THE LARGE MAMMALS OF
THE BUDA LOCAL FAUNA
(ARIKAREEAN: ALACHUA COUNTY, FLORIDA)

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THE LARGE MAMMALS OF THE BUDA LOCAL FAUNA (ARIKAREEAN: ALACHUA COUNTY, FLORIDA)

DAVID FRAILEY[1]

SYNOPSIS: The large mammals of the Buda Local Fauna are discussed. Two new species are described, *Daphoenodon notionastes* and *Bassariscops achoros,* and a new genus of Camelidae is recognized but not named. *Nanotragulus lulli* and *N. intermedius* are synonymized with *N. loomisi.* Additional taxa included are *Cynarctoides* sp., Mustelidae gen. et sp. indet., Nimravinae, gen. et sp. indet., *Cynorca* sp., Phenacocoelinae gen. et sp. indet., Camelidae gen et sp. indet., Anchitheriinae gen. et sp. indet., and *Moropus* sp. Biostratigraphic correlation indicates that the Buda Local Fauna is Arikareean in age.

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INTRODUCTION

The early and mid-Tertiary history of land mammals is very sparsely recorded in eastern North America. The broad sheets of continental sediments, which so beautifully preserved the successive faunas of western North America, have no counterparts in the East. Of all the eastern states, Florida has yielded the best collections of Oligocene and Miocene land mammals. This fortunate occurrence is due in great part to the widespread carbonate deposits that underlie much of the Florida peninsula. These marine carbonate deposits of the early Tertiary became riddled with solution cavities later in the Tertiary and were subsequently filled with clastic sediments. Such sinkhole deposits are small, randomly scattered, yield little stratigraphy, and are often destroyed before their presence is discovered. They are forming today in Florida in a wide variety of habitats ranging from swamp to upland areas (Harper 1914) and presumably did the same in the past. Sinkholes are natural traps, often attract animals because of the water they sometimes contain, and involve little transportation of an animal's remains after its death. Preservation is often exceptionally good. Unfortunately, fewer than a dozen mid-Tertiary sinks are known that contain vertebrate remains. Of these, most produced only a handful of fossils, the rest of the fossils having been lost during the mining operations that first uncovered the sites. The three most prolific mid-Tertiary sites have been I-75 of Whitneyan late Oligocene age (Patton 1969a); Buda of late Arikareean very early Miocene age (this paper), and Thomas Farm of Hemingfordian early Miocene age (Simpson 1932; White 1942; Olsen 1962; Patton 1967). They provide most of what is known about the Oligocene and Miocene land animals of Florida and, for that matter, of eastern North America.

Several fossil vertebrate local faunas in Florida have been described as Arikareean (very early Miocene) in age: Thomas Farm; Griscom Plantation (Simpson 1932); Seaboard Air Line Railroad Company, Tallahassee (Olsen 1964); Franklin Phosphate Pit No. 2, Newberry (Simpson 1932); Brooksville (Patton 1967); and SB-1A, near Live Oak (Frailey 1978). Two of these sites, Griscom and Seaboard, are small and dated primarily on their faunal relationships to the better known Thomas Farm Local Fauna. Studies of the fauna (Patton 1967, 1969b; Tedford and Frailey 1976) now date Thomas Farm as early Hemingfordian in age. On the basis of close resemblance to Thomas Farm, Griscom and Seaboard may also be transferred to the Hemingfordian faunal age. Franklin Phosphate Pit No. 2, Brooksville, and SB-1A then remain as the only fossil faunas in Florida still thought to be Arikareean in age. Another site containing the Buda Local Fauna is

the focus of the present study and is the largest Arikareean sample known from eastern North America.

In February, 1965, the Buda Local Fauna was discovered in NW ¼, NW ¼, S 32, T 8s, R 17E, near the small town of Buda, Alachua County, Florida (see Fig. 1), and extensively collected by S. D. Webb, N. Tessman, J. S. Waldrop, and E. Kayworth during field reconnaissance for the Florida State Museum. Subsequent collections were carried out by T. H. Patton, J. G. Klein, and Fred Dixon of the Florida State Museum. The fauna was discovered in the Buda Mine where limestone strip mining had cut into a fossiliferous clay-filled sinkhole. The sinkhole was situated within 10 yd of the south wall of the limestone mine and was not completely destroyed. It consisted of three shallow vertical chambers of from 2 to 8 ft in diameter which presumably had shared a common opening. The fossiliferous clays were oxidized only where they were in contact with the limestone wall.

Several fossils were found in place during the initial collecting. These include parts of *Daphoenodon notionastes* n. sp., the unidentifiable mustelid; *Nanotragulus loomisi*, the oreodont; an unnamed new genus of camel; a larger unidentifiable camel; the horse; and the chalicothere. The majority of the fossils were recovered by searching the spoil banks and by collecting pockets of clay which were later broken down and screened. The distribution of fossils in the spoil banks, as recalled by those who collected the locality, was not random (see Fig. 1). The small mammals were found in a clayey sand, in contrast to the clay sediments associated with the other mammals.

This study is limited to the 12 larger mammals in the Buda Local Fauna. These and the taxa of Brooksville, Franklin Phosphate Pit No. 2, and SB-1A are listed in Table 1. The hedgehog, *Amphechinus* sp., has been described by Rich and Patton (1975). The other small mammals, reptiles, amphibians, and fish will be reported on at a later date.

The majority of identifiable fossils in this fauna consists of isolated teeth. This imposes certain limitations on the interpretations that can be made. I have hesitated to recognize isolated teeth as holotypes, but where composite samples are adequate I feel that the differences will remain readily apparent and that the uniqueness of the sample justifies this course.

The specimens comprising the Buda Local Fauna are curated in the Collection of Fossil Vertebrates, Florida State Museum, University of Florida (abbreviated UF). Other abbreviations and symbols are as follows: AMNH, American Museum of Natural History; CM, Carnegie Museum; F:AM, Frick American Mammals, American Museum of Natural History; FGS, Florida Geological Survey Collection (now part of the Florida State Museum Collection); HC, Harold Cook Collection
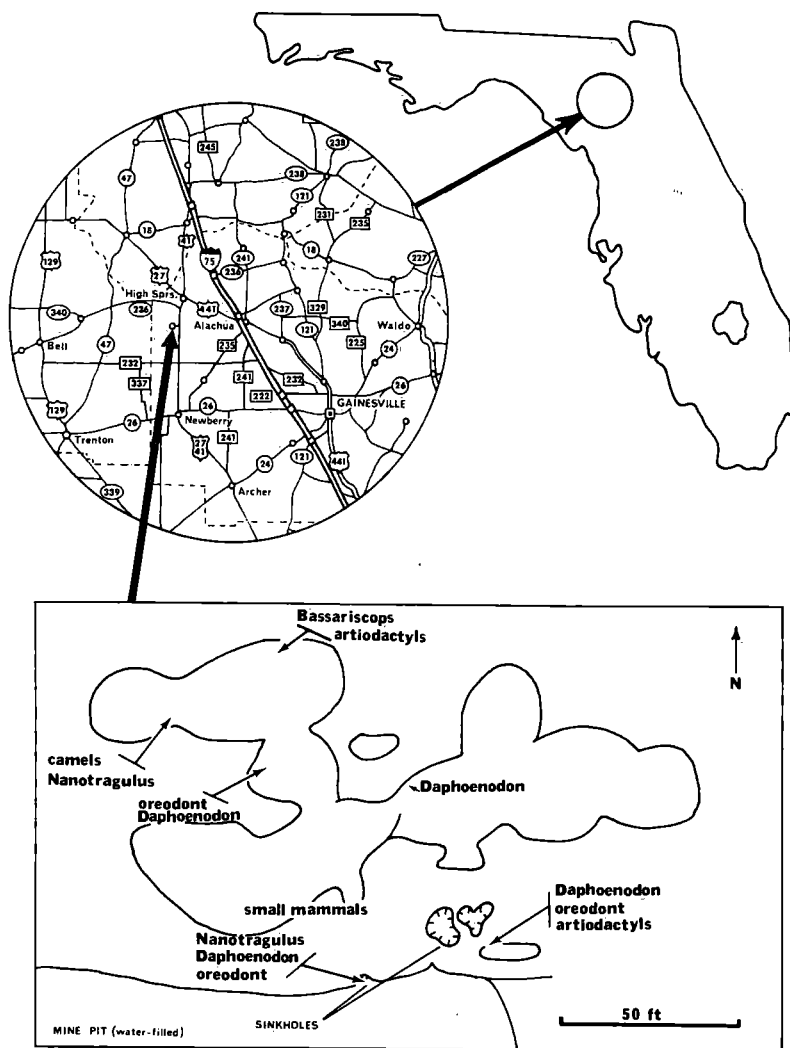
FIGURE 1.—The Buda Locality. General location and distribution of some of the fossils over the spoil piles.

(now part of the American Museum of Natural History Collection); MCZ, Museum of Comparative Zoology, Harvard University; PU, Princeton University; SDSM, South Dakota School of Mines; UC, University of Chicago; UCMP, University of California, Museum of Paleontology; YPM, Yale Peabody Museum; ( ), approximate measurement; N, number of specimens in sample; OR, observed range; $\overline{X}$, mean; SD, standard deviation; CV, coefficient of variation. All

measurements are in millimeters. The drawings were made with a camera lucida microscope.

TABLE 1.   FAUNAL LISTS OF THE ARIKAREEAN LOCAL FAUNAS OF FLORIDA.

Buda	Franklin Phosphate Pit No. 2 (modified from Simpson 1930)
Amphechinus sp.	
Daphoenodon notionastes n. sp.	*Daphoenodon notionastes*
Bassariscops achoros n. sp.	Anchitheriinae gen. et sp. indet.
Cynarctoides sp.	Rhinocerotidae gen. et sp. indet.
Mustelidae gen. et sp. indet.	Entelodontidae, ?*Daedon*
Nimravinae gen. et sp. indet.	Camelidae, ?*Oxydactylus*
Anchitheriinae gen. et sp. indet.	Blastomericinae or the unnamed new
Moropus sp.	camelid from Buda[1]
Cynorca sp.	
Phenacocoelinae gen. et sp. indet.	SB-1A
Camelidae n. gen. et sp.	(from Frailey 1978)
Camelidae gen. et sp. indet.	
Nanotragulus loomisi	*Protosciurus* sp.
	Mammacyon cf. *obtusidens*
Brooksville	Canidae gen. et sp. indet.
(modified from Patton 1967)	*Phlaocyon* sp.
	Paroligobunis frazieri
Daphoenodon notionastes n. sp.	Carnivora gen. et sp. indet.
Rhinocerotidae gen. et sp. indet.	Anchitheriinae gen. et sp. indet.
Tapiridae gen. et sp. indet.	*Nothokemas waldropi*
Merycoidodontidae gen. et sp. indet.	

[1]This identification is based on three upper molars, now lost, but two of which were figured by Simpson (1930); he referred these teeth to cf *Blastomeryx*. The features of these teeth, including those which bothered Simpson, can be seen in the upper molars of the new genus from Buda.

SYSTEMATIC INDEX

ORDER CARNIVORA

FAMILY AMPHICYONIDAE[1] TROUESSART 1885

SUBFAMILY AMPHICYONINAE TROUESSART 1885

GENUS *DAPHOENODON* PETERSON 1909

Daphoenodon notionastes **new species**

FIGURE 2, TABLE 2

ETYMOLOGY.—notios (Gr.): Southern; nastes (Gr.): Inhabitant.

HOLOTYPE.—UF 16965, M_1.

REFERRED MATERIAL.—UF 16936, 17 incisors; UF 16938, 3 upper premolars; UF 16906, P^4; UF 18499, P^4; UF 16944, M^2; UF 16921, 3 C_1's; UF 16940, 5 P_1's; UF 16968, P_4; UF 16901, 3 M_1 talonids; UF 16905, M_2; UF 18356, M_3; UF 17001, maxillary fragment with alveoli for M^{1-2}; UF 16910, edentulous mandible; UF 16970, 3 fragments of mandibles, 1 with P_4; and UF 16904, 16909, 16912, 16917, 16926, 16948, 16993, 16995, 16996, 17009-17011, 18338-18355, various postcranial elements.

COMPARATIVE MATERIAL EXAMINED.—*Daphoenodon superbus:* CM 1589A, 1589B, 1589D, 2774, 2199; AMNH 81003, 81025; FGS 1213, 1214; PU 11554. *Pericyon socialis:* YPM 12715, holotype.

DIAGNOSIS.—*Daphoenodon notionastes* is the smallest species of *Daphoenodon.* It is about 20% smaller than *D. superbus* and about 45% smaller than *D. robustum*[2]. The M_1 is low crowned and widest at the protoconid. The rim of the talonid is incomplete, forming a depression between the entoconid and the metaconid. The talonids of M_1 and M_2 are noticeably smaller (in length and width) than their respective trigonids. The mandible is slender and very *Canis*-like in appearance. The depth of the mandible beneath M_1 is less than 1½ times the length of M_1.

DESCRIPTION

UPPER DENTITION.—The P^4 (Fig. 2, E-F) of *Daphoenodon notionastes* is smaller than that of *D. superbus,* but not separable otherwise. A broken P^4 (UF 18499) is smaller than the only complete P^4 (UF 16906) and indicates that some individuals were more than 20% smaller than *D. superbus.*

No M^1 of *Daphoenodon* was found at Buda.

The M^2 of *D. notionastes* is essentially flat, the paracone being only slightly raised in contrast to the elevated paracone of M^2 in *D. superbus,* which in the latter produces a gentle concave curve when the crown is viewed anteroposteriorly. Few M^2's are housed in collections, and the differences listed here may not be diagnostic.

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[1] In this usage I am following Hunt (1972).

