Cope (Ed. D.)

ENGINEER DEPARTMENT, U. S. ARMY.

GEOGRAPHICAL EXPLORATIONS AND SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.

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

REPORT

UPON

VERTEBRATE FOSSILS

DISCOVERED IN

NEW MEXICO,

WITH

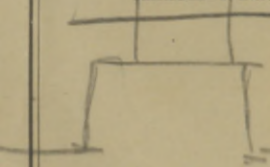
DESCRIPTIONS OF NEW SPECIES.

Prof. E. D. COPE,

PALEONTOLOGIST.

Presented by Geo. M. Wheeler

EXTRACT FROM APPENDIX FF OF THE ANNUAL REPORT OF THE CHIEF OF ENGINEERS, 1874.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
November 28, 1874.

With the Compliments of

Lieut. George M. Wheeler

Corps of Engineers,

U. S. Army.

ERRATA.

Page 4, third paragraph: for "Palaeosyopsos," read Palaeosyops.
Page 5, second paragraph: for "medium," read median.
Page 6, fifth paragraph: for "^{m}.010," read M .010.
Page 7, second paragraph: for "Ectoganus," read Esthonyx.
Page 11, seventh paragraph: for "Hyposyus," read Hipposyus.
Page 11, tenth paragraph: for "four molars," read three molars.
Page 12, ninth paragraph: for "mandibular series," read preceding species.
Page 13, eleventh paragraph: for "sectional," read sectorial.
Page 16, ninth paragraph: for "normal," read dermal.

ENGINEER DEPARTMENT, U. S. ARMY.

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[EXTRACT FROM THE ANNUAL REPORT OF THE CHIEF OF ENGINEERS TO THE SECRETARY OF WAR.]

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., October 20, 1874.

* * * * * * *

Lieutenant Wheeler has also submitted a report of Prof. E. D. Cope, paleontologist, from his camp, on Galinas Creek, in the Rio Grande basin, including a description of new species of vertebrate fossils, and of an extensive series of deposits of the Eocene age, indicating the existence in earlier geological time of an extensive lake of fresh water in that part of New Mexico.

The collections made and to be made by this special party are likely to prove of unusual interest.

(See Appendix FF 3.)

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APPENDIX FF 3.

REPORT ON PALEONTOLOGY.

UNITED STATES ENGINEER OFFICE,
EXPLORATIONS AND SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., October 15, 1874.

GENERAL: I have the honor to forward herewith a special report received from Prof. E. D. Cope, paleontologist to the expedition of this season, embodying some of the results of his labors in portions of New Mexico, up to the 27th of September. This report contains new and valuable information relative to vertebrate fossil remains.

Very respectfully, your obedient servant,

GEO. M. WHEELER,
Lieutenant of Engineers, in charge.

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

REPORT OF PROF. E. D. COPE, PALEONTOLOGIST.

CAMP ON GALLINAS CREEK, *September* 27, 1874.

SIR: In accordance with your instructions to forward a report of proceedings, I beg leave to state that I returned to this camp from Tierra Amarilla on the 15th of the month, and have remained here ever since. We have been mostly employed in examining the bad lands of the Eocene of the divide between the Chama and San Juan Rivers, and in collecting the vertebrate fossils which their beds contain. A little time has been devoted to the Cretaceous beds forming the rim of the Basin. From the Eocene beds, more than seventy-five species of vertebrates have been obtained, many of which are new to science, and others are largely illustrated by additional remains. Four species of a new order, the *Toxodontia*, have been discovered, and our knowledge of the structure of other peculiar forms enlarged. Interesting relations between the Cretaceous and Tertiary beds have been observed.

Mr. Shedd has been assisting in making collections and taking his meteorological observations at the stated times.

The health of the party continues good, and we hope to move camp to another point ere long.

Very respectfully, your obedient servant,

EDW. D. COPE,
Paleontologist.

Lieut. GEO. M. WHEELER,
Corps of Engineers, U. S. A

NOTES ON THE EOCENE AND PLIOCENE LACUSTRINE FORMATIONS OF NEW MEXICO, INCLUDING DESCRIPTIONS OF CERTAIN NEW SPECIES OF VERTEBRATES, BY PROF. E. D. COPE, PALEONTOLOGIST TO THE EXPEDITION.

PART I.

One of the results of the examinations made during the field-season of 1874 is the discovery of an extensive series of deposits of Eocene age. These indicate the existence, during early Tertiary time, of an extensive lake of fresh water in that part of New Mexico now drained by the tributaries of the Chama River on the east and the San Juan River on the west. This lake received the remains of the fauna of its shores and other regions adjacent, which have been preserved and obtained by the members of the expedition detailed by Lieutenant Wheeler for its investigation, in considerable numbers.

The shore of this lake was formed by rocks of the Cretaceous formation of an age near the No. 3 of Meek and Hayden. In approaching it from the east, we traverse the sandstones of Cretaceous No. 1, both horizontal, and tilted at various angles, and find No. 2 resting upon it frequently unconformably, and tilted at higher angles, frequently 45°, sometimes 50°, to the west and southwest, and containing numerous fossils, as *Inoceramus*, etc. The upper sandstones of this formation pass into a brackish or fresh-water formation, which includes a bed of lignite, of sometimes 50 feet in thickness. Above this rests, conformably where seen, a moderate thickness of rather soft marine rocks, containing numerous shells, *Acephala*, *Gastropoda*, and *Cephalopoda*, including *Oysters*, *Baculites*, and *Ammonites* resembling *A. placenta* most, with sharks' teeth. Resting unconformably on these, with a much reduced dip, is a mass of brown and reddish sandstones, some 1,500 feet in thickness, inclining perhaps 10° south and southeast. These pass continuously into the superincumbent red and gray marls, alternating with brown and white sandstone of the fossiliferous beds of the Eocene. The observed part of these beds is about 1,500 feet in depth.

A considerable number of species of *Vertebrata* have been obtained, a large majority of which are *Mammalia*. While it is premature to attempt to determine fully the character of the fauna, enough has been ascertained to indicate marked differences from that of the Bridger group of Wyoming. It is peculiar in the entire absence of the genus *Palæosyopsos*, so characteristic of the former, and its replacement by *Bathmodon*, which has never been recorded from the Bridger formation. The abundant species of *Hyrachyus* of the Bridger are here represented by a single one of small size, which occurs but rarely, while its companion, *Hyopsodus*, is very rare or wanting. While gar-remains are abundant in both, the *Amiidæ* and *Siluridæ* have not yet rewarded our examinations. The characteristic genera of the New Mexican fauna are *Bathmodon*, Cope; *Hipposyus*, Leidy; and *Phenacodus*, Cope, genera which it shares with the *Bathmodon* bed of the Green River formation of the Bear River Wyoming. There is in all respects so close a resemblance between these deposits as to lead to the belief in their horizontal identity, and with other reasons, to give to the southern basin a higher antiquity than belongs to the celebrated Bridger series. The interesting fact that the teeth of six or seven species of sharks and one *Ostrea* have been deposited with the mammalian remains indicates that the marine Cretaceous rocks formed the coast-material of this lake, and the earlier period of its deposit is probable on various grounds, to be considered at a future time. The facts are all confirmatory of the view already expressed by the writer that the population of the Bridger epoch was derived by migration from a southern region.

