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RANCHO GAITAN LOCAL FAUNA, EARLY CHADRONIAN, NORTHEASTERN CHIHUAHUA

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RESUMEN

Un pequeño conjunto de fósiles vertebrados fue recolectado del miembro tobáceo superior de una formación no nombrada del noreste de Chihuahua y designado como la fauna local Rancho Gaitán. Incluye tres géneros de roedores, dos géneros de perisodáctilos *(?Brontops* e *?Hyracodon)* y 5 géneros de artiodáctilos *(Protoreodon, Agriochoerus, Bathygenys, Hypertragulus* y cf. *Leptomeryx)*, así como una nueva especie de *Hypertragulus*.

La edad de la fauna local Rancho Gaitán se estableció como Chadroniano temprano y constituye así la primera fauna oligocénica descrita de México, y al mismo tiempo, una de las faunas de mamíferos más meridionales del Terciario temprano de Norte América. Esta fauna se correlaciona con la fauna local Little Egypt de la parte superior de la Formación Chambers Tuff, del Rim Rock Country, Texas. Se supone que condiciones húmedas hayan prevalecido en el área habitada por la fauna local Rancho Gaitán.

ABSTRACT

A small assemblage of vertebrates was collected from the upper tuff member of an unnamed formation in northeastern Chihuahua and designated as the Rancho Gaitan local fauna. It includes three genera of rodents, two genera of perissodactyls *(?Brontopos* and *?Hyracodon)* and five genera of artiodactyls *(Protoreodon, Agriochoerus, Bathygenys, Hypertragulus* and cf. *Leptomeryx)*, and a new species of *Hypertragulus*.

The Rancho Gaitan local fauna is dated as early Chadronian, thus constitutes the first Oligocene Fauna described from Mexico, and one of the southernmost early Tertiary mammalian faunas of North America. This fauna is correlated with the Little Egypt local fauna from the upper part of the Chambers Tuff Formation of the Rim Rock Country, Texas. Moist environmental conditions are supposed to have prevailed in the area occupied by the Rancho Gaitan local fauna.

INTRODUCTION

The Rancho Gaitan local fauna is the first Oligocene mammalian fauna described from Mexico, and constitutes one of the southernmost early Tertiary mammalian assemblages reported from North America. Some of the members of this fauna are reliable timemarkers that can be of primary importance for establishing the age.

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Very few early Tertiary mammals are known from Mexico. Müllerried (1932:71) described sirenian remains from Chiapas and dated them with reservation as late Oligocene. His is the first record of a fossil mammal older than the Miocene in Mexico. Vanderhoof (1942:298) described the desmostylian *Cornwallius sookensis* from the late Oligocene-early Miocene of Baja California. Maldonado (1953:148) described a second sirenian from Chiapas, asigning it questionably to *Halitherium* and dating it as Oligocene.

Early Tertiary rodents were first discovered at Guanajuato in 1950 by J. D. Edwards and G. Ortiz; unfortunately, the material was destroyed during the transportation from the field to the laboratory in Mexico City. The late Dr. Fries, who devoted most of his investigations to the Geology of Mexico, discovered more rodent material there and submitted it to C. Hibbard for study. D. H. Dunkle found iguanid remains at the same locality. Fries, Hibbard, and Dunkle (1955) published the combined results of their study, and on the basis of the sciuravid rodent *Floresomys guanajuatoensis*, the Red Conglomerates at Guanajuato were dated as late Eocene.

Morris (1966 and 1968) has described perissodactyl (*Hyracotherium seekinsi* Morris) and pantodont (cf. *Esthonys*) remains from Baja California, arguing for a late Paleocene, Clarkforkian age. The date is open to question, and the faunule might have been very early Eocene, even so, this provides the oldest fossil mammalian faunule recorded in Mexico.

Dr. J. A. Wilson suggested the project and guided me in fossil preparation. I am especially indebted to him for his patient supervision throughout this work and for placing at my disposal the research facilities of the Vertebrate Paleontology Laboratory at the Balcones Research Center, The University of Texas. I wish to thank Dr. W. F. Blair and Dr. Clark Hubbs for critically reading the original manuscript.

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Field work was made many times more enjoyable by Sr. Lorenzo Molinar and his family who kindly provided roof, topographic information and assistance, but most of all friendship and warmth. Special thanks are given to my field partner G. Heiken for his assistance and geological interpretations.

Discussions of various problems with Messrs. J. M. Harris and W. A. Akersten were most helpful. Editing was first undertaken by Mr. W. S. Brown. Translation of a Russian paper by Mr. W. T. Clark is appreciated. Illustrations were ably drawn by Mrs. M. S. Stevens whose advice on preparation of the fossil material was very helpful. The assistance of Dr. W. Langston in preparing a titanothere skull was invaluable, and I am additionally thankful to him and to Dr. E. L. Lundelius, Jr. for the use of their private libraries.

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LOCATION AND ACCESSIBILITY

The Rancho Gaitan local fauna occurs in the Cerros Prietos area, Municipio de Ojinaga, northeastern Chihuahua, México. The area lies between latitudes N 29° 49′ and 29° 57′, and between longitudes W 104° 39′ and W 104° 49′, the approximate dimensions are 14.5 km north-south by 13.0 km east-west (Fig. 1). It is an area made up of Tertiary volcanic rocks overlying Cretaceous sediments. The area is limited by the Presidio Bolson to the north and the Sierra de la Parra to the south. Cliffs, cuestas and mesas are the dominant features developed on the volcanic rocks, and rounded hills are developed on the Cretaceous sediments.

The area is arid and extremely hot during the summer. The fauna and flora are characteristic of a desert. The area is crossed by two unpaved roads, one that comes north from Ojinaga, approximately parallel to the Rio Grande to the Cerro Alto and thence by cut-off reaches Rancho Gaitan. Rancho Gaitan is 32 km by air NW of Ojinaga but 72 km by road. The summer rainfalls wash out the road in several places and make it nearly impassable. Under favorable conditions the trip from Ojinaga to the Rancho Gaitan takes about four hours. The other road comes from the Chinati Ranch, near Presidio, Texas, fords the Rio Grande and joins the Ojinaga-Rancho Gaitan road a little nort of Cerro Alto. This way is shorter but after rainfall is even more difficult to travel. Because both roads are not adequately shown on the maps of the region, local inquiries are absolutely necessary.

PREVIOUS WORK

The geology of the west Texas-northern Chihuahua region has been methodicaly studied by the staff and graduate students of The University of Texas Department of Geology during the last decade (Fig. 1). DeFord (1958, 1964) has reviewed these as well as other studies and explorations.

Tertiary vertebrates have been found in Big Bend National Park, Texas, and the Rim Rock Country, western Jeff Davis and Presidio Counties, Texas. Faunas of middle and late Paleocene, early, middle and late Eocene, and early Miocene have been found in Big Bend National Park (Wilson, 1965, Maxwell *et al.*, 1967). The Rim Rock Country has yielded a varied group of late Eocene and early Oligocene vertebrates from the Vieja Group. Reports on this fauna are those of Stovall (1948) Wood (1955), Wilson, 1965, 1966), Black and Dawson (1966), Harris (1967) and Wilson *et al.*, 1968.

J. A. Wilson suspected the presence of early Tertiary mammals in nothern Chihuahua, and suggested G. Heiken and I study the area. Heiken (1966), Ferrusquía (1967), Ferrusquía and Wood (in press) and this report are results of this study.

TERMS AND ABBREVIATIONS

The nomenclatorial system used to describe the cheek teeth of the perissodactyls and artiodactyls, is the classic Cope-Osborn system, but only a topo-

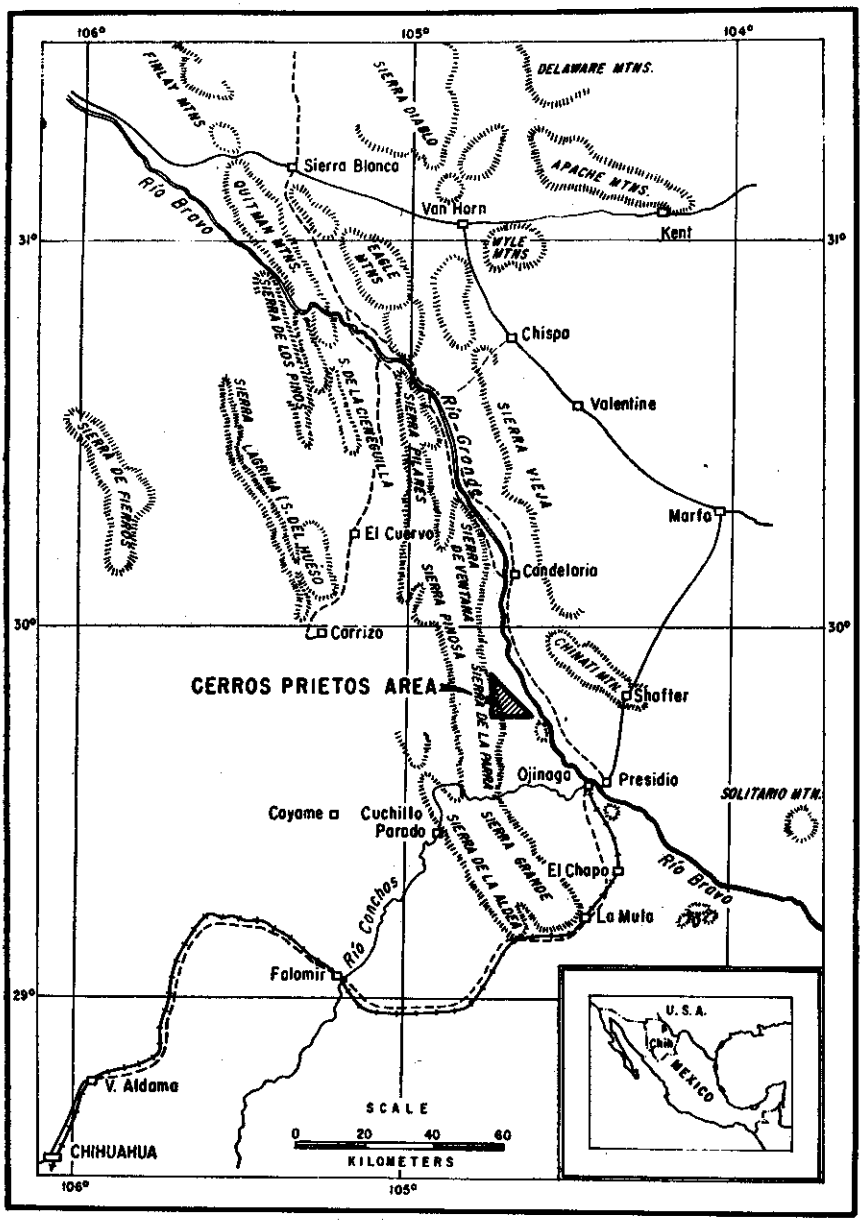


FIG. 1.—Index map, showing the location of Cerros Prietos area.

graphical equivalence is implied. The crests of the artiodactyl premolars were named following Loomis (1925).

The premolar-molar index is a ratio of the P2-4 length divided by the M1-3 length, and expresses in percent the relation of the premolar series length to the molar series length.

All of the measurements of the specimens are expressed in millimeters.

The fossil mammals herewith described were incorporated in the Instituto de Geología de la Universidad Nacional Autónoma de México Vertebrate Fossil Collection, catalog numbers IGM 65-21 to IGM 65-41; they were collected by the writer unless otherwise stated, during the summer of 1965 and a short period in the summer of 1966.

