APPENDIX.

ART. XXVI.—*Notice of New Tertiary Mammals*, IV; by O. C. MARSH.

THE remains described in the present communication include some new forms of Quadrumana from the Eocene and Miocene; a species of the new order *Tillodontia*, recently established by the writer; the first horned Rhinoceroses found in this country; a new genus of the *Brontotheridæ;* and a number of other extinct mammals from the Tertiary of the Rocky Mountain region and the Pacific coast. The specimens described are all preserved in the Museum of Yale College.

Lemuravus distans, gen. et sp. nov.

The first announcement of the order *Primates* from the Tertiary of this country was published by the writer, Oct. 8th, 1872, and subsequently appeared in this Journal, (vol. v, p. 405, Nov., 1872). In this paper, three genera of the *Limnotheridæ*, viz: *Limnotherium*, *Thinolestes* and *Telmatolestes*, previously described by the writer, were shown to belong to the lower Quadrumana, the principal parts of the skeleton being very similar to those of Lemurs, while the jaws were somewhat like those of Marmosets. The number of teeth was stated to be greater than in any known forms of the order. Subsequent researches have fully confirmed this determination, and many new facts may now be added in regard to the characters and affinities of this well marked group. From numerous specimens, the writer has ascertained that the *Limnotheridæ* should be placed in the *Prosimiæ*. The brain was nearly smooth, and the cerebellum large, and placed mainly behind the cerebrum. The orbits are open behind, and the lachrymal foramen is outside the orbit.

In addition to the genera mentioned above, an examination of the type specimens of *Notharctos*, *Hipposyus*, *Microsyops*, and *Palæacodon* of Leidy shows that they are true Primates, and probably all belong to the *Limnotheridæ*. To these may be added *Mesacodon*, *Bathrodon*, and *Antiacodon*, described by the writer.*

The genus *Lemuravus*, here described, is nearly related to *Hyopsodus* Leidy. The latter proves on investigation to belong to the *Primates*, and not to the Ungulates. This is shown by

* *Antiacodon nanus* Marsh was redescribed by Cope, several months later, under the name *Anaptomorphus æmulus*. *Limnotherium affine* Marsh was likewise redescribed by the same author as *Tomitherium rostratum* Cope.

the close correspondence of the skeleton with that of the Lemurs, and by the general structure of the skull. *Hyopsodus* and the present genus represent a distinct family, which may be called *Lemuravidæ*. The type genus, *Lemuravus*, has 44 teeth, indicating the most generalized form of the order. *Hyopsodus* has apparently but 42. In the former, the teeth form a continuous series above and below. The canines are small, and the upper incisors are not separated on the median line, as in Lemurs. The molar teeth appear to be essentially the same as those of *Hyopsodus*, but as the latter are only known with certainty from the lower jaw first described there may be important differences. The symphysis of the lower jaw is completely coössified. The brain was nearly smooth, and of moderate size. The skeleton most resembles that of the Lemurs. The humerus has at its distal end a supracondylar foramen, and a supratrochlear perforation. The radius and ulna are distinct. The femur has a small pit in the head for the round ligament. Its distal end is more flattened antero-posteriorly than in the Lemurs. The tibia and fibula are separate. The astragalus is very similar to that of *Lemur*.

Measurements.

Space occupied by entire upper dental series,	30· mm.
Extent of upper molar series,	21·5
Extent of three upper true molars,	11·
Extent of three upper incisors,	5·5
Extent of lower molar series,	23·
Extent of three lower true molars,	12·5
Diameter of head of femur,	5·
Transverse diameter of distal end of femur,	10·
Transverse diameter of proximal end of tibia,	9·
Transverse diameter of distal end,	5·5
Length of astragalus,	7·5

The present species was about the size of the largest squirrels. The type specimen was found in 1871, in the Lower Eocene of Wyoming, by Mr. T. G. Peck of the Yale party.

Laopithecus robustus, gen. et sp. nov.