[2] *Daphoenodon robustum* was originally described as *Borocyon robustum* by Peterson 1910. This species was transferred to *Daphoenodon* by Hunt (1971), and *Borocyon* was dropped. Hunt also synonymized *D. niobrarensis* Loomis 1936 and *D. periculosus* Cook 1909 with this species. Thus, *Daphoenodon superbus* and *D. robustum* are the only other valid species of this genus in the literature.
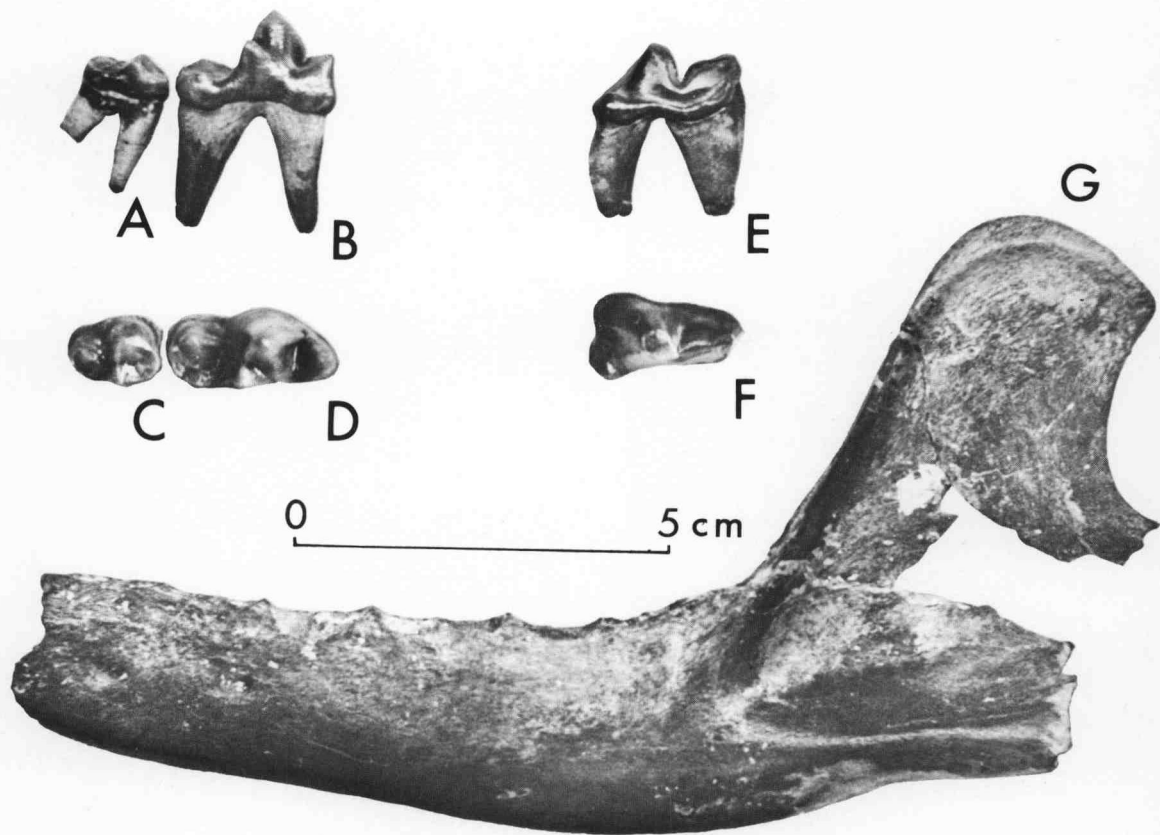
FIGURE 2.—*Daphoenodon notionastes* n. sp. A and C) UF 16905, M₂, lingual and occlusal views; B and D) UF 16965, holotype, M₁, lingual and occlusal views; E and F) UF 16906, P⁴, lingual and occlusal views; G) UF 16910, left ramus. Natural size.

TABLE 2. COMPARATIVE MEASUREMENTS OF *Daphoenodon notionastes* AND *D. super-bus*. MEASUREMENTS OF *D. superbus* WERE TAKEN FROM PETERSON (1910) EXCEPT WHERE ANOTHER SPECIMEN IS NOTED.

	D. superbus	*D. notionastes*
P^4 (length x width)	22.0 x 13.6 (CM 1589A)	20.0 x 11.3 (UF 16906)
	23.4 x 13.9 (CM 2774)	
M^2 (length x width)	19.9 x 13.4 (CM 1589A)	14.2 x 8.4 (UF 16944)
P_4 (length x width)	18.4 x 8.6 (CM 1589A)	14.9 x 6.0 (UF 16970)
		15.6 x 6.8 (UF 16968)
M_1 (length x width)	21.7 x 10.0 (PU 11554)	21.6 x 10.6 (UF 16965)
	23.5 x 11.0 (CM 2774)	
	25.5 x 11.5 (CM 1589A)	
M_1 talonid (length x width)	8.8 x 11.0 (CM 1589A)	8.1 x 9.6 (UF 16965)
	7.0 x 9.4 (PU 11554)	
M_2 (length x width)	12.2 x 8.8 (PU 11554)	12.3 x 8.7 (UF 16905)
	16.6 x 9.6 (AMNH 81003)	
M_2 talonid (length x width)	6.6 x 8.1 (PU 11554)	6.5 x 7.6 (UF 16905)
Depth of mandible at M_1	29.8 (CM 1589A)	28.4 (UF 16910)
	36.5 (CM 2774)	30.2 (UF 16997)
	37.3 (PU 11554)	
	39.3 (AMNH 81003)	
Humerus		
Greatest length	211	162 (UF 16948)
Anteroposterior diameter of head	52	40 (UF 16948)
Transverse diameter of head at the tuberosities	44	32 (UF 16948)
Greatest transverse diameter of trochlea	34	28 (UF 16948)
		34 (UF 18347)
Greatest anteroposterior diameter of distal end	32	33 (UF 18347)
Ulna		
Anteroposterior diameter at coronoid process	32	25 (UF 18349)
Transverse diameter at coronoid process	25	22 (UF 18349)
Innominate		
Width of ilium at great sacro-sciatic notch	30	24 (UF 18348)
Anteroposterior diameter of acetabulum	28	20 (UF 18348)
		21 (UF 18348)
		27 (UF 18348)
Vertical diameter of acetabulum	25	20 (UF 18348)
		22 (UF 18348)
		25 (UF 18348)
Tibia		
Length	(200)	(176) (UF 18352)

TABLE 2. CONTINUED

	D. superbus	D. notionastes
Anteroposterior diameter at lower end of cnemial crest	25	19 (UF 18352)
		21 (UF 18352)
		22 (UF 18352)
Transverse diameter at lower end of cnemial crest	17	15 (UF 18352)
		17 (UF 18352)
		18 (UF 18352)
Greatest anteroposterior diameter of distal end	19	20 (UF 18352)
Greatest transverse diameter of distal end	34	(29) (UF 18352)
		28 (UF 18352)
Calcaneum		
Greatest length	67	48 (UF 18354)
		58 (UF 16912)
Greatest transverse diameter	33	25 (UF 18354)
		31 (UF 16912)
		32 (UF 16912)
Length of tuber from susten- taculum to free end	40	28 (UF 18354)
		34 (UF 16912)
		36 (UF 16912)
Astragalus		
Greatest height	38	32 (UF 18353)
		36 (UF 16995)
		39 (UF 16995)
Transverse diameter of trochlea	21	15 (UF 18353)
		18 (UF 16995)
		19 (UF 16995)
Transverse diameter of head	21	16 (UF 18353)
		18 (UF 16995)
		19 (UF 16995)
Metacarpal II		
Length	51	38 (UF 18339)
Metacarpal IV		
Length	60	49 (UF 18340)
Metacarpal V		
Length	47	44 (UF 18341)
Metatarsal I		
Length	42	28 (UF 18342)
		30 (UF 18342)
		33 (UF 18342)
		35 (UF 18342)
Metatarsal III		
Length	70	61 (UF 16992)
Metatarsal IV		
Length	73	63 (UF 18337)

LOWER DENTITION.—Except for its smaller size, P₄ of *Daphoenodon notionastes* is inseparable from that of *D. superbus*.

A low rim, which does not extend anteriorly to the entoconid, closes the posterior boundary of the talonid of M₁ (Fig. 2 B, D) of *D. notionastes*. In *D. superbus* this rim continues beyond the entoconid to abut against the metaconid. In *D. superbus* wear produces a notch anterior to the entoconid similar to the unworn condition of *D. notionastes*. The talonid of M₁ in *D. notionastes* is shorter and narrower than the trigonid. The metaconid of the M₁ of *D. notionastes* has a slight posterior slant, unlike the vertical metaconid of *D. superbus*.

The holotype of *Daphoenodon notionastes* (UF 16965) is the largest M₁ (and the only complete one) in the sample. Measuring 21.6 x 10.6, length x width, it is at the low end of the measured range of *D. superbus* (21.7 x 10.0-25.5 x 11.5), a remarkable feature when one considers the difference in sturdiness between the mandibles of *D. superbus* and *D. notionastes* as discussed in the following section.

The M₂ (Fig. 2 A, C) of *D. notionastes* has a talonid that, even more than that of M₁, is decidedly shorter and narrower than the trigonid. This stands in contrast to the wide, elongate talonid of *D. superbus* that equals the trigonid in occlusal area and gives the M₂ of that species a rectangular occlusal outline.

MANDIBLE.—The mandible (Fig. 2G) of *Daphoenodon notionastes* is much less robust than the mandible of *D. superbus*. The massateric fossa is shallower than in *D. superbus*, and the line that indicates the separation of the attachment areas for the temporal and masseter muscles is faint, indicating weaker jaw musculature for *D. notionastes*. The depths of the mandibles referred to *D. notionastes*, measured at M₁, are 28.4 and 30.2. This is comparable to the size of a juvenile *D. superbus* mandible (CM 1589A), which measures 29.8, but is definitely smaller than the 36.5-39.3 range measured for adult mandibles.

POSTCRANIAL SKELETON.—Other than the smaller size, most of the postcranial elements referred to *Daphoenodon notionastes* are virtually indistinguishable from those of *D. superbus* (CM 1589B). Some elements can be grouped into two size classes and may represent sexual dimorphism, but others present a more continuous range of sizes. All are generally smaller than the corresponding elements of *D. superbus*. Two humeri (UF 16996, 18347), while essentially amphicyonid in their features, are much larger than other humeri of *D. notionastes* (UF 16948) from Buda. They also have an oval entepicondylar foramen instead of the elongate, slitlike foramen more typical of amphicyonids. No entepicondylar foramina are preserved on the other, smaller humeri referred to *D. notionastes*. It therefore cannot be determined whether

an oval foramen is a variable feature of *D. notionastes* or that these two humeri represent a larger amphicyonine that is presently not recognized in the fauna.

Other than size, no other significant differences exist between the postcranial skeleton of *Daphoenodon notionastes* and *D. superbus*. Measurements of postcranial elements of *D. notionastes* are compared in Table 2 to measurements listed by Peterson (1910) for *D. superbus*.

DISCUSSION

Daphoenodon notionastes has been collected in two other local faunas of Florida (Brooksville and Franklin Phosphate Pit No. 2), but its affinities have previously been unclear because of insufficient material. With the more complete sample from Buda, the recognition of *D. notionastes* in the Brooksville and Franklin Phosphate Pit No. 2 local faunas is possible.

An M_1 and a mandibular fragment (FGS V-1213 and 1214) were found in Franklin Phosphate Pit No. 2 in Alachua County. These were originally referred to *Mesocyon iamonensis* by Simpson (1929), who later (Simpson 1932) transferred them to *?Temnocyon*. Olsen (1958), working without the diagnostic M_2, felt certain that the specimens were indeed *Temnocyon*. Hunt (1971) recognized the features of *Daphoenodon* in the tooth and referred the specimens to *D. superbus*. FGS V-1213 is slightly smaller than UF 16965 and measures 21.4 x 9.8. UF 16965 is the largest M_1 in the Buda sample, and the size difference between this tooth and that from Franklin Phosphate Pit No. 2 does not seem to be critical. These two M_1's also have the posterior tilt of the metaconid, absence of the talonid rim between the entoconid and the metaconid, and the same narrowing of the talonid. FGS V-1213 does have an indistinct entoconid, unlike UF 16965, but this may be variable within the species. The similarities override the small differences and lead me to conclude that FGS V-1213 should be referred to the new species from Buda.

Among the fossils from Brooksville, Hernando County, Florida, is an isolated M_1 (UF 449) that looks much like that of *D. notionastes*, although it is smaller (19.3 x 9.4). This M_1 has a similarly incomplete talonid rim and posteriorly tilting metaconid that unites the *Daphoenodon* from Buda with that from Franklin Phosphate Pit No. 2 and has the indistinct entoconid of the latter. The Brooksville M_1 is stockier and has a relatively large, i.e. unreduced, talonid. The talonid is the widest part of the tooth and very similar to *D. superbus* (or a stocky *Daphoenus*) in this respect. An isolated M^1 from Brooksville looks like a miniature of the M^1 of *D. superbus* and measures 22.0 x 16.1. Although the M_1 from Brooksville has a relatively larger talonid

than the M_1 from Buda, the size of the tooth and other diagnostic land-marks are most in keeping with the new species of *Daphoenodon* described in this paper.

The greater size and general robustness of the teeth and postcranial skeleton place this species nearer to *Daphoenodon* than to *Daphoenus,* its probable Oligocene precursor. Furthermore, the morphology of *Daphoenodon notionastes* closely resembles that of *D. superbus* from western Nebraska.

Daphoenodon notionastes of Florida represents a southeastern group of *Daphoenodon* that apparently was distinct from its earliest occurrence (Brooksville). *Daphoenodon notionastes* was smaller than other species of *Daphoenodon,* especially *D. robustum.* Unlike most amphicyonids, including *D. superbus, Daphoenodon notionastes* deem-phasized the crushing function of its dentition by reducing the talonids of its lower molars. The mandible was shallower and contrasts with the massive bear-like mandibles of other amphicyonids.

FAMILY CANIDAE GRAY, 1821
SUBFAMILY CYNARCTINAE MCGREW, 1937
GENUS *BASSARISCOPS* PETERSON, 1928
Bassariscops achoros **new species**
FIGURES 3, 4, TABLE 3

ETYMOLOGY.—*achoros* (Gr.): Wanderer.

HOLOTYPE.—UF 18389, P^4

REFERRED MATERIAL.—UF 16933, 15 incisors; UF 22778, 4 P^4's; UF 16969, 2 M^1's; UF 18501, M^1; UF 16963, 5 M^2's; UF 18403, M^{1-2}; UF 16961, 10 lower premolars; UF 18412, DP_4; UF 18411, 2 DP_4 trigonids; UF 18410, Dp_4 talonid; UF 16989, M_1; UF 18390, 3 M_1 talonids; UF 16964, 2 M_2's; UF 16962, M_3; UF 16991, 2 lower mandibular rami, 1 with M_1 talonid and M_2; UF 18391, fragment of premaxilla; UF 18392, fragment of maxilla; UF 18397, 3 petrosals; and UF 16976, 16978, 16990, 18393-18396, 18398-18402, 18416, 18502, 19312, various postcranial elements.

COMPARATIVE MATERIAL EXAMINED.—*Bassariscops willistoni,* CM 11332, holotype, CM 11333, 11334 (casts in AMNH); *Phlaocyon leucosteus,* AMNH 8768, holotype; *Nothocyon annectans,* CM 1602, holotype (cast in AMNH); *Nothocyon geismarianus,* UCMP 90, *Nothocyon latidens,* AMNH 6896, holotype, *Nothocyon lemur,* AMNH 6888, holotype.

DIAGNOSIS.—P^4 is about 20% smaller than that of *Bassariscops willistoni,* the only other species of *Bassariscops.* P^4 has a smaller hypocone than *B. willistoni* and lacks the strong labial cingulum of that species. Upper molars are narrower and more angular in outline than those of *B. willistoni.* M_1 of *B. achoros* has the metaconid placed farther posterolabially than is seen in *B. willistoni.* The hypoconid and entoconid of M_1 are equal in height, unlike that of *B. willistoni* which has a taller hypoconid.

TABLE 3.—COMPARATIVE MEASUREMENTS OF THE TEETH OF *Bassariscops achoros* AND *B. willistoni.* MEASUREMENTS ARE LENGTH X WIDTH.