The following abbreviations are used:

AMNH	American Museum of Natural History
CIT	California Institute of Technology Collections
CM	Carnegie Museum
FAM	Frick Laboratory, American Museum of Natural History
IGM	Instituto de Geología de la Universidad Nacional Autónoma de México
LACM	Los Angeles County Museum
PU	Princeton University Museum
UTBEG	University of Texas Bureau of Economic Geology
YPM	Yale Peabody Museum

GEOLOGY OF THE CERROS PRIETOS AREA

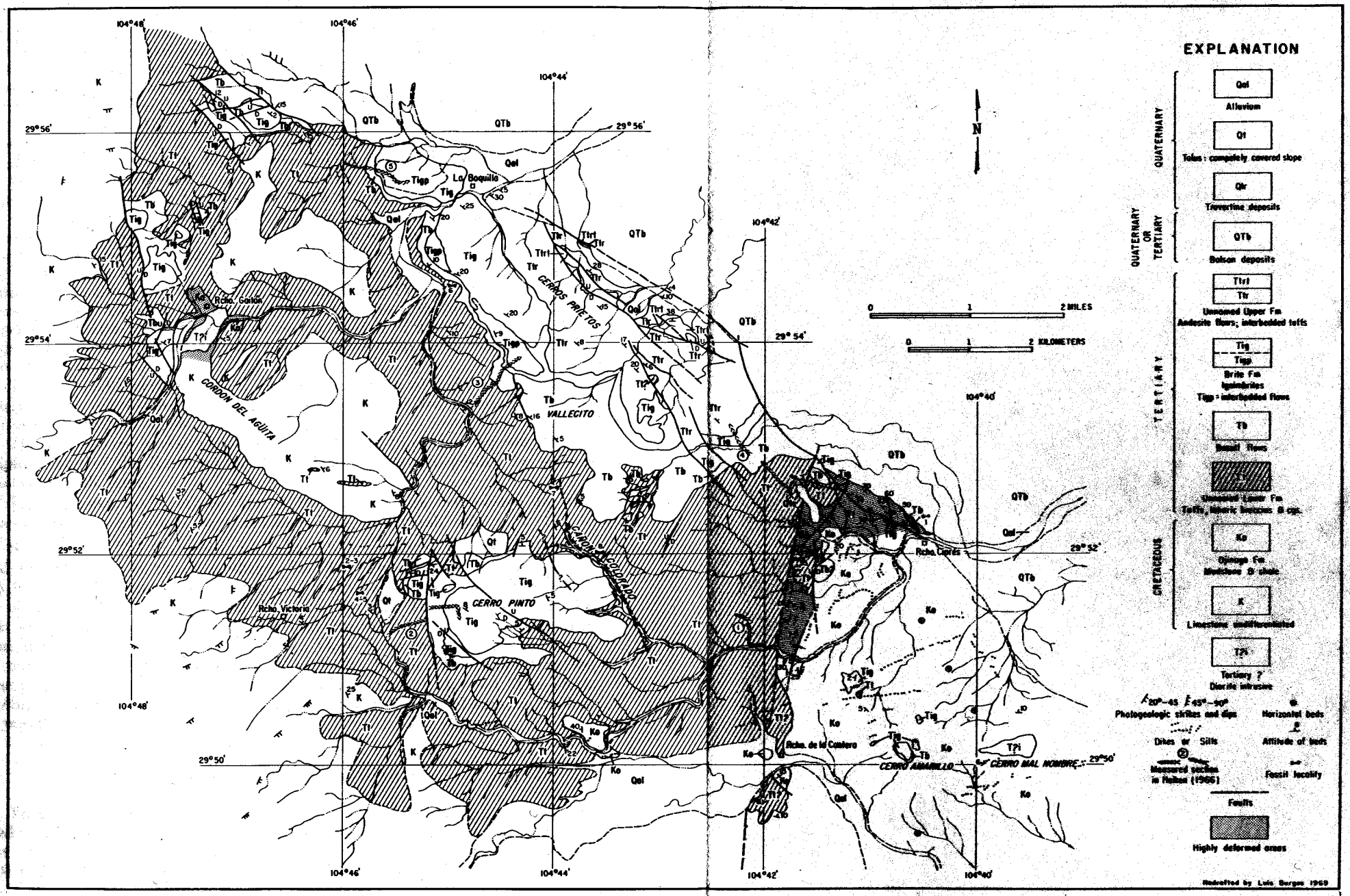
The following is a synopsis of the local geology (Plate 1) as interpreted by Heiken (1966). Fig. 2 is a generalized stratigraphic section of the Tertiary rocks, also from Heiken, 1966.

STRATIGRAPHY.—The Cretaceous System is represented by three units named in ascending order, Finlay Limestone, ?Benevides Formation, and Ojinaga Formation. At the Sierra de la Parra the Finlay is a thin to thick-bedded limestone about 230 m thick; rudists and *Dictyoconus* are the characteristic fossils of this unit. The ?Benevides Formation is present only on the southern flank of Cordon de la Agüita, consists of 6 m of thick-bedded orange-brown intramicrite. The Ojinaga Formation is found in a small area at the Rancho Gaitan and consists of greenish-brown siltstones.

The Tertiary System is represented by four units in ascending order, an unnamed tuff formation, unnamed basalts, ?Brite Formation, and an unnamed formation with andesites and tuff. The lower formation, a dominantly pyroclastic unit, with a maximum thickness of 250 m, rests unconformably on deformed Cretaceous rocks and diorite intrusions. The unit is divided into four members: 1) a basal conglomerate, 2) lower tuff lahar member, 3) upper tuff member, and 4) upper conglomerate. The basal conglomerate consists of alluvial deposits and has a maximum thickness of 18 m. This conglomerate is probably analogous to the Jeff Conglomerate of Trans-Pecos, Texas. The

	FORMATION		SECTION	DESCRIPTION	THICKNESS IN M.
TERTIARY OLIGOCENE	UNNAMED UPPER FORMATION			Andesite flows; dark red flow rock. The base and top of each flow is scoriaceous, with opal and chalcedony filled amygdule. Some contraction joints. Interbedded lithic tuff near top of the unit.	0 to 106.7
	?BRITE FORMATION			Two or three cooling units. White to gray welded vitric-crystal tuff and sillar. Red orange andesite flows interbedded with the cooling units.	42.7 to 122
	BASALT FLOWS (unnamed)			Massive dark to light gray rock. Flows separated by scoriaceous zones. No jointings in most of the flows.	0 to 100.6
	UNNAMED LOWER FORMATION	Upper cg. member		Cross-bedded fluvial conglomerates.	0 to 36.6
		Upper tuff member		Massive pink, gray and white vitric tuff with a few interbedded conglomerates. Vertebrate fossils and fresh water gastropods.	36.6 to 73.2
		Lower tuff member		Alternating dark red and purple massive lithic-vitric tuffs and laharic breccias. Much of it reworked.	0 to 122
		Basal cg.m.		Peb. to boulder limestone cg.	0 to 18
CRET.	OJINAGA FORMATION			Gray-green shale with minor sandstone and limestone lenses.	932.5

FIG. 2.—Generalized stratigraphic section of Tertiary rocks (after Heiken, 1966)



GELOGIC MAP OF CERROS PRIETOS, MUNICIPALITY OF OJINAGA, STATE OF CHIHUAHUA (AFTER HEIKEN, 1966)

age of this member is uncertain, and has been dated as post-Cretaceous pre-Oligocene. The tuff members have gradational contacts and were not mapped separately. The lower tuff member is 122 m thick and consists of alternating dark red and purple massive lithic-vitric tuffs and laharic breccias. The most extensive outcrops are at Cañon Colorado hill. The upper tuff member is 36 to 73 m thick and consists of massive pink, gray and whitish vitric tuff, with a few interbedded conglomerates. The most extensive outcrops are at Cerro Pinto. All of the vertebrates described in this paper, except one, were collected from 38 m below the upper limit of this member. The upper conglomerate is a greenish, highly cross-bedded stratum 0 to 36 m thick. At its base a titanothere skull was found. On the basis of vertebrate fossil, the upper part of this lower formation is dated as early Chadronian.

Black to gray-green basalt flows with a maximum thickness of 100 m, overlie the lower formation. A series of ignimbrites with interbedded andesite porphyries overlie the basalt flows. The ignimbrites are 43 to 122 m thick, and on the basis of texture and mineralogy, two cooling units are recognized, a third may exist below interbedded andesite flows. The ignimbrites are questionably correlated with the Brite Formation of the Rim Rock Country. The upper formation overlies the ignimbrites and consists of dark red andesite flows with lithic tuff interbedded near the top. This formation has a maximum thickness of 122 m.

Tertiary or Quaternary bolson deposits, consisting of light brown massive conglomerate interbedded with very coarse sandstone are present along the northeastern margin of the area.

The Quaternary rocks consist of alluvial and travertine deposits in the neighborhood of the Rancho Ciprés. The travertine was deposited by springs associated with faults.

The intrusive rocks at the Cerros Prietos area are represented by two diorite porphyry intrusions, several basalt dikes, and basalt sills.

STRUCTURE.—The Cretaceous rocks have been deformed by regional folding and faulting in a northwest-southeast direction. This folding is attributed to the Laramide Orogeny. A major series of faults lies between the bolson deposits of the Rio Grande Valley and the volcanic rocks. The downthrown blocks are on the northeastern side. A fault trending nearly north-south is present near the Rancho Gaitan. The downthrown block is on the east. A large series of minor north-south faults is present near the Rancho La Cantera, in the eastern part of the area; downthrown blocks are also on the east. The block faulting is part of the regional trend of Basin and Range deformation and is of middle Tertiary and later age.

SYSTEMATIC PALEONTOLOGY

Thousands of large fresh water gastropods, and a few fragments of turtle shells were associated with the mamalian fossils, but they are not part of this study. The mammals were found at nine localities scattered in the central part of the area. The vertebrate fossil localities are shown on Plate 1, and are

on record in the Catalogue of the Instituto de Geología de México, D. F. Locality number 7, at the northern slope of the Cañón Colorado hill, yielded most of the fossils. The fossils are rather poorly preserved, and no associated skulls and jaws were found.

Class MAMMALIA Linnaeus, 1758

Two families of rodents, two of perissodactyls, and four of artiodactyls, represent the mammalian assemblage of the Rancho Gaitan local fauna. The fauna is small, but relatively diverse; eleven genera and eleven species are recognized; three of the species are represented by a single specimen, in the others the number varies from two to five.

The rodents are described separately (Ferrusquía and Wood, in press).

Order PERISSODACTYLA Owen, 1848

Titanotheres and rhinoceroses constitute the perissodactyl stock of the Rancho Gaitan local fauna. Titanotheres are common to all of the Early Tertiary local mammalian faunas of the Rim Rock Country. Neither horses nor tapirs have been found in the Cerros Prietos area.

Suborder HIPPOMORPHA Wood 1937
Superfamily BRONTOTHERIOIDEA Hay, 1902
Family BRONTOTHERIIDAE Marsh 1873
Subfamily BRONTOPINAE Osborn 1941
Brontops Marsh 1887
B. brachycephalus (Osborn) 1902

?Brontops cf. *B. brachycephalus* (Osborn), 1902
(Figs. 3 and 4; Tables 1 and 2)

HOLOTYPE.—AMNH 4261 a complete skull from the Chadron Formation, Big Badlands, South Dakota.

REFERRED MATERIAL.—IGM 65-29, an incomplete skull, Figs. 3 and 4.

HORIZON AND LOCALITY.—Upper conglomerate, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 1, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—The skull is slightly crushed, premaxillae, nasals, lachrymals, anterior part of the frontals, left maxilla, most of the left zygomatic arch, and the posterior part of the cranium are missing. Neither the basilar length nor the zygomatic width, can be determined; however, the skull seems brachycephalic, medium size, and much less massive than that of *Brontotherium*.

