ENGINEER DEPARTMENT. U. S ARMY.

GEOGRAPHICAL EXPLORATIONS AND SURVEYS WEST OF THE 100TH MERIDIAN.

FIRST LIEUT. GEO. M. WHEELER,
CORPS OF ENGINEERS, IN CHARGE.

SYSTEMATIC CATALOGUE

OF

VERTEBRATA

OF THE

EOCENE OF NEW MEXICO,

COLLECTED IN 1874.

E. D. COPE, A. M.,
PALEONTOLOGIST.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
April 17, 1875.

With the Compliments of

Lieut. George M. Wheeler,

Corps of Engineers,

U. S. Army.

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OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., March 8, 1875.

SIR: Lieut. George M. Wheeler has sent to this Office report of Prof. E. D. Cope on the vertebrata from the Eocene of New Mexico, obtained by the geographical survey under his charge, during the field-season of 1874.

I have respectfully to recommend that it be printed at the Government Printing-Office, and that fifteen hundred copies be furnished on requisition from this Office.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,
Brigadier-General and Chief of Engineers.

Hon. W. W. BELKNAP,
Secretary of War.

Approved: By order of the Secretary of War.

H. T. CROSBY,
Chief Clerk.

WAR DEPARTMENT, *March* 9, 1875.

UNITED STATES ENGINEER-OFFICE,
GEOGRAPHICAL EXPLORATIONS AND SURVEYS
WEST OF THE ONE HUNDREDTH MERIDIAN,
Washington, D. C., March 5, 1875.

GENERAL: I have the honor to forward herewith a systematic catalogue of vertebrata from the Eocene of New Mexico, with description of new species, prepared by Prof. E. D. Cope, A. M., paleontologist to the expedition of 1874, and to request that, in order to establish priority of discovery, it be printed and bound at the Government Printing-Office, and that fifteen hundred copies be furnished for the use of this Office.

Very respectfully, your obedient servant,

GEORGE M. WHEELER,
Lieutenant of Engineers, in Charge.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

SYSTEMATIC CATALOGUE OF THE VERTEBRATA OF THE EOCENE OF NEW MEXICO.

BY E. D. COPE, A. M.

PHILADELPHIA, *February* 19, 1875.

SIR: The present essay completes the determination of the species of vertebrata obtained by the geographical survey under your charge in the Eocene formation of New Mexico during the field-season of 1874. The descriptions which have already appeared in your report to the Chief of Engineers, as published in the annual report of the latter for 1874, are not now repeated. The total number of mammalia is forty-seven species, of which the present report introduces twenty-four for the first time.

I remain yours, sincerely,

E. D. COPE,
Paleontologist.

Lieut. G. M. WHEELER,
Corps of Engineers.

MAMMALIA.

CARNIVORA.

The genera of this order which can be compared, differ as follows in points of dentition:

A. Carnassials without opposite inner tubercle.
  Carnassials with two cusps and without heel. *Hyænodon.*
  Carnassials with straight heel and anterior cone. *Mesonyx.*
  Carnassials with three or more tubercles in one series. *Ambloctonus.*

AA. Carnassials with inner cone or tubercle opposite the outer; no tubercular molar:
  Two tubercular carnassials. *Oxyæna.*
  Three tubercular carnassials. *Prototomus*

AAA. Tubercular teeth behind tubercular carnassials.
  One tubercular, and one tubercular carnassial; no incisors. *Didymictis.*
  Two tuberculars. *Cynodon.*

The series of dental types which precede the complex structures of teeth, presented by the most specialized divisions of the hoofed mammalia, have been pointed out by the writer in an essay on the Origin and Homologies of the Types of Dentition of the Mammalia Educabilia*. From this discussion the analysis of the most specialized sectorial tooth of the carnivora, as seen in the Felidæ, was omitted. As light has been thrown on the subject by later researches, a note of the

*Journal of the Academy of Natural Sciences of Philadelphia. 1874.

conclusions will be made here, chiefly with reference to the dentition of the lower jaw.

In the above essay I regarded the simple four-lobed or quadritubercular molar of the hypothetical *Bunotherium* as the starting-point of all more specialized forms of crested teeth. The second lower molars of the peccaries (*Dicotyles*) represent such a type. It was also pointed out that additional tubercles may be added to this or to a still simpler form by the development of basal cingula.

The genus *Hyopsodus* presents a modified form of quadritubercular molar. In the genera *Pantolestes* and *Antiacodon* we observe that the tubercles are similar, excepting that the anterior inner is double or slightly bifid. In *Pelycodus*, (whose systematic position is uncertain,) the two apices of this tubercle are separated more widely from each other, so as to constitute two cusps. These are connected with the anterior-outer cusp by acute ridges, which thus form two sides of a triangular area. The anterior ridge is evidently a developed cingulum.

The tubercular molar of some *Viverridæ*, and among the extinct forms especially the *Didymictis protenus*, Cope, present a similar structure to that just described. This furnishes a ready explanation of the tooth immediately in advance, which is the primitive form of sectorial tooth characteristic of that type of Carnivora. The three anterior tubercles are largely developed, standing at opposite angles of a triangular space; the outer and anterior cusps are the most elevated, and the ridge which connects them is now a cutting blade. The posterior portion of the tooth does not share in this elevation, and its two tubercles are in some genera obsolete, and in others replaced by an elevation of one margin, which leans obliquely toward the middle of the crown. In *Mesonyx* this is represented by a median longitudinal crest. If the two tubercles of the posterior part of this tooth (which may be termed a *tubercular sectorial*) are elevated and acute, we have the molar of many recent and extinct *Insectivora;* if the same portion (now called a *heel*) is much reduced, we have the type of *Oxyæna* and *Stypolophus*. In the *Canidæ* the three anterior tubercles are much less elevated than in the genera above named; the external is much the larger, and the anterior removed farther forward so as to give the blade a greater antero-posterior extent. The heel is large and without prominent tubercles. In the *Mustelidæ* the inner of the two median cusps is often reduced to a rudiment, or is entirely wanting, and the heel is large. The lower sectorial of the *Hyænidæ* has no inner tubercle, and the heel is much reduced. In some of the saber-toothed tigers the heel remains as a mere rudiment, while in the true cats it has entirely disappeared, and the carnassial tooth remains perfected by subtraction of parts, as a blade connecting two subequal cusps. The *Hyænodontidæ*, as is known, possess three carnassial teeth without inner tubercles. The history of this form is as yet uncertain, as it was evidently not derived from contemporary forms of the Eocene with tubercular sectorials.

The development of the carnassial dentition has thus been accomplished, first, by an addition of an anterior cusp, and subsequently by the subtraction of the inner and posterior cusps, so that of the original four of the quadritubercular molar but a *single one*, *i. e.*, the anterior external, remains. The same process may be observed in the successional modifications of the entire dentition of the jaws. The Eocene forms of carnivora frequently display more numerous sectorial teeth (such as they are) than any of the existing families. The important change, which is clearly indicated, is the progressive extinction of the genera with numerous sectorial teeth, accompanying the increasing specialization of the sectorial tooth in the genera which remain. In

other words, the numerous types of digitigrade carnivora which have survived, are those developing but one sectorial tooth, (whose earliest representative is *Didymictis.*) The increased perfection of the sectorial has been associated with a reduction in the number of other molars, first, posterior, then anterior to it, which reduction has been accompanied by an increased relative size of the sectorial. By this process concentration of the carnassial function has been gained, and increased robustness of the jaws, by progressive shortening. The slender form of the rami of the Eocene genera and *Hyænodon* are much less efficient in functional use than the stout jaws of existing *Mustelidæ*, *Hyænidæ*, and *Felidæ*.

A second point in the history of the Eocene carnivora remains to be considered. In all of the genera which I have had the opportunity of examining, excepting *Mesonyx*, namely, *Ambloctonus*, *Oxyæna*, *Prototomus*, *Didymictis*, the tibio-astragalar articulation is of a primitive character. The astragalus is flat, and the applied surfaces are nearly a plane, and without the pulley-shaped character seen in existing carnivora; as dogs, cats, and in a less degree in the bears and in other mammalia with specialized extremities, as *Perissodactyla*, *Artiodactyla*, etc. The simplicity of structure resembles, on the other hand, that found in the opossum and various *Insectivora*, *Rodentia*, and *Quadrumana*, and in the *Proboscidia*, most of which have the generalized type of feet. The structure indicates that the carnivorous genera named were plantigrade—a conclusion which is in conformity with the belief already expressed that the mammalia of the Eocene exhibit much less marked ordinal distinction than do those of the Miocene or the recent periods. It is indeed questionable whether some of the genera here included in the carnivora are not gigantic *Insectivora*, since the tibio-tarsal articulation in many, the separation of the scaphoid and lunar bones in *Synoplotherium*, the form of the molars, and the absence of incisor teeth in some are all characteristic of the latter rather than the former order.

AMBLOCTONUS, Cope.

The fossil remains which illustrate this genus include the greater part of the dentition of one side of the cranium and that of the posterior part of the mandible, with a number of bones of the limbs; the teeth are somewhat worn, but not so much so as to prevent determination. The superior molars preserved are three in number; four extend posteriorly from below the orifice of the foramen infraorbitale exterius. The crowns are longitudinal, and consist of a three-lobed exterior blade and an inner depressed tubercle. The last molar is longitudinal and not transverse, as in *Oxyæna*. The superior canine is large and is preceded, with a short intervening diastema, by a very large exterior incisor. The last inferior molar consists of two cusps and a rudimental heel. The cusps form a short carnassial blade. Their number cannot be determined on the penultimate molar, but there is a well-developed heel, and the anterior part of the crown is wide. The molar which precedes has three principal cusps, the two anterior forming together a blade; in the type species there are accessary tubercles adjacent to the posterior cusp.

The trochlear surface of the tibia is oblique and nearly uninterrupted, much as in *Oxyæna*, and without the grooves for an hour-glass shaped astragalus, as in *Mesonyx*.

This genus probably belongs to the *Hyænodontidæ*, and resembles *Hyænodon* in the structure of its superior molars. It differs in the inferior

molars, especially in the tubercular heel of the antepenultimate and penultimate, and probably in the arrangement of cusps on the interior part of the latter.

AMBLOCTONUS SINOSUS, Cope, (sp. nov.)

