle is less produced. The calcaneum is smaller. In the second there is a popliteal callus, the insertional face of the spine is concave, and the distal inner anterior angle is more produced In the third type there is no incised fossa of the shaft, and the general form is more slender. The corresponding astragalus and calcaneum are a good deal

smaller than those of the species before mentioned. There is a considerable popliteal callus, and, what is especially characteristic, the crest is divided by a vertical median groove, as in the genera Aphelops and Rhinoceros. This type of tibia corresponds to that of some of the species of Symborodon, *e. g.*, *S. bucco*, and perhaps others. There is no tibia nor any other bone, except perhaps part of a humerus, which corresponds with the smallest astragalus.

The bones of the two largest species are probably those of the *M. americanus* and *M. proutii*, but which belongs to which I cannot certainly determine. As the *M. americanus* is, in the characters of its muzzle and horns, the nearest to the *M. angustigenis*, it will be probably safe to refer to it the tibia which approaches the corresponding bone of that species. That will be the second of the above description. The third corresponds in size to the *M. angustigenis*, and agrees with it in approaching the species of Symborodon in some respects. I give corresponding measurements of the tibiæ, astragalus and calcanea of the two species :—

I. Tibia.

		M. proutii.	*M. americanus.*
Total length		387	355
Diameters of head	Anteroposterior	135	150
	Transverse	144	135
Diameters of shaft	Anteroposterior	60	55
	Transverse	60	60
Distal diameters	Anteroposterior	72	65
	Transverse	100	100[1]

II. Calcaneum.

Length		155	135
Length of tuber		90	80
Width distally		75	57
Diameters of cuboid facet	Vertical	35	42
	Transverse	55	30

III. Astragalus.

Diameters of trochlea	Transverse		80
	Anteroposterior	External roller	70
		Internal roller	57
Diameters of navicular facet	Vertical		54
	Transverse		49
Oblique length of cuboid facet			47

From the above it is evident that the hind foot of the *M. americanus* is relatively and absolutely larger than in the *M. proutii*. In the former the external cotylus has a greater transverse, and the internal a smaller anteroposterior diameter than in that of the *M. proutii*.

[1] Partly restored.

I describe here a humerus which I suppose to belong to one or the other of these large species. The great tuberosity is of huge dimensions, exceeding in anteroposterior diameter the head and lesser tuberosity together. Its external face forms a triangular area which terminates at its inferior apex in a large compressed process which is directed outwards. Below this the smooth surface of the shaft winds spirally from a posterior position to the front, where it is bounded below by a narrow, deep, transverse coronoid fossa. It is bounded externally below by a ridge which is produced upwards from the internal epicondyle in a short tuberosity. The olecranar fossa is very deep and has abrupt sides. The external epicondylar region is flat.

Measurement of Humerus.

			Mm.
Length			460
Anteroposterior diameter	of entire head		210
	of condyle only		110
Transverse diameter	of head		158
	of condyle		93
Diameter at narrow part of shaft	Anteroposterior		80
	Transverse		72
Diameter of distal condyles	Transverse		130
	Anteroposterior	External	98
		Internal	72
Distal width, with epicondyle			150

I compare the only entire femora in the Cypress Hills collection with one nearly entire from Colorado in my collection. The latter was found near other bones which belong probably to the *M. americanus*, and the Cypress Hills specimen not improbably belongs to the *M. proutii*. The head and condyles are smaller than those of the *M. americanus*. The great trochanter extends as far proximad as the line of the head, while it falls considerably short of it in the *M. americanus*. The third trochanter is not prominent, but forms the inferior extremity of the wide proximal two-fifths of the bone, a slight concavity of the external border existing between it and the great trochanter. Below it the shaft is abruptly contracted on the external side. It then expands equally on each side to the condyles, giving the posterior face a wide, slightly concave face proximad to the latter. Their articular surfaces are continuous with each other, and with that of the rotular surface, at the point of junction of which their external borders are notched. The rotular groove and its lateral ridges are injured. Enough remains to show that there is a fossa at its proximal border on the shaft. The inferior part of the femora of the *M. americanus* does not differ except in its superior dimensions. The following are the measurements:—

Measurements of Femora.

	M. proutii. Mm.	*M. americanus.* Mm.
Length	600	
Anteroposterior diameter of head	90	119
Width at great trochanter	187	182
" " third "	115	
" (least) below third trochanter	76	96
" above condyles	150	180
" of condyles	125	150
Anteroposterior diameter (least) below third trochanter	55	60

Three scaphoid bones of graduated sizes are contained in the Cypress Hills collection, and there are two magnums which correspond in size to the middle-sized scaphoid and to one between that size and the largest. These may be referred, comparing them with the other bones already described, as follows :—Scaphoid No. 1, *M. americanus ;* magnum, No. 1, *M. proutii* ; scaphoid and magnum No. 2, *M. angustigenis ;* scaphoid No. 3, *M. (?) syceras.* Comparisons will be made under the head of *M. angustigenis.*

Teeth of the large species of Menodus are rare in the collection, a last inferior molar and premolar representing them. Most of the teeth preserved belong to the size appropriate to the *M. angustigenis.*

Menodus angustigenis, Cope.

Annual Report Geol. and Nat. Hist. Survey of Canada, 1885, C., p. 81 ; *Haplacodon angustigenis,* Cope, American Naturalist, 1889, p. 153.

This large Mammal is represented by numerous specimens. I select for present description two maxillary bones from the same skull, each of which contains the first premolar and the true molars ; and two lower jaws from second and third individuals. One of these consists of little more than the symphysis. The other includes part of the symphysis and part of the left ramus, which contains all the molar teeth except the first and last.

I refer the species to Menodus, because both lower jaws have, like the *Menodus proutii,* Leidy, two incisor teeth on each side. The specimen in which the ramus is present has a small alveolus for the first premolar on each side ; the side of the other specimen, where this part is preserved, has no such alveolus. These specimens show the identity of the supposed genus Brontotherium with Menodus. In the contracted shape of its mandibular symphysis this species resembles the species of Symborodon rather than the *Menodus proutii,* and it resembles the smaller species of Symborodon in its inferior dimensions. It resembles the species of Menodus in the wide internal cingulum of the superior premolars. The species of Symborodon which present this character are the *S. trigonoceras* and the *S. heloceras,* Cope. Its measurements are inferior to those of the *S. trigonoceras,* and the superior molars are of different form. In the species just named their outline is oblong, the anteroposterior diameter exceeding the transverse in all three of them. In the *M. angustigenis* the molars are nearly square in outline.

The superior molars of the *S. trigonoceras* are characterized by the flatness of the middle portion of the external face of the external Vs. This surface is neither excavated, nor is it keeled, excepting a slight convexity on the middle of the anterior V of the first molar. The middle lines of the external faces of the Vs of the fourth premolar are slightly convex. There is a prominent vertical angle descending from the apex of each external V, and no lateral ones, so that there are no lateral pits at the internal base of the V on each side of the apex, as is seen in the *Symborodon trigonoceras.* The internal cones of the first superior premolar are not well distinguished. The only traces of cingula on the true molars are just in front of the median external vertical rib.

Measurements of Superior Molars.

		M.
Diameters of P. m. i.	Anteroposterior	.042
	Transverse	.054
Diameters of M. i.	Anteroposterior	.055
	Transverse	.055
Diameters of M. ii.	Anteroposterior	.071
	Transverse	.066
Diameters of M. iii.	Anteroposterior	.071
	Transverse	.071

As already observed, the *symphysis mandibuli* is narrowed forwards, and it displays a groove on the middle line between the positions of the alveoli of the canine teeth. The sides of the ramus at this point are vertical, and a little concave above and behind the canine alveolus. In profile the symphysis slopes in an almost straight line from the bifurcation to the incisive border. There are two mental foramina close together. The anterior is the larger, and is situated a little below the posterior, and is below the anterior root of the third premolar.

The inferior canine is of moderate size, and the crown is recurved and somewhat acuminate. The molars are narrow as compared with their length. Their crown consists of the usual two V's, except the anterior part of the third premolar, where the crest is only slightly concave outwards. The fourth premolar is represented by a single small alveolus Anterior to it is a diastema a little longer than its diameter. Excepting on the second premolar, the external cingulum is complete and well developed on all the molars (the last not present). There is a very distinct, short cingulum at the base of the low anterior one of the inner cusps, except on the second premolars.

Measurements of mandibles.

No. I.

		M.
Width between canines at exit from alveoli		.027
Length of premolar series		.088

No. II.

Diameters of base of canine	Anteroposterior	.024
	Transverse	.023
Length of premolar series		.698
Length of crown of P. m. iv		.029
Diameters P. m. i.	Anteroposterior	.038
	Transverse	.038
Diameter M. i.	Anteroposterior	.050
	Transverse	.031
Diameters M. ii.	Anteroposterior	.064
	Transverse	.041
Depth of ramus at front of M. ii		.086

Probably belonging to the same species, and perhaps to the same individual, are the greater part of the frontal and nasal bones, with horns, and the right posterior base of the skull, with part of the zygoma. The first-mentioned fragment shows that the species differs from the *Symborodontes trigonoceras* and *acer*, Cope, and the *Menodus americanus* Leidy, in the absence of angulation above, between the free and other parts of the nasal bones. It also clearly differs from the *S. trigonoceras* in the semi-erect horns, with little pronounced triangular section. From the *S. bucco* the lack of expansion of the zygomatic bones distinguishes it. As compared with the *S. altirostris*, Cope, it has much longer and wider nasal bones, and the horns are more widely separated. The compression makes their apices anteroposterior, while they are transverse in the *S. altirostris*.

The ascription of long bones in the collection to this species is more or less uncertain, although a considerable number of pieces which correspond in size with the parts already described probably belong to it. A nearly complete tibia, and the proximal part of a second, may be with great probability assigned here. As already remarked, it differs from those previously described in having the crest divided vertically with a deep grove. The external side is rather the most prominent. A considerable callus occupies the popliteal region posterior to the spine and the external cotylus, from the latter of which it is marked off by a groove. The anteroposterior diameter of the external cotylus is greater than the transverse. Below the crest the section of the shaft is triangular, with obtuse angles anterior and exterior. This tibia is much like one which I obtained in Colorado, near to the skulls of several species of Symborodons. A femur which accompanies the Cypress Hill tibia is of smaller size than that described under *M. proutii*, and is appropriate to the former. A similar femur accompanies the Colorado tibia. It resembles the one described under the *M. proutii* in having the great trochanter considerably less prominent than the head.