The skull vertex diverges anteriorly so that it is twice as wide across the orbits as across the parietals. The vertex is slightly convex transversely, and gently concave anteroposteriorly. The zygomatic arch is massive and considerably expanded at the squamosal region, whereas at the malar region it is relatively slender and much narrower. The orbit has been depressed by crushing,

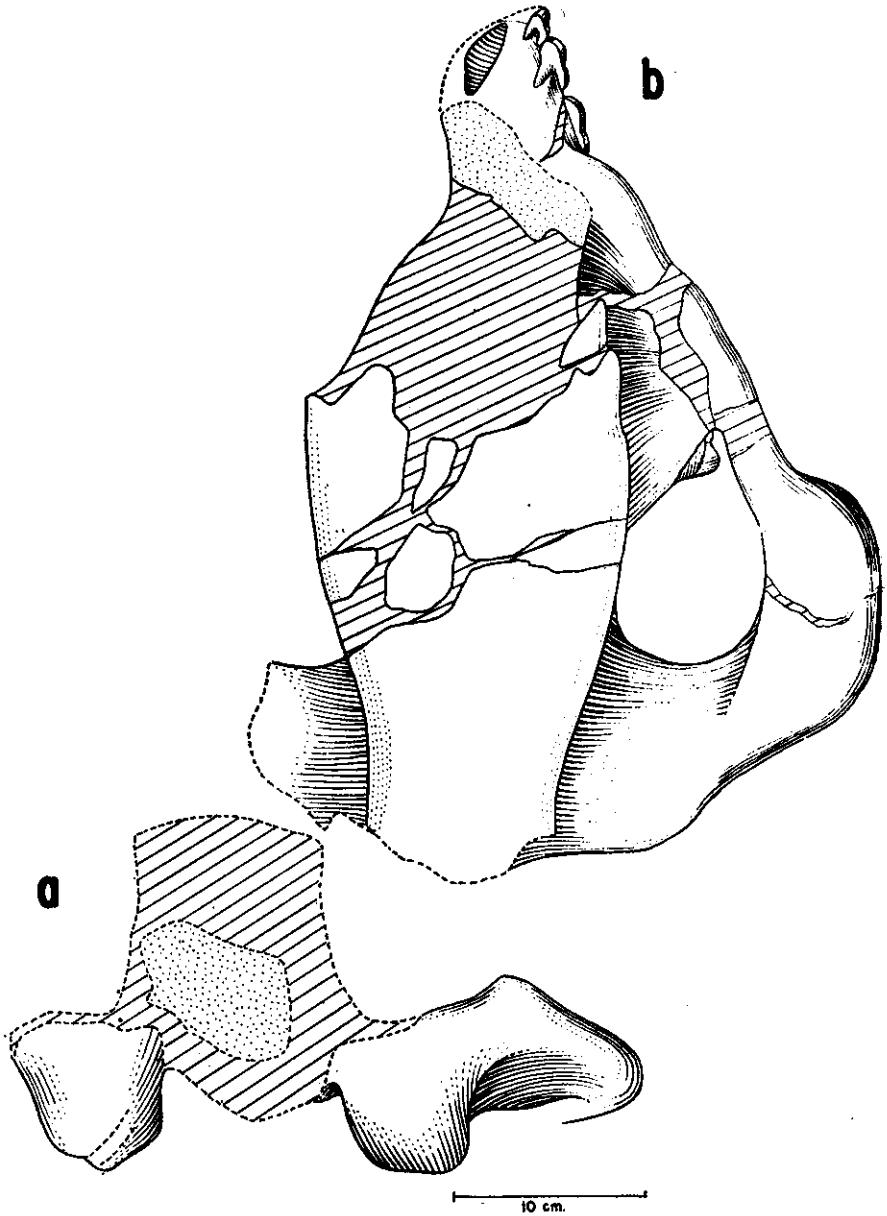


FIG. 3.—?*Brontops cf. B. brachycephalus* (Osborn), IGM 65-29, incomplete skull, a. posterior view, b. dorsal view.

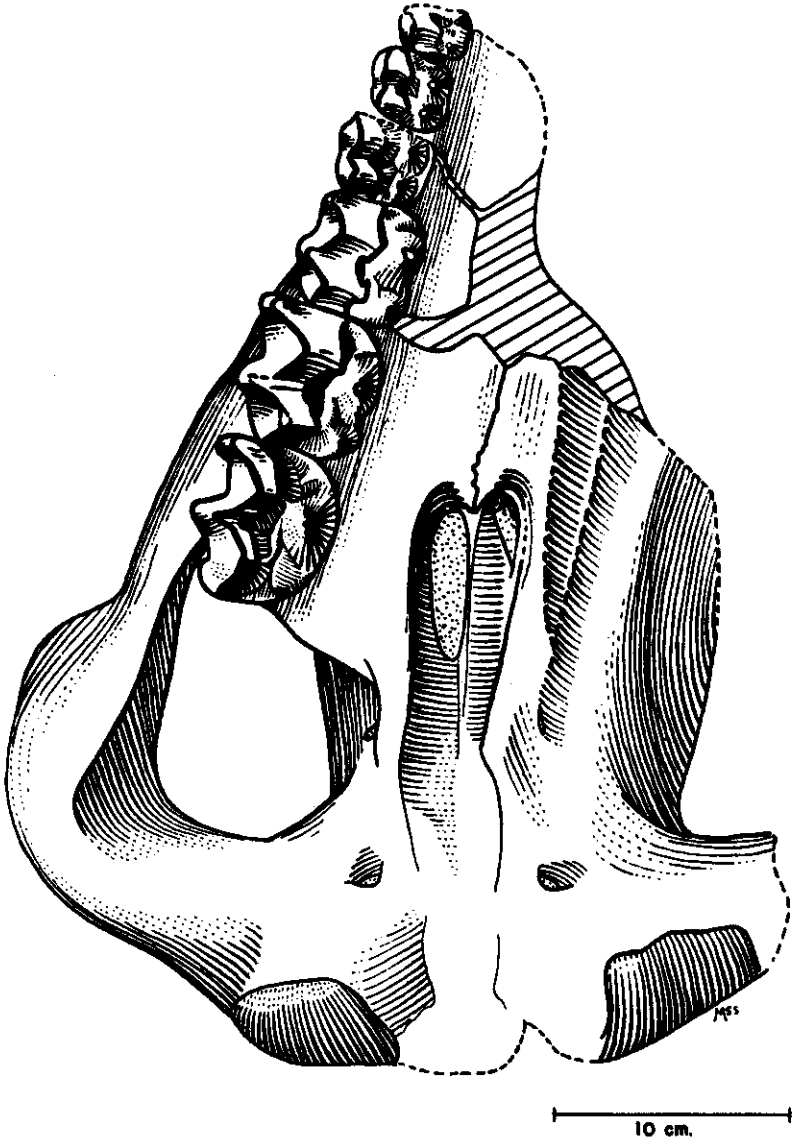


FIG. 4.—*?Brontops* cf. *B. brachycephalus* (Osborn), IGM 65-29, incomplete skull, ventral view.

TABLE 1.—Measurements of *?Brontops* cf. *B. brachycephalus* IGM 65-29

P2-M3	L	260
P2-4	L	83
M1-3	L	177
P2	L	20
	W	28
P3	L	31.5
	W	35
P4	L	31
	W	37
M1	L	49.5
	W	49
M2	L	64
	W	59
M3	L	64.2
	W	59

TABLE 2.—Measurements of two brontopine species. A after Stock, 1930:660-61; B, after Osborn, 1929:480.

		A	B	
		Protitanops curryi (CIT 1847)	*Brontops brachycephalus*	*?B. cf. B. brachycephalus* (IGM 65-29)
Basilar	L	680	580-648	
Zygomatic	W	486	441-480	462e
P1-M3	L	272a	265-297	
P2-M3	L			260
M1-3	L		167-180	177
Prem-mol. index			43-48	45

a = approximate, e = estimated.

but is much longer (70 mm) than wide (30 mm); the postorbital process is represented by a small swelling; only the ventral half of the infraorbital foramen is preserved, since the dorsal part of the maxilla is broken at this level.

The vertex slopes down anteriorly at an angle of approximately 15°. The zygomatic arch is deeper at the squamosal than at the malar region. The tooth row is very gently convex. The posterior part of the maxilla has been pushed posteriorly, covering the alisphenoid and hiding the foramina of this region; the foramen rotundum is the only one visible. The tooth row converges anteriorly. The internal naris (width 35 mm) opens opposite the anterior margin of M3. Only the foramina ovale are visible. The petrosals are very badly crushed and no foramina are distinguishable.

The cranial region posterior to the postglenoid processes is missing; however, a rear view of the skull helps to visualize the expansion of the zygomata in relation to the cranium itself, which, at this level represents only 25 per cent of the estimated zygomatic width. The cranial walls are much thinner than either the roof or the floor. The cranium is 150 mm high at this level, 70 mm representing the roof (parietals), 30 mm to the floor (sphenoid), and only 50 mm to the cranial cavity.

Right P2-M3 are present. The most striking character is an extreme labial hypsodonty, combined with lingual brachydonty, thus in M3 for example. the ectoloph at the level of the paracone is three times higher than the protocone. In M1 the most worn tooth, the ectoloph is as high as the protocone; hence, the ectoloph was worn at a greater rate than the protocone.

The incisors and canine are missing; however, the posterior half of the canine alveolus is preserved. This alveolus is 45 mm deep and 17 mm wide. There is no appreciable diastema between the canine alveolus and P2, although there is a small pit anterointernal to the P2. Whether this pit represents the alveolus of an excedingly small P1 is not known.

The premolars of titanotheres are relatively smaller and less molarized than those of horses. The premolars increase in size from P2 to P4, and are slightly wider than long. The premolar-molar index is about 45. The ectoloph is nearly straight, and less hypsodont than that of the molars. Feeble ribs are present, styles are lacking. A weak external cingulum is present. The hypocone is rounded, not produced lingually, and is about half as large as the protocone, except in P2, where both are of equal size. A sharp internal cingulum encircles both proto- and hypocone. The fossa for the protoconid is nearly central, triangular in occulsal outline and deeper than the fossa for the metaconid, which is smaller and rounded.

The molars increase in size from M1 to M3; M1 is nearly square, whereas M2 and M3 are longer than wide. The ectoloph is characteristically W-shaped, its external wall is nearly vertical; strong styles are present, para- and mesostyle are slightly oblique anteroexternally, whereas the metastyle is oriented posteroexternally. No external cingulum is present. The protocone is large, rounded, and massive; the hypocone is much smaller and triradiate, particularly so in M3. The internal cingulum is absent opposite the protocone, and has a swell-

ing on the anterointernal corner of the tooth, the protostyle of Osborn (1929:488). The fossa for the hypoconid is deep, triangular, with the middle vertex labial; while the fossa for the protoconid is much smaller and shallower.

DISCUSSION.—Osborn (1929:450) regarded the presence of a well developed hypocone and particularly of strong labial hypsodonty, as characters that separate the Oligocene from the Eocene titanotheres.

The lower Oligocene North American titanotheres have been allocated by Simpson (1945:138-39) into six genera and three subfamilies, namely: *Teleodus*. *Protitanops* and *Brontops* (= *Diploclonus*), Brontopinae; *Menodus* (= *Allops*), Menodontinae; *Megacerops*, and *Brontotherium*, Brontotheriinae. The systematics of these groups is based on characters such as the degree of evolution of the horns, the concomitant modification of the nasals, skull vertex, zygomatic arches, and occiput; the size and number of incisors, the size and shape of the canines, and the odontography of molars and premolars. Unfortunately, only a few of these characters can be observed in IGM 65-29; therefore its assignment to any of these genera can not be certain.

The presence of a divergent skull vertex, non-expanded premolars, vertical ectoloph, and moderately sharp internal cingulum of premolars, seem to exclude IGM 65-29 from Brontotheriinae relationships, and approximate it to the Brontopinae-Menodontinae (Menodontinae of Osborn, 1929: 444). Unlike *Menodus*, IGM 65-29 is brachycephalic, has the squamosal region of the zygomata expanded, proto- and hypocone not united, the external cingulum lacking, a large protostyle on molars, $\underline{M1-2}$ hypocones not protuberant molar internal cingulum discontinuous, and a premolar-molar index lower than 50. The molars are longer than wide, as in *Menodus*, however.

Teleodus is the least known genus of the Brontopinae, the two Oligocene species, *T. avus* Marsh, and *T. primitivus* (Lambe) are known only from the type lower jaws, which differ from those of *Brontops* in having three instead of two incisors (Osborn, 1929: 481, 482). Stock (1935: 458) described *T. californicus* from the uppermost Eocene of the Sespe Formation, California. The referred material includes several isolated upper teeth. Unlike IGM 65-29, this species has $\underline{P2}$ with proto- and hypocones joined, and the molars with continuous internal cingulum and a very small hypocone.

Protitanops curryi Stock (1936: 656) is the only species known of this brontopine genus. *P. curryi* was described from a single skull and jaws collected from the Titus Canyon Formation, Chadronian of California. The holotype is larger (Table 2) and less brachycephalic than IGM 65-29, and also differs from this specimen in having the premolars with the proto- and hypocones united, the hypocone very small and the internal margin of the tooth rounded; and having the molars with a very small protostyle, the hypocone large and protuberant, and the internal cingulum continuous in $\underline{M1}$. In spite of this, there is a general resemblance between these specimens, particularly in the expanded squamosal region of the zygomatic arches, abscence of external cingulum in both molars and premolars, and having molars longer than wide.