	B. achoros	B. willistoni
P^4	7.8 x 4.3 (UF 18389)	9.6 x 5.4 (CM 11332)
	8.0 x 4.7 (UF 22778)	
M^1	6.5 x 7.9 (UF 18403)	5.4 x (8.5) (CM 11332)
M^2	4.1 x 6.2 (UF 18403)	3.3 x 6.5 (CM 11332)
M_1	8.6 x 3.6 (UF 16989)	7.6 x 3.3 (CM 11334)

DESCRIPTION

UPPER DENTITION.—P^4 (Figs. 3A, 4A-B) of *Bassariscops achoros* is very much like that of *B. willistoni* except for its smaller size. The P^4 of *B. willistoni* has a stronger external cingulum as compared to the barely discernible external cingulum of *B. achoros.* The hypocone is slightly smaller than that of *B. willistoni.* The overall impression is of a more sectorial tooth in *B. achoros.*

M^{1-2} (Figs. 3B, 4C) are heavily worn, and the labial margins are broken on the holotype of *B. willistoni.* In general outline and shape these teeth have some of the appearance of M^{1-2} on *Phlaocyon leucosteus,* also heavily worn. This similarity may be effected in part by wear and breakage, but it appears to be genuine. The angular, squat (anteroposteriorly expanded) upper molars of *B. achoros* contrast with the smooth outline and narrow upper molars of *B. willistoni.* Remnants of cusps on M^{1-2} of *B. willistoni* indicate the same placement and prominence as in *B. achoros.*

As M^{1-2} are so heavily worn on the holotype of *B. willistoni,* M^{1-2} of *B. achoros* will be described in detail. M^1 of *B. achoros* is trapezoidal and variably cusped, but usually has five cusps. The paracone and metacone are of nearly equal size and together form the widest part of the tooth. The paracone has a labial deflection similar to that seen in *Parictis* and some other mustelids. The protocone is twice as large as the metaconule, but only slightly more lingually placed. The paraconule is variable in size and may be absent altogether. An additional cusp, as large as the metaconule, occurs between the metaconule and the metacone on one specimen (UF 18501). The internal cingulum begins anteriorly at the paracone as a thin line and lingually becomes a heavy cingulum that rises to a single definite cusp, the hypocone, just posterolingually to the metaconule before decreasing again to a thin cingulum that terminates posteriorly at the metacone. The hypocone is equal in height to the protocone, and both are of greater height than the metaconule. The position of the anterior root beneath the paracone in M^1 of *B. willistoni* is comparable to that seen in *B. achoros.* The M^1
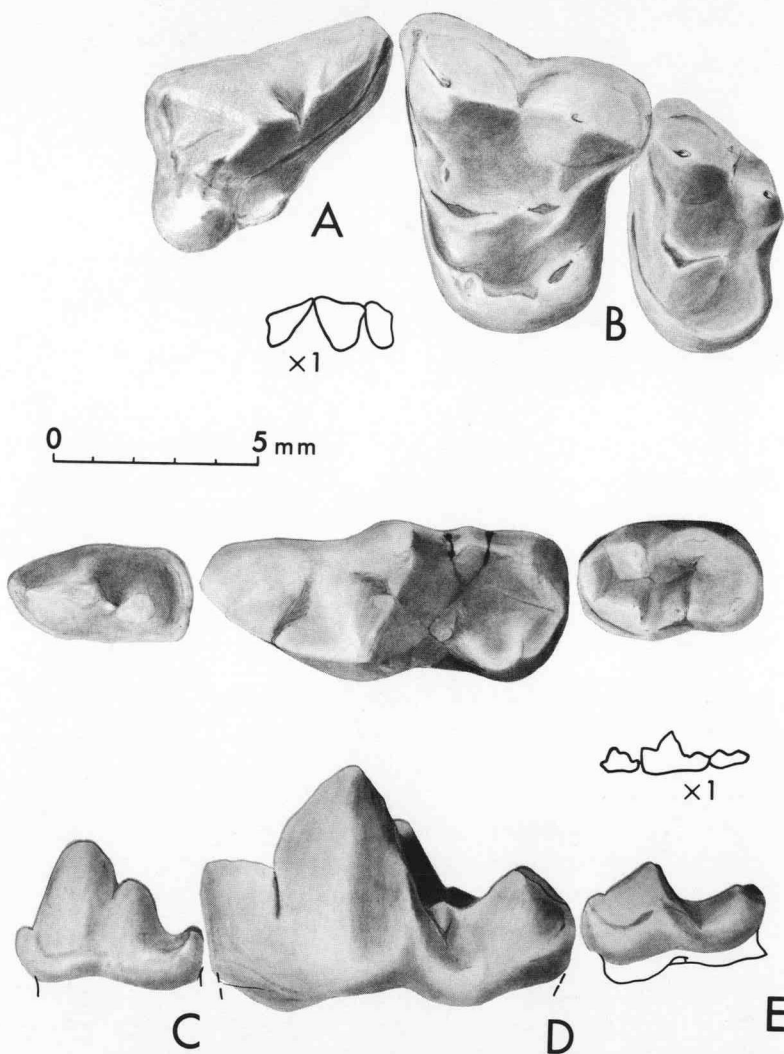
FIGURE 3..—*Bassariscops achoros* n. sp. A) UF 18389, P⁴, holotype; B) UF 18403, M$^{1-2}$; C) UF 16961, P$_4$; D) UF 16989, M$_1$; E) UF 16691, M$_2$. A and B are occlusal views; C, D, and E are shown in occlusal and labial views.

of *B. willistoni* looks like a lingually stretched version of the stockier M^1 of *B. achoros*.

In the M^2 of *B. achoros* the paracone is much larger than the minute metacone. There is a strong labial cingulum on the paracone (the parastyle) and no labial cingulum on the metacone. The paraconule and
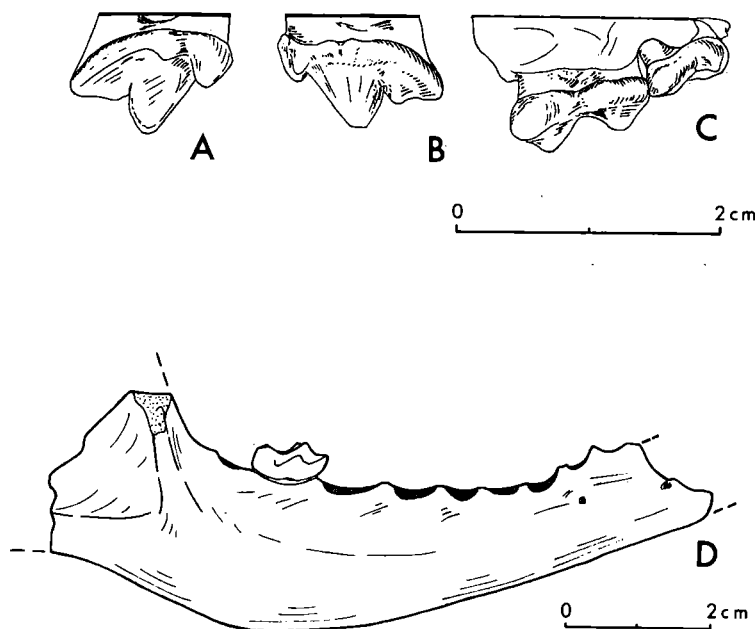
FIGURE 4.—*Bassariscops achoros* n. sp. A) UF 18389, P^4, holotype, lingual view; B) UF 18389, labial view; C) UF 18403, M$^{1-2}$, labial view; D) UF 16991, Right mandibular ramus with M$_2$.

metaconule may be absent and are variable in size when present. Relative to the protocone, the metaconule of M^2 is much smaller than in M^1. The internal cingulum is heavy, as in M^1; the only definite cusp on this cingulum is the posterolingual hypocone. The M^2 varies in size but is relatively large in this species.

LOWER DENTITION.—As no P$_4$ of *B. willistoni* has yet been found, this is the first description of a *Bassariscops* premolar. In P$_4$ (Fig. 3C) the protoconid is placed forward in the tooth, almost directly over the anterior root. The posterior accessory cusp is labial to the midline of the tooth; the posterior margin of the tooth is upturned. P$_4$ of *B. achoros* is similar to the P$_4$'s of many other small carnivores.

The M$_1$'s referred to *B. achoros* differ considerably from that referred to *B. willistoni* by Peterson (1928). In *B. achoros,* the metaconid of M$_1$ (Fig. 3D) lies posterolabially to the protoconid. The entoconid and hypoconid are equal in height and surround a basined talonid. The hypoconulid is indistinct. It agrees with *B. willistoni* in having a thin protoconid with small anterior and posterior blades projecting from the central cone. The M$_1$'s of both *B. achoros* and *B. willistoni* have deep carnassial notches. Both *Bassaricops achoros* and *B. willistoni*

have a small interoconid on the M_1. Another tubercle, little more than a line on *B. achoros* and *B. willistoni,* extends up the posterolabial margin of the protoconid to the same height as the metaconid. Whereas M_1 of *B. willistoni* has a hypoconid that is slightly higher than the entoconid, surrounding a large talonid basin, these cusps are of nearly equal size in *B. achoros.* The talonid of M_1 in *B. achoros* has a straight posterior margin as in *B. willistoni.*

The M_2's of *B. achoros* and *B. willistoni* are essentially the same. Each has a small paraconid, the protoconid and metaconid are of equal size, and the metaconid sits slightly posterior to the protoconid. The hypoconid is prominent. There is a large anterolabial cingulum on the M_2 of each species. This cingulum in *B. achoros* may be interrupted at the protoconid (Fig. 3E) or may be complete and form a small accessory cusp posterolabially to the protoconid.

M_3 of *B. willistoni* is unknown. In *B. achoros* this tooth is small, single-rooted, and has indistinct cusps.

MANDIBLE.—Mandibular specimens referred to *B. achoros* and *B. willistoni* consist of broken rami only. The mandible of *B. achoros* (Fig. 4D) is deepest beneath M_2 and becomes markedly narrower anteriorly, much like that of *Cynarctoides.* It differs from the more uniformly deep mandibles of *Nothocyon* and *B. willistoni.*

POSTCRANIAL SKELETON.—The postcranial skeleton of *B. willistoni* is unknown. Numerous fragmented postcranial elements of a small carnivore in the Buda Local Fauna are attributed to *B. achoros.*

The humeri assigned to *B. achoros* (UF 18393, 18395) have transversely elongated condyles, small subcircular entepicondylar foramina, and small and gently curving supracondyloid crests which resemble the humeri of the Procyonidae more than those of any other canoid family.

The astragalus is more canid-like in its very anterior-facing head and its deep trochlea. The astragalus is flattened like that of the astragali of mustelids.

The calcaneum bears more definitely canid features. It is narrow, the anterior part is long, and the lesser process is placed well posteriorly. The posterior part of the calcaneum equals the anterior part in length. The posterior part has its greatest height at the sustentacular facet and gradually decreases in height posteriorly. The sustentacular facet is procyonid-like, being less sharply curved than in canids.

DISCUSSION

The only previously known species of *Bassariscops, B. willistoni,* was found in the lower part of the Brown's Park Formation (?Arikareean) of Colorado (Peterson 1928). If *B. achoros* is an earlier

occurring species than *B. willistoni,* changes that could be interpreted as evolutionary trends are the labiolingual elongation of the upper molars and the slight increase in the size of P⁴ from *B. achoros.*

Bassariscops willistoni was originally included as a new species of *Phlaocyon* by Peterson (1924). *Phlaocyon* at that time was regarded as a procyonid, but now, mainly as a result of Hough's (1944, 1948) studies of the auditory region of the Canoidea, *Phlaocyon* is generally accepted as a canid. With the familial designation of *Bassariscops* in doubt, I compared three periotic bones (UF 18397) that were referred to *Bassariscops achoros* with the auditory regions of *Canis familiaris* (UF 5680), *Procyon lotor* (UF uncatalogued), *Bassariscus astutus* (UF 7865), *Mustela frenata* (UF uncatalogued), and *Taxidea taxus* (UF 6734).

The mustelids were quickly eliminated. Segall (1943) describes several characteristics which separate mustelids from other canoids, only two of which (the stylomastoid foramen and the tympanic cavity) could be used on the isolated periotic bones from Buda. These, however, were sufficient. The stylomastoid foramen (here referring to the stylomastoid foramen definitivum of some authors) is almost completely surrounded by the bulla in mustelids, unlike the equal participation of the bulla and the mastoid portion of the temporal bone in forming the stylomastoid foramen of *Bassariscops.* More conclusively, the tympanic cavity in mustelids extends well posteriorly to the promontory and only slightly anteriorly; the reverse expression of the tympanic cavity occurs in *Bassariscops.*

Hough (1948) observed that the reflected margin of the bulla covers only the base of the promontorium in the Procyonidae, but overlaps the promontorium extensively in the Canidae. In *Bassariscops* the characteristic rugosity indicating the area of contact with the tympanic bulla extends to the posterior lip of the fenestra cochlea, as in *Canis,* but unlike either *Procyon* or *Bassariscus.*

The shape of the definitive stylomastoid foramen is useful to separate procyonids from canids. The medial terminus of the definitive stylomastoid foramen (inside the bulla) in *Bassariscops* is slitlike, as in *Canis,* and differs from the round definitive stylomastoid foramina of both *Procyon* and *Bassariscus.*

Another characteristic mentioned but not listed as diagnostic by Hough (1948) is the grooving of the mastoid process for the facial nerve. This grooving is shallow in *Procyon* and *Bassariscus* but deep in *Canis* and *Bassariscops.* Other similarities between *Canis* and *Bassariscops* include the long anterior process of the petrosal which slopes forward to meet the basisphenoid, unlike the shorter anterior margin in procyonids. The proximity of the canal for the facial nerve to

the suture between the temporal bone and the occipital bone is another canid feature in common with *Bassariscops*. This suture lies near the canal, within one diameter of the canal from the canal itself, in *Canis* and *Bassariscops,* and farther, about two diameters in *Procyon* and *Bassariscus.*

The great degree of overlap of the auditory bulla, the slitlike medial terminus of the foramen stylomastoideum definitivum, the grooving of the mastoid process, the anterior projecton of the petrosal, and the position of the facial nerve canal are all features shared by *Canis* and *Bassariscops* in contrast to representative mustelids and procyonids. For these reasons *Bassariscops* is placed in the Canidae.

The referral of *Bassariscops* to a particular subfamily of the Canidae is even more difficult. For reasons outlined below, however, I am including the genus in the Cynarctinae.