Among the interesting specimens obtained by the writer during his late expedition to the "Bad Lands" in Nebraska was the lower jaw of a monkey, the first of the order found in that region. The specimen is well preserved, and indicates an animal about as large as a Coati. The crowns of the molar teeth agree essentially with those of some South American monkeys, but still more nearly with those of the Eocene *Limnotheridæ*. From that family the present genus may readily be distinguished by the first true molar, which is the largest of

the series, much larger than the penultimate. The last lower molar is smaller than the others. In the first and second true molars, the external cusps are slightly in advance of the corresponding inner ones. The anterior pair are higher and nearer together than those behind. A low ridge extends obliquely from the base of the anterior inner cone to the summit of the outer posterior cusp. The inner posterior cusp is smaller than the others, and separated from them. The crowns are bounded by a distinct basal ridge, except on the inner side. The enamel of the molars is rugose.

Measurements.

Space occupied by three lower true molars,	17· mm.
Antero-posterior diameter of first lower molar,	7·
Transverse diameter,	6·
Height of crown,	5·5
Antero-posterior diameter of penultimate molar,	5·5
Transverse diameter,	5·
Height of crown,	4·2
Depth of jaw below first lower molar,	12·6

This specimen was found in the *Oreodon* horizon of the Miocene "Bad Lands," about thirty miles south of the Black Hills.

Tillotherium fodiens, sp. nov.

Since this genus was proposed by the writer (this Journal, v, p. 485, June, 1873), much light has been thrown upon its affinities by additional remains. It proves to be quite distinct from *Anchippodus* (*Trogosus*) Leidy, although nearly related. The latter genus, unfortunately, is known only from portions of the lower jaw, but this shows marked differences from *Tillotherium*, which lacks the inner pair of small lower incisors, and has an incisor and a canine between the large scalpriform tooth and the first lower premolar. *Tillotherium* has 34 teeth in its permanent dentition (p. 221), and the molar teeth most resemble those in Ungulates. The upper true molars are similar to the premolars of some Eocene Perissodactyls, but are somewhat like the tubercular molars of the *Canidæ*. The lower molar series is of the *Palæotherium* type, and the last lower molar has a well developed posterior lobe.

In the present species, the canines were small, and the superior ones placed somewhat behind the premaxillary suture. The five digits on each foot were all well developed, and of moderate length. The metapodial bones are similar to those in *Ursus Americanus*, but the ungual phalanges preserved are more oblique, and less pointed at the extremity.

Measurements.

Length of skull, from front of incisors to end of occipital condyles,	355· mm.
Extent of entire upper dental series,	186·
Extent of upper molar series,	98·
Extent of three true molars,	59·
Antero-posterior diameter of penultimate upper molar,	20·5
Transverse diameter (greatest),	35·
Antero-posterior diameter of last upper premolar,	12·
Transverse diameter,	24·
Antero-posterior diameter of base of gliriform upper incisor,	22·
Transverse diameter,	16·5
Distance between bases of upper canines,	35·
Extent of lower dental series,	162·
Extent of last three lower molars,	70·
Extent of entire lower molar series,	93·
Antero-posterior diameter of lower gliriform incisor,	21·
Transverse diameter,	15·
Transverse diameter of condyle of lower jaw,	52·
Length of radius,	170·
Transverse diameter of humerus at distal end,	76·
Transverse diameter of tibia at proximal end,	59·
Length of calcaneum,	72·
Length of first metacarpal,	40·
Length of second metatarsal,	46·
Length of ungual phalanx,	35·
Width of articular face,	12·5
Vertical diameter,	14·

The remains here described indicate an animal about two-thirds as large as a Tapir. They are from the *Dinoceras* beds of the Eocene of Wyoming. *Anchippodus minor* Marsh (*Trogosus castoridens* Leidy) is from a lower horizon of the same formation. Both belong to the order *Tillodontia*.

Diceratherium armatum, gen. et sp. nov.

The present genus is of special interest, as it includes the first extinct rhinoceroses with horns found in America. It is an interesting fact, likewise, that these had each a pair of horns placed transversely, as in modern Ruminants, although the discovery of *Dinoceras* and *Brontotherium* has rendered this feature less unexpected. The existence of these horns is clearly indicated by large osseous protuberances on the anterior portion of the nasal bones. The latter are massive and firmly coössified, evidently to support well developed horns. The remainder of the skull, and the teeth, as well as the skeleton, so far as known, resemble the corresponding parts in *Aceratherium*. The dental formula appears to be,

$$\text{Incisors } \frac{1}{2},\ \text{canines } \frac{0}{0},\ \text{premolars } \frac{4}{3},\ \text{molars } \frac{3}{3}.$$