Measurements of Femur, in Mm.

		Cypress Hills.	*Colorado.*
Anteroposterior diameter of head		×	95
" " of great trochanter		×	80
Width of head and great trochanter		×	145
Distance from head to little trochanter, inclusive		×	2×5
Width at condyles		110	×
Diameters of shaft, 175 mm. above condyles, inclusive	Anteroposterior	43	×
	Transverse	65	×

Measurements of Tibia.

Total length (with spine)		325	415
Proximal diameters	Anteroposterior (with crest)	125	115
	Transverse, about	115	110
Least diameters of shaft	Anteroposterior	47	60
	Transverse	55	55
Distal diameters	Anteroposterior (at middle)	53	67
	Transverse (at middle)	78	80

Four astragali and three calcanea are appropriate in size to the *M. angustigenis*. The former have the ridge dividing the cuboid and navicular facets more prominent than in either of the two large species first described, so that it forms a sharply-angulate protuberance. The cuboid facet forms a wide and less oblique triangle. The navicular facet

is quite concave. The sustentacular facet is continuous with it, and forms an oval in the longitudinal axis of the astragalus. The cruscular facet is transverse and concave. The tuber is not very robust and is moderately oblique.

Measurements.

I. Calcaneum.

		Mm.
Total length		123
" " of tuber		80
Width of tuber at base		43
" at sustentaculum		84
Diameters of cuboid facet	Vertical	26
	Transverse	46

II. Astragalus.

Width	of trochlea	67
	below trochlea	75
Length	inner side	60
	outer "	55
Width of distal facets		70
" " navicular facet		42
" " cuboid "		29
Vertical diameter of navicular facet, at middle		40
" " of cuboid " "		25

The scaphoid appropriate to this species has, like the others, the facet for the magnum at the extremity of a step-like projection. The trapezium facet is but little smaller than that for the trapezoides. Both are subtriangular, while that for the magnum is anteroposteriorly oval, with straight internal and posterior borders, which unite at an angle Area about equal to that of the trapezoid facet. The bone differs from the large scaphoid before mentioned, in having the lower facets abbreviated posteriorly by a fossa, which is small and upward-looking in the latter.

The magnum referred to the *M. angustigenis* has the anterior face wider than deep. The corresponding bone of the large species differs from it in having the metacarpal facet relatively a little wider, and in having at the lateral posterior edge of that facet a narrow anteroposterior oblique facet, apparently for an internal facet of the proximal end of the fourth metacarpal.

Measurements of Scaphoides and Magnum, in Mm.

I. Scaphoides.

			M. (?) americanus.	*M. angustigenis.*
Diameters	Anteroposterior		90	75
	Vertical	at trapezoides	24	23
		at magnum	50	45
	Transverse at middle		61	50
Width of facet for magnum (transverse)			39	27
" " " trapezoides (anteroposterior)			19	27
" " " trapezium (")			22	27

II. Magnum.

		M. (?) proutii.	*M. angustigenis.*
Diameters of face	Vertical	29	31
	Transverse	54	50
Diameters scaphoid facet	Anteroposterior	75	60
	Transverse (in front)	36	28
Diameters metacarpal facet	Anteroposterior	50	45
	Transverse (at front)	48	42

This species appears to be nearest the *M. coloradoensis*, Leidy, which is only known from a nasal portion of the skull, with the attached horns. The form of the coössified nasals is different in the two specimens, the *M. angustigenis* having at the extremity an oblique truncation on each side of a median notch, approximately as in *Symborodon trigonoceras* (*Menops varians*, Marsh), while those of the *M. coloradoensis* have a gradually acuminate outline. The value of this character is uncertain, but I incline to think it important. What is more important is that the nasals in *M. angustigenis* have a deep longitudinal concavity below, bounded on each side by a strong marginal rib, both which appear to be wanting in the *M. coloradoensis*, as Leidy says[1] the nasals "are thinner" at these borders "than elsewhere." In one point they differ from those of any of the species of this genus or of Symborodon which I have seen. The lateral antrum is divided anteriorly into two fossæ by a vertical column, which materially strengthens the parts at the anterior base of the horn-core.

Menodus selwynianus, Cope.

American Naturalist, 1889, p. 628.

This species is founded on the free parts of the coössified nasal bones of a single individual of smaller size than any of those already described in this report. These parts differ from those of any species known to me.

The nasals, which are completely coössified, are prominent, narrowed and vaulted. The lateral borders are nearly parallel, and the extremity is rounded. Owing to their great thickness, their profile descends abruptly at the extremity, and the surface is roughened as though for the attachment of thickened integument, a small dermal horn, or enlarged muscles. From this tuberosity the surface descends steeply to a thin border. A short distance posterior to the extremity the lateral margins are decurved, forming lateral walls to a deep, longitudinal, median, gutter-like concavity. This is deeper than in any other species. The horns are broken off, and the upper surface of the nasal bones is so little recurved that it is evident that they are not only small, but more posteriorly placed than in the other species.

Measurements of Nasal Bones.

	M.
Length of fragment above	130
" of nasal border	70
Width at nareal notch	80
" near extremity	65
Depth at apical tuberosity	25

[1] Report U. S. Geol. Surv. Terrs., I., p. 240, plate i., figs 2, 3; ii., fig. 2.

A humerus, scaphoid and astragalus may be referable to this species. They do not differ from those of *M. angustigenis*, except in their smaller dimensions.

It is dedicated to Dr. A. R. C. Selwyn, Director of the Geological Survey of the Dominion of Canada, and formerly of the Geological Survey of Victoria, Australia.

Menodus syceras, Cope.

American Naturalist, 1889, p. 628.

This species is represented by three pairs of coössified nasal bones, one of which supports a horn, in the collection, which I cannot refer to any known species. One of them is smaller and less robust than the other, and as a trace of the median suture still remains, probably indicates a younger animal.

These nasal bones are flat and not decurved anteroposteriorly, nor vaulted transversely. Their free portion is shorter than wide. Accordingly the lateral margins soon begin to thicken downwards. The inferior surface is divided into two grooves by a median, longitudinal, obtuse ridge, which is not found in the *M. selwynianus*. The free border is regularly rounded, with a median notch, and its edge is subacute. The nasal bones are considerably decurved, making an angle with the frontal surface, from which their plane is separated by an obtuse angle which connects the bases of the horns. The bases of the horns are near together, while the horns themselves are erect and moderately divergent. They are of moderate length, and are like those of *M. coloradoensis* and *M. angustigenis*, with a longitudinally oval section, flattened at the base on the external side The apex is sub-round in section.

This species differs from the *M. angustigenis* in the shorter decurved nasal bones, separated by a transverse angle from the frontal plane. The horns, though similar, are much closer together. It differs in the same characters from the *M. coloradoensis*.

Measurements.

No. 1.

	M.
Width of nasals at base of horns	116
Length " from " "	70
Diameters of bases of horns { Anteroposterior	94
Diameters of bases of horns { Transverse	67
Width between external bases of horns	160
Elevation of horn from nasal border	160

No. 2.

Length of fragment above	120
Width at 30 mm. from extremity	80
Thickness " " "	25

No. 3.

Width at 53 mm. from end	80
Probable depth of nasal notch	60

This species belongs to the intermediate group of Menodus, as defined by Messrs. Scott and Osborn, in which both the nasal bones and the horns are of moderate length. They place here *M. proutii*, Leidy, and *M. tichoceras*, S. & O. From both of these *M.*

syceras differs in the angulation of the profile between the horns, and in the very close position of the horns. The entire width of the muzzle at the horns is not greater than the elevation of the horns themselves.

I may add that the bones of the skeleton described under the head of the *M. angustigenis* may well belong to the present species, or, *vice versa*, the horns and muzzle here described may belong to the species represented by the lower jaws, to which the name *M. angustigenis* has been given. In that case the name *M. syceras* becomes a synomyn, and the front and nasal bones described under the *M. angustigenis* must be referred to a different species; perhaps the *M. coloradoensis*.

CÆNOPUS, Cope.

American Naturalist, 1887, pp. 925, 1000.

Cænopus occidentalis, Leidy.

Cope l. c., *Rhinoceros occidentalis*, Leidy, Proceeds. Acad. Philadel., 1850, p. 119; 1851, p. 276; Ancient Fauna of Nebraska, 1853, p. 81, plates xii, xiii; *Aceratherium occidentale*, Leidy, Proceeds. Acad. Philadel., 1854, p. 157; Extinct Mammalia Dakota and Nebraska, p. 220, pl. xxi, fig. 34; xx, xxiii, 1-3.

The only specimen from the Cypress Hills which represents this species is a fragment of a right mandibular ramus supporting a damaged last molar tooth. The dimensions of the parts are as follows:—

		Mm.
Diameters of M. iii.	Anteroposterior	38
	Transverse	26
Width of ramus at base of coronoid		33

Cænopus mitis, Cope.

American Naturalist, 1887, p. 925; *Aceratherium mite*, Cope, Annual Report U. S. Geol. Survey Terrs., 1873 (1875), p. 493.

Fragments of mandibular rami of two individuals represent this species. The measurements are as follow:—

Measurements.

No. 1.

		Mm.
Diameters of base of M. iii.	Anteroposterior	25
	Transverse	16.5
Depth of ramus M. iii		42
Width of ramus at base of coronoid		20

No. 2.

Diameters of M. i.	Anteroposterior	24
	Transverse	19
Depth of ramus at M. i.		43

Cænopus pumilus, Cope.

Aceratherium pumilum, Cope, American Naturalist, 1885, p. 103 (name only); Annual Report G. & N. H. Survey, Canada, 1885, App. C., p. 83.

Portions of mandibles of two individuals represent this, the smallest of the Rhinocerontidæ. One of the rami possesses the alveoli of the large recumbent canine teeth, indicating

that the species is not a Hyracodon. The molar teeth are unfortunately broken away. The other ramus supports the second premolar, the last deciduous molar, with the first two permanent true molars.

The anterior (? fourth) premolar has a single large root, with a deep groove on the external side. In the true molars the V-shaped crests are fully developed, and there is a low cross-crest at the anterior border of the crown. There is no complete cingulum, but short sections opposite the valleys on both the internal and external bases of the crown, on the external side near the front, and at the posterior base. The measurements show how much smaller this species is than the *C. mitis*, and that it does not exceed the *Hyracodon nebrascensis*.