Perhaps the most important addition to paleontological science obtained during the course of the investigation is the discovery of four species of two new genera, *Calamodon* and *Ectoganus* of *Toxodontia*, an order which has not been heretofore identified as having existed on the North American continent.

DESCRIPTION OF SPECIES.

ECTOGANUS GLIRIFORMIS, *gen. et sp. nov.*

Char. gen.—This genus rests on a numoer ot remains of the crania of three species, including principally teeth, in a good state of preservation, all found in appropriate relations by the writer. The teeth include incisors, molars, and premolars, it is believed, of both superior and inferior series.

There are two types of gliriform incisor-teeth, and of one of these in the largest species three sizes. In the one, the teeth are elongate, compressed, convex in both directions on the anterior; are convex or angulate in section at the posterior face. In all, the enamel is confined to a band on the anterior face, extending more or less on one side or the other, the naked dentine extending prominently backward at the middle and basal portion of the shaft.

In the larger size, this portion is subacute behind; in the smaller, obtuse. Teeth of this type are of three sizes, the smaller two the most compressed and with narrowest enamel. Those of the second type are of one, an intermediate size, and are shorter

than those of the others and less compressed. One of their faces is concave in both directions, and is covered with enamel from the apex of the tooth for some distance posteriorly. From its terminus on the concave side, the enamel borders retire to the sides of the convex front.

There are three molars of the superior and many of the inferior series available for present determination. The superior are all remarkable for the great exposure of their external faces as compared with their internal, and the extension of the enamel on the outer face of the very thick external root, which is not distinguished from the crown. The true molar has three roots, and the crown is longer antero-posteriorly than transversely. It consists of two transverse tubercular ridges, connected by a medium oblique longitudinal ridge. The premolars have two of the roots connate, forming a support to the greater part of the crown. The worn surface is in form something like the Greek ω, the deep emargination being internal. The inferior molars have greater antero-posterior than transverse diameters. The enamel is more extended on one side than the other, covering the exposed portions of the roots. The grinding surface is plane, and has the form of a horizontal ∞; the limbs being angulate, as in the Greek Σ.

It isimpossible to determine the affinities of this curious genus with the material at present in my hands, but it is evidently nearer to the South American *Toxodon*, Owen, and *Typotherium*, Gervais, than anything yet discovered in the North American Tertiaries. It is no doubt related to the *Anchippodus*, Leidy, and *Tillotherium* Marsh, (which Marsh observes may be identical,) but differs from both in many points of the dentition.

Char. specif.—All the incisors are regularly convex in front. The surface of attrition of the large ones truncate, of the small ones oblique. The section of the large ones near the base is diamond-shaped, with one acute angle truncate and the other rounded. There are some shallow grooves on the sides, and on one side a more pronounced longitudinal shallow angulation. The enamel of these and of all the molars is smooth, and there are no cingula on the latter. The transverse crests of the unworn true molars support two tubercles, and the inner extremities of the crests of the premolars are produced in accordance with the oblique wearing of the incurved crown in mastication.

Measurements.

	M.
Length of incisor, largest, type 1	.043
Width of incisor, largest, type 1	.013
Depth of incisor, largest, type 1	.018
Length of incisor, medium, type 1	.034
Width of incisor, medium, type 1	.006
Depth of incisor, medium, type 1	.014
Depth (?) of incisior, last, type 1	.009
Width of incisor, last, type 1	.004
Length of incisor, type 2	.031
Width of incisor, type 2	.006
Diameter of crown of premolar { longitudinal	.010
Diameter of crown of premolar { transverse	.010
Length of enamel of face externally	.013
Length of enamel of face posteriorly	.005
Length of crown of posterior upper molar	.016
Width of crown of posterior upper molar	.012
Length of crown of posterior lower molar	.012
Width of crown of posterior lower molar	.009

Size about that of a fully-grown hog, (*Sus scropha.*)
Portions of several individuals have been found.

CALAMODON SIMPLEX, *gen. et sp. nov.*

Char. gen.—Molar teeth subcylindric, prismatic, rootless; the crown only distinguished by its investiture of enamel, which exhibits a weak marginal inflection for a portion of the length. Enamel extending in a band on one or both sides of the tooth to the base. Incisors rodent-like, curved, with a band of enamel on the anterior face, and obliquely-truncate extremity.

A number of specimens, probably representing this genus, have been found, and I select as typical those of an individual in which the molar and incisor teeth occurred together. The form is evidently allied to *Ectoganus*, as the close resemblance of the incisor teeth demonstrates, but the molars are of a much more simple type than anything yet discovered in this group, imitating superficially those of some *Edentata*.

Char. specif.—Molar (? superior) longitudinally bent, the convex (outer) face covered with enamel to the base. Enamel extending a much shorter distance on the inner face, and soon worn through by attrition on one of the other faces. Section of the base of crown a subquadrate oval. A slight inflection of enamel on the inner and a

still weaker one on the (?)posterior border of the triturating face. Enamel with slight longitudinal ridges. Incisor much curved, strongly convex in transverse section, the enamel obscurely longitudinally ridged on both sides near the border. Section of one side slightly concave.

These and other specimens indicate an animal at least as large as the American tapir.

Measurements.

	M.
Length of a molar	.042
Diameter of the same	015
Diameter of incisor, transverse	.019

CALAMODON ARCAMŒNUS, *sp. nov.*

This *Troxodont* is represented by a portion of the skeleton of a specimen including several teeth, and most probably by portions of another, which includes a large and perfect inferior incisior-tooth. The former displays the alveoli for molars and incisors, showing the one-rooted character of those of the lower jaw, and the deep implantation of the incisor below the antepenultimate molar. The number of molars indicated by the ramus is five, the anterior in close contact with the single large incisor. The molars are subquadrate in section, the last a little longer than broad. The only one in which the crown is preserved exhibits a short crown, with its inferior enamel border notched on two, and oblique on two sides, and the external layer of the root swollen above it all round. The summit of the crown is worn, and is divided subequally by a transverse, rather shallow, groove. One division of the crown exhibits two dentinal areas in transverse line, the other three small ones in a curved line. The extremity of the curved incisor is rodent-like, and regularly convex on the anterior face and entirely smooth. The posterior or grinding face is convex in cross-section.

A large lower incisor of another individual is about five inches in length and one and a half in depth, without the increase of elevation of the superior or interior edge, as is seen in *Ectoganus gliriformis*. This edge is obtusely rounded, and instead of being obliquely leveled to meet the masticatory surface of the extremity, is abruptly truncate, the masticating face turning off at one side of the shaft. The enamel is smooth and of equal width and convexity throughout.

Measurements.