Two incomplete skeletons represent this species in the collections of the survey. The best preserved includes the right maxillary bone, with crowns and roots of the last four molars. The first of these is wider behind than before, the posterior root being double. The next has a triangular crown, with the exterior and anterior borders at right angles to each other, and of subequal lengths. The fourth tooth is not quite so wide, but is about as long as the one just described, has three lobes of the outer summit, and a convex anterior border. The interior heel of the first molar is constricted at a point of its border, indicating an additional internal cusp, probably basal. The foramen infraorbitale is remarkably large. Owing to the state of the specimen, the number of premolars cannot be ascertained. The canine is worn almost to the alveolar border in a vertical truncation. The diameter of the alveolus for the third or outer incisor is but little less than that of the canine.

The characters of the three last inferior molars may be partially determined from the two individuals. The last molar is smaller, in the specimen already partially described, than the two which precede it, which are subequal. It has a very short heel, with a cutting edge on the outer side. The remainder of the crown is subtriangular in section at the base, supporting a posterior and an anterior tubercle, which are connected on their inner sides by a cutting edge. There is a cingulum on the external base, continuous with the border of the heel. The antepenultimate molar has three cusps, of which the anterior and posterior have subequal bases. The anterior turns to the inner side of the tooth, the median stands on the inner side, while the posterior is median. It has an accessary tubercle on each side of it, that of the inner side much the more elevated, and combining with the median to form an incurved grinding surface, on attrition.

The distal part of the calcaneum is rather elongate and compressed.

This species of carnivore is of robust character, and about the size of the jaguar.

Measurements.

	M.
Length of bases of last four superior molars, (No. 1)	.0710
Length of crown of antepenultimate molar	.0175
Width of crown of antepenultimate molar	.0170
Length of crown of last molar	.0180
Width of crown of last molar	.0160
Length of last three inferior molars	.0410
Length of crown of last inferior molar	.0120
Width of crown of last inferior molar	.0080
Length of crown of antepenultimate molar	.0140
Width of crown of antepenultimate molar	.0110
Diameter of superior canine	.0170
Length of last three inferior molars of specimen, (No. 2)	.0490
Length of antepenultimate molar of specimen, (No. 2)	.0150
Depth of ramus of jaw at penultimate molar	.0420
Diameter of shaft of femur of (No. 1,) below middle	.0240
Diameter of head of femur	.0270
Diameter of shaft of tibia, (least)	.0190
Diameter of distal end of tibia measured obliquely	.0350
Diameter of calcaneum, vertical	.0260
Diameter of calcaneum, transverse	.0130

As compared with the *Synoplotherium lanius*, Cope, to which this species is probably allied, all the teeth are wider and more robust, excepting the canines. Although the disposition of the tubercles of the lower molars in *Synoplotherium* is unknown, the narrow form of their bases renders it probable that the structure is rather as in *Hyænodon* than as in *Ambloctonus*, especially in regard to the antepenultimate, which is so exceptionally tubercular in the present animal.

OXYÆNA, Cope.

Report on Vertebrate fossils, obtained by the Wheeler Expedition in New Mexico, 1874, p. 11, (extracted from report of Lieutenant Wheeler to Chief of Engineers.)

This genus resembles *Pterodon*, as described and figured by Gervais, in the dentition of the maxillary bone; but the teeth of lower jaw are totally distinct in character, approaching more nearly those of the *Palæonictis* of Dr. Blainville. From the latter, it differs, among other points, in the character of the antepenultimate lower molar, which in *Oxyæna* is characterized by the presence of a median blade, but in *Palæonictis* by a heel supporting (in the typical species) two tubercles.

The *Oxyænas* were the most abundant of the Eocene carnivora, estimating them by the relative frequency of occurrence of their remains. There were at least three species, which ranged from the size of a terrier-dog to that of a jaguar. They are of a robust structure, and resemble *Synoplotherium* in the anterior production of their canine teeth, which are so closely approximated as to exclude the incisors altogether. Specimens obtained include the dentition of both jaws and bones of the skeleton. The phalanges have the same flattened form seen in the flat-clawed genera discovered in Wyoming.

OXYÆNA MORSITANS, Cope, l. c., p. 12.

OXYÆNA LUPINA, Cope, l. c., p. 11.

OXYÆNA FORCIPATA, Cope, l. c., p. 12.

PROTOTOMUS, (Cope.)

Loco citato, p. 13.

Having obtained more perfect specimens of the lower jaws of this genus, I find that I must correct the diagnosis given as above cited by the ascription of *three* tubercular sectorial molars to the inferior dentition, in correspondence with the number there stated to characterize the maxillary series of teeth. This is one more than exists in *Oxyæna*. Two such teeth are also ascribed to *Patriofelis*, Leidy, and *Viverravus* and *Limnocyon*, Marsh, by their describers. No existing genus of Carnivora possesses a similar dentition, but it is presented on a diminutive scale by some Insectivora.

PROTOTOMUS VIVERRINUS, Cope, l. c., p. 13.

PROTOTOMUS SECUNDARIUS, Cope, *sp. nov.*

Represented by an incomplete mandibular ramus, which supports four molars. The penultimate has a well-developed heel, whose outer border is elevated and acute, and turned in so as to approach the middle of the crown. The fourth molar from behind has a heel with a symmetrically median cutting-blade; enamel smooth. The ramus indicates a species the size of an opossum, and intermediate between the *P. viverrinus* and the *P. multicuspis*.

Measurements.

	M.
Length of crowns of two anterior true molars	.0150
Length of penultimate molar	.0075
Width of penultimate molar	.0033
Depth of ramus mandibuli at penultimate molar	.0125
Thickness of ramus mandibuli at penultimate molar	.0050
Length of crown of third premolar	.0080

PROTOTOMUS MULTICUSPIS, Cope, *sp. nov.*

Established on a series of superior molars, which accord so closely with two series of inferior molars as to leave no room for doubt that they pertain to the same species. One of the latter specimens includes the greater part of the right ramus of the mandible; the other the principal part of both rami.

The superior molars are twice the size of those of *P. viverrinus*, and have much the same structure. The last or transverse molar has less extent and is inserted by one root only; the penultimate molar is wider than long; the antepenultimate longer than wide. There is a short blade in front of the double cone in the penultimate, but none in front of the corresponding cones in the two molars which precede. The cingulum of the inner base is very obscure.

In the true inferior molars the three anterior cusps are much elevated above the heel. The latter is quite elongate on all of these teeth, and forms a cutting-blade on the last premolar and anterior two molars; the second and third premolars support a low trenchant posterior heel. No external cingulum; enamel smooth; rami of the mandible slender.

Measurements.

	M.
Length of posterior four molars	.0270
Length of penultimate molar	.0070
Width of penultimate molar	.0090
Width of antepenultimate molar	.0070
Width of first molar	.0060
Length of first molar	.0075
Elevation of first molar	.0050
Length of last six inferior molars	.0450
Length of three true molars	.0235
Length of last true molar	.0090
Elevation of true molar	.0070
Length of second true molar	.0075
Elevation of third premolar	.0035
Depth of ramus at penultimate molar	.0015

About the size of the red fox.

PROTOTOMUS STRENUUS, Cope, *sp. nov.*

Both mandibular rami, with representatives of all the teeth except the first premolar, form the basis of our knowledge of this carnivore. The characteristic feature is the great robustness of the jaw as compared with the species last described as well as the somewhat larger size. The third premolar has a cutting edge and basal tubercle in front, which are wanting in the *P. multicuspis*. The third and fourth premolars are stout teeth, composed of a large cusp of lenticular section and a trenchant heel. The fourth is thickened on the inner side, but the apex is broken away. The penultimate molar is larger than the last, and its heel, with that of the one preceding, is well developed. The first true molar is smaller than the second, and its cuspidate portion smaller than the corresponding part of the last molar The inferior canine is stout at the base and acute at the apex. The external face

exhibits two shallow longitudinal grooves separated by a low convex rib. Enamel of all the teeth smooth.

Measurements.

	M.
Length of last five molars	.0375
Length of last premolar	.0080
Length of first true molar	.0080
Length of second true molar	.0080
Width of second true molar	.0065
Length of last true molar	.0075
Depth of jaw at last true molar	.0210
Depth of jaw at second premolar	.0175
Thickness of jaw at second premolar	.0080
Length of inferior canine	.0123
Long diameter of inferior canine at base	.0065

The thickness of the mandibular bones is twice as great as that of the species last described.

Other species formerly referred to this genus are now placed in *Apheliscus* and *Pelycodus* respectively.

DIDYMICTIS, Cope.

Inferior molars, six, consisting of four premolars and two true molars. True molars, a posterior tubercular and an anterior tubercular sectorial, *i. e.*, with three elevated cusps and a posterior heel; premolars with a lobe behind the principal cusp. The canine teeth are directed forward and are very close together, so that it is doubtful whether there were any incisors. An ungueal phalange of the typical species is strongly compressed.

The resemblance of this genus to the existing *Viverra* in dental characters is so great that the only distinctive feature appears to be the deficiency of the full number of incisors. I formerly referred the type-species to *Limnocyon*, but that genus is stated to possess "two tubercular molars," which are not applicable to the present form, whether true tuberculars or tubercular sectorials is intended by that expression.

DIDYMICTIS PROTENUS, Cope.

Limnocyon protenus, Cope, Report on Vertebrate Fossils of New Mexico, 1874, p. 15.

Not rare in the Eocene of New Mexico.

PACHYAENA, Cope.

Loc. cit., 1874, p. 13.

PACHYÆNA OSSIFRAGA, Cope, l. c., p. 13.

DIACODON, Cope.

Genus Novum.—Four true inferior molars, which are composed of two portions; the anterior much elevated, and supporting two opposite acute cusps; and a posterior much depressed, bounded by some low tubercles posteriorly. Superior premolar compressed, without basal tubercles.

This form is probably a true insectivore. It differs from many genera in the number of its true molars, adding one to the usual number. It differs from most of them also in the absence of the anterior cusp of the molars; among others, from *Herpetotherium*, Cope, of the Miocene, where the number of molars is the same. Of the numerous genera of

Insectivora reported from the Eocene of Wyoming but few have been described, and among the latter I find none without the anterior cusps.

DIACODON ALTICUSPIS, Cope, *sp. nov.*

Represented by a right mandibular ramus, which supports the last premolar and the true molars, with a superior premolar included in an attached portion of matrix.

The two elevated cusps of the anterior part of the crown are of equal height, and are separated by a pronounced notch. There is a narrow cingulum extending across their front. The heel supports two or three low cusps, of which the exterior sends an oblique ridge to the base of the inner of the anterior pair. No basal external nor internal cingulum; enamel smooth. The mandibular ramus is quite robust.