Brontops is the best known of the brontopine genera. *B. brachycephalus* Marsh is the most primitive species of this genus. IGM 65-29 is as brachycephalic, and falls within the same size range of this species (Table 2). IGM

65-29 also resembles *B. brachycephalus* in having the internal margin of the premolars flat, having the molars with no protuberant hypocones, and a discontinuous internal cingulum. There are also some differences, however. The zygomatic arches are more expanded in IGM 65-29 than in *B. brachycephalus*, proto- and hypocones are united by a thin bridge in the latter, and not united in IGM 65-29; and the molars are nearly square in *B. brachycephalus*, and longer than wide in IGM 65-29. On the evidence available, the specimen under discussion seems to be closer to *B. brachycephalus* than to *P. curryi*, and I tentatively assign it to the former.

Suborder CERATOMORPHA Wood, 1937
Superfamily RHINOCEROTOIDEA Gill, 1872
Family HYRACODONTIDAE Cope, 1879

Hyracodon Leidy, 1856
?Hydracodon sp.

(Figs. 5a and b; Table 3)

TYPE SPECIES.—*H. nebraskensis* Leidy, 1856, from the lower Brule, White River Group.

REFERRED MATERIAL.—IGM 65-30, skull fragment with P2-M2 worn and badly broken, Fig. 5a; IGM 65-31A right mandible fragment with parts of M2-3; IGM 65-31B, left mandible fragment with natural casts of dP3-4, and M1 erupting, Fig. 5b.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 2 yielded IGM 65-30, 31 B; locality no. 3 yielded IGM 65-31A; Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—The skull fragment consists of part of the left maxilla which has been crushed laterally. The interior part of the orbit is well preserved, and the jugal has not been disturbed. The dentition is very badly worn and poorly preserved, and no traces of the pattern remain, except for two small enamel lakes on P2. On the anterior end of the maxilla, the root is present. The alveolus is rather small and narrow, suggesting a small canine. Such a condition is characteristic of the Hyracodontidae (Scott, 1941: 823; Wood, 1927b:10).

There is a gap 35 mm long between the canine alveolus and P2. Although P1 is missing, this tooth is small in the hyracodontids about half the size of P2, hence the diastema is long for *Hyracodon*.

The premolars are four-sided, increasing in width from P2 to P4. P2 is nearly square and so worn that only the floor of the anterior (or median) and posterior valleys are present. A faint anterior cingulum is present, but there is no trace of an external cingulum. P3 differs from P2 in being wider, having two swelligns on the labial margin, one anterior and one posterior, that suggests the presence of ribs. P4 is wider than P3 and has better developed ribs, a small parastyle, and its internal margin is not flat but rounded.

The molars are trapezoidal and have the anteroexternal region very much produced. The paracone rib is much larger that the metacone rib, and there

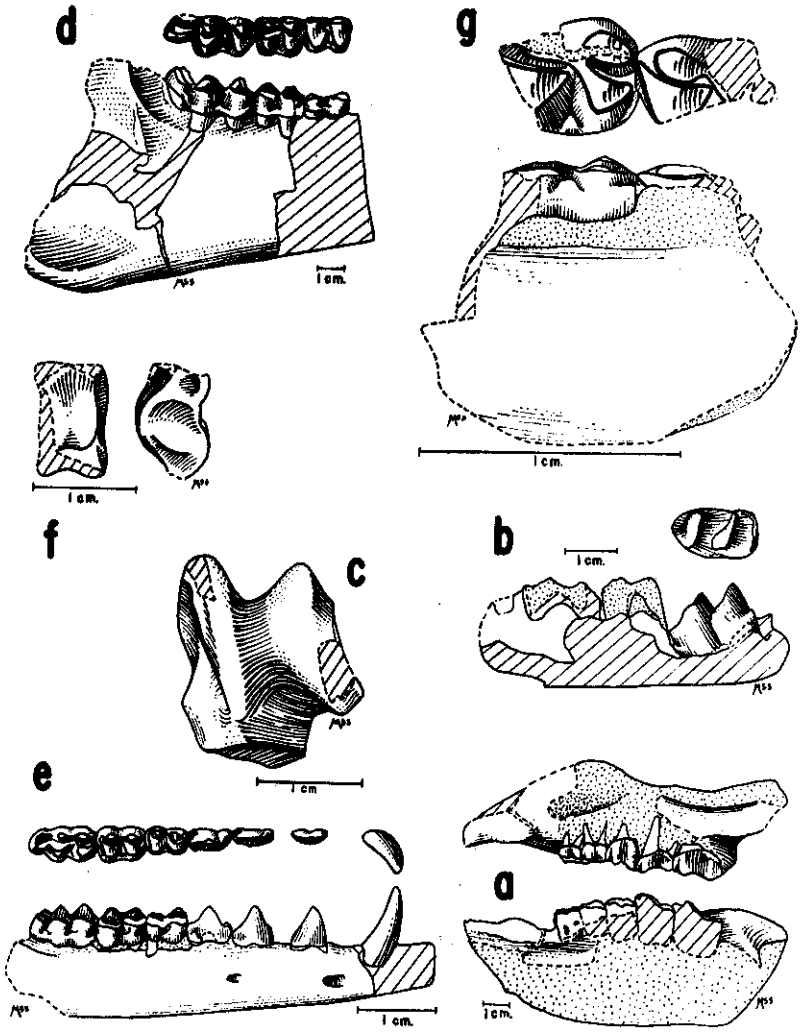


FIG. 5.—a. *?Hyracodon* sp. IGM 65-30, skull fragment with left P2-M2 occlusal and labial view. b. IGM 65-31B, left mandible fragment with $d\overline{P3}$-$d\overline{P4}$, $M\overline{1}$ labial view and occlusal view of M1.

c. Undetermined rhinocerotoid, IGM 65-31C, left astragalus, dorsal view.

d. *Agriochoerus maximus* Douglass, IGM 65-34, right mandible fragment with $M\overline{1}$-$\overline{3}$, labial and occlusal view.

e. *Hypertragulus heikeni* sp. nov., holotype IGM 65-39 right mandible fragment with $P\overline{1}$-$M\overline{3}$, labial and occlusal view. f. IGM 65-40D, right astragalus, ventral and lateral view.

g. cf. *Leptomeryx* sp., IGM 65-41, right mandible fragment with parts of $M\overline{1}$-$\overline{2}$, labial and occlusal view.

is a parastyle but no meso- or metastyles. M1 is larger than P4, has a flat internal margin, and a very faint external cingulum below the posterior rib. M2 is larger than M1, but its external cingulum is less developed than that of the former.

The mandible fragments were found in two different localities, but are similar and I regard them as belonging to the same taxon. The right mandible fragment is that of an adult individual, whereas the left fragment represents a juvenile individual; M1 and natural casts of dP3-4 are present in this specimen. The milk teeth are very narrow. dP3 has three lophids, whereas dP4 has only two; such a condition is present in *Hyracodon* and *Subhyracodon* (Scott, 1941:825). M1 is erupting, resembling that of *Hyracodon* in both size and shape.

DISCUSSION.—*Hyracodon* Leidy is the best known and most abundant of the hyracodonts, but it also presents the most complex taxonomic problem. Wood (1927b: 26-77) recognizes five species, adding his *H. petersoni* (Wood, 1927a) to the four previously recognized by Sinclair (1922: 65-79): *H. arcidens*, *H. nebraskensis*, *H. apertus* and *H. leidyanus*. The separation of the species is based mainly on the degree of molarization of the upper premolars. Scott (1941:941) however, invoking reasons of simultaneousness and lack of geographic isolation, claims that these four species (he did not mention *H. petersoni*), should be considered as a single species that "must be named *H. nebraskensis* Leidy". He accepts *H. priscidens* from Cypress Hills, Saskatchewan, Canada (Lambe, 1905: 37) as a valid species.

IGM 65-30 only differs from *H. nebraskensis* (*sensu* Scott) in having a much longer diastema, comparable to that of *Subhyracodon*. The lower jaws (IGM 65-31 A and B), are also comparable to those of *H. nebraskensis* (*sensu* Scott) in both size and shape. The assignment of this material to *Hyracodon* remains tentative, because of its poor preservation.

Superfamily RHINOCEROTOIDEA Gill, 1872
Fam., gen., et sp. indet.
(Fig. 5c; Table 4)

REFERRED MATERIAL.—IGM 65-31C, left astragalus slightly broken, Fig. 5c.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 2, Plate 1.

DESCRIPTION.—The astragalus is nearly as large as that of *Mesohippus bairdii*, and about 40 per cent smaller than that of *Hyracodon nebraskensis* (Table 4), but morphologically is closer to the latter. The trochlea is short and wide, the medial condyle is longer than the lateral, as in *Hyracodon*, but not both above and below as in *Mesohippus* (Scott, 1941: 929). On the distal end of the medial condyle there is a short ridge that separates it from the articular facet for the navicular; such a feature is present in *Hyracodon* and *Subhyracodon*, whereas in *Mesohippus*, the distal end continues directly with the navicular facet without a break (Scott, 1941: 929). The articular facet for the cuboid, located on the distal end of the lateral condyle, is very

TABLE 3.—Measurements of Hyracodon.
A. after Wood, 1926:317. B. after Scott, 1941:842.

		?*Hyracodon* (IGM 65-30)	A *H. nebraskensis* (CM 3572, holotype of "*H. petersoni*")	B *H. nebraskensis* (PU 11414)
P2	L	10.0	13.6	16.0
	W	13.0a	15.2	
P3	L	10.0	14.4	19.0
	W	13.0a	18.5	
P4	L	12.8	14.7	20.0
	W	16.3	20.6	
M1	L	15.2	17.3	20.0
	W	19.0	20.2	
M2	L	17.7	18.5	23.0
	W	23.0a	21.3	

a = approximate.

TABLE 4.—Measurements of the astragalus of IGM 65-31C, *Hyracodon nebraskensis* (from Scott, 1941:843), and *Mesohippus bairdii* (from Scott, 1941:938).

	(IGM 65-31C)	*Hyracodon nebraskensis* (PU 14414)	*Mesohippus bairdii* (AMNH 1477)
Length	21	37	22
Greatest width	17	28	21

small and oriented laterally. On the internal side of the medial condyle, above the navicular facet, there is a small pit for the internal malleolus of the tibia. The fossa for the interarticular tongue of the *cochlea tibialis*, located on the distal end of the groove of the trochlea is large and deep. The navicular facet and the sustentacular facet (for the calcaneus) are partly broken, and only the proximal calcaneal facet is complete.

DISCUSSION.—The astragalus IGM 65-31C has these rhinocerotoid characters: the medial condyle is much longer than the lateral condyle, and unlike the astragalus of *Mesohippus*. In IGM 65-31C, the distal extremes of both medial and lateral condyles end at about the same level, whereas in *Mesohippus*, the lateral condyle is shorter and does not reach as far distally as the medial condyle (Scott 1941:929). The other rhinocerotoid characters of IGM 65-31C are: having a protruding facet for the navicular, and a very small facet for the cuboid.

This astragalus is approximately 40 per cent smaller than that of *H. nebraskensis*. If such a ratio is the same for the whole skeleton, IGM 65-31C would represent a small Chadronian rhinoceros about the size of the Bridgerian *Triplopus cubitalis* from the Lower Washakie, Wyoming (Wood, 1927: Table 1a), or the enigmatic Chadronian *Toxotherium hunteri* from the Cypress Hills, Saskatchewan, Canada (Wood, 1961:3). Unfortunately, the astragalus is unknown in both species. *Toxotherium* has been reported from the Chadronian of the undifferentiated Vieja Group, Rim Rock Country, Texas, by Harris (1967a:95, 1967b). But *T. cf. T. woodi*, the species described from Texas, is about half as large as *T. hunteri*. Under the evidence available, the assignment of IGM 65-31C beyond the level of superfamily is not justified.

Order ARTIODACTYLA Owen, 1848

The artiodactyls are more diverse and better represented than the other two orders. Four families and five genera are present. Only one genus, *Hypertragulus*, had not been proviously found in the Texas local faunas of comparable age.