	M.
Elevation of crown of molar	.013
Length of crown of molar	.015
Width of crown of molar	.013
Diameter of incisor^{m}, 010 from tip	.013
Length of series of five molars	.090
Depth of jaw at third molar	.055
Thickness of jaw at third molar	.035

CALAMODON NOVOMEHICANUS, *sp. nov.*

Represented by a superior incisor-tooth of a species of smaller size than either of those already described, and differing in various respects from those of the *C. simplex*, of which a fine specimen has been obtained since it was first described. Both anterior and posterior edges are protected by a convex band of enamel; and the triturating surface is tranverse in the direction of the depth, and oblique in that of the width. The shaft increases in depth toward the root and is longitudinally concave on one face and convex on the other. The enamel bands are most extended on the convex face, and unite on that side round the triturating face and present an abrupt emargination on the middle of their convex border. The other, being formed of dentine only, is deeply worn by attrition.

Measurements.

	M.
Length of fragment	.038
Depth at fracture	.018
Depth at grinding face	.011
Width at grinding face	.009

This species differs from the supposed *C. simplex* in this incisor in other respects than in the smaller size. The latter is concave on both sides, and on the lower border; the former convex on one side, and on the lower border.

ESTHONYX BISULCATUS, *gen. et sp. nov.*

Char. gen. (?).—Incisors of two forms; the inferior subgliriform, but not growing from persistent pulps; the enamel covering a long and narrow external vertical face, and terminating above the alveolus, thus distinguishing crown and root. The other form of (?)incisor with the apex encased in enamel, but extending much farther on the

outer than the inner side; the crown compressed, not wider than the root. Molars supporting two V's with rounded apices directed outward, the posterior soon wearing into a triangle lower than the anterior. The anterior elevated and transverse only distinguished from a triangle by a notch on the inner side. Last lower molar with this anterior transverse triangle, a diagonal ridge and a heel with raised border.

The type of this genus is *Ectoganus bisulcatus*, Cope, and a second species is *E. burmeisterii*, Cope. It differs from *Ectoganus* as well as from *Anchippodus* in the far less gliriform character of the incisor teeth, which may be compared with the extremities of the slender fingers of some monkeys with narrow nails.

Char. specif.—A species about the size of the *Capybara* is represented by the greater part of the dentition of the lower jaw, which includes representatives of both kinds of incisors already described under the characters of the genus. The rodent-like form is less typical of the genus than in the *E. gliriformis* in being rather shorter and furnished with a less extensive external enamel-plate. The dentinal column projects well internally, giving the tooth a regularly oval section. The incisor of the second form has the internal as well as the external enamel-face, and the former possesses a longitudinal angle bounding its concavity. The grinding-face of the molars and some of the premolars is ϖ-shaped as in the other species, but the anterior limb of the figure is much thickened on the inner face, so as to have a triangular form, the base being inward. This base is notched by a second groove of that side of the tooth, which interruption is obliterated by prolonged attrition. This portion of the crown is elevated above the posterior, in consequence of the more rapid removal of the latter by trituration. The large internal and external grooves continue nearly to the base of the crown, as in the larger species. The last inferior molar is longer than the others, and is three-lobed, forming by its base nearly an isoceles triangle. The heel is formed by the backward production of the posterior convexity of the ϖ, the central line of the figure forming a diagonal ridge across the middle of the tooth.

The mandibular ramus is of a deep compressed form.

Measurements.

	M.
Length of three consecutive molars	.0250
Length of last two molars	.0210
Length of penultimate molar	.0084
Width of penultimate molar	.0062
Length of last molar	.0112
Width of last molar	.0070
Length of incisor, second form	.0250
Diameter of incisor, second form	.0050
Diameter of incisor, first form, transverse	.0030
Diameter of incisor, first form, antero-posterior	.0070

ESTHONYX BURMEISTERII, *sp. nov.*

A species more nearly allied to the *E. bisulcatus* than to the type of the genus is represented by a portion of the right mandibular ramus, with the last molar tooth in perfect preservation. While the jaw is of depth similar to that of the *E. bisulcatus*, it is more slender in its proportions. The molar, also, while of nearly the same length, is relatively narrower, especially in its anterior portion. The crown of this tooth is worn in the specimen, and the anterior portion is elevated above the posterior, and displays a trace of the notch of the inner margin already observed in the species last described. The composition of the tooth is similar in other respects. No cingular; enamel smooth.

Measurements.

	M.
Length of last lower molar	.009
Length of last lower molar from anterior tubercles	.0060
Width { anteriorly	.0050
Width { posteriorly	.0025
Depth of ramus at last molar	.0240

This species is dedicated to Prof. Hermann Burmeister, director of the museum of Buenos Ayres, who has studied the group of *Toxodontidæ*, and given us an excellent account of their osteology.

ESTHONYX ACER, *sp. nov.*

Char. specif.—Established on a portion of the lower jaw, in which the last four premolars remain. They resemble those of the species already named, except in the anterior one of the series. This tooth in *E. acer* assumes the form of a premolar, the posterior V becoming a curved median cutting edge, and the anterior V opening into a crescentoid section; it rises to an acuminate apex, having thus a rather sectorial character. In the last three molars, there is a small tubercle at the inner base of the posterior limb of the anterior V. Posterior V much lower; enamel smooth.

Measurements.

	M.
Length of four last molars	.035
Length of three last molars	.026
Length of penultimate molars	.008
Width of penultimate molars	.005
Length of last molar	.011
Width of last molar	.005
Depth of jaw at last molar	.020

This species differs from the *E. bisulcatus* in the modified form of the last premolar; in the latter, it is relatively larger and more like the true molars. The last molar of *E. acer* is more like that of the *E. burmeisterii*, but the mandibular ramus of that species is relatively much deeper and similar to that of *E. bisulcatus*.

ESTHONYX MITICULUS, *sp. nov.*

Represented by portions of mandibular rami of three or four individuals of much smaller size than any of those referred to the species already described. There are represented two premolars and three molars; other teeth are lost. The molars differ from those of the three species named in lacking the notch or groove on the inner side of the anterior triangle of the crown, which constitutes it a V in those species, giving the worn surface a more simply sigmoid form; the anterior portion is, moreover, not materially more elevated than the posterior. The last molar has a large heel, an inner and two anterior tubercles when little worn. The premolars preserved are each two-rooted, the last is like the correponding one in *E. acer*, the penultimate without heel or inner tubercles.

Measurements.

	M
Length of three true molars, (No. 1)	.0120
Length of two last premolars, (No. 2)	.0064
Length of first true molar, (No. 1)	.0040
Width of first true molar, (No. 1)	.0030
Depth of ramus at first true molar, (No. 1)	.0080

The worn surfaces of the first and second true molars are much like those of the corresponding teeth of *Menotherium*, Cope. That genus differs in the reduced form of the last inferior molar and in the premolars.

MENISCOTHERIUM CHAMENSE, *gen. et sp. nov.*

Char. gen.—Molars three, with two continuous external crescents and two internal tubercles, except on the posterior, where there is but one, the anterior conic tubercle. The posterior tubercles on the other molars crescentoid in section. A well-developed crescent between the anterior tubercle and anterior crescent, and an oblique crest extending from the latter to the adjacent horn of the posterior inner tubercle. Two external crescents on the last premolar.

