THE PEARCE-SELLARDS *Series*

NUMBER 32

LATE HEMPHILLIAN MAMMALS OF THE OCOTE LOCAL FAUNA, GUANAJUATO, MEXICO

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February 29, 1980

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William G. Reeder, Director

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LATE HEMPHILLIAN MAMMALS OF THE OCOTE LOCAL FAUNA, GUANAJUATO, MEXICO

By Walter W. Dalquest[1] and Oswaldo Mooser[2]

ABSTRACT

The Ocote local fauna is described from several thousand fossils, mostly isolated teeth, of large mammals, obtained from sediments near the village of Los Rodriguez, District of San Miguel de Allende, northeast of the city of San Miguel de Allende, Guanajuato, México. *Teleoceras ocotensis*, *Desmathyus brachydontus*, and *Palaeolama guanajuatensis* are described as new, the name *Paenemarmota mexicana* (Wilson) is revived, and descriptions of the dentitions of six species of horses are given. It is suggested that the Pliocene evolution of *Desmathyus* and *Palaeolama* took place on the Mexican Plateau. The evolutionary stage of the Ocote mammals suggests that the fauna is of late Hemphillian age.

RESUMEN

Se describe la fauna local "Ocote," basado sobre varios miles de piezas fósiles principalmente dientes aislados de mamíferos grandes, obtenido de sedimentos geológicos cerca del Rancho "El Ocote," Congregación de los Rodriguez, Distrito de San Miguel de Allende, situado al nordeste de la Ciudad de San Miguel de Allende, Estado de Guanajuato, México. *Teleoceras ocotensis*, *Desmathyus brachydontus*, y *Palaeolama guanajuatensis* se describen como especies nuevas. El nombre *Paenemarmota mexicana* (Wilson) es revivido y se hace la descripción de la dentición de seis especies de caballos. Se sugiere que la evolución de *Desmathyus* y *Palaeolama* durante el Plioceno tuvo lugar en la Altaplanicie Mexicana. El estado evolutivo de los mamíferos de Ocote sugiere que la edad de la fauna es Hemphill tardío.

INTRODUCTION

The Ocote local fauna was named and briefly described by Arellano (1951). Specimens were first collected at a small canyon locally called "Arroyo de la Carreta" by Enrique Diaz Lozano, in the 1940's. These were examined by Claude Hibbard in 1949 and Chester Stock in 1950. A much larger collection made by Arellano in 1950 was the basis of his faunal list (1951). Between 1954 and 1960, Mooser and persons employed by him obtained thousands of bones and teeth at Arroyo de la Carreta, and these, subsequently purchased by Midwestern State University, form the basis of the present report.

The name "Ocote" is derived from the name of the ranch where the fossils occur. The site is near the small village of Los Rodriguez, District of San Miguel de Allende, State of Guanajuato, 20 km north and 5 km east of the city of San Miguel de Allende, at an elevation of 2,000 meters. The species listed in Arellano's (1951) preliminary faunal list are listed also by Silva-Barcenas (1969). The horses of the Ocote local fauna have been described in several papers by Mooser (1958, 1960, 1964, 1965, 1968, 1973). We know of no other published, original contributions dealing with the Ocote local fauna.

Arellano termed the fossiliferous horizon a "bone bed" about two meters thick, of white to light green or yellowish silty sand with coarser detritus disseminated, or in pockets or lenses. The site has also been described by Mooser (1958).

In the accounts that follow, catalogue numbers are of the Midwestern State University's Collection of Fossil Vertebrates (MWU) and of The University of Texas at Austin's Texas Memorial Museum Collection (TMM). Measurements are in millimeters and in diameters of teeth, the first measurement is the length of the tooth, the second value is the width.

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This study was supported by a grant from Midwestern State University, made available through the efforts of Dr. Travis White. We are indebted to Dr. S. David Webb for helpful criticism of the manuscript.

ORDER RODENTIA

FAMILY SCIURIDAE

Paenemarmota mexicana (Wilson)

Marmota mexicana Wilson, 1949, Carnegie Inst. Washington Publ., 584:168.

Three almost unworn teeth (11056) are from a giant ground squirrel: an upper M^1, an upper M^3, and a lower M_1. The two M1's match teeth of *Paenemarmota barbouri* Hibbard and Schultz, as described by Repenning (1962), but the third molar differs in having a distinct and prominent anteroposterior bisection of the posterior valley (dental terminology is from Bryant, 1945). A high ridge reaches from the posterior cingulum to the metaloph. The labial part of the valley becomes a closed lake that will remain as a deep pit until a late stage of wear. The slightly expanded metaconule pinches the lingual part of the valley to a crescent. The ridge is marked on the external face of the posterior cingulum by a sharp vertical groove. This condition was recognized by Repenning (1962: 547) in the upper M^3's of Hemphillian *Paenemarmota* from the Yepómera local fauna of Chihuahua and the Goleta local fauna of Michoacán.

The separation of the posterior valley is a character readily apparent to the unaided eye, even in specimens with moderately worn teeth. It occurs in the upper M^3's of *Paenemarmota* from all three known Hemphillian occurrences of the genus in Mexico. A divided valley is absent in described specimens from the United States. The divided posterior valley may be diagnostic of either Hemphillian or Mexican *Paenemarmota.* The Mexican, Hemphillian, giant ground squirrels are thus set off from the Blancan animals of the United States, and the divided valley is presumed to be a character of specific value. The name *Paenemarmota mexicana* (Wilson), type locality Yepómera, Chihuahua, placed in the synonymy of *P. barbouri* by Repenning (1962), is revived.

The teeth from Ocote, measured at the base of the enamel as described by Repenning, are smaller than all of the teeth listed by Repenning (1962): upper M^1, 6.2 x 6.7; M^3, 7.3 x 6.5; lower M_1, 6.4 x 6.3. They may be near minimum size for the genus.

ORDER EDENTATA

FAMILY MEGALONYCHIDAE

Megalonyx sp.

A sloth tooth (TMM 41685-9) is referable to *Megalonyx.* It is somewhat triangular in shape, and is probably an upper anterior molariform. It is 35 high, of uniform diameter throughout its crown, and is therefore from an adult. The least diameter (anteroposterior), measured near the top of the crown, is 13.7 and the greatest diameter (transverse) is 19.0 at the same level.

The tooth is too large for *Pliometanastes* Hirshfeld and Webb, but is comparable in size to remains from Hemphillian deposits that have been referred to *Megalonyx* (Hirshfeld and Webb, 1968).

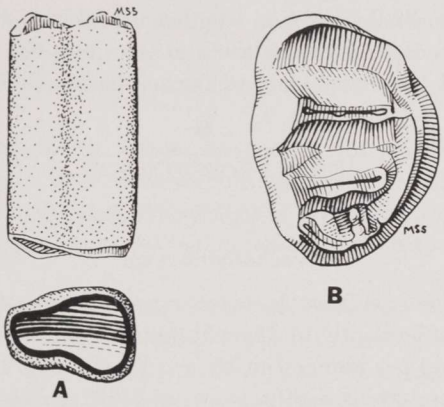

Fig. 1.—A, *Megalonyx* sp., tooth, probably upper anterior molariform, in lateral and occlusal views. B, *Paenemarmota mexicana* (Wilson), upper third molar, occlusal view.

ORDER CARNIVORA

FAMILY CANIDAE

Osteoborus cf. *O. cyonoides* (Martin)

Hyaenognathus cyonoides Martin, J. Mammal., 9:235.

The bone-eating dog is represented in the collection by one upper (11058) and one lower (11059) carnassial. The P^4 is lightly worn, and the protocone is broken away. The tooth is 27.8 long. The M_1 is almost unworn and measures 26.7 x 11.3.

The measurements of these teeth are within the range of variation for *Osteoborus cyonoides* from the Coffee Ranch local fauna of Texas (Dalquest, 1969). The lower molar is a bit lower-crowned than any of the available Texas teeth. Webb (1969) described *Osteoborus dudleyi* (White) and *O. galushai* Webb, from Hemphillian sites in Florida. The two species are approximately equal in size to the type species *O. cyonoides*, and to the specimens from Guanajuato. The Mexican teeth may represent an undescribed species but the two carnassials are not sufficient evidence to establish this.

FAMILY URSIDAE

Indarctos?

A huge, almost unworn, upper canine (11062) can only be from a bear. The root and part of the crown have been broken away. The preserved parts of the tooth are everywhere covered with enamel. A small but prominent cingulum on one side of the tooth suggests that the base of the specimen was near the true base of the tooth. There is a small ridge along the posterior face. At the base the fossil measures 28.6 x 21.9.

FAMILY FELIDAE

Machairodus sp.

A lower carnassial (11063) is from a sabertooth and is well preserved, except that one root is broken away. The blade of the tooth shows moderate wear, at the oblique angle usual in sabertooth cats. Measurements are 28.0 x 11.8. The tooth is similar to the lower first molars of *Machairodus coloradensis* Cook (for use of this name rather than *M. cato-*

copis see Martin and Schultz, 1975), but smaller. Carnassials from the Coffee Ranch local fauna of Texas range from 32.0 to 35.8 in length and 12.4 to 13.8 in breadth (Dalquest, 1969). The measurements of the Mexican tooth are like those of the carnassial of a jaw from the late Hemphillian Axtel local fauna of Texas (Mawby, 1965).