Measurements.

	M.
Length of five posterior molars	.0125
Length of three true molars	.0085
Length of penultimate molars	.0025
Width of penultimate molars	.0018
Depth of ramus at penultimate molar	.0045

The jaw is nearly twice the size of that of the common mole, (*Scalops aquaticus.*)

DIACODON CELATUS, Cope, *sp. nov.*

The smallest mammal of the Green River Eocene yet known is represented by left mandibular ramus, which I found exposed on the face of a precipice of sandstone, on a peak of the Bad Lands. It supports the last three molars, which have nearly the character of those of the species last described. The last molar is less than the others in the present animal, but equal to them in the *D. alticuspis.* The posterior part of the crown is deeply excavated, and supports on its outer angle a sharp cusp. The anterior cusps are twice as high. There is no external basal cingulum. The ramus is shallow, and the masseteric fossa is deeply excavated.

Measurements.

	M.
Length of ramus from antepenultimate molar to angle	.0100
Length of last three molars	.0048
Length of penultimate molar	.0015
Elevation of penultimate molar anteriorly	.0013
Depth of ramus at antepenultimate molar	.0018

This species resembled some of our very small sorices in dimensions.

GENERA INCERTÆ SEDIS.

Under this head are included, provisionally, a number of genera whose position cannot be determined by the structure of the molar teeth alone. Some of them are quadrumana, and others perissodactyla. Until their structure is sufficiently known, I distinguish them by peculiarities of dentition only, in the following table. The molars of the inferior series are all bunodont, but the upper series is only certainly known to be such in *Phenacordes.* In *Hyopsodus* and *Orotherium,* they are perissodactyle

in type, the external cusps being flattened, and the internal more or less connected with them by intermediate tubercles or ridges. I include in the table some perissodactyle genera.

A. The anterior inner tubercle of the inferior molars double.
  I. The three anterior cusps, embracing a triangular area.
    Last premolar with internal cusp, four premolars; last inferior molar with heel ..... *Pelycodus.*
    Last premolar like that anterior to it, (*i. e.*, without internal cusp;) three premolars.—(Leidy) ..... *Omomys.*
  II. Twin cusps closely united, posterior cusps present.
    Last premolar without internal cusp; premolars continuous ..... *Pantolestes.*
    Last premolar with internal cusp; sectorial.... *Antiacodon.*
    Last premolar similar to the first molar.—(Marsh) ..... *Orotherium.*

AA. The anterior inner tubercle of the true molars not divided.
  d. Last inferior molar without heel.
    Last premolar without inner tubercle..... *Apheliscus.*
  dd. Last inferior molar with a heel.
    Last inferior molar with a longitudinal series of tubercles..... *Opisthotomus.*
    Three premolars; no diastemata.—(Leidy).... *Microsyops.*
    Four premolars, the last with internal cusp; no diastemata ..... *Hyopsodus.*
    Four premolars, last with internal cusp and posterior tubercle; first premolar isolated.... *Orohippus.*

PELYCODUS, Cope.

Genus novum.—The principal characters of this genus, as above defined, are derived from a right mandibular ramus supporting five molar teeth, which was accompanied by numerous bones of the skeleton. Other specimens support the last molars. The proper nomenclature of the teeth is uncertain. If there are three molars and four premolars, then the canine alveolus is much smaller than that of the external incisor. Assuming these numbers as correct, the anterior premolar has left only its roots close to the canine alveolus. It is two-rooted. The incisor precedes the canine nearly in contact, and is stout. The second premolar is a flat cone, with anterior and posterior cutting-edges. The third premolar has two strong median cusps, the outer the larger, and a short broad heel. The last premolar resembles the first molar. The molars are peculiar in the width behind as compared with that of the front of the crown. Three approximated cusps stand on the latter, while a marginal ridge incloses a wide basin-like area behind. This ridge rises into a cusp on the external posterior border, and sends an oblique ridge toward the anterior cusps. The last molar differs from the others in the presence of a posterior heel, and resembles the one which immediately precedes it in its basin-like crown. The genus resembles *Omomys* (Leidy) in many respects, but is obviously distinct from it. It approaches also *Tomitherium*, Cope, but is quite distinct in the two-rooted premolars, the complex third premolar, the enlarged outer incisor, etc. With that genus, it is doubtless to be referred to the *Quadrumana.*

PELYCODUS JARROVII, Cope.

Prototomus jarrovii. Report on Vert. Fossils of New Mexico, 1874, p. 14.

The remains of this species indicate its size to have been about that of the raccoon, and that its jaws were robust. The second premolar is broad at the base and has a posterior cingulum. The third premolar has an anterior basal cusp, and a broad low heel supporting a small tubercle. Neither premolar possesses any lateral cingula. The three molars have a basal cingulum on the outer side only. In the fourth premolar the marginal posterior ridge is strong, except on the inner posterior angles, where it disappears. In the other molars it continues all around. The two inner interior cusps are connected with the corresponding external one by concave ridges. Symphysis of the rami not co-ossified.

Measurements.

	M.
Length bases of seven molars	.0335
Length bases of four premolars	.0160
Length base of fourth premolar	.0050
Width of crown of fourth premolar	.0040
Length of crown of last molar	.0060
Width of crown of last molar	.0050

The enamel of all the teeth is smooth.

Three individuals obtained.

PELYCODUS FRUGIVORUS, Cope, *sp. nov.*

This species is known from a portion of the mandibular ramus, which supports the last two molars. The size of the animal is about half that of the *Pelycodus jarrovii.* The last molar is oval and narrowed behind. The lateral margins are raised, inclosing a concavity. The border is thickened behind at the heel and supports an inner anterior tubercle which has a lesser one at its anterior base. There are two obtuse external tubercles. The penultimate molar is robust, and two inner and one outer anterior tubercles; the former connected with the latter by ridges. A stout posterior outer tubercle sends an oblique ridge to the anterior inner, while the tubercle at the posterior inner angle is insignificant; enamel smooth, the external bases of the last two molars furnished with a cingulum.

Measurements.

	M.
Length of penultimate molar	.0045
Width of the same	.0040
Length of last lower molar	.0060
Width of last lower molar	.0035
Depth of ramus at penultimate molar	.0090
Width of do. at same point	.0040

PELYCODUS ANGULATUS, Cope, *sp. nov.*

This species was probably less than one-fourth the size of the last described, and is represented in our collections by but few specimens. One of these is a portion of the mandibular ramus, with a single perfect molar; another individual is known from an isolated molar. The former displays the characters of the larger species, viz, a crown narrowed in front, where it supports three approximated cusps, and widened behind, where an elevated border embraces a basin-shaped concavity. In this species the anterior cusps are well defined and subequal in size, and the posterior angles of the posterior concavity each support a cusp. The

outer posterior cusp is connected by a strong oblique ridge with the posterior of the two anterior inner cusps. A well-marked cingulum surrounds the external basis of the crown, and extends round its front nearly to the anterior inner cusp. Enamel smooth.

Measurements.

	M.
Length of crown of molar	.0034
Width of crown of molar	.0027
Depth of ramus at the same	.0065
Thickness of do. at the same	.0030

PANTOLESTES, Cope.

Proceed. Amer. Philos. Soc. 1872, p. 467. (Separata, August 30.)

The type of this genus resemble in structural characters of the dentition of the lower jaw, the *Hyopsodus* and *Antiacodon*, already known in the collections of the different explorations of the Rocky Mountain lake basins. While it possesses the normal number of molar teeth belonging to these, it preserves a sectorial character of the premolars more posteriorly than in any of the allied genera. The typical specimen of the *P. chacensis* presents four premolar and three molar teeth, the fourth premolar alone remaining with the three true molars. The premolars are all two-rooted except perhaps the first. The fourth is a simple flattened triangular cusp, with a small tubercle at the base behind, wanting the inner cusp of other genera. The molars exhibit the usual four cusps, the external crescentoid, the inner discoid in section, excepting the inner anterior, which is duplicated by an anterior twin-cusp of smaller size being closely united with it. The last molar has a distinct fifth tubercle or heel. This genus is probably also quadrumanous.

PANTOLESTES CHACENSIS, Cope, *sp. nov.*

The mandibular ramus of this species is very slender in both vertical and transverse diameters. There is a minute tubercle at the anterior base of the fourth premolar. There is a very minute median tubercle on the posterior border of the first and second true molars, and no anterior ledge. The heel of the last molar is short, and the other tubercles protuberant. The enamel is smooth, and there is no basal cingulum on either side of the teeth preserved.

Measurements.

	M.
Length of bases of seven molars	.037
Length of bases of three true molars	.018
Length of bases of last premolar	.005
Width of bases of last premolar	.0025
Length of penultimate molar	.0055
Width of penultimate molar	.0040
Length of last molar	.0070
Width of last molar	.0040
Depth of ramus at fourth premolar	.0080

This species is considerably larger than the type of the genus, *P. longicaudus*, Cope. (See Annual Report U. S. Geol. Survey Terrs., 1872, p. 549.)

OPISTHOTOMUS, Cope, *genus novum.*

Represented by inferior molar teeth of two species. These do not display a bifid or double anterior interior cusp, and the crowns exhibit

two anterior cones, and an inner cone and outer crescent posteriorly. The posterior crescent is well defined and is continued on a narrow crest to the anterior inner tubercle. The posterior molar presents the peculiarity of a series of three cusps in one line, the median having another or lateral cusp near it.

This genus is also probably quadrumanous, but differs widely in the form of the last molar from *Tomitherium*, *Pelycodus*, *Pantolestes*, etc.

OPISTHOTOMUS ASTUTUS, Cope, *sp. nov.*

Established on two posterior lower molars which were found in immediate association, but not attached to the jaw. The penultimate molar has a convex cingulum in front connecting the two cusps, and a median posterior cusp of small size. The last molar has a wide ledge in front, and the anterior cusp is on its outer side.

It is separated by a valley from the middle cusp, which is the most elevated. Directly on its inner anterior aspect a stout cusp is attached, and connects by a low ridge with the anterior. The posterior cusp is elevated, conic, and median, and is connected with the central cusp except at its apex. There is no heel behind it, nor any cingulum on this or the anterior molar tooth. The enamel of both teeth is nearly smooth.

Measurements.