Suborder SUIFORMES Jaeckel, 1911
Superfamily MERYCOIDODONTOIDEA Thorpe, 1937
Family AGRIOCHOERIDAE Leidy, 1869
Protoreodon Scott and Osborn, 1887

Protoreodon petersoni Gazin, 1955
(Fig. 6a. Table 5)

HOLOTYPE.—PU 14404, skull and jaws with complete dentition, and other skeletal portions, collected from the Myton Pocket, Uinta Basin, Utah; Uinta C (Gazin, 1955: 49).

REFERRED MATERIAL.—IGM 65-32 an incomplete skull lacking the post-

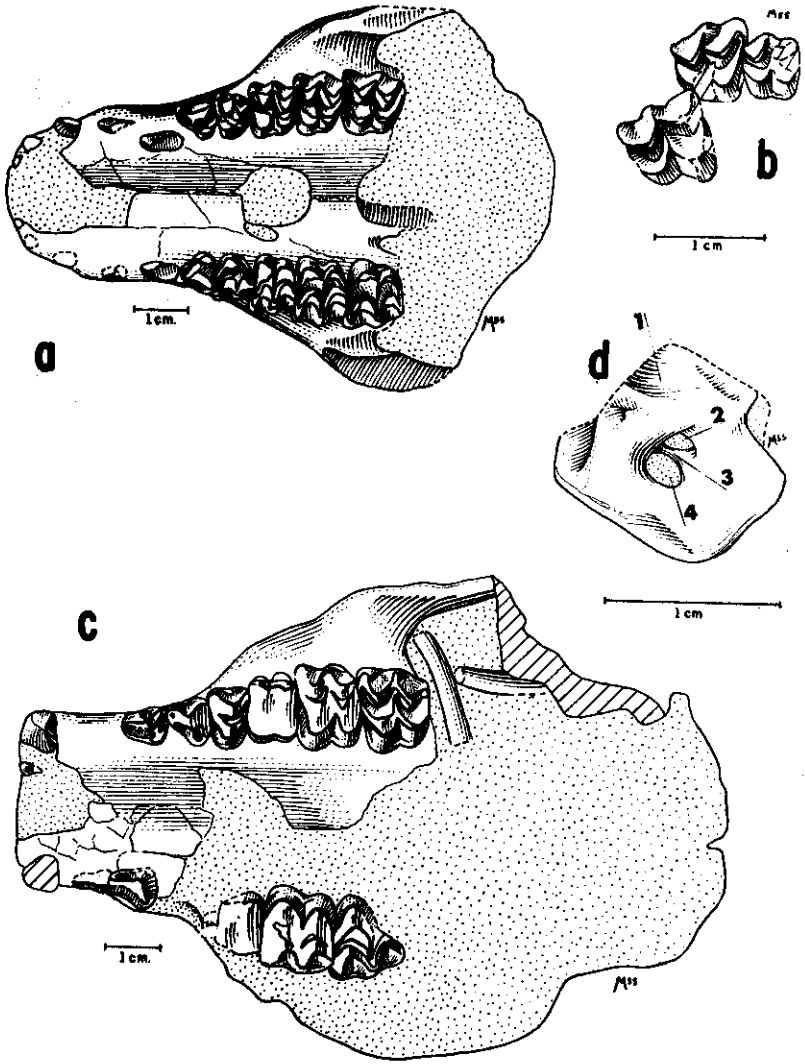


FIG. 6.—a. *Protoreodon petersoni* Gazin, IGM 65-32, incomplete skull, ventral view.
b. *Bathygenys alpha* Douglass, IGM 65-35, right M1-3, occlusal view.
c. Merycoidodontidae gen. et sp. indet. IGM 65-37, incomplete skull, ventral view.
d. IGM 65-38, left petrosal partly broken, internal view:
1. fossa subarcuata.
2. fossa for the facial (VII cranial) nerve.
3. falciform crest (notice its oblique position).
4. fossa for the acoustic (VIII cranial) nerve.

erior part of the cranium, collected by Dr. J. A. Wilson in the summer of 1965, Fig. 6a; IGM 65-32A, a right maxilla fragment with P3-M1; IGM 65-33A, a right mandible fragment with P1-M2; IGM 65-33B, left mandible fragment with P3-M3; IGM 65-33C, left mandible fragment with P1-M3.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW Ojinaga, Chihuahua; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—The rostral region of the skull IGM 65-32, is badly broken, but the outline is preserved. The rostrum is short and relatively broad, truncated anteriorly. The frontals are broad, well defined postorbital processes. Only the left supraorbital foramen remains, from which a short sulcus is directed anterointernally. The orbits are circular and open posteriorly. The temporal ridges of the parietals are sharply defined. The posterior half of the cranium is missing.

The skull is nearly 40 mm deep, with its right side slightly depressed by crushing. The infraorbital foramen is above P3. Anterior to it a small shallow oval depression is present. The lachrymal is oval without an antorbital fossa. The malar is 12 mm deep with the posterior portion missing. The tooth rows are nearly parallel. The internal naris opens opposite the anterior margin of M3.

Only small portions of left I2-3 remain. Premolars do not have an external cingulum. P1, the smallest, is trenchant, single-cusped, with the posterior half worn and anterior half sharp and unworn. A faint internal cingulum is present. P2 is as wide as P1 and slightly longer. P3 has a triangular occlusal outline. A sharp internal cingulum joins the base of the anterior crest and the protocone; the median crest of the main cusp also joins the internal cingulum. P4 is triangular but the main cusp is split into two external cusps. The protocone is much larger, quasi-crescentic, and has migrated anteriorly. On its anterior crest, the protoconule is clearly visible. A small cuspule (hypocone) posterior to the protocone is present; a short internal cingulum forms a shelf between them. A well defined anterior cingulum is present. Ribs are lacking, faint styles are present.

The molars have the characteristic agriochoerid pattern, that is, the posterior crest of the protocone meets the anterior crest of the hypocone at a rigth angle, leaving a pocket anterointernal to the metacone (Gazin, 1955:48). Small but well defined protoconules are present on all molars. M1-2 have thick rounded para- and mesostyles, but no metastyle. M3 has a faint metastyle, however. An anterior cingulum and well defined shelves are also present in all molars. There is no posterior cingulum.

IGM 65-32A (P3-M1) is similar to IGM 65-32 except that P4 has a better developed hypocone.

The lower jaw fragments differ slightly among themselves in size and morphologic details. All of them have the alveolar border straight, the jaw rapidly increasing in depth posteriorly; teeth brachydont, and the premolars crowded. Unfortunately none of them have the molars well preserved. IGM 65-33C is the best preserved of the three. The horizontal ramus is slender, 16 mm deep below P1 and 32 mm below the base of the ascending ramus. P1-4, and the labial

TABLE 5.—Measurements of *Protoreodon petersoni*.

		IGM 65-32	IGM 65-32A	IGM 65-33A	IGM 65-33B	IGM 65-33C
C-M3	L	65.4				
C	L	5.6				
C	W	4.5a				
P1-M3	L	56.5				
P1-P4	L	29.0				
M1-M3	L	27.9				
P1	L	7.0				
	W	3.8				
P2	L	8.0				
	W	3.8				
P3	L	7.7	7.5			
	W	6.5	6.7			
P4	L	8.0	7.3			
	W	8.3	8.4			
M1	L	8.5	8.5a			
	W	9.8				
M2	L	9.4				
	W	11.1				
M3	L	10.0				
	W	12.0				
P1-M3	L					62.1
P1-P4	L					30.5
M1-M3	L					31.6
P1	L					6.5
	W					3.5a
P2	L			6.3a		7.0a
	W			3.2a		3.0a
P3	L			7.2	8.1a	8.0
	W			4.0a	4.0a	3.8
P4	L			7.6	8.0a	9.0
	W			5.7	4.0a	5.3
M1	L			9.0a	8.5a	7.3(+)
	W				7.5a	
M2	L			10.6		8.3(+)
	W			8.0a		
M3	L					15.0(+)

a = approximate. (+) = measured at alveolus.

halves of $M\bar{1}$-$\bar{3}$ are preserved. $P\bar{1}$ is caniniform, and $P\bar{2}$ trenchant, unfortunately, the lingual half is missing. $P\bar{3}$ is compressed and longer anteroposteriorly than $P\bar{2}$; $P\bar{3}$ main cusp is slightly grooved, forming incipient labial and lingual cuspules; its posterior and posterointernal crests form a narrow valley; the anterior crest is sharp, and the internal cingulum very feeble. $P\bar{4}$ is larger and more advanced than $P\bar{3}$. The main cusp is already split and proto- and metaconid are discrete cusps; the talonid is molarized with the hypo- and entoconid crescentic. The anterior crest and the internal cingulum are sharper than in $P\bar{3}$.

IGM 65-33A has the inferior border of the ramus broken. $P\bar{2}$-$M\bar{2}$ are present. The teeth are slightly smaller than those of IGM 65-33C. The premolars are less well preserved; the main cusps of $P\bar{3}$-$\bar{4}$ are unsplit, and the talonid of the latter is not molarized.

IGM 65-33B is badly crushed, with the ventral part of the horizontal ramus missing; most of the ascending ramus is well preserved, however.

DISCUSSION.—IGM 65-32 is of comparable size to that of PU 10398, the holotype of *P. parvus*, and YPM 11891, a specimen referred to this species (Thorpe, 1937:279; Gazin, 1955:54), both from the Uinta Basin (Uinta B), Utah. The cheek teeth are similar (particularly $P\bar{3}$-$\bar{4}$ large protocones) but IGM 65-32 has the $P\bar{4}$ primary cusp split into para- and metacones); whereas in *P. parvus*, $P\bar{4}$ primary cusp is either unsplit or grooved. In this character, IGM 65-32 resembles *P. pumilus* and *P. primus* (Gazin, 1955:53, 57); both are larger, however.

IGM 65-32 is distinguished from *P. paradoxicus*, a species of comparable size (Gazin, 1955:55), by having a much larger protocone on $P\bar{3}$ and $P\bar{4}$ and also in the split primary cusp of $P\bar{4}$. J. A. Wilson (personal communication, August, 1966), has found *P. pumilus* remains in the Chambers Tuff Formation of the Rim Rock Country, Texas, and has dated them as earliest Chadronian. *P. parvus*, however, had not been found in this stratum, but in the older Colmena Tuff Formation dated as Uinta C (Wilson, personal communication. August, 1966). When the specimens from the Prietos area are compared with UTBEG 31281-14, a well preserved skull and jaws, from the Colmena Tuff, the following differences are noticed. The Colmena skull is smaller, the premolars narrower, $P\bar{4}$ primary cusps are split, but the cusps are still very close.

There is only one internal cusp on $P\bar{4}$ (protocone). The molars have large protoconules and less crescentic main cusps. The Prietos skull (IGM 65-32) is larger, the premolars wider transversely; $P\bar{4}$ with well split primary cusp, and two internal cusps (protocone crescentic, hypocone incipient); molars with small protoconule and main cusps more crescentic than the Texas specimen.

IGM 65-33A, a lower jaw, is similar in size and shape to that of UTBEG 31281-14, but the former is slightly larger than the latter. The $P\bar{4}$ talonid is not crescentic in both specimens. IGM 65-33B and -33C are slightly larger than UTBEG 31281-14. IGM 65-33C unlike UTBEG 31281-14 has the talonid of $P\bar{4}$ crescentic. IGM 65-33B is not well enough preserved to make a significant comparison. Although the differences are not extreme, the specimens from the

Prietos area seem to be more advanced than those from the Colmena Tuff, particularly in the larger size, more molarized upper and lower P4, and smaller protoconules on the molars.

Protoreodon has been previously known from northern localities, such as the Uinta Basin, Utah (Gazin, 1955); Beaver Divide and Badwater areas, Wyoming (Gazin, 1956); Sage Creek area, Montana (Hough, 1955, Gazin, 1956); Swift Current, Saskatchewan, Canada (Russell and Wickenden, 1933); a southwestern locality, the Poway Conglomerate, San Diego County, California (unpublished record, LACM 249/17117); and as far south as the Rim Rock Country (Wilson, unpublished manuscript). The finding of *Protoreodon* remains in the Ojinaga area, Mexico constitutes the southernmost record.