This genus presents a curious combination in the structure of its molars of the character of *Palæosyops*, *Hyopotamus*, and *Hipposyus*. It is exceptional among the ungulates of the same fauna in the number of crescents of the molars.

Char. specif.—Last molar with the oblique inner posterior crest terminating at the posterior margin of the crown. Prominent external ribs at the point of connection of the external crescents of the crown. No cingula; enamel entirely smooth.

Measurements.

	M.
Length (externally) of last four molars	.029
Length of true molars	.022
Length of penultimate	.009
Width of penultimate	.010

This animal was about the size of the raccoon, and probably had the habits of the tapirs.

BATHMODON SIMUS, *sp. nov.*

Represented by the remains of a great number of individuals, including all parts of the skeleton, dentition, &c., but especially by one of the most complete of these, which possesses, among other portions, the premaxillary bones. These indicate a species very distinct from the *B. radians*, Cope, and one approaching the *Metalophodon armatus* in the structure of the molar teeth.

The canine teeth have cylindric roots and trihedral crowns, the section of the latter forming a nearly equilateral spherical triangle. The crown of the inferior canines are shorter, and have one concave side. The superior molars support two crests, which are

nearly parallel on the single and last tooth of this type. The posterior crest is composed of two portions, the posterior conic and the anterior flatter, and which becomes the external posterior crescent on the penultimate molar. The anterior cingular crest is very well developed on the last lower molar.

The premaxillary bone is short and stout, and descends steeply from an elevated front, presenting its three teeth downward. The canine follows closely from an elevated rib on the side of the face. Behind it is a considerable diastema. The humerus is a very stout bone, and the femur is rather slight in comparison with it.

Measurements.

	M.
Length of bases of last three molars	.083
Length of basis of last molar	.026
Width of basis of last molar	.035
Diameter of canine at base	.025
Length of penultimate inferior molar	.030
Width of penultimate inferior molar	.021

Individuals of larger size than the above are more common. Measurements of one of these are:

	M.
Length of last superior molar	.032
Width of last superior molar	.043
Diameter of crown of canine, (another species)	.030

This is the especially characteristic large mammal of this fauna, and must have existed in herds.

BATHMODON MOLESTUS, *sp. nov.*

Established on remains of one species and probably respresented by those of others in possession of the expedition. The teeth differ in several important respects from those of *B. radians* and *B. simus*. Thus the canine is quite compressed in the coronal portion, and is narrow triangular in section, the narrow base of the triangle being concave; that is, the section of a strong groove, which is bounded by a sharp edge on each side. The edge proper of the crown is also duplicated by a ridge of the enamel, which joins it at an acute angle. The last upper molar is characteristic in its wide crown, the posterior usually transverse crest being curved so as to represent the segment of a circle, the convexity posterior. The ramus of the lower jaw is very slender. The posterior inferior molar is large, and has subequal transverse crests. The posterior cingulum, which descends from the external angle, is moderately developed on both of the crests.

In a young specimen of this or an allied species of *Bathmodon*, the deciduous tooth which is replaced by the last premolar has two external crescents; an interesting point of resemblance to the *Perissodactyle* ungulates.

Measurements.

	M.
Width of anterior crest of last inferior molar	.023
Width of anterior crest of superior molar	.039
Length of superior molar	.029
Antero-posterior diameter of crown of canine	.022
Transverse diameter of crown of canine	.013
Depth of mandible at last lower molar	.050

BATHMODON LOMAS, *sp. nov.*

The very numerous remains of the genus *Bathmodon* obtained are referrible to several species, as indicated especially by the teeth. The present form is characterized among other points by the form of the last inferior molar. The anterior crest is much more elevated than the posterior, with its inner apex almost a cone, with anterior, thick, revolute border. The usual oblique cingulum descends from the outer apex forward. The longitudinal ridge connecting the crests is low but distinct, while the posterior cingular ridge is remarkably large. This, which constitutes one of the specific marks, is extended horizontally so as to form a broad ledge, whose border is a segment of a circle. Enamel roughened with five ridges on all the external surfaces. Tooth well worn by prolonged use.

Measurements.

	M.
Length of crown	.041
Width of crown anteriorly	.027
Width of posterior crest	.022
Elevation of posterior crest	.011
Elevation of anterior crest	.024

BATHMODON ELEPHANTOPUS, *sp. nov.*

The most abundant species of the New Mexican Eocene formation, and of the largest size, exceeding in this respect both the *B. simus* and *B. molestus*. I describe at present the last molars of both superior and inferior series. The former is a transverse oval, slightly swollen on the posterior border external to the middle point. The two crests are parallel, the anterior as usual curving round to the inner extremity of the shorter posterior, and leaving a wide interval between them. The posterior is not divided, but is elevated at the extremities. Anterior cingulum strong, posterior obsolete, excepting on the external border, where it sends a low ridge to the elevated extremity of the anterior crest. Exteroanterior to this ridge is a shallow fossa. Enamel very slightly rugose. The posterior lower molar exhibits a great disparity of elevation of the crests, the anterior being high, and terminating on the inner side in an elevated cone. The connecting ridge is low, and there is only a trace of a descending posterior cingulum on the posterior crest.

Measurements.

	M.
Width of last superior molar	.040
Length of last superior molar	.030
Length of last inferior molar	.039
Width of last inferior molar	.026
Elevation of posterior crest of inferior molar	.015
Elevation of anterior crest of inferior molar	.025

A remarkably fine skeleton of a species of this genus, discovered by my friend and assistant, William G. Shedd, exhibits characters heretofore only inferential, and demonstrates the correctness of a number of positions heretofore based on a few fragmentary bones. The feet exhibit proboscidian characters throughout. They are very short and plantigrade, and there are five digits on the hind foot. The calcaneum is recurved inward, and the astragalus flat above. The navicular is transverse and very thin, while the cuboid is subequilateral. The metatarsals are short, and the phalanges much wider than long. The cranium remarkably resembles that of a carnivorous animal in its massive expanded zygomas and huge canine tusks. It differs remarkably from this type, and shows its affinity to *Uintatherium* in the broad plane of the upper cranial wall, with overhanging marginal crests for the attachment and protection of the temporal and neck muscles. These crests do not support horns. The muzzle is contracted at the diastema, thus rendering more prominent the ridges which mark the position of the alveoli of the tusks. The latter are directed downward, giving the profile the pick-ax-like form of that of *Uintatherium*, though more robust in its proportions than the latter. The length of this skull is 19 inches; the width at the zygomas 13.

PHENACODUS PRIMÆVUS, Cope.*

Char. gen.—The genus *Phenacodus* was first recognized by the writer in a posterior inferior molar of a mammal of about the size of a hog, of unknown affinities, which was named *P. primævus*. Specimens of the same species, embracing the dentition of both jaws, having been procured in the Eocene of New Mexico, I am prepared to add to the characters of the genus.