The Subfamily Cynarctinae has accumulated genera rather haphazardly, and Galbreath (1956) presented a genera review of its taxonomic history. Hough (1948) first showed *Cynarctus, Cynarctoides, Phlaocyon,* and *Aletocyon* to be canids without mentioning the subfamily, and Galbreath (1956), in describing a specimen of *Cynarctoides acridens* in which the basicranial region was typically canid-like, placed *Cynarctoides* in the Cynarctinae. In this way *Cynarctus, Cynarctoides, Aletocyon, Phlaocyon, Nothocyon annectans,* and now *Bassariscops* have become associated with the Subfamily Cynarctinae within the Canidae. The relationships of these genera are not fully understood, and they may not all be closely related. At the present time I think there is merit in having a subfamily of small Miocene canids which have, as Hough (1948) pointed out, additional cusps and cingula of all gradations modifying the typical canid carnassial and molar pattern. *Bassariscops,* with only a small hypocone on the P^4 and an interoconid as the only accessory cusp on M_1, is one of the least modified genera of the subfamily.

Cynarctoides McGrew 1938
SPECIES INDETERMINATE
FIGURE 5A, TABLE 4

MATERIAL.—UF 18415, M_1.

DISCUSSION

The M_1 from Buda resembles that of *Cynarctoides acridens* (AMNH 82558, holotype) and *C. mustelinus* (AMNH 20502, holotype)

in (1) the presence and shape of the opisthoconid (large and clearly defined to the base of the protoconid in *Cynarctoides*), (2) the position of the interoconid (on the crest immediately posterior to the metaconid in *Cynarctoides*; in the talonid notch in *Nothocyon,* except *Nothocyon*
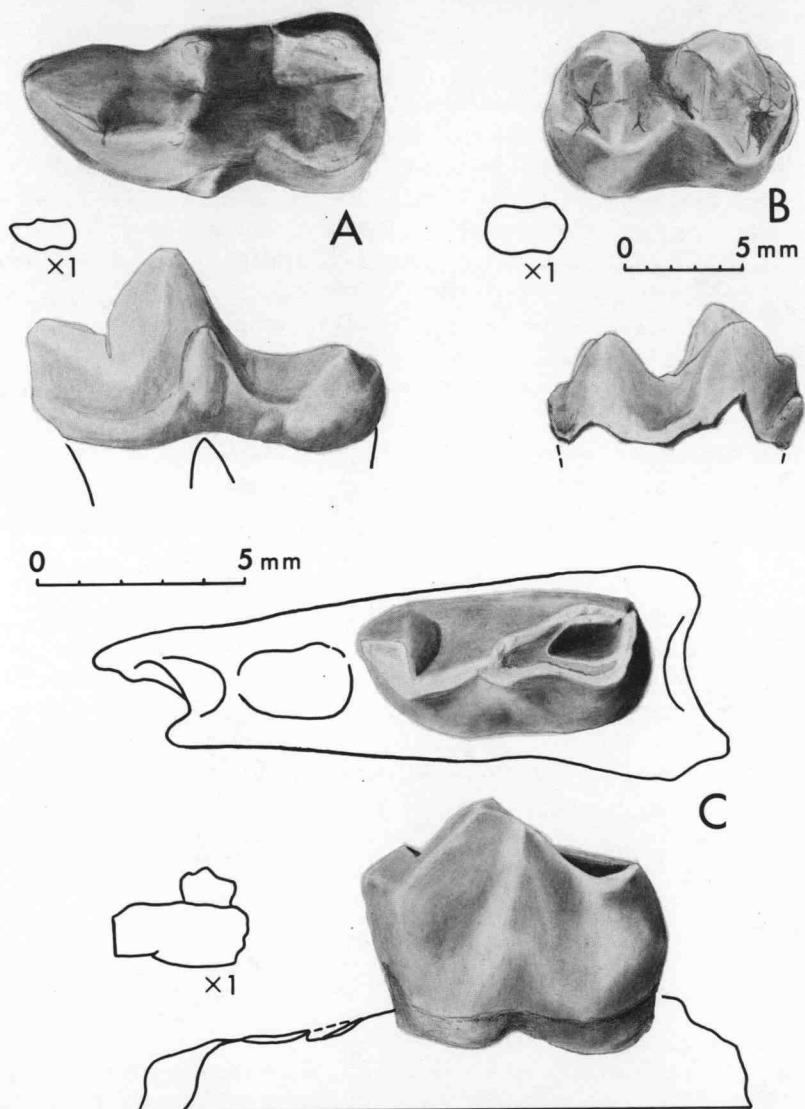

FIGURE 5.—A) *Cynarctoides* sp., M₁, UF 18415; B) *Cynorca* sp., M₁, UF 18498; C) Camelidae, n. gen. et sp., P₄, UF 18374. Occlusal and labial views of each. Note that B, *Cynorca* sp., is drawn to a smaller scale than A and C.

TABLE 4.—COMPARATIVE MEASUREMENTS OF THE M_1 OF *Cynarctoides*.

	C. acridens AMNH 82558	C. mustelinus AMNH 20502	Buda UF 18415
length	9.1	8.4	8.4
width of trigonid	4.2	4.0	3.0
width of talonid	4.3	4.0	4.2

annectans); (3) in the greater length of the talonid relative to the trigonid; and (4) in the large size of the entoconid.

The shape of the opisthoconid is distinctive in *Cynarctoides* although the cusp itself is present in other canid groups. It is found on some specimens of *Nothocyon* (*N. latidens,* AMNH 6896, holotype; 6897; and YPM 12794; *N. lemur,* YPM 12797) but is more generally absent. Cope (1884) considered this tubercle as diagnostic of *N. latidens,* but Thorpe (1922) and Merriam (*in* Thorpe 1922) found this tubercle on *N. lemur* and considered it to be a variable characteristic of the genus. A slight ridge in the position of the opisthoconid can be seen in *Bassariscops* (UF 16989, Fig. 3D), *Phlaocyon* (AMNH 8768, holotype), and occasionally in modern canids (*Urocyon:* Gawne 1973). The occurrence of this cusp seems to be within the genetic capability of all canids, and its presence less indicative of relationship within the family than of adaptive response.

The M_1 from Buda is the most primitive looking tooth referred to the genus *Cynarctoides*. It differs from *C. acridens* and *C. mustelinus* in (1) its relatively lower, blunter cusps; (2) in having the entoconid and hypoconid of nearly equal height (vs. a taller entoconid in the other species); and (3) in having a wide talonid relative to the trigonid. The last character is possibly not primitive. This isolated tooth probably represents a new species of *Cynarctoides,* but at this time, having as yet no hypodigm, I prefer to assign this specimen to *Cynarctoides* sp.

FAMILY MUSTELIDAE SWAINSON 1835

GENUS AND SPECIES INDETERMINATE

REFERRED MATERIAL.—UF 18409, petrosal; UF 16996, humerus; UF 16927, 3 tibiae; UF 18404, 2 innominata; UF 18503, femur; UF 18408, calcaneum; UF 18405, metatarsal III; UF 18406, 2 metapodials; UF 18407, 12 proximal phalanges.

DISCUSSION

A large mustelid is represented in the fauna by several unassociated postcranial elements and one petrosal. Comparisons were

made with postcranial elements of fossil and recent canids, felids, and mustelids. The size of the postcranial elements is near that of *Sthenictis*.

The petrosal from Buda has features that are uniquely mustelid among the canoid carnivores, as outlined by Segall (1943). In adult mustelids the foramen stylomastoideum is almost completely surrounded by the auditory bulla. The tympanic cavity extends well posteriorly to the promontorium, and there is no indication that the mastoid portion of the temporal bone forms part of the foramen stylomastoideum.

Other than the petrosal, the most confidently referrable element is the humerus (UF 16996). The large blade-like lateral condyloid crest is exceeded in size only by the unusually large crest on the humerus of *Hoplophoneus*; the crest is generally more reduced in carnivore families other than the Mustelidae. The olecranon fossae of mustelids, and of the Buda humerus, are intermediate in depth between canids and felids.

Due to breakage and absence of diagnostic features, the other elements cannot be definitely assigned to any carnivore family. They are placed with the mustelid humerus and petrosal because of their correspondence in size.

FAMILY FELIDAE GRAY 1821
SUBFAMILY NIMRAVINAE TROUESSART 1885
GENUS AND SPECIES INDETERMINATE

REFERRED MATERIAL.—UF 16908, calcaneum.

DISCUSSION

This Buda calcaneum represents the first Arikareean felid in Florida. The anteroposterior elongation immediately separates this calcaneum from the stocky calcanea of canids, procyonids, mustelids, and machairodont cats. The distance from the lesser process to the anterior end is equal to one diameter of the articular surface of the lesser process, and the distance from the posterior process to the sustentaculum is equal to or greater than the length of the rest of the calcaneum. The calcaneum from Buda also resembles those of Nimravinae, but not machairodonts, in its straighter ventral silhouette.

ORDER PERISSODACTYLA OWEN 1848
FAMILY EQUIDAE GRAY 1821
SUBFAMILY ANCHITHERIINAE OSBORN 1910
GENUS AND SPECIES INDETERMINATE

MATERIAL.—UF 19318, lateral proximal phalanx.

DISCUSSION

This phalanx is inseparable from those of *Parahippus leonensis* from the Thomas Farm Local Fauna but does not constitute sufficient evidence for a definite taxonomic designation. The extreme rarity of horses in the Buda fauna is in direct contrast to Thomas Farm, where horses make up over half the faunal population. This suggests that different environmental parameters were operating at these two localities during the accumulation of the respective sediments.

FAMILY CHALICOTHERIIDAE GILL 1872
SUBFAMILY SCHIZOTHERIINAE HOLLAND AND PETERSON 1914
GENUS *Moropus* MARSH 1877
SPECIES INDETERMINATE
FIGURE 6

MATERIAL.—UF 24131, M^1; UF 16916, M^2, ectoloph; UF 24132, trigonid of lower molar; UF 24133, fragment of lower molar; UF 24129, metatarsal IV; UF 16918, metatarsal IV, partial; UF 24130, proximal phalanx; UF 16911, medial phalanx; UF 16919, ungual phalanx; UF 16915, ungual phalanx, partial.

DESCRIPTION

The M^1 of the Buda chalicothere is remarkable in that it is nearly quadrangular in outline, a primitive characteristic seen in Chalicotheriinae and in *Schizotherium* among Schizotheriinae. Other schizotherine genera display a quadrangular M^1 at advanced wear stages, but UF 24131 has not been shortened by interstitial wear. The parastyle is large and conical but does not extend anteriorly to the anterior margin of the tooth, as is also seen in *Schizotherium*. The protocone and hypocone have approximately the same height and conical shape. The protocone and hypocone are connected on their labial edges by a low crest that divides the central valley. A similar crest occurs in an unnamed Hemingfordian species of *Moropus* and rarely if at all in *M. elatus* (Coombs 1973:124). Both the protocone and the hypocone display apical wear. The mesostyle, metastyle, and the paracone are the tallest cusps on the crown at this wear stage. An external rib is

present on the paracone, and a weak flexure is developed between the paracone and the parastyle. An anterior valley with a well-developed anterior cingulum and a postfossette are present. A small lingual cingulum is present. The length and width of this M^1 are 21.1 x 20.7.

Although only the ectoloph and metaloph of the M^2 are preserved, its relatively unworn condition permits the description of characters that are seldom seen on the typically well-worn M^2's of *Moropus*. The paracone is the tallest cusp on the tooth. The large, conical parastyle is the next tallest and is intermediate in height between the paracone and the equally tall mesostyle, metacone, and hypocone. The mesostyle and metacone are not identifiable as distinct cusps but rather consist of crests that lie parallel to the occlusal plane before tapering smoothly to the base of the crown at their outer margins. The metaloph arises near the mesostyle and quickly drops to a saddle before rising again to a sharply pointed hypocone. The hypocone is thin and elongate near its peak but broadens at its base. A small posterior cingulum is present but only weakly closes the posterior fossette; its greatest expression is on the posterolabial base of the hypocone. A weak external cingulum is present labial to the paracone. External ribs are present on the paracone and on the metacone, although the latter rib is very weak and would quickly disappear with wear. Shear facets are present on the lingual surface of the ectoloph anterior and posterior to the paracone, between the mesostyle and the origin of the metaloph, and on the lingual side of the metaloph between its origin at the ectoloph and the hypocone. The length of the ectoloph is 26.0.

The single trigonid of a right lower molar (UF 24132) cannot yield more than a few features of this species of *Moropus*. In most respects, this trigonid is similar to those of *M. elatus* and may be the trigonid of an M_2, judging by the prominence of the paraconid, the V-shaped valley of the trigonid basin, and the relatively large, symmetrical crest that closes the lingual border of the trigonid basin. The length (antero-posteriorly) of the trigonid is 10.3; the width is 13.0.

Two metatarsals IV (UF 16918, 24129) are preserved in the Buda sample. UF 16918 lacks the proximal end. These two metapodials are unequal in size and evidently represent two size groups in the population, a situation known to occur among chalicotheres (Coombs 1975). The proportions of the metarsal IV are very similar to those of *Moropus elatus*. The articular facets for metatarsal III are separate, with the volar facet about one-half the size of the dorsal facet. There is no articular facet for the ectocuneiform on the dorsal facet.