	M.
Length of crown of median lower molar	.0065
Width of crown of median lower molar	.0060
Length of crown of posterior lower molar	.0085
Width of crown of posterior lower molar in front	.0050
Length to middle cusp	.0045
Elevation of middle cusp	.0050

OPISTHOTOMUS FLAGRANS, Cope, *sp. nov.*

A larger species, belonging to this genus, is represented by a portion of the lower jaw, from which the molars are broken, excepting the last. The outline of the base of the crown of the latter is elongate subtriangular, the base of the triangle being anterior. The anterior fourth of the crown is a ledge with angulate border, and a tubercle at the outer anterior corner; the remainder of the crown consists of three elevated cusps, an external alternating with an internal and a median posterior. The inner and outer cusps are rather obtuse, and are separated by a deep notch; the posterior cusp is much lower, is obtuse, and has a still smaller tubercle at its inner basis. The surface of the heel is oblique, for the external anterior tubercle sends a ridge to the internal median cusp, so that the line of elevation of the crown is a zigzag of three limbs.

Measurements.

	M.
Length of crown	.012
Width of crown anteriorly	.006
Length between first and third cusps	.006
Depth of ramus	.002

APHELISCUS, Cope.

The present genus is nearly allied to *Pantolestes*, but differs in the absence of heel of the last inferior molar, and the simplicity of the inner anterior tubercle of all the molars. The characters of the inferior molars are as follows: Premolars four, molars three; the latter subequal in size. Premolars compressed; the fourth with a heel, but no internal

tubercle. Last two molars with four subequal angular cusps, connected round a central concavity by their adjacent angles. Symphysis mandibuli with persistent suture.

The affinities of this genus cannot now be ascertained, but the molar teeth are so much like those of the lumurine genus *Anaptomorphus*, Cope, from the Eocene of Wyoming, as to suggest relationship. The premolars are totally different.

APHELISCUS INSIDIOSUS, Cope.

Protutomus insidiosus, Cope. Report on the Vertebrate Fossils of New Mexico, 1874, p. 14.

ANTIACODON, Marsh.

Cope. U. S. Geol. Survey Terrs., Ann. Report 1872, p. 608.

Two species are provisionally referred to this genus on account of their resemblance to the known species *A. pygmæus*, Cope, and *A. furcatus*, Cope, but not definitely, because the premolar teeth are unknown in both cases. One of them is similar in size to the species mentioned, while the other is much larger than any of the allies, approaching the larger species of *Orohippus*.

ANTIACODON MENTALIS, Cope, *sp. nov.*

Established on a portion of a ramus mandibuli, on which the first and second true molars only remain. The fangs of the last premolar are stout, and evidently supported a robust crown. The cusps of the true molars are, as usual, crescentic in section on the outer side; the posterior inner conic, while the double anterior inner is rounded on the internal face, and not flattened, as in many species. The second true molar has a distinct posterior median tubercle; there are no basal cingula except a trace between the external cusps. This species resembles the *A. furcatus*, but differs materially from it as from *A. pygmæus* in the deeper and more robust mandibular bone.

Measurements.

	A. mentalis. M.	*A. pygmæus.* M.
Length first true molar	.0044	.0043
Width first true molar behind	.0033	.0031
Depth ramus at front of m. 3	.0085	.0075
Depth ramus at front of last premolar	.0078	.0055

ANTIACODON CRASSUS, Cope, *sp. nov.*

Represented by a portion of the right mandibular ramus which supports the first and second true molars. It is a peculiar species, known among its allies by the obtuseness of the cusps and ridges of the crown. The double cusp is thick, and the component apices little separated; the anterior only is connected with the external anterior tubercle. The posterior part of the crown is wider than the anterior, and is quite concave. The outer border supports a stout tubercle; the inner, a very small one behind, and there is a small ledge representing the posterior median. The oblique ridge from the posterior external cusp is low, and the anterior cusps rise abruptly. The enamel is smooth and the cingulum is represented by a trace between the bases of the external tubercles.

Measurements.

	M.
Length of second true molar	.0080
Width of ditto posteriorly	.0075
Elevation at same point	.0040
Transverse diameter of ramus	.0080

OROTHERIUM, Marsh.

Amer. Journ. Sci. and Arts, 1872. (Separata, p. 26.)

OROTHERIUM VINTANUM, Marsh, l. c.

Specimens, undistinguishable, from the description given as above cited, embrace dentition of both jaws. This has a near resemblance to that of *Orohippus*.

HYOPSODUS, Leidy.

Report U. S. Geol. Survey Terrs, I, p. 75.

HYOPSODUS PAULUS, Leidy, l. c.

Part of a single specimen is undistinguishable from this species. I may mention here that *Hyopsodus vicarius* is the proper name of a species described by myself as *Microsyops vicarius*, and later by Dr. Leidy as *Hyopsodus minusculus*, *l. c.*, p. 81.

HYOPSODUS MITICULUS, Cope.

Esthonyx miticulus, Cope. Report on Vertebrate Fossils of New Mexico, 1874, p. 8.

Parts of several specimens of this species show that the molars are similar in size to the *H. paulus*, but that it has a much smaller last inferior molar, which has such a low heel as to resemble the corresponding tooth of the species of *Esthonyx*. The last two premolars are more robust than in *H. paulus* and possess rudimental anterior basal tubercles of which a trace only exists in the *H. paulus*. The mandibular ramus is considerably shallower, and the species was probably more diminutive.

PHENACODUS, Cope.

Paleontological Bulletin, No. 17, p. 3, 1873; Report on Vertebrate Fossils of New Mexico, 1874, p. 10.

The dentition of the anterior parts of the jaws of the species referred by me to *Phenacodus* is unknown, but the premolar and molar teeth are similar in character to those of the genus Palæochœrus of the French Eocene. The well-marked external crescents are, however, characteristic, and the details of structure of the molars so closely resemble those of *Opisthotomus* and *Tomitherium* that I entertain a suspicion that this genus is quadrumanous. If so, it includes the largest of the primitive Eocene monkeys, the *P. primævus* equaling the orang in the size of its jaws. There are abundant specific peculiarities distinguishing the French and American species, the upper molars of the latter resembling in a greater degree the genus *Chœropotamus*.

PHENACODUS PRIMÆVUS, Cope, l. c., (p. 10.)

PHENACOHDUS OMNIVORUS, Cope, l. c., (p. 11.)

PHENACODUS SULCATUS, Cope, l. c., (p. 11.)

PERISSODACTYLA.

MENISCOTHERIUM, Cope.

Report on the Vertebrate Fossils of New Mexico, 1874, p. 8.

MENISCOTHERIUM CHAMENSE, Cope, l. c.

HYRACHYUS, Leidy.

HYRACHYUS SINGULARIS, Cope, *sp. nov.*

Represented by the maxillary bones and teeth of two individuals, one of which includes those of both sides of the cranium, with the molars and last two premolars. In size this species is less than the *H. nanus*, the smallest of the genus. The third and fouth premolars have two transverse crests each, of which the anterior forms the border of the crown and the posterior marks its middle. The supernumerary cusp at the external anterior angle of the crown is well marked in both premolars and molars. The posterior transverse crest of the molars is less elevated than the anterior, as it approaches the longitudinal cusps. The latter are well joined together, and are strengthened by an external vertical rib, which extends to the apex. There is a weak cingulum on the anterior base of the crown, which passes round the inner base of the anterior internal cone, but is wanting at the base of the posterior, and very weak on the posterior and exterior bases of the crown. Enamel smooth in young as in old teeth.

Measurements.

	M.
Length of five posterior molars	.0330
Length of third premolar	.0054
Width of third premolar	.0056
Length of second true molar	.0080
Width of second true molar	.0100
Length of three true molars	.0220

This species is, as observed in my preliminary report, the only representative of the numerous *Hyrachyi* of the beds of the Bridger formation. In my exploration of this horizon in Wyoming, I obtained remains of six species, in great abundance, so that the existence of a single small species in few individuals constitutes a marked feature of the New Mexican Eocene fauna. The absence of *Palæosyops*, a genus perhaps still more abundant than *Hyrachyus* in Wyoming, adds to the evidence in favor of the belief that the difference between the faunæ of the respective localities is due to something more than the peculiarity of geographical distribution, but points to diversity of horizon or time, as is indeed sufficiently indicated by the study of the stratigraphy in Wyoming. There the Green River beds contain the same fauna as those under consideration, and underlie the Bridger formation.

OROHIPPUS, Marsh.

Amer. Journal Science and Arts, 1872.

This genus has numerous near allies in the Eocenes of France and the United States, from which it has not yet been distinguished. I have therefore instituted some comparisons for the purpose of ascertain-

ing its characteristic peculiarities. The mandibular teeth are identical in structure with those of *Lophiotherium*, Gervais, with the exception that, in that genus, the first premolar is part of a continuous series, while in *Orohippus* it is separated by a diastema from the second premolar. In comparison with *Orotherium* I find that the last premolar is different in structure from the first true molar, while they are alike in the last-named genus. The anterior inner tubercle of the molars is simple in *Orohippus*, double in *Orotherium*. The superior molars described by Leidy under the name of *Hipposyus* strongly resemble those of *Orohippus*, but belong, as I now believe, to another genus. The inner cones are always distinct in *Orohippus*, but confluent in *Hipposyus;* the latter also lacks the posterior median tubercle.

After those of the genus *Bathmodon*, individuals and species of this genus are most numerous in the beds of the Green River Eocene of New Mexico. I therefore succeeded in obtaining a full representation of their structure, including dentition, etc. The latter indicates seven species, which differ very materially in size and proportions, but agree closely in general characters. They may be distinguished as follows. first by their mandibular bones and teeth, and second by their maxillary teeth.

Mandibles.

Largest, last molar m. .014 in length; ramus .020 in depth at last premolar; molars with a produced ledge in front..... *tapirinus*
Large, last molar, .012; ramus, .020; ledges not prominent. *vasacciensis*
Smaller, last molar, .010; jaw, .020; ledges not prominent..... *index*
Small, last molar, .010; jaw, .014..... *major*
Small, last molar, .010; jaw, .0125..... *angustidens*
Smallest, last molar, .0085; jaw, .0135..... *procyoninus*

Superior molars.

Neither external nor internal cingulum of the crown..... *? species.*
External but no internal cingulum..... *procyoninus.*
External and internal cingula present, but the internal weak... *major et vasacciensis.*
External and internal cingula very strong, enamel rough.
Larger, outer cusps flattened..... *agilis*
Least species, outer cusps conic and well separated... *cuspidatus*

It is evident from the above tables that I am not certainly acquainted with the superior molars of *O. tapirinus*, *O. index*, and *O. angustidens*, nor with the mandibular teeth of *O. cuspidatus*. I have, however, numerous teeth which are not associated with those of the opposing series, and which doubtless cover nearly the entire ground of comparisons.