Measurements.

No. 1.

	M.
Width between bases of P. m. i	.033
Length of base of anterior three premolars	.042
Depth of ramus at diastema	.036
" " " third premolar	.042

No. 2.

Length of molars i and ii		.039
Diameter M. ii.	Anteroposterior	.020
	Transverse	.012
Depth of ramus at front of M. ii		.033

ANCHITHERIUM, Kaup.

Anchitherium westonii, Cope.

American Naturalist, 1889, p. 153.

This species is represented by a single superior molar and two inferior molars, the latter in place in a part of the mandible. The teeth are smaller than those of the *A. bairdii*, from which they also differ in their greater transverse as compared with their anteroposterior diameters. The intermediate tubercle of the posterior cross-crest is more distinct than that of the anterior, and the posterior intermediate cingular cusp, so prominent in the *A. bairdii*, is here wanting. The posterior cingulum continues round the internal base of the posterior internal cusp. Diameters of superior molar: Transverse, 13.5 mm.; anteroposterior, 10 mm. Diameters of inferior molar: Transverse, 8 mm.; anteroposterior, 10.5 mm. This species, interesting for its primitive character in the absence of the posterior cingular cusp, is dedicated to Mr. T. C. Weston, the most successful collector in the region from which these fossils were obtained.

ARTIODACTYLA.

ELOTHERIUM, Pomel.

Entelodon, Aymard.

Elotherium arctatum, Cope.

American Naturalist, 1889, p. 629. *Elotherium mortonii*, Leidy, Cope, Report G. & N. H. Surv., Canada, 1885, p. 154.

Established on a left mandibular ramus which supports all the molar teeth, but

lacks the canine and incisors, and its inferior border anterior to the first premolar. From the last circumstance it results that the presence or character of the mandibular tuberosities cannot be ascertained. Some separate molar teeth of the same species I have recorded as above as the *E. mortonii*, to which the *E. arctatum* is nearly allied.

The present species is a little inferior in dimensions to the *E. mortonii* and *E. magnum*, and it differs from the former in the absence of diastemata between the premolar teeth, except a very short one between the third and fourth. The latter is separated by a very short space from the canine. The second premolar is larger than the first, and the third and fourth are abruptly smaller than either. The latter has but one, a compressed, laterally-grooved root. The crowns of all the premolars are compressed, and have fore and aft cutting edges. The true molars are peculiar in the elevation of the anterior part of the crown of two tubercles, above the posterior part. The latter consists of three tubercles, the third or posterior median tubercle being better developed than in the *E. mortonii*, especially on the last molar. As the jaw is adherent to a block of conglomerate rock, only the internal sides of the teeth are visible. These are without cingula, and the enamel of the molars is smooth, while that of the premolars is wrinkled.

A wide space separates the last molar from the base of the coronoid process, which is low. The condyle is in line with the crowns of the molars. The ramus is compressed and not very deep.

Measurements.

		Mm.
Length from condyle to edge of canine alveolus		295
" " " " " last molar		125
" of true molar series		67
Diameters of m. iii	Longitudinal	23
	Transverse	13
Diameters of M. i	Longitudinal	22
	Transverse	13
Diameters of P. m. i	Vertical	20
	Longitudinal at base	28
Diameters of P. m. ii	Vertical	21
	Longitudinal at base	28
Diameters of P. m. iv	Vertical	13
	Longitudinal at base	13
Elevation of coronoid above border		57
Depth of ramus at m. i		55

This species is interesting as presenting a more primitive character than the American species so far known, in the closely-placed premolar teeth. The form of the true molars is also more primitive in the elevation of the anterior pair of cusps, almost resembling some species of Mioclænus in this respect. The large fifth tubercle has a similar significance. The type specimen was found by Mr. T. C. Weston near the head of the Swift Current Creek in August, 1889.

? OREODON, Leidy.

The scarcity of Oreodontidæ in the collections from the Cypress Hills is a matter of surprise. An inferior fourth (first) premolar is the only indication of their presence. The genus is not determinable.

HYPERTRAGULUS, Cope.

Bulletin U. S. Geol. Survey Terrs., I., 1874, p. 26; Annual Report do., 1873 (1874), p. 502; American Naturalist, 1889, p. 111, pl. vi.

Hypertragulus transversus, Cope.

American Naturalist, 1889, p. 154.

Indicated by two superior molar teeth of old individuals. They are of nearly twice the linear dimensions of the only known species, *H. calcaratus*, Cope. The external cusps are subconical, and the external rib which separates them in the Leptomeryx is wanting here. Anterior cingular cusp small. The anterior horn of the posterior internal crescent enters the notch between the external cusps, but does not fuse with either of them. Slight cingula on the anterior and posterior sides of the internal lobes, which do not pass round their internal sides. No external cingulum. Diameters: anteroposterior, 12 mm.; transverse (at base), 15 mm. Crown very brachyodont.

LEPTOMERYX, Leidy.

Proceeds. Academy Philada, 1853, p. 394; 1857, p. 89; Extinct Mammalia Dakota and Nebraska, 1869, p. 165; Cope, Proceeds. Amer. Philos. Soc., 1884, p. 23; ibid, 1887, p. 389.

Leptomeryx esulcatus, Cope.

American Naturalist, 1889, p. 154.

A single superior molar indicates this species, which is of about the dimensions of the *L. evansii*. It differs distinctly from this Tragulid in the greater convexity of the external face of the external cusps, and the absence of the sulci which define an external rib of that surface in the *L. evansii*. The rib which defines the external faces of the cusps from each other is present. Anterior external cingular cusp small, continuous with anterior cingulum. No internal nor external cingulum. Diameters of crown: Anteroposterior, 6.5 mm.; transverse, 7.5 mm.

Leptomeryx mammifer, Cope.

Report G. & N. H. Survey, Canada, 1885, App. C. p. 84; American Naturalist, 1889, p. 154.

This species is represented by a fragment of the mandible which supports the last two molars. Four superior molars add to the characters already derived from mandibular teeth, but their reference to the same species is provisional, as they were found separately. A tarsal cannon bone in the collection may belong to the same species. It is not certain that it belongs to a Leptomeryx, but I leave it there until further information enables me to make a final determination.

The crowns of the inferior molars are not prismatic, nor are they brachyodont. The crown is well distinguished, and expands but little. The sections of the internal columns are lenticular, while the external are crescentic. There are no basal columns or cingula between the latter. In the second true molar, the horns of the anterior internal crescent join the anterior external crescent early on wearing, while the junction comes later in the case of the two posterior columns. In the third true molar the anterior horn of the posterior crescent does not reach the posterior external column, but only touches the anterior internal column. In the same way, the posterior horn does not reach the external

column, but is separated from it by a distinct mammary tubercle or short column, which has an anteroposteriorly short oval section. The heel of this tooth is broken off, but it was small, judging by the fragments of its base.

The peculiar column intercalated between the heel and the posterior internal column distinguishes this species from all the selendont Artiodactyla known to me.

The enamel is slightly wrinkled. The half-worn condition of the crowns show that the animal was adult.

Measurements.

		Mm.
Diameters of M. ii.	Anteroposterior	.0098
	Transverse	.0070
	Vertical (of enamel)	.0045

In the superior molars the median and anterior external cingular cusps are large and obtusely subconical. The anterior external cusp has a very strong median external rib, while the posterior has a very weak one. The anterior horns of the internal crescents are much produced; the posterior but little. The cingula are slight, and are not continued round the internal base. Diameter of superior molar: anteroposterior, 11 mm.; transverse, 11.5 mm.

Leptomeryx semicinctus, Cope.

American Naturalist, 1889, p. 154.

A large species possessing twice the linear dimensions of the *L. evansii* in the superior molar teeth, is represented by three of the teeth designated. In these the external crescents are more compressed and less conical than the two species above described, resembling more nearly those of the *L. evansii*. The posterior has a weak vertical rib; the anterior a strong one. The external cingular cusps are thoroughly fused with the external crescents, forming their anterior horns. The anterior horns of the internal crescents are a little more produced than the posterior. No external or posterior cingulum; a much interrupted anterior cingulum, which is continued round the internal base of the anterior crescent, and which is further continued on the anterior side of the internal base of the posterior crescent. Enamel finely wrinkled. Diameters: anteroposterior, 14 mm.; transverse, at base, 15 mm.

EXPLANATION OF PLATES.

PLATE I.

Bones of fishes and tortoises, natural size.

Fig. 1. *Amia whiteavesiana*, Cope, anterior vertebra, articular face; *a* from above; *b* from below.
Fig. 2. *Amia macrospondyla*, Cope, anterior vertebræ, articular face; *a* from above; *b* from below.
Fig. 3. *Rhineastes rhœas*, Cope, dorsal vertebra, articular face; *a* from above; *b* the side.
Fig. 4. *Amiurus cancellatus*, Cope, dorsal vertebræ, articular face; *a* from above; *b* from below.
Fig. 5. *Amiurus cancellatus?* caudal vertebra, articular face; *a* from above; *b* from side.
Fig. 6. *Amiurus maconnellii*, Cope, dorsal vertebra, articular face; *a* from below; *b* from side.
Fig. 7. *Amiurus maconnellii?* vertebra, articular face; *a* from side.
Fig. 8. *Trionyx leucopotamicus*, Cope, costal bone from above; from White Buttes, Dakota, U. S.
Fig. 9. *Trionyx leucopotamicus*, Cope, part of costal bone from above; typical specimen.

PLATE II.

Right mandibular ramus (lacking posterior part) of the *Hemipsalodon grandis*, Cope, natural size; *a* superior view.

PLATE III.

Hemipsalodon grandis, Cope, femora, two-thirds natural size.

Fig. 1. Anterior view; trochanter restored from smaller specimen.
Fig. 2. Posterior view; " " " " "
Fig. 3. Proximal extremity, end view; taken from the second and smaller specimen.
Fig. 4. Distal end left side; from specimen No. I.

PLATE IV.

Fig. 1. *Chalicotherium bilobatum*, Cope, symphyseal part of mandible, the right alveolar ridge wanting, left side; two-thirds natural size; *a* symphysis, posterior view; *b* from above.
Fig. 2. *Cænopus mitis*, Cope, part of mandibular ramus, with crowns of third and fourth premolars, two-thirds natural size, from above.
Fig. 3. *Cænopus mitis*, Cope, symphysis and part of left ramus mandibuli, from above; *a* from left side.
Fig. 4. *Cænopus pumilus*, Cope, part of right mandibular ramus from above, natural size.