The cuboid articulation is rectangular and separated from the facets for metatarsal III by a sharp crest. The fibular-volar pro-tuberance is well developed as in *M. elatus*. The shaft is square in
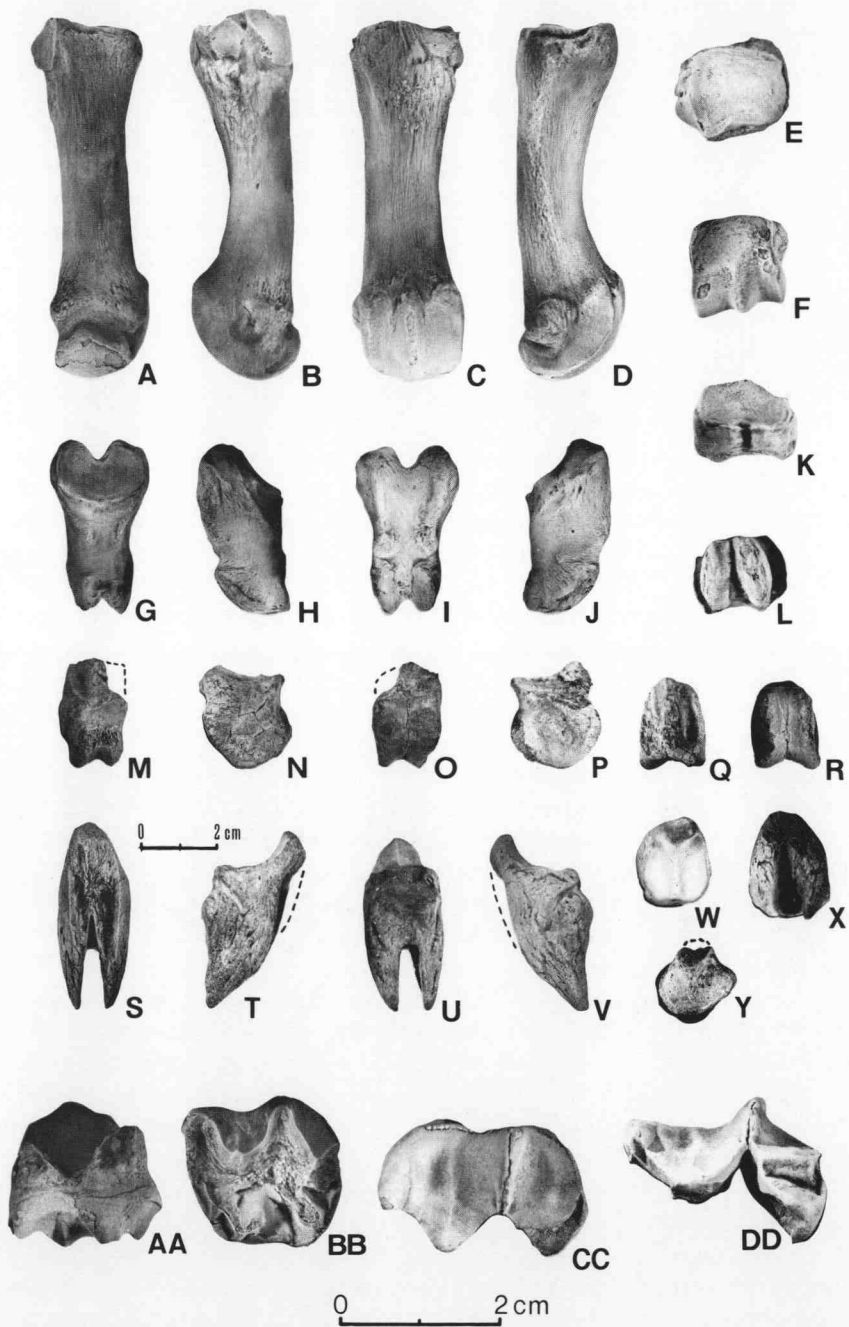
FIGURE 6.—*Moropus* sp. A-F: left metatarsal IV, UF 24129. A) dorsal view; B) medial;
C) volar; D) lateral; E) proximal end; F) distal end. G-L: left proximal phalanx, UF
24130. G) dorsal view ; H) medial; I) volar; J) lateral; K) proximal end; L) distal end.
M-R: right medial phalanx, UF 16911. M) dorsal view; N) lateral; O) volar; P) medial; Q)
proximal end; R) distal end. S-X: left ungual phalanx, UF 16919. S) dorsal view; T)
medial; U) volar; V) lateral; W) proximal end; X) distal end. Y) partial ungual phalanx,
UF 16915, proximal end. AA) left M¹, UF 24131, labial view; BB) UF 24131, occlusal
view. CC) partial left M². UF 16916, labial view; DD) UF 16916, occlusal view. Large
scale refers to teeth only.

cross-section proximally, whereas in specimens of *M. elatus* the shaft
is roughly triangular for the distal four-fifths of its length.

Measurements of metatarsals IV, (UF 24129, 16918), are as
follows: maximum length 93.7; proximal end, depth 24.1, width 30.0;
distal end, depth 28.5, 23.2 (UF 16918), width, 26.2, 21.0 (UF 16918);
mid-shaft, minimum depth 17.9, 13.0 (UF 16918), minimum width
18.0, 15.4 (UF 16918); length/distal width ratio 3.6; length/shaft width
ratio 5.2.

The proximal phalanx (UF 24130) closely resembles the left prox-
imal phalanx of pedal digit III of *Moropus elatus* illustrated by
Holland and Peterson (1914:375). Measurements of the proximal
phalanx are: length 45.7; proximal width 26.5; distal width 18.5; depth
at dorsal margin of metapodial facet 21.3; depth at volar termination
of distal articular surfaces 16.8.

The medial phalanx (UF 16911) displays a slight asymmetry in the
proximal articular surfaces in that one facet, the medial?, is longer
than the other. The distal articular surfaces are symmetrical. The size
of this medial phalanx is surprisingly large, approaching that of *M.
elatus* females (=*M. "petersoni"*; Coombs 1975). Measurements are as
follows: length 28.1; width of distal articular surface at the dorsal ter-
mination, 13.2; at the volar termination 17.6; dorsal to volar depth of
the distal end 23.9.

The proximal end of one ungual phalanx (UF 16915) is flatter and
more asymmetrical than another (UF 16919) and apparently is from a
marginal digit. The more complete ungual phalanx (UF 16919), miss-
ing only a portion of the dorsal surface, cannot confidently be referred
to a particular digit of the pes or manus. This ungual does not narrow
proximal to the cleft and has a large dorsal process. The claw sides of
the phalanx are deeply rugose and, in volar view, widely separated (6
mm). Measurements of the ungual phalanges are: maximum length
51.3; greatest width 20.7; height 24.5; volar depth of cleft 14.7; dorsal
depth of cleft 27.3; height and width of articular surfaces 18.6 x 16.2
(UF 16919), 10.5 x 17.2 (UF 16915).

DISCUSSION

In the quadrangular M^1, and probably M^2 and M^3 as well, and the absence of an ectocuneiform contact on the metatarsal IV, the Buda chalicothere resembles *Schizotherium*, a primitive Eurasian Oligocene schizotherine (Coombs 1973). These features, however, are primitive in the Chalicotheriidae and hence of dubious taxonomic importance at this level. The metatarsals of *Schizotherium*, as seen in *S. priscum* and *S. turgaicum* (Coombs 1974, 1978) are far more slender than those of the Buda chalicothere.

In the lack of an ectocuneiform facet on the metatarsal IV and in the combined convexity of the facets for metatarsal III, the Buda chalicothere is similar to an unnamed new genus of North American Schizotheriinae (Coombs, in press) in which the metapodials are much more shortened and stocky, but in which the upper molars are more strongly elongated.

Small species of *Moropus* are known from earliest Miocene deposits of North America and Europe, although available material is fragmentary. *Moropus oregonensis,* from the John Day Basin of Oregon (Leidy 1873) is known only from teeth: *Moropus distans,* also from the John Day (Marsh 1877), is known only by podial elements; and *Moropus* sp. from St. Gérand-le-Puy, France, is known only from a partial ramus of a juvenile and a metatarsal IV (Coombs 1974, in press). The Buda material cannot be compared with that of *M. distans,* and it is neither *M. oregonensis* nor *Moropus* sp. from St. Gérand. It differs from *M. oregonensis* in having a quadrangular M^1 and a larger, more labially placed mesostyle on M^1. The metatarsal IV of the Buda chalicothere differs from that of *Moropus* sp. from St. Gérand in that it lacks an articular facet for the ectocuneiform, and it has a smaller and more convex volar facet for metatarsal III. Coombs (in press) suggests that *M. distans* may be conspecific with *M. oregonensis* on the basis of their small size and sympatry. If this proves to be the case, then I doubt that the Buda chalicothere can be referred to this species because of differences already noted between the teeth of *M. oregonensis* and the Buda chalicothere.

The Buda chalicothere is apparently a primitive schizotherine chalicothere in that it does not have strongly elongated upper molars and the length and sturdiness of the metatarsals is relatively unmodified. The metatarsals IV are most similar to those of *Moropus elatus* and for this reason the generic identification is given to *Moropus.*

ORDER ARTIODACTYLA OWEN 1848
SUBORDER SUIFORMES JAECKEL 1911
FAMILY TAYASSUIDAE PALMER 1897
Cynorca COPE 1867
SPECIES INDETERMINATE
FIGURE 5B

MATERIAL.—UF 18498, M_1; UF 18496, fragment of innominate; UF 18495, fragment of metapodial; UF 19317, 5 proximal phalanges; UF 18497, 2 medial phalanges.

DESCRIPTION

The simplicity of the cusps and the small size of the M_1 from Buda (Fig. 5B) are characteristic of *Cynorca*, the smallest of the Oligocene-Miocene peccaries. The M_1 from Buda is more elongate than that of *C. sociale* and the cusps are less swollen. In these features the M_1 from Buda is like that of *C. proterva*. However, the diagnostic post-metaconid ridge of *C. proterva* is not evident on the Buda M_1, and the M_1 of *C. proterva* appears wider. The narrowness of the Buda M_1 may be due partly to breakage at the base of the crown. The length and width of the M_1 from Buda is 11.8 x 6.8.

DISCUSSION

The only other Arikareean occurrences of *Cynorca* presently known are *C. sociale* from the John Day fauna of Oregon, and a single specimen, *Cynorca* cf. *sociale* from the "Loup Fork Tertiary" of Nebraska (Woodburne 1969)[1]. The latter may in fact be later than the Arikareean.

Cynorca proterva is known from the Barstovian of Maryland, Texas, and Nebraska, with a questionable late Hemingfordian occurrence in Nebraska (Woodburne 1969).

Woodburne (1969) stated that *Cynorca proterva* is primarily an eastern and Gulf coastal species that probably arose from *C. sociale* in the early or middle Miocene. The single molar of *Cynorca* from Buda, which bears features of both *C. sociale* and *C. proterva*, supports this hypothesis.

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[1] Woodburne (1969) stated that there are few stratigraphic data associated with this specimen. The Loup Fork is an obsolete term that was once in general use for part or all of the Miocene (Simpson 1933).
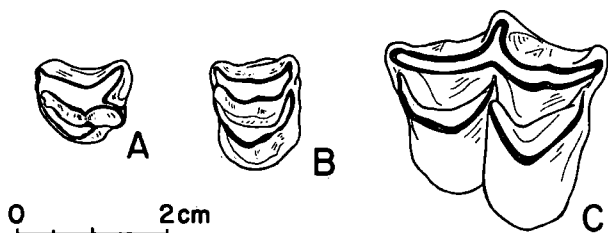
FIGURE 7.—Merycoidodontidae, Phenacocoelinae gen. et sp. indet. A) Right P³, UF 18424; B) Left P⁴, UF 16903; C) Right M³, UF 16931. Occlusal views.

FAMILY MERYCOIDODONTIDAE THORPE 1923
SUBFAMILY PHENACOCOELINAE SCHULTZ AND FALKENBACH 1950
GENUS AND SPECIES INDETERMINATE
FIGURE 7

REFERRED MATERIAL.—UF 18423, C_i; UF 16902, C^1; UF 18424, P³; UF 16903, 2 P⁴'s; UF 16932, M¹; UF 16931, 2 M³'s; UF 18428, 2 incisors; UF 16979, teeth fragments; UF 19319, auditory bulla; UF 18336, petrosal; UF 17007, axis vertebra; and UF 18420, 18421, 18425-18427, 18430, 18432, various postcranial elements.

DISCUSSION

Unlike most fossil mammals, the taxonomy of the oreodonts is largely based on cranial anatomy and not on dental features. Because of the critical lack of cranial materials from Buda, precise identification of this oreodent is not possible[1]. Some preliminary statements, however, can be made from the dentition alone, especially from the P³.

Although there is a great amount of individual variation among oreodonts in the shape of P³, members of the Phenacocoelinae, in contrast to other subfamilies of oreodonts, have an anteroposteriorly compressed P³, which approaches P⁴ in outline. The anteroposterior compression of P³ is evident in the reduction, almost to insignificance, of the anterior crescent of this tooth. The flexure of the labial crest of the P³ from Buda (Fig. 7A) is more concave than is commonly seen in any subfamily of oreodonts, including the Phenacocoelinae.

Within the Phenacocoelinae, the nearest comparison of the Buda material is with *Phenacocoelus stouti* (Schultz and Falkenbach 1950). The P⁴, M¹, and M³ of *P. stouti* are inseparable from those of the Buda

[1]Dr. Bruce Lander, in the course of his studies of oreodonts at the University of California, examined the oreodont material from Buda. Although he concurred with the identification of the dental material, he felt the isolated auditory bulla (UF 19319) was more like that of *Merycochoerus matthewi* from the lower part of the Marsland Formation of Nebraska.

oreodont. The P³, although close, does not have the same degree of anteroposterior compression as is seen in the Buda P³. Also, the anterior crescent of P³ is slightly smaller and the exterior crescent is more concave on the P³ from Buda than on that of *P. stouti*. A new species of *Hypsiops* from the Big Bend area of Texas may also be related to the Gulf Coastal phenacocoelines (Stevens *et al.* 1969).

The Subfamily Phenacocoelinae contains four genera: *Phenacocoelus, Hypsiops, Submerycochoerus,* and *Pseudomesoredon.* All species of the four genera, except *Phenacocoelus stouti*, are strictly Arikareean species. *Phenacocoelus stouti* is a Hemingfordian species. The subfamily is widely distributed over the western part of the United States (Schultz and Falkenbach 1950), but was unknown in the southern states until Stevens *et al.* (1969) described a new species, *Hypsiops leptoscelos,* from the Castolon Local Fauna (Arikareean) of the Big Bend area of Texas. The oreodont from Buda is the first occurrence of the Phenacocoelinae in the Gulf Coastal Plain.

SUBORDER TYLOPODA ILLIGER 1811
FAMILY CAMELIDAE GRAY 1821
NEW GENUS AND SPECIES
FIGURES 5C, 8

REFERRED MATERIAL.—UF 18373, 6 incisors; UF 17015, 8 incisors; UF 18382, 10 premolars; UF 18385, 3 P⁴'s; UF 18384, 12 upper molars; UF 18378, 25 upper molar fragments; UF 19313, 2 P₂'s; UF 18365, 3 P₃'s; UF 18387, 3 P₄'s; UF 18374, P₄ with mandibular fragment; UF 18379, 19 lower molar fragments; UF 18388, 7 lower molars; UF 19314, 2 M₃'s; UF 22779, 4 DP³'s; UF 22780, 3 DP₃'s; UF 19315, 6 deciduous lower premolars; UF 16950, 7 deciduous teeth; UF 18384, 4 mandibular fragments; UF 16907, 16914, 16955, 17006, 18367-18369, 18370-18372, 18375-18377, 18380, 18381, various postcranial elements.

COMPARATIVE MATERIAL EXAMINED.—*Floridatragulus dolichanthereus,* F:AM 31864, 31865; *Gentilicamelus sternbergi,* AMNH 7910, holotype; *Miolabis transmontanus,* AMNH 8196, holotype; *Miolabis* sp., F:AM 68985, 68986; *Miotylopus bathygnathus,* MCZ 2924, holotype (cast in AMNH); *Nothokemas floridanus,* UF 19929, AMNH 22672; *Oxydactylus campestris,* AMNH 17620, holotype; *Oxydactylus longipes,* CM 918, holotype (cast in AMNH); *Paratylopus primaevus,* AMNH 9806, holotype; *Poebrotherium eximium,* AMNH 632, holotype.

DESCRIPTION

Excluding the oromerycids, this is the smallest known camel, equal in size to *Leptomeryx* or *Hyemoschus.* These specimens probably represent a new genus of camel. I am, however, reluctant to erect a new

genus on the basis of isolated teeth, because the possibility exists that future researchers may recognize another taxon in this sample or not be able to differentiate species of a genus whose holotype is an isolated tooth.

Among the Camelidae, this small camel from Buda may be related to a group comprised of *Oxydactylus, Nothokemas, Gentilicamelus,* and perhaps *Floridatragulus* and *Miolabis.* Each has characteristic features of its own, but all share a distinctive enamel pattern in the molars, especially evident in the lower molars, in contrast to all other camelid genera.