ORDER PROBOSCIDEA

FAMILY MASTODONTIDAE

Rhynchotherium sp.

All of the mastodon material from Ocote seems referable to a single genus and species, and we refer it somewhat hesitantly to *Rhynchotherium.* The most informative specimen is a fragmentary left lower jaw ramus with M_1 and M_2 (11251). The jaw is from a young animal. M_1 is greatly worn, M_2 is slightly worn, and the ramus is broken just behind the anterior edge of M_3. The anterior crest of the unerupted M_3 is visible in the broken bone. Most of the left side of the symphysis, and a bit of the side of the right symphysis, are present. The anterior end of the symphysis, with the alveolus for a tusk, is missing.

The Ocote mastodon is also represented by two tusk fragments and numerous teeth and tooth fragments. All lower teeth, except P_2, are represented and show the characteristic pattern of *Rhynchotherium.* All lower teeth except M_2 and M_3 have a low anterior crest, or cingulum, consisting of a variable number of small, usually beadlike cusps, set off from the anterior main crest by a sharp, narrow valley. The second and third molars lack an anterior crest. The main lophids consist of large, trenchant ridges, each composed of an external cusp that wears to a distinct, simple, trefoil, and an internal cusp in the form of a simple transverse lophid. In the Ocote mastodon the lingual cusps, when worn nearly to the base, exhibit an indistinct trefoil or hourglass pattern. All teeth have a posterior crest of one or two simple, flattened cusps. The posterior crest of M_3 usually is of two simple, conelike, somewhat procumbent cusps.

The cusp pattern of the lower teeth of the Ocote mastodon is like the pattern of *Rhynchotherium praecursor* (Cope), from the Blanco local fauna of Texas (Dalquest, 1975) but is slightly more complicated. In *R. praecursor* the internal cusps of the main crests are simple and wedge-like, and do not show an hourglass or indistinct trefoil pattern when worn to the base. In other features, as far as they can be compared, the Ocote and Blanco mastodon teeth are similar, and the Mexican form may be ancestral to the Blanco animal.

The mental foramen of the jaw is round, 9 in diameter, and is located 68 above the bottom of the ramus and 80 anterior to the anterior edge of M_1. The symphysis is solidly fused but there is a distinct suture. The width of the tongue groove is about 38, and the groove is semicircular in cross section. The edges of the groove are bordered dorsally by sharp edges or crests. The depth of the ramus under the middle of M_1 is about 140; breadth at this point about 81. The depth of the ramus under the middle of M_2 is approximately 140; breadth about 95.

The largest tusk fragment (8863) is about 60 long and has the complete, rounded, unworn tip. At 45 from the tip it measures 22.3 wide and 20.9 high, and is almost round. The enamel band extends halfway around the circumference of the tusk fragment.

The other fragment (11253) is only about 30 long and lacks the tip. It is oval in cross section, 20.4 x 16.4; the lesser measurement is presumably the transverse. Enamel, 2 thick, forms a ventral band 15.5 wide, but some enamel seems to have been broken away.

Upper teeth are represented only by a nearly complete third molar and several damaged and fragmentary third molars. The best specimen measures 197.0 x 89.2. There is no anterior crest. Main crests one to three are worn, especially on the outside, to expose the trefoils. Main crest four and the posterior crest are unworn. The typical pattern is exposed.

Specific identification of the Ocote mastodon is not practical at this time. The genotype of *Rhynchotherium* is *R. praecursor* Cope, 1893, from the Blanco local fauna of Texas. The Ocote animal (Hemphillian Age) is probably specifically distinct from the younger Blanco (Blancan Age) *Rhynchotherium*, but better material is required to establish this.

Three species of *Rhynchotherium* were recorded from Mexico by Alvarez (1965). The type locality of *Mastodon shepardi* Leidy is Contra Costa County, California. The specimens from the Valley of Mexico referred to this species by Cope (1884) lacked lower tusks and thus are not *Rhynchotherium*. See also Pichardo del Barrio (1961) and Ochoterena and Silva-Barcenas (1970).

The names *Rhynchotherium tlascalae* and *R. browni* are available for the Ocote mastodon, but the relationships of these forms to *R. praecursor* must be determined before identification is possible.

ORDER PERISSODACTYLA
FAMILY RHINOCEROTIDAE

Teleoceras ocotensis new species

Holotype.—TMM 41685-8, upper third molar, crown well preserved but roots mostly missing.

Referred.—Upper incisor (11065); isolated upper premolars and molars (11066-11078); lower jaw fragment with P_3-M_1 (11079); isolated lower premolars and molars (11080-11086); tusk fragment (11087); metacarpal (11090); metatarsal (11091).

Type locality.—Arroyo de la Carreta, near the Village of Los Rodriguez, District of San Miguel de Allende, Guanajuato, México; Ocote local fauna, Hemphillian age, Pliocene epoch.

Diagnosis.—A large *Teleoceras* with large upper lateral incisor, hypsodont cheek teeth, upper first premolar present, median valley of upper cheek teeth closed to form isolated or nearly isolated lakes at early age, cingula strongly developed on upper teeth.

Description.—The rhinoceros teeth from Ocote suggest a large animal, equal in size to Hemphillian species from the Great Plains. The upper incisor is shaped like the upper incisors of described species, as far as they are known, but is large. The unworn tooth is bean-shaped in lateral view, almost heart-shaped in cross section, with a trenchant edge. The enamel of the incisor is delicately wrinkled.

The first upper premolar is similar in appearance to the upper first premolars of Clarendonian and early Hemphillian *Teleoceras* from the Great Plains. Middle Hemphillian *Teleoceras* may lack the upper P^1.

Premolars ^{2} to ^{4} are represented by lightly to well worn teeth. The teeth are like Hemphillian *Teleoceras* from the Great Plains in that the enamel of the lingual borders of the teeth creates lophs that close the median valleys to form lakes. In the teeth from Ocote, however, the closure seems to have occurred at an earlier age than in specimens of *Teleoceras* from the Great Plains.

There is a single moderately worn upper M^1, but no upper M^2's. There are 5 lightly to moderately worn upper M^3's. In all of these the posterior crochet, on the metaloph, extends anteriorly to contact the protoloph. The two folds are appressed but not fused.

This condition occurs sporadically but to a lesser degree in individual teeth from Hemphillian sites on the Great Plains, but is the norm for upper molars from Ocote.

Cingula are strongly developed on upper teeth. On P^3 and P^4, cingula extend completely across the lingual margins of the teeth, and between the protoloph and metaloph are sharp ridges rising to the height of the crown and leaving deep pits externally that persist as isolated enamel islands to a late stage of tooth wear. On M^1 the cingula are similarly developed but are not as strong. There are no M^2's in the collection. On M^3, there are strong cingula at the anterolingual margin of the protoloph and at the posterior margin of the ectoloph, but the cingula do not connect across the median valley (Fig. 2). The cingula of the premolars of *T. ocotensis* are stronger than those of Hemphillian *Teleoceras* from the Great Plains of the United States, and a cingulum at the lingual border of M^1 and at the posterior end of the ectoloph of M^3 is rarely present, and if present only very weakly developed, on Hemphillian species from the Great Plains.

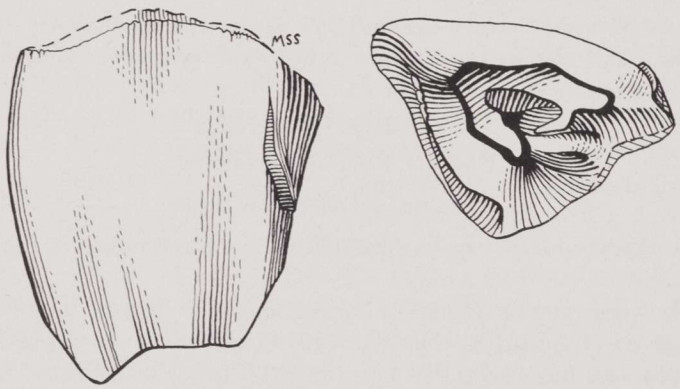

Fig. 2.—*Teleoceras ocotensis* new species, holotype, upper third molar in labial and occlusal views.

The lower dentition is represented by the jaw fragment with P_2-P_4 and numerous complete and fragmentary premolars and molars. The lower teeth seem to be like lower teeth from the Great Plains, and no distinguishing characters can be noted in them.

Etymology.—The species is named from its occurrence in the Ocote local fauna.

Discussion.—Tanner (1975) has described a stratigraphically successive series of species of *Teleoceras* from the northern Great Plains and his work has been helpful in identification of the Ocote rhinoceros. Successive species, from Miocene (Clarendonian) through the lower Pliocene, are: *Teleoceras major* Hatcher, *T. fossiger* (Cope), *T. hicksi* Cook, and *T. schultzi* Tanner. The Kimball local fauna seems to be almost exactly equivalent to the Coffee Ranch local fauna (type of the Hemphillian Land Mammal Age), and *T. schultzi* is older than the late Hemphillian *T. ocotensis.*

Teleoceras ocotensis exhibits an advanced dentition in having large, strongly hypsodont teeth. It seems to show the climax for the genus in the closure of the median valley of the molars by the crochet to form isolated lakes, a trend extending from the Miocene through the Pliocene. The Ocote rhinoceros seems to be relatively primitive, however, in the strongly developed cingula on the upper cheek teeth, large lateral incisor, and retention of the upper first premolar.