PLATE V.

Fig. 1. *Menodus angustigenis*, Cope, posterior four superior molars, three-eighths natural size, from below.
Fig. 2. *Menodus angustigenis*, Cope, mandibular ramus of another individual (also figured on plate vii.), three-eighths natural size.
Fig. 3. *Menodus selwynianus*, Cope, nasal bones from above, three-eighths natural size; *a* the left side; *b* from below.

PLATE VI.

Fig. 1. *Menodus? americanus*, Leidy? female; nasal and part of frontal bone, from above; one-half natural size.
Fig. 2. *Menodus angustigenis*, Cope, left ramus mandibuli, external view; three-eighths natural size; *a* internal side.

PLATE VII.

Fig. 1. *Menodus angustigenis*, Cope, symphyseal part of right mandibular ramus, from the right side, two-thirds natural size; *a* from below; *b* from front. Type of the species.
Fig. 2. *Menodus angustigenis?* Cope, nasal bones and right horn, from the front; one-half natural size. Type of *M. syceras*, Cope.

PLATE VIII.

Fig. 1. *Menodus? americanus*, Leidy? female, nasal bones, from the front; one-half natural size.
Fig. 2. *Menodus? americanus*, specimen represented in fig. I, left side; one-half natural size.
Fig. 3. Same as fig. 2, outline of section of base of left horn.
Fig. 4. *Menodus angustigenis*, Cope, (*M. syceras*) nasal bones and horn, right side; one-half natural size; external view.
Fig. 5. Outline of section of base of horn of specimen fig. 4.

PLATE IX.

Fig. 1. *Menodus? proutii*, O. N. & E. horn of right side; three-eighths natural size; external view; *a* section of horn at base.

Fig. 2. *Menodus americanus*, Leidy, horn of left side; external view; three-eights natural size; *a* base of same with adjacent exteusions, from below.

Fig. 3. *Menodus? americanus*, head of tibia, proximal view, figured at No. 1, plate xii.

PLATE X.

Fig. 1. *Menodus*, sp. humerus; two-fifths natural size; posterior view.

Fig. 2. *Menodus? americanus*, Leidy, scaphoid bone; two-fifths natural size, from front; *a* proximal face; *b* distal face.

Fig. 3. *Menodus? proutii*, O. N. & E. tibia; proximal view of head; two-fifths natural size. From tibia figured at No. 2, plate xii.

PLATE XI.

Bones of *Menodus*, three-eighths natural size.

Fig. 1. *Menodus? angustigenis*, Cope, femur, from front; rotular face injured; *a* posterior view; *b* proximal view of head.

Fig. 2. *Menodus*, sp. humerus, figured on plate x.; head, proximal view; *a* condyles, distal view.

PLATE XII.

Tibiæ of *Menodus*, three-eighths natural size.

Fig. 1. *Menodus? americanus*, Leidy, front view; *a* posterior view; *c* distal end.

Fig. 2. *Menodus? proutii*, O. N. & E. front view; *a* posterior view.

Fig. 3*c*. *Menodus? proutii*, second individual; distal extremity.

Fig. 4. *Menodus? angustigenis*, Cope, tibia, from front; *b* proximal view of the same; *c* distal view of the same, another specimen.

PLATE XIII.

Bones of the feet of *Menodus*, three-eighths natural size.

Fig. 1. *Menodus? angustigenis*, Cope, scaphoid, from front; *a* proximal side; *b* inferior side.

Fig. 2. *Menodus*, least species; scaphoid bone, from front; *a* proximal view; *b* distal view.

Fig. 3. *Menodus? proutii*, os magnum from above; *a* from front.

Fig. 4. *Menodus? angustigenis*, os magnum from above; *a* from frout.

Fig. 5. *Menodus americanus*, Leidy, calcaneum from above; sustentaculum wanting; *a* distal extremity.

Fig. 6. *Menodus? angustigenis*, calcaueum from above; *a* distal view.

Fig. 7. *Menodus? americanus*, astragalus from above; *a* distal view.

Fig. 8. *Menodus angustigenis*, astragalus from above; *a* distal view.

Fig. 9. *Menodus*, least species; astragalus from above; *a* distal view.

PLATE XIV.

Chiefly teeth of *Diplarthra*, uatural size, except figure 3, which is two-thirds natural size.

Fig. 1. *Anchitherium westonii*, Cope, superior molar from below; external wall restored.

Fig. 2. *Anchitherium westonii*, fragment of lower jaw, with two molar teeth, from above; *a* do., external side.

Fig. 3. *Elotherium arctatum*, Cope, left ramus of mandible, lacking the anterior extremity, aud part of inferior border, internal view; *a* dentition, viewed from above.

Fig. 4. *Hypertragulus transversus*, Cope, worn superior molar tooth, from below; *a* external view.

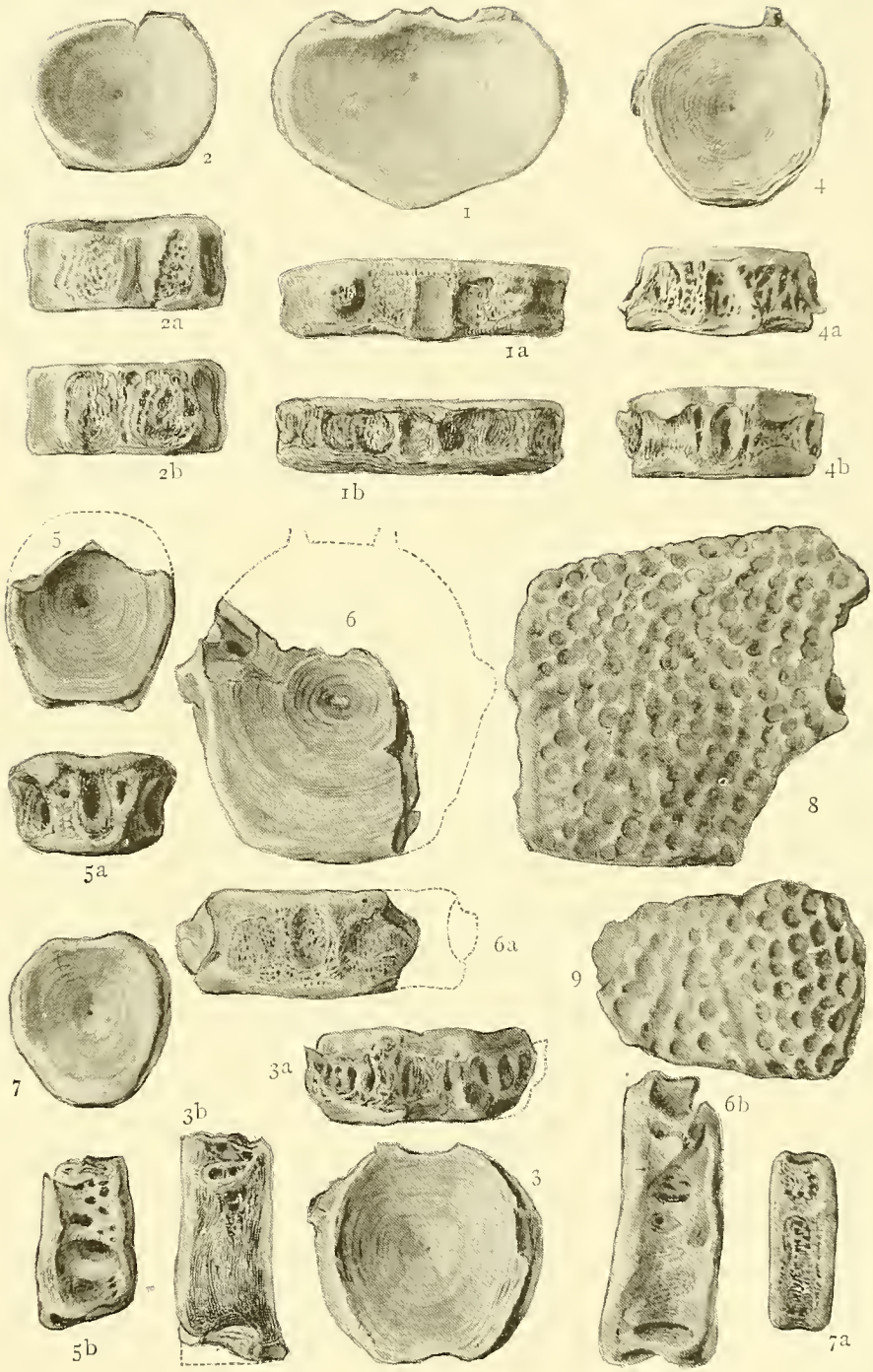
Fig. 5. *Leptomeryx esulcatus*, Cope, superior molar, $\frac{3}{2}$ natural size; *a* natural size; external wall of anterior crescent restored.

Fig. 6. *Leptomeryx mammifer*, Cope, superior molar; *a* external view.

Fig. 7. *Leptomeryx mammifer*, Cope, portion of mandible, with second aud parts of the first and third true molars, from above; *a* from external side. Typical specimen.

Fig. 8. *Leptomeryx semicinctus*, Cope, superior molar, from above: *a* from external side.

Fig. 9. *Patæologus turgidus*, Cope, left mandibular ramus, external view; *a* superior view.