There are three molars in each jaw, and the specimens include two premolars, which form a continuous series, as in *Achænodon*. There are four principal tubercles on the inferior molars and sometimes a third small one between the posterior pair, always on the last one, which is, however, not largely developed. The first inferior premolar presents a broad heel, a double medium tubercle, and an anterior tubercle, (in *P. primævus*.) The crowns of the superior molars are low and broad, and support numerous tubercles; these are low and vary in number, but there are two near the external border which are quite constant. They have general resemblances to those of hogs, bears, and monkeys. The first true molar is broader than long, and there are no diastemata between it and the premolars, or between the latter, which are quadri-, and tri-cuspid, respectively. The forms of these teeth are entirely different from those of the corresponding teeth in *Elotherium*.

Char. specif.—The posterior molar of the left side is wide in front and regularly oval in posterior outline, and has two equal anterior and three unequal posterior tubercles. One of the posteriors is situated near the middle of the outer side, and is separated from the adjacent anterior by a deep groove. The corresponding inner tubercle is more posterior; anterior tubercles low, trihedral, and connected by a shelf-like cingulum across the front of the tooth; rudimental cingula on outer side of crown. The penultimate molar has three tubercles on the posterior border; and a deep fissue, corresponding to that of the last molar, separates one of them from the anterior tubercle.

* Paleontological Bulletin, No. 17, p. 3, October 25, 1873.

Measurements.

	M.
Length of last molar	.015
Width { anteriorly	.011
Width { between two posterior tubercles	.005
Elevation of anterior cusp from base	.008
Width of penultimate molar behind	.010

From the same locality as the preceding species.

PHENACODUS OMNIVORUS, *sp. nov.*

Superior molar with low and broad tubercular crown, with outline of base parallelogrammic, with one end oblique; the oblique end with two principal low tubercles, which form the extremities of two series of similar ones, some of which arise from the strong cingulum which forms part of the summit of the crown.

Char.—Molar without cingulum on the (?) outer side only; elsewhere very strong and crenate, at one point rising into a stout, low tubercle. The largest tubercle is near this, on the inner summit of the crown, and is connected with the larger outer by a low, broad tubercle. A smaller one intervenes between the cingular tubercle and the smaller external. The outer tubercles low and broad, a smaller one opposite the internal between them in the position of a cingulum. Enamel coarsely rugose.

Measurements.

	M.
Transverse diameter	.014
Longitudinal	.010
Distance between apices of inner and outer tubercles	.007
Elevation of cingulum	.004
Elevation of outer cusp	.005

The tooth described is about the size of the posterior inferior molar of the black bear, (*Ursus americanus.*)

PHENACODUS SULCATUS, *sp. nov.*

Represented especially by the molar tooth corresponding to that above described under the head of *P. omnivorus*, in good preservation. It is a species considerably less than half the size of the one just named, and presents several important differences of structure. Of the two outer tubercles, one is very small, and there is a third adjacent to the larger, produced by the enlargement of the cingulum. As in *P. omnivorus*, the cingulum extends entirely round the remainder of the crown, and is tubercular on the side of the least outer tubercle. The inner tubercle is connected with the larger outer by an intermediate of elongate form, so that the series when worn down resembles the transverse ridge of the superior molar of *Hyposyus*, and which is separated by a groove from the cingular ridge on each side.

Measurements.

	M.
Transverse diameter	.008
Longitudinal diameter	.006
Distance between apices of inner and outer tubercles	.004
Elevation of cingulum	.002
Elevation of outer cusp	.003

Size similar to that of the corresponding tooth of a *Coati*.

OXYÆNA LUPINA, *gen. et sp. nov.*

Represented by a portion of the cranium, which includes the greater part of the dentition. The generic characters are, three premolars and four molars above and below; lower premolars with anterior cone and posterior cutting heel; last premolar and all the molars of the superior series with an internal heel; the last molar transverse; first and second upper molars with an anterior cone and posterior cutting lobe; the penultimate with two anterior acute cones, the posterior forming a sectorial edge with the posterior lobe; last superior molar trenchant.

Mandibular dentition, I., 0; C., 1; P. M., 3; M., 3; the canine teeth directed forward and upward without intervening incisors. First premolar one-rooted; second and third consisting of an anterior elevated cone, and posterior heel, which is elevated in the middle.

The first true molar is nearly similar, with the posterior tubercle sharp edged. Last two molars with an anterior elevated portion and small low heel; the former consisting of three acute tubercles, of which the largest or interior forms with the anterior a sectorial blade oblique to the axis of the mandibular bone.

This genus has one less molar with double median cones than *Protolomus*. It is one of the flat-clawed group, of which two forms have already been described, *Mesonyx*, Cope, and *Synoplotherium*, Cope, which present in their dentition a nearer resemblance to the genus *Hyænodon* than to any other of later age. It differs from both the genera named in having only six molar teeth, and the triangular type of inferior sectorial teeth has not yet been obtained among them. The *O. forcipata* is the larger species; the smallest one described by me is the *Oxyæna morsitans*. In *Stypolophus brevicalcaratus*, I find three sectorials of the form described instead of two only.

Char. specif.—The posterior cutting lobes of molars 1 and 2 elevated and rather obtuse, that of molar 3 lower and more acute. Molar 2 has a well-marked anterior tubercle; molar 4 consists of an outer cutting edge and inner cone. The inner tubercle of molar 3 is smaller than in the three teeth preceding. First lower premolar well developed with one root. Enamel of all the teeth, especially of the canines, rugose.

This species is allied to those of the genus *Pterodon*.

Measurements.

	M.
Length of four posterior superior molars	.055
Length of first true molar	.016
Width of first true molar	.015
Length of second true molar	.016
Width of third (transverse) molar	
Length of five anterior inferior molars	.054

This species is intermediate in size between the *O. forcipata* and *O. morsitans*. The penultimate inferior molar differs from that of both these species in the much weaker development of the internal lateral tubercle and more obtuse anterior tubercle; in *O. forcipata* the blade is continued on the front of this tubercle.

Two specimens embracing five series of teeth have been examined by the writer; the measurements given are those of the smaller.

OXYÆNA MORSITANS, *sp. nov.*

The genus of flesh-eating mammals, described in 1872 under the name of *Stypolophus*, presents a type of dentition which is further illustrated by the present addition of new species much larger than any hitherto known to possess it. Those described are in the order of size: *S. insectivorus*, *S. pungens*, and *S. brevicalcaratus*, Cope. The present new species is twice the bulk of the last. It is represented by broken mandibles with molars and canines of two specimens, and part of the maxillary dentition of a third. The molar, which is typical of the genus, in its subtriangular basis supporting three elevated cusps, and a short heel, is evidently functionally the sectorial, whatever its homological relations may be. In the present instance, the inner posterior cusp is much reduced, while there is a small additional cusp on the front of the anterior near its basis. The trihedral outer posterior forms a cutting edge with the large outer anterior, which is produced forward. A posterior molar exhibits a corresponding tricuspidate portion, and a more elongate heel, with acute circumference. In a premolar, the posterior heel becomes trenchant and median. The canine is very stout and compressed at basis. The enamel in all the teeth is more or less rugose.

Measurements.