Arellano (1951) listed *Aphelops?* in his preliminary list of the Ocote local fauna, but this must be an error. We have found only *Teleoceras.*

Table 1. Measurements of teeth of *Teleoceras ocotensis.* Length of upper teeth was measured along the ectoloph and breadth at the base of the enamel. Some lower teeth called M2's may be M3's.

Upper Teeth	Lower Teeth
Incisor . . . . . 39.4 x 17.9	P2. . . . . 21.8 x 14.7
P1. . . . . 19.5 x 18.6	P3. . . . . 35.0 x 22.7
P2. . . . . 32.2 x 33.3	35.0 x 23.4
30.2 x 32.0	35.6 x 22.3
31.1 x 33.8	P4. . . . . 46.4 x 24.2
? x 29.5	42.0 x 25.6
32.0 x 34.0	M1 . . . . . 48.9 x 31.9
P3. . . . . 38.4 x 44.5	49.6 x 31.0
P4. . . . . 45.6 x 44.5	M2 . . . . . 61.7 x 32.4
M1? . . . . . 46.7 x 51.6	65.2 x 34.1
M3 . . . . . 72.2 x 51.7	60.9 x 36.7
67.9 x ?	58.8 x 32.9
71.2 x 55.0	
72.0 x 53.1	
74.5 x ?	

FAMILY EQUIDAE

Astrohippus albidens Mooser

Astrohippus albidens Mooser, 1968, Southwest. Nat., 13:2.

This is the most abundant species of horse in the Ocote local fauna. It is represented by several fragmentary lower jaws and more than two thousand isolated upper and lower teeth.

The teeth of *Astrohippus albidens* are strongly hypsodont. The upper teeth are almost straight to moderately curved. The lakes are simple, the styles moderately strong. The protocone is broadly oval in shape and usually deeply grooved on the lingual side. A hypoconal groove is absent in 90 of 176 teeth. The groove is only rarely found in the lower 40 mm of the crown. A distinct groove is present in 45 teeth, and a slender-walled hypoconal fossette was found in 41 teeth.

In the lower cheek teeth, protoconid and hypoconid are broad and flattened. Metaconid and metastylid are well elevated, are stretched and elongated, and the internal valley (linguaflexid) is sharply "V" shaped. Parastylids are weak or absent, paralophids strong and prominent. The ectoflexid (metaconid-metastylid valley) is deeper in the molars than in the premolars but does not enter into the metaconid-metastylid isthmus.

Astrohippus albidens is not strongly differentiated from *A. stockii*, but the following differences are apparent: size slightly larger, protocones longer and more deeply grooved, and linguaflexids of lower molars sharply V-shaped. Nearly all isolated lower cheek teeth of *A. albidens* have sharply V-shaped linguaflexids, and teeth thought to be molars tend to have the groove most sharply V-shaped. Permanent lower dentitions of *A. stockii* figured by Lance (1950) show U-shaped or broadly V-shaped linguaflexids.

Mooser (1973) listed *Astrohippus ansae* (Matthew and Stirton) (type from the Coffee Ranch local fauna of Texas) and *A. stockii* Lance (type from the Yepómera local fauna of Chihuahua) as members of the Ocote local fauna. The teeth illustrated by Mooser show the characters of those species but we feel that the teeth are only atavistic individuals showing the characters of more primitive species, such as might be selected from

any large collection of horse teeth. Teeth can be found in the collection that show various degrees of intermediacy between the older species and the progressive conditions that are the norm for the Ocote population, *Astrohippus albidens*. The teeth with more complicated enamel borders of the lakes, ungrooved protocones, and strongly developed hypoconal grooves, are slightly aberrant individuals of *A. albidens*. Teeth of *A. albidens* are distinctly more hypsodont than those of *A. ansae*.

Protohippus castilli Cope, from Tehuichila, Veracruz (actually in the state of Hidalgo according to Silva-Barcenas, 1969), seems referable to the genus *Astrohippus*. The holotype tooth is apparently the only representative of the species, and according to Gidley (1907), the tooth was lost. However, it must have been found, for Osborn (1918) gave a new figure of it. The tooth differs from teeth of *Astrohippus albidens* in having a strongly developed metastyle, rounded, ungrooved protocone, distinct hypoconal groove, and rather strongly curved crown. The tooth, if typical of its population, represents a more primitive species than *A. albidens*.

Table 2. Measurements of teeth of *Astrohippus albidens*. Occlusal lengths of some lower dentitions are: P_2-M_3, 116.8, 128.6; P_2-P_4, 61.0, 64.7, 68.3; M_1-M_3, 55.0, 55.6, 57.9, 61.4, 62.1, 63.9.

Lengths of isolated teeth measured 40 above bases			
	N	Mean	Range
P^2	50	23.4	21.8-25.9
P^3-P^4	100	19.9	18.6-22.6
M^1-M^2	100	18.7	16.7-22.6
M^3	50	18.3	16.5-19.9
P_2	50	20.4	18.7-22.4
P_3-P_4	100	20.8	19.9-22.1
M_1-M_2	100	18.9	17.4-21.0
M_3	50	20.9	18.8-23.5
Mean occlusal lengths and breadths of teeth in lower jaws			
P_2	4	21.8 x 10.5	
P_3	4	19.8 x 11.6	
P_4	4	19.2 x 10.9	
M_1	4	18.8 x 10.8	
M_2	4	18.0 x 10.0	
M_3	3	20.5 x 9.6	

Astrohippus albidens is the most advanced species of its genus yet described. It, or a related form, may be ancestral to the genus *Asinus*, the dominant horses of the Pleistocene of North America.

Dinohippus ocotensis (Mooser)

Hippotigris ocotensis Mooser, 1958, Anal. Inst. Biol. México, 28:360.
Protohippus muelleri Mooser, 1965. Anal. Inst. Biol. México, 35:157.
Dinohippus muelleri, Mooser, 1973, Southwest. Nat., 18:258.
Equus (Dolichohippus) mesamexicanus Mooser, 1973, Southwest. Nat., 18:261.

A large horse is represented in the Ocote local fauna by a fragmentary lower jaw ramus with P_2-M_3 (holotype of *D. ocotensis)*, a fragmentary ramus with part of P_3 and com-

plete P_4-M_3 (holotype of *D. muelleri),* about 100 upper cheek teeth and about 300 lower cheek teeth, including the holotype tooth of *E. mesamexicanus.*

This ancestral zebra was recognized and described as a zebra by Mooser. The teeth of the holotype of *Dinohippus ocotensis* are but lightly worn; crown height of P_4 is about 71; of M_2 about 64. The teeth are slender and lightly built.

Protohippus muelleri was based on a jaw fragment with greatly worn teeth. The bases of the teeth are not exposed but are certainly less than 30 in crown height, and probably less than 20. The teeth are broad and the enamel relatively thick. In spite of the heavy wear and advanced age of this individual, metaconid and metastylid of P_4 are elevated on a distinct isthmus.

The apparent differences separating these two specimens are due to difference in age at the time of death and possibly to sexual dimorphism. The type of *D. muelleri* was probably a male, the type of *D. ocotensis* a female. The large collection of isolated lower teeth includes relatively narrow specimens, probably from females, broad teeth, probably from males, and numerous intermediates also. The holotype of *D. muelleri* is near the maximum breadth for the species, but is exceeded in breadth by some isolated teeth. Some lightly worn teeth are broad and have heavy enamel. With advanced age these would resemble the holotype of *D. muelleri.* The enamel pattern, however, of these unworn teeth exhibits the characteristic features of *D. ocotensis,* including the wrinkled entoflexid characteristic of the genus *Dinohippus. D. muelleri* is a synonym of *D. ocotensis.*

Equus (Dolichohippus) mesamexicanus was based on an upper P^3 and referred upper and lower cheek teeth. Upper teeth referred to *E. mesamexicanus* had elongated and deeply grooved protocones. Upper teeth referred to *D. muelleri* had rounded, ungrooved protocones. Lower teeth referred to *E. mesamexicanus* were relatively slender. Lower teeth referred to *D. muelleri* were broad, with swollen protoconids. The differences separating lower teeth referred to *D. muelleri* and *E. mesamexicanus* are probably due to sexual dimorphism. Lower teeth of *D. interpolatus* from the Coffee Ranch local fauna of Texas can similarly be separated into slender and broad kinds, probably the result of sexual dimorphism.