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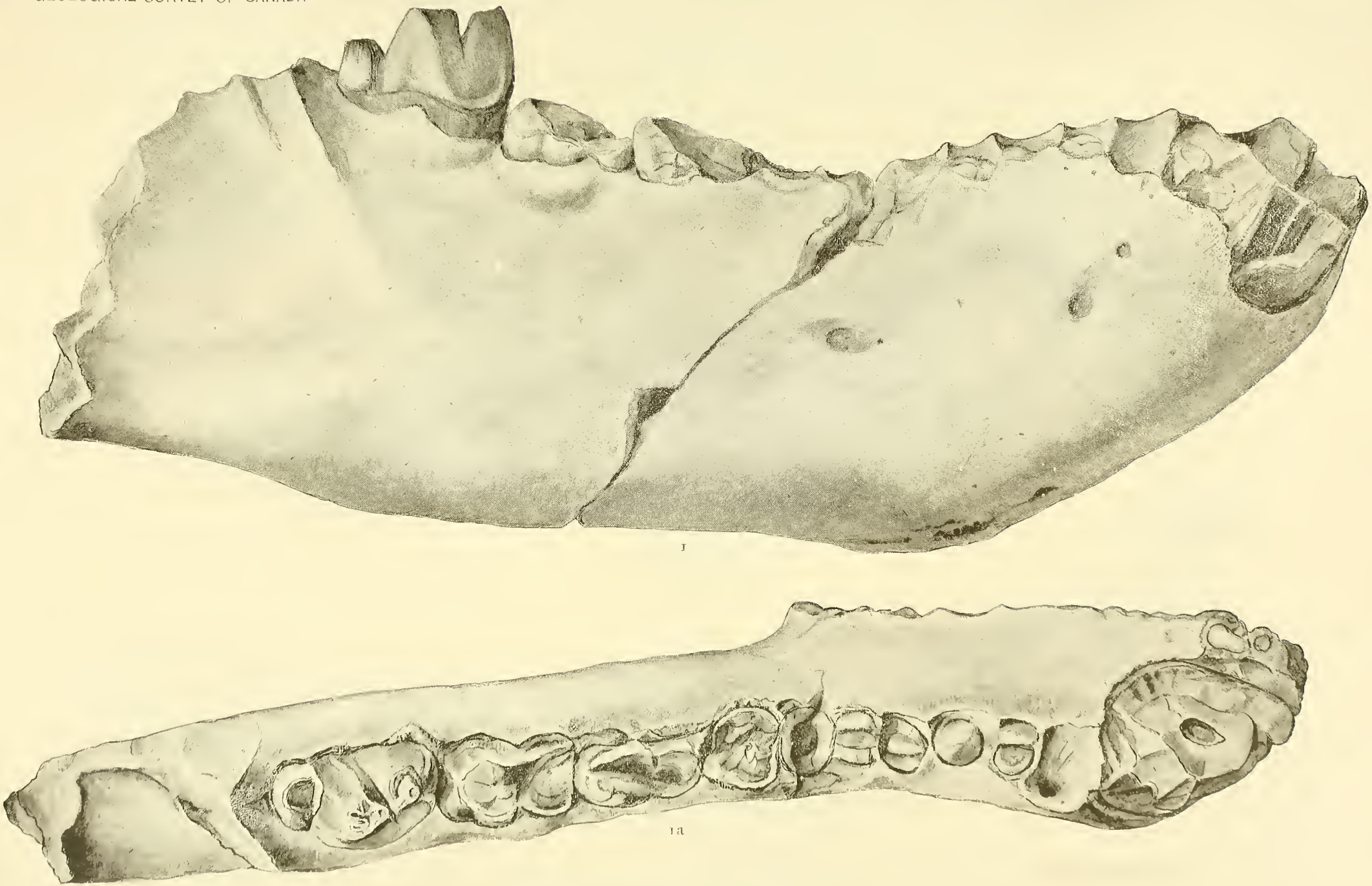

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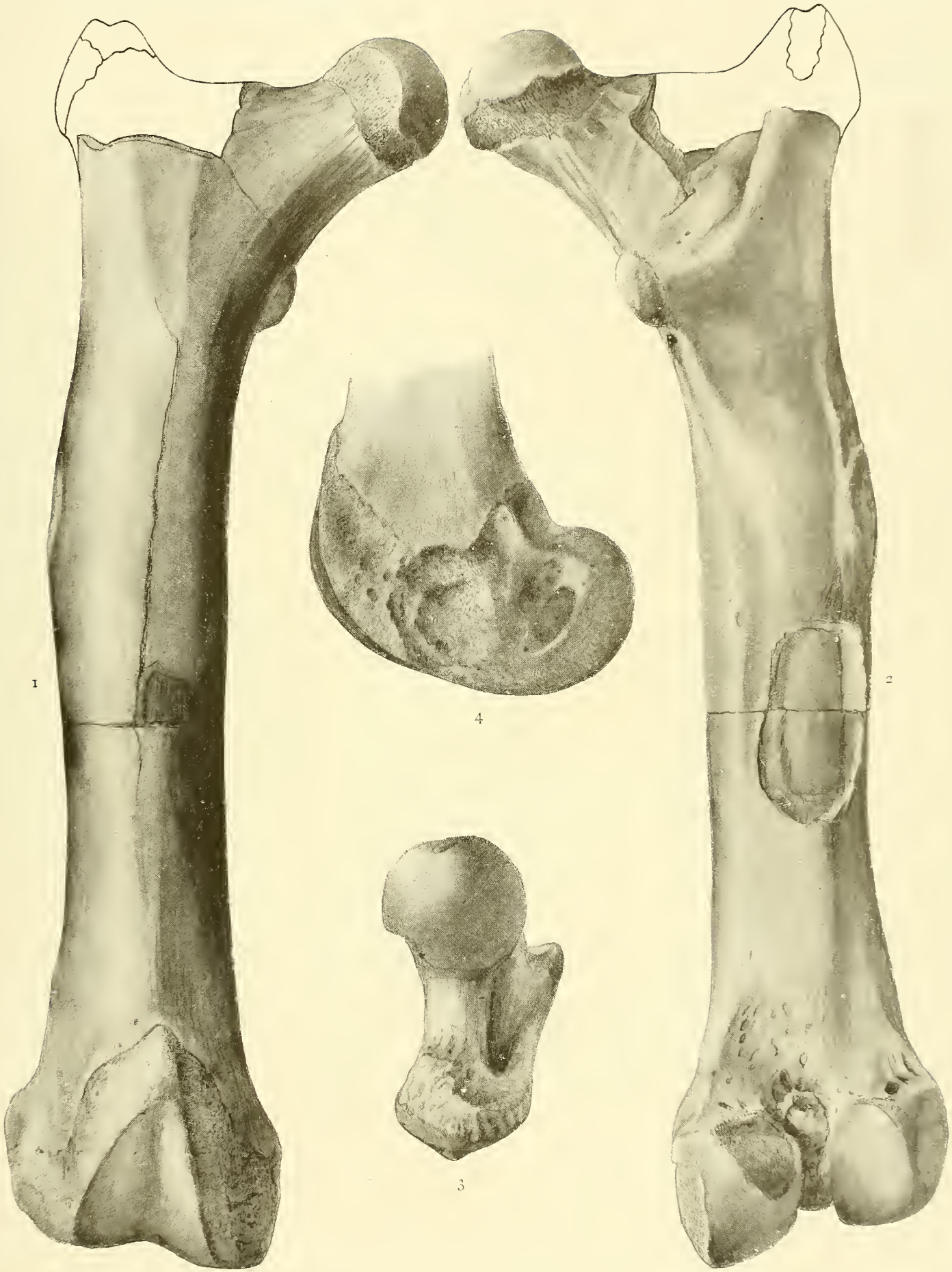
1a

HEMIPSALODON GRANDIS, Cope.