	M.
Length of base of crown of sectorial tooth	.014
Width of base of crown of sectorial tooth	.009
Elevation of principal cusps	.015
Elevation of inner posterior cusps	.007
Length of basis of posterior molar	.012
Width of basis of posterior molar	.007
Length of heel of posterior molar	.005
Elevation of principal cusps	.011
Elevation of anterior cusps	.006
Long diameter of canine at base	.018

The maxillary series belongs to a still larger animal. The sectorial presents the same form as that of the mandibular series, and is more robust in form than in existing *Carnivora*. The section of the middle crests is very convex on the inner side, so that the shear is oblique. The heel is small and low. The premolar preceding has a large, broad heel. In another premolar, the heel supports a median crest, while the anterior part of the crown is a slightly-compressed cone, with a small tubercle at the anterior base. Other specimens indicate that this species lacks the inferior incisor teeth.

OXYÆNA FORCIPATA, *sp. nov.*

Char. specif.—Mandibular rami robust and deep, with the symphysis short, and the chin contracted. The canine tooth forms a vertical oval in section. The first one-

rooted premolar is a stout tooth; there is no anterior basal tubercle on the second and third premolars, but a distinct one on the first true molar. There is a small tubercle at the base of the anterior lobe of the last or second sectorial molar. This tooth is larger than the penultimate. The enamel of all the teeth is quite rugose, although they are well worn by use.

Corresponding characters are exhibited by four specimens of this species, one of which includes portions of the upper jaw. All the bones are particularly massive, and there is a high parietal crest, a fair indication of the size of the temporal muscles.

Additional specimens of the *Oxyæna morsitans*, Cope, show that it differs in the reduced size of the sectorial molars, and the very small first premolar, which is quite rudimental.

Measurements.

	M.
Length of inferior dental series	.103
Depth of ramus at last molar	.040
Depth of ramus at second premolar	.030
Diameter of canine tooth	.019
Length of premolar series	.035
Length of base of penultimate molar	.016
Length of base of last molar	.019
Width of base of last molar	.012
Elevation of crown of last molar	.019
Length of superior last molar	.020
Width of superior last molar	.013

This animal differs in specific characters from the Wyoming carnivores, already referred to, in the greater robustness of all its parts. From *Synoplotherium lanius*, it also differs in the regular increase backward in the size of the molars. In the Wyoming species the penultimate is largest in the lower jaw.

The fragments of the *Oxyæna forcipata* are as large as corresponding parts of the jaguar.

PACHYÆNA OSSIFRAGA, *gen. et sp. nov.*

Char. gen.—Established on a single superior molar tooth of a large carnivore, apparently allied to the group of flat-clawed *Carnivora*. It is either the last premolar or first true molar. It is characterized by the absence of the cutting edge seen in the allied genera, and its replacement by a conic tubercle.

The principal lobe is also a cone, and the inner one a perfect cone, a little less elevated than the principal one.

Char. specif.—Crown with well-developed anterior and posterior basal tubercles; no cinguli, either internal or external. Enamel slightly rugose.

Measurements.

	M.
Length of crown	.020
Width of crown	.018
Elevation of anterior basal tubercle	.006
Elevation of central cone	.011
Elevation of interior cone	.010

This is the largest carnivore yet observed in this formation, and of peculiar character; its structure indicating a diet not purely carnivorous.

PROTOTOMUS VIVERRINUS, *gen. et sp. nov.*

Char. gen.—Three true molars in the maxillary bone; premolars compressed, the last of the upper series triangular in form; each angle enlarged; the center of the crown with a compressed conic tubercle. First and second true molars triangular, with a tubercle at each angle, and two adjacent cones in the center. The tubercle of the posterior angle forms a slight sectional edge with the posterior of the central pair. Last (third molar) transverse, with a median cone. Supposed mandible with the posterior two molars tubercular; the anterior tubercles similar to the posterior.

This genus is evidently allied to the *Viverridæ*, differing from *Viverra*, so far as known, in the simple character of the last two inferior molars. From *Limnocyon* it differs, according to Professor Marsh's descriptions, in possessing three instead of two superior true molars, or, if we include with these the last premolar, as does Professor Marsh, four instead of three. According to Professor Marsh, the tubercular molars in his *Vulpavus* are generally similar to those of the existing genus *Canis*. *Prototomus* presents the number of superior molars seen in *Amphicyon*.

Char. specif.—The *P. viverrinus* is established on a considerable part of the cranium and skeleton of one individual in good preservation. The last upper premolar is triradiate, having concave and subequal sides. The first molar is as broad as long, and is triangular, presenting a right angle outward and forward.

The second molar is broader than long, and presents an acute tubercle on the anterior border between the inner and anterior median cones. There is a tubercle at the inner and outer extremities of the base of the last molar. No cingulum on the posterior or outer sides of the last premolar. External cones of the last two inferior molars subcrescentic in section; anterior inner obsolete; posterior inner prominent.

Measurements.

	M.
Length of last five molars	.0250
Length of true-molar series	.0135
Length of last premolar	.0060
Width of last premolar	.0050
Length of penultimate molar	.0050
Width of penultimate molar	.0068
Width of last molar	.0047
Length of last two inferior molars	.0090

About the size of the domestic cat.

PROTOTOMUS INSIDIOSUS, *sp. nov.*

Represented in the collections of the survey by parts of the maxillary bone and both mandibular rami with teeth. The species is much less than the preceding, and differs materially in the forms of the teeth. The two anterior tubercles of the tubercular molars are similar and approximated; the posterior slightly divergent, and on the last tooth inclosing a third of small size. The last premolar has a broad heel and stout anterior cone, but no anterior tubercle. The tooth immediately preceding is much smaller, and also possesses a heel. The mandibular ramus is particularly slender, and the angle is not inflected.

Measurements.

	M.
Length of last two inferior molars	.0060
Length of last molar	.0034
Width of last inferior molar	.0020
Depth of ramus at last inferior molar	.0045
Length of last premolar	.0030
Elevation of last premolar	.0028

PROTOTOMUS JARROVII, *sp. nov.*

This *Carnivore* is of considerably larger proportions than either of the preceding. It is readily recognized as pertaining to the same genus by the identical form of the last two inferior molars, which are quite different from the corresponding ones in *Oxyæna* and other genera. These indeed, with the portion of the mandibular ramus which supports them, are the only well-preserved remains of this animal as yet in our possession. They indicate an animal of the size of the gray fox. In the last molar, the inner anterior tubercle is double, though low and obtuse. It differs from that in the species last enumerated in the presence of only two tubercles on the posterior portion of the crown instead of three, one being terminal and the other on the middle of the outer side. There are but two on the posterior end of the penultimate tooth, and all are low and unconnected excepting by the distinct rim of the crown. The center of the crown is thus concave. The rim is interrupted by notches between the tubercles on the outer side. No cingulum on inner, a weak one on outer side. Enamel smooth.

The form of the molars is rather stout, and the ramus is thick and not deep, and with broad, simple, lower border below the molars.

Measurements.