In the present species the skull is of moderate length. The horn-cores are oval in outline, and placed directly opposite each other on the free portion of the nasals, a short distance back from the extremity. They are directed upward and outward, and their surface is rugose. The orbit is small, and there is a prominent postorbital process on the frontal. The premaxillaries are slender, and each supports a single incisor, with a compressed crown. The molar teeth are large, and without cement. The posterior nares terminate in front of the penultimate upper molar. There is a large rounded tubercle on the supraoccipital, just above the foramen magnum. The bones of the limbs preserved indicate that there were four digits in the manus, and three in the pes.

Measurements.

	mm.
Distance from front of first premolar to end of occipital condyles,	456·
Distance from front of orbit to anterior narial opening,	133·
Extent of upper molar series,	256·
Extent of upper premolar series,	121·
Antero-posterior diameter of last upper molar,	41·
Transverse diameter,	50·
Antero posterior diameter of penultimate upper molar,	49·
Transverse diameter,	55·
Antero-posterior diameter of last upper premolar,	35·
Transverse diameter,	50·
Antero-posterior diameter of first upper premolar,	25·
Transverse diameter,	25·
Width of palate between first upper premolars,	43·
Width between penultimate upper molars,	69·
Length of third metacarpal,	190·
Width of proximal end,	50·
Length of first phalanx of third digit of manus,	31·
Transverse diameter of unciform,	60·
Vertical diameter,	45·

The known remains of the present species indicate an animal about two-thirds the size of the Indian Rhinoceros. They are from the Miocene beds, near the John Day River, in Eastern Oregon.

Diceratherium nanum, sp. nov.

A second species of the above genus is indicated by the greater part of a skull and teeth, and some other remains. These specimens pertained to an animal scarely more than one-half the bulk of that last described. The horn-cores are more compressed, and the extremity of the nasals in front of them is pointed. The anterior narial opening is large. The premaxillaries are slender and compressed. They do not extend so far forward as the nasals.

Measurements.

Distance (approximate) from front of first premolar to postorbital process,	155· mm.
Distance from end of premaxillary to first upper premolar,	91·
Antero-posterior diameter of upper incisor,	25·
Transverse diameter,	11·
Antero-posterior diameter of first lower premolar,	24·
Transverse diameter,	14·
Antero-posterior diameter of second premolar,	26·
Tranverse diameter,	18·

The geological horizon and locality are essentially the same as in the last species.

Diceratherium advenum, sp. nov.

A species clearly belonging to the Rhinoceros family, and possibly to the same genus as the preceding, is indicated by a few fragmentary remains, which are of interest from their geological horizon and locality. The most perfect of these specimens is a last upper molar, and the corresponding lower molar. The former has a wide sigmoid valley between high and nearly parallel transverse crests. There is a strong anterior and posterior basal ridge, but only a faint trace on the inner side near the bottom of the valley. The enamel of the outer and posterior faces especially is marked by delicate vertical striæ. The lower molar has a high narrow crown. The enamel is rugosely striate.

Measurements.

Greatest antero-posterior diameter of last upper molar,	40· mm.
Transverse diameter (approximate),	42·
Depth of transverse valley,	19·
Antero-posterior diameter of last lower molar,	40·
Transverse diameter,	19·
Height of unworn posterior crest,	22·

The known remains of this species pertained to an animal half the bulk of the Indian Rhinoceros. The main interest attached to them is the fact that they were found with upper Eocene fossils, in Utah, and are the first indications of this group in that region. Possibly the strata containing these fossils may in part prove to be lower Miocene.

A comparison of the Lophiodont genus *Hyrachyus* with the Miocene Rhinoceroses, especially *Hyracodon*, seems to point to the former as the Lower Eocene representative or ancestor of the latter group. The skull and teeth of *Hyrachyus* are so similar to those of *Hyracodon* that only slight changes are necessary to transform one into the other. The skeletons, too, are much alike, but *Hyracodon* has only a rudiment of the fifth

metacarpal, and hence the line of descent for the four-toed forms was probably a different one.

Brontotheridæ.