Agriochoerus Leidy, 1850
Agriochoerus maximus Douglass, 1902
(Fig. 5d; Table 6)

HOLOTYPE.—CM 749, right maxilla fragment with P1-M3, left M1-2 and other skull fragments, from the Pipestone beds, Chadronian, Montana.

REFERRED MATERIAL.—IGM 65-34A, right mandible fragment with $\overline{M1\text{-}3}$, Fig. 5d; IGM 65-34B, left mandible fragment with $\overline{M1\text{-}3}$.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—Both specimens were found in the same block of matrix but they differ from one another in such a way that it seems unlikely that they belonged to the same individual. IGM 65-39A is 60 mm deep below $\overline{M3}$; its $\overline{M1\text{-}3}$ length measures 73 mm, and the teeth are moderately worn. IGM 65-34B is only 50 mm deep below $\overline{M3}$, $\overline{M1\text{-}3}$ measures 75.1 mm, and are nearly unworn. The specimens are represented by the posterior half of the horizontal ramus, and a very small part of the ascending ramus.

The horizontal ramus is large and thick (18 mm maximum). Both the alveolar and the ventral borders are straight, the jaw increasing in depth posteriorly. The masseteric fossa is limited anteriorly by a strong ridge, which is the ventral projection of the external edge of the sulcus posterior to $\overline{M3}$. The pterygoid fossa is shallower than the masseteric, but nearly as large. The jaw does not show a well developed angular region.

The molars are large, subhypsodont, with a conspicuous pocket anterointernal to the hypoconid. Anterior and posterior cingula, strong pillars, and wide ribs are present. The ribs are flanked inferiorly by small spurs. This condition is seen in *Protoreodon*, but the spurs are less prominent.

DISCUSSION.—Douglass (1902:267, Pl. 9, Fig. 4) described and figured *A. maximus* on the basis of a single right maxilla fragment from the little Pipestone Beds of Montana. Douglass' (1902:267) distinguishing characters for *A. maximus* are as follows: "Size large, teeth plain, the cheek teeth low, except P1, made up of crescents which are approximately low three-sided pryramids with broad bases".

The mandibles of *A. maximus* have not been previously reported. IGM 65-34A and -34B have a typical *Agriochoerus* molar pattern and are of comparable size to that of the holotype of *A. maximus*, and therefore I assigned them to this species.

Family MERYCOIDODONTIDAE Thorpe, 1923
Subfamily OREONETINAE Schultz and Falkenbach, 1956
Bathygenys Douglass, 1902

Bathygenys alfa Douglass, 1902
(Fig. 6b; Table 7)

TABLE 6.—Measurements of *Agriochoerus maximus*. Measurements of CM 749 after Douglass, 1902:268.

		CM 749 (holotype)	IGM 65-34A	IGM 65-34B
$\underline{M1\text{-}3}$	L	70		
$\overline{M1\text{-}3}$	L		72.9	75.1
$\underline{M1}$	L	19		
	W	22		
$\underline{M2}$	L	24.5		
	W	27		
$\underline{M3}$	L	26.5a		
	W	20		
$\overline{M1}$	L		17.5	18.0
	W		12.8	14.8
$\overline{M2}$	L		20.4	22.5
	W		15.3	15.2
$\overline{M3}$	L		35.0	34.6
	W		16.4	16.6

a = approximate.

HOLOTYPE.—CM 708, right mandible fragment with C-P4, from the Chadronian, Pipestone Springs, Jefferson County, Montana.

REFERRED MATERIAL.—IGM 65-35, skull fragment with right M1-3, Fig. 6b; IGM 65-36, right maxillary fragment with P4-M3.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—The skull fragment is badly crushed. It consists of most of the right maxilla, the orbit, and the anterior part of the zygomatic arch. The orbit is broken posteriorly. The infraorbital framen is missing in IGM 65-35, but in IGM 65-36 it is above P3. The zygomatic arch is very thin and shallow, about 4.5 mm deep.

The teeth are small and brachydont. IGM 65-36 has P4-M3. Unfortunately, P4-M1 are so badly broken and crushed, that it is not possible to determine the pattern accurately. M2-3 lack the metaselene. IGM 65-35 has only the molar series, but the preservation is better. The molars are nearly square, the protoselene increasing from M1 to M3, where it is considerably larger than the hyposelene. Para- and mesostyles are much larger than the metastyle, which is nearly indiscernible. The mesostyle is oblique anteroexternally in M1-2, whereas in M3 it is directed externally. The cingulum is confined to the anterior margin of the teeth.

The molars of IGM 65-36 differ from those of IGM 65-35 in that they are smaller, the styles are not slender but bluntly rounded, and the proto- and hyposelenes are of the same size.

DISCUSSION.—Douglass (1902:256) established *Bathygenys alpha*, on the basis of two mandible fragments from Pipestone Springs, Montana. Later, Matthew (1903:229, Fig. 4) described and figured a right maxilla fragment with P4-M3. Thorpe (1937:37-42), accepted Matthew's assignment, and redescribed the genus on the basis of both upper and lower teeth. Schultz and Falkenbach (1956:465) questioned the validity of Matthew's assignment, claiming that: "Matthew's maxilla is most likely referable to the cervids".

FAM 45334 was collected from Bates Hole, Natrona County, Wyoming, and was available for comparison with IGM 65-35, -36; the results are summarized as follows: FAM 45334 falls within the size range of IGM 65-35, -36 (Table 7); the labial surface of the molars is less depressed, the styles are oblique anteroexternally in all molars; and both anterior and posterior cingula are present. IGM 65-35 and -36 have the labial surface more depressed, M3 mesostyle is not oblique, and the posterior cingulum is absent.

Until a larger sample is available, these differences do not warrant the establishment of a new taxon for the Mexican specimens.

Bathygenys was previously known from two northern localities: Pipestone Springs, Montana (Douglass, 1902:256), and Bates Hole, Natrona County, Wyoming (Shultz and Falkenbach, 1956:466). J. A. Wilson has found *Bathigenys* remains in the Rim Rock Country, Texas, thus extending the geographic distribution of the genus considerably southward. However, the spec-

imens collected at the Prietos area constitute the southernmost record of *Bathygenys*.

TABLE 7.—Measurements of *Bathygenys alpha*.

		IGM 65-35	IGM 65-36	FAM 45334
M1 3	L	20.0	15.5a	17.5
P4	L		5.5a	4.4
	W			4.4
M1	L	5.5a	5.0	4.3
	W	6.0		4.6
M2	L	6.8	5.0	6.2
	W	7.2	5.7	6.2
M3	L	7.7	5.5a	7.0
	W	7.2	6.7	5.7

a = approximate.

Family MERYCOIDODONTIDAE Thorpe, 1927
Gen. et. sp. indet.
(Fig. 6c and d; Table 8)

REFERRED MATERIAL.—IGM 65-37, incomplete and crushed skull with the dentition nearly complete, Fig. 6c; IGM 65-38, incomplete and badly crushed skull with left M1, and the internal half of P4-M3.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—Both skulls are unfortunately poorly preserved, and diagnostic characters such as the shape and size of the antorbital fossa, the occiput, and the bullae, are lacking. The skulls are brachycephalic, the rostrum much shorter than the cranium. In IGM 65-37, the better specimen, most of the rostral roof is missing. The antorbital fossa is approximately one third as large as the orbit, but neither the shape nor the depth can be determined. The frontals are wide. Only the left orbit is preserved, it is nearly circular and closed posteriorly. Most of the left zygomatic arch is missing; the right one is short, shallow, turning sharply inward posteriorly, forming a notch. The temporal fossa is short and wide. Most of the cranium is missing, however,

the left exoccipital process, compressed anteroposteriorly, is partly preserved. The internal naris opens opposite to the protocone of M3.

IGM 65-38 has the cranial base partly preserved, but the bullae are missing. Both petrosals are present. The left petrosal is partly broken, showing incompletely the cochlea. I removed this bone (Fig. 6d) and compared it with the petrosal of UTBEG 40268-1, *Merycoidodon culbertsoni;* the following differences were found:

TABLE 8.—Measurements of IGM 65-37 and FAM 45489, the holotype of *Stenopsochoerus (Pseudostenopsochoerus) chadronensis.*

		IGM 65-37	FAM 45489
C-M3	L	73.5	84.0
C	L	6.0	7.5
C	W	7.5(+)	7.8
P1-M3	L	66.2	73.5
P1-P4			
M1-M3			
P1	L	7.3	8.0
	W	4.8	5.7
P2	L	8.3	9.5
	W	7.4	7.8
P3	L	8.7	9.4
	W	8.5	8.7
P4	L	7.3	8.6
	W	11.0	11.0
M1	L	10.0	13.0
	W	11.4	15.0
M2	L	11.5	15.3
	W	15.0	17.0
M3	L	12.5	15.2
	W	15.6	16,5

(+) = measured at alveolus.

1) The subarquate fossa is relatively smaller and shallower in IGM 65-38 than in UTBEG 40268-1. 2) The falciform crest, a septum dividing the internal acoustic meatus, is oblique in IGM 65-38, and horizontal in UTBEG 40268-1. 3) In IGM 65-38, the fossa for the facial (VII cranial) nerve is anterodorsal, and the fossa for the acoustic (VIII cranial) nerve is posteroventral; whereas in UTBEG 40268-1, the fossae are dorsal and ventral respectively.

The dentition is nearly complete in IGM 65-37. The teeth are remarkably brachydont and thin-enameled. The incisor row is straight and does not protrude anterior to the canines. Right $\underline{I1}$ and left $\underline{I2}$ are the only incisors present. Although poorly preserved, what remains indicates that the incisors were small, uncrowded and styliform, thus contrasting with those of *Merycoidodon*. Both canines are broken near the alveolus; the transverse diameter is larger than the anteroposterior diameter. $\underline{P1}$ is compressed laterally, the labial wall is vertical, and does not have an external cingulum. A small basin posterointernal to the main cusp is present. $\underline{P1}$ is triangular in occlusal outline, and has a faint external cingulum. The internal cingulum is weak and extends from the anterior crest to the median crest, which is not prominent. The anterointermediate crest is extremely short and weak, so the fossette between this crest and the anterior crest is a very small and shallow pit. The hypocone is very low and produced lingually beyond the median crest. $\underline{P3}$ is larger than $\underline{P2}$. $\underline{P4}$ is bicrescentic, the external cingulum is sharp, and completely surrounds the internal crescent. The molars are fully crescentic, their styles are very short and rather thick, and the metastyle is smaller than the meso- and parastyles. The external cingulum is weak.

DISCUSSION.—The specimens lack several diagnostic characters, as was pointed out above, making definite assignment to any of the merycoidodontid subfamilies not possible. Schultz and Falkenbach (1956:388) stated that:

> "It is evident within the oreodonts, particularly within forms from the Oligocene, that similarity of measurements or range in size of the skulls may not be indicative of species or even close relationship. The actual characters..., as well as geologic occurrence must be considered".

On the basis of the geologic occurence, as well as the size, however, some progress on the identification of the specimens can be achieved.

The lower formation, as will be discussed later, seems to be correlated with the Chambers Tuff Formation of the Rim Rock Country, Texas, which has been dated as early Chadronian (Wilson, 1956:229, Wilson *et al.*, 1968). The following oreodont subfamilies have Chadronian representatives: Oreonetinae, Miniochoerinae (Schultz and Falkenbach, 1956, Chart 1), Desmatochoerinae (Schultz and Falkenbach, 1954: Chart 1), and the Merycoidodontinae (Thorpe, 1937:46-47, Schultz and Falkenbach, 1968, pt. 1, Chart 1).

IGM 65-37, -38 exceed the size range of any member of the subfamily Oreonetinae (Schultz and Falkenbach, 1956:455).

The Chadronian miniocherines are: *Stenopsochoerus (Pseudostenopsochoerus) chadronensis, S. (P.) douglassensis* and *S. (P.) reideri* (Schultz and Falkenbach, 1956: 445, 447, 449). The holotypes of the three species of *Pseudo-*

stenopsochoerus were available for comparison. The Mexican specimens show and overall resemblance to *Pseudostenopsochoerus*, particularly to *S. (P.) chadronensis*, whose skull is the most brachycephalic and less deep vertically of the three. There are, however, a number of differences.