UPPER DENTITION.—The DP³'s from Buda resemble those of *Oxydactylus* but differ from those of *Miolabis,* which are shortened and have only one prominent cusp not two.

P⁴ of the Buda camel is very similar to P⁴ of all camelids.

The upper molars of the Buda camel (Fig. 8H, I, K, L) also resemble those of *Oxydactylus, Gentilicamelus, Miolabis, Nothokemas,* and *Floridatragulus.* In appearance, the metacone (posterior crest) slightly overlaps the paracone (anterior crest) with the forward edge of the metacone turning out sharply to form a prominent mesostyle. With wear the crests unite first and then the crescents. The upper molars of each genus have prominent mesostyles and external ribs. Small intercolumnar styles are present on molars of the Buda camel, *Gentilicamelus,* and *Floridatragulus* and are individually variable in size and presence in *Oxydactylus* and *Miolabis.*

LOWER DENTITION.—P₂ and P₃ (Fig. 8A, B) have simple enamel patterns lacking lingual stylids in contrast to those of *Gentilicamelus* and *Nothokemas.* A lingual stylid may or may not occur on P₃ of *Oxydactylus.* A DP₃ found at Buda (Fig. 8F) has a prominent, curved lingual stylid as does DP₃ of *Oxydactylus.* DP₃ of *Miolabis* has a straight lingual stylid. Deciduous lower premolars of *Nothokemas, Floridatragulus,* and *Gentilicamelus* are unknown.

P₄ of the Buda camel (Figs. 5C, 8C) is diagnostic. This tooth is not wedge-shaped as are P₄'s of most other camelid genera. The width of P₄ at the protoconid is approximately equal to the width at the hypoconid giving the tooth a quadrate outline. This is also seen in *Floridatragulus* and in some individuals of *Miolabis.*

The enamel pattern of the lower molars is shared by this new genus (Fig. 8D, E, G) and *Oxydactylus, Gentilicamelus, Nothokemas, Floridatragulus,* and *Miolabis.* The crests of the lower molars are not in the same vertical plane but rather in parallel planes, the metaconid (anterior crest) slightly overlapping the entoconid (posterior crest). The metaconid remains free of the entoconid, the hypoconid (posterior crescent), and the posterior end of the protoconid (anterior crescent)
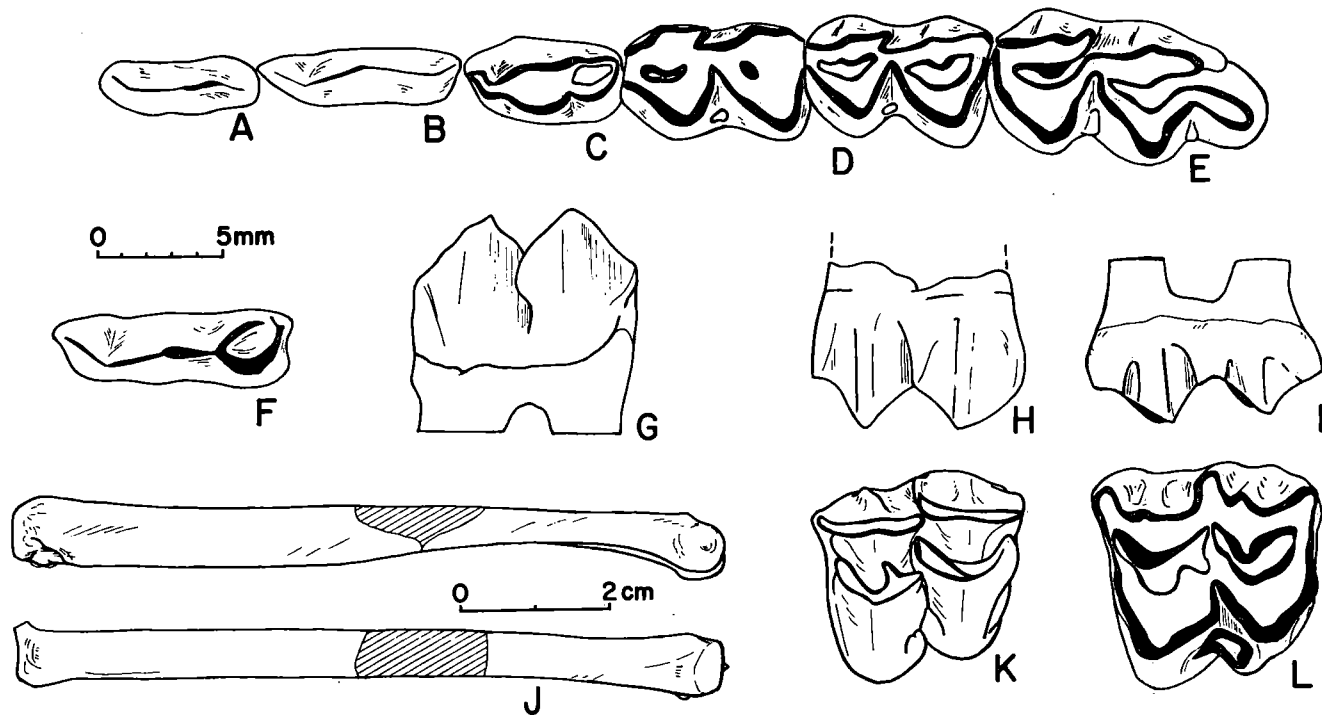
FIGURE 8.— Camelidae n. gen. et sp. A-E: Composite left lower tooth row. A) P$_2$, UF 19313; B) P$_3$, UF 18365; C) P$_4$, UF 18387; D) Lower molars, M$_2$ reversed, UF 18385; E) Composite M$_3$ using M$_3$, UF 19314, and lower molar, UF 18385; F) Left DP$_3$, UF 22780; G) Left M$_1$ or M$_2$, UF 18388; H, I, K, L) Upper molars, UF 18384, (H-I. Labial views, K and L, Occlusal views, H and K are reversed); J) Left metacarpal III, UF 18367, natural size.

until advanced wear of the tooth. The protoconid and entoconid are the first parts of the tooth to unite after wear. Slight internal ribs are present on the lower molars of all six genera. Intercolumnar styles are present on *Gentilicamelus*, the Buda camel, and *Nothokemas* and, as in the upper molars, variably present in *Oxydactylus* and *Miolabis*.

MANDIBLE.—The lower ramus of this new genus has a longer diastema between P_1 and P_2 than does *Gentilicamelus sternbergi*. The ramus is sharply constricted in this area as in *Oxydactylus*.

POSTCRANIAL SKELETON.—The postcranial skeleton of the Buda camel is difficult to separate from skeletal elements of other Arikareean camels on features other than size. The metapodials are unfused and of the same proportion as those of *Gentilicamelus*. A single complete metacarpal III (UF 18367; Fig. 8J) measures 94.7 mm in length. None of the elongation of neck and limbs typical of *Oxydactylus* is seen in the skeleton of the new genus from Buda.

DISCUSSION

During the Arikareean and the Hemingfordian, the generic diversity of camels with low crowned teeth was greater in the Gulf Coast than anywhere else in North America. In the Arikareean, *?Oxydactylus* or *?Nothokemas* (Simpson 1930) and this new genus from Buda were present in Florida. The second camel found at Buda, discussed in the next section of this paper, may be yet another genus. Further discussion of these camels is deferred to that section.

CAMELIDAE GRAY 1821
GENUS AND SPECIES INDETERMINATE
FIGURE 9

REFERRED MATERIAL.—UF 19316, upper molar; UF 18386, 2 lower molars; UF 18364, 3 fragments of scapulae; UF 18362, 5 fragments of humeri; UF 18358, 5 fragments of radii; UF 18363, 2 fragments of innominata; UF 18361, 3 fragments of sacra; UF 18359, 6 fragments of femora; UF 18360, 6 fragments of tibiae; UF 16956, 10 astragali; UF 18383, 2 fragments of metapodials; UF 16925, 53 metapodials; UF 18366, 70 phalanges.

DESCRIPTION

A second camel, about twice the size of the camel discussed in the previous section, is represented in the Buda Local Fauna by numerous fragmentary postcranial elements. Only two complete teeth, an upper molar and a lower molar, can be referred to this taxon. Each tooth, however, has the pronounced overlapping parallel crests that are seen
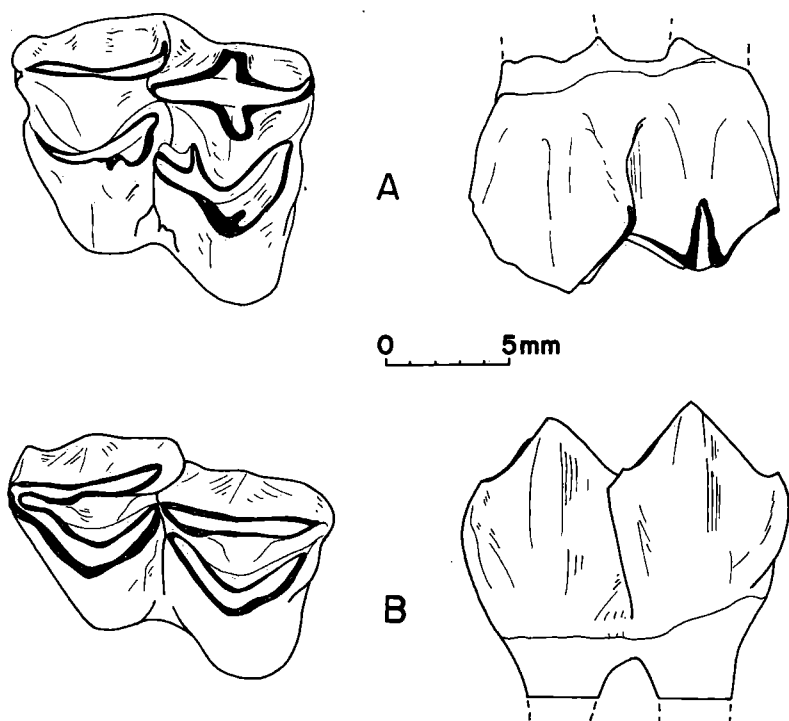
FIGURE 9.— Camelidae, gen. et sp. indet. A) Right upper molar, UF 19316, occlusal and labial views. B) Left lower molar, UF 18386, occlusal and lingual views.

in *Oxydactylus* and a few other genera, as is discussed in the previous section and again below.

The upper molar is an M². The degree of brachydonty and overlap of the paracone by the metacone is comparable to that seen in *Gentilicamelus* and *Floridatragulus*. A small intercolumnar style is present and resembles those of *Floridatragulus,* the unnamed new genus from Buda, and *Gentilicamelus*. The external ribs and styles, however, are less pronounced than in *Floridatragulus* or *Gentilicamelus*, but resemble those in *Nothokemas*.

The lower molar (Fig. 9B) lacks an intercolumnar cingulum. In the great degree of overlap of the entoconid (posterior crest) by the metaconid (anterior crest), this camel is very much like the unnamed new genus from Buda. The internal ribs of the lower molars are more pronounced than in any other camelid genus examined, including *Gentilicamelus* and *Floridatragulus*.

The proximal ends of broken metapodials suggest that the

metapodials were not fused. This is a primitive tylopod feature also observed in *Oxydactylus* and *Gentilicamelus*.

DISCUSSION

The low crowned teeth with an *Oxydactylus*-like pattern can be compared with *Oxydactylus, Gentilicamelus, Nothokemas, Miolabis, Floridatragulus,* and the unnamed new genus previously described. All occur in the Gulf Coastal Plain, and *Floridatragulus, Nothokemas,* and the new genus are restricted to the Gulf Coast.

The two camels from Buda both have brachydont molars and un-fused metapodials. The retention of these primitive camelid features in both species suggests that selection pressures on these camelid populations in Florida during the Arikareean differed from those on many camelids in western North America where hypsodont molars and fused metapodials were more common. Presumably Buda sampled a forested region where there was no great emphasis on a harsh diet and sustained running.

INFRAORDER PECORA LINNEAUS 1758
FAMILY HYPERTRAGULIDAE COPE 1879
Nanotragulus LULL 1922
Nanotragulus loomisi LULL 1922
FIGURE 10, TABLES 6, 7

REFERRED MATERIAL.—UF 16953, 29 incisors; UF 16937, 25 P^2's; UF 18482, 14 P^3's; UF 16985 14 P^4's; UF 16994, 62 upper molars; UF 18418, M^2 embedded in limestone; UF 18500, M$^{2-3}$; UF 17014, 14 M^3's; UF 18483, 38 P$_1$'s; UF 18484, 25 P$_2$'s and P$_3$'s; UF 16960, 19 P$_4$'s; UF 16958, 43 lower molars; UF 18485, 15 M$_3$'s; UF 18486, 2 fragments of maxillae; UF 16959, 19 fragments of mandibles; UF 16913, 16924, 16949, 16951, 16997, 16998, 18487-18494, various postcranial elements.

COMPARATIVE MATERIAL EXAMINED.—*Nanotragulus loomisi:* YPM 10330, holotype. *N.* cf. *loomisi:* SDSM 5995, 53397, 53402, 53432, 54340, 59109. *N. "lulli":* AMNH 13821, holotype. *N. "intermedius":* MCZ 2301, holotype; MCZ 2812, paratype; and numerous referred specimens at SDSM from the Sharps Formation of South Dakota.

DESCRIPTION

Three genera of hypertragulids and one leptomerycid (*sensu* Taylor and Webb 1976) have unfused metapodials and approximate the size of the material from Buda. These are *Nanotragulus, Hypertragulus, Hypisodus,* and *Leptomeryx.* Each genus has distinctive dental features which permit certain identification, even though only a few isolated teeth may be available (see Table 5). Comparisons of these four genera are presented in this section to illustrate the differences

TABLE 5.—DENTAL FEATURES THAT DIFFERENTIATE *Nanotragulus, Hypisodus, Hypertragulus,* AND *Leptomeryx.*

	Nanotragulus	*Hypisodus*	*Hypertragulus*	*Leptomeryx*
P^4: lingual fossette, after wear	2, almost equal in size	2, equal in size	2, posterior smaller	1
Crown height:	subhypsodont	subhypsodont	brachydont	brachydont
Upper molars: mesostyles	absent	absent	minute	present
intercolumnar styles	small, often absent	small, often absent	minute, small, variable	present, small, variable
intercolumnar cingulum	absent	absent	present	present but very small
M^3 metastyle	large, leans anteriorly	large, leans anteriorly	small, parallel to external rib	small, parallel to external rib
P$_4$: metaconid	indistinct	distinct	distinct	distinct
Lower molars:				
intercolumnar stylids	variable in size and presence	usually absent	small	absent
intercolumnar cingula	absent	usually absent	present	small, usually absent
M$_3$ posterior fossettid	closed	closed	closed	open
Size: relative to *Nanotragulus*	1.0	0.7	1.0	1.2

among them and the reasons for the subsequent referral of the Buda material to *Nanotragulus.*

UPPER DENTITION.—Although variable, the characteristics of the P⁴ of all four genera listed above are roughly similar. The protocone of *Nanotragulus* is displaced anteriorly on the P⁴. P⁴ of *Nanotragulus* has a small tubercle which, with a little wear, becomes a ridge connecting the protocone medially with the ectoloph and dividing the central fossette of an unworn tooth into two slightly unequal fossettes (the anterior being larger) that persist until advanced wear. P⁴ of *Hypertragulus* is like that of *Nanotragulus,* except that the two fossettes in *Hypertragulus* are very unequal in size, the smaller posterior fossette quickly disappearing with wear. In contrast to *Nanotragulus,* P⁴ of *Leptomeryx* has a more medially located protocone and has only one fossette, never two, although the posterior part of the single fossette wears away first, giving the appearance of there having been at one time two fossettes. P⁴ of *Hypisodus,* unlike *Nanotragulus,* has a large, medially placed protocone that after slight wear is connected to the ectoloph by a crest that divides the single fossette of an unworn tooth into two nearly equal fossettes that persist until advanced wear.