During a recent expedition to the "Bad Lands" of Dakota, the writer secured a large number of specimens belonging to the *Brontotheridæ*, most of them in good preservation. From the Miocene of Colorado, explored by the writer in 1870, and subsequently, a large amount of similar material has been obtained, so that at the present time the Yale Museum contains portions of more than 100 different individuals of this family. A study of these specimens, in connection with the types originally discribed, promises to leave but few points in doubt in regard to the structure or affinities of the group. The results will be published at an early day, but a few are given here, which may clear up some of the existing confusion about the different genera.

It may now be regarded as established that all the species of the *Brontotheridæ* had horns, and there is no reasonable doubt that these were common to both sexes. The osseous horn-cores in each species varied much in size and shape with difference of age, and probably of sex. The incisors are small, and in old specimens are frequently lost.

There appear to be four well marked genera in this family now known, which may be distinguished as follows:

1. *Titanotherium* Leidy (*Menodus* Pomel.)

Dentition $=$Incisors $\frac{2}{2}$; canines $\frac{1}{1}$; premolars $\frac{4}{4?}$; molars $\frac{3}{3}$.

Diastema behind upper canines. Basal ridge on inner side of upper premolars not continuous. Nasals short. A postorbital process. Third trochanter rudimentary or wanting. Type *T. Proutii* Leidy.

2. *Megacerops* Leidy. (*Megaceratops* Cope), (*Symborodon* Cope in part.)

Dentition $=$Incisors $\frac{2}{0}$; canines $\frac{1}{1}$; premolars $\frac{4}{3}$; molars $\frac{3}{3}$.

Diastema behind upper canine. Inner basal ridge on upper premolars not continuous. Nasals more elongated. A postorbital process. Third trochanter rudimentary or wanting. Type *Megacerops coloradensis* Leidy.

3. *Brontotherium* Marsh. (*Symborodon* Cope, in part.) (*Miobasileus* Cope.)

Dentition $=$Incisors $\frac{2}{2}$; canines $\frac{1}{1}$; premolars $\frac{4}{3}$; molars $\frac{3}{3}$.

No superior diastema. Strong continuous basal ridge on inner

side of upper premolars. No postorbital process. Third trochanter distinct. Type *B. gigas* Marsh.

4. *Anisacodon* Marsh, gen. nov.

Dentition $=$Incisors $\frac{0}{1}$; canines $\frac{1}{1}$; premolars $\frac{4}{3}$; molars $\frac{3}{3}$.

No superior diastema. Strong inner basal ridge on upper premolars. Last upper molar with two inner cones. No postorbital process. Type *A. montanus* Marsh.

Anisacodon montanus, sp. nov.

This species is especially distinguished by the emargination of the extremity of the nasals; the short premaxillaries; and the rectangular form of the last upper molar. The inner posterior cone of this molar is smaller than the one in front, and quite distinct from the posterior basal ridge.

Measurements.

Extension of premaxillaries in front of canines,	15· mm.
Distance from end of premaxillaries to narial aperture,	76·
Width of nasals above end of premaxillaries,	95·
Antero-posterior diameter of last upper premolar,	43·
Transverse diameter,	63·
Antero-posterior diameter of penultimate upper molar,	77·
Transverse diameter,	85·
Antero-posterior diameter of last upper molar,	84·
Transverse diameter,	88·

The specimen here described was found by the writer in November last, in the Miocene of northern Nebraska.

Diplacodon elatus, gen. et sp. nov.

The genus here established presents characters in some respects intermediate between *Limnohyus* and *Brontotherium*. It agrees with the former in its complete dentition (44 teeth), and in the general form of the incisors, canines, and true molars. It resembles the latter still more closely in the premolar and molar teeth, and parts of the skeleton, especially in the vertebræ, and bones of the extremities. From the Eocene *Limnohydiæ*, already described, this genus is sharply distinguished by the last upper premolar, which has two distinct inner cones, thus agreeing essentially with the first true molar. This character, which has suggested the name of the genus, is one step toward the modern type of Perissodactyl dentition. The dental formula of the genus is the same as *Limnohyus*, viz:

Incisors $\frac{3}{3}$, canines $\frac{1}{1}$, premolars $\frac{4}{4}$, molars $\frac{3}{3}$.

In other respects the teeth most resemble those of the *Bron-*

totheridæ. From this family, *Diplacodon* differs widely in its dentition, and the absence of horns.