Teeth with rounded, ungrooved, and posteriorly placed protocones thought to be characteristic of *Dinohippus muelleri* are probably atypical, atavistic specimens, such as often are found in large collections of horse teeth from a single locality. The teeth exhibit features more typical of *D. interpolatus* of the older Coffee Ranch local fauna of Texas. Specimens showing the protocone shape thought to be diagnostic of *D. muelleri* are very rare; specimens with the protocones slightly grooved and slightly angular are more common. These intermediate specimens and the "typical" *D. muelleri* teeth almost all appear to be premolars. Almost all of the upper teeth thought to be molars are of the *E. mesamexicanus* type, with elongated, grooved protocones. Most apparent premolars are of the *E. mesamexicanus* type also.

In the upper teeth referred to *Dinohippus muelleri* by Mooser (1973), the protoconal isthmus is very short and narrow. This is a very rare condition in the collection of large horse teeth from Ocote, and is not confined to specimens with the *D. muelleri* pattern. The extreme is reached in a tooth, otherwise typical of *D. ocotensis,* in which the protocone is completely isolated, as in the hipparions.

Lower teeth of the large horse, represented by nearly 300 specimens, do not exhibit any features suggesting that more than one species is represented. Most of these teeth,

when only lightly worn, have the floor of the entoflexid wrinkled, often greatly so. The wrinkling sometimes extends to the floor of the metaflexid as well, and the metaconid-metastylid isthmus of the premolars, less often the molars, has small, semicircular bulges. Not uncommonly the bulges on the isthmus are at the same height on anterior and posterior faces of the column, and form round, bead-like structures. The ectoflexids of the premolars are relatively short and do not enter between the metaconid and metasylid; metaconid and metastylid are perched on slender isthmuses. The ectoflexids of the molars are deep and blunt-ended, usually almost square-ended, and do penetrate between metaconids and metastylids. Often there is no true metaconid-metastylid isthmus but instead a short antroisthmus and postisthmus along the edges of the ectoflexid, while the metaconid and metastylid are widely separated and connected by a metaisthmus (for explanation of terms see Skinner, 1972). Premolars and molars are easily recognized, even in advanced stages of wear.

The characters thought to separate upper teeth of the three nominal species of large horses in the Ocote local fauna grade into one another, and are now thought to be the result of differential wear on the teeth, sexual dimorphism, and individual variation within a species. The lower cheek teeth cannot be separated and, as a group, exhibit a suite of characters unique in the Ocote horse fauna. All of these specimens probably belong to one species, for which the oldest name is *Hippotigris ocotensis (Dinohippus ocotensis).*

Dinohippus ocotensis differs from *D. mexicanus* (Lance), from the Yepómera local fauna of Chihuahua, in having the protocones of the upper cheek teeth more elongate, more angular, more deeply grooved, and in having an anterior extension or spur extending in advance of the isthmus. (We refer here to the large dentitions figured by Lance, 1950, figs. 4 and 5. The holotype dentition of *D. mexicanus* is so much smaller than the larger referred specimens that we wonder if more than one species might be involved.)

Dinohippus ocotensis differs more from *D. interpolatus,* of the Coffee Ranch local fauna of Texas, than it does from *D. mexicanus. D. interpolatus* has the upper cheek teeth shorter-crowned, more curved, protocone round or oval, with no or virtually no lingual groove, and almost never is there a trace of an anterior spur extending anterior to the protoconal isthmus. Lower cheek teeth of *D. interpolatus* are somewhat shorter-crowned than those of *D. mexicanus* and *D. ocotensis* but no other consistent differences between the three species were found.

The characters of *Dinohippus ocotensis* are very close to those of the Blancan zebra, *Dolichohippus simplicidens* (Cope). The Blancan zebra is larger, the anterior spur on the protocone larger, and the wrinkling of the enamel of the floor of the entoflexid does not extend as far down the crown as it does in the Hemphillian species. Greater differences in the skull and post-cranial skeleton probably exist, and the Blancan and Hemphillian species properly belong in separate genera. However, it seems clear that a species of *Dinohippus,* possibly *D. ocotensis,* was ancestral to *Dolichohippus simplicidens.*

Both upper and lower teeth of *Dinohippus ocotensis* change in proportions along the height of the crown. Usually the diameter of a tooth is smaller and relatively shorter anteroposteriorly near the base than near the top of the crown. An upper premolar, probably P^4, with the occlusal surface very slightly worn and roots just formed, crown height 71.2, was measured at 20, 40 and 60 above the base of the enamel. Anteroposterior diameters are: 24.5; 25.8; 26.8. A lower P_3, crown height 71, at similar increments above the base of the enamel, measured: 25.6; 26.0; 28.0. Tapering of teeth is not consistent. Some teeth show greater tapering but others retain almost uniform diameter throughout the height of the crown. Comparable measurements can be obtained only at

a uniform height above the bases of teeth. Breadth of teeth of *Dinohippus* can be accurately measured only at the occlusal surface; elsewhere the enamel is partly concealed by cementum. Length of cheek teeth can be measured almost anywhere along the length of the crown. In measurements of horse teeth used here, only the length of the tooth is given, unless otherwise specified. Measurements of teeth of *Dinohippus ocotensis* were taken 35 above termination of the tooth enamel.

Upper P^2's (14 teeth) ranged from 30.4 to 36.0. Larger teeth are probably males and smaller ones females but the series is too small to show a distinctive curve.

M^3's (27) form a bimodal curve. Probable female teeth range from 20.9 to 23.7; probable males from 24.3 to 27.2.

Upper P^3-M^2's cannot be separated with certainty on morphological features and measurements are not given here. The 105 teeth in this group include eight possible classes: males and females of P^3, P^4, M^1, and M^2.

Lower P_2's (28 teeth) ranging from 27.1 to 29.5 may be females and from 29.5 to 31.7 may be males. Lower M_3's (55 teeth) measuring 26.0 to 28.6 are probably females and from 29.1 to 31.2 are probably males.

Lower premolars and molars are readily separated, but P_3 cannot be distinguished from P_4 and M_1 cannot be distinguished from M_2.

The P_3-P_4 (121 teeth) measurements do not form a curve that can be readily separated into four classes. Doubtless there is considerable overlap in measurements of teeth of males and females, and of P_3 and P_4. However 99 teeth (82%) range between 23.6 and 26.7 and this is the typical length for the lower P_3 and P_4 of *D. ocotensis.*

Overlapping of measurements also must be responsible for the lack of four distinct classes in measurements of lower M_1-M_2's (111 teeth). However 107 teeth (96%) range from 22.2 to 25.0.

Maximum crown height in upper P^2 of *D. ocotensis* is approximately 64; of upper M^3, about 60. Maximum crown height of lower P_2 is 50.7; P_3 or P_4, 75.0; of M_1 or M_2, 71.1; of M_3, 68.2.

Measurements of the dentition of the holotype jaw of *D. ocotensis* (measured at the occlusal surface) are: P_2-M_3, 163.0; P_2-P_4, 82.6; M_1-M_3, 80.4; P_2, 30.0 x 13.3; P_3, 27.0 x 15.0; P_4, 25.4 x 12.5; M_1, 25.0 x 11.5; M_2, 27.0 x 11.2; M_3, 28.4 x 9.0.

Measurements of the dentition of the holotype jaw of *Protohippus muelleri* are: P_4-M_3, 99.3; M_1-M_3, 75.2; P_4, 24.5 x 17.0; M_1, 22.8 x 13.5; M_2, 22.5 x 13.5; M_3, 29.5 x 12.5. The greatly worn teeth are relatively shorter than would be the case were they measured 35 above the base of the enamel.

The holotype upper P^3 of *Equus (Dolichohippus) mesamexicanus* measures 26.7 x 26.0.

Neohipparion otomii Mooser

Neohipparion otomii Mooser, 1960, Anal. Inst. Biol. México, 30:376.

When Mooser described *Neohipparion otomii* he designated as the holotype a series of 12 upper molars and premolars, selected from his large collection, not from one individual horse, and two lower jaw fragments. Silva-Barcenas (1969:10) noted that this was incorrect, and selected as lectotype a lower jaw fragment (MWU 11378) with the complete and well-preserved cheek tooth series.

The common *Neohipparion* of the Ocote local fauna is represented by two fragmentary jaws and more than two hundred isolated teeth. *N. otomii* is similar to *N. floresi* Stirton, of the Yepómera local fauna, but the protocones of the upper teeth are elongated and have pointed ends rather than the "fishtail" shape typical of *N. floresi.* The pli

caballin of the Ocote horse is usually bifurcated, a rare condition in the Yepómera horse. *N. otomii* seems to be related to, probably is descended from, but is more advanced than *N. floresi.*

In 18 upper P^2's, the protocone is isolated in 4 teeth, united to the protoselene by a narrow isthmus in 13, and by a broad isthmus in one. Eight teeth have a small, slender, simple pli caballin and 10 have the pli caballin doubled or even more complicated. In only 7 teeth are the fossettes normal and separated. In 11 teeth the labial borders are fused to form a single heavy enamel band across the tooth. In 7 of these teeth the thin enamel forming the complicated anterior, lingual and labial borders of the fossettes is joined to form a single large fossette. In four teeth the thin enamel, medially, abuts the thick labial enamel to form two fossettes dependent from the labial border.