	M.
Length of last lower molar	.0070
Width { anteriorly	.0045
Width { posteriorly	.0020
Width of penultimate behind	.0050
Elevation of anterior cusp of last	.0030
Depth of ramus at last molar	.0140

This species is dedicated to my friend Henry C. Yarrow, M. D., to whom was committed the charge of that party of the survey to which I was attached, and to whose zeal in the cause of the natural sciences the success of the special expedition is largely due.

LIMNOCYON PROTENUS, *sp. nov.*

A civet-like Carnivore represented by one entire and a portion of the other mandibular ramus, with teeth well preserved, agrees in generic characters with the species referred by Professor Marsh to his genus *Limnocyon*, but differs from them all in its superior size. The molars are $\frac{4}{4}$, but the first molar is like the premolars of the *Canidæ*, except in a slight widening of its posterior basis by the development of a broad cingulum on the inner side and round the basal lobe behind. From this point it extends forward on the outer side to the beginning of the anterior basal lobe, and there ceases. The second molar has the anterior portion elevated, supporting three cusps and a large heel, with lateral and sub-median cutting edges. The last molar is smaller, elongate, oval, and two-rooted, with marginal posterior, intermarginal external, and two anterior tubercles, of which the inner is bifid. The ramus is slender, and the symphysis elongate. The angle is not incurved. First premolars one-rooted.

Measurements.

	M.
Length of dental series	.0680
Length of four premolars	.0340
Length of first molar	.0105
Length of second molar	.0100
Width of second molar	.0055
Length of third molar	.0080
Width of third molar in front	.0040
Depth of ramus at third premolar	.0130
Depth of ramus at last molar	.0150

ALLIGATOR CHAMENSIS, *sp. nov.*

Represented by portions of the mandibular arch of a small crocodilian resembling in some respects the *A. heterodon* of the Wyoming beds. The posterior teeth have the same short, expanded, sessile, bean-shaped crowns, with a median longitudinal ridge, and more delicate lines radiating close together from it to the border of the crown. The anterior teeth differ in being cylindric instead of compressed. There is a large canine preceded and followed by teeth of much smaller size.

Measurements.

	M.
Length of symphysis	.019
Length of alveoli of six teeth from symphysis	.022
Width of ramus just behind symphysis	.010
Long diameter of posterior tooth	.005

The specimens selected as type is one of the smallest. The surface of the bones is roughened with pits.

PLASTOMENUS LACHRYMALIS, *sp. nov.*

The largest species of the genus, and abundantly represented in the Eocene of New Mexico. The costal bones are rather finely punctate, the posterior as well as the anterior. The anterior costal bones are crossed by numerous ridges from side to side obliquely; the obliquity increasing posteriorly. On the posterior bones, they are broken into vertical bars, separated by considerable intervals, and of linear form. The posterior costals reach a thickness of 0m.006 and a width of 0m.025.

The pitting of the posterior part of the carapace distinguishes this species from the *P. ædemius*.

PART II.

In addition to the investigations pursued in the regions already indicated, and of which some of the new species have been described, it may be stated that a careful examination was made of the extensive lacustrine deposits in the valley of the Rio Grande.

These deposits are supposed to commence to the northward of Taos, N. Mex., and continue to an unknown distance southward, certainly at least fifty miles beyond Santa Fé, and occupy that portion of the valley between the Rocky Mountains in the east and the Jemez range in the west, and have been stated as late Tertiary, but without special determination or co-ordination with the other known lacustrine formations of this continent.*

Abundant material having been obtained by the party, it is easy to determine the fauna, whose remains are entombed in it, to be a part of that already described by Dr. Leidy and the writer as occurring in Dakota and Colorado under the name of Pliocene.

* The new species described from the valley of the Rio Grande were discovered from August 20 to September 1, 1874.

This conclusion is indicated by the presence of the genera *Hippotherium*, *Protohippus*, *Procamelus*, *Cosoryx*, and *Merychippus*, and known Pliocene species of other genera, among which may be mentioned *Canis*, *Aceratherium*, &c. In addition to species already known, a number new to science were obtained, of some of which descriptions are here given.

MARTES NAMBIANUS, *sp. nov.*

Represented by a mandibular ramus, which supports three teeth. The anterior blade of the sectorial is rather obtuse.

The first premolar is one-rooted; the second and third are without posterior coronal lobes, but exhibit small basal lobes, both anterior and posterior. The anterior of the second is rather elevated, and the entire crown is directed obliquely forward. Canine compressed; mental foramina below the second and third premolars.

Measurements.

	M.
Length of three premolars	.006
Elevation of anterior lobe of sectorial	.002
Depth of ramus at anterior lobe of sectorial	.003

This species is of smaller size than the *M. mustelinus*, Cope, and the sectorial tooth less elevated and trenchant.

COSORYX RAMOSUS, *sp. nov.*

Char. gen.—Inferior molars prismatic, $\frac{3}{3}$; the premolars all sectorial, last with short branch-crests. Molars with basal intercolumnar tubercles. Horns superciliary, solid, branched. This genus was indicated by Dr. Leidy from a horn of the species known to him, the *Cosoryx furcatus*, from the Pliocene beds of the Niobrara. The same or a similar species has left abundant remains in the Santa Fé marls, and, in connection with the more numerous *C. ramosus*, has enabled me to determine the dental and other characters of the genus. After a careful examination of the horns of these species in my possession, those of eighteen individuals (at least I find that of ten where the basal portion is preserved) the beam has been broken off and reunited by anchylosis in six. In most of these the spot is marked by a ring of exostosed tuberosities, like those constituting the burr of the deer's horn. On a specimen of this character, pertaining to a third species, Professor Leidy based his *Cervus warrenii*, which may now be called *Cosoryx warrenii*. It is abundant in the Santa Fé marls.

The fracture has taken place in every instance at a point as far above the frontal bone as the burr of deer is situated, and is irregular in outline, higher on the one side than the other. In some of the specimens the smaller antlers are also broken, and exhibit a similar burr, but the terminal portion is usually lost. In one specimen, a broken antler is anchylosed in the usual manner of overlapping ends. The horns are solid, the center having a narrow, spongy axis. The surface is dense and marked by arterial grooves, but not pierced by noticeable foramina.

It is evidently a question whether this genus should be referred to the hollow or solid-horned *Ruminantia;* to the *Bovidæ*, or *Cervidæ*. The horns might be regarded as those of deer were it not for the occasional specimens without burr, while the teeth are both cervine and bovine. We way here draw such inferences as we can respecting the nature of the covering of the horn. That the fractured beam should not be lost indicates the presence of some kind of covering to retain it. That this covering was not horny is probable from the fact that the horns are branched, a structure impossible to the *Bovidæ*, since antlers effectually prevent the usual mode of increase of horn by additions at the base and removal at the extremity. That such covering protected arteries, which aided in the production of burrs, is also probable. We may thus believe it to have been dermal like that of the giraffe, or the *Antilocapra*, at the period of immaturity of its horny sheath.