IGM 65-37 P1-M3 length, is 2 mm smaller than the smallest specimen of *S. (P.) chadronensis*, geologic variety from the "Zone A" of Brule Formation, Nebraska and Wyoming (Schultz and Falkenbach, 1956: 385). IGM 65-37 P1-M3 length is 12 mm smaller than the holotypes of *S. (P.) dogulassensis* and *S. (P.) reideri* (Schultz and Falkenbach, 1956:336). *Pseudostenopsochoerus* has less brachydont teeth and P1-3 with a longer and well defined anterointermediate crest. The P3 of *Pseudostenopsochoerus* has a crescentic hypocone. P4 has an anteroexternal pit and may or may not have an external cingulum. Its internal cingulum is discontinuous. The molars have prominent styles, and do not have shelves.

The Mexican specimens have remarkably brachydont, thin-enameled teeth. The anterointermediate crest of P1-3 very short and low, the hypocone of P3 is very small, low and not crescentic. P4 does not have an anteroexternal pit, and has both external and internal cingula; the latter is continuous. The molars have shelves and not prominent styles. In *Pseudostenopsochoerus*, the internal naris opens opposite the posterior margin of M3, while in the Mexican specimens it opens opposite the protocone of M3.

Thorpe (1937:46-47) listed two Chadronian representatives of the subfamily Merycoidodontinae, *Merycoidodon affinis* (Leidy) and *M. culbertsoni* Leidy. *M. affinis* has been transferred to the subfamily Miniochoerinae, and has been synonymized with *Miniochoerus (Paraminiochoerus) affinis* by Schultz and Falkenbach (1956:405). They consider that "all of the material of *M. (P.) affinis*... indicates that the form is restricted to the lower part of the Brule" (Schultz and Falkenbach, 1956:407). *M. (P.) affinis* is about the same size as IGM 65-37 (Schultz and Falkenbach 1956:56), has thin-enameled, brachydont teeth, and shallow zygomata; but unlike IGM 65-37, *M. (P.) affinis* has longer and better developed anterointermediate crests in the premolars, the molars with prominent styles, and zygomata without a notch posterior to the orbit.

The Chadronian material referred to *M. culbertsoni* from the Cypress Hills Formation, Saskatchewan, Canada (Lambe, 1908:29), consists of three isolated teeth: C, P1 and M2. This does not seem to be sufficient evidence to extend the geologic range of *M. culbertsoni* beyond the lower Brule (Scott, 1940:670).

The Chadronian desmatochoerines are represented by a single species, *Prodesmatochoerus meeckae*. The holotype of this species was available for comparison. It differs from IGM 65-37, -38, in being much larger (Schultz and Falkenbach, 1954:218), highly dolichocephalic and deeper vertically. In *P. meekae*, the internal naris opens opposite to the posterior margin of M3, rather than opposite to the protocone of M3 as in the Mexican specimens. The incisors of *P. meekae* are larger and relatively narrower than those of IGM 65-37. The anterointermediate crest of P1-3 is much larger and placed farther

lingually than in IGM 65-37 or in *Pseudostenopsochoerus*. P4 of *P. meekae* has a discontinuous internal cingulum, while that of IGM 65-37 is continuous.

In conclusion, an assignment of the specimens below family rank is not warranted on the basis of the available evidence. The specimens seem to be closer to *Stenopsochoerus (Pseudostenopsochoerus) chadronensis* than to any of the other oreodonts considered, suggesting miniochoerine affinities. Oreodont material currently being prepared and studied by J. A. Wilson from the Chambers Tuff formation, seems to suport this suggestion, but it is too early to make any formal statement.

Suborder RUMINANTIA Scopoli, 1777
Infraorder TRAGULINA Flower, 1884
Family HYPERTRAGULIDAE Cope, 1879
Hypertragulus Cope, 1873

*Hypertragulus heikeni** sp. nov.
(Fig. 5e and f; Table 9)

HOLOTYPE.—IGM 65-39, both mandible rami with $P\bar{1}$-$M\bar{3}$, collected by G. Heiken in the summer of 1965, Fig. 5e.

HYPODIGM.—Holotype; IGM 65-40A, right edentulous mandible fragment; IGM 65-40B, isolated right $P\bar{2}$; IGM 65-40C, isolated right $M\bar{2}$.

REFERRED MATERIAL.—IGM 65-40D, right astragalus, Fig. 5f; and IGM 65-40E, left astragalus, both questionable references.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW Ojinaga, Chihuahua; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DIAGNOSIS.—A smaller species than *H. calcaratus Cope;* anterior mental foramen below diastema; posterior mental foramen below the contact of $P\bar{3}$ and $P\bar{4}$; dentition brachydont; $P\bar{2}$ isolated; $P\bar{3}$ with a tiny accessory cusp; $P\bar{4}$ bicusped, basined posteriorly; lower molars typically selenodont; well-defined shelves but not pillars; $M\bar{1}$-$\bar{2}$ with sharp and equally developed anterior and posterior cingula; $M\bar{3}$ talonid noncrescentic, but with a small spur on the internal crest.

DESCRIPTION.—The rami are very long and shallow with the alveolar border straight, and the ventral border gently convex, increasing in depth very little posteriorly. The anterior mental foramen is larger than the posterior mental foamen.

The teeth are brachydont. The premolars are not crowded, and the molars resemble very much those of *Simimeryx hudsoni*. Incisors and canine are missing. $P\bar{1}$ is tusk-like, directed obliquely anteroexternally, its subapical region slightly abraded anteriorly. A diastema 3.3 mm long separates $P\bar{1}$ from $P\bar{2}$; the alveolar edge is horizontal at this region. $P\bar{2}$ is the smallest of the cheek teeth, is simple, trenchant, and single cusped; its edges are sharp, and

* Specific designation after my field partner Grant Heiken.

TABLE 9.—Measurements of lower teeth of four hypertragulid species. A and B, after Gazin, 1955:16; C, after Scott, 1940:522.

		A	B	C	
		Simimeryx hudsoni (CIT 1244)	*Simimeryx minutus* (CM 11913)	*Hypertragulus calcaratus* (AMNH 1341)	*Hypertragulus heikeni* sp. nov. (IGM 65-39)
$P\bar{1}$-$M\bar{3}$	L	42.4		44.0	34.5
$P\bar{2}$-$M\bar{3}$	L	33.8		35.0e	27.7
$P\bar{1}$-$P\bar{4}$	L	21.8		24.0e	19.5
Diastema ant. to $P\bar{2}$		4.9		6.0e	3.3
Diastema post. to $P\bar{2}$		0.0		2.5e	1.5
$P\bar{2}$-$P\bar{4}$	L	13.9		15.0	12.6
$M\bar{1}$-$M\bar{3}$	L	19.5		20.0	15.1
$P\bar{1}$	L	3.0		3.0	3.0
	W	2.0a		2.5	2.0
$P\bar{2}$	L	3.6		3.0	3.1
	W	1.9		2.0	1.5
$P\bar{3}$	L	5.0		4.5e	4.0
	W	2.6			2.0
$P\bar{4}$	L	5.3	3.9	5.0	4.0
	W	2.1	1.7e	2.0	2.0
$M\bar{1}$	L	4.9	4.1	5.0	4.0
	W	4.0	2.8	3.5	2.9
$M\bar{2}$	L	5.6	4.6	6.0	4.6
	W	4.5	3.1a	4.5	3.4
$M\bar{3}$	L	9.0		9.0	6.5
	W	4.4		5.0	3.3
Premolar-molar index		51.2		75.0	83.4

a = approximate, e = estimated.

do not show wear. The anterior border is gently convex, whereas the posterior one is gently concave, with a tiny swelling at its base. A small diastema 1.5 mm long separates $P\bar{2}$ from $P\bar{3}$. $P\bar{3}$ is also single-cusped, but is larger and more complex than $P\bar{2}$, in that the anterior crest of the main cusp projects downward shifting inward at a point corresponding to approximately half the height of the crown, and thus forming an accessory anterointernal pillar-like cuspule in the position of a paraconid. The posterior crest is sharper than the anterior crest, and at its base joins the posterior cingulum, which is short and sharp, thus forming a small basin. The external cingulum is short and is located opposite the basin.

$P\bar{4}$ is larger than $P\bar{3}$, but is similar. The anterointernal cuspule and the basin of $P\bar{4}$ are better defined; the external rim of the basin has a small spur anteriorly. The main cusp is not divided. The external cingulum extends nearly through the posterior half of the tooth. $P\bar{4}$ is not molarized.

The molars are selenodont, but as in *Protoreodon*, they have a well defined pocket posterointernal to the metaconid. Shelves and a small spur anterointernal to the metaconid are present on all molars. The molars are worn only on the anterior half of their cusps, with the posterior halves of the internal cusps practically unworn. The talonid of $M\bar{3}$ is ovoid with its major axis oblique anterointernally to the anteroposterior axis of the tooth. The talonid is not crescentic, but has only a small spur on the internal crest.

IGM 65-40D, the right astragalus, is nearly complete, lacking part of the lateral condyle of the proximal trochlea. IGM 65-40E, the left astragalus, is less complete and slightly smaller. IGM 65-40D is 12 mm long and 7.0 wide, the proximal trochlea is more deeply grooved than the distal one. The fossa for the intercondylar tongue of the *cochlea tibialis* is large, deep, and placed centrally on the dorsal surface.

DISCUSSION.—IGM 65-39 is geologically and morphologically an intermediate form between the latest Eocene *Simimeryx hudsoni* Stock, from the Sespe Formation, California; and the Orellan *Hypertragulus calcaratus* Cope, from the White River Group. The former has been regarded as ancestor of the latter (Stock 1934:628; Gazin, 1955:43). Both are remarkably similar. On lower tooth characters they differ as follows: *S. hudsoni* has crowded premolars, $P\bar{3}$ single- cusped and not basined, $P\bar{4}$ with unsplit primary cusp, basined posteriorly, and without hypo- and entoconids; the molars of *S. hudsoni* have shelves, both anterior and posterior cingula, and the selenes, are much more worn anteriorly than posteriorly.

Conversely, *H. calcaratus* has $P\bar{2}$ isolated; $P\bar{3}$ tricusped basined posteriorly; $P\bar{4}$ with split primary cusp (proto- and metaconids present), talonid with hypo- and entoconids well developed, separated by a deep valley. The molars do not have shelves, only the anterior cingulum is present, and the selenes are equally worn anteriorly and posteriorly. Unlike *S. hudsoni*, *H. calcaratus* has the talonid of $M\bar{3}$ crescentic.

IGM 65-39 is smaller than both *S. hudsoni* and *H. calcaratus* (Table 9). IGM 65-39 resembles CIT 1244, the paratype of *S. hudsoni*, in the structure of

$P\bar{4}$ and molars, but differs from it in having $P\bar{2}$ isolated, $P\bar{3}$ bicusped and basined posteriorly, $M\bar{3}$ talonid has a spur on the internal crest, and the premolar-molar index is much larger. These characters are closer to *Hypertragulus* than to *Simimeryx*, and I therefore, have assigned IGM 65-39 to the former.

Simimeryx minutus (Peterson), known from a single right lower jaw fragment with $P\bar{4}$-$M\bar{2}$ from the Lapoint Member of the Duchesne River Formation, Utah (Peterson, 1934:386) is comparable in size to IGM 65-39, and differs from it in having $P\bar{4}$ with the primary cusp split, and well developed hypo- and entoconids. Unfortunately, none of the characters that distinguish the lower teeth of *S. hudsoni* from those of *H. heikeni* (namely, isolated $P\bar{2}$, and more advanced $P\bar{3}$ and $M\bar{3}$), are observable in *S. minutus*. It would be useless to consider whether or not such characters were present in *S. minutus*, so on the basis of the evidence available I regard *H. heikeni* as a different taxon than *S. minutus*.

The astragali (IGM 65-40D and -40E) are referred to *H. heikeni*.

H. heikeni furnishes an excellent geologic and morphologic bridge between the latest Eocene *Simimeryx* and the Orellan-Arikareean *Hypertragulus*. Structurally, *H. heikeni* is the most primitive species of *Hypertragulus*, and has advanced little beyond *Simimeryx*. The occurrence of *H. heikeni* in the Prietos area extends considerably southwards the geographic distribution of *Hypertragulus*, and extends its geologic range to the early Chadronian.