Intermediate teeth (P^3-M^2) are hypsodont: the highest crown measures 74 mm, and there are numerous teeth exceeding 68 mm. All teeth are slightly curved, and fossettes are extremely complicated. Premolars are separated from molars by larger size, thicker enamel, and bolder enamel pattern. P^3 cannot be distinguished from P^4, and M^1 cannot be separated from M^2. Measurements of 25 upper P^3's and P^4's range from 23.0 to 26.2 x 17.0 to 22.7; means 23.7 x 19.2. Measurements of 35 upper M^1's and M^2's range from 19.1 to 22.2 x 14.4 to 21.8; means 20.9 x 19.5.

Thirty upper M^3's have isolated protocones, complicated fossettes, simple pli caballins, and long, curved crowns. Maximum height is 71.4. Measurements are: 20.7 to 26.6 (mean 22.7) x 16.2 to 19.2 (mean 17.5).

The lower cheek teeth of *Neohipparion otomii* are distinctive. The metaconid and metastylid are rounded and prostrate, their axes nearly parallel with the anteroposterior axis of the tooth. The intervening linguaflexid is broadly and shallowly "U" shaped or, in about half of the teeth, "W" shaped, with a prominent median spur. The metaconid-metastylid isthmus is of complicated shape, usually with slender anterior and posterior projections. Paralophids and parastylids are strong and prominent. Premolars 3 and 4 cannot be distinguished from molars 1 and 2.

The highest P_2 measures 74.5. Measurements of 36 lower P_2's are: 19.8 to 24.9 (mean 22.0) x 9.7 to 12.5 (mean 11.0). The highest M_3 measures 72.5. Measurements of 25 lower M_3's are: 22.5 to 27.0 (mean 25.2) x 9.8 to 11.4 (mean 10.3).

Neohipparion monias Mooser

Neohipparion monias Mooser, 1964, Anal. Inst. Biol. México, 34:394.

This species was described on the basis of two upper molars (MWU 11130, holotype; MWU 11131, paratype). The teeth differ from the upper molars of *Neohipparion otomii* as follows: crowns very high, teeth narrow anteroposteriorly, lakes compressed and simple, pli caballin obsolete, and protocones lingually placed.

We were tempted to consider this form a synonym of *Neohipparion otomii* but, if the listed characters are simply extreme variants of that species, we should expect to find teeth showing intermediate conditions, but we did not. Further, just as the characters of *N. otomii* suggest relationship to but advance over *N. floresi* Stirton, of the Yepómera local fauna of Chihuahua, so do the characters of *N. monias* show relationship to but advance over *N. arellanoi* Stirton, of the Yepómera local fauna. Stirton (1955) noted that the collecting sites containing remains of *N. floresi* and *N. arellanoi* were different, but were close together and at the same stratigraphic level. Perhaps the ecological demands of *N. otomii* were different from those of *N. monias*, and the latter rarely visited the Ocote habitat, where *N. otomii* was common.

Stirton (1955) suggested that *Neohipparion arellanoi* might prove to be a synonym of *N. floresi*, and *N. monias* may yet prove to be a synonym of *N. otomii*. However, at this time it appears that *N. otomii* is a species descendent from *N. floresi* and *N. monias* is the lineal descendant of *N. arellanoi*.

The holotype tooth of *Neohipparion monias* measures 20.3 x 21.8; the paratype measures 19.2 x 21.0.

Nannippus aztecus Mooser

Nannippus aztecus Mooser, 1968, Southwest. Nat., 13:7.

Nannippus aztecus is known from the holotype maxillary, two mandibular fragments, and about 80 isolated cheek teeth. It is a diminutive species, whose relations are clearly with *N. minor* (Sellards) of the Hemphillian of Florida. Lance (1950) referred tiny *Nannippus* remains from the Yepómera local fauna of Chihuahua to *N.* cf. *minor*, and this material also is close to *N. aztecus*. The collection from Ocote is relatively large. Unfortunately, tiny *Nannippus* from elsewhere are known from relatively few specimens.

The holotype maxillary of *N. aztecus*, carefully described by Mooser (1968), is from an aged individual. The protocones are connected to the protoselenes in all three premolars, a condition thought by Mooser to be the result of wear. However other teeth, including some that are certainly P^3's and P^4's, are as worn as the teeth of the holotype, or even more so, but the protocones of these teeth are isolated. Teeth of *Nannippus aztecus* are extremely hypsodont, and the enamel pattern remains almost to the bottom of the teeth; typically, the protocones of all cheek teeth except P^2 are isolated to the base. We now regard the connected protocones of P^3 and P^4 of the holotype as an abnormal condition, exposed only near the tooth base.

Dr. S. David Webb has provided specimens, including a cast of the neotype palate, of *Nannippus minor*. This small collection, like that from Ocote, includes a seemingly disproportionate number of greatly worn teeth. In lightly to moderately worn upper teeth from Ocote, the protocones are slender ovals, and the oval shape, though it becomes broader with wear, remains consistent, even in aged horses. In *N. minor* the protocones are rounded, even in young individuals, and become almost perfectly round with age.

Until greatly worn, upper teeth of *N. minor* have strongly developed pli caballin folds on both premolars and molars. The premolars of *N. aztecus* have strong pli caballin folds but M^1 has only a slight fold, and M^2 and M^3 have none. There is some question as to the consistency of this last character, for identification of isolated teeth, other than P^2 and M^3, is often difficult, and the comparative material of *N. minor* is limited.

In lower cheek teeth, faint parastylid ridges are present in *N. aztecus* but are absent in *N. minor*. In both species the ectoflexid penetrates the protoconid-hypoconid isthmus of the molars but not the premolars.

Material available suggests that *Nannippus minor* and *N. aztecus* are distinct species. More and better material from Florida might show the apparent differences to not be significant. *N.* cf. *minor*, from the Yepómera local fauna, may be closer to *N. aztecus* than to *N. minor*.

None of the upper teeth of *Nannippus aztecus* appear to be near full crown height. Three lower teeth, probably premolars, are between 34 and 35 high, and appear to be near full crown height.

Upper and lower P2's and M3's are readily identified, and lower P_3 and P_4 are easily separated from M_1 and M_2. Some uncertainty exists as to separating the remaining upper cheek teeth, but it is felt that the teeth are probably correctly placed, and not more than

one tooth from their proper position in any case (e. g., some teeth termed M^1's might be M^2's, etc.). There is some doubt as to separation of lower P_3 from P_4, but most are probably correctly identified. We are unable to separate lower M_1's from M_2's. The measurements that follow are means; figures in parentheses are the number of teeth measured. All teeth are lightly to moderately worn; none are of aged individuals.

Upper P^2 (1), 18.1 x 4.4; upper P^3 (2), 16.1 x 14.8; upper P^4 (3), 14.8 x 13.8; upper M^1 (3), 14.1 x 13.4; upper M^2 (3), 13.6 x 13.0; upper M^3 (6), 13.3 x 11.2; lower P_2 (2), 16.1 x 7.9; lower P_3 (5), 14.3 x 8.3; lower P_4 (4), 14.1 x 7.9; lower M_1 or M_2 (9), 13.5 x 7.3; lower M_3 (5), 16.1 x 6.5.

The diminutive species of *Nannippus* seem to be limited to southern Hemphillian localities, from Florida to Mexico. Wherever found they are associated with large species, except at Yepómera, Chihuahua, where no large species has been reported. A few fossils seem to suggest that the line of tiny species extended into the Blancan age, but specimens discovered to date are poor.

Nannippus hesperides Mooser

Nannippus hesperides Mooser, 1968, Southwest. Nat., 13:10.

The only material representing a large *Nannippus* found to date at Ocote is an upper tooth, probably an M^1, and a worn lower P_3 or P_4. The species is the rarest horse in the fauna. Only the lower tooth was figured in the original description. The holotype (though only lightly worn and well preserved) has the occlusal surface eroded, and the enamel pattern could not be clearly distinguished. The occlusal surface of the tooth has been sanded and polished to reveal the enamel pattern (Fig. 3). The crown height was originally 57. The tooth measures 18.6 x 14.3. The lower premolar measures 17.4 x 10.3.

Nannippus hesperides is very similar to *N. lenticularis* (Cope), from the Coffee Ranch local fauna of Texas. An upper M^1 from the Coffee Ranch is in almost the identical stage of wear to the holotype tooth of *N. hesperides.* It measures: crown height, 53.5; diameter, 19.0 x 14.0. Seven lower P_3's and P_4's, in the same stage of wear as the lower tooth from Ocote, have mean diameters of 18.1 x 9.9.