The cervical vertebræ are short, and opisthocœlous. The radius and ulna, and tibia and fibula, are distinct, and the feet show well marked Perissodactyl characters. There were four digits in front, and apparently three behind.

In the present species, the incisors are all well developed, and those in the lower jaw are directed forward. The canines are large, and have long curved crowns with pointed extremities. The first three upper premolars have the two inner cones connate. The upper true molars are surprisingly like those of *Brontotherium*.

Measurements.

Extent of upper molar series,	242 mm.
Extent of upper true molars,	152.
Antero-posterior diameter of first upper premolar,	14.
Antero-posterior diameter of second upper premolar,	21.
Transverse diameter,	23.
Antero-posterior diameter of fourth upper premolar,	28.
Transverse diameter,	34.
Antero-posterior diameter of first upper true molar,	42.
Transverse diameter,	57.
Antero-posterior diameter of second upper molar,	52.
Transverse diameter,	57.
Antero-posterior diameter of last upper molar,	60.
Transverse diameter,	59.
Width of palate between posterior molars,	92.
Distance between bases of canines of lower jaw (2d specimen)	46.
Antero-posterior diameter of canine, at base,	32.
Transverse diameter,	28.
Height of crown,	27.
Antero-posterior diameter of first lower premolar,	17.
Transverse diameter,	10.
Antero-posterior diameter of second premolar,	26.
Transverse diameter, in front,	15.
Antero-posterior diameter of third premolar,	28.
Transverse diameter, in front,	17.
Transverse diameter, posteriorly,	20.
Length of median cervical vertebra,	45.
Transverse diameter of anterior articular face,	60.
Vertical diameter,	63.

The remains here described belonged to an animal nearly as large as a rhinoceros. They are from the Upper Eocene beds of Utah.

Orohippus Uintensis, sp. nov.

The present species is the largest of the genus, and in some respects indicates a transition between the lower Eocene species and the allied forms in the Miocene. It agrees with the known

species of the genus in the number and general structure of the teeth, and in the absence of the posterior intermediate lobe of the upper molars, and especially in the presence of the fifth digit in the manus. It differs in the much deeper transverse valleys of the upper molars, and in their wider crowns. The outer faces of the external cusps of the upper molars have a strong crest extending from the basal ridge to the apex.

Measurements.

Antero-posterior diameter of penultimate upper molar,	9· mm.
Greatest transverse diameter,	12·
Extent of lower molar series,	48·
Extent of lower premolar series,	28·
Antero-posterior diameter of last lower premolar,	8·5
Transverse diameter,	6·
Depth of jaw below third lower premolar,	14·

This species occurs in the upper Eocene deposits of Utah.

Mesohippus, gen. nov.

This genus presents characters intermediate between *Orohippus** Marsh, and *Anchitherium* von Meyer. The skull and teeth are very similar to those of the latter genus, and the dental formula is the same. In the feet, however, the lateral digits are larger; the fifth metacarpal is represented by an elongated splint bone; and the second and third cuneiform bones of the pes are not coossified. The type of the genus is *Mesohippus Bairdi*, = *Anchitherium Bairdi* Leidy. *Mesohippus celer*, = *Anchitherium celer* Marsh, is a smaller species. Both are from the Miocene.

Thinohyus lentus, gen. et sp. nov.

This genus is nearly related to *Dicotyles*, and apparently represents an earlier form of the same type. This is shown in the similar structure of the skull, and form of the teeth. The most noteworthy differences seen in the remains under description are, an additional premolar in the lower jaw, and the extension of the posterior nares between the last upper molars. The orbit is not enclosed behind, and there is no antorbital fossa. The brain was small—less than one-half the size of that of a *Dicotyles* of the same bulk—and much convoluted. There is a strong bony tentorial ridge. The molar teeth have the principal cusps more isolated than in *Dicotyles*, and the intermediate lobes larger.

In the present species the temporal fossæ are separated above only by a narrow ridge. The auditory bullæ are large, and oval in outline. The nasal bones are broad posteriorly. The

* In several recent publications, Prof. Cope has referred the genus *Orohippus* to *Hipposyus* Leidy. The two, however, as shown by a comparison of the type specimens, have no affinity, the latter belonging to the Quadrumana.

postorbital process on the frontal is longer than in *Dicotyles*, and more pointed. There is a strong cingulum on the upper molars, excepting on the base of the inner cones.