The upper molars of *Nanotragulus* and *Hypisodus* are equally subhypsodont and lack mesostyles and internal cingula. An intercolumnar style is variable in both presence and size. In contrast, the upper molars of *Leptomeryx* are brachydont with large parastyles, mesostyles, and metastyles. A small intercolumnar style rises from an intercolumnar cingulum on the metaconule of each upper molar of *Leptomeryx.* These styles and cingula vary in size but are never large or prominent. The upper molars of *Hypertragulus* are also brachydont, have incomplete internal cingula (larger than those seen on the upper molars of *Leptomeryx,* yet they do not extend over the most lingual surface of each cusp), and there is a minute mesostyle. The presences of intercolumnar cingula and mesostyles on the upper molars of *Hypertragulus* contrast this genus with *Nanotragulus.* Lull (1922) and Cook (1934) stated that the upper molars of *Hypertragulus* have no mesostyles, but in fact minute mesostyles are present.

In M³ of *Hypertragulus* the metastyle is parallel to the external ribs for most of its length, and *Leptomeryx* has a similar small metastyle. In contrast, the metastyles of *Nanotragulus* and *Hypisodus* are large and lean anteriorly (the teeth widen towards their bases) instead of being parallel to the external ribs.

LOWER DENTITION.—P₄ of *Nanotragulus* is extremely variable (Fig. 10E) but most similar to that of *Leptomeryx.* The metaconid is never separate as in *Hypertragulus* and *Hypisodus;* instead it is difficult to differentiate from the inner enamel wall of the P₄.
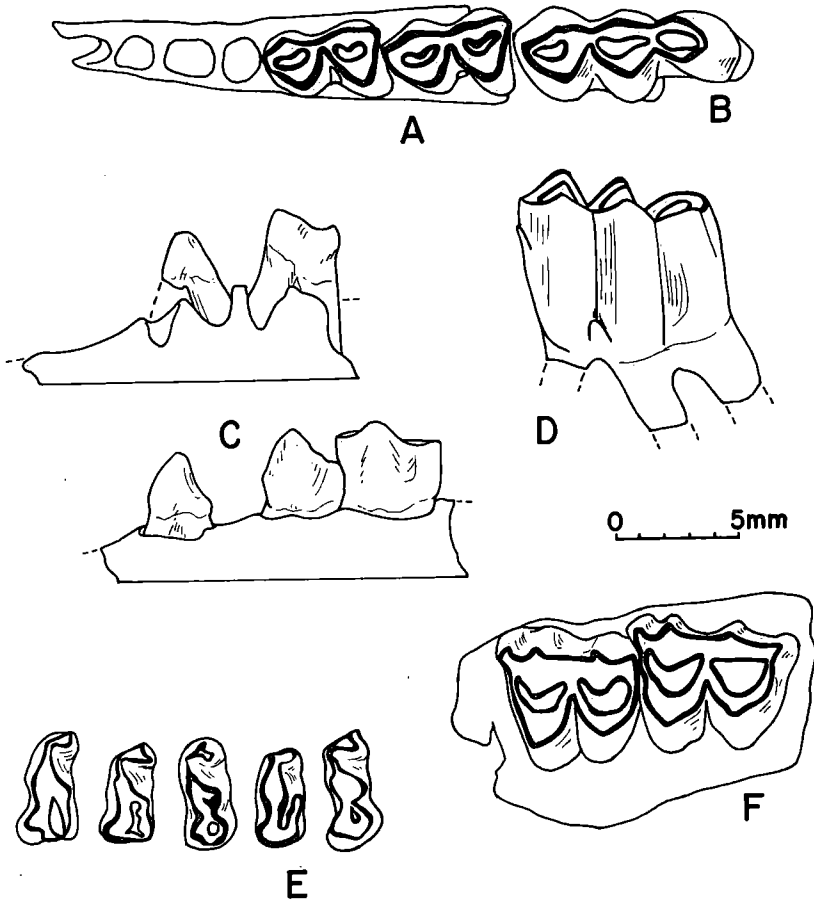
FIGURE 10.—*Nanotragulus loomisi*. A) Fragment of left mandibular ramus with M_{1-2}, UF 16959, occlusal view; B,D) Left M_3, UF 18485, occlusal and labial views; C) Two fragments of left mandibular rami, UF 16959, labial view, showing variation in the P_2-P_3 diastema, lower specimen with P_2-P_4; E) Five left P_4's, UF 16960, showing variation in enamel pattern; F) Left M^{2-3}, UF 18500, occlusal view.

The lower molars of *Hypertragulus* have intercolumnar cingula. On M_3 the cingulum is variable in extent and may appear more as a style between the hypoconid and the hypoconulid. It is usually absent on the posterior part of the hypoconulid. The intercolumnar labial cingula of *Nanotragulus* are vertically accentuated into thin styles (Fig. 10D). These are variable both in size and presence. The intercolumnar cingula of *Hypisodus* are very reduced and usually absent altogether. The cingula and styles on the lower molars of *Leptomeryx* are variable

in size yet smaller than in *Hypertragulus* or *Nanotragulus*. Few lower molars of *Leptomeryx* have intercolumnar cingula and none have intercolumnar styles. *Leptomeryx* differs from the hypertragulids compared in having an open posterior fossette on M_3.

DISCUSSION

The specimens from Buda fall within *Nanotragulus* Size Group IV[1] of Frick (1937). Size is certainly the easiest and may even be the most reliable way to identify the species of *Nanotragulus,* but other differences between *N. loomisi* and species in other size groups are noteworthy.

Nanotragulus albanensis Frick (1937) (F:AM 13785, holotype) is 50 percent larger than the Buda species. The lower molars have larger intercolumnar tubercles than those of *N. loomisi* (especially M_3, which has two).

Nanotragulus ordinatus (Matthew 1907) (F:AM 13013, 13011) is 25 percent larger than the Buda species. P_2 of all *N. ordinatus* specimens examined differ from the Buda specimens in having the major cusp centrally placed between the roots and not over the anterior root. The inner selenes of the lower molars, especially those of *N. ordinatus* var. (*sensu* Frick 1937) (F:AM 31534-6), are more rounded than those of *N. loomisi.*

Nanotragulus matthewi Cook (1934) compares in size to *N. ordinatus* (Stevens *et al.* 1969).

Frick (1937) included two species, *N. loomisi* Lull (1922) and *N. lulli* Frick (1937) in his Size Group IV, the smallest size group. Schlaikjer (1935) named a new species, *N. intermedius,* which was briefly mentioned but not discussed by Frick (1937) and which also falls in this size group. The amount of variation seen in the teeth and postcranial elements of *Nanotragulus* material from Buda, a very restricted sample both temporally and geographically, casts doubt on the diagnostic charactersitics used by Frick (1937) and Schlaikjer (1935) to distinguish these two species from *N. loomisi.*

While Frick (1937) diagnosed *N. lulli* on the basis of the large auditory bulla, the longer limb elements, and the slightly larger size of the type specimen, the teeth are morphologically inseparable from those of *N. loomisi.* Frick (1937:643) stated that the bulla of *N. lulli* is large in comparison to *Hypertragulus.* This is true, however, for all species of *Nanotragulus* and is not diagnostic of a single species. A tibia from Buda (UF 18493) measures 92 mm and is thus closer to *N. loomisi.* On the other hand, the third metatarsal of *N. loomisi*

[1]Frick (1937) grouped species by size as a convenient first step in systematic discussion. The number of groups or the size range within a group differed with each major taxon.

measures 50 mm; that of *N. lulli* measures 56 mm. Two third metatarsals from Buda both measure 50 mm, but a metatarsal IV (which is usually within 1 mm of the matching metatarsal III) is 54 mm, bridging the gap in metatarsal measurements between the two species. The lengths of the limb elements of *Nanotragulus* from Buda do not cluster around comparable measurements of either *N. loomisi* or *N. lulli*, nor are they consistently larger or smaller than these two species. The variation in limb lengths lends support to the contention that this is due to individual variation and is not diagnostic of a single species of *Nanotragulus*. Other measurements of the postcranial elements of *Nanotragulus* from Buda indicate a wide size range in this population, overlapping samples referred by Frick (1937) to *N. loomisi* and samples of *N. lulli* (Table 6).

Much of Schlaikjer's (1935) diagnosis of *N. intermedius* was made on cranial elements and complete tooth rows, which cannot be compared for lack of counterparts in the Buda specimens. The diagnostic characteristics that pertain to teeth and size, however, are all variable within the limits of the Buda *Nanotragulus* material. Dental measurements of *Nanotragulus loomisi, N. "lulli" (=N. loomisi)*, and *N. intermedius* (Table 7) do not differentiate these species, while coefficients of variation between 4 and 10 indicate a unified sample (Simpson *et al.* 1960). The consistency of the coefficients of variation of *Nanotragulus* is remarkable since these specimens represent deposits of similar but not identical ages from localities in Florida, Wyoming, and South Dakota. A scatter diagram of upper and lower third molars, the largest sample of recognizable isolated teeth from Buda (Fig. 11),

TABLE 6.—COMPARATIVE MEASUREMENTS OF POSTCRANIAL ELEMENTS OF *Nanotragulus loomisi* (F:AM 31537-9) FROM NEAR SPANISH DIGGINGS, WYOMING; *N. loomisi (=N. lulli;* in Loomis 1933) FROM PORCUPINE CREEK, SOUTH DAKOTA; AND *N. loomisi* FROM THE BUDA LOCAL FAUNA.

	Spanish Diggings	Porcupine Creek	Buda
Greatest internal diameter of acetabulum	7.4	—	8.9 - 10.0 N=2
Greatest length of tibia	106.2	118	92.4
Maximum width of distal end of humerus	(9.9)	—	10.0 - 11.4 N=6
Length of metatarsals	(50.3 - 50.9) N=2	56	50.0 - 54.4 N=3
Length of astragali	10.4 - 10.9 N=2	—	10.8 - 12.5 N=14

TABLE 7.—MEASUREMENTS AND STATISTICS OF *Nanotragulus* MOLARS.

		N	OR	$\overline{\text{X}}$	SD	CV
M^1 (length)						
N. loomisi (YPM 10330, holotype)		1	5.3			
N. "lulli" (AMNH 13821, holotype)		1	5.6			
N. "intermedius" (MCZ 2103, holotype)		1	6.3			
N. "intermedius" (MCZ 2812, paratype)		1	5.9			
N. "intermedius" (Sharps Fm.)		7	5.5-6.8	5.8	0.459	7.947
N. cf. *loomisi* (Sharps Fm.)		3	5.3-6.8	5.8	0.568	9.860
all		14	5.3-6.8	5.8	0.435	7.533
M^{1-2}						
N. loomisi (YPM 10330, holotype)		1	11.3			
N. "lulli" (AMNH 13821, holotype)		1	13.3			
N. "intermedius" (MCZ 2103, holotype)		1	12.5			
N. "intermedius" (MCZ 2812, paratype)		1	12.4			
N. "intermedius" (Sharps Fm.)		7	11.3-13.9	12.2	0.817	6.707
N. cf. *loomisi* (Sharps Fm.)		3	11.3-12.1	11.6	0.461	3.993
all		14	11.3-13.9	12.1	0.768	6.344
M^3 (length and width)						
N. loomisi (YPM 10330, holotype)	L	1	6.9			
	W		4.8			
N. "lulli" (AMNH 13821, holotype)	L	1	7.6			
	W		5.7			
N. "intermedius" (MCZ 2103, holotype)	L	1	(6.4)			
	W		(4.4)			
N. "intermedius" (MCZ 2812, paratype)	L	1	7.1			
	W		5.3			

Table 7.—Continued

	N		OR	$\overline{X}$	SD	CV
N. loomisi (Buda)	L	15	6.7-8.1	7.3	0.381	5.229
	W		5.2-6.3	5.9	0.376	6.396
N. "intermedius" (Sharps Fm.)	L	7	6.3-7.2	6.8	0.298	4.406
	W		5.1-6.5	5.8	0.535	9.231
N. cf. *loomisi* (Sharps Fm.)	L	2	6.1-6.7	6.4	0.424	6.629
	W		5.7-5.8	5.8	0.070	1.229
all (except MCZ 2103)	L	26	6.1-8.1	7.1	0.454	6.416
	W		4.8-6.5	5.8	0.443	7.655
All (incl. MCZ 2103)	L	27	6.1-8.1	7.1	0.464	6.579
	W		4.4-6.5	5.7	0.507	8.850
M_1 (length and width)						
N. loomisi (YPM 10330, holotype)	L	1	4.8			
	W		3.2			
N. "lulli" (AMNH 13821, holotype)	L	1	4.8			
	W		3.9			
N. "intermedius" (MCZ 2103, holotype)	L	1	5.0			
	W		3.3			
N. loomisi (Buda)	L	1	5.1			
	W		3.5			
N. "intermedius" (Sharps Fm.)	L	14	3.9-4.9	4.4	0.338	7.704
	W		3.2-3.9	3.4	0.216	6.315
N. cf. *loomisi* (Sharps Fm.)	L	2	4.6-4.8	4.7	0.141	3.008
	W		3.3-3.6	3.4	0.212	6.148
all	L	20	3.9-5.1	4.5	0.364	8.042
	W		3.2-3.9	3.4	0.223	6.489