Nannippus montezuma (Leidy) [*Hippotherium montezuma* Leidy, 1883, type from "Lacualtipan," now Zacualtipán, Hidalgo] is apparently known only from the holotype, an upper P^3. The crown is 47 high, and appears from the figure (Osborn, 1918:198) to be but slightly worn. The diameter is 19.5 x 17. The protocone is long and slender with pointed ends but would doubtless appear more lens-shaped when worn more deeply. The anteroposterior length of the tooth is within the range observed in *N. lenticularis* from the Coffee Ranch but the stated breadth is extreme, and may be an error. The enamel pattern, including shape of protocone, can be matched by lightly worn upper teeth from the Coffee Ranch and by the holotype of *N. aztecus.*

Nannippus peninsulatum (Cope) [*Hippotherium peninsulatum* Cope, 1885, type from Tehuichila, Veracruz, actually from the state of Hidalgo, according to Silva-Barcenas, 1969], is known from an upper tooth, probably an M^2. The tooth is high-crowned (51.1) and, to judge from the figure (Osborn, 1918:198), only lightly worn. It measures 17.5 x 15.0. The protocone is elongated and has pointed ends; it will probably show a lens shape on further wear. This tooth too can be matched by specimens from the Coffee Ranch local fauna of Texas, but the crown appears to be more curved than is usual in *N. lenticularis.*

Thus three species of large *Nannippus* have been named from the Hemphillian of Mexico, two from single teeth and one from two teeth. All three appear doubtfully distinct from *N. lenticularis*. Gidley (1907) considered *Nannippus peninsulatum* to be synonymous with *N. montezuma*. Better material may show that all or some of the nominal Mexican species are valid, or may be synonymous with *N. lenticularis*. *Nannippus montezuma* (Leidy) has priority over the three younger names. Until the relationships of the large *Nannippus* are determined, we suggest that all four names be retained.

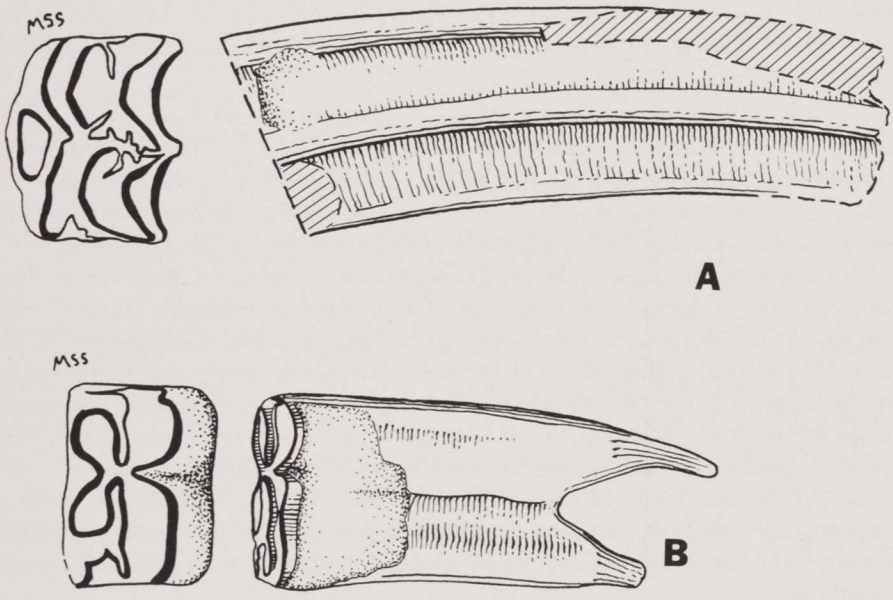

Fig. 3.—*Nannippus hesperides* Mooser. A, upper tooth, probably first molar, holotype, in labial and occlusal views. B, lower tooth, probably third or fourth premolar, in labial and occlusal views.

ORDER ARTIODACTYLA

FAMILY TAYASSUIDAE

Desmathyus brachydontus new species

Holotype.—TMM 41685-13, lower third molar, probably of a male.

Referred.—19 upper third molars, 27 lower third molars, 11 upper second molars, 10 lower second molars, 69 other isolated cheek teeth, and two tusk fragments.

Type locality.—Arroyo de la Carreta, near the village of Los Rodriguez, District of San Miguel de Allende, Guanajuato, Mexico; Ocote local fauna, Hemphillian Age, Pliocene Epoch.

Diagnosis.—A very large peccary, larger than *Desmathyus pinensis* Matthew, the type of the genus, and other described species. Almost exactly the size of the Blancan-age *Platygonus bicalcaratus* Cope. Distinguished from described species of *Desmathyus* by small but distinct posterior lobe of upper M^3 and cusps of molars only lightly wrinkled. Readily distinguished from species of *Platygonus* by extremely brachydont dentition.

Description.—The holotype tooth is beautifully preserved except that the roots have been damaged. The crown is almost unworn. The 46 referred upper and lower third molars are also well preserved and range from unworn to moderately worn. In all of these teeth the cusps are only moderately wrinkled, the valleys are deep and sharp, and the cingula are strong. The enamel pattern, in occlusal view, is almost identical to that of *Platygonus bicalcaratus* Cope, from early Blancan deposits of the Great Plains of the United States, except that the cusps lie closer together, more appressed at their tips, than in the Blancan animal. In unworn teeth the tips of the cusps are barely separated while in *P. bicalcaratus* the cusps are well separated. In lateral view, however, *D. brachydontus* differs from all described *Platygonus* in its strongly brachydont teeth. In upper and lower third molars in comparable stages of wear, teeth of *D. brachydontus* are readily identified in all instances.

Dr. David S. Webb has pointed out that the present peccary teeth from Ocote are best referred to *Desmathyus* rather than to *Platygonus*, and that similar teeth occur in Hemphillian deposits in Florida. Dr. Webb kindly provided several specimens from Florida, and resemblance of Florida and Mexican fossils is close. Measurements of Florida teeth are within or nearly within the range of variation found in Mexican teeth but the Florida teeth have the cusps of the third molars more wrinkled. Of 26 lower M_3's from Ocote, one has the posterior cusp as wrinkled as does the single Florida M_3, and another tooth has the anterior cusp as wrinkled as the anterior cusp of the single lower M_3 from Florida. The enamel pattern of the Ocote teeth is relatively simple and none have both cusps as wrinkled as does the Florida tooth. An upper M^2 from Florida has the cingulum stronger and more wrinkled than any of 10 upper M^2's from Ocote. Two lower M_2's from Florida are available, one measuring 21.4 in length (equal to the longest upper M^2 from Ocote) and one measuring 21.6 (exceeding all Ocote teeth in length). The cusps and cingula of these teeth are also more complicated than those of the Ocote teeth. Differences are slight but, in view of the limited material available for comparisons, appear to be significant.

Only upper and lower second and third molars were studied. The 69 other teeth available include premolars and first molars of juvenile, mature and senile peccaries, and it has proven impossible to determine with certainty the correct place in the tooth row of many teeth, or even to separate some upper from lower teeth. Upper third molars,

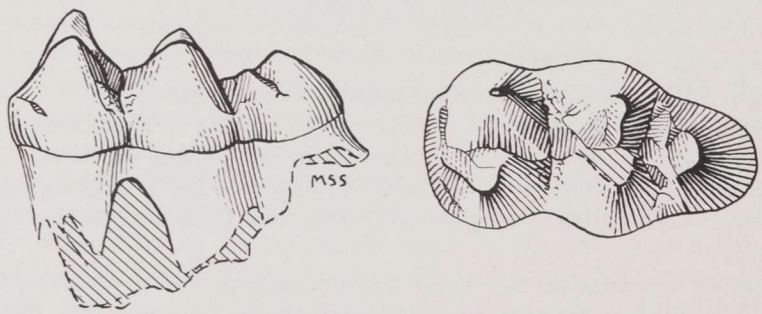

Fig. 4.—*Desmathyus brachydontus* new species, holotype, lower third molar, in lingual and occlusal views.

however, have small but well-developed posterior lobes (variably present in species of *Platygonus)* that give the tooth a triangular appearance, and upper second molars are large, almost square, and have heavy cingula. Lower third molars are quite elongated, have strong posterior lobes and lack cingula. Lower second molars resemble upper second molars but cingula are weak or lacking.

Measurements of molars were made at the base of the crown, where the enamel has its greatest dimensions. Measurements of length of upper third molars, and of length and breadth of lower third molars, form bimodal curves. Possibly there was sexual dimorphism in size of these teeth in *Desmathyus brachydontus*, as there is in the domestic pig. However, such size difference in the sexes is not strong in living peccaries, so far as I can discover, nor has it been reported in *Platygonus*. Possible male and female specimens are grouped together in Table 3.

A fragment of upper tusk has a maximum diameter of 22.3 x 13.5, and a fragment that appears to be of a lower tusk has a maximum diameter of 17.6 x 15.6.

Table 3. Measurements of upper and lower molars of *Desmathyus brachydontus*.

		Length		Breadth	
	N	Mean	Range	Mean	Range
M^2	11	20.8	19.7-23.0	17.1	14.2-19.4
M^3	19	24.8	22.6-27.6	18.2	16.6-20.8
M_2	10	20.7	19.2-21.4	15.9	14.2-17.0
M_3	26	29.4	25.8-34.4	16.6	14.8-19.8

Etymology.—The name is based on the extremely brachydont teeth characteristic of the species.

Discussion.—*Desmathyus* (including *Pediohyus* Loomis) is known primarily from early Miocene sites of the Great Plains area of the United States (Matthew, 1907; Loomis, 1910) but the genus has been little mentioned in recent years. During the Clarendonian and Hemphillian ages, the common peccary of the Great Plains was *Prosthenops*. It now appears that *Desmathyus* was displaced southward where it persisted to give rise to Blancan and Pleistocene species of *Platygonus*.