OROHIPPUS TAPIRINUS, Cope, *sp. nov.*

Represented by mandibles with teeth of five individuals, which exceed in size those of the species heretofore known, being larger than the smaller *Hyrachyi*. The opposite cusps of the molars are not separated by so deep a notch as in some of the other species, while the oblique ridges extending forward from the outer tubercles are well developed. The same is true of the ridge which extends from the prominent heel of the last molar. The anterior ledge is horizontal, and is bounded by a ridge which descends from the anterior external tubercle

and becomes transverse. It is less marked in all the other species. Enamel nearly smooth. The external cingulum is very faint on the last molar, but becomes more distinct on the anterior; none on the inner side.

Measurements.

	M.
Length of bases of last two molars, (No. 1)	.025
Length of base of penultimate, (No. 1)	.011
Width of base of penultimate	.008
Depth of jaw at penultimate	.022
Depth of jaw at last premolar, (No. 2)	.020

OROHIPPUS VASACCIENSIS, Cope.

Lophiotherium vasacciense, Cope. Proceedings American Philosophical Society, 1872, 474.

Ten individuals from our collections are referred to this species, some of which embrace portions of both jaws.

Selecting as type a left mandibular ramus, which supports the five posterior molars, (the last broken,) it may be observed that the third premolar has a strong median cusp, with a small accessory one on its inner side, and a similar one immediately in front of it. The posterior base of the crown is expanded, and supports a single obtuse cutting edge of little elevation. The only cingulum of the tooth bounds the outer and inner sides of this part of the crown. The fourth premolar is similar, except that the two median cusps are subequal, the anterior one much reduced, and the general form stouter. It differs from the first true molar, in the presence of a single posterior low cusp, which connects with the anterior by an oblique ridge. The opposite cusps of the true molars are well separated by fissures, and the anterior ledges are but slightly developed. External cingula well marked; enamel wrinkled where not worn.

Measurements.

	M.
Length of five posterior molars	.044
Length of last two premolars	.013
Length of last two molars	.022
Length of penultimate molar	.0085
Width of penultimate molar	.0070
Depth of ramus at last premolar	.0200
Depth of ramus at last molar	.0220

In a specimen with the last two superior molars the rather coarse wrinkling of the enamel is visible on the external face, although the teeth are well worn. The external tubercles are compressed cones connected by a ridge at the base. The accessory anterior external cusp is moderately developed. The cingula are distinct, but not prominent on both inner and outer side.

Measurements.

	M.
Length of last two molars	.0160
Length of penultimate molar	.0085
Width of penultimate molar	.0100

This species resembles the *O. tapirinus* in the robustness of the jaws, but the teeth are materially smaller.

OROHIPPUS MAJOR, Marsh.

Orohippus major, Marsh. American Journal of Science and Arts, 1874, p. 248.

Between a dozen and twenty examples of this species were obtained.

OROHIPPUS ANGUSTIDENS, Cope, *sp. nov.*

A number of jaws were obtained which resemble in general proportions those of the *O. procyoninus*, but differ in the greater length of the last inferior molar. This tooth is as large as the corresponding one in *O. major*, but the other teeth and the ramus of the jaw belong evidently to a smaller species, and one near to the least forms of the genus.

Selecting for description a portion of a ramus which supports the last three molars, we observe the close resemblance between the latter and those of other species. The anterior ledge and posterior median tubercle are little developed; the oblique ridges are well developed, and the heel of the last molar elevated. The molars have a strong cingulum on the outer side, and the enamel is slightly rugose. The ramus is slender.

Measurements.

	M.
Length of bases of three true molars	.024
Length of penultimate molar	.007
Width of penultimate molar	.005
Depth of ramus at last molar	.012

In another specimen of about the same size the bases of three premolars are preserved, and measure .016 in length.

OROHIPPUS PROCYONINUS, Cope.

Helotherium procyoninum, Cope. Proceedings American Philosophical Society, 1872, 466, (August 3.)
Orohippus pumilus, Marsh. American Journal of Science and Arts, 1872, (Aug. 7.)

Several specimens, with much of the dentition, accompany those of the other species.

OROHIPPUS AGILIS, Marsh.

Orohippus agilis, American Journal of Science and Arts, 1873, p. 407.

Some superior molars agree in size and other characters with those noticed by Professor Marsh, under the above name, so far as I can ascertain.

OROHIPPUS CUSPIDATUS, Cope, *sp. nov.*

This is the least species of the genus known to me, and is known especially from a portion of the left maxillary bone which supports the first and second true molars. Other separated molars of the same character are not uncommon, and probably belong to the same species.

The molars are characterized by their regularly quadrate form, the anterior external angle not being produced as in most of the species. The first is also as long as broad, and is not narrowed as in others. Both molars are entirely surrounded by a strong cingulum, which is not interrupted on the inner side of the crown, and rises into a low accessory cusp at the anterior external angle. The turbercles of the tooth are conical, the outer circular in section and slightly connected by a ridge at the base. The median tubercles are well separated from the interior, and are conical, thus differing from other species. The enamel is coarsely rugose. The malar ridge overhangs the maxillary in a marked manner. The animal described was adult, but the cusps are not much worn.

Measurements.

	M.
Length of first and second true molars	.0130
Length of first true molar	.0060
Width of first true molar	.0065
Length of second true molar	.0060
Width of second true molar	.0075

In these measurements the disparity in width of the crowns of the first and second true molars is a noticeable feature.

RODENTIA.

PARAMYS, Leidy.

PARAMYS DELICATIOR, Leidy.
Report U. S. Geol. Surv. Terrs., vol. I, p. 110, Pl. VI, figs. 26-7.

PARAMYS DELICATISSIMUS, Leidy, l. c., p. 111, Pl. VI, figs. 28-9.

TOXODONTIA.

In an essay published by the United States Geological Survey of the Terrs., dated February, 1874, I discussed the origin of the great population of animal forms which previous explorations had disclosed in the lake deposits of Wyoming. The conclusion was that they had been derived by migration from the South, as geological investigations pointed to the earlier elevation of the land in that direction. During the summer of 1874, as paleontologist of the United States Geographical Explorations and Surveys, under Lieutenant Wheeler, I sought for and discovered a great mass of lacustrine deposits of somewhat earlier age than those of the Bridger epoch, Wyoming, containing the remains of a great number of animal species and genera, which so nearly resemble those of Wyoming as to leave no doubt that the latter were derived by descent and migration from New Mexico and the South.

In a memoir read before the Academy of Natural Sciences of Philadelphia, at or near the same time, I stated that the primitive type of the mammals with convoluted brains "must have been bunodonts with pentadactyle plantigrade feet;" that is, must have had tubercle-bearing grinders, and have had five-toed feet, whose entire soles were applied to the ground in walking, and not merely the toes, as in most living higher mammals. It was also stated that variations in the number and relations of the front teeth might be expected in such a hypothetical group of animals, which was named *Bunotheriidæ*. During the explorations in New Mexico the following season a remarkable genus was discovered, and afterward named *Calamodon*. Its jaws and teeth were discovered, and the latter had tubercle-bearing crowns. Subsequently Professor Marsh described more perfect specimens of related animals, which show that they are also five-toed, (pentadactyle,) and walked on the soles, (plantigrade.) With other similar genera he forms an order *Tillodontia*, and says that they are related to hoofed animals (*Ungulata*) and *Carnivora*, and that their brains were somewhat convoluted. This is a full confirmation of the anticipation above mentioned.

It was also stated that the primitive Ungulate "cannot be far removed from the primitive Carnivore and the primitive quadrumane." The dentition of the genus *Esthonyx* bears a strong resemblance to that of certain quadrumana, especially of the genus *Pelycodus*, while the resemblance of the molars to those of *Ectoganus* is not less marked.

In *Calamodon arcamœnus*, Cope, the claws are compressed, but less so than in recent *Carnivora*, and resemble more closely those of the *Edentata*. They have a double trochlear articulation with the phalanges, and are without basal sheath. The extremity is somewhat fissured.

ESTHONYX, Cope.

Report on the Vertebrate Fossils of New Mexico, 1874, p. 6.

ESTHONYX BISULCATUS, Cope.
Report, l. c., p. 6. *E. acer*, Cope, l. c., p. 7.

ESTHONYX BURMEISTERII, Cope, l. c., p. 7.

ECTOGANUS, Cope.

Report, loc. cit., p. 4.

ECTOGANUS GLIRIFORMIS, Cope, l. c., p. 4.

CALAMODON, Cope.

Report, loc. cit., p. 5.

CALAMODON SIMPLEX, Cope, l. c.

CALAMODON ARCAMŒNUS, Cope, l. c., p. 6.

CALAMODON NOVOMEHICANUS, Cope, l. c., p. 6.

AMBLYPODA.

BATHMODON, Cope.

Proceedings Amer. Philos. Society, Jan., 1872.

STRUCTURE OF THE FEET.

Fore-foot.

A fore-foot of a species of this genus possesses five metacarpal bones, although I have as yet obtained the exact articulations of but four. Of these, the inner is the smallest, the second and third subequal, the fourth as stout as the third, but a very little shorter, and the fifth a little shorter than the fourth, but as stout. These bones, as well as the phalanges, are very short, shorter even than those of the *Elephantidæ*. The carpus of this specimen retains in place all of its elements, except the trapezium. The unciform is a transverse wedge-shaped bone, with the obtuse apex postero-exterior; the superior face gently concave in transverse section, the inferior convex. The posterior side is beveled slightly up toward its center. The magnum has considerable vertical and antero-posterior extent, but is narrow in the transverse direction. The outline seen from the side is subtriangular; the superior side is a single antero-posterior facet; the inferior face is concave antero-posteriorly for the metacarpal articulation, and on the inner side is a narrow facet for the second metacarpal. The unciform is concave in the transverse direction above, and its inferior surface presents three facets, of which the outer and middle are large. The inner facet presents the same obliquity as the external. This carpal presents an upturned inner superior border, which supports a facet contact with the lunar. Both the cuneiform and unciform have considerable transverse extent. The lunar has much less transverse extent. It displays a single convex facet above, and three longitudinal concave ones below. One of the latter is nearly external, joining the

scaphoid; a concave facet on the inner side connects with the cuneiform. The two inferior facets then are applied to the unciform and magnum. The scaphoid has a hook-like posterior portion; superiorly it supports two approximated facets; it is rather smaller than the lunar. The trapezium is larger than the trapezoides.