It may be concluded, then, that the genus *Cosoryx* represents the ancestral type of the *Cervidæ*, and explains the origin of the remarkable type of horns of that family as follows: Ruminants with fixed horns of structure more dense and brittle than others of the same type, in their annual combats at the rutting-season, very frequently broke the beams off not far above the base. The usual location of nutrition followed, which, being annually repeated, became as periodical in its return as the activity of nutrition of the reproductive system. This activity ceasing, the horn, being dense, lost its vitality, the more so as the normal covering would have already perished in its distal portions. The natural consequence, the separation of the dead from the living bone by suppuration, would follow. This process would, however, probably require a longer time for the establishment of its periodical return than the fracture and attachment of the existing horn.

This appears to be the only explanation of the origin of the phenomena exhibited by the horns of the *Cervidæ*, and is suggested by the specimens of *Cosoryx* to be described.

Char. specif.—This species is larger than the *C. furcatus*, Leidy, and differs from the *C. warrenii* in possessing two antlers instead of one, of which the first is given off at a point much farther from the base than in that species.

The beam near the base is curved a little inward, and is semicircular in section, the outer face being slightly concave, the inner very convex. The base is situated a short distance within the free superciliary border. The beam becomes more cylindric, and then, expanding in a fore and aft direction, gives off an antler at right angles nearly parallel to the cranial axis. At a distance little over half the elevation of the first antler, the beam gives off a second in a plane tranverse to the axis of the skull. The terminal portion of the beam is cylindric, curved, and acute at the apex.

Mandibles, with teeth of two species of this genus, were found, the smaller of which occurring with the other portions of *C. furcatus*, belong to it. The larger differs in the elevation of the intercrescentic column of the first molar, which is worn into a loop at ordinary maturity; this may, however, be but an individual variation. The diastema is long and the ramus of that point quite slender.

Measurements.

	M.
Long diameter of base, No. 1	.016
Long diameter of base, No. 2	.020
Elevation of first antler from base, No. 1	.080
Elevation of second antler from first, No. 3	.042
Length of terminal part of beam, No. 4	.095
Length of molars 2–5, No. 5	.037
Length of molars 4–5, No. 5	.022
Length of fifth molar	.012
Width of fifth molar	006

COSORYX TERES, *sp. nov.*

Established on the connected frontal bones, supporting the horns of one specimen, and represented by portions of horns of two others. The former individual is larger than any one belonging to the other species, and the species is doubtless the largest of the genus. The horns stand above the posterior part of the orbit, which excavates its base, and presenting a considerable face, descending into the temporal or zygomatic fossa. There is no free superciliary rim outside of the base as in *C. ramosus*, Cope. The section of the beam near the base is a regular oval; the long axis directed longitudinally and a little outward in front. The beam is erect, with a slight curvature outward at the inner base only. So far as preserved, it does not branch, but may do so in its distal portion, which is lost. The tissue is more spongy interiorly than in the other species; supraorbital foramen far within the superciliary border.

Measurements.

	M.
Outer width between bases of horn-cores	.112
Inner width between bases of horn-cores	.055
Width of temporal fossa behind horns	.053
Long diameter of horn-core	.028
Short diameter of horn-core	.021
Length of part preserved	.033

This species was as large as the *Antilocapra americana* of the plains.

HESPEROMYS LOXODON, *sp. nov.*

An entire mandibular ramus, with all the teeth preserved, was found in the same deposits as the preceding species. Molars subequal, short-crowned; triturating surface sigmoid. The apices of the sigma on the inner side tubercular, and anterior to the outer apices. First molar with an additional transverse crest in front. Incisor compressed; outer angle of enamel face rounded smooth. Molar series oblique, rising anteriorly.

Measurements.

	M.
Length of molar series	.0050
Length of first molar	.0018
Depth below last molar, (inner side)	.0030
Depth below first molar	.0045
Depth of incisor	.0015
Depth at diastema	.0027

PANOLAX SANCTÆFIDEI, *gen. et sp. nov.*

Char. gen.—Molars prismatic, transverse, except the first and last; each divided by a plate of enamel extending transversely from the inner side. Anterior molar longitudinal; posterior molar composed of two columns.

This genus is represented by numerous teeth and portions of the cranium. It evidently belonged to the *Leporidæ*, and is allowed to both *Lepus* and *Palæolagus*. As the teeth are mostly separate, it is not easy to determine which is the posterior and which the anterior molar. Judging by the analogy of the known species, the determination as here made is correct; should the relations be reversed, the species will be referred to *Palæolagus*.

Char. specif.—The teeth are curved, the convexity inward. Inner face grooved, the groove occupied by cementum, the outer border compressed either without or with very shallow groove. First molar with triturating surface twice as long as wide, with an entering loop of enamel on the inner side anteriorly narrower. Last molar as wide antero-posteriorly as transversely, the shaft curved backward, the posterior column sub-cylindric half the diameter of the anterior.

Measurements.

		Inch.
Diameter of middle molar	antero-posterior	.093
	transverse	.187
Diameter of first molar	antero-posterior	.140
	transverse	.062
Diameter of last molar	antero-posterior	.100
	transverse	.065
Length of crown of last molar		.250

This species is about the size of the northern hare.

CATHARTES UMBROSUS, *sp. nov.*

Represented by numerous portions of nearly all parts of the skeleton, in excellent preservation. The beak from the frontal bone to near the apex is preserved; it displays the depression just anterior to the nares, which marks the anterior boundary of the cere. The culmen is nearly horizontal to just beyond this mark, and then exhibits a gradual decurvature to the apex. The beak is strongly compressed, and the tomia strongly decurved, forming an open festoon, whose middle point marks one-fourth the length of the beak from the nares. The latter are directed obliquely downward and forward, narrowing anteriorly and having a prominent inferior bounding ledge.

The mandible is weak, the symphisis-marking on half the length of the beak from the anterior angle of the nares.

The bones of the anterior extremities exhibit large and powerful proportions, as compared with the posterior, appropriately to capacity for sustained flight. The head of the humerus is much compressed, and the articular face is nearly divided into two by the deep bicipital groove. The head of the femur is small, and the rotular face a wide and deep groove.

The tibia is slender, the shaft much compressed, with a prominent ridge. The cnemial crest is short, and not produced downward on the shaft. The distal posterior bridge is narrow and oblique. The tarso-metatarsus has a strong exterior crest, which constitutes half the width of the shaft.

Measurements.

	Inch.
Length of beak from base of culmen, (axial)	1.90
Length of beak from cere to apex, (axial)	1.20
Depth of beak at culmen	.87
Depth of premaxillary at festoon	.75
Length of symphysis	.69
Length of nares	.37
Width of palate at festoon	.50
Width of head of humerus	1.37
Width of condyles	1.13
Width of distal end of femur	.94
Width of head of tibia	.81
Width of condyles of tibia	.66
Width of condyles of tarso-metatarsus	.75
Length of a first phalanx	1.12
Length of seven sacral vertebræ	1.87
Length of two dorsal vertebræ	1.12
Depth of a dorsal vertebra, (total)	.93
Depth of a dorsal vertebra to roof of arch	.44
Depth of centrum of roof of arch	.25
Width of centrum of roof of arch	.32
Length of two cervical vertebræ	1.12
Depth of two cervical vertebræ to apex of neural spine	.44
Depth of articular face of centrum	.17
Width of articular face of centrum	.25