LEPTOMERYCIDAE Scott, 1899
Leptomeryx Leidy, 1853

cf. *Leptomeryx* sp.
(Fig. 5g)

TYPE SPECIES.—*Leptomeryx evansi Leidy*, 1853 from the White River Group.

REFERRED MATERIAL.—IGM 65-41, a right mandible fragment with part of $M\bar{1}$-$\bar{2}$, Fig. 5g.

HORIZON AND LOCALITY.—Upper tuff member, lower formation, 32 km NW of Ojinaga, Chihuahua; locality no. 2, Plate 1.

GEOLOGIC AGE.—Early Chadronian.

DESCRIPTION.—The ramus fragment is 5.4 mm thick, but its depth is unknown, since it is broken off ventrally. $M\bar{1}$ is represented only by the entoconid, and part of the posterior cingulum. $M\bar{2}$ has proto- and metaconid complete, and both are fully crescentic. The posterior half of the hypoconid and most of the entoconid are broken. The fossettids are very shallow and narrow. The anterior cingulum is sharp, and a strong pillar is present.

DISCUSSION.—The size and shape of the teeth of IGM 65-41 are much like those of PU 12961 referred to *Leptomeryx evansi* (Scott, 1940:553), however this specimen shows neither pillar nor cingulum (Scott, 1940, Pl. 56, Fig. 1d). Rather than representing a specific character it seems that this lack represents variation. Most of the specimens in The University of Texas, Bureau

of Economic Geology Collection referred to *Leptomeryx* have both pillar and cingulum. Although IGM 65-41 is very likely *Leptomeryx*, the fragmentary condition of the specimen makes assignment uncertain.

Leptomeryx has a wide geologic and geographic range, extending through the whole White River Group Oligocene and reaching lower Miocene (Scott, 1940:537). Geographically it extends as far north as Saskatchewan (Cypress Hills Formation, Lambe, 1908:30-32), is very abundant in the Big Bad Lands of South Dakota and Nebraska (Scott, 1940:554); reaches as far southwest as California (Titus Canyon Formation, Stock, 1949:241). It has been found in the Texas Rim Rock Country (Wilson, unpublished manuscript). If IGM 65-41 is *Leptomeryx*, the Ojinaga, Mexico area would be the southernmost record of the genus.

AGE AND CORRELATION

The early Tertiary vertebrates of the Rim Rock Country have been allocated to five local faunas by Harris (1967a:40-41) and Wilson *et al.*, (1968). The Colmena Tuff has yielded the Candelaria local fauna, dated as Uinta C; the Chambers Tuff has yielded the Porvenir local fauna dated as earliest Chadronian, and the slightly younger Little Egypt local fauna. The upper member of the Hogeye Tuff from the northern Indio Mountains has yielded a faunule (Underwood, 1962) assigned to the Porvenir local fauna. The Capote Mountain Tuff has yielded the Airstrip local fauna, dated as late early Chadronian. The fossiliferous member of the undifferentiated Vieja Group (Harris, 1967a:38) has yielded the Ash Spring local fauna dated also as late early Chadronian (Harris, 1967a:135).

Table 10 lists the mammals from the Little Egypt and The Rancho Gaitan local faunas. The largest assemblages belong to the Candelaria and Porvenir local faunas. The diversity of taxa and their irregular distribution in the local faunas, makes it difficult to correlate them with a high degree of certainty.

The Rancho Gaitan local fauna is closer to the Little Egypt local fauna than to any of the others. The rodents are represented in both faunas by two families, Paramyidae and Cylindrodontidae. Paramyids are represented by large manitshines. The cylindrodonts are more numerous in the Rancho Gaitan (two genera and four species) than in the Little Egypt local fauna, however, *Pseudocylindrodon* is present in both of them.

Carnivores are represented by and undetermined felid in Little Egypt, but have not been found in the Rancho Gaitan local fauna.

Unfortunately, no horses are known from the Rancho Gaitan, *Mesohippus* is present in the Little Egypt.

Titanotheres occur in all local faunas, but their remains are fragmentary.

Tapirs are represented by *Colodon* in the Little Egypt local fauna, but have not been found in the Rancho Gaitan.

Hyracodonts constitute the rhinoceros stock of the Rancho Gaitan, but are lacking in the Little Egypt. Hyracodon remains, however, are rare in the

Chadron, and even in the lower Brule (early Orellan) stages of the White River Oligocene (Scott, 1941:842).

Entelodonts are present in the Little Egypt, but are unknown in the Rancho Gaitan.

Agriochoerids are represented in the Little Egypt by *Agriochoerus* sp., a form of medium size, whereas in the Rancho Gaitan they are represented by the large *Agriochoerus maximus*. *Protoreodon petersoni* is present in the Rancho Gaitan.

Small to medium sized merycoidodontids are present in the Porvenir, Little Egypt and Rancho Gaitan local faunas. Medium to large sized merycoidodontids

TABLE 10.—Early Tertiary mammals of the Rancho Gaitan and Little Egypt local faunas.

	RANCHO GAITAN	LITTLE EGYPT
RODENTIA		
Paramyidae	x	x
Cylindrodontidae	x	x
CARNIVORA		
Felidae		
Gen. et sp. Indet.		x
PERISSODACTYLA		
Equidae		
Mesohippus sp.		
Brontotheriidae		
?*Brontops* cf. *B. brachycephalus*	x	
Gen. et sp. Indet.		x
Helaletidae		
Colodon sp.		x
Hyracodontidae		
?*Hyracodon* sp.	x	
ARTIODACTYLA		
Entelodontidae		
Gen. et sp. Indet.		x
Agriochoeridae		
Protoreodon petersoni	x	
Agriochoerus maximus	x	
Agriochoerus sp.		x
Hypertragulidae		
Hypertragulus heikeni sp. nov.	x	
Leptomerycidae		
cf. *Leptomeryx*	x	
Merycoidodontidae		
Bathygenys alpha	x	x
Gen. et sp. Indet.	x	x

are present in the Airstrip and Ash Spring local faunas. *Bathygenys alpha*, very abundant in the Little Egypt, is represented by two specimens in the Rancho Gaitan local fauna.

Hypertragulids are represented in Rancho Gaitan and Ash Spring local faunas; *Hypertragulus* in the former and *Hypisodus* in the latter.

Leptomerycids (*Leptomeryx* sp.) are represented in the Porvenir and Rancho Gaitan local faunas. In the latter, *Leptomeryx* is represented by a single specimen, whereas in Porvenir, *Leptomeryx* remains are much more numerous.

No camels are known in the Rancho Gaitan and Little Egypt local faunas, however, they have been found in the Airstrip and Ash Spring local faunas (Harris, 1967a:47).

The preceeding comparison leaves but little doubt that the Rancho Gaitan is closest in age to the Little Egypt local fauna. On the basis of a similar assemblage of rodents and the presence of small and medium sized merycoidodontids, I believe that the Rancho Gaitan is most likely correlated with the Little Egypt local fauna.

Heiken (1966:28) tentatively correlated the unnamed lower formation with the Capote Mountain Tuff of the Rim Rock Country and pointed out that the Chambers Tuff Formation was not present in the area studied. The lower formation is overlain by basaltic flows (unnamed), and these are covered by ignimbrites questionably referred to the Brite Ignimbrite of the Rim Rock Country. Heiken's conclusion was based on the position of the lower formation with respect to the Brite Ignimbrite.

The Rancho Gaitan is similar to the Little Egypt, and therefore, I propose that Heiken's tentative correlation of the upper tuff member of the lower formation to the Capote Mountain Tuff be disregarded, and that it be correlated with the Chambers Tuff Formation of the Rim Rock Country.

Correlation of the Rancho Gaitan with other faunas from other regions of western North America also supports the early Chadronian dating. The cylindrodonts of the Rancho Gaitan (Ferrusquía and Wood, in press) show a similar stage of tooth evolution to those of the Chadronian of Montana. *Pseudcylindrodon* is present in both the Rancho Gaitan and the Pipestone Springs local faunas.

The titanothere of the Rancho Gaitan has reached the Oligocene level of tooth evolution, and is comparable to that of *Brontops brachycephalus* from the early Chadronian of the Big Bad Lands of South Dakota, or *Protitanops curryi* from the Titus Canyon Formation, earliest Oligocene of California.

The hyracodontid of the Rancho Gaitan is closer to *Hyracodon nebraskensis* (= *H. petersoni)* from the Chadronian of the White River Group, than to the Orellan-Whitneyan *H. nebraskensis* forms.

Agriochoerus maximus has been only previously known from the Pipestone Beds, Chadronian, Montana.

Bathygenys alpha was known from a few specimens from the Chadronian of Montana and Wyoming, and the Rancho Gaitan specimens seem to be conspecific with the specimen from Natrona County, Wyoming.

Hypertragulus heikeni of the Rancho Gaitan local fauna is slightly more advanced than *Simimeryx hudsoni* from the uppermost Eocene of the Sespe

Formation of California, and less advanced than *H. calcaratus* of the Orellan of the White River Group.

Summarizing, I believe that the Rancho Gaitan local fauna is of early Chadronian age.

ECOLOGICAL CONSIDERATIONS

The Rancho Gaitan local fauna is too small to obtain a precise ecological interpretation of the community that it belonged to. A few general inferences can be made, however. The presence of an enormous quantity of large fresh water gastropods associated with the vertebrate remains, suggests the presence of a neighboring permanent body of water. Some of the rodents, the cylindrodonts, seem to have been burrowers (Burke, 1936:136), if so they are of little value for an ecological interpretation, because there are burrowing rodents in both the grassland and the woodland types of communities.

Perissodactyls and artiodactyls of the Rancho Gaitan local fauna have from very brachydont to brachydont dentition, thus suited to chew upon plants of soft foliage. The presence of *Agriochoerus* might suggest a marshy type of habitat for the community or at least the presence of a neighboring body of water, since *Agriochoerus* has been supposed to have fed upon fleshy roots and tubers that grow in temporally innundated soils (Scott, 1940:726). Scott also pointed out other hypotheses that have been proposed to explain the habits of this puzzling creature.

Hypertragulus and *Leptomeryx* resemble the Asiatic chevrotains (Tragulidae), and are supposed to have had similar habits. Chevrotains live in woodland communities and frequent the banks of streams.

I believe that the Rancho Gaitan local fauna belonged to a woodland community that lived near a permanent body of water.

Harris (1967a:139-40) has proposed the hypothesis that drier environmental conditions started earlier in the Rim Rock Country than in the High Plains.

Harris (1967a:139-40) considers that at the time of deposition of the Chambers Tuff, increasingly drier conditions prevailed. His hypothesis is based in the presence of an increasing amount of caliche cement in the sediments of the Chambers Tuff. The environment that would support a great number of large freshwater gastropods, such as that of the upper tuff member of the unnamed formation, would not seem characteristic of a dry climate. Therefore, I suppose that the Rancho Gaitan and the Little Egypt local faunas belonged to different communities and biotic provinces of the Rim Rock Country-northern Chihuahua area.

CONCLUSION AND SUMMARY

The Rancho Gaitan local fauna, a small assemblage of vertebrates from the upper tuff member of an unnamed formation, northeastern Chihuahua, constitutes the first Oligocene fauna described from Mexico and is one of the southernmost early Tertiary mammalian faunas in North America.

Rodents, perissodactyls and artiodactyls are represented in this fauna. The rodents (Ferusquía and Wood, in press) are a new species of paramyd and two new species of cylindrodonts. The perissodactyls are: *?Brontops* cf. *B. brachycephalus* (Osborn), and *?Hyracodon* sp. The artiodactyls are: *Protoreodon petersoni* Gazin, *Agriochoerus maximus* Douglass, *Bathygenys alpha* Douglass, *Hypertragulus heikeni* sp. nov., cf. *Leptomeryx* sp. and an indetermined merycoidodontid.

The Rancho Gaitan local fauna is dated as early Chadronian and correlated with the Little Egypt local fauna, from the upper part of the Chambers Tuff Formation, Rim Rock Country, Texas.

Moister environmental conditions are supposed to have prevailed at the area occupied by the Rancho Gaitan local fauna than that occupied by the Little Egypt Local fauna.

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