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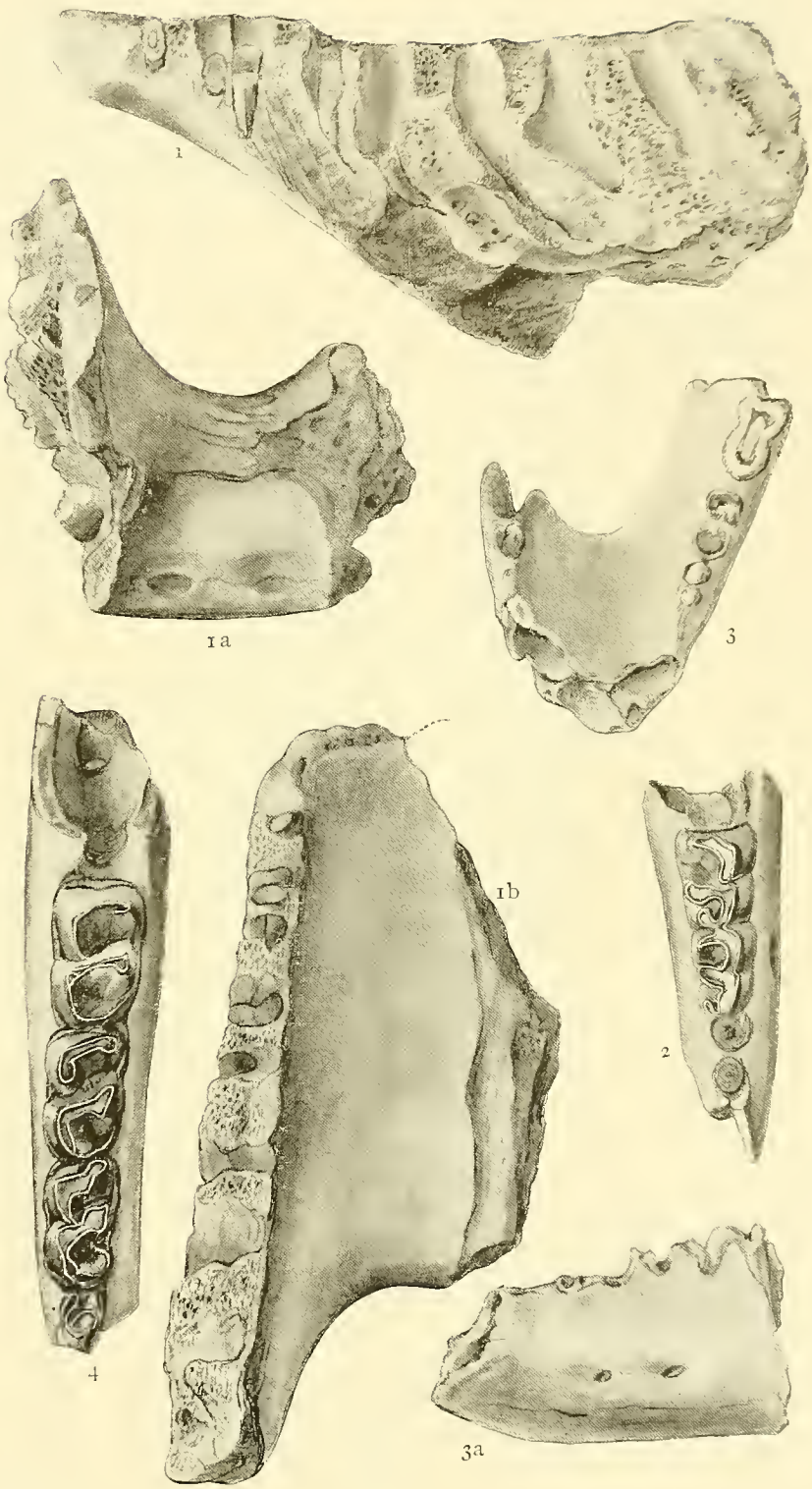
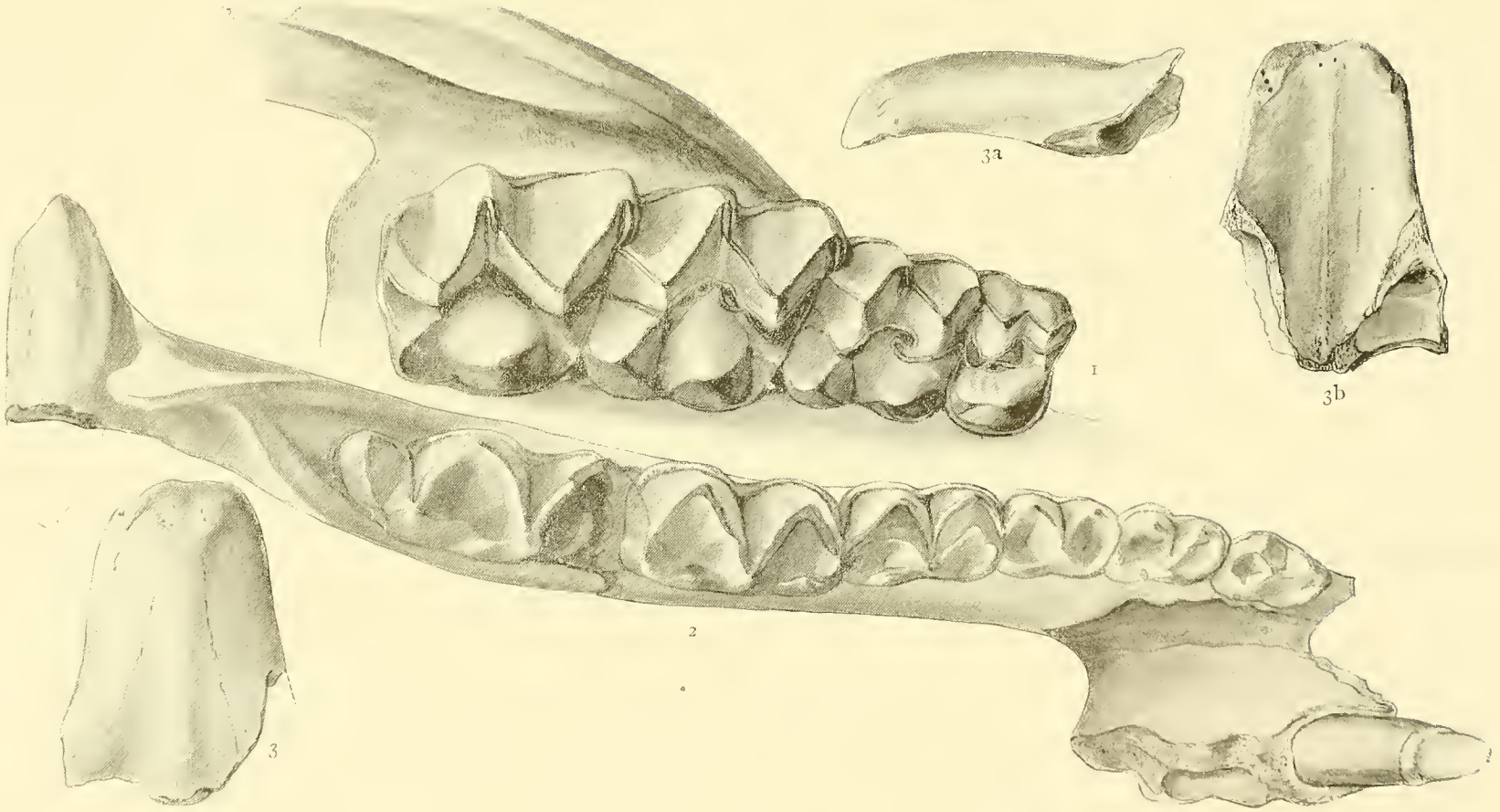
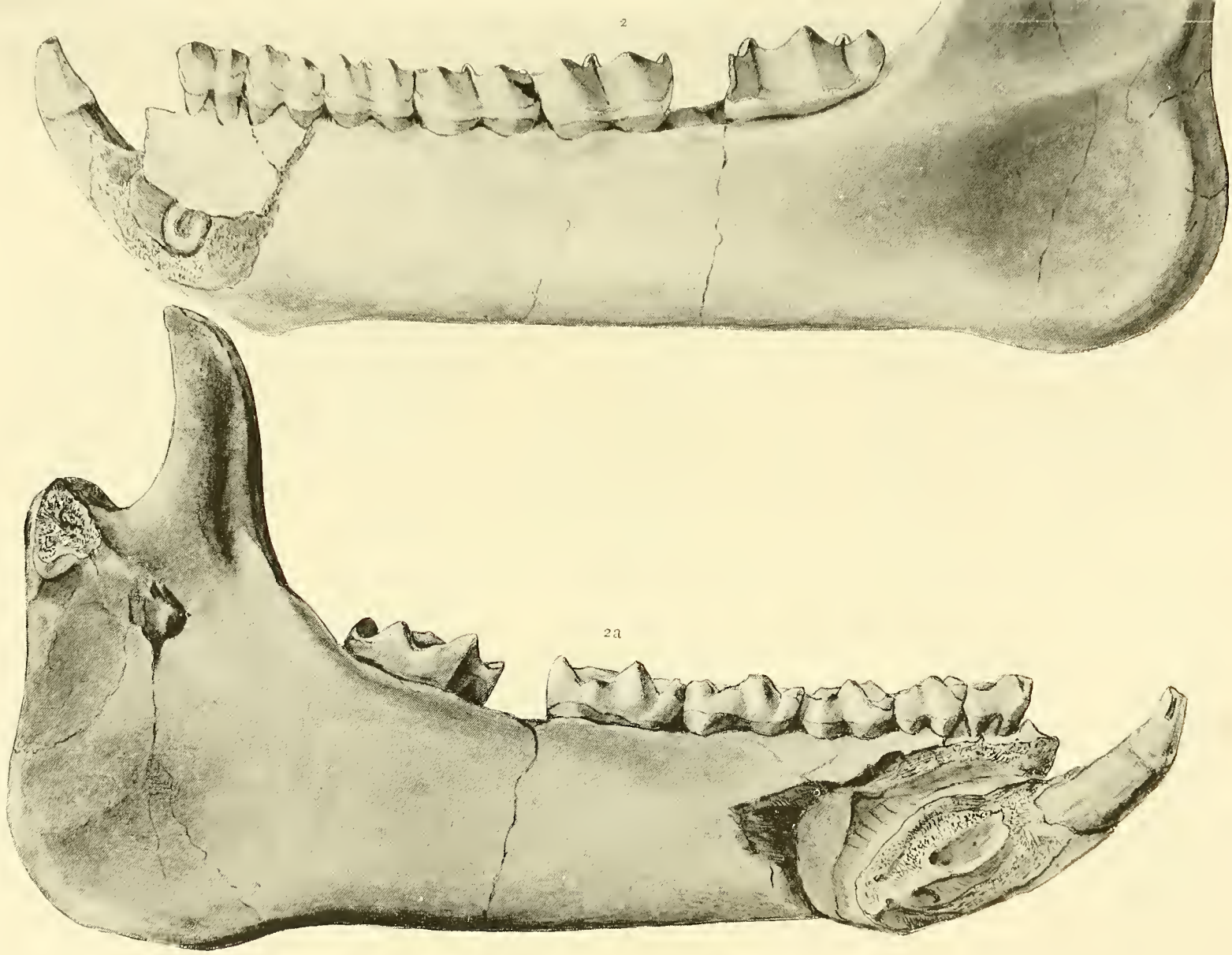


ANCYLOPODA and PERISSODACTYLA.

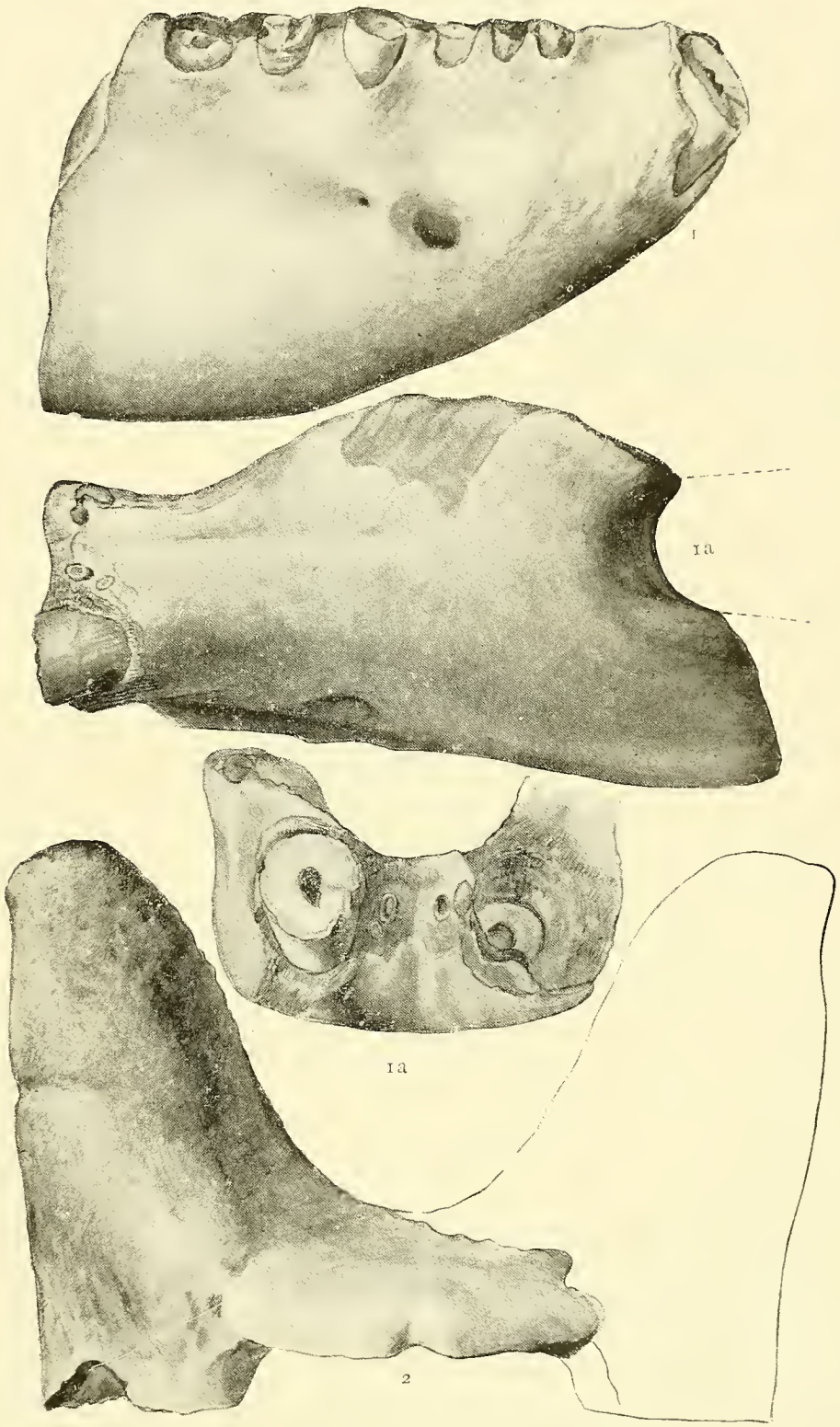


1-2 MENODUS ANGUSTIGENIS, Cope. 3 M. SELWYNIANUS, Cope.