Webb has noted (personal communication) that the *Desmathyus* of the Hemphillian of Florida is almost intermediate between *Desmathyus* and *Platygonus*, and the same is true of the Ocote peccary. Direct comparison of teeth of *D. brachydontus* with Blancan specimens of *Platygonus bicalcaratus* shows that Matthew (1924) was correct in considering *Desmathyus* to be the ancestor of *Platygonus*. A hiatus remains between known Hemphillian species of *Desmathyus* and *Platygonus bicalcaratus*, but specimens demonstrating the transition may eventually be found in deposits on the Mexican Plateau.

FAMILY CAMELIDAE

Megatylopus cf. *Megatylopus matthewi* Webb

Megatylopus matthewi Webb, 1965, Bull. Los Angeles Co. Mus. Sci., 1:42.

Several isolated camel teeth are very well preserved and are referable to *Megatylopus.* Direct comparison with topotypes from the Coffee Ranch of Texas shows no significant differences.

Cheek teeth, especially upper teeth, of Hemphillian camels taper upward swiftly. The upward taper is less in the anteroposterior diameter, and measurements of length taken at a uniform height above the base of the enamel are usually comparable. The taper in the transverse diameter, however, is often so great that a difference of a millimeter or two in the height at which measurements are made will result in significant differences. Measurements of transverse diameter of camel teeth, especially upper teeth, must be used with caution.

Two upper P^3's (8869, 8870), 5 mm above the base measure 24.9 x 14.5 and 25.4 x 14.1. Two teeth that are probably upper M^1's (8866, 8868) measure, 25 above the base, 44.4 x 29.6 and 43.3 x 28.1. A tooth thought to be the upper M^2 (8864) measures 49.6 x 38.5 at 25 above the base and lower M_1 or M_2 (8865) measures 50.9 x 23.2.

Pliauchenia sp.

A fragment of lower jaw with part of M_2 and complete M_3 (8871), two isolated lower M_2's, or M_3's with the posterior lobe broken away (8867, 11238), and an astragalus (11240), represent a large camel, much smaller than *Megatylopus,* but too large and heavy-jawed for a species of *Hemiauchenia.* Teeth are like those of the large camel from the Coffee Ranch of Texas that has been referred to *Pliauchenia.*

The M_3 in the jaw fragment (8871) measures (10 above base) 40.8 x 18.5. The lower M_2 (or damaged M_3) measures (10 above base) 44.4 x 16.1. The astragalus measures: greatest length, 65.5 plus; greatest breadth, 48.0.

Hemiauchenia sp.

There are ten complete molars, some tooth fragments, and four astragali, apparently referable to *Hemiauchenia.* The teeth are much smaller and more lightly built than teeth of *Pliauchenia* sp., but larger and higher-crowned than teeth of *Palaeolama guanajuatensis.* They differ additionally from teeth of *Palaeolama* in that the styles of the molars are distinctly weaker and less prominent. The *Hemiauchenia* teeth closely resemble teeth referred to *Hemiauchenia* from the Coffee Ranch local fauna of Texas. If more complete material were available, the Ocote camel might prove to be specifically distinct but, until such specimens are found, it seems best to leave the specific identity undetermined.

Measurements of teeth (5 above base of enamel) are: upper M^1 or M^2 (2), 25.7 x 18.1, 25.4 x 17.7; lower M_1 or M_2 (5), 24.5 x 13.7, 25.6 x 14.8, 24.3 x 14.0, 26.7 x 13.2, 24.3 x 14.2; lower M_3 (3), 33.5 x 14.0, 30.8 x 13.2, 32.2 x 14.8. The astragali measure: greatest length, 60.6, 56.2, 54.2, and 51.0; greatest breadth, 41.2, 39.8, 39.8, and 38.8.

Palaeolama guanajuatensis new species

Holotype.—TMM 41685-11, upper third premolar, well preserved except that the roots are broken away.

Referred.—Right maxillary (9010) largely encased in hard matrix but crowns of P^3 and P^4 exposed, M^1 broken away, M^2 and M^3 present; 75 isolated upper and lower cheek teeth; 4 astragali; 1 medial phalanx.

Type locality.—Arroyo de la Carreta, near the village of Los Rodriguez, District of San Miguel de Allende, Guanajuato, Mexico; Ocote local fauna, Hemphillian Age, Pliocene Epoch.

Diagnosis.—A tiny camel, approximately the size of the modern domestic llama. Differing from Hemphillian and Pleistocene species of *Hemiauchenia* in smaller size, shorter-crowned teeth, upper P^3 with three rather than two roots, and styles of lower molars better developed. Similar to Pleistocene species of *Palaeolama* in size and basic tooth pattern but styles not as well developed and ectoloph between styles gently convex rather than drawn out into ribs.

Description.—The holotype tooth is well preserved and only lightly worn. It measures 11.7 x 10.0, is triangular in shape, has a single open crescent of moderate depth, and shows the remains of three roots. The tooth is essentially similar to upper P^3's of *Palaeolama mirifica* (Simpson) (Webb, 1974). There is a lightly worn lower P_4 (9005) measuring 14.8 x 7.3, and a moderately worn P_4 (9013), measuring 13.7 x 7.9. Both have the typical, complicated enamel pattern of *Palaeolama* (Webb, 1974:181).

The maxillary fragment is largely unprepared, but most of the teeth are exposed. Further preparation might endanger the specimen. The moderately worn P^3-M^3 has an

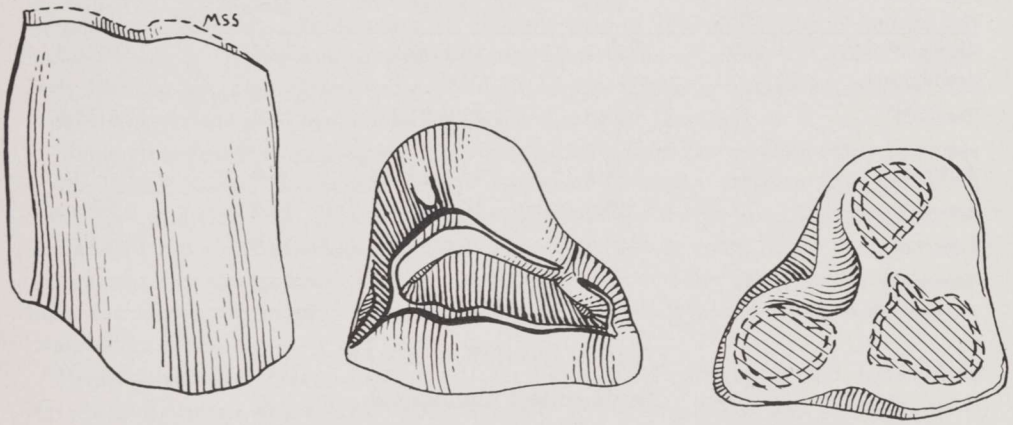

Fig. 5.—*Palaeolama guanajuatensis* new species, holotype, upper third premolar, in labial, occlusal and inferior views.

alveolar length of about 84.5. The occlusal length of the individual teeth, measured along the ectoloph, are: P^3, 11.1; P^4, 12.0; M^1, ? ; M^2, 23.5; M^3, 23.0. The premolars are smaller than, and the molars approximately the size of, the few specimens of *Palaeolama* available to Webb (1974) from Florida.

Upper and lower molars are well represented in the collection. The teeth are small and brachydont. They closely resemble teeth of the living domestic llama of South America, and the Pleistocene *Palaeolama mirifica*. They are readily separated, however, by the

relatively poor development of the ribs (the sharp labial bulges) of the upper and lower molars. *P. guanajuatensis* is congeneric with and probably ancestral to *P. mirifica.*

Etymology.—The species is named for the Mexican state of Guanajuato.

Discussion.—Small camels are known from Hemphillian deposits of the United States, but those we have seen seem referable to the genera *Hemiauchenia* or *Pliauchenia.* The presence in the Ocote local fauna of a species of camel probably ancestral to the Pleistocene forms of *Palaeolama* of the southeastern United States and South America suggests that the origin of the South American camelids took place in Mexico during Hemphillian times. Both *Palaeolama* and *Hemiauchenia* occur in the Ocote local fauna and are well differentiated. Divergence or radiation of the ancestral llama stock must have occurred in early Hemphillian or Clarendonian time.

Measurements.—All teeth were measured 5 above the base of the enamel. In llamas, the upper M^2 is larger than M^1, and the posterior lobe of M^3 is relatively narrow. However, in the series of isolated upper molars from Ocote, we could not reliably separate M^1 from M^2, and even have doubts about the identity of some M^3's. Variation in relative development of the posterior lobe causes extreme variation in the length of lower M_3.

The four astragali measure: greatest length, 48.1, 41.3, 41.2, 38.2; greatest breadth, 30.1, 28.4, 27.3, 25.0. The greatest length of the calcaneum is 85.9. The ungual phalanx measures: greatest length, 78.0; breadth at proximal end, 20.0; midshaft breadth, 11.0; breadth of distal end, 16.1.