The transverse extent of the cuneiform indicates a wide articulation of the ulna with the carpus.

The indications of affinity derivable from the fore-foot are the following:

There are three lines of relation which present modifications of the carpal articulations, in passing from generalized to specialized forms of *mammalia*. The first is the cubito-carpal articulation; the second, the intercarpal; the third, the carpo-metacarpal. In the primary relation of the cubito-carpal articulation the ulna and radius take equal shares in it, or the ulna has the greater part. In the progress of specialization, whether it be as in the *Quadumana* to secure the rotary movement of the hand, or as in the *Artiodactyla* and higher *Perissodactyla*, to acquire firmness and solidity in connection with high speed, the successive modification consists in the reduction of the ulnar articulation, and increase of the radial. The same successive modification is seen in the *Carnivora*. The *Elephantidæ* exhibit the unmodified relation of the bones of the cubitus to the fore-foot, in the great extent of the ulno-carpal articulation. *Bathmodon* resembles it in this respect. A considerable reduction of the ulnar articulation is seen in the representatives of those different orders which approach nearest to the Proboscidia, the degree of reduction being somewhat similar in all, viz: *Hyrax* of the *Hyracoidea; Rhinocerus* of the *Perissodactyla* and *Hippopotamus* of the *Artiodactyla*. The reduction continues from these points of beginning until it is reduced to a minimum in the highest representatives of the last two orders, *Equus* and *Bos*.

In the composition of the first series of carpal bones the *Carnivora*, some *Rodentia*, (*Hystrix*,) and some *Marsupialia* (*Macropus* and *Hypsiprymnus*) exhibit a coössification of the lunar and scaphoid bones; in *Bathmodon*, as in most other *Mammalia*, these elements are distinct.

In the intercarpal articulation we find in the simpler forms that the scaphoid bone joins two of the second row, trapezium and trapezoides; the lunar joins the magnum only; and the cuneiform the unciform on its distal face. This is the case with many rodents, monkeys, and with the *elephantidæ*. In passing from this starting-point, we notice two lines of modification. The most important is seen in the outer side of the foot, where the unciform is extended inward so as to have a facet of articulation with the lunar; the other change is on the inner side, where the trapezium and the corresponding inner digit disappear. The first-named modification does not appear in *Hyrax*, but is well marked in *Bathmodon*, and is about equally developed in *Typotherium*, Gerv., (fide Burmeister.) It is still more marked in *carnivora* and in *Rhinocerus* and *Hippopotamus*, and in the higher genera of the two orders represented by the last two named, the unciform facet occupies half or more of the distal end of the os lunare. The reduction of the trapezium and its loss follow the same series, while in the higher *artiodactyla* the trapezoides also disappear by coössification with the magnum. As there are five metacarpals in *Bathmodon* the trapezium and trapezoides are distinct.

In the carpometacarpal articulation, the least modified types exhibit one metacarpal to each of the three inner carpals and two to the unciform. This relation is found in *proboscidia*, many rodents, (*hystricidæ*,) *carnivora*,(*hyaena*, *canis*,) *quadrumana*, *edentata*,(*dasypus*,) and *marsupialia*,

(*macropus.*) But in some of the *carnivora*, e. g., *felis* and *ursus*, the middle metacarpal extends to the side of the unciform, causing the presence of a third distal facet of that bone, which is in these cases lateral. In the orders *perissodactyla* and *artiodactyla*, both types of articulation occur, as has been pointed out by Kowalevsky. In these orders those genera without the third metacarpal facet of the unciform are principally extinct, while the living genera nearly all display the lateral facet for the third as well as the distal ones for the outer metacarpals. When, as in the higher artiodactyla, the exterior digit is wanting, there remains but one distal facet of the unciform.

In *Synoplotherium* and the Toxodont genus *Typotherium* the facet of the unciform for the third metacarpal is lateral. In *Bathmodon* it is not more lateral than the external facet of the unciform. In *Rhinocerus*, *Hyrachyus*, *Palæotherium*, *Hyrax*, *Tamandua*, &c., it is oblique and subinferior.

From the preceding it appears that *Bathmodon* resembles the *Elephantidæ* in the number of the digits of the fore-foot, in the short, wide form of the same, and in the composition of the cubito-carpal articulation. In the intercarpal articulation it resembles the Toxodont *Typotherium* and the Carnivora; in a lesser degree the lower *Perissodactyla*. In the carpo-metacarpal articulation the resemblance is stronger to the *Perissodactyla* than to any other order.

Posterior foot.

The least specialized type of mammalian hind foot presents the following relation between the bones of the tarsus; the navicular bone supports three cuneiforms; the cuboid is in contact with the calcaneum only, and supports on its distal facets two metatarsals; each of the cuneiforms supporting a metatarsal. The total number of the latter is five. This arrangement prevails in the *Edentata*, *Quadrumana*, and *Carnivora*, the inner cuneiform being often reduced in the latter and the corresponding digit wanting. In the more specialized forms of the same order the external digit is thrust outward from the distal face of the cuboid by the metatarsal bone of the penultimate digit.

A striking modification of this type is seen in the *Elephantidæ*, where the navicular bone is extended outward so as to separate the cuboid from contact with the astragalus.

In the *Hystricidæ* the arrangement only differs from that of the unspecialized foot, in the position of the inner cuneiform, which is removed backward on the inner side of the tarsus, so as to be in contact with the astragalus.

In *Ungulata*, with the exception of *Elephantidæ*, the penultimate toe excludes the outer from the distal articulation of the cuboid. This toe is then loosely attached to the outer side of the cuboid, or in the great majority of cases is altogether wanting. At the same time the cuboid is widened inward so as to have some contact with the astragalus. The wide cuboid exists in the *Proboscidia*, but is excluded from contact with the astragalus by the intervention of the wide navicular; but in the *Perissodactyla* and *Artiodactyla* the navicular is narrower, being confined to a greater or less inner portion of the distal end of the astragalus. In most *Perissodactyla* the resulting contact of the cuboid with the astragalus is slight, but in *Artiodactyla* it is very extensive, in the specialized forms involving half the extremity of the astragalus. In both of these orders the loss of the inner toe is common, and in many of the latter the inner cuneiform is also wanting. As is well known, the external digit is wanting from the hind foot of all existing *Perisso-*

dactyla, while it is present in many *Artiodactyla*, while the inner is alike wanting in the living members of both orders. In the *Artiodactyla* the second and fifth diminish *pari passu* to extinction in the higher ruminants, leaving the third and fourth; while in the *Perissodactyla* the second and fourth present a coincident reduction of size to the condition seen in *Equus*, where the third alone remains.

In the genus *Bathmodon* we observe a generalized type of foot, with two slight modifications. As already described, the foot is short and plantigrade, and furnished with five digits. The calcaneum is short and flat, and its heel is incurved; the astragalus is flat, broader than long, and like the calcaneum furnished with a facet for the fibula. The navicular bone is not only thin, but shortened in the transverse direction. It supports entirely only two cuneiforms, the inner and median; the outer presents a narrow facet to it, but rests principally on the astragalus. The facet of the latter, to which it is applied, is well distinguished by an angle from that of the navicular, and is the one formerly supposed to be in relation with the cuboid. The cuboid is in contact with the entire distal facet of the calcaneum, and extends a little further inward so as to have a slight contact with the astragalus also, as well as with the ectocuneiform. Each cuneiform supports a well-developed digit; and the cuboid supports two, one on each facet of its distal extremity.

In the characters of the calcaneum and astragalus, as in the articulation of the two outer digits to the distal face of the cuboid, this genus differs from all known *Ungulata* excepting the *Elephantidæ*. In the withdrawal of the navicular from between the overlapping ends of the cuboid and astragulus, it differs from *Elephantidæ* and resembles *Perissodactyla*. In the three well-developed cuneiforms the resemblance is again to the *Elephantidæ*, but in the further abbreviation of the navicular and articulation of the ectocuneiform with a facet of the astragalus. *Bathmodon* differs alike from *Elephantidæ* and all other *Ungulata*.

SUMMARY.

The structure of the feet of this genus indicate that it cannot be received into any of the orders of *Mammalia* without modification of their definitions. The greater number of the characters are those of *Proboscidia*, while some in both fore and hind feet are those of *Perissodactyla*, and others of the hind limb are peculiar. The general structure of the forefoot coincides nearly with that of the genus *Typotherium** of the order *Toxodontia*, with the exception of the limited ulno-carpal articulation, which appears from a figure of Professor Burmeister's to be small, and thus totally distinct from that characteristic of *Bathmodon*. In the hinder foot there are also both resemblances and differences. Thus the incurvature of the calcaneum behind; its inward extension to support the astragalus, and the large calcaneo-fibular facet are in near relation to corresponding parts of *Toxodon*. But the latter genus is said to exhibit a single distal facet of the astragalus, that for the navicular, instead of two or three.

Thus the claims of *Bathmodon* to enter the *Proboscidia* on the one hand and the *Toxodontia* on the other are about equal, and it cannot be placed with either without violating their definitive features. It becomes, then, a question whether all three groups may not properly be combined into a single one. But this introduces another difficulty, namely, the

*I am indebted to Professor Burmeister for information respecting the osteology of this genus.

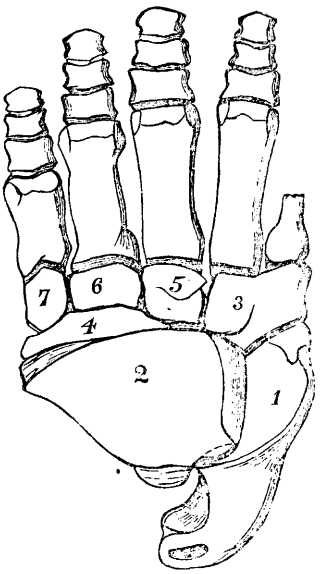
impossibility of discrimination of the division thus constituted from the *Perissodactyla*. The characters distinctive of each of the three groups in question are also those that separate them from the *Perissodactyla*. Hence none can be ignored without the union of the four divisions into one. There is then but one taxonomic solution to the difficulty, and I therefore propose to regard *Bathmodon* as the type of a distinct order of *Mammalia*, which will also include the genera *Loxolophodon* and *Uintatherium* in a distinct subdivision. The definition is as follows:

Order AMBLYPODA.

Char.—Fore limb.—Ulno-carpal articulation as large as or exceeding radio-carpal; antrorse. Lunar distinct, articulating with unciform; digits five, very short, with short wide hoofs; foot plantigrade.