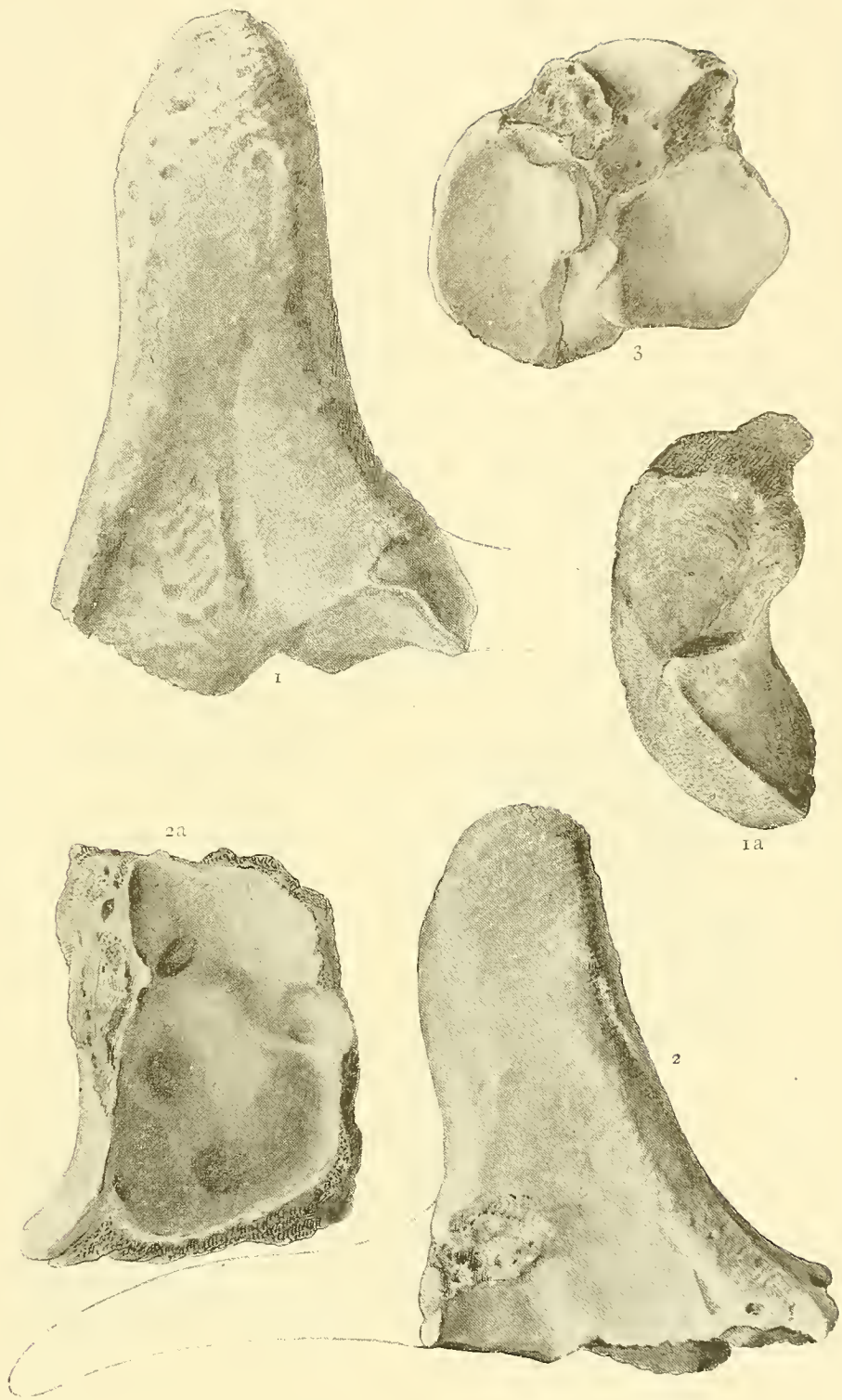
MENODUS.

MENODUS.



1 MENODUS ANGUSTIGENIS, C. 2 M. SYCERAS, Cope.

1-3 MENODUS AMERICANUS, Leidy. 4-5 M. SYCERAS, Cope.



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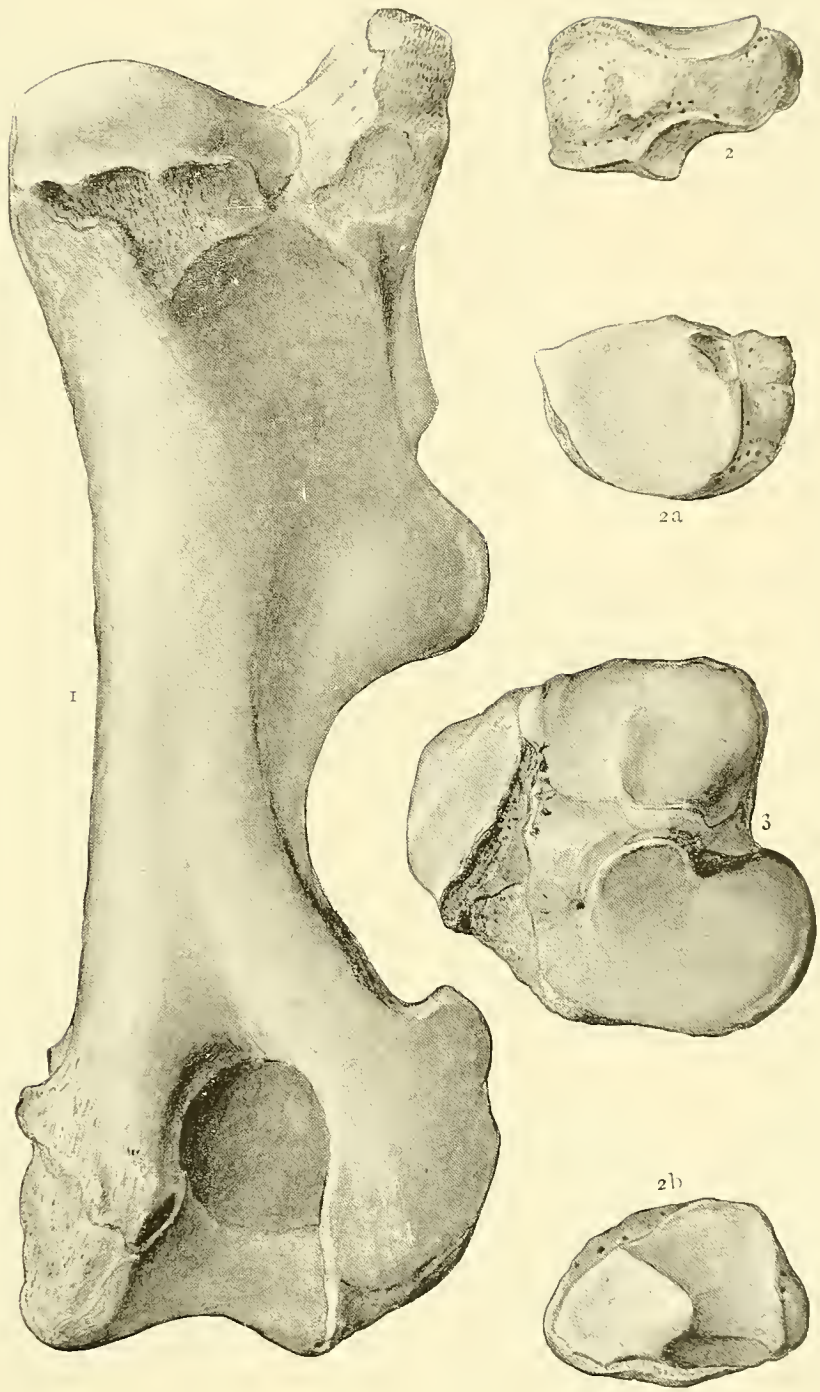