Table 4. Measurements of teeth of *Palaeolama guanajuatensis.*

		Length		Breadth	
	N	Mean	Range	Mean	Range
Upper M^1-M^2 (combined)	30	21.2	18.1-23.6	15.7	13.0-18.5
Upper M^3	17	22.6	21.0-24.2	15.0	12.5-16.6
Lower P_4	2	14.4	14.1-14.6	8.0	7.7- 8.2
Lower M_1	7	18.6	17.4-20.8	10.9	9.2-14.3
Lower M_2	9	20.9	20.0-21.9	10.9	10.0-11.7
Lower M_3	12	26.5	21.1-29.5	11.2	9.7-12.8

FAMILY ANTILOCAPRIDAE

Unidentified Antilocaprid

A large antilocaprid was common at Ocote, and the collection contains a maxillary fragment with M^1-M^3 (8872) and many isolated upper and lower cheek teeth.

The teeth are large and hypsodont. They are of the proper size to refer to *Hexobelomeryx fricki* Furlong, of the Hemphillian of Florida (see Webb, 1973). In view of the large number of described species of Hemphillian antilocaprids, and in the absence of a horn core from Ocote, the prongbuck from Ocote is left unidentified.

Teeth of antilocaprids are strongly wedge-shaped, broader above than near the base. Measurements are comparable only when taken at a uniform level above the base of the tooth enamel. The Ocote teeth were measured 20 above the base of the enamel. Upper M^1's are difficult to separate from M^2's. At 20 above the base of the enamel, diameters of M^1's and M^2's overlap. However, M^1's are less wedge-shaped than M^2's, and higher on the crown the M^2's are longer than teeth here identified as M^1's.

Table 5. Measurements of teeth of unidentified antilocaprid.

		Length		Breadth	
	N	Mean	Range	Mean	Range
Upper M^1	10	12.5	10.8-13.7	9.5	8.1-11.7
Upper M^2	8	13.4	12.0-14.0	10.7	9.7-11.7
Upper M^3	15	18.6	16.7-20.3	10.0	9.4-11.3
Lower M_1	1	10.2		6.1	
Lower M_2	11	12.9	12.0-14.5	6.9	6.5-7.8
Lower M_3	6	23.8	22.5-24.1	7.2	6.8-7.5

AGE AND RELATIONSHIPS OF THE OCOTE LOCAL FAUNA

Since there are no sequential strata at the Ocote collecting site that might aid in accurate dating of the Ocote sediments and, so far as we know, no datable volcanic ashes or basalts intimately associated with the sediments, the position of the Ocote local fauna among described Hemphillian local faunas must be determined by biostratigraphic correlation with other local faunas.

The Ocote local fauna is clearly of late Hemphillian age. In comparisons with Clarendonian and early Hemphillian local faunas, the evolutionary level of the Ocote mammal species is much advanced over species of the older faunas. On the other hand, the Ocote local fauna is much older than described early Blancan local faunas. By the Blancan age, rhinoceroses *(Aphelops, Teleoceras)*, so characteristic of Hemphillian local faunas, had become extinct. Of the four genera of Ocote horses, *Neohipparion* was extinct by the early Blancan age, *Dinohippus* had evolved into *Equus (Dolichohippus)*, *Astrohippus* had evolved into *Asinus* and only *Nannippus* persisted into the Blancan.

Mammalian fossils of middle and late Hemphillian age are known from many localities in the United States. However, except in Texas and Nebraska, there are few up-to-date faunal lists available from these sites, making difficult the correlation of the Ocote local fauna with that from elsewhere. The lack of microvertebrate fossils, such as shrews and mice, is another serious obstacle to correlation. Nevertheless the Ocote fossils, and especially the horses, do permit rather close placement of the Ocote local fauna in the late Hemphillian series.

Hemphillian local faunas from the Great Basin, the Pacific Coast and eastward to Nevada and Arizona differ significantly from the Ocote local fauna. For example, Shotwell (1958 and elsewhere) lists *Hipparion* and *Neohipparion*, but not *Nannippus* or any of the caballine horse genera, from Oregon. MacDonald and Pelletier (1958 or 1961) and MacDonald (1959) list only *Pliohippus* from the Hemphillian of Nevada, other than the occurrence of *Neohipparion leptode* Merriam from the Thousand Creeks local fauna, and Lindsay and Tessman (1974) similarly list only *Pliohippus* from Hemphillian local faunas of Arizona. The significance of the rarity of hipparion horses in the southwest, and the apparent absence of caballine horses in Oregon, during Hemphillian time, is unclear. Both tribes are represented in most Hemphillian local faunas of the Great Plains and in Chihuahua. On present evidence it would seem best to avoid attempts to correlate the Ocote local fauna with Hemphillian local faunas from the western United States.

In the eastern United States, Hemphillian land mammals are known only from Florida (Webb, 1969). Complete faunal lists are not available but horses include a tiny *Nannippus*

much like *N. aztecus* from Ocote along with a larger *Nannippus (N. ingenuus* Leidy), apparently similar to *N. hesperides* Mooser, an advanced species of *Osteoborus (O. dudleyi)* the size of the Ocote hyaenoid dog, and other faunal elements resembling those of Ocote. Detailed comparison of the Ocote local fauna with the mammals of the upper Bone Valley fauna would be informative, but is not possible at this time.

A Hemphillian fauna has been listed from Nebraska by Schultz, Schultz and Martin (1970). Tanner (1967) has used this assemblage, the Kimball local fauna, as the type local fauna of his "Kimballian Land Mammal Age." This mammalian age was intended for the time interval between Hemphillian and Blancan ages, and thus to furnish a technical name for the time period usually termed late Hemphillian. I see little utility in a formal name for the period usually called late Hemphillian. A more serious criticism is that the Kimballian Land Mammal Age is based on a local fauna, the Kimball local fauna, that is not intermediate between Hemphillian and Blancan ages but instead is almost exactly the age of or a trifle older than the Coffee Ranch local fauna of Texas, the type local fauna of the Hemphillian Land Mammal Age. Several species, including a peccary, *Prosthenops graffhami* Schultz and Martin, a rhinoceros, *Aphelops kimballensis* Tanner, a horse, *Neohipparion eurystyle* (Cope), and an antilocaprid, *Texoceros altidens* (Matthew) (=*Texoceros guymonensis* Frick), and perhaps other species also, appear to be the same or very closely related in the two local faunas. For purposes of correlation the Kimball and Coffee Ranch local faunas may be considered informally as mid-Hemphillian in age.

The Ocote local fauna resembles the Coffee Ranch and Kimball local faunas at the generic level. However, when materials are suitable for specific comparisons, the Ocote mammals are seen to be distinctly more advanced than those of the Coffee Ranch and Kimball local faunas. Some of these differences have been detailed in the preceding accounts of the horses. *Teleoceras* apparently does not occur in the Coffee Ranch local fauna but the Ocote *Teleoceras* is advanced over *T. schultzi* Tanner of the Kimball local fauna.

Several "latest Hemphillian" local faunas are listed by Schultz (1977) from Texas but, although the faunal lists certainly suggest that the local faunas are younger than the Coffee Ranch local fauna or other described mid-Hemphillian local faunas, uncertain identifications make detailed comparisons with the Ocote local fauna difficult. If the *Astrohippus* cf. *stocki* is truly *A. stocki*, and the *Dinohippus* cf. *mexicanus* is actually *D. mexicanus*, these local faunas correlate with the Yepómera local fauna of Chihuahua and are slightly older than the Ocote local fauna. At present we can only suggest that the evolutionary level of the latest Hemphillian local faunas of Texas is approximately that of the Ocote local fauna or a bit older.

The Yepómera local fauna of Chihuahua (Lance, 1950; Stirton, 1955) is chronologically close to the Ocote local fauna. The giant ground squirrel *(Paenemarmota mexicana)* appears to be the same species in the two local faunas. The horses of the Ocote local fauna are similar to but slightly advanced over the Yepómera horses. Thus, the Ocote local fauna appears perhaps slightly younger than the Yepómera local fauna.

On the basis of these correlations, the Ocote local fauna appears to be the youngest Hemphillian local fauna well represented by fossil materials. There is an obvious gap in the fossil record between the Ocote local fauna and well-known early Blancan faunas such as the Rexroad of Kansas (Skinner and Hibbard, 1972), a gap seemingly not yet represented by fossils from the Great Plains area of the United States or on the Mexican Plateau.

Broadly speaking the late Hemphillian faunas of the Mexican Plateau and the Great Plains have close formal continuity.

Successional species of the horses and *Teleoceras*, and perhaps the giant ground squirrel and other forms, seem to show steps in an evolutionary sequence, in chronological order, on the Great Plains of the United States and on the Mexican Plateau, ending, for Pliocene forms, in the Ocote species. However two species, *Desmathyus brachydontus* and *Palaeolama guanajuatensis*, are present in the Ocote local fauna that are not represented, so far as we know, by ancestral forms in the Pliocene of the mid-continental United States. Thus certain lineages seem to have centered uniquely in the Mexican Plateau well south of the classic fossil fields of the High Plains. Additional Hemphillian local faunas, both older and younger than the Ocote, may well be discovered on the Mexican Plateau, thus shedding further light on the evolution of the Pliocene mammal fauna.

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