Hind limb.—Foot plantigrade, very short; calcaneum and astragalus transverse, flat; cuboid bone uniting with both calcaneum and astragalus; digits four or five, short, with short wide hoofs.

Hind foot of Bathmodon.



1. Calcaneum; 2. Astragalus; 3. Cuboid; 4. Navicular; 5. Ectocuneiform; 6. Mesocuneiform; 7. Entocuneiform.

Suborder PANTODONTA. A rudimental third trochanter of the femur; calcaneum with fibular facet; superior incisor teeth present. Genera *Bathmodon*, *Metalophodon* and probably *Coryphodon* of Owen.

Suborder DINOCERATA; no third trochanter; no fibular facet of the calcaneum; no superior incisor teeth. Genera *Uintatherium* and *Loxolophodon*.

The order *Amblypoda* is evidently more generalized in its foot structure than the *Artiodactyla*, *Perissodactyla* and *Carnivora*, but not more so than the *Proboscidia*, from which it differs in the reduction of the outer portion of the navicular and the mutual articulation of the lunar

and cuneiform bones. It resembles armadillos and *Glyptodons* in the composition of the carpus, but not in the tarsus.

More or less perfect specimens of one hundred and fifty individuals of *Bathmodon* were obtained by the expedition. These I refer to seven species in which the dentition can be determined. They are distinguished as follows:

I. The anterior outer cone of the superior molars larger, the posterior more crest-like, making a strong angle with the anterior;

Superior canine compressed ..... *B. molestus.*

II. Anterior cone smaller, posterior cresent wide; both in one line on M. 3.

a. Inferior molars with wide heel.

Canine compressed, premaxillary bones elongate ..... *B. lomas.*

Canine triangular, premaxillary bone short ..... *B. simus.*

aa. Inferior molars with very narrow or no heel.

Large; premolars large, superior fourth .035 wide; lower molars longer than wide ..... *B. radians.*

Medium; fourth superior premolar .025 wide; lower molars elongate without posterior cingulum ..... *B. elephantopus.*

Medium; inferior molars nearly as wide as long; premaxillary bone short ..... *B. latidens.*

III. Last lower molar with a conic cusp on the inner side.

Last lower molar with narrow heel ..... *B. cuspidatus.*

BATHMODON ELEPHANTOPUS, Cope.

Report on Vertebrate Fossils of New Mexico, 1874, p. 10.

BATHMODON LOMAS, Cope, loc. cit., p. 9.

BATHMODON SIMUS, Cope, loc. cit., p. 8.

BATHMODON MOLESTUS, Cope, loc. cit., p. 9.

BATHMODON LATIDENS, Cope, *sp. nov.*

Represented by both mandibular rami with dentition nearly complete, by the left premaxillary bone with its teeth, and by a right superior canine. These portions belong to a species of about the size of the *B. elephantopus*, but one of a shorter and more robust form of skull. It differs in the same way from *B. radians*, besides being of distinctly smaller size.

The rami are stout, especially below the last molars, and not shallow anteriorly. Posteriorly, below the last molar the inferior border retreats upward, so that the angle of the jaw is opposite to the superior fourth of the vertical diameter of the ramus at the middle. The inferior border of the angle is slightly deflected. The condyle has great transverse extent, and the coronoid process is recurved and broad in front.

The canines are directed at an angle of 45° upward, and 90° outward, the apices turned backward; the crown is subtriangular, and has a slightly alate anterior angle. External face convex, and without angle. Each is in contact with the external incisor, but is separated from the first molar by a diastema. There are five premolars on each side in this specimen, of which the second is probably intercalated abnormally, as it is smaller than the others. The crowns of the premolars are elevated, and their posterior crests short. The true molars are characterized by their short anteroposterior diameter as compared with their transverse. The anterior descending crest is but little marked, and its termination at the inner extremity is not prominent as in other species. The anterior transverse crest is distinctly higher than the posterior, and its posterior face is scarcely marked by the connecting ridge. The latter is

well marked on the front of the posterior crest, while a very narrow ledge represents the wide cingulum of such species as the *B. lomas.* Enamel generally rather finely rugose. The premaxillary bone is short and elevated, and the teeth are large and with a rudimental cingulum on the outer face. Superior canine with triangular crown.

Measurements.

	M.
Total length of jaw from angle to incisor alveolar border	.306
Depth of ramus at third premolar	.063
Depth of ramus just behind last molar	.035
Diameter of ramus at last molar	.035
Elevation of coronoid process	.160
Width of condyle	.080
Length of dental series	.156
Length of true molars	.080
Length of penultimate molar	.030
Width of penultimate molar	.027
Length of last molar	.0335
Width of last molar	.0260
Diameter of canines at base	.032
Width between bases of canines	.053
Length of crown of canines	.063

The skull of this animal was about the size of that of a bull.

BATHMODON CUSPIDATUS, Cope, *sp. nov.*

Represented by a portion of a mandibular ramus, which supports the last molar. The posterior transverse crest of this tooth is low, and sends a well-marked oblique ridge to the anterior crest. A cingulum projects from the posterior base of the crown, which is not very prominent, and disappears at the base of the inner end of the transverse crest. Just external to and in front of this extremity a prominent conic tubercle is directed upward and inward. This process is not seen in any other of the numerous jaws and teeth in my possession. Enamel slightly rugose.

Measurements.

	M.
Width of molar behind	.023
Elevation of conic cusp	.006

This species is probably about the size of the *B. lomas.*

RECAPITULATION.

The preceding catalogue includes the following representation of the Mammalian orders.

Carnivora	11
Insectivora*	2
Incertæ Sedis	14
Perissodactyla	9
Rodentia	2
? Toxodontia	6
Amblypoda	6
	50

* A genius of this order from the Miocene of Colorado has been termed by me *Isacis,* (Ann. Rept. U. S. Geol. Surv. Terr., 1873, p. 470.) As this name is preoccupied it may be replaced by *Mesodectes.*

REPTILIA.

CROCODILIA.

DIPLOCYNODUS, Pom.

DIPLOCYNODUS SPHENOPS, Cope, *sp. nov.*

Indicated by a fragmentary skeleton, in which occur numerous portions of the cranium and vertebræ; a second specimen includes corresponding parts, with more numerous vertebræ. In both the distal part of the mandibular ramus is preserved, and shows two enlarged teeth inserted close together, the posterior opposite to the posterior border of the symphysis. In front of these there is an edentulous space; behind them is a series of quite small teeth. The dentary bone is quite narrow at this point, indicating an acuminate symphysis and muzzle.

The type specimen includes the frontal and parietal bones; the former, united, are not expanded, but are about as wide as in *Crocodilus elliottii*, Leidy. The interparietal face is plane and narrow; its lateral borders sharply defined, including two rows of deep pits. The front is rough, with deep pits, which have a transverse direction opposite the postfrontal bones; anteriorly they are smaller and less pronounced. The lateral olfactory ridges of the inferior surface are not strongly defined.

The sculpture of the lower jaw consists of rather distant impressed punctiform pits in shallow depressions. A larger mandibular tooth is smooth and not sulcate at the base. A cervical vertebra has a short, obtuse, simple hypapophysis, not connected with the parapophyses. Its cup is a little deeper than wide; surface near articulations, smooth; a dorsal with hypapophysis and lateral capitulum, has a depressed centrum; fragments of the jaws are coarsely-pitted rugose.

The second specimen is of a larger crocodile, and presents similar characters. The third and fourth cervicals show the hypapophyses and parapophyses fused together into a crescentoid mass below the articular cup, as in *D. subulatus*, Cope. The dermal bones are large, not keeled, and coarsely pitted.

Measurements of No. 1.

	M.
Width of parietal bone	.013
Width of frontal at orbits	.043
Depth of ramus at two canines	.037
Depth of ramus just behind two canines	.030
Width of ramus at symphysis posteriorly	.020
Length of a cervical vertebra	.043
Diameter of cup { vertical	.022
Diameter of cup { transverse	.021

The size of the *Alligator mississippiensis.*

CROCODILUS, Linn.

Remains of species of this genus are exceedingly abundant, chiefly in the upper beds of the formation, associated with gar fishes. The lower beds contain the greater number of mammalian remains, with a smaller percentage of crocodiles. The latter do not include any gavials, and resemble in some degree those of the Bridger group, some of the species being probably identical.

The New Mexican species are naturally divided into those with flat

frontal bone, with the inferior ridges little developed, and those in which the interorbital region is bounded below by strong orbital or olfactory crests. In the latter the superior plate is narrower and thicker.

CROCODILUS GRYPUS, Cope, *sp. nov.*

Established on remains of two individuals which are in a fragmentary state, including portions from all parts of the skeleton. The teeth are of unequal sizes, and are round in section in the anterior half of the jaws, are conic, and compressed at apex, curved, and with delicate opposed cutting edges which extend to the base of the crown. The middle of the length of the crown is delicately rugose striate. A large premaxillary tooth occupies a position a little anterior to the lateral notch. In the lower jaw a very large tooth occupies a position opposite the posterior extremity of the symphysis, the latter marking the middle of the alveolus. Three teeth of much smaller size follow posteriorly in close succession, and are followed by a fossa to receive the apex of a superior tooth. The ramus is wide at the symphysis. The extremity of the lower jaw supports a large tooth close to the symphysis, which is followed by one of half its diameter. A part of the posterior outer side of the ramus is deeply pitted.

In the second specimen a part of the frontal bone shows that part of the cranium to be deeply and rather irregularly pitted. The orbital border is wide and shallow, and the lateral olfactory ridges not prominent. There are three larger teeth on the median posterior part of the mandibular ramus, which is thin, rather slender, and but little rugose. The premaxillary bone and tooth are as in the first specimen. Another series of fragments, perhaps belonging to the same individual as the last, includes numerous vertebræ and other skeletal elements. A cervical vertebra has a prominent hypapophysis with long base, and is free from the parapophyses. There are rugose lines between the latter and the edge of the cup. The dorsals have a hypapophysis with short base, and have a prominent shoulder with smooth surface bone. In the articular cups the transverse slightly exceeds the vertical diameter. The caudals are of moderate length. The condyles of the femur are of unequal size, and the head not expanded.

Measurements.

No. 1.

	M.
Width of ramus at symphysis	.030
Diameter of large alveolus at symphysis	.015
Length of bases of four teeth following	.029
Diameter of large premaxillary tooth	.010
Diameter of anterior lower incisor	.013
Width of ramus at second incisor	.031

No. 2.