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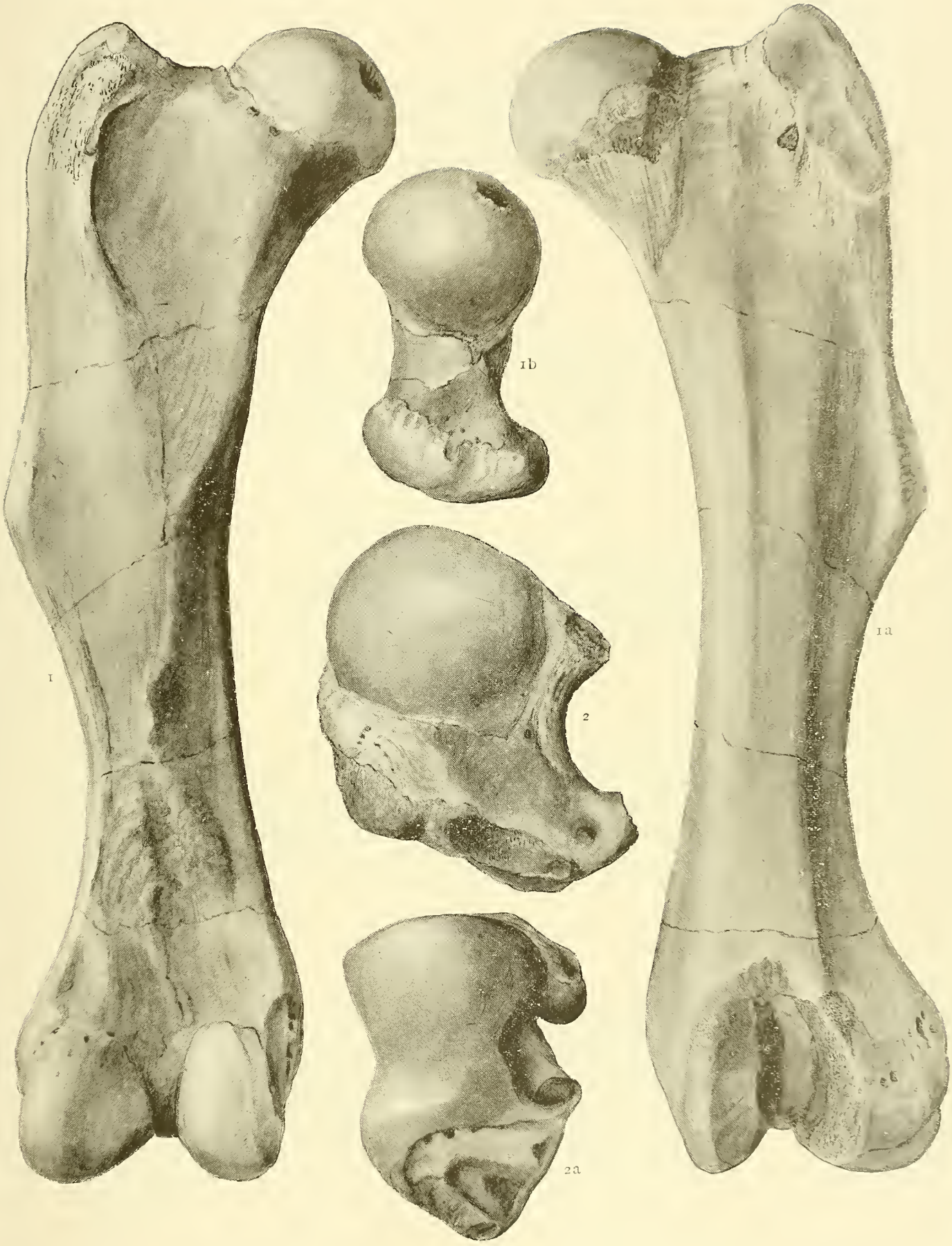
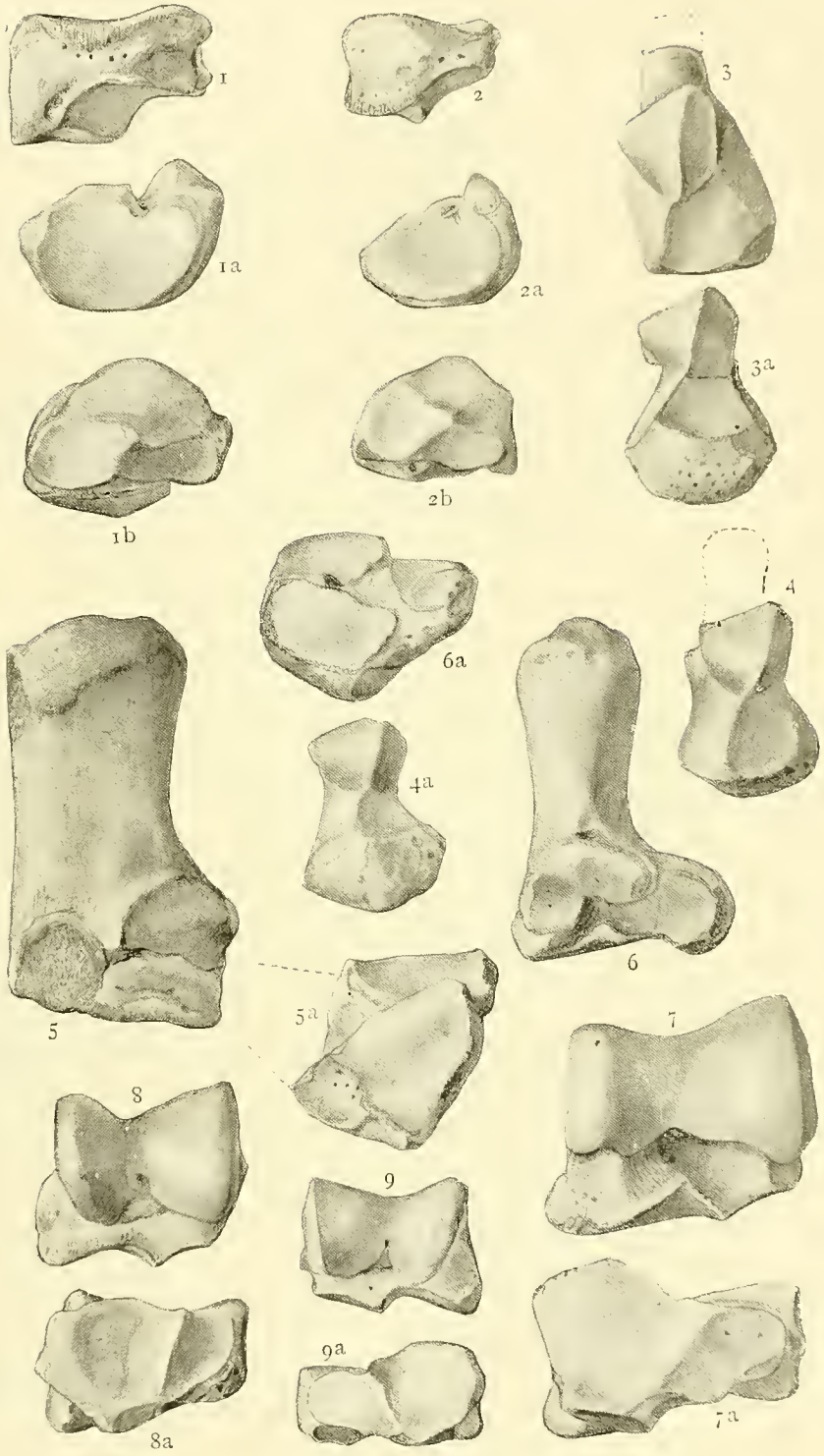


MENODUS.

MENODUS.



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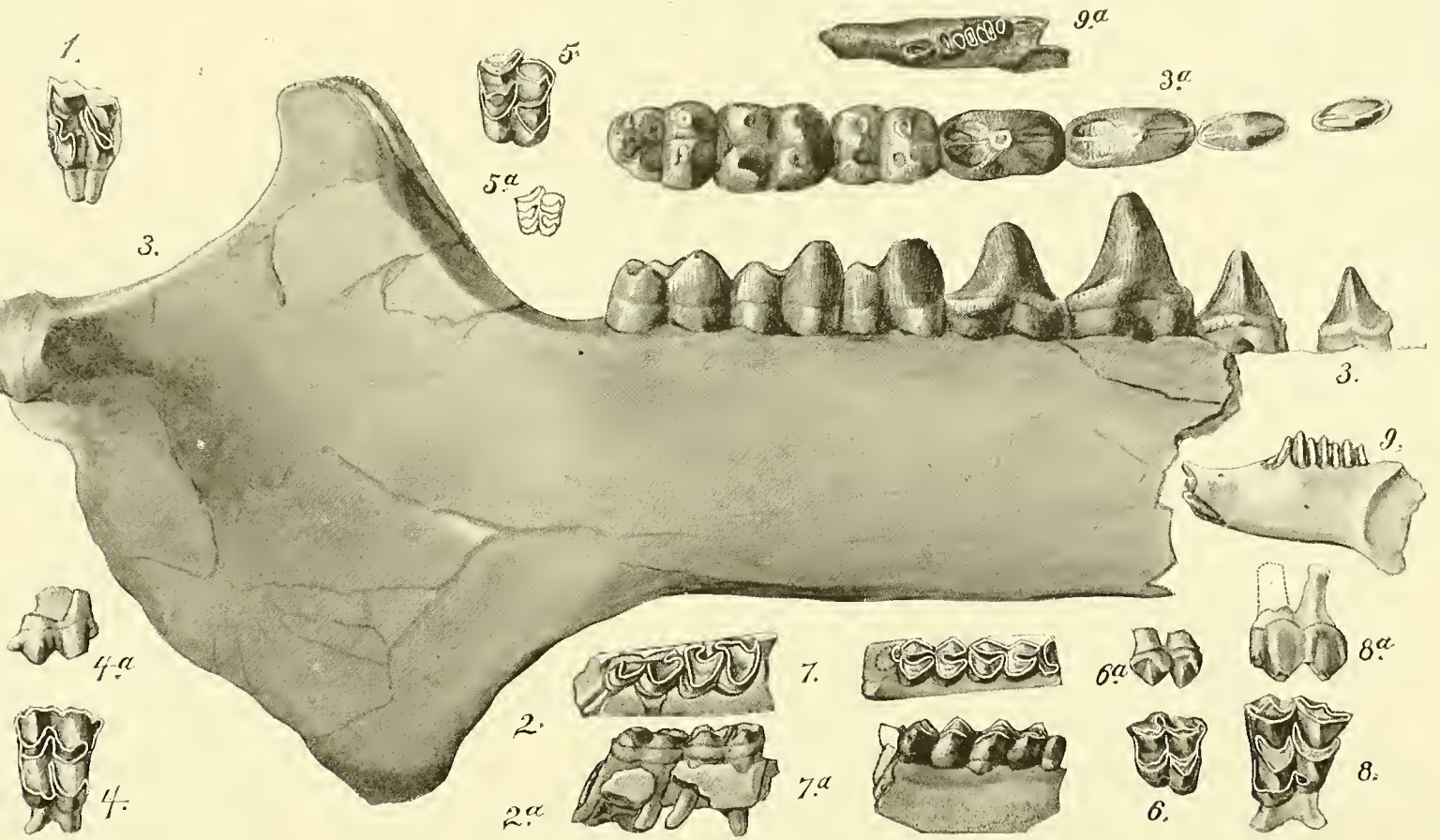

PERISSODACTYLA ARTIODACTYLA, and GLIRES.