Measurements.

Distance from fronto-nasal suture to inion, on median line,	97· mm.
Distance between orbits, over frontals,	64·
Expanse of zygomatic arches,	95·
Extent of last three upper molars,	43·
Antero-posterior of first upper true molar,	14·
Transverse diameter,	14·
Antero-posterior diameter of second molar,	16·
Transverse diameter,	14·
Width between auditory bullæ,	9·
Antero-posterior diameter of auditory bulla,	24·
Transverse diameter,	18·
Length of symphysis of lower jaw (second specimen),	54·
Distance between lower canines,	13·
Space between lower canines and first premolar,	8·
Space between first and second lower premolars,	10·

The present species was somewhat larger than the *Dicotyles torquatus*. The remains here described are from the Miocene, of the John Day River, in Oregon.

Thinohyus socialis, sp. nov.

A second species of the same genus, about half as large as the preceding, is indicated by some fragmentary remains, and particularly by some portions of upper jaws with teeth in excellent preservation. In the present species, the last upper molar is proportionately narrower, and the intermediate lobes of all the upper molars are less developed. In other respects the teeth agree closely with those of the last species. The enamel of the upper molars is somewhat rugose, and there is a distinct basal ridge, except on the inner side.

Measurements.

Antero-posterior diameter of last upper molar,	12· mm.
Transverse diameter through anterior cones,	10·
Transverse diameter through posterior cones,	8·
Antero-posterior diameter of second upper molar,	12·
Transverse diameter, in front,	12·
Height of crown,	6·5

The type specimen of this species was found in November, 1871, in the Miocene beds of Oregon, by Mr. F. Mead, Jr., of the Yale party.

Eporeodon, gen. nov.

Among the species now placed in the genus *Oreodon* of Leidy there are two well marked genera which may readily be distinguished by the base of the skull, and apparently by other char-

acters. In the form first described, of which *Oreodon Culbertsoni* Leidy may be considered the type, there is no indication of an auditory bulla, and for this group the name *Oreodon* may be retained. The other genus, which has a large auditory bulla, may be named *Eporeodon*. The type species is *Eporeodon occidentalis* = *Oreodon occidentalis* Marsh, from the Miocene of Oregon. The other known species of this genus are the following: *Eporeodon superbus*, = *Oreodon superbus* Leidy; *Eporeodon major*, = *Oreodon major* Leidy; and *Eporeodon bullatus*, = *Oreodon bullatus* Leidy. These species, so far as observed, occur in a somewhat different horizon of the Miocene, from the true *Oreodons*. They are, moreover, of larger size, and to this the proposed name refers.

Agriochœrus pumilus, sp. nov.

A number of specimens of a selenodont Artiodactyl, from the upper Eocene, agree so nearly with the known remains of *Agriochœrus* Leidy, that the species they represent may provisionally be placed in that genus. They indicate an animal less than one-half the size of the species already described. The teeth preserved agree in structure essentially with those of *A. latifrons* Leidy. The temporal fossæ were separated only by a sharp crest. Nothing has been known hitherto of the skeleton of this genus, but fortunately some of the more important bones were found with the teeth of the present species. These show that the feet are of the true Artiodactyl type, and somewhat resemble those of *Oreodon*. The tibia and fibula are distinct. The navicular and cuboid are separate. The metapodial bones are not united, and the second and fifth were present.

Measurements.

Extent of last three lower molars,	32· mm.
Antero-posterior diameter of penultimate lower molar,	10·
Transverse diameter,	8·
Transverse diameter of humerus at distal end,	24·
Transverse diameter of articular face,	17·
Least vertical diameter,	11·5
Transverse diameter at distal end,	16·
Antero-posterior diameter,	15·
Extent of three upper true molars (second specimen),	32·
Antero-posterior diameter of first upper molar,	9·5
Transverse diameter,	11·
Antero-posterior diameter of second upper molar,	11·
Transverse diameter,	13·

The present species was about three-fourths the size of the Collared Peccary (*Dicotyles torquatus*). The specimens described are from the upper Eocene of Utah.

Yale College, New Haven, Feb. 20, 1875.