Width of frontal bone above orbit to inferior groove	.020
Depth of ramus near middle	.032
Length of cervical vertebra	.038
Width at articular ball	.025
Length of a dorsal	.037
Width at articular cup	.025
Length of a caudal	.043

In comparison with a common large species of the Bridger formation

from Wyoming, which agrees with such characters as can be found in the description of *C. affinis*, Marsh, I find the position of the large mandibular tooth is quite different, its position being considerably anterior in the Wyoming species. The first incisor tooth is also less enlarged in the latter.

CROCODILUS WHEELERII, Cope, *sp. nov.*

This crocodile is known from remains in the same fragmentary condition as those already described. There are numerous portions of the cranium with vertebræ.

This species is at once distinguished by the relative width of the interorbital portion of the frontal bone, and the slight development of the lateral inferior ridges. The pitting is relatively smaller than in any of the others here described, numbering five or six rows on the parietal region; there is a smooth border of the superciliary edge. The frontal has a narrow anterior prolongation between the prefrontals, longer than in "*C. affinis*," and without the transverse impression preceded by a smooth space seen in that species. The pitting is, on the other hand, gradually reduced toward the nasal region. Other cranial bones are strongly sculptured. A portion of the maxillary contains teeth. These are robust, with slightly compressed obtusely conic crowns, with rugulose enamel.

A cervical vertebra is elongate with short hypapophysis, free from the parapophyses; its ball is subcircular.

Measurements.

	M.
Length of frontal bone, (10 mm. supplied)	.130
Length of anterior production of do	.053
With of do. at front of orbits	.037
Width of do., by to inferior groove posterior	.030
Depth of mandible at cotylus	.053
Length of a cervical vertebra	.043
Width and depth of ball of do	.025
Length of a lumbar	.042

The size of this species was equal to that of the fully-grown Louisiana alligator.

CROCODILUS ELLIOTTII, Leidy.

With this species we enter the second group of the genus above noted where the frontal bone is stout and furnished with prominent inferior ridges. The specimens referred provisionally to the *C. elliottii* embrace cranial bones and teeth, but I do not consider the reference final.

CROCODILUS LIODON. Marsh.

Amer. Journ. Sci. Arts, 1871, p. 454.

Two individuals with depressed dorsal centra and articulated dermal scuta approach the description above cited sufficiently to render it necessary to make this provisional identification. The frontal bones are not preserved.

CROCODILUS CHAMENSIS, Cope.

Report on Vertebrate Fossils of New Mexico, 1874, p. 15. (*Alligator.*)

Besides the type-specimen, I obtained a fragmentary cranium and

numerous dermal scuta of another individual. The muzzle is wide and flat, and is emarginate at the sides, for the accommodation of the large mandibular tooth. This species must, therefore, be referred to the genus *Crocodilus*. The cranium is very rugose above, especially on the muzzle. The interorbital part of the frontal bone is narrow and thick, and with strong inferior crests and the superior surface covered with numerous closely placed round pits, of which five and six may be counted between the orbital borders. The extremity of the quadrate bone is concave transversely, and the anterior end of the condyle is not or but little wider than the posterior. A prominent ridge extends from the latter, forming a posterior alate border of the quadrate. Inferior face of quadrate concave. The dermal scuta are very few of them keeled, and they are mostly united by suture. Their surface is covered with rather small, sharply-defined pits.

This crocodile is, perhaps, double the size of the *Crocodilus heterodon*, Cope, which I formerly referred to *Alligator*, but now, by analogy with its ally the *C. chamensis*, place here.

CROCODILUS HETERODON, Cope.

Alligator heterodon, Cope. Proceed. Amer. Philos. Soc., 1872, p. 544; U. S. Geol. Surveys of Terrs., 1872, p. 614.

The smallest species, represented by remains of two individuals, one of them adult.

LACERTILIA.

Remains of two species of this order were obtained, one of which resembles, in the portions preserved, the genus *Glyptosaurus*.

TESTUDINATA.

Besides the descriptions from the carapace and plastron given below, I may mention some vertebræ whose correct reference cannot now be made. These are opisthocœlian with well developed zygapaphyses and a mass of a depressed oval form for neural spine. The centra are compressed and elongate, and indicate a long tail as in the genus *Chelydra*. The diapophyses are well developed, and the chevron facets are excavated and continuous with the posterior cup.

TRIONYX, Geoffr.

Species of this genus were exceedingly abundant during the Eocene period, in New Mexico. Over considerable tracts where other fossils are rare, these are commonly found. They present considerable uniformity of sculpture, and mostly have the coarse character of the cretaceous species rather than the delicate patterns of surface of the existing and many of the Miocene species. The only species which appears to be identical with those of the Bridger formation is the *T. uintaensis*, Leidy. The characters are as follows:

I. Costal bones with transverse ribs at their distal ends.

A. The dermal ossification extending beyond the bases of the free-rib ends.

T. LEPTOMITUS. Costal ridges numerous and close together.

T. CARIOSUS. Costal ridges narrow and widely separated.

AA. Dermal ossification graduating into the free-rib end.

T. RADULUS. Surface ridges numerous.

II. Costal bones with the honey-comb sculpture nearly to their ends.

T. UINTAËNSIS. Sculpture uniform.

All of the above species are of considerable size, and the bones of the carapace and plastron are rather thick. The sculpture of the median portion of the carapace is in all a coarse, uninterrupted honeycomb; that of the plastron is of finer character. To *T. leptomitus*, Cope, I refer four individuals; to *T. cariosus*, Cope, six individuals; to *T. radulus*, Cope, three; and to *T. uintaënsis*, four. Many other specimens are not finally classified, owing to the absence of the essential parts of the carapace, etc.

PLASTOMENUS, Cope.

U. S. Geological Survey Terrs., 1872, p. 617.

Portions of the skeletons of species of this genus are very abundant in the Eocene of New Mexico. Though one seldom obtains an entire carapace or plastron, the form, size, and sculpture indicate that the remains belong to several species. The figures, composed of ridges, pits, &c., variously distributed, are often quite elegant. The species do not attain the average size of the *Trionyches* of the same era, but the *P. communis*, *P. lachrymalis*, and *P. catenatus* exceed in dimensions the living species of North American waters.

Among the very numerous remains, no marginal bones occur, and the extremities of the ribs are either very short or do not project at all. A sternal bone of the *P. corrugatus* resembles that already described* in inclosing a fontanelle by one of its inner borders, while the bridge is well developed. The specific characters are as follows:

I. Carapace with corrugated ridges, more or less inosculating;

P. CORRUGATUS. Ridges fine, inosculating little; no welts.

P. FRACTUS. Ridges fine, inosculating much, and thrown into oblique welts.

P. CATENATUS. Ridges as wide as the interspaces, inosculating more or less; no welts.

II. Sculpture coarsely or finely punctate.

P. COMMUNIS. Costals with coarse pits and distinct oblique welts.

P. LACHRYMALIS. Costals with finer pits; the welts broken into tubercles posteriorly.

P. THOMASII. Cope l. c., p. 618. Costals with approximate transverse ridges, separating one or two rows of pits.

I have selected, as typical of the above species, four individuals of *P.* (?) *thomasii;* one of *P. lachrymalis;* eight of *P. communis;* two of *P. catenatus*, and a considerable number of the remaining two species.

*Annual Report U. S. Geol. Surv., 1872.

BAËNA, Leidy.

BAËNA ARENOSA.

Leidy's Report U. S. Geol. Survey of Territories, I, p. 161.

One specimen obtained.

DERMATEMYS, Gray.

DERMATEMYS (?) COSTILATUS, *sp. nov.*

Six individuals contribute fragments to our knowledge of this species, but without the completeness desirable. The species is essentially characterized by the presence of an elevated but obtuse rib, which crosses the costal bones at right angles to their length. As costals with all degrees of definition of the rib are preserved, I suppose that it disappeared at the middle of the carapace, or only existed on the posterior portion. Associated with the costals are vertebral bones, with a similar but more pronounced rib on the median line. This, also, is faint or wanting on associated vertebrals. I therefore suppose that this keel, also, is confined, as in the *D. wyomingensis*, to the posterior extremity of the carapace. Other portions of the skeleton are of uncertain reference, but there are associated in four of the specimens portions of carapace with the free borders marked by a broad, smooth band, which thickens inwards to an abrupt descending margin. The surface of this border is regularly marked with parallel obtuse ribs. The vertebral bones, on which the median rib is obsolete, have their lower surface produced in a projecting point on each side of the rather narrow excavation for the extremity of the vertebra which precedes it. The size is about that of the *Dermatemys wyomingensis*, and the robustness of the bones similar.

The reference of this species to the genus *Dermatemys* is provisional only, and is based on specific resemblances to the *D. wyomingensis*, Leidy.

EMYS, Broug.

EMYS LATILABIATUS, Cope.

Paleontological Bulletin, No. 3, page 3, U. S. Geolog. Survey Terrs., 1872, p. 626.

Abundant.

EMYS (?) STEVENSONIANUS, Leidy.

Report U. S. Geol. Survey Terrs., I, p. 141.

Specimens in which the lip of the anterior lobe of the plastron is not incised at the sides are provisionally referred to this species.

HADRIANUS, Cope.

HADRIANUS CORSONII, Leidy, (*Testudo.*)

Cope, Amer. Report, U. S. Geol. Surv., 1872, p. 631.

Abundant remains of a species of this genus are too fragmentary for final reference. The characters derived from the forms of the lobes of the carapace are those of this species rather than of the others described, viz, *H. octonarius* and *H. allabiatus.*

PISCES.

The only fishes discovered by my exploration of the Green River beds of New Mexico are gars, probably of the genus *Clastes*, Cope. Individuals are abundant, but the number of specimens in which the jaws and teeth are preserved is too few to permit of satisfactory comparison with the species of the Bridger group, described in Hayden's annual report for 1872. The scales, &c., do not present marked peculiarities.

Besides these, there occur, as already noted, (Report Foss. Vert. New Mexico, 1874, p. 4,) the teeth of several species of sharks. These are, two of *Lamna*, one of *Oxyrhina*, two of *Galeocerdo*, and one fragment apparently pertaining to *Carcharodon*. The teeth resemble those of known species of the Cretaceous formations, and generally have a worn appearance. With them were portions of oysters, and both have the appearance of having been transported.

RECAPITULATION.

Mammalia		50
Reptilia		24
Crocodilia	7	
Lacertilia	2	
Testudinata	15	
Pisces		8
		82

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