TABLE 7.—CONTINUED

	N		OR	$\overline{X}$	SD	CV
M_{1-3} (length)						
N. *loomisi* (YPM 10330, holotype)		1	18.3			
N. *"lulli"* (AMNH 13821, holotype)		1	20.5			
N. *"intermedius"* (MCZ 2103, holotype)		1	(17.2)			
N. *"intermedius"* (Sharps Fm.)		14	16.3-20.4	17.5	1.120	6.414
N. cf. *loomisi* (Sharps Fm.)		1	18.2			
all (except MCZ 2103)		18	16.3-20.5	17.7	1.262	7.120
all (incl. MCZ 2103)		19	16.3-20.5	17.7	1.231	6.956
M_3 (length and width)						
N. *loomisi* (YPM 10330, holotype)	L	1	8.3			
	W		3.8			
N. *"lulli"* (AMNH 13821, holotype)	L	1	9.2			
	W		4.0			
N. *"intermedius"* (MCZ 2103, holotype)	L	1	(7.2)			
	W		(2.8)			
N. *loomisi* (Buda)	L	5	8.0-9.5	8.7	0.571	6.588
	W		3.4-3.9	3.7	0.192	5.227
N. *"intermedius"* (Sharps Fm.)	L	15	6.9-9.2	7.9	0.732	9.259
	W		3.2-4.3	3.7	0.265	7.197
N. cf. *loomisi* (Sharps Fm.)	L	3	7.4-9.4	8.3	1.014˙	12.227
	W		3.5-4.3	3.9	0.400	10.256
all (except MCZ 2103)	L	25	6.9-9.5	8.2	0.771	9.436
	W		3.2-4.3	3.7	0.262	7.035
all (incl. MCZ 2103)	L	26	6.9-9.5	8.1	0.780	9.583
	W		2.8-4.3	3.7	0.315	8.537

also fails to separate *Nanotragulus intermedius* from *N. loomisi* and *N. "lulli" (=N. loomisi).*

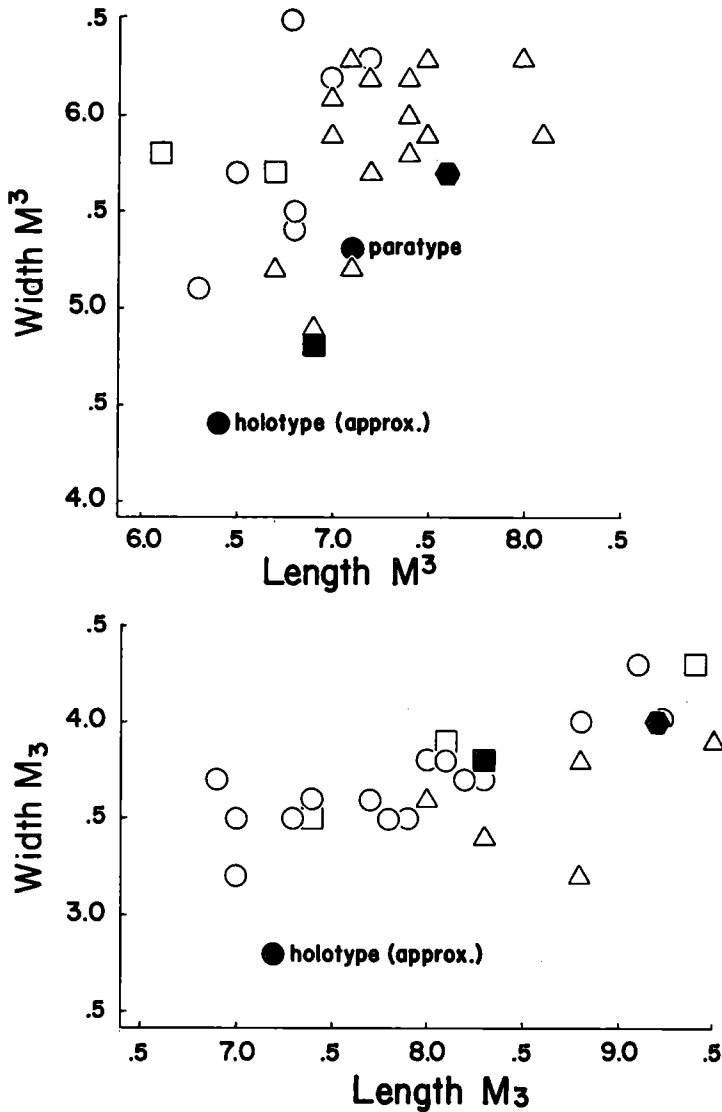Other diagnostic features used by Schlaikjer (1935) are equally in-

FIGURE 11.—Scatter diagrams of M³ and M₃ of *Nanotragulus*. Squares = *N. loomisi;* circles = *N. "intermedius";* hexagons = *N. "lulli";* triangles = *Nanotragulus* from Buda. Solid symbols represent holotypes or paratypes. Measurements are in millimeters.

conclusive. The upper molars vary greatly in outline. They may be quadrangular (as Schlaikjer [1935] described the molars of *N. intermedius*), or the metacone may be more labially displaced giving an uneven appearance to the tooth. The internal cusps of the P^3's from Buda are variable in size. Some have large inner cusps while in others (5 of 14) this cusp is reduced to a cingulum. Schlaikjer (1935) described the P^3 of *N. intermedius* as having a small internal cusp. In the holotype of *N. intermedius* (an immature individual in which M^3 and M_3 have not fully erupted) the M^3 does not appear to overlap M^2 as much as in specimens of *N. loomisi,* but in the paratype of *N. intermedius* (MCZ 2812, an adult), the degree of overlap is as great as that seen in comparable specimens of *N. loomisi.* The degree of overlap of M^2 by M^3 appears to be highly variable within the Buda population of *Nanotragulus.* I_3 is not larger than I_1 or I_2 on *N. intermedius* as Schlaiker (1935) stated in the diagnosis, but is smaller as Schlaikjer noted in the description. In either event the difference is slight and variable. In *N. intermedius,* P_2 and P_3 are said to be closely appressed. In the Buda sample, four mandibular fragments have no diastema between P_2 and P_3 and two others have small diastemata, the largest equalling P_2 in length (Fig. 10C). The presence or absence of a diastema between P_2 and P_3 seems also to be a variable feature in *Nanotragulus* populations. The presence or absence of intercolumnar pillars is another variable feature of the teeth of *Nanotragulus.* Lull (1922) stated that they were absent in *N. loomisi.* Schlaikjer (1935) found them on the holotype of *N. intermedius* but absent on the paratype. Of 60 complete upper molars of *Nanotragulus* from Buda, 6 (one M^3) have definite intercolumnar pillars. Of 19 complete lower molars (no M_3's) from Buda, 5 have a small intercolumnar pillar.

The small size attributed to *N. intermedius* in the sample examined by Schlaikjer (1935) appears to be due to one small individual (the paratype, MCZ 2812), and an immature individual (the holotype, MCZ 2013). From those measurements and morphological characters that could be compared between the holotype and paratype of *N. intermedius,* the holotype of *N. loomisi* (YPM 10330), referred specimens from South Dakota, and the sample from Buda, it seems that only one species can be recognized. By priority that species is *Nanotragulus loomisi* Lull 1922.

AGE AND CORRELATION

The age of the Buda Local Fauna is difficult to place in that of four species that could be accurately identified, three are new. Because

Nanotragulus loomisi has been recognized elsewhere in the United States, it is the best age indicator in the fauna.

The holotype of *Nanotragulus loomisi* was described from Castle Butte, near Spanish Mines, Wyoming (Lull 1922). Lull (1922) considered these beds to be "Lower Harrison" equivalents. Loomis (1933) considered Lull's "Lower Harrison" beds as equivalent to "Lower Rosebud" beds of South Dakota. Schlaikjer (1935) went even further and regarded Lull's (1922) Spanish Mines "Lower Harrison" and the "Lower Rosebud" as facies of the same rock unit. These "Lower Rosebud" beds of South Dakota are now known to include beds from the upper part of the Sharps Formation through the lower part of the Harrison Formation (Macdonald 1963). Macdonald (1963) found *Nanotragulus loomisi* in the Sharps Formation only. According to Macdonald (1963), the Sharps Formation is the lower-most Arikareean stratum in the Wounded Knee area and is overlain by the Monroe Creek and Harrison formations. Although other *Nanotragulus* species may occur in the Whitneyan and Hemingfordian deposits, the genus is most frequently found in deposits of Arikareean age (Frick 1937). The presence of *N. loomisi* in the Buda Local Fauna gives the fauna a decidedly Arikareean aspect.

The presence of *Daphoenodon notionastes* and its stage of evolution also indicate a late Arikareean or, at the latest, a very early Hemingfordian age for the Buda Local Fauna. It is not found in early Hemingfordian (Garvin Gully and Thomas Farm) or later local faunas of the Gulf Coast. In addition, the presence of *D. notionastes* in two small local faunas of Florida, Brooksville amd Franklin Phosphate Pit No. 2, strengthens this view and suggests that these three faunas are similar in age. The degree of evolution of *D. notionastes* at Buda and Franklin Phosphate Pit No. 2 is advanced with respect to that found at Brooksville, indicating that Brooksville is probably slightly older than these two faunas.

Bassariscops achoros, as a new species, is of little value in determing the age of the Buda Local Fauna, although the only other record of this genus, *B. willistoni,* is from the lower part, possibly Arikareean, of the Brown's Park Formation of Colorado (Peterson 1928).

The Nimravinae are not known to occur later than the Arikareean elsewhere in North America (L. D. Martin, pers. comm.). The Schizotheriinae are not known elsewhere in North America before the late Arikareean (Skinner 1968). The overlap of these two subfamilies in the Buda Local Fauna suggests a late Arikareean age.

The single tooth of *Cynorca* found at Buda has features transitional between *C. sociale* and *C. proterva.* Woodburne (1969) placed this

probable transition in the late Arikareean or early Hemingfordian. Also, *Cynarctoides* sp. and the phenacocoeline oreodont occur in known western faunas no earlier than late Arikareean (Barbour and Cook 1914; Schultz and Falkenbach 1950; Galbreath 1956; Stevens *et al.* 1969). These taxa, therefore, all favor a late Arikareean age not clearly indicated by the occurrence of *Nanotragulus loomisi* alone.

The *Oxydactylus*-like camels in the Buda Local Fauna have a temporal range which extends from the Arikareean to the Barstovian in North American faunas. These taxa, as well as the even more inclusive group Mustelidae, provide no further refinement of the age of this fauna.

ZOOGEOGRAPHY

The major portion of the continental mid-Tertiary faunal record of North America is preserved in the thin blankets of rocks that cover much of the Great Plains from Saskatchewan to Mexico. However, during the Tertiary Florida, as now, surely had a different spectrum of climate, topography, soil type, and vegetation. Paleontological studies of the Gulf Coast (Quinn 1952; Wilson 1960; Patton 1969b; Klein 1971; Waldrop 1971; Webb 1974) indicate that the Gulf Coastal Plain has been a distinct faunal province throughout most of the Tertiary.

The composition of the Buda Local Fauna, the first extensive Arikareean sample in the Gulf Coastal Plain, bears a general resemblance to Arikareean faunas of the Great Plains. Only the new camel is completely new at the generic level. *Cynorca* was extremely rare in the Great Plains during the Arikareean, as possibly was *Bassariscops,* previously known only from the Brown's Park Fauna of Colorado.

Most taxa in the Buda Local Fauna, while generically related to groups found in the Great Plains during the early Miocene, are probably distinct species. *Daphoenodon notionastes* is distinct from the more bear-like species of the Great Plains, but it did not survive into Hemingfordian time when *Daphoenodon superbus* appears in the Hemingfordian Garvin Gully fauna (Wilson 1960) of Texas. The Buda *Cynarctoides* might be a distinct species from the Colorado and Nebraska samples.

Nanotragulus loomisi is the only identifiable species in the Buda Local Fauna that is not a new species. The inclusion of *N. loomisi* in this local fauna constitutes a major range extension from its previously known occurrences in South Dakota and Wyoming (Lull 1922; Loomis 1933; Frick 1937; Macdonald 1963). *Nanotragulus loomisi* ap-

parently retained its species identity over a range that encompassed at least two faunal provinces, the Great Plains and the Gulf Coastal Plain.

The more indeterminate taxa in the fauna, such as the nimravine cat, the large mustelid and the anchitherine horse, are of little interest zoogeographically, except to record the presence of these groups in Florida during the Arikareean.

The Buda Local Fauna is characterized by a mixture of elements from better known faunas of western North America. Although similarities can be seen between the Buda Local Fauna and western faunas, the Buda Local Fauna is nonetheless distinct from Great Plains and Pacific Coast faunas. Presumably this reflects its geographic location in the Gulf Coastal Province where evolutionary tendencies were influenced by wholly different conditions. Geographic barriers helped establish species distinctions, but persistent insularity postulated by White (1942) is not indicated in this fauna.

SUMMARY

The Buda Local Fauna is the first extensive sample of Arikareean mammals in Florida, and most taxa in this fauna are new to the fossil record of Florida. Two new species are described: *Daphoenodon notionastes* and *Bassariscops achoros*. A new genus of Camelidae is recognized but not named. Other taxa are *Cynarctoides* sp. Mustelidae, Nimravinae, *Cynorca* sp., Phenacocoelinae, Camelidae, Anchitheriinae, *Moropus* sp., and *Nanotragulus loomisi*. *Daphoenodon notionastes*, the anchitherine horse, and the two camels in the Buda Local Fauna also occur in Franklin Phosphate Pit No. 2, another Arikareean local fauna in Florida. The only element in common with a third Arikareean local fauna, Brooksville, is *Daphoenodon notionastes*.

Daphoenodon notionastes de-emphasized the bear-like massive mandible and crushing dentition which are typical of related amphicyonids in the Great Plains. It did not survive into the Hemingfordian in the Gulf Coastal Plain.

Bassariscops achoros is a canid on the basis of its petrosal structure. It is recognized as a cynarctine by the presence of accessory cusps on the carnassials. *Bassariscops achoros* is even more primitive than *B. willistoni* in retaining wider, more angular upper molars. Among the Cynarctinae, *Bassariscops* is one of the least modified genera.

A single M_1 is readily referable to *Cynarctoides* but is the most unspecialized specimen of that genus yet recorded.

The mustelid in the fauna is as large as *Sthenictis,* although generic identification is not possible due to lack of material. The same can be said for the identification of the nimravine felid and an anchitherine horse.

A small species of *Moropus* in the Buda Local Fauna is only broadly comparable with other small schizotherine chalicotheres from Arikareean deposits of the John Day Basin of Oregon and Aquitanian deposits at St. Gérand-le-Puy (Coombs 1974; in press).

An oreodont extends the range of the Phenacocoelinae into Florida from the Arikareean of Texas (Castolon Local Fauna, Stevens *et al.* 1969).

Two camels in the fauna, a small form that is a new genus and a larger, unidentifiable species, represents a group of camels with brachydont teeth and unfused metapodials. This group had its greatest diversity in the Gulf Coast region. The unnamed new genus is the smallest known camel, excluding the oromerycids.

An excellent sample of *Nanotragulus* in the Buda Local Fauna provides sufficient examples of variation among individuals to justify synonymizing *N. "lulli"* Frick and *N. "intermedius"* Schlaikjer with *N. loomisi,* which thus had a geographic range including Nebraska, South Dakota, and Florida.

Faunal correlations place the age of the Buda Local Fauna in the Arikareean, probably in the late Arikareean.

The composition of the Buda Local Fauna suggests that the Gulf Coast faunal province was as distinct from the Great Plains during the Arikareean as later. The two new species and the unnamed new camel genus are found only in Florida. *Cynorca* is found in only one, possibly two, other localities during the Arikareean, and *Bassariscops* is known only from the lower part of the Brown's Park Formation of Colorado.

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